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ENGLISH FOR ELITE TECHNICAL STUDENTS

Part 1
TEXTS AND EXERCISES

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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»**

АНГЛИЙСКИЙ ЯЗЫК ДЛЯ СТУДЕНТОВ ЭЛИТНОГО ТЕХНИЧЕСКОГО ОБРАЗОВАНИЯ

Часть 1
СБОРНИК ТЕКСТОВ И УПРАЖНЕНИЙ

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Пособие содержит тексты и упражнения по темам: открытия и иннова-ции, наука и технологии, математика, физика, и направлено на введение в английский язык в профессиональной сфере.

Предназначено для студентов 2 курса, обучающихся по программе элитного технического образования Томского политехнического университета.

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MODULE 1
INVENTION AND INNOVATION

1.1. KEY VOCABULARY

Mind the pronunciation:

English word	Transcription	Translation
development	[dɪˈveləpmənt]	развитие
innovation	[ˌɪnəˈveɪʃn̩]	изобретение
inventor	[ɪnˈventə]	изобретатель
developer	[dɪˈveləpə]	разработчик
database	[ˈdeɪtəbeɪs]	база данных
patent	[ˈpeɪtnt]	патент
patent application	[ˈpeɪtnt ˌæplɪˈkeɪʃn̩]	заявка на патент
under license	[ˈʌndə ˈlaɪsns]	по лицензии
product development	[ˈprɒdʌkt dɪˈveləpmənt]	развитие продукта, разработка изделия
cutting edge	[ˈkʌtɪŋ edʒ]	выигрышное качество; свойство, дающее преимущество
intellectual property	[ˌɪntəˈlektʃʊəl ˈprɒpəti]	интеллектуальная собственность
research centre	[rɪˈsɜːtʃ ˈsentə]	научно-исследовательский центр

English word	Transcription	Translation
innovative	[ˈɪnəveɪtɪv]	инновационный
obsolete	[ˈɒbsəliːt]	устаревший; вышедший из употребления
low-tech	[ləʊ tek]	низкотехнологичный
hi-tech	[haɪ tek]	высокотехнологичный
royalty	[ˈrɔɪəlti]	авторский гонорар
breakthrough	[ˈbreɪkθruː]	достижение, прорыв, успех, открытие
state-of-the-art	[steɪt əv ði ɑːt]	новейший, передовой
technology	[tekˈnɒlədʒi]	технология
technologist	[tekˈnɒlədʒɪst]	технолог
proprietary	[prəˈpraɪətri]	собственность
copyright	[ˈkɒpɪraɪt]	авторское право
to come up with	[tə kʌm ʌp wɪð]	находить решение; предлагать план; придумывать
to approve	[tu əˈpruːv]	одобрять; утверждать план
to encourage	[tu ɪnˈkʌrɪdʒ]	одобрять; поощрять
to discover	[tə dɪˈskʌvə]	открывать; обнаруживать
licensing agreement	[ˈlaɪsnsɪŋ əˈgriːmənt]	лицензионное соглашение
royalty payment	[ˈrɔɪəlti ˈpeɪmənt]	оплата авторского гонорара
copyright infringement	[ˈkɒpɪraɪt ɪnˈfrɪndʒmənt]	нарушение авторского права
innovator	[ˈɪnəveɪtə]	новатор
invention	[ɪnˈvenʃn̩]	изобретение
to take up	[tə teɪk ʌp]	браться за что-либо; заниматься чем-то
to inspire	[tu ɪnˈspaɪə]	влиять; воздействовать; вдохновлять; стимулировать
project	[ˈprɒdʒekt]	проект
revolutionary	[ˌrevəˈluːʃənri]	революционный; кардинальный
commercially-viable	[kəˈmɜːʃl̩i ˈvaɪəbl̩]	коммерчески жизнеспособный
benefit	[ˈbenɪfɪt]	выгода, прибыль, преимущество
solution	[səˈluːʃn̩]	решение, разъяснение
to avoid	[tu əˈvɔɪd]	избегать
to cause	[tə kɔːz]	послужить причиной, поводом

to create	[tə kriːˈeɪt]	создавать, творить
to have good results	[tə həv gʊd rɪˈzʌlts]	достичь хороших результатов
to perform	[tə pəˈfɔːm]	выполнять, демонстрировать
to reduce	[tə rɪˈdjuːs]	сокращать, уменьшать
to respond to	[tə rɪˈspɒnd tuː]	отвечать, реагировать
pilot project	[ˈpaɪlət ˈprɒdʒekt]	экспериментальный проект
to obtain	[tu əbˈteɪn]	получать, приобретать
to invest in	[tu ɪnˈvest ɪn]	инвестировать в …
search	[sɜːtʃ]	поиск, исследование; гл. исследовать
basic research	[ˈbeɪsɪk rɪˈsɜːtʃ]	фундаментальные исследования
prototype	[ˈprəʊtətaɪp]	прототип, опытный образец
to analyse	[tu ˈænəlaɪz]	анализировать, исследовать
analysis	[əˈnæləsɪs]	анализ, изучение, исследование
analyst	[ˈænəlɪst]	аналитик, лаборант-химик
analytical	[ˌænəˈlɪtɪkl̩]	аналитический
experiment	[ɪkˈsperɪmənt]	эксперимент, опыт
experimentation	[ɪkˌsperɪmenˈteɪʃn̩]	экспериментирование
experimenter	[ɪkˈsperɪməntə]	экспериментатор
experimental	[ɪkˌsperɪˈmentl̩]	экспериментальный, опытный
inventive	[ɪnˈventɪv]	изобретательный
to file a patent	[tə faɪl ə ˈpeɪtnt]	формировать патент
to register a patent	[tə ˈredʒɪstər ə ˈpeɪtnt]	регистрировать патент
feasible	[ˈfiːzəbl̩]	возможный, реальный, правдоподобный
me-too product	[miː tuː ˈprɒdʌkt]	аналогичный товар, товар-аналог, товар-замена
technical know-how	[ˈteknɪkl̩ nəʊ ˈhaʊ]	техническое ноу-хау
trial	[ˈtraɪəl]	испытание, проба

1.2. VOCABULARY AND GRAMMAR

1. Read the following words, translate them and make sentences:

Science – scientist – scientific; electric – electrical – electricity; physics – physical – physicist; to generate – generator – generation; to invent – invention – inventor; to achieve – achievement; to design – design – designer; to measure – measurement;

chemistry – chemist – chemical; to found – founder – foundation; possible – possibility.

Translate the following sentences:

1. Сегодня ученые пытаются изобрести новые устройства, которые облегчат жизнь человека. 2. В свои исследованиях ученые используют научные методы. 3. В воздухе много химических элементов. 4. Для того чтобы измерить угол треугольника используется транспортир. 5. Человек каменного века изобрел колесо. 6. Девятнадцатый век знаменит своими научными открытиями. 7. Химические элементы были сгруппированы Дмитрием Менделеевым. 8. Российский химик открыл новый химический элемент. 9. Американский физик достиг больших успехов в измерении электрического тока. 10. Химию и физику очень тщательно изучают в технических вузах. 11. Мы пытались превратить кухню в электролабораторию. 12. Зонд (sonde) осуществил измерения атмосферы, пока летел вниз.

2. Choose the correct form to complete the sentences:

1. White came up with (a design/design) that combined lightness and warmth.
2. There's an exhibition on architecture and (the design/design) at the Museum of Modern Art.
3. McGrew is vice president of (a development/development) and product planning.
4. The FDA has approved (a development/development) for treating tooth disease, a new laser machine.
5. Electric light was (an invention/invention) which enabled people to stay up late.
6. Sometimes (an invention/invention) is so obvious that it is hard to believe nobody thought of it before.
7. Channel Four has always encouraged experimentation and (an innovation/innovation) in its films.
8. He discovered (an innovation/innovation) that has enabled him to build guitars more efficiently.

3. Fill in the gap by paraphrasing the word given in brackets:

1. Suzanne King is in charge of product _____ at Westworld Electronics. (develop)
2. I want to be a graphic _____ when I graduate. (design)
3. I think that the Internet is the greatest _____ of the past 50 years. (innovate)
4. We are looking for someone with _____ of databases and spreadsheets. (know)
5. Christopher Cockerell was the _____ of the hovercraft. (invent)
6. You have to pay a lot to get a good software _____. (develop)
7. Have you seen her _____ for the new shopping centre? (designer)

4. Connect each word on the left to a word on the right to make a word pair. There is an extra word that you do not have to use.

patent	development
product	license
cutting	property
research	application

under	copyright
intellectual	centre
	edge

Use these word pairs to complete the sentences below:

1. We have made a ______ ______ to stop people copying our invention.
2. Our drug for pain relief is made _____ _____ in 32 countries.
3. I'm in charge of _____ _____ at Minnow Technologies.
4. We use the latest technologies to keep our products at the _____ _____.
5. We took them to court because the original idea was our _____ ______.
6. We test all new drugs at our _____ _____ in Zurich.

5. Choose the best word from the brackets to fill in the gap:

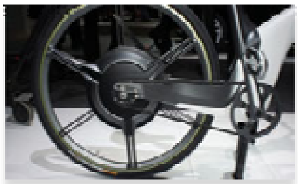
1. I bought a PC just five years ago and now it is _____. (innovative/obsolete)
2. Our new engine uses state-of-the-_____ electronics. (art/science)
3. I think that the _____ of computer control systems is fascinating. (technology/ knowledge)
4. Advanced, _______ systems are great, but there is more to go wrong. (low-tech/ hi-tech)
5. I receive a _____ of 10 % on all my books that the publisher sells. (royalty/ license)
6. Finding out how antibiotics work was a tremendous _____. (breakthrough/ breakout)

6. Match the expressions with their meanings:

copyright infringement	a payment to the owner of a design, or to an author
intellectual property	an arrangement between the owner of a design and someone else, allowing them to use the design for money
patent application	when someone uses another's text, pictures, etc. without permission
proprietary information	when an inventor asks the authorities to officially recognize an invention as his/her property
royalty payment	designs, ideas, etc. that belong to someone
licensing agreement	the law relating to designs, ideas, etc. that belong to someone

7. Do you know these simple machines? Match the pictures with the words and phrases in the box. Which of these simple machines are used in your industry or technical field? How are they used?

rack and pinion



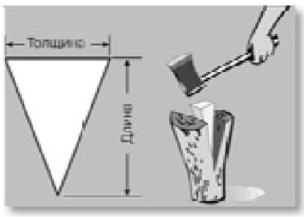
gear

lever

pulley and belt

ratchet and pawl

screw



wheel and axle

wedge

8. Put the present or past passive of the verbs in brackets.

Here are some examples of spinoffs from space travel. The devices _____ (create) many years ago for space programs. But now they _____ (use) by many people in everyday life.

The smoke detector _____ (make) for the Skylab space station in the 1970s to detect toxic gases. Now they _____ (install) in most buildings to warn people of fire.

The CADCAM computer program _____ (invent) by NASA engineers over 20 years ago to find problems in spaceships. Now nearly all cars _____ (design) using these programs.

Today many computer games _____ (control) by means of small joysticks _____ (introduce) many years ago to control the Apollo Lunar Rover.

1.3. READING AND SPEAKING

1. Read the text, translate the words in bold.

I'm head of **product development** at Lightning Technologies. Lightning makes semiconductors, the components at the heart of every computer. I'm in charge of **research and development** (R&D) at our **research centre** just outside Boston. Our **laboratories** are some of the most **innovative** in the computer industry, and we have made many new discoveries and **breakthroughs**.

I love **technology**, using scientific **knowledge** for practical purposes. The technology of semiconductors is fascinating. We are at the **cutting edge** or **leading edge** of semiconductor technology: none of our competitors has better products than us. Everything we do is **state-of-the-art**, using the most advanced techniques available.

Of course, the **hi-tech** products of today become the **low-tech** products of tomorrow. Products that are no longer up-to-date because they use old technology are **obsolete**. It's my job to make sure that Lightning's products never get into that situation.

2. Read the text and answer the questions after it:

An **inventor** is an individual or group able to generate an idea for a new or improved device, product or process. The idea must then be transformed into concrete information in the form of a description, sketch or model.

An **invention** is an idea, concept or design for a new or improved device, product or process that is available as concrete information in the form of a description, sketch or model.

So an inventor may have many ideas for new products or improvements to existing processes, say, but these do not constitute an invention until the ideas have been transformed into something real, such as drawings or a prototype with the potential for practical application. As you will see later on, the conditions for granting a patent to protect an invention from being copied are that the invention must be new, must not be obvious to someone who knows about the subject and must be capable of industrial application.

Questions:

What is the task of the inventor?
What is an invention? What is an innovation? What is the difference between them?
What is a prototype?
What should an inventor do for protecting his/her invention?

3. Read and translate the text.

Information or knowledge that belongs to an individual or company is **proprietary**. A product developed using such information may be protected in law by **patents** so that others cannot copy its design.

Other companies may pay to use the design under license in their own products. These payments are **royalties**.

In publishing, if a text, picture, etc. is **copyright**, it cannot be used by others without permission. Payments to the author from the publisher are royalties.

The area of law relating to patents and copyright is **intellectual property**.

4. Connect the inventor with his invention:

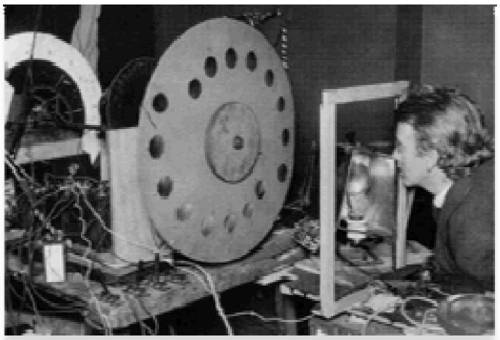
1. Yablochkov is famous for	a) working out the theory of flights.
2. Zhukovsky is famous for	b) formulating the law defining the direction of electric current.
3. Lenz is famous for	c) inventing the electric candle.

5. Answer the following questions:

1. What is J.J. Thomson famous for?
2. What is V.V. Petrov famous for?
3. What is A.S. Popov famous for?
4. What is D.I. Mendeleev famous for?
5. What is A. Einstein famous for?

6. Read the text about great inventions and answer the questions according to the text.

1. TELEVISION (1920S)



John Logie Baird with his television apparatus, circa 1925

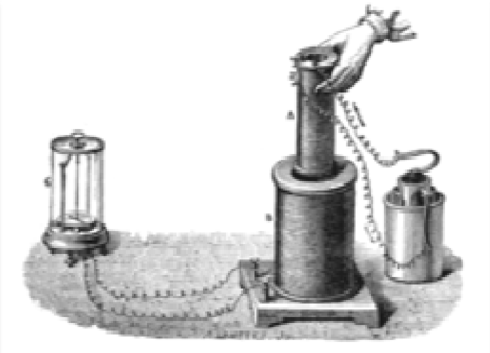
The invention that swept the world and changed leisure habits for countless millions was pioneered by Scottish-born electrical engineer John Logie Baird. It had been realized for some time that light could be converted into electrical impulses, making it possible to transmit such impulses over a distance and then reconvert them into light

2. MOTOR CAR (LATE 19TH CENTURY)

Benz Patent MotorCar, 1886

With television, the car is probably the most widely used and most useful of all leisure-inspired inventions. German engineer Karl Benz produced the first petrol-driven car in 1885 and the British motor industry started in 1896. Henry Ford was the first to use assembly line production for his Model T car in 1908. Like them or hate them, cars have given people great freedom of travel.

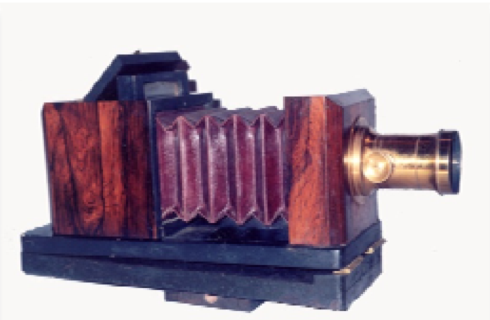
3. ELECTRICITY



The name came from the Greek word for amber and was coined by Elizabeth I's physician William Gilbert who was among those who noticed that amber had the power to attract light objects after being rubbed. In the 19th century such great names as Michael Faraday, Humphry Davy, Alessandro Volta and Andre Marie Ampere all did vital work on electricity.

One of Faraday's 1831 experiments demonstrating induction

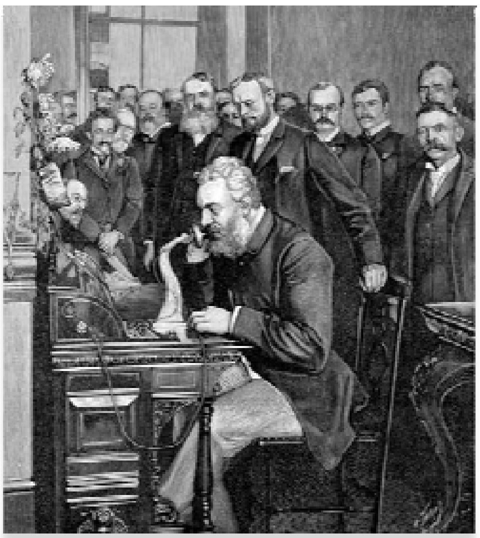
4. PHOTOGRAPHY (EARLY 19TH CENTURY)



Leonardo da Vinci had described the camera obscure photographic principle as early as 1515. But it was not until 1835 that Frenchman Louis Daguerre produced camera photography. The system was gradually refined over the years, to the joy of happy snappers and the despair of those who had to wade through friends' endless holiday pictures.

Louis Daguerre- first photograph – «daguerreotype»

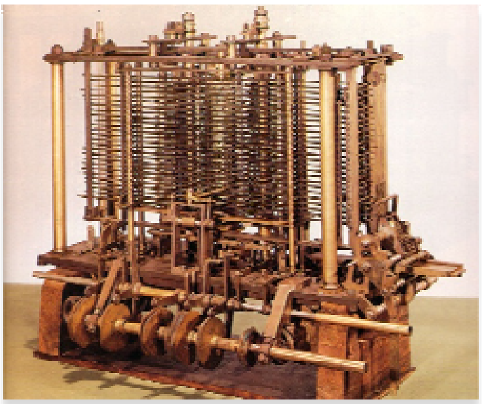
5. TELEPHONE (1876)



Edinburgh-born scientist Alexander Graham Bell patented his invention of the telephone in 1876. The following year, the great American inventor Thomas Edison produced the first working telephone. With telephones soon becoming rapidly available, the days of letter-writing became numbered.

Bell «Centennial» Telephone Replica of 1876 model

6. COMPUTER (20^{TH} CENTURY)



Babbage's Analytical Engine (fragment)

The computer has been another life-transforming invention. British mathematician Charles Babbage designed a form of computer in the mid-1830s, but it was not until more than a century later that theory was put into practice. Now, a whole generation has grown up with calculators, windows, icons, computer games and word processors, and the Internet and e-mail have transformed communication and information.

7. AEROPLANE

The first stage in the evolution of flying began on the day the Wright Brothers made the first controlled, powered flight in 1903

The plane was the invention that helped shrink the world and brought distant lands within easy reach of ordinary people. The invention of the petrol engine made flight feasible and the American Wright brothers made the first flight in 1903.

Questions:

1. When did British motor industry start?
2. Who invented the first television?
3. Who did the vital work on electricity?
4. Who began the production of camera photography?
5. Who produced the first working telephone?
6. What invention transformed the world of communication?
7. What invention made flight feasible?
8. What invention can people live without?
9. What invention has both positive and negative effects?
10. What invention is more useful for you?

7. Read the text translating words in brackets.

A GREAT INVENTION OF A RUSSIAN SCIENTIST

Radio occupies one of the _____ (лидирующее) places among the greatest ______ (достижения) of modern engineering. It was invented by Professor A.S. Popov, the talented Russian scientist, who ______ (продемонстрировал) the first radio-receiving set in the world on May 7, 1895. And it is on this day that we mark the _____ (юбилей) of the birth of the radio.

By his _____ (изобретение) Popov made a _____ (бесценный) contribution to the _____ (развитие) of world science.

Nearly at the same time an Italian inventor G. Marconi, who _____ (переехал) to Great Britain in 1896, got an English patent on using _____ _____ (электромагнитные волны) for communication without _____ (провода). As A.S. Popov had not yet patented his _____ (изобретение) by that time, the world considered Marconi to be the _____ (изобретатель) of the radio. But in our country it is A.S. Popov who we by right call an inventor of the radio.

A.S. Popov was born in the Urals on March 16, 1859. For some years he had been studying at the seminary in Perm and then went to the University of St. Petersburg. In his student days he worked as a _____ (механик) at one of the first electric power-plants in St. Petersburg which was producing electric lights for Nevsky prospect.

After graduating from the University in 1882, A.S. Popov remained there as a post-graduate at the Physics Department. A year later he became a _____ (лектор) in Physics and Electrical Engineering in Kronstadt. By this time he had already won recognition among specialists as an authority in this field.

After Hertz _____ (опубликовал) his experiments proving the _____ (существование) of electromagnetic waves, A.S. Popov thought of a possibility of using Hertz waves for ______ (передача) signals over a distance. Thus the first _____ (беспроводное) (radio) receiving set was created. Then Popov developed his device and on March 24, 1896 he demonstrated the transmission and reception of a _____ (радиограмма) consisting of two words: Heinrich Hertz. On that day the radio-telegraphy was convened from an abstract theoretical problem into a real fact. A.S. Popov did not live to see the great progress of his invention.

Popov's invention laid the foundation for _____ (дальнейшие) inventions and _____ (улучшения) in the field of radio engineering. Since that time scientists all over the world have been developing the modern systems of radio-telegraphy, broadcasting, television, radiolocation and other branches of radio electronics.

Make the plan of the text and retell it according to it.

8. Read the text and name the main steps of the wheel history.

INVENTION OF THE WHEEL

It’s difficult to imagine our lives without any form of movement. Wheels are one of the most ancient discoveries of humankind. However, none of us question how the wheel was actually discovered?

Wheels have made it much easier for all of us to travel. The creation of the wheel is perhaps the most significant discovery. As soon as the wheel was invented, there was a revolt in the manufacturing industry.

The first inventor of the wheel remains unknown. What is known, is the fact that the first ever wheel was discovered approximately 3,000 years ago where weavers and potters were the first to utilize them.

The containers that were prepared by the potters were helpful for carrying the essentials; drinking water and nutritious food. There was yet another enhancement by utilizing the wheels for moving on the vehicles. The advanced version of these same wheels is now being used by the cars which we use today, for our own convenience.

There was always a regular growth in the advancement of inventing new and innovative designs the wheel. The wheels that we now see in heavy vehicles were also invented during the early centuries, but the differences are huge. The initial designs were much simpler in comparison to the designs we see today.

Unlike other inventions that took place around 5000 B.C. or even earlier, wheels are still commonplace today and are still high in demand. Many contemporary discoveries are derived from the ancient and original wheel. It's clear that if there was no invention of the wheel, there would be no vehicles. Our roads would have been empty and aero-planes would not have been able to take to the skies.

As a result, there has been a great development in the field of industrialization. The different manufacturing factories and companies are a productive outcome of wheels. If the wheel had been a relatively new invention, the inventor would have received worldwide acclaim. Although what we determine to be a simple idea, the concept at that time was truly groundbreaking and ingenious – a concept that has withstood the ultimate test of time.

Read the following sentences about the text. Choose True or False for each sentence.

1. Wheels are one of the earliest discoveries.
2. We know the person who invented the wheel.
3. Travelers were the first who started to use wheels.
4. Wheels are still high in demand.
5. If there was no invention of the wheel, there would be no cars.

Translate from Russian into English.

1. Изобретение колеса способствовало развитию ремёсел. 2. Колесо – это механизм, который служил для передвижения. 3. История колеса неразрывно связана с изобретением и развитием дорог. 4. Время и место изобретения колеса точно определить сложно. 5. Колесо широко применяется в транспортных целях, а также повсеместно используется в различных механизмах и инструментах. 6. Первым небесным телом, на котором появилось колесо, стала Луна. 7. Самое древнее колесо было

найдено в Месопотамии. 8. В Шотландии, на реке Клайд, по проекту инженера Смитона соорудили крупнейшее в мире водяное колесо (waterwheel) диаметром более 20 метров.

9. Read the article and mark the inventions on the timeline.

TOOLS THROUGH THE AGES

The first knives were made about two and a half million years ago. They were crafted by early ancestors of modern humans. At first, sharp pieces of stone were broken off a rock, but in later times they were sharpened and straightened into blades.

The abacus is one of the first mechanical counting devices, an ancestor of today's computers. It consisted of a frame containing beads on wires. The modern abacus was designed by the Chinese around the year 1200.

The compass allowed sailors to navigate across oceans and discover new worlds. The compass was invented by the Chinese about 2200 years ago. A spoon-shaped piece of magnetic rock was balanced on a flat surface. Since it was magnetic, the handle rotated to align itself with the Earth's magnetic poles.

The first mass-produced pencils were made in Germany in 1662, which helped writing and education to develop.

The harness lets people control horses and attach them to carts. It was probably invented about 6000 years ago, when horses were first tamed and kept.

The scythe allows people to cut grass and harvest crops from the field. It consists of a long wooden shaft with handles on the end and in the middle, and a long curved blade on the other end. The blade is sharp on the inside. It was first used in Europe in the 12th century.

Glasses (or spectacles) make workers more productive and accurate, and allow people to work into old age. Mathematical calculations for a spherical lens were first made by Arab scientists in the 11th century. The first spectacles were manufactured by Italian craftsmen in the 13th century.

Saws were first used by the Egyptians more than 5000 years ago to cut both wood and stone. They were made of copper.

The first balance scales were seen in southern Mesopotamia about 9000 years ago. They consisted of two weighing pans attached to either end of a beam, which was balanced on a central pivot. They allowed merchants to calculate the exact weight of goods.

The chisel consists of a long, narrow, sharpened edge attached to a handle. It's different from a knife or axe, because it is driven by a sharp blow from a hammer or mallet. The earliest chisels were made from flint (a kind of stone) 10,000 years ago. Later, they were used by the Egyptians to carve stone for the pyramids.

Find in the text «Tools through the ages» English equivalents for the following:

Нож, лезвие, доска для счета, каркас, магнитная горная порода, упряжка, телега, коса, урожай, рукоятка, ручка, пила, чаща, брусок, резак, кремень, вырезать, точить, выпрямлять, приручать, считать, вращать, выстраивать в ряд.

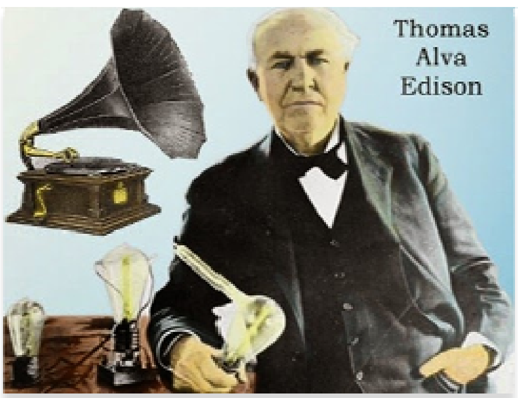
Answer the questions:

1. What material was used for the first knives?
2. What was the first mechanical counting device?
3. What allowed sailors to navigate across oceans?
4. Who invented the compass?
5. Describe the first compass.
6. What invention lets people control horses?
7. What invention allows people to cut grass?
8. When were the first spectacles manufactured?
9. What were the first saws used for?
10. What did the Egyptians use to carve stone for the pyramids?

Translate into English

1. Первые ножи были сделаны из камня. 2. Позже к ножам начали прикреплять деревянные и костяные рукоятки. 3. Около пяти тысяч лет назад человек стал изготавливать ножи из меди и бронзы. 4. Нож состоит из лезвия и рукоятки. 5. Впервые абак появился 3 тыс. лет до н. э. Первоначально представлял собой доску, разграфлённую на полосы. 6. Традиционно телеги изготавливают из дерева. 7. Телега является сложным техническим сооружением, состоящим из многих деталей. 8. Коcá – сельскохозяйственный ручной инструмент для скашивания травы. 9. В Индии слонов ловят и приручают. 10. Земля вращается с запада на восток.

10. Read the text and answer the questions.



Thomas Alva Edison was probably the greatest inventor who ever lived, though at school he never did really well. In fact, he went to the bottom of his class and stayed at the bottom for three months. Shortly after, at the age of 12, he left school and never went back! His first job was selling newspapers on trains, and later, at the age of 16, he got a job working in a telegraph office. Not all of Edison's inventions were successful. In fact, his first one was a failure. Many that followed, however, were spectacular successes and Edison became famous. Most people regard him as a genius.

Edison worked hard all his life, often working all night in his laboratory, and would not come home for days at a time. When asked what makes a genius he said, «Genius is 99 % perspiration and 1 % inspiration.» Edison married his first wife, Mary Stilwell, when he was 24. She was only 16 at the time. The story goes that he tapped out his proposal to her in Morse code on a gas-pipe: «Will you marry me?» «I will,» came the reply, also in Morse code.

Mary died when Edison was 37 years old and two years later he married his second wife, Mina Miller. Although most of the inventions which made Edison famous were made in the first half of his life, Edison continued to work and invent till he was over 70, often working 16 hours a day! During his long and productive life Edison made 1,300 inventions. Edison died on October 18, 1931, at the age of 84. America and the world mourned his passing.

Answer the questions:

1. How old was Edison when he left school?
2. What was his first job?
3. What did Edison answer when asked what makes a genius?
4. How did Edison propose to his first wife?
5. How old was Edison when his first wife died?
6. How many inventions did Edison make in his life?
7. How old was he when he died?
8. Was Edison an American?

Decide if the following statements are true or false.

1. Edison sometimes worked longer than 12 hours a day.
2. Edison knew Morse code, but Mary Stilwell didn't.
3. Edison returned to his old school after becoming famous.
4. Mina Miller became Edison's wife 2 years after Mary died.
5. Edison made his greatest inventions before he was 42.

11. Read the text.

MAN OF ART. MAN OF IDEAS. MAN OF INVENTIONS

His life
Leonardo da Vinci (1452–1519) lived in a small town in Italy with his grandparents. He studied at home and enjoyed music, singing and mathematics. At the age of 16, he wanted to study art, so he moved to the city of Florence for art classes. He finished his studies after four years. He then worked in Milan as an engineer and he started his life as an inventor. In 1500 he returned to Florence and in 1516 he travelled to France, where he stayed for the rest of his life.

His inventions
Leonardo da Vinci lived and worked before people used electricity and petrol for power, but he had the first ideas for many machines that we use today.

The robot
Leonardo built his robot in 1495. The robot stood up, sat down and held things in its arms.

The car
A single passenger drove the car. It travelled 40 metres at a time.

The helicopter
Leonardo designed the first helicopter but he never made it. His design used a screw to lift the helicopter into the air. This is different from the modern design, but the general idea is similar.

The diving suit
Leonardo made the suit of leather and added long pipes to carry the air to the diver. He also invented special gloves for divers. Today, divers use them on their feet!

These are just some of Leonardo's hundreds of inventions. He also invented a parachute and even high heels!

Read the text and say if the following statements are true or false.

1. When he was young, Leonardo was at a large school.
2. Leonardo was an engineering student.
3. A lot of modern inventions use his ideas.
4. The robot could only move its legs.
5. The car could only travel a short distance.
6. Leonardo's helicopter is the same as the modern ones.
7. Modern divers use Leonardo's diving glove.

12. Read the text about cameras.

CAMERAS

One of the latest technological developments is cameras, which have been used for many years, especially to fight against crime. First, cameras have started to be installed in public places such as car parks and shopping centres where the number of the staff isn't enough to prevent theft. Recent surveys have shown that theft has decreased in the places where cameras are installed. Cameras have also been used in schools, colleges and office lifts to prevent the theft of valuable equipment such as computers. Secondly, cameras are helpful in preventing hooligans from spoiling the pleasure of the majority at some social events like football matches. They film people at large sporting events so it is easy to distinguish the people who are hooligans. Finally, cameras are used outside our houses as it is a good way of catching thieves. To conclude, it is possible to reduce crime and feel more secure by means of cameras.

Read and decide if the following statements are T (True) or F (False).

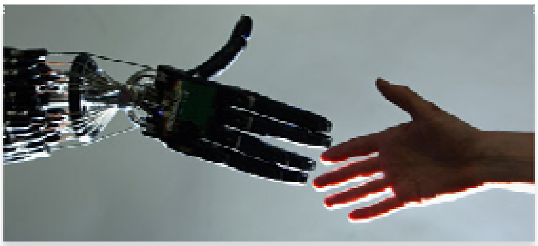
1. Cameras have just started to be used against crime.
2. There has been a fall in theft thanks to cameras.
3. It is not possible to identify hooligans by using cameras.
4. People prefer to use cameras outside their houses for burglars.
5. Technology helps us to feel more secure in our daily lives.

Read the text and write the reasons why cameras are installed in the places mentioned.

PLACES WHERE CAMERAS ARE INSTALLED	REASON
schools, colleges and office lifts	
football fields	
outside our houses	

13. Fill in the blanks with the correct form of the verbs.

In the past, there (1) ___ (be) thousands of servants in great empires like ancient Rome, Egypt or Greece. There were slaves doing all the work for their masters and mistresses so rich people (2) ___ (spend) their time for travel, sports, leisure activities and education. Today the slaves (3) ___ (not be) human – they are machines which (4) ___ (call) 'robots'. The word 'robot' (5) ___ (come) from Czechoslovakia. They are machines which can be (6) ___ (teach) or programmed to do useful work. They mostly (7) ___ (work) in factories, especially on production lines. That's where something like a TV or a car is put together piece by piece. For years, this work (8) ___ (be) very boring and tiring for human workers.



Today's robots (9) ___ (be) more intelligent than ever before. They may even have mini TV cameras which (10) ___ (make) them able to see. In the future, they (11) ___ (be able to / work) at homes, offices, shops almost anywhere. Since they were invented, they (12) ___ (also / do) other jobs apart from working on production lines. They can help to defuse bombs, work underground helping to find metals and minerals, control flying weapons, take photos and collect rocks on planets like the Mars without risking human life. Robots (13) ___ (also / work) under the sea as robot divers and submarines to repair oil-rigs and find wrecks.

Robots are clever but still not clever enough to do some tasks like washing the dishes, making beds, cleaning floor or cutting grass. But it is a fact that robots will help to create a leisure society for the next generation and they may increase unemployment. So this (14) ___ (depend) on us. Only we can decide whether we control the robots or they (15) ___ (control) us.

14. For questions 1-8, read the text below and decide which answer (A, B, C or D) best fits each gap. Mark your answers on the separate answer sheet. There is an example at the beginning (0).

THE INVENTION OF TELEVISION

Few inventions have **(0) had** more scorn and praise (1).......... them at the same time than television. And few have done so much to unite the world into one vast audience for news, sport, information and entertainment. Television must be (2).......... alongside printing as one of the most significant inventions of all time in the (3).......... of communications. In just a few decades it has reached (4).......... every home in the developed world and an ever-increasing proportion of homes in developing countries. It took over half a century from the first suggestion that television might be possible before the first (5).......... pictures were produced in laboratories in Britain and America. In 1926 John Logie Baird's genius for publicity brought television to the (6).......... of a British audience. It has since (7).......... such heights of success and taken on such a pivotal function that it is difficult to imagine a world (8)………… of this groundbreaking invention.

Example

0 A had B even C been D done

1.	A	taken over	B	heaped upon	C	picked on	D	given over
2.	A	awarded	B	rated	C	graduated	D	assembled

3.	A	location	B	site	C	post	D	field
4.	A	simultaneously	B	actually	C	virtually	D	substantially
5.	A	flaring	B	glimmering	C	sparkling	D	flickering
6.	A	attention	B	concentration	C	initiation	D	surveillance
7.	A	found	B	left	C	gained	D	reached
8.	A	without	B	shallow	C	bereft	D	lacking

1.4. PRODUCTION

1. Translate the following sentences:

1. Важно также, чтобы системы защиты прав интеллектуальной собственности обеспечивали развивающимся странам возможности для создания собственного производственного потенциала.
2. Патент выдается государственным органом исполнительной власти по интеллектуальной собственности.
3. Первый патентный закон США (Patent Act) издан в 1790 году.
4. В современных условиях правительства различных стран инвестируют огромные средства в научные исследования и инновационную деятельность.

2. Using the Internet, connect inventions with inventors:

Rudolf Hell	the jeans
Julius Lothar Meyer	the helicopter
Felix Hoffmann	the scanner
Albert Einstein	the air conditioner
Wilhelm Conrad Röntgen	periodic table of the chemical elements
Hubert Booth	electromagnetic theory of light and electromagnetic waves
Levi Strauss	compact and modern vacuum cleaner
Willis Carrier	the aspirin
Heinrich Hertz	the theory of relativity
Heinrich Focke	the X-rays

3. Prepare the information about the latest science gadgets using the Internet:

http://www.inventionreaction.com/latest/
or reading one of the texts (Appendix 2):

- Retro Diner Slush Maker
- Pioneer rearview mirror telematics unit
- Inch curved TV

4. Project. Work in small groups:

- Choose an industry or work process which you know something about.
  Examples: building, heavy lifting, fishing, mining, road-building, communications, sea or land travel, heating, lighting, pumping.
- How was the work done in the past? How is it done now? Make notes showing the contrast between past and present.

- Explain your ideas to the group.

5. **Describe any device according to this set:**

   Name of device: ________
   Specifications: (e.g. dimensions, weight, speed) ___
   Main parts and functions: _________
   Materials and properties: _________
   Operation/How it works: _________
   Strengths: _____________________
   Weaknesses: ___________________

6. **Write a description of the space elevator, using all the information. You can use your own headings to paragraphs: *definition*, *purpose*, *main components*, *function of components*, *specifications*, *dimensions*, *location*, *speed*, *material*, *properties*, *operation*, *advantages*, *problems*.**

CABLE FOR SPACE ELEVATOR	
length	100,000 km
material	carbon nanotubes
properties	light, cheap, strong in tension
advantages	car manufacture it cheaply

Advantage: rocket propulsion not needed
Problem: radiation belt at 1000–20,000 km altitude

Operation
counterweight floats in zero gravity
earth rotates → platform
pulls cable → counterweight tightens it
robot climber moves up cable, escapes gravity of Earth

7. **Project. Work in small groups:**

   - Choose a product that you would like to improve or re-design.
   - Use the Internet and/or a library to find ideas for a new design.
   - Brainstorm ways to modify and improve the product. Make notes.
   - Using your notes, discuss and decide the design brief.
   - Write the design brief for the new product.
   - Design the new product, following the design brief. Make sketches.
   - Prepare a presentation about your new product. Draw a large visual to show the group.
   - Give a group presentation about your new product.

8. **Describe the invention you consider to be one of the greatest in the world according to the plan:**

   - the name of the person it was designed by
   - the country this invention was made in
   - what this thing/invention was made for
   - how it is used now
   - how it influenced our life

MODULE 2
SCIENCE AND TECHNOLOGY

2.1. KEY VOCABULARY

Mind the pronunciation:

English word	Transcription	Translation
achievement	[əˈʧiːvmənt]	достижение
analysis	[əˈnæləsɪs]	анализ
analyze	[ˈænəlaɪz]	анализировать
application	[ˌæplɪˈkeɪʃ(ə)n]	устройство, прибор
apply	[əˈplaɪ]	включать, использовать
attempt	[əˈtɛmpt]	попытка
biochemistry	[baɪəʊˈkɛmɪstri]	биохимия
breakthrough	[ˈbreɪkˌθruː]	открытие, прорыв
cell	[sɛl]	клетка
datum	[deɪtəm]	значение, данная величина
digital	[ˈdɪʤɪtl]	цифровой
electrochemist	[ɪˈlɛktrəʊ-ˈkɛmɪst]	электрохимик

evolution	[ˌiːvəˈluːʃən]	эволюция, развитие
experiment	[ɪksˈpɛrɪmənt]	эксперимент
fact	[fækt]	факт
flask	[flɑːsk]	лабораторный сосуд, склянка
fossil	[fɒsl]	окаменелость, ископаемое
genetics	[ʤɪˈnɛtɪks]	генетика
geology	[ʤɪˈɒləʤi]	геология
geophysics	[ˌʤiəʊˈfɪzɪks]	геофизика
gravity	[ˈgrævɪti]	гравитация
greenhouse gases	[ˈgriːnhaʊs ˈgæsɪz]	парниковые газы
irrelevant	[ɪˈrɛlɪvənt]	неактуальный, неподходящий
laboratory	[ləˈbɒrətəri]	лаборатория
magnetism	[mægnɪtɪzm]	магнетизм
mass	[mæs]	масса
matter	[mætə]	вещество, сущность
measure	[mɛʒə]	мера измерения, мера, единица измерения
microscope	[ˈmaɪkrəskəʊp]	микроскоп
molecule	[ˈmɒlɪkjuːl]	молекула
observatory	[əbˈzɜːvətri]	наблюдение, наблюдательная станция
observe	[əbˈzɜːv]	наблюдать
obsolete	[ˈɒbsəliːt]	устарелый, вышедший из употребления
particle	[ˈpɑːtɪkl]	частица
phase	[feɪz]	фаза, стадия
polyphase	[ˈpɒlɪ-feɪz]	многофазный
radiology	[ˌreɪdɪˈɒləʤi]	рентгенология
research	[rɪˈsɜːʧ]	исследование
scale	[skeɪl]	мера, величина, масштабирование
science	[ˈsaɪəns]	наука

English word	Transcription	Translation
scientist	[ˈsaɪəntɪst]	ученый
state-of-the-art	[steɪt-ɒv-ði-ɑːt]	самый современный
technophile	[ˈtɛknəʊ fail]	технофил
technophobe	[ˈtɛknəʊ fəʊb]	технофоб
telescope	[ˈtɛlɪskəʊp]	телескоп
test tube	[tɛst tjuːb]	пробирка
theory	[ˈθɪəri]	теория
thermometer	[θəˈmɒmɪtə]	термометр
variable	[ˈveərɪəbl]	изменчивый, непостоянный, меняющийся
wide-ranging	[waɪd-ˈreɪnʤɪŋ]	обширный, в широком диапазоне, широкомас-штабный
appliance	[əˈplaɪ.əns]	прибор

2.2. READING AND SPEAKING

1. Answer the questions:

1. Why did you choose to study at the institute of High Technology Physics/ Natural Resources/ Power Engineering/ Cybernetics/ Non-Destructive Testing/ Physics and Technology/ Humanities, Social Sciences and Technologies?
2. Can you explain what High Technologies are?
3. What kind of technologies is considered advanced nowadays?
4. What are the most perspective technologies nowadays?

2. Read the text and put the words in bold in the right part of speech.

SCIENTIFIC AND TECHNOLOGICAL PROGRESS

It's difficult to **overestimation** the role of science and **technological** in our life. They accelerate the **develop** of civilization and help us in our co-operation with nature. **Sciences** investigate the laws of the universe, discover the secrets of nature, and apply their **know** in practice improving the life of people.

Let's **comparison** our life nowadays with the life of people at the beginning of the 20th century. It has **changeable** beyond recognition. Our ancestors hadn't the slightest idea of the trivial things created by the scientific progress that we use in our everyday life. We mean refrigerators, TV sets, computers, microwave ovens, radio telephones, what not. They would seem miracles to them that made our life easy, **comfort** and pleasant. On the other hand, the great **inventors** of the beginning of the 20th century, I mean radio, airplanes, combustion and jet engines, have become usual things and we can't imagine our life without them. A century is a long period for **science** and technological progress, as it's rather rapid. Millions of investigations, the endless number of outstanding **discover** have been made. Our century has had several names that were **connection** with a certain era in science and technology. At first it was called the atomic age due to the discovery of the splitting of the atom. Then it became the age of the conquest of space when for the first time in the history of mankind a man overcame the gravity and entered the Universe. And now we live in the information era when the computer network embraces the globe and connects not only the countries and space stations but a lot of people all over the world. All these things prove the **powerful** and the greatest progressive role of science in our life. But every medal has its reverse. And the **rapidly** scientific progress has aroused a number of problems that are a matter of our great concern. These are **ecology** problems, the safety of nuclear power stations, the nuclear war threat, and the **responsible** of a scientist. But still we are grateful to the outstanding men of the past and the present who have courage and patience to disclose the secrets of the Universe.

Answer the questions:

1. How has the scientific and technological progress changed the life of people?
2. What problems has the rapid scientific progress brought with itself?
3. Could you name great inventions of the 21^{st} century?
4. What is the greatest invention?

3. Work in pairs. Choose two pictures and think of as many ways as you can in which they:

make our life easier or more pleasant
may be dangerous to individuals or environment
may change the life in the future



4. Read the text.

SCIENCE AND TECHNOLOGY

A lot of technological inventions and advances (from steam engines to organ transplantation, from radio to semiconductors and so on) made people's lives easier, safer and more comfortable. But technology goes alongside with science. Moreover the history of technology is longer than and distinct from the history of science. Science is the systematic attempt to understand and interpret the world; technology is the systematic study of techniques for making and doing things. While technology is concerned with the fabrication and use of artifacts, science is devoted to the more conceptual understanding of the environment, and it depends upon the comparatively sophisticated skills of literacy and numeracy. Such skills became available only with the emergence of the great world civilizations, so it is possible to say that science began with those civilizations, some 3000 years BC, whereas technology is as old as manlike life. Science and technology developed as different and separate activities, the science was practiced by a class of aristocratic philosophers, while the technology remained a matter of essentially practical concern to craftsmen of many types. There were points of intersection, such as the use of mathematical concepts in building and irrigation work.

The situation began to change during the medieval period of development in the West (AD 500-1500), when both technical innovation and scientific understanding interacted with the stimuli of commercial expansion and a flourishing urban culture. The robust growth of technology in these centuries attracted the interest of educated men. Early in the 17th century, the natural philosopher Francis Bacon had recognized three great technological innovations – the magnetic compass, the printing press, and gunpowder – as the distinguishing achievements of modern man, and he had advocated experimental science as a means of enlarging man's dominion over nature. By emphasizing a practical role for science in this way, Bacon implied a harmonization of science and technology, and he made his intention explicit by urging scientists to study the methods of craftsmen and craftsmen to learn more science. Still over the next 200 years, carpenters and mechanics – practical men – built iron bridges, steam engines, and textile machinery without much reference to scientific principles, while scientists – still amateurs – pursued their investigation in a haphazard manner. Only in the 19th century the Royal Society in London formed in 1660 represented a determined effort to direct scientific research towards useful ends, first by improving navigation and cartography, and ultimately by stimulating industrial innovation and the search for mineral resources. Similar bodies of scholars developed in other European countries, and by the 19th century scientists were moving toward a professionalism in which many of the goals were clearly the same as those of the technologists. Thus Justus von Liebig of Germany, one of the fathers of organic chemistry and the first proponent of mineral fertilizer, provided the scientific impulse that led to the development of synthetic dyes, high explosives, artificial fibers, and plastics; and Michael Faraday, the brilliant British experimental scientist in the field of electromagnetism, prepared the ground that was exploited by Thomas A. Edison and many others.

The role of Edison is particularly significant in the deepening relationship between science and technology, because the prodigious trial-and-error process by which he selected the carbon filament for his electric light bulb in 1879 resulted in the creation at Menlo Park, N.J., of what may be regarded as the world's first genuine industrial research laboratory.

From the achievement the application of scientific principles to technology grew rapidly. It led easily to the engineering rationalism applied by Frederick W. Taylor, to the organization of workers in mass production, and to the time-and-motion studies of Frank and Lillian Gilbreth at the beginning of the 20th century. It provided a model that was applied rigorously by Henry Ford in his automobile assembly plant and that was followed by every modern mass-production process. It pointed the way to the development of systems engineering, operations research, stimulation studies, mathematical modeling, and technological assessment in industrial processes. This was not just a one-way influence of science on technology, because technology created new tools and machines with which the scientists were able to achieve an ever-increasing insight into the natural world. Taken together, these developments brought technology to its modern highly efficient level of performance.

In the present day sense a technology is the study and utilization of manufacturing and industrial methods, systematic application of knowledge to practical tasks in industry. Whereas a science is considered as an absolute authority, technology becomes the cutting edge of history, the new frontier. In the early 1970s the phrase «high technology» began to appear as a synonym for computer technology. Today "high technology" has become a symbol of progress, like the space program in the 1960s, biotechnology innovations in the 1980s or the development of new medical techniques in the 1990s.

Answer the following questions according to the text:

1. What is the difference between science and technology?
2. What is science devoted to?
3. Who practised and developed science at an early stage of civilization?
4. Who was engaged in practical work at that time?
5. Why did technology attract the interest of educated men in the medieval period?
6. What were the most significant technological achievements in the 17th century?
7. Who emphasized the practical role of science?
8. When and where was the first scientific society formed?
9. Name the scholars and experimental scientists who were the first to apply scientific principles to technological innovations?
10. When did the term «high technology» appear?

Agree or disagree with the following statements:

1. In ancient times science and technology developed together as two sides of one activity.
2. None of technological innovations were recognized in the 17th century.
3. In the 19th century the scientists made the first attempts to apply scientific research to industrial innovation.
4. Thomas A.Edison was the only experimental scientist in the 19th century.
5. Influence of science on technology was a one-way process.
6. The term "High Technologies" has always meant computer technologies.

Give English equivalents of the following words and combinations:

расширять влияние; рост технологий; систематическое изучение; методы; приемы; попытка объяснить; точки пересечения/соприкосновения; технические новшества; ремесленники; защищать; привлекать чей-либо интерес; признавать; метод проб и ошибок; приводить к; применения; одностороннее влияние; поднимать на высокий уровень.

Fill in the sentences with the words or word combinations from the text:

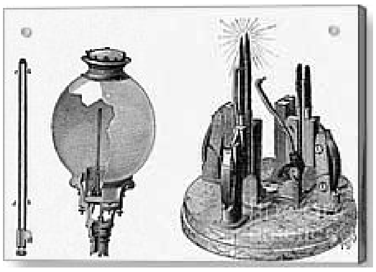
1. Technology is the systematic study of … and their … .
2. Science depended on the comparatively sophisticated skills of … and … .
3. Over the centuries the technology remained … to … of many types.
4. F.Bacon … three … : the magnatic compass, the printing press and gunpowder.
5. Advances in systems engineering, math modeling, technological assessment in industrial processes brought technology to its modern … .

Complete the following sentences:

1. Technology studies techniques … .
2. Science attempts to … .
3. Technology is concerned with …
4. Science was practised by … .
5. Technology was developed by … .
6. According to F.Bacon experimental science was … .
7. Modern term «high technology» implies … .

5. Read the text and find English equivalents for the following words:

под названием, вносить большой вклад, осуществлять революцию, гордиться учеными, первый в мире, использовать изобретения, за границей



Russia gave the world many outstanding scientists. Russian scientists made a great contribution to world science. V.V. Petrov (176l–1834), the follower of Lomonosov in studying electricity, is called a pioneer of the world electrical engineering. He was experimenting with electricity and made many discoveries of great importance. He published a great number of articles on electricity. The electric arc discovered by Petrov became the first source of electric lighting. Petrov discovered the possibility of getting metals out of ores by means of electricity. Academician E.Kh. Lenz (1804–1875) is one of the most prominent Russian physicists. He discovered the law of heat generation by an electric current and the law defining the direction of an induced electric current. P.M. Yablochkov (1847–1894) is a prominent inventor and designer. He did much for using alternating current. He is famous for inventing the «Yablochkov candle» (arc lamp) known abroad under the name of the «Russian Light».

A.S. Popov (1859–1906) is known for his invention of a radio. After demonstrating his device Popov was offered a lot of money for the commercial use of the radio abroad. But he was a true Russian patriot, he refused to leave Russia. He said that all his knowledge and his achievements belonged to his native land.

Dolivo-Dobrovolsky (1862–1919) is a Russian engineer. He is the inventor of a three-phase generator and a three-phase transformer. He proposed a number of original designs of measuring instruments. We know many other names of great Russian scientists and we are proud of them.

Lobachevsky's non-Euclidean geometry brought about a revolution in science. Mendeleev discovered the periodic law of elements. The world's first photoelectric cell was built by Stoletov. Lebedev succeeded in measuring the pressure of light experimentally. Zhukovsky and Chaplygin worked out the theory of flight and the principles of aerodynamics. Vernadsky laid the theory of flight and the principles of aerodynamics. Vernadsky laid the foundations of geochemistry – the science of chemical elements.

The first atomic power station and Yuri Gagarin's flight into space, lasers, semiconductors and many other achievements of modern science and technology have been created and discovered by such prominent Russian scientists as Tsiolkovsky and Kurchatov, Keldysh and Korolyov, Basov and Prokhorov and many others.

Look through the text and connect the verbs with prepositions and make sentences:

to be famous	out
to succeed	to
to belong	for
to be proud	in
to bring	of
to work	about

Answer the following questions:

1. Who is called a pioneer of the world electrical engineering?
2. What are Lenz's discoveries connected with?
3. What is Yablochkov known for?
4. What is Dolivo-Dobrovolsky famous for?
5. Whose name is linked to non-Euclidean geometry?
6. What field of science did Mendeleev and Vernadsky make great contribution to?
7. What scientists worked in the sphere of space flights?

Fill in the table about Russian inventors:

Inventor	Invention	Field of science
E.E. Artamonov		
I. Fedorov		
A.N. Lodygin		
I.I. Polzunov		
S.V. Lebedev		
M.V. Lomonosov		
N.I. Pirogov		

Choose the right inventor:

Who was the first to formulate the law of conservation of matter and movement?	E.E. Artamonov
Do you know the name of the outstanding engineer, designer and inventor who made one of the most remarkable watches of all times?	I. Fedorov
The Ural region was the homeland of such inventions as the first pedal bicycle, the steam-engine and the locomotive. What names are connected with these inventions?	A.N. Lodygin

Who was the first man to set up a printing press in our country?	I.I. Polzunov
Who did the idea of the incandescent lamp belong to?	S.V. Lebedev
Synthetic rubber was produced in Russia in 1910. Who was the author of this invention?	M.V. Lomonosov
The way for the scientific use of anesthesia was paved by a great Russian surgeon. What is his name?	N.I. Pirogov
Who is the founder of the materialist teaching on the higher nervous activity of animals and men?	I.P. Pavlov
	I.P. Kulibin
	The Cherepanovs

6. Complete the sentences with the right form of the word in bold:

1. The site is being … by a local property company. **DEVELOPMENT**
2. The manager gave us a brief … of the computer's functions**. DEMONSTRATE**
3. A scientist showed an … design of a new computer laboratory. **INVENTION**
4. Leaving your car unlocked is just … someone to steal it. **INVITATION**
5. … – a means of sending messages by the use of electric current along wires. **TELEGRAPH**

7. Complete definitions 1-15 with words and phrases:

safeguard	information technology	genetic engineering	life expectancy	biology
breakthrough	cybernetics	modified	cryogenics	experiment
technophobe	genetics	technocrat	research	innovation

1. _____ is the practice or science of changing the genes of a living thing, especially in order to make it more suitable for a particular purpose.
2. A _____ is a rule, law, or plan that protects people or something from harm or problems.
3. _____ is a study of living things.
4. A _____ is someone who does not like, trust or want to use technology, especially computers.
5. A _____ is a discovery or achievement that comes after a lot of hard work.
6. _____ is the study or use of computers and electronic systems for storing and using information.
7. If something is _____, it is changed slightly in order to improve it.
8. A _____ is a scientist who studies or works in genetics.
9. _____ is the use of technology to make copies of natural things (for example, artificial body parts).
10. A _____ is a scientist or other technical expert with a high position in industry or government.
11. _____ is a detailed study of something in order to discover new facts.
12. _____ is the science that studies the effect of low temperatures, especially the use of low temperatures for preserving the bodies of dead people.

13. An _____ is a scientific test to find out what happens to someone or something in particular conditions.
14. _____ is the length of time that someone is likely to live.
15. _____ is the invention or use of new ideas, methods, equipment, etc.

8. Complete the sentence by forming a word from the root in brackets at the end of the sentence. Use a dictionary if you need to:

Example: When you have finished your _dissection_ please turn to page 55 (dissect)
I came to the ______ that the theory was incorrect. (conclude)
Researchers must first make a careful _____ of the problem. (analyze)
Fleming was responsible for the _____ of penicillin. (discover)
The _____ of the earth on its axis causes night and day. (rotate)
The _____ of these two gases can be dangerous. (combine)
The scientists carried out many _____. (experiment)
Joy is a systems _____. (analyze)
We owe a great deal to the _____ of the steam engine. (invent)
The _____ of the steam engine was James Watt. (invent)
You must take out a _____ on this idea. (patent)
There was a violent _____ when the chemical was added. (react)
Scientists have to _____. (theory)
They also have to _____. (hypothesis)
Don't forget to switch on the video _____. (record)

9. Chose the types of technology which can be associated with the following:

digital technology satellite communication biotechnology artificial intelligence ergonomic

- around the world yachtsman/woman trying to establish his/her exact position
- a designer creating a new type of computer keyboard which would be more efficient
- a scientist producing a new type of wheat which does not need to be sprayed against insects
- a camera that does not use film
- a computer that could make decisions for itself

10. Read the text and complete it with words and phrases from the table. You may need to change the form of some of the words:

discover	life expectancy	breakthrough	internet	research
invent	e-mail	innovation/invention	technophobe	technophile
cybernetics	genetic engineering	nuclear engineering	safeguard	
analyze	experiment	control		

In scientific and technological terms, the twentieth century saw more changes than in the previous five hundred years. Penicillin was (1) _____ and used to treat infections that would have once been fatal, and there were many other remarkable advances in medicine that helped to increase our average (2) _____ way beyond that of our ancestors. Incredible (3) _____ such as television changed the way we now spend our leisure hours. Perhaps the most important (4) _____, however, was the microchip. Nobody could have imagined, when it was first (5) _____, that within a matter of years, this tiny piece of silicon and circuitry would be found in almost every household object from the kettle to the camcorder. And nobody could have predicted the sudden proliferation of computers that would completely change our lives, allowing us to access information from the other side of the world via the (6) _____ or send messages around the world by (7) _____ at the touch of a button. Meanwhile, (8) _____ into other aspects of information technology made it easier and cheaper for us to talk to friends and relations around the world. Good news for (9) _____ who love modern technology, bad news for the (10) _____ who would have preferred to hide from these modern miracles.

But everything has a price. The development of (11) _____ led to mass automation in factories, which in turn led to millions losing their jobs. The genius of Einstein led to the horrors of the atomic bomb and the dangerous uncertainties of (12) _____ (we often hear of accidents and mishaps at nuclear power stations around the world, where (13) _____ to prevent accidents were inadequate). The relatively new science of (14) _____ has been seen as a major step forward, but putting modified foods onto the market before scientists had properly (15) _____ them was perhaps one of the most irresponsible decisions of the late twentieth and early twenty-first century.

Meanwhile, pharmaceutical and cosmetic companies continue to (16) _____ on animals, a move that many consider to be cruel and unnecessary.

Of course we all rely on modern science and technology to improve our lives. However, we need to make sure that we (17) _____ it rather than the other way round.

11. Read the text.

THE HERO OF THE ELECTRICITY AGE

Thomas Alva Edison was born on February 11, 1847 in Milan, Ohio; the seventh and last child of Samuel and Nancy Edison. When Edison was seven, his family moved to Port Huron, Michigan. Edison lived here until he struck out on his own at the age of sixteen. Edison had very little formal education as a child, attending school only for three months. He was taught reading, writing, and arithmetic by his mother, but was always a very curious child and taught himself much by reading on his own. This belief in self-improvement remained throughout his life.

Edison began working at an early age, as most boys did at the time. At thirteen he took job as a newsboy, selling newspapers and candy on the local railroad that ran through Port Huron to Detroit. He seems to have spent much of his free time reading scientific and technical books, and also had opportunity at this time to learn how to operate a telegraph. By the time he was sixteen, Edison was proficient enough to work as a telegrapher full time.

The development of the telegraph was the first step in the communication revolution and the telegraph industry expanded rapidly in the second half of the 19th century. This rapid growth gave Edison and others like him a chance to travel, see the country and gain experience. Edison worked in a number of cities throughout the United States before arriving in Boston in 1868 where he began to change his profession from telegrapher to inventor. He received his first patent on an electric vote recorder, a device intended for use by elected bodies such as Congress to speed the voting process. In general, Edison was probably the world's greatest inventor. He had patented on 1,093 inventions.

Edison moved to New York City in 1869. He continued to work on inventions related to the telegraph and developed his first successful invention, an improved stock ticker called the «Universal Stock Printer». For this and some related inventions Edison was paid $40,000. Edison set up his first laboratory and manufacturing facility in New Jersey in 1871. During the next five years, Edison worked in Newark inventing and manufacturing devices that greatly improved the speed and efficiency of the telegraph. He also found time to get married to Mary Stilwell and start a family.

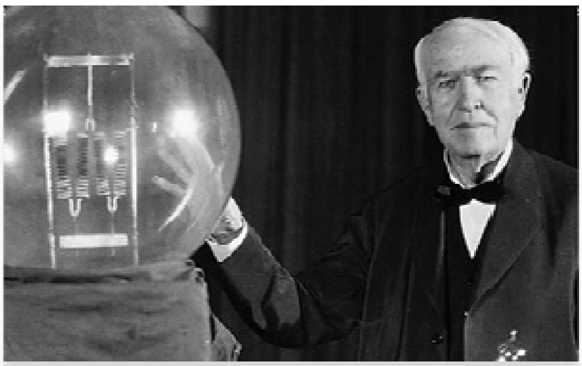
In 1876 Edison sold all his Newark manufacturing concerns and moved his family and staff of assistants to the small village of Menlo Park, 25 miles southwest of New York City. Edison established a new facility containing all the equipment so as to work on any invention. This research and development laboratory was the first of its kind anywhere; the model for later, modern facilities such as Bell Laboratories, this is sometimes considered Edison's greatest invention. Here Edison began to change the world.

The first great invention developed by Edison in Menlo Park was the tin foil phonograph. The first machine that could record and reproduce sound created a sensation and brought Edison international fame. Edison toured the country with the tin foil phonograph and was invited to the White House to demonstrate it to President Rutherford B. Hayes in April 1878.

In 1877 Edison made a recording on a little machine which he had invented and played it back to himself. Although he knew that he would hear his own words, he was astonished just the same when they were spoken back to him. The first phonograph was not at all like a record player of our time.

Edison next undertook his greatest challenge, the development of a practical incandescent, electric light. The idea of electric lighting was not new, and a number of people had worked on, and even developed forms of electric lighting. But up to that time, nothing had been developed that was remotely practical for home use. After one and a half year of work, success was achieved when an incandescent lamp with a filament of carbonized sewing thread burned for thirteen and a half hours. The first public demonstration of the Edison's incandescent lighting system was in December 1879, when the Menlo Park laboratory complex was electrically lighted. Edison spent the next several years creating the electric industry. In September 1882, the first commercial power station went into operation providing light and power to customers in a one square mile area; thus marking the beginning of the electric age.

The following decade was devoted to the invention and exploitation of methods for the distribution of electricity, improved dynamos and motors, and an electric railway for carrying freight and passengers. In 1885 he patented a method of transmitting telegraphic signals from moving train.



The success of his electric light brought Edison to new heights of fame and wealth, as electricity spread around the world. Edison's various electric companies continues to grow until in 1889 they were brought together to form Edison general Electric. Despite the use of Edison in the company title however, Edison never controlled this company. The tremendous amount of capital needed to develop the incandescent lighting industry had necessitated the involvement of investment bankers such as J.P. Morgan. When Edison General electric merged with its leading competitor Thompson-Houston in 1892, Edison was dropped from the name, and the company became simply General Electric.

This period of success was marred by the death of Edison's wife Mary in 1884. Edison's involvement in the business and of the electric industry had caused Edison to spend less time in Menlo Park. After Mary's death, Edison was there even less, living instead in New York City with his three children. A year later, while vacationing at a friend's house in New England, Edison met Mina Miller and fell in love. The couple married in February 1886 and moved to West Orange, New Jersey where Edison had purchased an estate Glenmont, for his bride. Thomas Edison lived here with Mina until his death.

When Edison moved to West Orange, he was doing experimental work in makeshift facilities in his electric lamp factory in nearby Harrison, New Jersey. However, a few months after his marriage, Edison decided to build a new laboratory in West Orange itself, less than a mile from his home. Edison possessed the both resources and experience by this time to build, «the best equipped and largest laboratory extant and facilities superior to any other for rapid and cheap development of an invention». The new laboratory complex consisting of five buildings opened in November 1887. The large size of the laboratory not only allowed Edison to work on any sort of project, but also allowed him to work on as many as ten or twenty projects at once. One of the projects he was involved in was the development of a better storage battery for use in electric vehicles which he enjoyed very much. He even owned a number of different types of automobiles, powered by gasoline, electricity, and steam. Edison thought that electric propulsion was clearly the best method of powering cars, but realized that conventional lead-acid storage batteries were inadequate for the job. Edison began to develop an alkaline battery in 1899. It proved to be Edison's most difficult project, taking ten years to develop a practical alkaline battery. By the time Edison introduced his new alkaline battery, the gasoline powered car had so improved that electric vehicles were becoming increasingly less common, being used mainly as delivery vehicles in cities. However, the Edison alkaline battery proved useful for lighting railway cars and signals, maritime buoys, and miners lamps. Further, Edison's work paved the way for the modern alkaline battery.

In 1913 he produced talking motion pictures. On his seventy-fifth birthday Edison was asked what his philosophy of life was. He said that work was bringing out secrets of nature and applying them for the happiness of man.

He worked till the very last moment of his life. At ten o'clock on the evening of his funeral, in homage to the memory of a great man, every American switched off the electric light and for the space of one minute the entire country was in darkness.

Edison was also a ruthless businessman who fought to defeat his competitors. One of the most famous examples of his competitive vigor was the war of the currents (direct current vs alternating current) he conducted to discredit Nicola Tesla's Alternating Current system.

Edison had enough genius to see the genius in others. Already by the time he moved to Menlo Park, he had gathered many of the men who would work with him for the rest of their lives. By the time Edison built his West Orange lab complex, men came from all over the US and Europe to work with the famous inventor. Often these young «muckers», as Edison called them, were fresh out of college or technical training. What better place to start a career? Unlike most inventors, Edison depended upon dozens of «muckers» to build and test his ideas. In return, they received «only workmen's wages». But, the inventor said, it was «not the money they want, but the chance for their ambition to work». The average work week was six days for a total of 55 hours. But if Edison had a bright idea, days at work would extend far into the night. What was it like to work for Edison? One «mucker» said that he «could wither one with his biting sarcasm or ridicule one into extinction». Just think how it would feel to listen to the world's greatest inventor criticize your work. On the other hand, as electrician Arthur Kennelly stated, «The privilege which I had being with this great man for six years was the greatest inspiration of my life».

Answer the following questions:

1. What kind of education did Edison get?
2. How did phonograph work?
3. How many inventions did Edison patent?
4. How did Edison's electric light work and how was it improved?
5. What was his philosophy of life?
6. Could you name other men of science equally possessed by the idea to create so that they were «deaf and blind to everything else in the world except science?» like Edison?
7. How can you characterize Edison's education?
8. Did Edison create for people or was his only goal to find medium for the expression of his ideas, feelings, and get free of his obsession?
9. How did Edison's inventions change our everyday life?

Complete the sentences with prepositions if necessary:

1. Edison attended … schools only for three month. 2. At the age of 13 Edison began to work … a newsboy, selling newspapers and candy. 3. A number of people had worked … the idea related … developing electric lighting. 4. He began work … a large difference engine which he believed he could complete in three years. 5. Edison hired the young engineers who were superior … the any other candidates.

Give English equivalents to the following words and word combinations:

получить работу; воспроизвести звук; самосовершенствование; приносить международную славу; записать, сделать запись; любопытный ребенок; ходить в школу; проводить много свободного времени; читать научные и технические книги; дать шанс; обзавестись семьей; капиталовложения банкиров; конкурент, соперник; самостоятельно обучаться; основать первую лабораторию.

Comment on the following quotations:

«Necessity is the mother of invention» (Plato, 427–327 B.C.)
«Experience, the universal Mother of Sciences» (Miguel de Cervantes, 1547–1616)
«Invention breeds invention» (Ralph Waldo Emerson, 1803–1882)

Find information about Guglielmo Marconi and choose the correct option:

Guglielmo Marconi was the first who

1) assembled radio.
2) invented radio.
3) transmitted the first radio signal.

As a boy he liked to spend his free time
1) carrying out laboratory experiments.
2) studying with the help of a private tutor.
3) reading the works of famous scientists.

He received higher education
1) with the help of a private physics tutor.
2) on his own but it was very hard.
3) He never had any kind of a university degree.

He was granted his first patent for
1) magnetic detector.
2) a system of wireless telegraphy.
3) horizontal directional aerial.

A lot of people didn't think he was a great scientist because
1) he was not the only person who sent wireless messages.
2) he was not the first person who sent wireless messages.
3) he never sent any wireless messages.

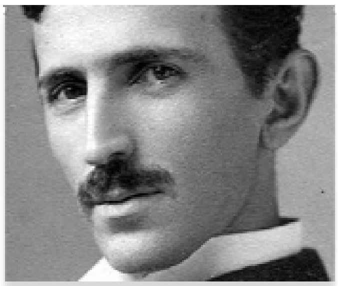
During his life Marconi considered himself to be
1) a successful industrialist and businessman.
2) a famous inventor.
3) an outstanding physicist.

Cross out an odd word in each line:

to conduct: an experiment, a baby, an interview, an orchestra
to erect: a station, a leg, a tent, an institution.
short: waves, building, man, speech.
fundamental: mistake, distinction, discovery, hotel.
to assemble: a car, an army, forces, flowers.

12. Read the text:

THE GENIUS WHO LIT THE WORLD



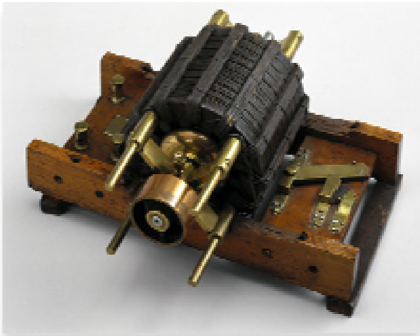
Nikola Tesla was born on July 10, 1856 in Smiljan, Croatia, which was then part of the Austo-Hungarian Empire. His father was a Serbian Orthodox Priest and his mother was an inventor in her own right of household appliances. Tesla studied at the Realschule, the Polytechnic Institute in Graz, Austria and the University of Prague. At first, he intended to specialize in physics and mathematics, but soon he became fascinated with electricity. (1)

He began his career as an electrical engineer with a walking with a friend through the city park after seeing a telephone company in Budapest in 1881. Once when Tesla was walking with a friend through the city park, the elusive solution to the rotating magnetic field flashed through his mind. With a stick, he drew a diagram in the sand explaining to his friend the principle of the induction motor. Before going to America, Tesla joined Continental Edison Company in Paris where he designed dynamos. While in Strasbourg in 1883, he privately built a prototype of the induction motor and ran it successfully. Unable to interest anyone in Europe in promoting this radical device, Tesla accepted an offer to work for Thomas Edison in New York. His childhood dream was to come to America to harness the power of Niagara Falls. (2)

Nikola Tesla came to the United States in 1884 with an introduction letter from Charles Batchelor to Thomas Edison: «I know two great men», wrote Batchelor, «one is you and the other is this young man». Tesla spent the next 59 years of his productive life living in New York. Tesla set about improving Edison's line of dynamos while working in Edison's lab in New Jersey. It was here that his disagreement with Edison over direct current versus alternating current began and soon led to the war of the currents as Edison fought a losing battle to protect his investment in direct current equipment and facilities. Tesla pointed out the inefficiency of Edison's direct current electrical powerhouses that had been built up and down the Atlantic seaboard. The secret, he felt, lay in the use of alternating current, because to him all energies were cyclic. Why not build generators that would send electrical energy along distribution lines first one way, than another, in multiple waves using the polyphase principle? (3)

Edison's lamps were weak and inefficient when supplied by direct current. This system had a severe disadvantage in that it could not be transported more than two miles due to its inability to step up to high voltage levels necessary for long distance transmission. Consequently, a direct current power station was required at two mile intervals. Direct current flows continuously in one direction; alternating current changes direction 50 or 60 times per second and can be stepped up to vary high voltage levels, minimizing power loss across great distances. He was convinced that the future belonged to alternating current. Nikola Tesla developed polyphase alternating current system of generators, motors and transformers and held 40 basic U.S. patents on the system. He introduced his motors and systems in a classic paper, «A New System of Alternating Current Motors and Transformers» which he delivered before the American Institute of Electrical Engineers in 1888. One of the most impressed was the industrialist and inventor George Westinghouse. One day he visited Tesla's laboratory and was amazed at what he saw. Tesla had constructed a model polyphase system consisting of an alternating current dynamo, step-up and step-down transformers and A.C. motor at the other end. The perfect partnership between Tesla and Westinghouse for the nationwide use of electricity in America had begun. (4)

Later Tesla discovered the principle that drives almost every practical use of electricity today, the rotating magnetic field. The field is what powers generators and all forms of electrical motors. Although the generator had already been discovered, it was Tesla who figured out why it worked. (5)



Tesla was a pioneer in many fields. The Tesla coil, which he invented in 1891, is widely used today in radio and television sets and other electronic equipment. That year also marked the date of Tesla's United States citizenship. His alternating current induction motor is considered one of the ten greatest discoveries of all time. Among his discoveries are the fluorescent light, laser beam, wireless communications, wireless transmission of electrical energy, remote control, robotics, Tesla's turbines and vertical take off aircraft[1]. Tesla is the father of the radio and the modern electrical transmissions systems. He registered over 700 patents worldwide. His vision included exploration of solar energy and the power of the sea. He foresaw interplanetary communications and satellites. (6)

The Electrical Review in 1896 published X-rays of a man, made by Tesla, with X-ray tubes of his own design. They appeared at the same time as when Roentgen announced his discovery of X-rays. Tesla never attempted to proclaim priority. Roentgen congratulated Tesla on his sophisticated X-ray pictures, and Tesla even wrote Roentgen's name on one of his films. He published schematic diagrams describing all the basic elements of the radio transmitter which was later used by Marconi. In 1896 Tesla constructed an instrument to receive radio waves. He experimented with this device and transmitted radio waves from his laboratory on South 5th Avenue to the Gerlach Hotel at 27th Street in Manhattan. The device had a magnet which gave off intense magnetic fields up to 20,000 lines per centimeter. The radio device clearly establishes his priority in the discovery of radio. And in 1943 the United States Supreme Court, held Marconi's most important patent invalid, recognizing Tesla's more significant contribution as the inventor of radio technology. (7)

Tesla built an experimental station in Colorado Springs, Colorado in 1899, to experiment with high voltage, high frequency electricity and other phenomena. When the Colorado Springs Tesla Coil magnifying transmitter[2] was energized, it created sparks 30 feet long. From the outside antenna, these sparks could be seen from a distance of ten miles. From this laboratory, Tesla generated and sent out wireless waves which mediated energy, without wires for miles. In Colorado Springs, where he stayed from May 1899 until 1900, Tesla made what he regarded as his most important discovery – terrestrial stationary waves. By this discovery he proved that the Earth could be used as a conductor and would be as responsive as a tuning fork to electrical vibrations of a certain frequency. He also lighted 200 lamps without wires from a distance of 25 miles and created man-made lightning. At one time he was certain he had received signals from another planet in his Colorado laboratory. (8)

The old Waldorf Astoria was the residence of Nikola Tesla for many years. He lived there when he was at the height of financial and intellectual power. Tesla organized elaborate dinners, inviting famous people who later witnessed spectacular electrical experiments in his laboratory. (9)

Tesla lectured to the scientific community on his inventions in America and before scientific organizations in both England and France in 1892. Tesla's lectures and writings of the 1890s aroused wide admiration among contemporaries, popularized his inventions and inspired untold numbers of younger men to enter the new field of radio and electrical science. (10)

Nikola Tesla was one of the most celebrated personalities in the American press, in this century. Tesla was the genius who ushered in the age of electrical power. Tesla had a vivid imagination and an intuitive way of developing scientific hypotheses. He used his imagination to prove and apply his hypotheses. Here is how he explained his creative process: *«Before I put a sketch on paper, the whole idea is worked out mentally. In my mind I change the construction, make improvements, and even operate the device. Without ever having drawn a sketch I can give the measurements of all parts to workmen, and when completed all these parts will fit, just as certainly as though I had made the actual* *drawings. It is immaterial to me whether I run my machine in my mind or test it in my shop. The inventions I have conceived in this way have always worked. In thirty years there has not been a single exception. My first electric motor, the vacuum wireless light, my turbine engine and many other devices have all been developed in exactly this way.»* (11)

Tesla possessed a striking physical appearance over six feet tall with deep set eyes and a stately manner. To the contemporaries he was a man endowed with remarkable physical and mental freshness, ready to surprise the world with more and more inventions as he grew older. (12)

In 1915, a New York Times article announced that Tesla and Edison were to share the Nobel Prize for physics. Oddly, neither man received the prize, the reason being unclear. It was rumored that Tesla refused the prize because he would not share with Edison, and because Marconi had already received his. (13)

Tesla was clearly ahead of his time, a problem which would haunt his entire career. His inventions and patents for remote operation of robotic devices, for instance, were stunningly advanced but largely ignored at the time. The military inexplicably failed to understand the usefulness of remote-controlled attack vehicles and torpedoes until after Tesla's patents had expired. Even then, they began researching it over from scratch, rather than working with his established techniques. The end result was military technology nearly identical to Tesla's inventions, but developed literally decades later and at many times the cost. Tesla never made a dime off of the discovery of the radio-controlled automation that today is the basis of a multibillion dollar aerospace specialty. (14)

Answer the following questions:

1. What sciences attracted Tesla?
2. Where did he work?
3. What was his childhood ambition? Did he achieve it?
4. How did he come across the idea of induction motor?
5. What device did Tesla conceive and design first?
6. Did European manufacturers get interested in it?
7. What advantages did alternating current have over/versus direct current?
8. What was the reason for the war of currents?
9. What invention did Tesla consider his most important one?
10. What did he look like?
11. How did Tesla develop his ideas?
12. Which device by Tesla is still widely used in electronic equipment?
13. Were Tesla's inventions and ideas studied after his death?
14. Do you think Nikola Tesla was a successful inventor?

Using the affixes *in-* (*il-*, *ir-*, *im-*), *un-*, *dis-*, *mis-*, *-less* make the opposites to the following words:

connect	responsible	literate	use	finite
logical	advantage	care	take	finished
possible	complete	productive	accuracy	understood
fortunate	patient	like	publish	real

Complete the sentences with prepositions if necessary:

1. While studying at the University of Prague, Tesla was fascinated … electricity.
2. In the USA he joined … T. Edison's team in New Jersey.
3. Nikola Tesla worked … Edison until Tesla conceived polyphase alternating current system.
4. How many inventions did Tesla hold patens …?
5. Tesla experimented a lot … radio waves, X-rays and terrestrial stationary waves.
6. Tesla had many reasons to refuse … the Nobel Prize.

Give English equivalents to the following words and word combinations:
специализироваться в к-л области науки; представить устройство; разрабатывать динамо-машину; неэффективность ламп; серьезный недостаток; сводить потери мощности к минимуму; идеальное сотрудничество; постигать принцип; предвидеть межпланетную связь; объявить об открытии; заявлять о первенстве; наземные стационарные волны; искусственная молния; мысленно разрабатывать; усовершенствовать устройство; делать набросок; задумать изобретение; отказаться от приза.

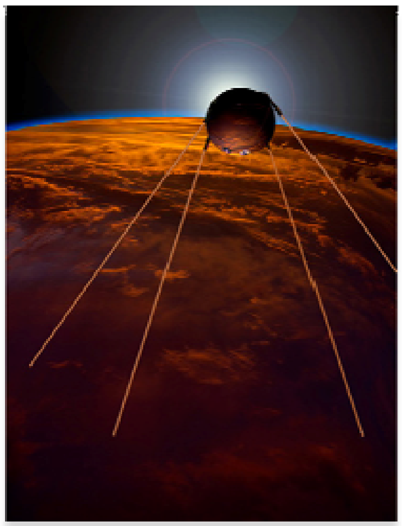
Sum up the text using the following key-points:

- Edison's family background
- His main interests
- Areas of science and research activity
- Major achievements
- Personality

13. Read the text.

SCIENTIFIC AND TECHNOLOGICAL PROGRESS IN MODERN SOCIETY

We live in a world created by science. Our epoch is an epoch of scientific and technological revolution when new ideas are being born and new discoveries and inventions are being made. To illustrate this statement one may mention the telephone, the radio, the television, the automobile, the airplane and the like. Man has created complex cybernetic machines and made nuclear energy work for him. He has developed modern automatic production lines, laser technology and all kinds of computers. The list of major scientific achievements could be continued.



At the beginning of the 20-th century we could hardly believe that we should be able to sit at home and watch astronauts working in space. Twelve years separated the launching of the «Sputnik-1» Soviet satellite in 1957 and man's first landing on the Moon in 1969. The first long-term «Salyut» orbital station launched in 1971 opened a new era in space research. Some automatic interplanetary stations have reached Mars and Venus and have explored the planets' physical conditions. In 1981 we could witness the launching of a typically new cosmic vehicle – the Shuttle. Scientific achievements in space research gave the possibility of conducting investigations in the fields of astrophysics, medicine, biology, geology and some others.

One of the major problems of modern physics is the study of the atomic nucleus and elementary particles. A well-known Russian scientist Igor Kurchatov made a great contribution to the theory of elementary particles and to the experimental techniques which made it possible to use nuclear energy for practical purposes. Modern nuclear research requires complex and costly apparatus including powerful accelerator facilities. The Joint Institute of Nuclear Research at Dubna has created and launched a high-energy accelerator – protonsynchrotron (синхрофазотрон). The scientists of Dubna are conducting intensive research into the problem of controlled thermonuclear reactions which could provide mankind with an inexhaustible source of energy. World science has already heard of the «TOKAMAK» nuclear installation which is to provide the basis for the first thermonuclear power stations by the end of the 20-th century.

The most important role for modern technology is played by automation. Automation should contribute to high production efficiency. Advanced automation is based on computers. At present computer science is the most promising one. Computers are able to help space programmes, armed forces, business and industry, sports and medicine. As computers work accurately and at high speeds they save years of research workers' hard work. Automation and computer science are of great social importance.

Translate and find related words to the following words:
Technology, automation, to produce, science, to achieve, to launch, orbit, planet, physics, to investigate, atom, nucleus, element, part, experiment, power, to accelerate, to install, efficient, important.

Translate the phrases:

Научно-техническая революция, кибернетическая машина, ядерная энергия, поточная линия, лазерная технология, научные достижения, орбитальная станция, исследование космоса, межпланетные станции, физические условия, космический корабль, атомное ядро, элементарные частицы, экспериментальный метод, ядерное исследование, термоядерная реакция, источник энергии, ядерная установка, современная техника, производственная эффективность, высокая автоматизация, вычислительная техника, научный работник.

Translate sentences:

1. Мы стали свидетелями новых открытий. 2. Человек сумел создать сложные кибернетические машины. 3. Студентам необходимо регулярно работать с компьютерами. 4. В космосе ученые проводят биологические и медицинские опыты. 5. Компьютеры должны экономить рабочее время специалистов.

Connect definitions with the words:
Discovery, invention, nuclear energy, achievement, astronaut, biology, accelerator, automation, computer, research worker.

1. The science about the physical life of animals and plants.
2. A person who travels in a space vehicle.
3. An electronic device which stores, analyses and produces information.
4. The power of atomic nucleus.
5. Getting knowledge of something existing but not yet known.
6. A thing done successfully.
7. A device used for accelerating nuclear particles.
8. The creation of something not existing before.

9. A person engaged in investigation to discover new facts or information.
10. The use of machines to save labour.

Retell the text according to the plan:

The text is entitled...
It deals with...
The text can be divided into... logical parts.
The first (second, etc.) part contains (describes, enumerates, speaks about, touches upon, etc.)...

14. Read the text and translate it.

SCIENCE AND INTERNATIONAL COOPERATION

Modern science is characterized by increasing the tendency towards closer cooperation between scientists and scientific institutions all over the world. Many problems that affect the world today cannot be solved without joining scientific efforts and material resources on a world-wide scale. The exploration of space, world finance, global environment protection problems and the development of new sources of the power are the examples of areas of scientific research which are so costly and complicated that it is difficult for a single country to solve them efficiently and in a short period of time.

Many countries are successfully cooperating on a programme called «Intercosmos» and have already launched 23 «Intercosmos» satellites, 11 vertical geophysical rockets and a large number of artificial satellites. Russia conducts space exploration programmes together with the USA, France, Sweden, Austria and India. Joint manned flights of Russian and foreign cosmonauts included citizens from numerous countries. 12 international crews worked in orbit and carried out more than 200 scientific experiments.

Another sphere of international cooperation among scientists is high-energy physics. Dubna is the town where a large international group of physicists is constantly researching new nuclear particles. It is a tremendous scientific complex of six large laboratories called the Joint Institute of Nuclear Research. The Institute prepares research personnel for its member-countries. The laboratories are staffed by young talented scientists from different countries. Physicists heed regular contacts, discussions and seminars. So Dubna is known as a town of international friendship.

Find English equivalents from text «Science and international cooperation».

Научное учреждение, материальные ресурсы, исследование космоса, защита окружающей среды, источники энергии, научное исследование, запускать спутники, осуществлять программы, пилотируемые полёты, интернациональные экипажи, научные эксперименты, ядерные частицы.

Find English synonyms of the following words and make sentences with them:

establishment, to influence, to decide, to combine, force, research, working-out, energy, field, complex, hard, sputnik, cosmos.

Make a short annotation to the text.

Translate the text into English.

Ученые всего мира стремятся к плодотворному сотрудничеству. Сегодня многие научные проблемы можно решить, только объединив материальные, технические и умственные ресурсы разных стран. Развитые страны успешно сотрудничают в области физики больших энергий. Физики, работающие в Объединенном институте ядерных исследований, регулярно проводят семинары и конференции по проблемам ядерной энергетики.

15. Read the text, give the title, divide it into paragraphs and write a short annotation to it:

Title ____

Annotation ____

____

____

____

____

The Coordinated Science Centre in Moscow works for the application of science and research for useful purposes. It has a broad programme of activities and can perform various researches. There are 10 departments in the Centre. The laboratories of these departments carry out investigations on the basis of advanced facilities. The Centre also has a few experimental plants. More than3000 staff members are engaged in individual and group researches. Research teams are organized to work at a specific problem to be solved coordinating the skills of scientists, engineers and economists. The present activities of the Centre include research programmes in solid state physics, semiconductor physics, advanced automation, communication systems, computer-aided design, human-computer interaction, information science systems, energy studies, man-machine systems, studies of the human environment. Integration of research with education has been a decisive factor in the distinguished reputation enjoyed by the Centre. Both graduates and undergraduates cooperate with staff members in research activities, and concepts developed through research are reflected in the instructional programme at all academic levels. The close contact of higher schools with the Coordinated Science Centre introduces students to the latest achievements in science and engineering, and helps them to learn modern research methods and handle the most complex equipment. The Coordinated Science Centre may be considered a multinational organization. It is supported by the governments of several countries. In some fields the very nature of the work may demand facilities which a particular country does not possess. Space exploration with joint flights is one example of this approach. That is why the Centre cooperates with research laboratories in Germany, Poland, Bulgaria and some other countries. There is a special committee at the Centre which holds symposia, conferences, seminars, and meetings aimed at increasing international research cooperation. The study of the ocean, the atmosphere, the inner structure of the earth, environmental protection, health protection and other global problems can be solved only if scientists of many countries unite their efforts.

Find English equivalents from the text:

Научный центр, программа деятельности, проводить исследования, усовершенствованное оборудование, коллективное исследование, исследовательские коллективы, автоматизированное проектирование, обучающая программа, достижения науки и техники, управлять оборудованием, международное сотрудничество, защита окружающей среды.

Translate the following phrases into Russian and make sentences with them in Russian and ask your group-mates to translate them into English:

Research programmes, solid state physics, semiconductor physics, communication systems, human-computer interaction, information science systems, man-machine systems, energy studies, human environment, staff members, research activities, research methods, research cooperation, health protection.

16. Read the text:

THE RUSSIAN ACADEMY OF SCIENCE (RAS)

In 1724, Peter the Great established the Academy of Sciences as part of his push for reform to strengthen Russia. He wished to make the country as economically and politically independent as possible and he was aware of how important scientific thought, along with education and culture, was to this. However, unlike other foreign organizations at that time, the Academy was a state institution, which Peter intended should offer scientists from any country the opportunity to do their research in complete freedom, as well as providing the opportunity for students to study under these famous people. The Academy officially opened in 1725.

Over the next three decades, work was done in many fields, among them: work on electricity and magnetism theory. Research enabled the development of mining, metallurgy, and other branches of Russian industry. Work was done in geodesy and cartography and 1745 saw the first atlas of Russia created.

From its earliest days, the Academy carried out mathematical research, which added greatly to the development of calculus, hydrodynamics, mechanics, optics, astronomy, and made discoveries in various fields, such as chemistry, physics and geology. In addition, expeditions in1733–1742 and 1760–1770 helped contribute to the discovery of Russia's natural resources.

The 19th century was a time of many more contributions from the Academy. The Academy's naturalists were involved in voyages of discovery, including that of F.F. Bellingshausen and M.P. Lazarev in 1820, when Antarctica was discovered. In the fields of mathematics and physics, progress was furthered by N.I. Lobachevskv and his theory of non-Euclidean geometry as well as by P.L. Chebyshev who made progress in the field of probability, statistics and Number Theory. Other notable achievements were the invention of the radio, the creation of the periodic table of the chemical elements, the discovery of viruses and the cell mechanisms of immunity. In the 1890s and early 1900s, I.P. Pavlov carried out experiments which resulted in the discovery of classical conditioning or conditioned reflexes. Clearly, throughout the 18th and 19th centuries and into the 20th century, the Russian Academy led the way in Russian science.

In 1925, the name of the Academy changed to the Academy of Sciences of the USSR. One of the achievements of the Academy was to help set up scientific research centres in all Soviet republics. The Academy also gave scientists the opportunity to work and study in different parts of the USSR and abroad. In 1934, its headquarters were moved to Moscow. At that time, it had 25 member institutions. The Academy continued to grow, reaching a high point of 260 member institutions. In 1991, after the breakup of the USSR, the Academy's name was changed to the Russian Academy of Sciences (RAS).

Today, the RAS supervises the research of a large group of institutions within Russia which focus on different research areas, including philosophy, botany, anthropology, paleontology and archaeology as well as nuclear physics, astrophysics, mathematics, computer engineering and many others. A special Internet system, called the Russian Space Science Internet (RSSI), which links over 3000 members, has also been set up.

Becoming a member of the RAS is not easy. Only scientific researchers who have done outstanding work or who have great potential are chosen to become members.

Last but not least, the RAS gives awards to members who have made significant discoveries. Its highest award is the Lomonosov Medal, named after the outstanding Russian scientist, writer and polymath of the 18th century. Many RAS award winners have later gone on to be awarded prestigious Nobel Prizes.

Read the text one more time and decide if the following statements are true or false:

1. Peter the Great set up educational and cultural centres.
2. The Academy was unusual in not being a private interest.
3. The 19th century was a time of numerous expeditions to find Antarctica.
4. In the 20th century, the Academy changed name several times and moved its central office.
5. Nowadays, members are obliged to communicate via the Internet.

Retell the text about Russian Academy of Science due to the plan:

- the history of the RAS;
- goals of the RAS;
- examples of Academy's success.

2.3. PRODUCTION

1. Find information about Nobel Prize and be ready to answer the questions:

1. What is a Nobel Prize?
2. Who decided to set up the Nobel Prizes and why?
3. Who were the last scientists to receive this prize? What did they receive it for?
4. How are people nominated for these prizes?

2. Write an article on the history of the Nobel Prize and give some examples of scientists who have won it. (200-250 words)

Paragraph 1 Explain what the Nobel Prize is and give a brief history of it;
Paragraph 2/3 Give two or three examples of Russian scientists who have won the Nobel Prize and explain why have they won it. Which achievement do you consider to be the most important one? Why?
Paragraph 4 Sum up by saying what the Prize represents and that many Russian scientists have been proud receivers.

3. **Participate in a Student Conference.**

Hold a mini-conference in your group devoted to the outstanding people in your field of science (information technologies, mathematics, physics, engineering, systems analysis). Prepare a five-minute presentation on the scientist's biography and work.

- Find information on any scientist or inventor who is the most interesting from the point of view of the biography and contribution. Think of bits that might get listeners interested.
- Develop the materials into separate paragraphs. Write each paragraph on a separate piece of paper.
- Structure your text. Decide on the order of each paragraph.
- Write the text as a whole, adding introduction, conclusion and links between paragraphs.
- Think of a «catchy» beginning and an interesting ending but be brief.
- Proofread the material checking the spelling, punctuation, grammar and vocabulary.
- Practise to be very precise with time: rehearse it.
- Don't forget you must speak, not read.
- Use various visual aids (handouts, PowerPoint, photos, sound) to make your presentation interesting and captivating.
- Be ready to answer any questions that might arise.

Useful links:

- Scientists, Inventors and Explorers - Guide to science biography indexed by subject and academic level, timelines and science on stamps
  http://www.juliantrubin.com/sciencebiography.html
- Academy of US Achievement: Science and Exploration – Collection of Biographies of US explorers, profiles and interviews with them.
  http://www.achievement.org/autodoc/halls/sci
- Biographies PolySearch Engine – Search for biographical information, sketches, and full biographies of famous and infamous scientists.
  http://www2.hawaii.edu/~jacso/extra/egyeb/poly-bio.htm
- About: Inventors – A collection of biographies of famous inventors indexed in alphabetical order
  http://inventors.about.com/library/bl/bl1_1.htm

4. **Divide into the groups and choose a topic to discuss:**

- the positive impact of new technologies on people's lives;
- the negative impact of new technologies on people's lives;
- retarded technologies: pros and cons.

5. **Think of supporting sentences for each of the topic sentences. Work in pairs:**

- Many people think that using a computer is an enjoyable time.
- Soon art will be created on computers.
- Computers and computer labs are very expensive to set up and maintain.
- Sitting in front of a computer screen all day can make students feel lonely and bored.

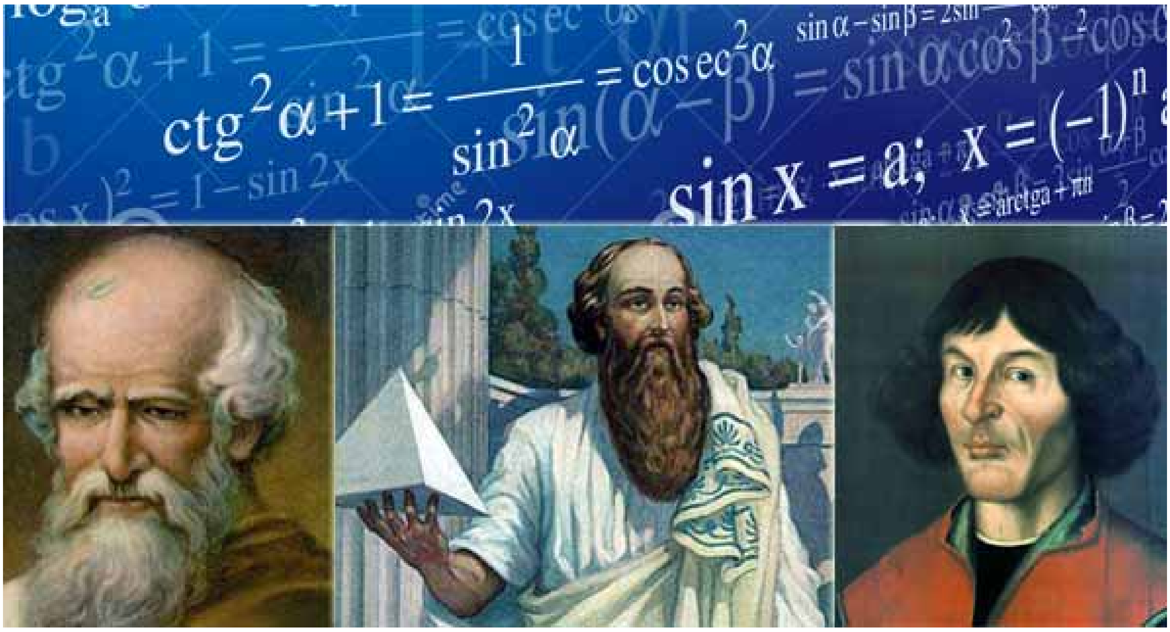
6. **Work in groups of 3 - 4. Find information about one of the departments at your faculty and prepare a poster presentation of it. Include the following topics:**
   - history of the department;
   - prominent scientists and teachers who work in the department, famous graduates;
   - scientific research carried out by the department fellows.
7. **Collect information about various inventors (date of birth/death, nationality, etc.) and their inventions (year, reason/use, etc.). Find or draw pictures and prepare a poster of famous inventors and their inventions.**
8. **Write an essay (200-250 words). Topics for essay writing:**
   1. Present development of technology has great impact on modern society.
   2. Technology plays an important role in people's lives, transforming them whether for good or for ill.
   3. Science and technology are two sides of one coin.
   4. Since the 20^{th} century the relations between science and technology have been a two-way process.
   5. Advanced technologies enable people to do useful new things or to do old things efficiently.
   6. Term «high technology» is a symbol of progress.
9. **Paraphrase the famous quotations:**

   Lewis Mumford (US philosopher) «Modern science and techniques have taught mankind at least one lesson: Nothing is impossible».

   Clive James (Australian critics) «It is only when they go wrong that machines remind you how powerful they are».

   Joseph Wood Krutch (US naturalist) «As machines get to be more and more like men, men will come to be more like machines».

MODULE 3
MATHEMATICS



3.1. KEY VOCABULARY

Mind the pronunciation:

plane figure	[pleɪn ˈfɪgə]	плоская фигура
line segment	[laɪn ˈsegment]	часть прямой линии
ray	[reɪ]	луч
triangle	[ˈtraɪæŋgl̩]	треугольник
circle	[ˈsɜːkl̩]	круг
closed curve	[kləʊzd kɜːv]	замкнутая кривая
polygon	[ˈpɒlɪgən]	многоугольник
vertice	[vɜːtis]	вершина
quadrilateral	[ˌkwɒdrɪˈlætərəl]	четырехугольник
trapezoid	[ˈtræpɪzɔɪd]	трапеция
rectangle	[ˈrektæŋgl̩]	прямоугольник
polyhedron	[ˌpɒliˈhiːdrən]	многогранник
octahedron	[ˌɒktəˈhiːdrən]	восьмигранник
icosahedron	[ˌaikəsəˈhiːdrən]	двадцатигранник
reasoning	[ˈriːzənɪŋ]	рассуждение, обоснование
proposition	[ˌprɒp.əˈzɪʃ.ən]	предложение, утверждение (требующее доказательства), теорема
proof	[pruːf]	доказательство

plane	[pleɪn]	плоскость
congruent	[ˈkɒŋgrʊənt]	конгруэнтный, совмещающийся
arc	[ɑːk]	дуга, арка
corollary	[kəˈrɒləri]	следствие
hypothesis	[haɪˈpɒθəsɪs]	гипотеза
rephrase	[ˌriːˈfreɪz]	перефразировать
converse theorem	[kənˈvɜːs ˈθɪərəm]	обратная теорема
bisector	[baɪˈsektə]	биссектриса
assumption	[əˈsʌmpʃn̩]	предположение, допущение
deduce	[dɪˈdjuːs]	выводить заключение, формулу
point	[pɔɪnt]	точка
dot	[dɒt]	точка
dimension	[dɪˈmenʃn̩]	измерение
undefined	[ˌʌndɪˈfaɪnd]	неопределенный
length	[leŋθ]	длина
thickness	[ˈθɪknəs]	толщина
depth	[depθ]	глубина
flat	[flæt]	плоский
infinitely	[ˈɪnfɪnətli]	бесконечно
intersect	[ˌɪntəˈsekt]	пересекать
coincide	[ˌkəʊɪnˈsaɪd]	совпадать
vertex	[ˈvɜːteks]	вершина
sine	[saɪn]	синус
interior	[ɪnˈtɪərɪə]	внутренняя часть
acute	[əˈkjuːt]	острый (угол)
obtuse	[əbˈtjuːs]	тупой (угол)
align	[əˈlaɪn]	ставить в ряд
protractor	[prəˈtræktə]	транспортир
plus	[plʌs]	плюс
summand	[ˈsʌmænd]	слагаемое
addend	[ˈædend]	слагаемое
sum	[sʌm]	сумма
minuend	[ˈmɪnjʊend]	уменьшаемое
subtrahend	[ˌsʌbtrəˈhend]	вычитаемое
difference	[ˈdɪfrəns]	разность
multiplicand	[mʌltɪplɪˈkænd]	множимое

multiplier	[ˈmʌltɪplaɪə]	множитель
dividend	[ˈdɪv.ɪ.dend]	делимое
divisor	[dɪˈvaɪ.zər]	делитель
quotient	[ˈkwəʊ.ʃənt]	частное
involution or Raise to power	[ɪnvəˈluːʃn ɔː(r) reɪz tə paʊ]	возведение в степень
evolution	[ˌiː.vəˈluː.ʃən]	извлечение из корня
to extract the root of	[tə ɪkˈstrækt ðə ruːt əv]	извлекать корень из…

3.2. READING AND SPEAKING

1. Read the following information:

Addition

$a+b=c$ is read: *a* plus *b* equals *c*; *a* and *b* is equal to *c*; *a* added to *b* makes *c*; *a* plus *b* is *c*.
a, *b* are called «addends» or «summands»; *c* is the «sum».

Subtraction

$4-1=3$ is read: three from four is one; four minus three is one; four minus three is equal to one; four minus three makes one; the difference between four and three is one; three from four leave(s) one.
4 is called «a minuend»; 3 is «a subtrahend»; 1 is «a difference».

Multiplication

$2\times 3=6$; $2\cdot 3=6$ is read: two multiplied by three is six; twice three is six; three times two is six; two times three make(s) six.
$5\cdot 3=15$ five threes is (are) fifteen; 2, 5 are «multiplicands»;
3 is «a multiplier» / «factor»; 6 is «a product».

Division

$35/7=7$ is read: thirty five divided by five is 7; five into thirty five goes seven times; 35 divided by 5 equals 7.
35 is «a dividend»; 5 is «a divisor»; 7 is «a quotient».

Involution or Raise to power

32, 53 are read: three to the second power or 3 squared; five cubed or 5 to the third power (to power three).
x^2 *x* is called the «base of the power»; 2 is called «an exponent or index of the power».

Evolution

$\sqrt{9}=3$ is read: the square root of nine is three.
$\sqrt[3]{27}=3$ is read: the cube root of twenty seven is three.
$\sqrt{\ }$ is called «the radical sign» or «the sign of the root».

Equations

There are different kinds of equations. In general the equation is an equality with one or several unknown variable(s). The reading of equations is the same as in Russian:

$30+15+x^2+x^3=90$ – is read: thirty plus fifteen plus *x* squared plus *x* cubed is equal to ninety.

$2+b+\sqrt{6}+b4=160$ – is read: two plus *b* plus the square root of six plus *b* to the fourth power is equal one hundred and sixty.

The identity is an equality, valid at all admissible values of its variables. The identities are read:

$a+b=b+a$ – *a* plus *b* equals *b* plus *a*;

$\sin 2x+\cos 2x=1$ – sine squared *x* plus cosine squared *x* is equal to one.

2. Examples of reading:

129,862	one hundred and twenty-nine thousand, eight hundred and sixty-two	сто двадцать девять тысяч восемьсот шестьдесят два
583,950,487	five hundred and eighty-three million, nine hundred and fifty thousand, four hundred and eighty-seven	пятьсот восемьдесят три миллиона девятьсот пятьдесят тысяч четыреста восемьдесят семь
8,004,090,871	eight billion, four million, ninety thousand, eight hundred and seventy-one	восемь миллиардов четыре миллиона девяносто тысяч восемьсот семьдесят один
1,123,980,191,425	one trillion, one hundred and twenty-three billion, nine hundred and eighty million, one hundred and ninety-one thousand, four hundred and twenty-five	один триллион сто двадцать три миллиарда девятьсот восемьдесят миллионов сто девяносто одна тысяча четыреста двадцать пять
7/100	seven hundredths	семь сотых
19.021	nineteen point oh (zero) two one; nineteen point oh (zero) twenty one; nineteen and twenty-one thousandths	девятнадцать целых двадцать одна тысячная
– 136	minus a hundred and thirty-six	минус сто тридцать шесть
104	ten to the fourth power	десять в четвёртой степени
3161	thirty-one to the sixty-first power	тридцать один в шестьдесят первой степени
$(3.6+4.4)/7.7=1.093$	The sum of three point six and four point four divided by seven point seven equals one point oh nine three; three point six plus four point four divided by seven point seven equals one and ninety-three thousandths	Три целых шесть десятых плюс четыре целых четыре десятых разделить на семь целых семь десятых равно одна целая девяносто три тысячных

$\sqrt{X} \cdot 63 = 89Y$	the square root of *X* times sixty-three equals eighty-nine times *Y*	квадратный корень из икс умножить на шестьдесят три равно восемьдесят девять игрек
$2\left(X + 45\left(X\right)\right)/2.9 = Y$	forty-five times *X* plus *X* times two divided by two point nine equals *Y*	икс плюс 45 икс, умножить на два, разделить на две целых девять десятых, равно игрек
$\log 3\left(81\right) = 4$	logarithm eighty-one with a base of three equals four	логарифм восьмидесяти одного с основанием три равен четырём
$\left(2 + x\right)/\left(3 - y\right) = z$	Two plus *x* divided by three minus *y* equals *z*.	Два плюс икс, разделить на, три минус игрек, равно зет
$f\left(x\right) = 4x^2$	The function of *x* equals four *x* squared	Эф от икс равно четыре икс квадрат

3. Read the following examples:

$$\left(3,6x + 2,5\right) - \left(1,8x + 2,3\right) = 1,6x$$

$$\left(4,1x + 2,5\right) - \left(2,3x + 3,9\right) = 1,6x$$

$$\left(3,3x + 1,2\right) - \left(0,7x + 1,6\right) = 0$$

$$2 - \left(0,9x - 1,3\right) = 1,3x$$

$$\left(1,8x - 1,9\right) - \left(2,7x - 3,7\right) = 2,1x$$

$$\left(4,1x - 5,5x\right) - \left(7,3x + 3,6\right) = -5,3x$$

$$\left(7,4x - 12,3x\right) - \left(1,56 - 2,3x\right) = 2,6x$$

$$\left(8,8x + 4,7\right) - \left(5,4x + 2,2\right) = -1,6x$$

$$\left(1,3x - 2,5x\right) - \left(3,8x - 2,3\right) = 3,7$$

$$\left(7,1x - 6,3\right) - (6,7x - 7,9) = 0$$

$$1,2a - \left(0,7x + 1,3a\right) = 3,2x - 0,1a\ 115$$

$$4,4x - 1,5a - 2,2 = 3,3x - 1,5a$$

$$\frac{1}{6} = \frac{x}{12}$$

$$5/39 - 1/511 = 24/221$$

$$72/663 = 24/221$$

$$\frac{3}{4}; \frac{2}{5}; \frac{7}{8}; \frac{10}{10}; \frac{1}{10}$$

$$\frac{5}{3}; \frac{7}{3}; \frac{11}{5}; \frac{6}{6}; \frac{2}{5}$$

$$\frac{3}{4}; \frac{7}{8}; \frac{11}{50}; \frac{9}{20}; \frac{4}{7}$$

$$\frac{11}{12}; \frac{8}{9}; \frac{10}{11}; \frac{12}{3}; \frac{4}{8}$$

$$y = \left(\sqrt{2x} - 3\right)/6$$

$$y = 8 - 2x/5$$

$$y = 3x^2 + \sqrt{7x} + 1$$

$$y = 1 - x^2 + x - 3x^4$$

$$y = -x^3 + 4x^2 - 5$$

$$y = 5x^3 - \sqrt{2x^2} + 6x$$

$$15x^2 - 2\sqrt{2x} + 6$$

$$y = (x-1)\left(x^2 + 3\right)$$

$$y = (x+2)^2 - 5x^3$$

$$y = \left(2x^2 - 4x\right)\sqrt{x}$$

$$y = \sqrt{x + 4/4}; \;\; x \geq -4$$

4. How do you write this number using words?

1. 3,004
   A) three thousand, forty-four
   B) three thousand, forty
   C) three thousand, four
   D) three thousand, four hundred
2. 2,405
   A) two thousand, four hundred fifty
   B) two thousand, forty
   C) two thousand, four hundred and fifty
   D) two thousand, four hundred five
3. 1,101
   A) one thousand, eleven
   B) one thousand, one hundred one
   C) one thousand, one hundred ten
   D) one thousand, one

4. 4,400
   A) four thousand, four hundred
   B) B) four thousand, four
   C) C) four thousand, forty
   D) four thousand, forty-four

5. 6,629
   A) six thousand, twenty-nine
   B) six thousand, six hundred twenty-nine
   C) C) six thousand, six hundred nine
   D) six thousand, two hundred

6. 7,500
   A) seven thousand, five hundred
   B) B) seven thousand, five
   C) C) seven thousand, fifty
   D) seven thousand, fifty-five

7. 8,917
   A) eight thousand, ninety-seven
   B) B) eight thousand, seven
   C) C) eight thousand, seventeen
   D) eight thousand, nine hundred seventeen

How do you write this number using numbers?

1) two thousand, twenty-two
   A) 2,200
   B) 2,022
   C) 2,202
   D) 2,002

2) one thousand, one hundred one
   A) 1,111
   B) 1,010
   C) 1,100
   D) 1,101

3) nine thousand, twenty
   A) 9,200
   B) 9,202
   C) 9,020
   D) 2,092

4) seven thousand, seven hundred seventy-seven
   A) 7,707
   B) 7,777
   C) 7,007
   D) 7,700

5) three thousand, one hundred twenty-seven
   A) 3,177

B) 3,701
C) 3,127
D) 3,120

6) five thousand, five hundred twenty-two
A) 5,005
B) 5,225
C) 5,252
D) 5,522

7) eight thousand, eighty
A) 8,080
B) 8,808
C) 8,880
D) 8,800

8) six thousand, six hundred sixty six
A) 6,666
B) 6,060
C) 6,066
D) 6,606

9) one thousand, two hundred twelve
A) 2,121
B) 1,212
C) 1,221
D) 2,112

5. Write the following notes in full sentences, using words rather than figures or symbols:

Example: 4.8=% rubber tyres recycled USA 1988.

Four point eight represents the percentage of rubber tyres which were recycled in nineteen eighty eight.

1) Area size of 10,965 football fields of tropical forest cut down India 1990.
2) $1,098 annual military spending per person USA - $8 annual military spending per person Nigeria.
3) 14,894,000 landmines recovered Poland since 1945.
4) 55 sq. ft. rainforest need clearing to produce enough beef for ¼ lb hamburger.
5) 1,108,180 tons of ozone layer destroying nitrogen oxides emitted each year UK road transport.

6. Match the following numbers and symbols with their names:

+	×	÷	**3**	**4**	**8**	**9**	**10**	**11**

1) odd numbers ___________________
2) even numbers ___________________
3) prime numbers ___________________

4) addition ____________________

5) multiplication ____________________

6) division ____________________

7. Read the story problem and choose the answer:

1. Betty bought 36 apples for her class. She cut each apple into fourths. About how many apple pieces were there?
A) 220 B) 180 C) 360 D) 140

2. José ordered 54 pizzas. Each pizza had 8 slices. About how many slices of pizza were there?
A) 1000 B) 500 C) 800 D) 400

3. Shannon's mom filled 27 boxes with a dozen donuts each. About how many donuts were there?
A) 120 B) 320 C) 49 D) 400

4. Our Saturday art class bought 73 packs of markers. Each pack had 12 markers. About how many new markers does the art class have?
A) 840 B) 120 C) 7300 D) 1300

5. Doug collected caterpillars. He found 13 on Monday, 23 on Tuesday, 15 on Wednesday, and 31 on Thursday. About how many caterpillars did Doug find?
A) 50 B) 80 C) 110 D) 175

6. In December, I had $783.50 in my bank account. Now, I only have $420.90. About how much did I spend?
A) $300 B) $360 C) $480 D) $1200

8. Find the averages of the numbers below:

1) 62, 78, 45, 59
2) 59, 48, 67, 86, 85
3) 89, 102, 105, 99, 110
4) 213, 225, 190, 264, 203

9. Write these numerical expressions in words:

Example: $2 \times 2 = 4$ Two times two equals four

1) 32°F=0°C

2) 36.8 %

3) $15.4 = 15\frac{2}{5}$

4) $56 + 7 = 8 + 41 - 3 = 46$

5) $2^4 = 4^2$

10. Match these words with their definitions:

spatial	a way of drawing things so that they look real
roots	relating to physical space

perspective	beginning
concentric	with a common centre
intersect	limited
deduction	a conclusion
finite	to cut across
radius	a free two-dimensional shape
plane	a straight line from the centre to the edge of a circle

11. Match the math symbol with the word or words.

=	addition sign
π	degrees
≠	multiplication sign
≤	less than
×	greater than or equal to
√	equals sign
+	percent sign
>	pi
–	square root
÷	squared number
%	not equal to
X^2	less than or equal to
<	greater than
°	subtraction sign
≥	division sign

12. Read the text:

GEOMETRY

Geometry (from the Greek *geometria*, the Earth's measure) has its roots in the ancient world, where people used basic techniques to solve everyday problems involving measurement and spatial relationships. The Indus Valley Civilization, for example, had an advanced level of geometrical knowledge – they had weights in definite geometrical shapes and they made carvings with concentric and intersecting circles and triangles. Gradually, over the centuries, geometrical concepts became more generalized and people began to use geometry to solve more difficult, abstract problems.

However, even though people in those times knew that certain relationships existed between things, they did not have a scientific means of proving how or why. That changed during the Classical Period of the ancient Greek civilization (490 BC-323 BC). Because the ancient Greeks were interested in philosophy and wanted to understand the world around them, they developed a system of logical thinking (or deduction) to help them discover the truth. This methodology resulted in the discovery of many important geometrical theorems and principles and in the proving of other geometrical principles that had been known by earlier civilizations. For example, the Greek mathematician Pythagoras was the first person that we know of to have proved the theorem $a^2 + b^2 = c^2$.

Some of the most significant Greek contributions occurred later, during the Hellenistic Period (323 BC-31 BC). Euclid, a Greek living in Egypt, wrote *Elements*, in which, among other things, he defined basic geometrical terms and stated five basic axioms which could be deduced by logical reasoning. These axioms or postulates were: 1. Two points determine a straight line. 2. A line segment extended infinitely in both directions produces a straight line. 3. A circle is determined by a centre and distance. 4. All right angles are equal to one another. 5. If a straight line intersecting two straight lines forms interior angles on the same side and those angles combined are less than 180 degrees, the two straight lines if continued, will intersect each other on that side. This is also referred to as the parallel postulate. The type of geometry based on his ideas is called Euclidean geometry, a type that we still know, use and study today.

With the decline of Greek civilization, there was little interest in geometry until the 7^{th} century AD, when Islamic mathematicians were active in the field. Ibrahim ibn Sinan and Abu Sahl al-Quhi continued the work of the Greeks, while others used geometry to solve problems in other fields, such as optics, astronomy, timekeeping and map-making. Omar Khayyam's comments on problems in Euclid's work eventually led to the development of non-Euclidean geometry in the 19^{th} century.

During the 17^{th} and 18^{th} centuries, Europeans once again began to take an interest in geometry. They studied Greek and Islamic texts which had been forgotten about, and this led to important developments. Rene Descartes and Pierre de Fermat, each working alone, created analytic geometry, which made it possible to measure curved lines. Girard Desargues created projective geometry, a system used by artists to plan the perspective of a painting. In the 19^{th} century, Carl Friedrich Gauss, Janos Bolyai and Nikolai Ivanovich Lobachevsky, each working alone, created non-Euclidean geometry. Their work influenced later researchers, including Albert Einstein.

Find the main sentence in each paragraph, make the plan and retell the text. Then translate one paragraph into Russian (in written form), close the text and translate the paragraph from Russian into English.

Complete the definitions below with words from the table:

slope	diverse	rectangle	acceleration	cube
embrace	sphere	approximation	indispensable	

1. If something is a(n) _____, it isn't exact.
2. An increase in speed is called _____.
3. If something is _____, you can't manage without it.
4. If you _____ an idea, you accept it.
5. A _____ is a three-dimensional, square shape.
6. Something which is _____ is different or of many kinds.
7. If you place two squares side by side, you form a(n) _____.
8. A _____ is a three-dimensional surface, all the points of which are the same distance from a fixed point.
9. A _____ is also known as a fall.

Connect English word combinations with their translation:

properties of geometric figures	один из четырех углов оказывается прямым
it is useful to notice	теоремы обратны друг другу
to be true/false	ознакомиться с моделями рассуждения
one of the four angles turns out to be right	считать доказанным
to acquaint yourself with the forms of reasoning	из теоремы следует
the theorems are converse to each other	быть истинным/ложным
it follows from the theorem	свойства геометрических фигур
one can distinguish two parts	полезно отметить
to take for (as) granted	можно выделить две части

13. Read the text:

MATHEMATICAL PROPOSITIONS

In geometry, the process of reasoning is a principal way to discover properties of geometric figures. It would be instructive therefore to acquaint yourself with the forms of reasoning usual in geometry.

All facts established in geometry are expressed in the form of propositions. The propositions that we take for granted without proof are called assumptions. With regard to a different set of assumptions the same proposition may, or may not be true. The assumptions themselves are neither true nor false. They may be said to be «true» only in the sense that their truth has been assumed.

Definitions are propositions which explain what meaning one attributes to a name or expression.

Axioms (some axioms are traditionally called postulates) are those facts which are accepted without proof. This includes, for example, some propositions: through any two points there is a unique line; if two points of a line lie in a given plane then all points of this line lie in the same plane.

Propositions that can be logically deduced from the assumptions are often called theorems. For example, if one of the four angles formed by two intersecting lines turns out to be right, then the remaining three angles are right as well.

Corollaries are those propositions which follow directly from an axiom or a theorem. For instance, it follows from the axiom «there is only one line passing through two points» that «two lines can intersect at one point at most».

In any theorem one can distinguish two parts: the hypothesis and the conclusion. The hypothesis expresses what is considered given, the conclusion what is required to prove. For example, in the theorem «if central angles are congruent, then the corresponding arcs are congruent» the hypothesis is the first part of the theorem: «if central angles are congruent», and the conclusion is the second part: «then the corresponding arcs are congruent»; in other words, it is given (known to us) that the central angles are congruent, and it is required to prove that under this hypothesis the corresponding arcs are congruent.

It is useful to notice that any theorem can be rephrased in such a way that the hypothesis will begin with the word «if», and the conclusion with the word «then». For example, the theorem «vertical angles are congruent» can be rephrased this way: «if two angles are vertical, then they are congruent».

The theorem converse to a given theorem is obtained by replacing the hypothesis of the given theorem with the conclusion (or some part of the conclusion), and the conclusion with the hypothesis (or some part of the hypothesis) of the given theorem. For instance, the following two theorems are converse to each other:

If central angles are congruent, then the corresponding arcs are congruent.	*If arcs are congruent, then the corresponding central angles are congruent.*

If we call one of these theorems direct, then the other one should be called converse.

In this example both theorems, the direct and the converse one, turn out to be true. This is not always the case. For example the theorem: «if two angles are vertical, then they are congruent» is true, but the converse statement: «if two angles are congruent, then they are vertical» is false.

Indeed, suppose that in some angle the bisector is drawn. It divides the angle into two smaller ones. These smaller angles are congruent to each other, but they are not vertical.

Answer the questions according to the text:

1. What is a principal way to discover properties of geometric figures?
2. Dwell on the types of propositions.
3. What is a definition?
4. Axioms are statements that must be proved, aren't they?
5. What is particular about theorems?
6. Does a corollary follow directly from a definition or from a theorem?
7. How many parts can one distinguish in any theorem?
8. Can the hypothesis of one theorem become the conclusion of the other?
9. Give your own examples of two theorems which are converse to each other.
10. What is the difference between an assumption and an axiom?

Match the English words and word combinations with their Russian equivalents:

the process of reasoning	пересекаться в одной точке
to discover properties of figures	существует единственная линия
what meaning one attributes	какое значение придают
to accept without proof	процесс рассуждения
there is a unique line	начинать со слов
to lie in the same plane	конгруэнтные дуги
congruent arcs	обнаружить свойства фигур
the remaining angles	принимать без доказательства
to intersect at one point	остающиеся углы
under this hypothesis	провести биссектрису
to be converse to the given theorem	быть обратным данной теореме

to begin with the words	по этой гипотезе
to draw a bisector	лежать на одной плоскости

Find out whether the statements are True or False according to the information in the text. Use the introductory phrases:

I think, it is right. *Quite so. Absolutely correct.* *I quite agree to it.*	*I am afraid, it is wrong.* *I don't quite agree to it.* *On the contrary. Far from it.*

1. In geometry all facts are expressed in the form of formulas.
2. Two parts are distinguished in any theorem: the proposition and the conclusion.
3. Scientists discover properties of geometric figures by means of reasoning.
4. Corollaries follow directly from definitions.
5. We obtain a converse theorem by replacing the hypothesis of the given theorem with the conclusion.
6. The direct and the converse theorems always turn out to be true.
7. Axioms are postulates which should be proved.
8. There are two types of propositions: congruent and central.
9. In any theorem the hypothesis can begin with the word «if», and the conclusion with the word «then».

Fill in the blanks with the words from the box. Mind that there are two extra words:

hypothesis	*further*	*theorems*	*reasoning*	*accepted*	*meaning*
to discover	*conclusion*	*deduced*	*remaining*	*established*	*propositions*

1. All that is necessary is that the words and phrases used shall have the same ... for everybody.
2. The ... that we take for granted without proof are called assumptions.
3. That which is given is sometimes called the ..., and that which is to be proved is sometimes called the ... .
4. Propositions that can be logically deduced from the assumptions are often called ... .
5. All facts ... in geometry are expressed in the form of propositions.
6. The answer to a problem in actual life can often be obtained by ... investigation of the actual facts, while in geometry it can always be obtained by ... alone.
7. The scientist has two problems – one, ... new scientific propositions; the other, to devise a set of assumptions from which all his propositions can be logically ... .

Match the left and the right parts of the following statements:

If the same quantity is added or subtracted from equal quantities, then	these two quantities are equal to each other.
If two points of a line lie in a given plane, then	it is divisible by 6.
If each of two quantities is equal to a third quantity, then	the equality remains true.

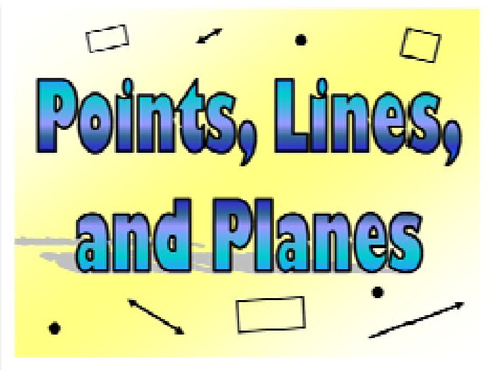
If central angles are congruent, then	the remaining three angles are right as well.
If a number is divisible by 2 and by 3, then	all points of this line lie in the same plane.
If one of the four angles formed by two intersecting lines is right, then	the corresponding arcs are congruent.

Translate the following sentences into English:

1. В данном случае обе теоремы – как прямая, так и обратная – оказываются справедливыми. 2. Пять аксиом Евклида – это предложения, вводящие отношения равенства или неравенства величин. 3. Учебник Евклида по геометрии «Начала» читали, читают и будут читать многие (люди). 4. Предложение, которое следует непосредственно из аксиомы, называется следствием. 5. Следующие две теоремы обратны друг другу. 6. Одно и то же предложение может быть или не быть истинным относительно другого множества допущений. 7. В любой теореме есть две части: гипотеза и вывод. 8. Вас просят записать кратко предположения, которые вы сделали. 9. Аксиома – это истинное, исходное положение теории. 10. Постулат – это утверждение, принимаемое в какой-либо научной теории как истинное, хотя и не доказуемое ее средствами, и поэтому он играет в ней роль аксиомы.

14. Read the text.

POINTS, LINES, PLANES AND ANGLES



The most fundamental idea in the study of geometry is the idea of a point. Think of a point as an exact location in space, it has no dimensions. When writing about points, you represent the points by dots. Remember, the dot is only a picture of a point, and not the point itself. Points are commonly referred to by using capital letters. The dots mark points and are referred to as point A, point B and point C.

A **line** is one of the undefined terms in geometry. A description of a line is that it has length but no thickness or depth. In theory, a line may be extended infinitely in each direction.

A **plane** is a flat surface that extends infinitely in all directions. Imagine extending the length and width of a table top forever. Lines that lie in the same plane are called coplanar lines. Any two coplanar lines must have one and only one of the characteristics listed below.

- The lines may intersect. If they intersect and form right angles, they are perpendicular lines.
- The lines may be parallel. Parallel lines will never meet.
- The lines may coincide. Lines that coincide are actually the same lines.

Lines that lie in different planes and do not intersect are called noncoplanar lines or skew lines.

- If two planes do not intersect, the planes are parallel.
- If two planes intersect, their intersection is a line.

An angle is formed by two rays that have the same endpoint, which is called the vertex of the angle. The rays are called the sides of the angle. (A ray is a part of a line drawn from a given point called the endpoint. The ray continues forever in the other direction.) A point between the sides of the angle is in the interior of the angle. «∠» is the symbol for angle. To name an angle use three letters. The center letter corresponds to the vertex. The other two letters are points on each ray.

The angle can be named ABC or CBA. It can be read as «angle ABC or angle CBA».

An angle is measured in degrees with an instrument called a protractor. There are five types of angles that are essential to the study of geometry.

- Acute angle – an angle whose measure is less than 90°.
- Right angle – an angle whose measure equals 90°. A box in the vertex denotes a right angle.
- Obtuse angle – an angle whose measure is greater than 90° and less than 180°.
- Straight angle – an angle whose measure equals 180°.
- Reflex angle – an angle whose measure is greater than 180° and less than 360°

Equal angles are angles that have the same number of degrees.
A ray that bisects an angle divides it into 2 equal parts. The line is called the angle bisector.

Congruent angles have the same measure.
Perpendiculars are lines that form right angles.
All right angles are congruent.
The sides of a straight angle lie on a straight line.
All straight angles are congruent.
A perpendicular bisector of a line bisects the line and is perpendicular to the line.

Answer the following questions:

1. What does this text deal with?
2. What is the most fundamental idea in the study of geometry?
3. What is a point?
4. What do we usually use the letters of the alphabet for?
5. What is a description of a line?
6. Does a plane extend infinitely in all directions?
7. What lines are called coplanar?
8. What characteristics can you list for coplanar lines?
9. What lines are called noncoplanar?
10. How is an angle formed?
11. What is a ray?
12. Is there any special symbol to denote an angle?
13. What are the ways of naming an angle?
14. How is an angle measured?
15. What kinds of angles do you know, and what are their degree measures?

Match English words and word combinations with their Russian equivalents:

the undefined term	вершина угла
to extend indefinitely	отличительные черты
the vertex of the angle	если не указано иное

the interior of the angle	неопределенный термин
distinguishing features	внутренняя часть угла
the exterior part	продлеваться бесконечно
unless stated otherwise	внешняя часть
reflex angle	смежные углы
perpendicular bisector	угол между 180° и 360°
adjacent angles	перпендикулярная биссектриса

Find out whether the statements are true or false according to the information mentioned in the text:

1. A point has length, width or thickness.
2. A line is limited and extends infinitely in one direction.
3. A line unless stated otherwise is understood to be straight.
4. A line is the shortest distance between two points.
5. A surface has length and width, it doesn't have thickness.
6. Equal angles are angles that have the same number of degrees.
7. Right angles are not congruent.
8. A perpendicular bisector of a line bisects the line and is perpendicular to the line.
9. If two planes intersect, their intersection is a line.
10. A point is a location and it has size.
11. The size of the angle depends on the lengths of the rays forming it.

Translate the words in brackets:

1. To (измерить) an angle, compare its side to the corner of this page.
2. The corner represents (прямой угол), whose measurement is 90°.
3. If the angle is smaller than the corner, the angle is (острый угол).
4. If the opening is larger than the corner of the page, the angle is (тупой). Its measure is more than 90°.
5. Locate the point of your (транспортир) which represents the (вершина) and align the vertex with the point.
6. Rotate the protractor keeping the vertex aligned until one (сторона) of the angle is on the 0°–180° line of the protractor.
7. The angle measure that is (определяется) by the side of the angle that is not on the 0°–180° line of the protractor.
8. You may have to (продлить) one side of the angle so that it crosses the scale.
9. Use the proper (обозначение), *m* is the symbol for «measure of».

Match the left and the right parts of the following statements:

A group of two angles is known	two angles whose measures add up to 180°
Adjacent angles are	two nonadjacent angles formed by two intersecting lines.
Vertical angles are	is the complement of the other.
Complementary angles are	two angles whose measures add up to 90°
One angle	as a pair of angles.

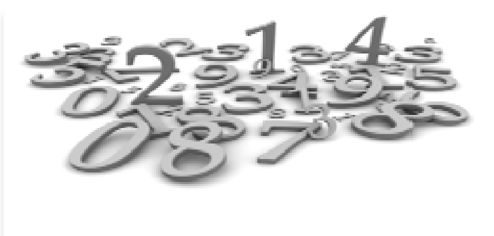
Supplementary angles are	two angles that have the same vertex and a common side.
If an angle is cut into two adjacent angles	are congruent.
If the exterior sides of a pair of adjacent angles are perpendicular	then the sum of the measures of the adjacent angles equals the measure of the original angle.
If two angles are congruent and supplementary	then the angles are complementary.
Vertical angles are	then each angle is a right angle.

Translate the following sentences into English:

1. Первая линия, с которой мы знакомимся, изучая математику, – это прямая линия.
2. Дать строгое определение этого понятия совсем непросто.
3. В работах Евклида линия определялась как длина без толщины.
4. Угол – это самая простая геометрическая фигура после точки, прямой, луча и отрезка.
5. Если в плоскости из точки О провести два различных лучах ОА и ОВ, то они разделят плоскость на две части, каждая из которых называется углом с вершиной О и сторонами ОА и ОВ.
6. Луч, делящий угол пополам и берущий начало в вершине угла, называется его биссектрисой.
7. Биссектриса развернутого угла делит его на два смежных угла, называемых прямыми углами.
8. Большое значение для теории и практики имеет определение величины и меры угла.
9. Основное свойство меры угла должно заключаться в том, чтобы равные углы имели одинаковую меру.
10. Углы меньше прямого называются острыми, а углы больше прямого, но меньше развернутого называются тупыми.

15. Read the text about mathematics and applied mathematics and name the facts about mathematics learnt from the text:

MATHEMATICS AND APPLIED MATHEMATICS



Mathematics can be called «the queen of knowledge». Due to the close relationship between abstract theorems, principles and their physical counterparts in the material world, mathematics can be applied to different branches of science. It is vital in the study of mechanics, engineering, optics, astronomy, geodesy, electricity and other fields of knowledge.

Mathematics thrived and flourished with the growth of civilization as man's quantitative needs increased. One might say that mathematics was born when the man began to count.

The Greeks elevated mathematics to the field of abstract thinking. In its higher form, mathematics becomes a form of logic in which basic assumptions are laid down and results are then deduced within the framework of the system. The system itself is composed of a few elementary terms such as numbers, points and lines which are called primitives and rules that govern their operations.

Mathematics is a language of symbols that is understood in all civilized countries of the world. It can also be described as the study of patterns, where a pattern is any kind of regularity in the form of an idea. This study of patterns has been very important for science because pattern, regularity and symmetry occur quite often in nature. Light, sound, electric currents, waves of the sea, magnetism and even the flight of a bird or the shape of a snowflake and the mechanics of the atom can be classified by mathematics.

The main branches of mathematics are: geometry, trigonometry and calculus. Pure mathematics includes arithmetic – the science of numbers and computation; algebra – the language of symbols, operations and relations; geometry – the study of shapes, sizes and spaces; statistics – the study of interpreting data and graphs; calculus – the study of limits and infinity.

Today mathematics includes many newly developed branches, for example, one of the leading departments at the Faculty of Mechanics and Mathematics – the Department of Algebra and Discrete Mathematics – is concerned not only with algebra. The game theory, the theory of analytical function, pseudodifferential operators, systematic programming and many other problems are studied there. One of the important areas of study in the department – the operators of a convolution type – is widely applied in the theory of random processes and mechanics.

Another field of research involves the study of approximate methods of solving equations with convolution operators. These methods are also applied in the theory of equations of mathematical physics and in the study of mapping and modelling.

Mathematical logic is also one of the main fields of algebra studied in this department, since mathematical logic is increasingly used in modern computers.

Answer the following questions according to the text:

1. Why is mathematics called «the queen of knowledge»?
2. Which fields of science and life is it widely used in?
3. What is the role of ancient civilizations in the development of matematics?
4. What main branches does mathematics include?
5. What does pure mathematics study?
6. Which trends of research are considered to be the most promising at your institute?

Agree or disagree with the following statements:

1. Practical needs made people start and develop mathematics.
2. Mathematics is a universal language of science.
3. The invention of modern computers gave rise to the development of matematical logic.

Give English equivalents of the following word combinations:

применяться в различных областях науки; абстрактное мышление; основные предположения; изучение шаблонов (моделей), основные разделы математики; недавно появившиеся разделы; одна из ведущих кафедр; область научного исследования; изобретение компьютеров; одно из величайших достижений человечества; моделирование.

Match the fields of mathematics with their definitions:

1. algebra	a) a branch of mathematics that deals with integers, rational numbers, real numbers, or complex numbers under addition, subtraction, multiplication, and division
2. geometry	b) a branch of mathematics that concerns itself with the application of mathematical knowledge to other domains
3. trigonometry	c) a branch of mathematics that deals with limits and the differentiation and integration of functions of one or more variables
4. arithmetics	d) a branch of mathematics which may be roughly characterized as a generalization and extension of arithmetic, in which symbols are employed to denote operations, and letters to represent number and quantity
5. statistics	e) mathematics motivated entirely for reasons other than application
6. pure mathemetics	f) a branch of mathematics dealing with angles, triangles and functions such as sine, cosine and tangent
7. applied mathematics	g) a branch of mathematics concerned with the properties of and relationships between points, lines, planes, and figures and with generalizations of these concepts
8. calculus	h) a branch of mathematics concerned with the collection, organization, and interpretation of numerical data, especially the analysis of population characteristics by inference from sampling

16. Read the text to learn more facts from the history of mathematics and name the main dates.

HISTORY OF MATHEMATICS

Mathematics starts with counting. It is not reasonable, however, to suggest that early counting was mathematics.

In Babylonia mathematics developed from 2000 BC.

Number problems such as that of the Pythagorean triples (*a*, *b*, *c*) with $a \wedge b^2 = c^2$ were studied from at least 1700 BC. Systems of linear equations were studied in the context of solving number problems. Quadratic equations were also studied and these examples led to a type of numerical algebra.

Geometric problems relating to similar figures, area and volume were also studied and values obtained for π.

The Babylonian basis of mathematics was inherited by the Greeks and independent development by the Greeks began from around 450 BC.

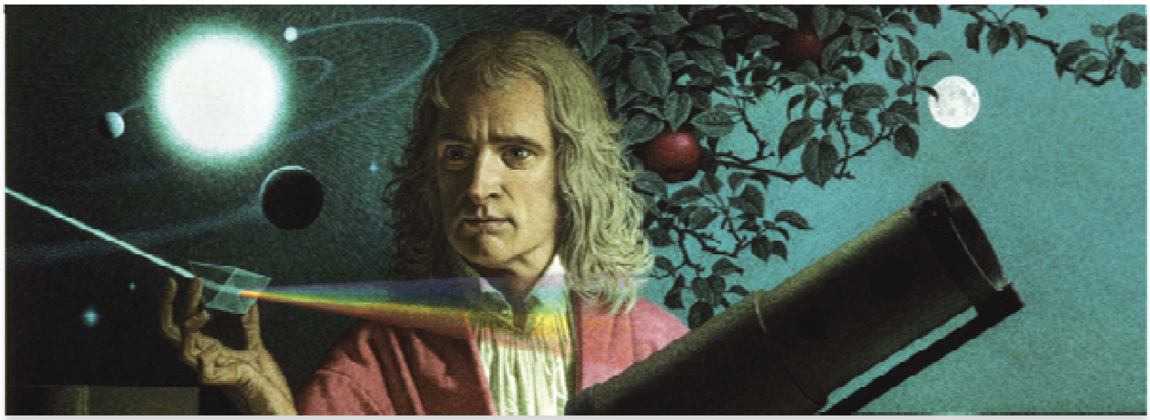
The major Greek progress in mathematics dated back to 300 BC – 200 AD. After that time mathematics flourished in Islamic countries in Iran, Syria and India, in particular.

From about the 11^{th} century Adelard of Bath, then later Fibonacci, brought the Islamic mathematics and its knowledge of Greek mathematics back into Europe.

Major progress in mathematics in Europe was made again at the beginning of the 16th century by Pacioli, then Cardan, Tartaglia and Ferrari with the algebraic solution of cubic and quartic equations. Copernicus and Galileo revolutionized the applications of mathematics to the study of the universe.

The 17^{th} century saw Napier, Briggs and others greatly extended the power of mathematics as a calculatory science with the discovery of logarithms.

Progress towards the calculus continued with Fermat, who, together with Pascal, began the mathematical study of probability.



Newton developed the calculus into a tool to push forward the study of nature. His work contained a wealth of new discoveries showing the interaction between mathematics, physics and astronomy. Newton's theory of gravitation and his theory of light took us into the 18^{th} century.

The most important mathematician of the 18^{th} century was Euler who, in addition to work in a wide range of mathematical areas, invented two new branches, namely the calculus of variations and differential geometry.

Toward the end of the 18^{th} century, Lagrange began to develop a rigorous theory of functions and of mechanics.

The 19^{th} century saw rapid progress in mathematics. Fourier's work on heat was of fundamental importance. In geometry Pibcker produced fundamental work on analytic geometry and Steiner – in synthetic geometry.

Non-Euclidean geometry developed by Lobachevsky and Bolyai led to characterization of geometry by Riemann. Gauss, thought by some to be the greatest mathematician of all time, studied quadratic reciprocity and integer congruence. His work in differential geometry revolutionized the topic. He also contributed in a major way to astronomy and magnetism.

Cauchy, building on the work of Lagrange on functions, began rigorous analysis and began the study of the theory of functions of a complex variable. This work would continue through Weierstrass and Riemann.

Analysis was driven by the requirements of mathematical physics and astronomy. Lie's work on differential equations led to the study of topological groups and differential topology. Maxwell was to revolutionize the application of analysis to mathematical physics. Statistical mechanics was developed by Maxwell, Boltzmann and Gibbs. It led to ergodic theory.

Match these words with their definitions:

natural number	the proof that something is mathematically true
integer	a number larger than zero
operation	any number (positive or negative) or zero
function	a way numbers combine together
right angle	the relationship between argument and result in calculus
square	the result of combining numbers
sum	an angle of 90 degrees
satellite navigation system	system in orbit around the Earth for directions
theorem	the product of two equal terms
axiom	principle

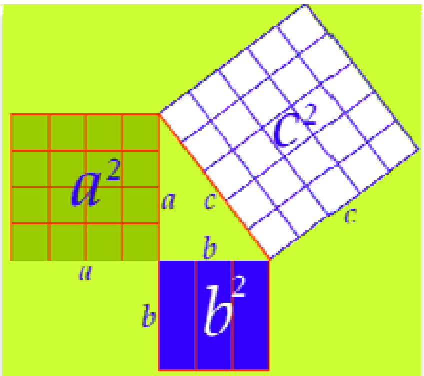
17. Read the text and complete the summary.

MATHEMATICS

What mathematicians study can be summed up as relating to four major fields. They look at quantities – how much or how many. There is also the study of structure – how things are arranged together and the relationship between the parts. Then there is the study of space, where mathematicians are interested in the shape of things. Finally, there is change and how things move, over time or through space.

Quantity is mostly concerned with numbers. Mathematicians are interested in both natural numbers and integers. Natural numbers are those which are greater than zero, while integers may be zero itself or more or less than zero. There are four ways these may combine together; these are called operations. In arithmetic, we know the operations as addition (+), subtraction (–), division (-r) and multiplication (×). For a fuller, more philosophical understanding of number and the operations that can be applied to them, mathematicians look to Number Theory.

The study of the structure of things is said to have begun with the Greek mathematician, Pythagoras, who lived from 582 to 507 BG. Every mathematician has to learn his most famous theorem. A theorem is a proof of mathematical truth. Pythagoras showed us that in a right-angled triangle, the square of the side of the hypotenuse is equal to the sum of the squares of the other two sides. The hypotenuse is the longest side of such a triangle and that length, multiplied by itself is the same as the length of one side multiplied by itself and added to the other side multiplied by itself. Mathematicians find it easier to write this as $a^2 + b^2 = c^2$, (a squared plus b squared equals c squared) where c is the hypotenuse. It is Pythagoras' Theorem which gives us algebra, a branch of mathematics that originated in the Arab world.



Another Greek mathematician laid the foundations for our understanding of space. More than 200 years after Pythagoras, Euclid used a small set of axioms to prove more theorems. This, we know today as geometry. He saw the world in three dimensions – height, width and length. Developments in other sciences, most notably in physics, have led mathematicians to add to Euclid's work. Since Einstein, mathematicians have added a fourth dimension, time, to Euclid's three. By combining space with number we have developed the trigonometry used in making maps both on paper and in satellite navigation systems.

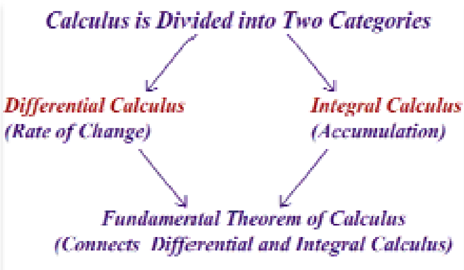
From algebra and geometry comes calculus. This is the most important tool that mathematicians have to describe change, for example, if you calculate the speed of a moving car or analyse the way the population of a city changes over time. The most significant area of calculus is function, which is concerned with the relationship between argument and result. Indeed, the field of functional analysis has its most important application in quantum mechanics, which gives us the basis for our study of physics and chemistry today.

There is more to maths than this. For example, pure maths involves a more creative approach to the science. An important field of study is statistics which uses Probability Theory, the mathematical study of chance, to predict results and analyse information. Many statisticians would say that they are not mathematicians, but analysts. However, without maths, statisticians would all agree, there would be no statistics at all.

Summary

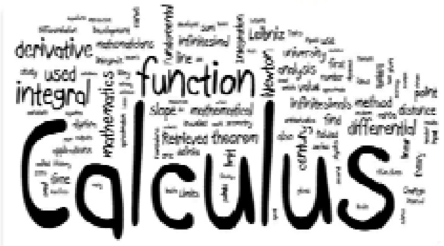
1. Maths studies four areas: quantities, structure, space and (1) ___.
2. Natural numbers are larger than (2) ___ but (3) ___ can be zero.
3. (4) ___ was a Greek mathematician who made the famous theorem $a^2 = b^2 + c^2$ which helps us find the size of a (5) ___.
4. Algebra came from (6) ___ countries.
5. With (7) ___ Euclid helped us understand (8) ___.
6. Trigonometry combines space with (9) ___.
7. Calculus describes (10) ___ and used in quantum mechanics allows us to study physics and (11) ___.
8. Statistics predicts results and analyses (12) ___.

18. Read the text about calculus and decide if the following statements are true or false:



1. Calculus and geometry led to the development of algebra.
2. India was using calculus before Europe.
3. In the 17th century, calculus was applied to physics.
4. Integral calculus can calculate the rate at which a population increases.
5. 5. Differential calculus has to do with systems that are undergoing change.

CALCULUS



Calculus is the branch of mathematics that deals with the rates of change of quantities as well as the length, area and volume of objects. It grew out of geometry and algebra. There are two divisions of calculus – differential calculus and integral calculus. Differential calculus is the form concerned with the rate of change of quantities. This can be illustrated by slopes of curves. Integral calculus is used to study length, area and volume.

The earliest examples of a form of calculus date back to the ancient Greeks, with Eudoxus developing a mathematical method to work out area and volume. Other important contributions were made by the famous scientist and mathematician, Archimedes. In India, over the course of many years – from 500 AD to the 14th century – calculus was studied by a number of mathematicians. In fact, the first text on calculus was written in India. However, it was not until the end of the 1600s that calculus was taken up in Europe. There was much scientific activity at the time, and calculus was able to answer many questions, particularly in the field of physics. Many great mathematicians of the time embraced calculus and furthered its development, including Rene Descartes and Pierre de Fermat, but the most important contributions were made by Gottfried Leibniz and Isaac Newton. Newton was the first to use calculus in his studies of physics and Leibniz developed many of the symbols that we use in calculus.

The starting point of calculus is the idea that you can use an approximation and keep increasing the accuracy until an exact answer is found. An example of this would be to calculate the volume or area of a sphere by using shapes such as rectangles or cubes that become increasingly smaller until the exact volume or area is determined in calculus, this final result is called a limit.

Differential calculus describes processes that are in flux – which means they are constantly changing. Examples of this are temperature variations or the speed of a moving object. By using differential calculus, it is possible to determine the rate at which the temperature changes and the rate of acceleration of the moving body. Integral calculus begins with a known rate of change and, working backwards, finds certain values. For example, if you know the rate of acceleration of a car, you can find out its speed at a given point.

Today, both forms are used in every area of science and knowledge. Fields as diverse as engineering, medicine, business and economics make use of calculus. Calculus is such an indispensable tool that it is applied whenever we have a problem that can be solved by mathematics.

19. Match the words with their definitions. Then make sentences with them in Russian and ask other students to translate them into English:

linear algebra	money gained or lost
reunion	rewriting
matrices	linear equations
profit and loss	coming back together
transposing	arrangement of mathematical elements
operators	what goes into something and what comes out
input and output	signs used in maths

20. Read the text about algebra and decide if the following statements are true or false:

1. Algebra is a mathematical system which rewrites a problem making it as simple as possible.
2. Written down, algebra differs from arithmetic in the operators it uses.
3. Algebra has some advantages to offer the mathematician.
4. Algebraic formulae are primarily of use in businesses.
5. Universal algebra combines all the structures from the other three areas.

ALGEBRA

Algebra originated in the Middle East. Earlier than 1000 BG, the Babylonians developed an arithmetical system for solving problems that could be written algebraically. This was in advance of other systems, notably that of the Ancient Egyptians, who were able to solve the same problems, but did so by using geometry. The word algebra comes from Arabic and translates into English as *reunion*. It describes a system of mathematics which performs calculations by firstly rewriting, that is, transposing them, and then reducing them to their simplest form.

Algebra is the branch of mathematics which studies the structure of things, the relationship between things and quantity. It looks different from arithmetic when it is written. Arithmetic uses numbers and the four operators (plus, minus, multiply and divide). Algebra uses symbols, usually letters, and the operators. Actually, it is not very different from arithmetic; what can be done in algebra can be done in arithmetic. There are good mathematical reasons, however, why algebra is used instead of arithmetic.

Firstly, by not using numbers, mathematicians are able to set out arithmetical laws. In this way they are able to understand the system of numbers more clearly. Secondly, by using algebra, mathematicians are able to perform calculations where unknown quantities are involved. This unknown is usually represented by x. Solutions can then be applied not just to the immediate problem, but to all problems of the same nature by the use of a formula. A common algebraic problem to solve in school exams would be, for example: find x where $3x+8=14$. A third reason for the use of algebra rather than arithmetic is that it allows calculations which involve change in the relationship between what goes into the problem and what comes out of it, that is, between input and output. It is an algebraic formula which allows a business to calculate its potential profit (or loss) over any period of time.

It is possible to classify algebra by dividing it into four areas. Firstly, there is elementary algebra in which symbols (such as x and y, or a and b) are used to denote numbers. In this area, the rules that control the mathematical expressions and equations using these symbols are studied. Then, there is abstract or modern algebra in which mathematical systems consisting of a set of elements and several rules (axioms) for the interaction of the elements and the operations are defined and researched. Thirdly, there is linear algebra (linear equations) in which linear transformations and vector spaces, including matrices, are studied. Finally, there is universal algebra in which the ideas common to all algebraic structures are studied.

Like all branches of mathematics, algebra has developed because we need it to solve our problems. By avoiding the use of numbers we are able to generalize both the problem and the solution.

Match the words with their definitions. Then make sentences with them in Russian and ask other students to translate them into English:

enable	to make something easier to do or understand
arise	to make better
refine	to allow
exclude	to occur
simplify	to leave out
adjustments	understandable
comprehensible	small changes

Match the words to make phrases. Then make sentences with them in English and ask other students to translate them into Russian:

applied	of mathematics
branch	developments
mathematical	variety
final	mathematics
second	terms
knowledgeable	model
real	solution
major	stage
mathematical	life
wide	mathematician

21. **Read the text. Then put the events (A-F) below in the correct order, from first to last, to show the procedure for using applied mathematics:**

A. The revised model is applied.
B. The model is adjusted.
C. A mathematical model is created.
D. A problem arises.
E. A solution is found.
F. Approximate solutions are obtained.

Event 1		Event 2		Event 3		Event 4		Event 5		Event 6	

APPLIED MATHEMATICS

Most of the major developments in mathematics were the result of trying to solve a particular problem. When faced with a problem, people would ask themselves 'How can we do this?' 'What's the best way of doing that?' Thus, mathematics arose. Today, we have many different branches of mathematics, all of which can be used to answer questions like the ones above.

When mathematics is used to solve problems in other related areas of life, it is known as applied mathematics. Mathematics is applied, that is, used, to provide us with answers and solutions. It is used in numerous ways. A few examples are numerical analysis, engineering and programming. In these and other areas, applied mathematics takes problems from real life, and gives us successful and creative tools for solving them. Often, the first step when using applied mathematics is to create a mathematical model. This is a description of the problem in mathematical terms. This model is then studied to obtain exact or approximate solutions. If the solution is exact, the model is applied to the problem; if it is approximate, the model is refined until it is exact. Then, the conclusions are interpreted and explained in comprehensible terms. Often the model is changed to be more realistic or to include more features of the problem. Thus, the modeling process may involve many adjustments. The second stage is the final solution to the problems mathematically formulated in the first stage. Mathematics is used or *applied* to other fields to solve problems in these fields.

It is often not clear which mathematical tools will be useful in the study of a new problem, for example, algebra or differential calculus. For this reason, applied mathematicians need to be well trained in a range of mathematical areas so they will have a wide variety of mathematical tools available to them. They must not only be skilled mathematicians but must also be knowledgeable in the specific area to which mathematics is being applied. For example, in dealing with business and industry, the knowledge of economics is necessary. In this way, a good applied mathematician can then create and interpret appropriate models. A good applied mathematician must therefore be knowledgeable in both mathematics and the field of application in order to successfully deal with a problem.

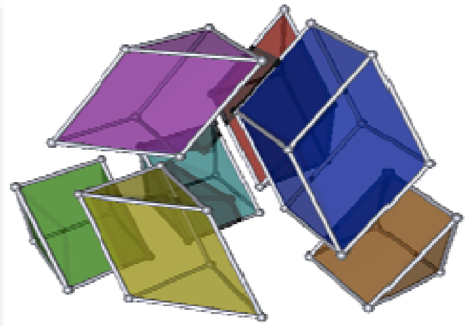
When it comes to creating models, the mathematician will make choices about which factors to include and which to exclude. The goal is to produce a model that is realistic enough to reflect the main aspects of the problem being studied, but simple enough to be treated mathematically.

Sometimes the mathematician has to either simplify this model so it can be analyzed, or devise new mathematical methods that will allow the model to be analyzed. The modeling process may involve a sequence of models of increasing complexity. Problems sometimes lead to new mathematical methods, and existing mathematical methods often lead to a new understanding of the problems.

Mathematics in its most useful, practical form becomes a tool with which we can improve our world. That is exactly what applied mathematics is and what it does.

22. Read the text and answer the questions:

BASIC GEOMETRIC CONCEPTS



The practical value of Geometry lies in the fact that we can abstract and illustrate physical objects by drawings and models. For example, a drawing of a circle is not a circle, it suggests the idea of a circle. In our study of Geometry we separate all geometric figures into two groups: plane figures whose points lie in one plane and space figures or solids. A point is a primary and starting concept in Geometry. Line segments, rays, triangles and circles are definite sets of points. A simple closed curve with line segments as its boundaries is a polygon. The line segments are sides of the polygon and the end points of the segments are vertices of the polygon. A polygon with four sides is a quadrilateral. A trapezoid is a quadrilateral with one pair of parallel sides. A rectangular is a parallelogram with four right angles. A square is a rectangle with all sides of the same length. The regular polyhedra are a part of geometric study chiefly in antiquity. Thanks to the ancient Greeks we know that there are exactly five types of polyhedra. All objects in their view are composed of four basic elements: earth, air, fire and water. They believe that the fundamental particles of fire have the shape of tetrahedron; the air particles have the shape of octahedron, of water – the icosahedron, and the earth – the cube. The fifth shape, the dodecahedron, they reserve for the shape of the universe itself.

Questions:

1. What groups can all geometric figures be separated into?
2. What is a line segment in a square?
3. What is a polygon?
4. How many sides are there in a rectangular?
5. What figure represents the particles of air/fire/earth/water/universe according to the ancient Greeks?
6. What instruments are used for drawing figures?
7. In what way do we classify polygons?
8. Which formula is used for finding the sum of the interior angles of any polygon?
9. How can we find the perimeter of a regular polygon?
10. What special properties does a parallelogram possess?

Match the English words and word combinations with their equivalents:

to draw diagonals	делят друг друга пополам
from one single vertex	специальные четырех угольники
in addition to	дополнительные углы
to circumscribe about the circle	плоская фигура
complex or crossed quadrilaterals	вписать в окружность
adjacent sides	описать вокруг окружности
to draw tangents to the circle	означает

a convex or a concave trapezium	последовательная пара
stands for	начертить диагонали
special quadrilaterals	провести касательные к окружности
to inscribe into the circle	обладают свойствами
a consecutive pair	кроме того
regular polygons	из одной вершины
supplementary angles	смежные стороны
bisect each other	сложные или пересекающиеся четырехугольники
the measure of the sides	величины сторон
a plane figure	правильные многоугольники
possess properties	выпуклая или вогнутая трапеция

Guess what figure possesses the following properties and memorize them (a square, a trapezoid, a kite, a rectangle, a parallelogram, a rhombus):

1. A ... has two parallel pairs of opposite sides.
2. A ... has two pairs of opposite sides parallel, and four right angles. It is also a parallelogram, since it has two pairs of parallel sides.
3. A ... has two pairs of parallel sides, four right angles, and all four sides are equal. It is also a rectangle and a parallelogram.
4. A ... is defined as a parallelogram with four equal sides. It does not have to have 4 right angles.
5. ... only has one pair of parallel sides. It’s a type of quadrilateral that is not a parallelogram.
6. ... has two pairs of adjacent sides that are equal.

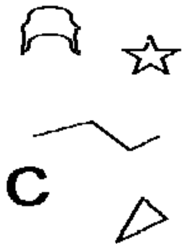
Name the shapes.

1. It has four sides and all the sides are equal.
2. It has three sides.
3. It has four sides, all sides are not equal, opposite sides are equal and parallel.
4. Its round and round with no sides.
5. It has six sides.

Answer the questions.

1. Can a triangle have 2 right angles?
2. Can a triangle have 2 acute angles?
3. Can a triangle have 2 obtuse angles?
4. Can a triangle have 3 acute angles?
5. Can a triangle have each angle more than 60°?
6. Can a triangle have each angle less than 60°?
7. What is the sum of angles in triangle?

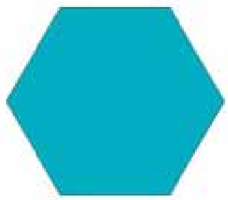
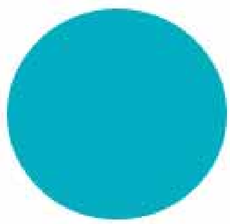
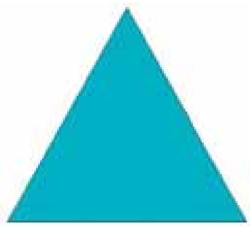
Look at the pictures and find plane figures. Remember that a plane figure is closed and has straight or curved lines:

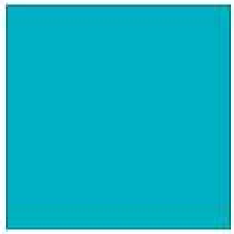


Some letters of the alphabet are plane figures. See if you can decide which letters are plane figures. Remember that a plane figure is a flat, closed, shape in a plane:

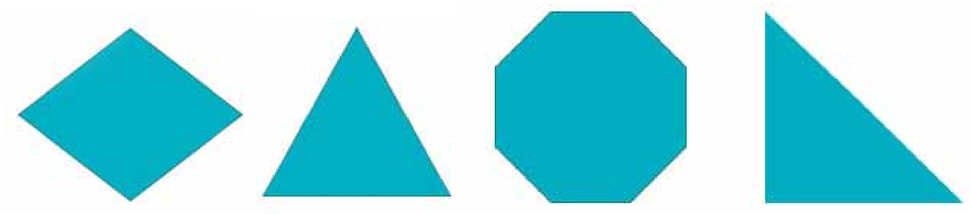
M	**O**	**Z**	**E**	**R**	**B**	**D**	**P**

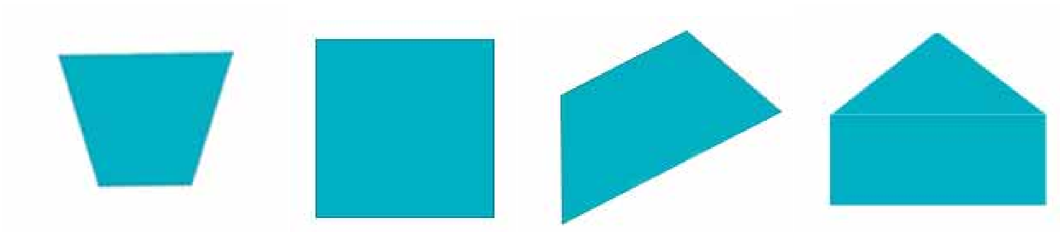
Connect plane figures with their definitions:

TRIANGLE	
CIRCLE	
SQUARE	
RECTANGLE	
HEXAGON	

PENTAGON	

Look at the following figures and tell how many angles and sides they have:





Look around your room for plane figures. Get a sheet of paper and draw and label 4 plane figures with 4 different shapes.

Match words with their definitions:

Circle, hexagon, octagon, parallelogram, pentagon, rectangle, rhombus, square, trapezoid, triangle

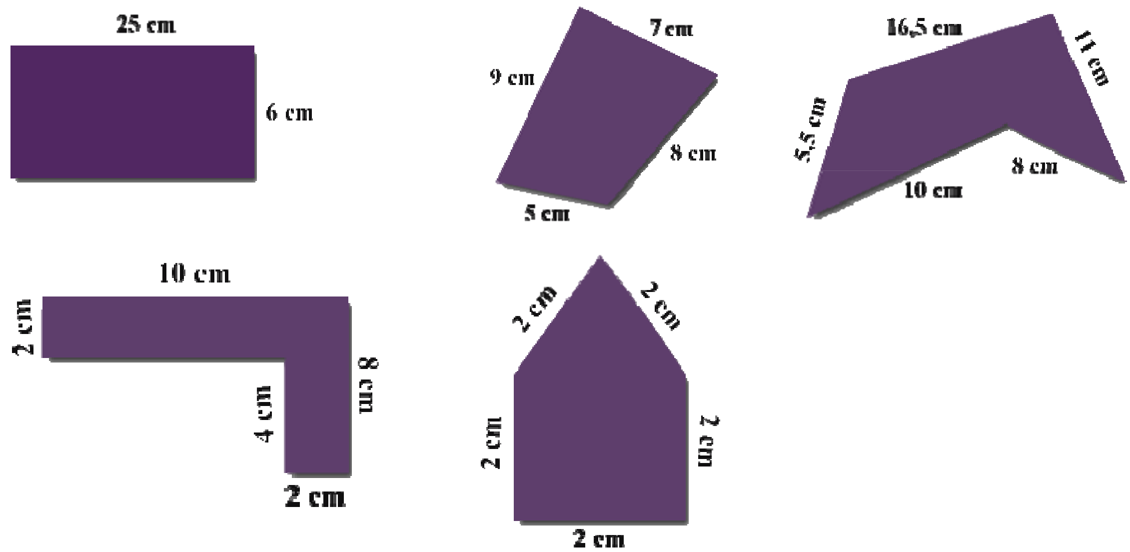
1. A four-sided polygon with two pairs of parallel sides.
2. An eight-sided polygon.
3. A quadrilateral with four equal sides and four right angles.
4. A six-sided polygon.
5. A three-sided polygon. The sum of the angles equals 180 degrees.
6. A four-sided polygon with one pair of parallel sides.
7. A five-sided polygon.
8. A four-sided polygon having all four sides of equal length.
9. A quadrilateral with four right angles and two sets of parallel opposite sides that are equal.
10. A collection of points in a plane that are the same distance from a center point.

Draw the following figures:

a square		an octagon	

a triangle		a pentagon	
a circle		a cube	
an oval		**a ray**	

Find perimeter and area for every figure:



Match the word with its definition:

Pi, or π	3.14159265359...
Radius	3.14253245359...
Diameter	any line segment that starts at the center of the circle and whose endpoint lies on the circle
	any line segment that starts in the circle and whose endpoint lies out of the circle
	any line segment that starts on the circle and whose endpoint lies on the circle
	any line segment that starts on the circle and whose endpoint lies on the circle and go through the center

Match the English words and word combinations with the Russian equivalents:

to draw diagonals	делят друг друга пополам
from one single vertex	специальные четырехугольники
in addition to	дополнительные углы
to circumscribe about the circle	плоская фигура
adjacent sides	вписать в окружность

to draw tangents to the circle	описать вокруг окружности
a convex or a concave trapezium	означает
stands for	выпуклая или вогнутая трапеция
special quadrilaterals	последовательная пара
regular polygons	начертить диагонали
supplementary angles	провести касательные к окружности
bisect each other	обладают свойствами
the measure of the sides	кроме того
a plane figure	из одной вершины
possess properties	смежные стороны
a consecutive pair	сложные или пересекающиеся четырех-угольники
to inscribe into the circle	величины сторон
complex or crossed quadrilaterals	правильные многоугольники

Fill in the blanks with the words from the box. Mind there are two extra words:

interior length	concave	rectangle
quadrilateral	special	regular
diagonals	product	vertices
number	rhombus	line segments
inscribed	dimensions	corners
trapezoid	vertex	circumscribed
congruent	convex	kite

1. A simple closed figure formed by ... is called a polygon.
2. In Euclidean plane geometry, a ... is a polygon with four sides and four ... or ... .
3. The area of a rectangle figure is the ... of its ... .
4. A shape that is both a ... and a ... is a square (four equal sides and for equal angles).
5. A polygon is called ... if all of its sides and all of its interior angles are ... .
6. Applying these geometric theorems we can obtain both a regular polygon ... into the circle and a regular polygon ... about the circle.
7. Finding the sum of the ... angles of a polygon is not difficult.
8. If you wish to find the perimeter of a regular polygon you should multiply ... of the sides by the ... of the sides.
9. By drawing all … from one single … of a polygon we can separate it into triangles.
10. Simple quadrilaterals are either … or … .
11. A parallelogram possesses … properties.

Guess what figure possesses the following properties and memorize them (a square, a trapezoid, a kite, a rectangle, a parallelogram, a rhombus):

1. A ... has two parallel pairs of opposite sides.
2. A ... has two pairs of opposite sides parallel, and four right angles. It is also a parallelogram, since it has two pairs of parallel sides.

3. A ... has two pairs of parallel sides, four right angles, and all four sides are equal. It is also a rectangle and a parallelogram.
4. A ... is defined as a parallelogram with four equal sides. It does not have to have 4 right angles.
5. ... only has one pair of parallel sides. It's a type of quadrilateral that is not a parallelogram.
6. ... has two pairs of adjacent sides that are equal.

Translate into English:

1. Простая замкнутая фигура, сформированная отрезками, называется многоугольником. 2. Само слово «многоугольник» состоит из двух греческих слов ʿpolyʾ – много, ʿgonʾ – угол. 3. Правильный многоугольник – это многоугольник, у которого все углы и стороны конгруэнтны. 4. Простейшим многоугольником является треугольник, имеющий три стороны, три угла и три вершины. 5. Пятиугольник имеет пять сторон, шестиугольник – шесть, восьмиугольник – восемь, десятиугольник – десять. 6. Многоугольники могут быть сгруппированы в соответствии с величиной их углов и сторон. 7. Четырехугольник – это тоже плоская фигура. 8. Если стороны четырехугольника равны и все углы прямые, то такой четырехугольник называется квадратом. 9. Линия вокруг плоской фигуры называется периметром. 10. Периметр плоской фигуры равен сумме длин ее сторон.

23. Read the text and translate it:

THE CIRCLE

Let's turn now to the simplest of all curved lines, the circle. We shall study its properties and its relation to straight lines and to figures made up of straight lines, especially polygons.

In a plane all the points at a given distance from a given fixed point are said to form a circle. A circle is a set of points in a plane, all of which are the same distance from a given point.

The fixed point O is called the CENTER of the circle, from which all other points are equidistant. The distance r is called the RADIUS. A radius is a line segment from the center of a circle to a point on the circle.

Every point at a distance r from O is said to be on the circle. Every point at a distance less than *r* from O is said to be inside the circle and every point at a distance greater than *r* from O is said to be outside the circle. If the center of the circle is taken as the origin of a rectangular network, it follows from the Pythagorean Theorem that the coordinates (*x*, *y*) of every point P of the circle will satisfy the equation $x^2 + y^2 = r^2$. This equation is the equation of the circle.

Answer the questions:

1. How can we define a circle?
2. What is the center of a circle?
3. What is a radius?
4. When do we say that a point is on the circle, inside the circle and outside the circle?
5. How can you formulate the equation of the circle using the Pythagorean Theorem?

Find the area of any circle:

Area = $\pi \times r^2$

1. Radius – 4 cm	4. Radius – 6 cm
2. Diameter – 6 cm	5. Radius – 2 m
3. Radius – 8 cm	6. Diameter – 10 cm

Translate sentences into English:

1. Геометрия занимается построениями и изучение свойств и отношений геометрических фигур и тел. 2. Геометрические построения должны выполняться только с помощью циркуля и линейки. 3. Геометрические фигуры определяются через понятия множества точек. 4. Чертежи – это модели, изображающие геометрические объекты. 5. Начальное понятие геометрии точка. 6. Отрезки прямой, лучи, углы, круги и треугольники – геометрические фигуры на плоскости. 7. Многогранники – это геометрические тела. 8. Существуют формулы для измерения площадей и объемов.

Complete the sentences:

1. The set of all points in Geometry is a … (volume, plane, line, space, model, surface).
2. Sets of points which all lie in one plane are … (circles, rays, angles, solids, ellipses, plane figures, squares).
3. The regular polyhedra are a part of geometric study in antiquity. How many different types are there? (rhombus, trapezoid, square, cube, tetrahedron, octahedron, dodecahedron, icosahedron).
4. A solid with opposite faces equal and parallel is a … (cube, cylinder, prism, pyramid, sphere).
5. The set of three points not all on one line and all the points between them on the segments is a … (parallelepiped, triangle, rhombus, rectangle, cone).
6. The angle of 90° is … (straight, right, acute, obtuse, adjacent, complementary).
7. A triangle with its sides equal is … (right, acute, isosceles, equilateral).
8. The distance around the circle is a(n) … (perimeter, parabola, hyperbola, circumference, ellipse).

3.3. PRODUCTION

1. Imagine you have started an algebra course. Write a letter to a friend telling him/her what you have learnt about algebra. Use the following plan:

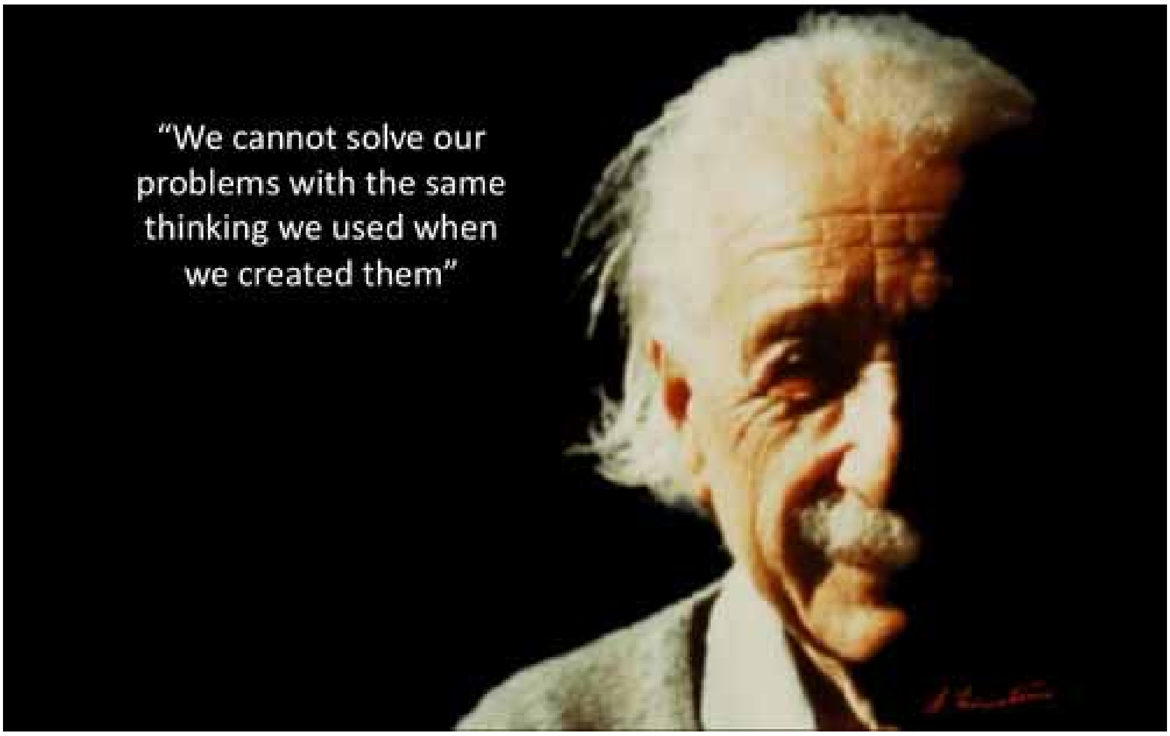
- brief history of algebra;
- what algebra is and the four areas of algebra;
- how algebra is useful.

Don't forget about *the rules of writing informal letters.*

2. Using the Internet, find information about these systems and present it in the class:

- the ancient Greeks' numeration system;
- Chinese-Japanese numeration system;
- Mayan numeration system;
- Hindy-Arabic symbolic system;
- Binary system.

MODULE 4
PHYSICS



4.1. KEY VOCABULARY

Mind the pronunciation:

word/phrase	**transcription**	**translation**
Aristotle	['æristot(ə)l]	Аристотель
Archimedes	[ˌa:ki'mi:di:z]	Архимед
Galileo	[ˌgælə'leiəʊ]	Галилео
Copernicus	[kəʊ'pɜ:nik əs]	Коперник
Ampere	['æmpeə]	Ампер
Faraday	['færədi]	Фарадей
equation	[i'kweiʒən]	формула, уравнение
appliance	[ə'plai əns]	устройство (эл. прибор)
planetary motion	['plænitəri 'məʊʃn]	движение планет
matter	['mætə]	вещество
motion	['məʊʃ(ə)n]	движение
gadget	['gædʒit]	приспособление, устройство, техническая новинка
device	[di'vais]	механизм, аппарат, прибор
to predict	[pri'dikt]	предсказывать, прогнозировать
astronomer	[ə'strɔnəmə]	астроном

work on dynamics	[dai'næmiks]	работа по динамике
investigation	[inˏvesti'geiʃ(ə)n]	научное исследование, изыскание, разбор
research	[ri'sɜ:tʃ]	исследование, научно-исследовательская работа
survey	['sɜ:vei]	изыскание, исследование, анализ
to set out the theory	['θi(ə)ri]	выдвигать теорию
to split a nucleus	['nju:kli əs]	расщеплять атомное ядро
particle	['pa:tik(ə)l]	частица
dark matter	['da:k 'mætə]	темная материя, невидимая материя
to reveal	[ri'vi:l]	показывать, открывать, обнаруживать
to accelerate	[ək'seləreit]	ускорять, форсировать, увеличивать скорость
scientific explanation	[ˏsaiə'tifik ˏeksplə'neiʃ(ə)n]	научное объяснение
to observe	[əb'zɜ:v]	наблюдать, подмечать
experiment	[ik'speriment]	опыт, эксперимент
to exert force on	[ig'z ɜ:t]	прилагать силу, действовать с силой на
to apply force to	[tə əˈplaɪ fɔːs tə]	прилагать усилие/силу
conductor	[kən'dʌktə]	проводник
electrical current	['kʌrənt]	электрический ток
to generate	['ʤenəreit]	генерировать, порождать
static	['stætik]	статический
charged	['tʃa: ʤd]	заряженный
electromagnetic field	[i'lektrə mæg'netik]	электромагнитное поле
electrically-charged particle	[ɪˈlek.trɪ.kəl tʃɑːdʒd ˈpɑː.tɪ.kl̩]	электрически заряженная частица
static electricity	[iˏlek'trisiti]	статическое электричество
Voltaic pile	[vɔl'teiik pail]	вольтов столб
loop	[ˈlu:p]	цикл, петля
modest	[ˈmɔdist]	незначительный, малых размеров
status	[ˈsteitəs]	статус, положение, текущие состояние
to set to work	[set tə ˈwɜːk]	браться за работу
to make use of	[ˈmeɪk ˈjuːs ɒv]	воспользоваться чем-либо, применить
homopolar	[hɔməˈpɔʊlə]	гомеополярный, однополюсный
Law of induction	[lɔ: əv inˈdʌkʃən]	Закон индукции, закон Фарадея
dynamo	[ˈdainəməʊ]	генератор

4.2. READING AND VOCABULARY

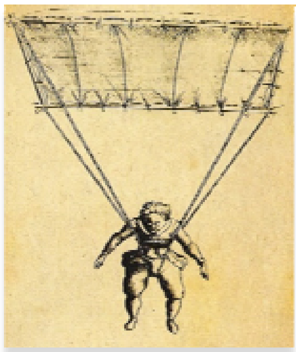
1. Read the text and answer the questions.

PHYSICS ALL AROUND

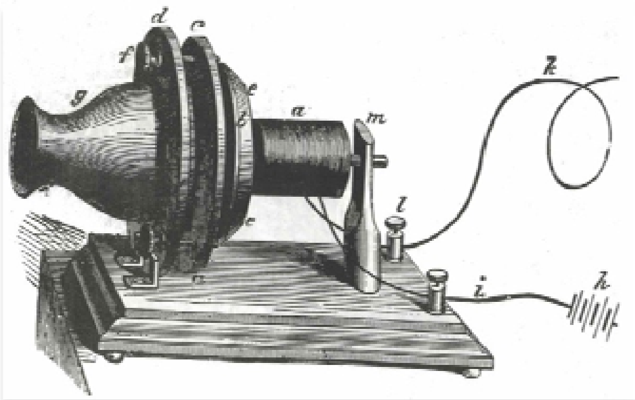
People have been studying physics – without calling it that – for thousands of years, and using their discoveries to make life easier along the way. The first people who invented the wheel, or built canoes, were using the rules of physics. Without physics there would be no …

PARACHUTES

In 1617, Croatian inventor Faust Vrancic made an early kind of parachute by strapping a curved canopy to his back. It slowed his fall when he jumped off a tall tower in Venice.



TELEPHONES

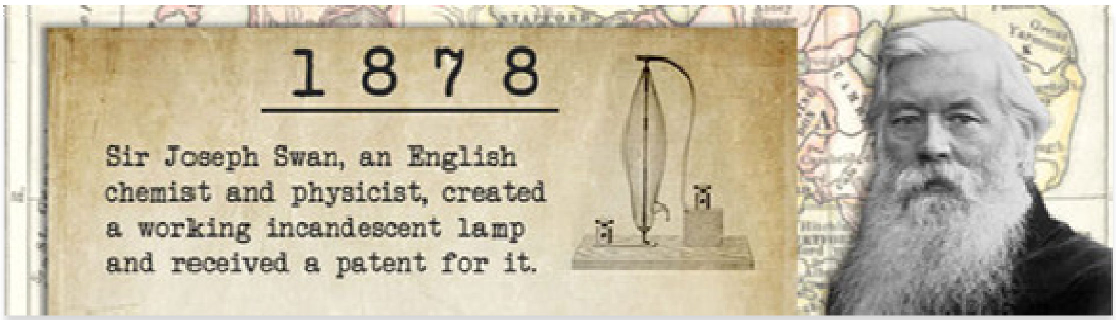


Bell's first Telephone (Transmitter)

a. Electro-magnet;
b. Diaphram
c. Collar
d. Collar and tube
e. Screw
f. Mouthpiece
g. Battery
h. Wire from battery to coil
i. Telegraph wire
j. Through binding screw
k. Pillar Holding magnet

The telephone was invented by Scotsman Alexander Graham Bell in 1876. Bell spent years investigating the way sounds are created and how they move.

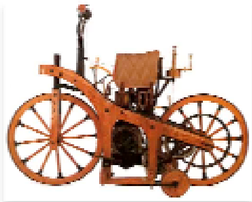
LIGHT BULBS



In 1878, Englishman Sir Joseph Swan and Thomas Edison from the USA invented the light bulb almost simultaneously. Instead of fighting the pair went into business together.

MOTORBIKES

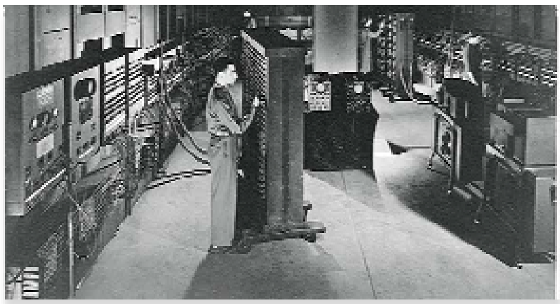
In 1885, German engineer Gottlieb Daimler attached an engine to a wooden bicycle to make the first (rather wobbly) motorbike.



PLANES

The Wright brothers made the first powered flight in America in 1903. Their plane only stayed in the air for 12 seconds and, when it landed, the wind blew it away – so they had to build a new one.

COMPUTERS



One of the first computers, the ENIAC, was designed by two American scientists, John Mauchly and J. Presper Eckert. It took them three years to build it. When they finished, in 1946, it took up the space of about five classrooms. The first home computer wasn't invented until 1975 – until then, computers were too big to have at home.

TELEVISIONS

John Logie Baird pictured with his invention, the television, which he invented in 1925

The first television was built in 1925 by Scottish inventor John Logie Baird. He made it in his attic out of household objects. By 1929, the British Broadcasting Corporation was using his television system to broadcast TV shows.

WORLD WIDE WEB

In 1989, British scientist Tim Berners-Lee invented a way of sharing information between computers quickly and easily. It's called the World Wide Web, and today it links computers all over the world.

Berners-Lee in 2014.

MICROWAVE OVENS

In 1945, American scientist Percy Spencer was walking past a machine called a magnetron when the chocolate bar in his pocket suddenly melted. He worked out that a kind of energy called microwave energy, emitted by the magnetron, was responsible. He used the magnetron to invent the microwave oven.

Questions:

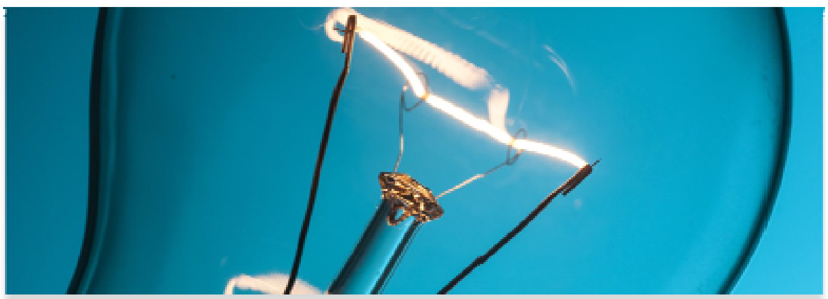
1. Who invented the first parachute?
2. What did the inventor of the first parachute do to test it?
3. What scientists went into business together?
4. Who made the first wobbly motorbike?
5. How much did the first plane stay in the air?
6. How much space did the first computer take up?
7. When was the first home computer invented?
8. What links computers all over the world today?

Choose the correct answer A, B, or C.

1. Scientists use _____ to make measurements.
   A) calculations B) estimations C) equations
2. 2. The molecules are in _____.
   A) movement B) motion C) activity
3. 3. A(n) _____ is a mathematical statement that shows two expressions are equal.
   A) estimation B) calculation C) equation
4. 4. A machine is a mechanical _____.
   A) gadget B) device C) appliance

2. Read the text to know more about physics and do the tasks after it.

PHYSICS



The word «physics» has its origin in the Greek word «pheusis» meaning nature.

Physics is a broad science concerning nature. Nature consists of countless objects. Any object (a pencil, sand, stone, a drop of water, etc.) is called a physical body or a body. All bodies consist of matter. Steel, copper, water, air and a stone are some examples of matter.

Upon close observation of different physical bodies, we notice, without any particular difficulty, that various changes are taking place within them.

All changes which occur in a physical body are known as phenomena. The melting of ice, the boiling of water, the falling of a stone, the heating of a wire by an electric current, wind, lightning – all these are different phenomena.

Physics studies not only various natural phenomena (mechanical motion, heat, sound, electricity, magnetism, light, etc.), but, more importantly, determines exact relations between physical phenomena. Physics is divided into a number of different fields – acoustics, optics, thermodynamics, astrophysics, radiophysics, nuclear physics, the physics of solids and others. These different fields are not mutually exclusive. In all cases, physics deals primarily with phenomena that can be accurately described in terms of matter and energy.

Physics can be divided into two great branches: experimental physics and theoretical physics. Experimental physics is the science of making observations and devising experiments. On the basis of experimental facts, theoretical physics formulates laws and predicts the behaviour of natural phenomena. Every physical law is based on experiments.

Physics helps explain the mysteries of the natural world; the development of other sciences depends in many respects on the knowledge of physical phenomena.

In the Physics faculty, students specialize in optical spectroscopy, X-ray spectroscopy, astrophysics, chemical physics, microwave electronics and quantum radiophysics, the physics of the ionosphere and wave propagation, the physics of thin films and many other areas.

Answer the following questions according to the text:

1. What is the origin of the word «physics»?
2. What is the physical body?
3. What is a phenomenon?
4. What physical phenomena do you know?
5. What are two great branches of physics?
6. How many areas of physics do you know?
7. What is a physical law based on?

Find English equivalents:

Состоит из, физическое тело, медь, входить в состав, падение, таяние, кипение, природное явление, электричество, магнетизм, поделить на, через призму, наблюдение, оптическая спектроскопия, распространение волны.

Match different parts of the sentences:

Physics helps explain…	formulates laws and predicts the behaviour of natural phenomena
Experimental physics is the science of…	that can be accurately described in terms of matter and energy

In all cases physics deals primarily with phenomena…	various changes are taking place within them
We notice without any particular difficulty, that…	making observations and devising experiments
On the basis of experimental facts, theoretical physics…	the mysteries of the natural world

Fill in the gaps with the words and word combinations from the text:

1. Physics is a broad science … … .
2. Any object is called a body or a ….
3. All bodies consist of steel, water, …, … and a … are some examples of matter.
4. All changes which … in a physical body are known as phenomena.
5. The melting of ice, …, …, …, – all these are different phenomena.
6. Physics can be divided into two great branches: … and ….
7. Experimental physics is the science of … … and … ….
8. Every physical law is based on ….

Complete these sentences:

1. All changes which occur in a physical body…
2. … – all these are different phenomena.
3. Physics studies not only various natural phenomena but more importantly…
4. Different fields of physics are not…
5. The development of other sciences depends in many respects…

3. **Read the text about the history of physics and choose the best title for each paragraph. There is one title which you do not need to use:**

A. Early ideas about physics.
B. Mechanical devices.
C. Ideas that created the modern world.
D. What we can learn from physics.
E. Atomic physics.
F. The origins of modern physics.

THE HISTORY OF PHYSICS

Ever since humankind first looked at the stars moving about the sky, they have wondered how and why they do that. People have always wondered why things behave the way they do. For thousands of years people have been asking questions like why things fall to the ground, not away from it. Why are some types of stone hard and others soft? Why does the Sun come up in the east and go down in the west? These are all questions that physics can answer.

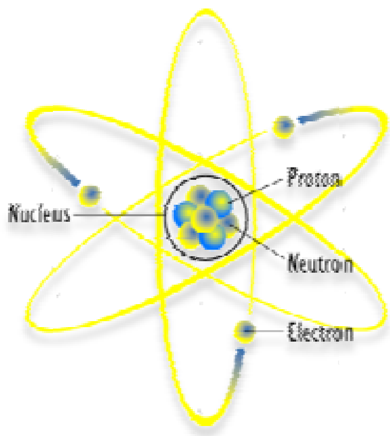
In the beginning, people answered questions like these in philosophical or religious ways. In early descriptions of the world, philosophers such as Aristotle reported what they believed to be true, rather than what they saw to be true. Others, however, such as astronomers from India, Egypt and China, or the Greek thinker, Archimedes, were able to use calculations to predict the movements of the Sun and the Moon or to describe and build machines.

The works of Eastern scholars reached Europe in the 12th and 13th centuries. There were studies of planetary motion by Indian astronomers, the theories of light from Buddhist and Persian thinkers and especially the work of the Persian philosopher Nasir al-Din al-Tusi on the planetary system. Eventually, these ideas pushed Europe into a scientific revolution. Galileo laid the foundations for this with his work on dynamics, that is, how things move. Nicolas Copernicus and then Johannes Kepler described the solar system with the Sun at its centre. Later, building on their work, Isaac Newton set out his Laws of Motion and modern physics was born.

The Copernican Planisphere, illustrated in 1661 by An-dreas Cellarius

The next great area of investigation was electricity and in the 19th century Michael Faraday first demonstrated an electromagnetic motor. Later, it was improved by James Clerk Maxwell, whose equations were also used to describe light. In proving Maxwell's equations, Heinrieh Hertz discovered radio waves and Wilhelm von Rontgen, X-rays. Maxwell's work was also the starting point for Einstein's Theory of Relativity. At the same time, other scientists were working on thermodynamics, that is, the study of changes of heat in matter. Physicists such as Robert Boyle, James Prescott Joule and many others set out the theories that allow us today to make use of engines and other mechanical devices. Rontgen's discovery of X-rays and the work of Pierre and Marie Curie on radioactivity led to the development of the science of nuclear physics.

In the first half of the 20th century, developments in physics were concerned with the structure of atoms. The parts of the atom were identified – its nucleus, protons and electrons. Eventually in the 1940s, scientists in the USA were able to split a nucleus and the result was the world's first nuclear explosion. Also at that time, scientists such as Max Planck were looking at the relationship between matter and wave motion. The field of quantum mechanics, which explains not only how atomic particles move, but how the universe does, came into being. Without physics to describe the way things behave, we would have none of the technology and machinery we take for granted today.



Discuss these questions with your partner:

1. How old is the science of physics?
2. Can you name any famous physicists?
3. Have people always believed that the Earth goes round the Sun?
4. What is lightning?
5. Which travels faster, sound or light?
6. What do you find the most fascinating about physics?

Match these words with their definitions. Then complete the sentences below with these words:

dark matter	carry out
survey	show
reveal	to increase in speed
spark	investigation
accelerate	quick flash
three-dimensional	best
leading	having height, width and depth
perform	hypothetical, invisible material which does not take in or give out light

1. The scientist wanted to _____ a dangerous experiment in the laboratory.
2. You have to wear these _____ glasses to watch this film.
3. He's a _____ heart surgeon; the operation is bound to be successful.
4. Usually trains _____ after pulling out from the station.
5. The company carried out a very interesting _____ the results of which were published in the newspaper.
6. Rub the two stones together until there is a _____.
7. What do you know about _____? It's difficult to explain.
8. He's innocent and i'll do whatever it takes to _____ the truth.

4. Read the text about the Universe formation and find 5 key words:

HOW DID THE UNIVERSE BEGIN

Scientists are still struggling to understand how the Universe began. No one knows exactly when or why it started. But in the 1940s physiciasts came up with theory known as the BIG BANG. It goes a bit like this:

Up until about 13,7 billion years ago, there was nothing. Then suddenly – BANG – there was something. Scientists still don't know how something came out of nothing, but it did. And that something was an incredibly tiny speck. This speck was really, amazingly small – thousands of times smaller than the head of a pin – but it contained all the matter and energy that has ever existed. The speck exploded, and expanded at an increadible speed.

Within a second it had become a huge, blisteringly hot fireball, and it grew bigger with every moment. As the fireball spread out, it cooled down and lumps of matter started to form. After about a billion years, these lumps joined together to form the first stars.

The Big Silence

Although scientists call this event the Big Bang, the beginning of the Universe would actually have been completely silent – because sound can't travel through empty space.

The Universe is still expanding. Some physicists believe it will go on getting bigger and bigger forever. Others think that, eventually, it will collapse back in on itself in a «Big Crunch» – and disappear completely – until another Big Bang happens.

Read the text about Universe myths.

CREATION IDEAS

Over the centuries, non-physicists have come up with other ideas for how the Universe might have began ...

An ancient Chinese myth says it all started when a giant hatched from a huge egg. The egg became the heavens and the Earth, and the giant's eyes turned into the Sun and Moon.

An African myth tells how a giant called Mbobo felt a terrible pain in his stomach, and vomited up the Sun, Moon, stars and everything in the world.

In 1975, a French racing car driver called Claude Vorilhon founded a religious cult called Raëlism. His followers believe that aliens used their superior technology to create life on Earth – including humans.

What myths about the Universe formation do you know?

Choose a proper word and complete the sentences:

1. How soon after the Big Bang did matter begin to *(cluster/coalesce/ coincide)* into the stars and galaxies?
2. Large-scale surveys have *(viewed/violated/verified)* the existence of super-clusters of galaxies.
3. The existence of super-clusters has long been *(converted/conjectured/ connected).*
4. The original distribution of matter is *(singled out/smeared out) by* evolutionary «mixing».
5. An understanding of the largest structures in the universe will *(clarify/ clean/coincide)* the processes that give rise to structures of all dimensions.
6. Astronomers and cosmologists are much preoccupied these days with explaining the *(convergence/emergence/existence)* and distribution of aggregates of matter in the Universe.

Give a free translation of the text below:

ЗВЕЗДА В 2.500 СОЛНЦ

Астрономы Висконсинского университета (США), анализируя данные, полученные с помощью искусственного спутника Земли, подтвердили, что в газовой туманности Тарантул (Tarantula Nebula) в Большом Магеллановом облаке (Large Magellanic Cloud) существует сверхмассивная звезда. Ученые, наблюдавшие ее ранее с использованием оптических телескопов, высказывали предположение, что масса этого небесного тела больше массы Солнца в 200–1.000 раз, однако спутниковые наблюдения вносят поправку – в 2.500 раз!

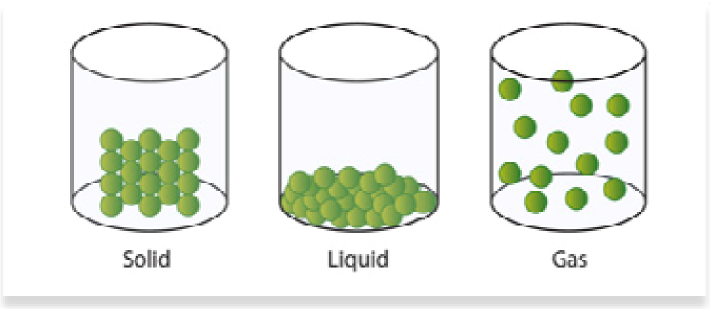
Звезда расположена в центре самого яркого облака ионизированного водорода – газовой туманности Тарантул, светимость которой в сто миллионов раз выше светимости Солнца.

5. **Read the text to know more about the main notions in physics:**

Read the text about matter:

What do trees, air, and water have in common? They all have matter. That means they take up space. You might be wondering why these things look so different if they all have matter. Everything found on Earth can be grouped into one of three states of matter: solid, liquid, or gas. In order to figure out which state of matter an object fits in, we have to examine its properties. The properties we look at are shape, mass, and volume. Mass is the amount of matter an object has, and volume is the amount of space the matter takes up.

Solids are easy to recognize. They have definite shape, mass, and volume. Trees are solids. They are made up of tiny particles called atoms. These atoms are packed closely together, and they hold the solid in a definite shape that does not change. If you look around your house, you will see lots of solids. Televisions, beds, tables, chairs, and even the food you eat.



Liquids do not have definite shape, but they do have definite mass and volume. Liquids are similar to solids because their atoms are close together, but what makes a liquid different is that those atoms can move around. Liquids can change shape by flowing. If you've ever spilled milk, then you know it spreads out across the floor. It does this because the milk is taking the shape of the floor. Since liquids do not have a definite shape of their own, they will take the shape of their containers. This is why the same amount of milk can look different in a tall glass, a wide mug, or spread out on your kitchen floor.

Gases do not have definite shape or volume. Like liquids, gasses will take the shape of their containers. If a gas is not in a container, it will spread out indefinitely. This is because the atoms in a gas are spaced farther apart than in a solid or a liquid. And, being spread out like this allows them to move around freely. Think about the air you breathe every day. That air is spread across the empty space around the earth. You've probably also noticed that you usually cannot see the air. This is another property of gases. Even though we cannot see them, you come in contact with them every day. There's air in the tires of your family car and your bicycle. There are many different types of gas in the earth's atmosphere, such as oxygen, carbon dioxide, nitrogen, water vapor, and helium.

When trying to remember the three states of matter, think about water. If it freezes into a solid, it becomes ice. Its atoms are packed together keeping its shape. Of course, we know water can also be a liquid. It flows in rivers or it can be poured from a glass. When water evaporates it becomes water vapor, a type of gas in the air. Try a little experiment of your own by placing an ice cube in a covered glass or container. You will be able to observe the ice first in its solid form and then watch as it melts into a liquid to become water. Eventually the water will turn to water vapor and your glass or container will be filled with this gas.

Choose a word from the box to complete each sentence:

solid	volume	container	matter	ice	juice
gases	mass	atoms	chair	oxygen	melting
liquids	shape	space	milk	helium	

1. The three basic properties of matter are ____, ____, and ____.
2. All matter is made up of tiny particles called ____.
3. Volume is the amount of ____ that matter takes up.
4. Mass is the amount of ____ an object has.
5. Liquids take the shape of their ____.
6. ____ do not have a definite shape or volume.
7. ____ do not have a definite shape, but they do have a definite volume.
8. ____ have a definite shape and volume.
9. A ____ and ____ are examples of solids.
10. ____ and _____ are examples of liquids.
11. ____ and _____ are examples of gas.
12. Solid ice is ____ when it is changing into a liquid.

Tell whether each is a solid, liquid, or gas:

milk		cookie	
oxygen		fish	
pencil		maple syrop	
shampoo		carbon dioxide	
ice cube		paint	
oil		salt	
water vapor		gasoline	
helium		sand	

Complete each sentence with the word solid, liquid or gas.

1. A ____ has a definite shape. It does not take the shape of its container. It also has a definite volume because it can be measured.
2. A ___ does not have a definite shape. It takes the shape of its container. It does have a definite volume because it can be measured.
3. A ___ does not have a definite shape. It sometimes takes the shape of its container and sometimes flies freely around you. These particles are not connected to each other and takes up whatever space is available.

Read the text about quantity of matter:

QUANTITY OF MATTER

Materials quite obviously take up space; we say they have volume. In Britain we buy petrol by the gallon, on the continent we buy it by the litre. The gallon, the litre are all units of volume – measures of a quantity of material bought or sold. But it is also quite common to buy and sell things by weighing them in ounces, pounds, kilograms or tons.

The simplest form of weighing machine consists of a balanced level with equal arms. When two identical lumps of material are hung from the ends of the arms, they exactly balance each other. If one of the lumps, say the coin is replaced by something quite different but which still balances it, then we say that the two things have the same quantity of matter. To quantity of matter measured in this way we give the name mass.

In this balancing method we are really balancing two forces, the weights of the objects. It is important to distinguish between the mass which we measure this way and the weight which helps us to do so. The heaviness of objects is due to the attraction which our planet, the Earth, has for them. This heaviness is different at other places. Thus it has been calculated that objects on the Moon have only one-sixth of their earth-weight; a 10-stone boy would weigh only 23 pounds on the Moon, would find it possible to jump 30 feet. And throw a cricket ball a quarter of a mile. The space traveller of the future will find that 50 pounds of luggage become less heavy the further he goes from the Earth. But the quantity of it – its mass – will not change; it will still balance 50 pounds on a level balance.

The standards of mass on the metric system and on the British system are the kilogram and the pound respectively The abbreviations for these are kg and lb. The abbreviations for the forces which the Earth has on them are Kg (for the kilogram-weight) and Lb (for pound-weight).

Questions:

What are the units of volume?
What are the units of weight?
What is the difference between weight and mass?
What is the the heaviest star?
What is matter?
What is mass?
What is volume?

Everything in our world has matter in one of three forms (solid, liquid, gas). Choose the correct state of matter for the following words:

frog		house		lemonade	
oxygen		chair		water	
desk		carbon dioxide		orange juice	

Fill the gaps (*matter*, *volume*, *mass*, *properties of matter*, *states of matter*):

1. The measure of how much material makes up an object is the ____________________.
2. _________________________ is the amount of space an object takes up.
3. The ______________________________ are solids, liquids, and gases.
4. Everything that takes up space and has mass is _________________________.
5. The ________________________________ are the things about an object that can be observed, such as its size, color, shape, or sound.

Choose the best answer.

1. The amount of space an object takes up is called ___________.
   a) mass b) volume c) matter d) property

2. Rocks are the ________ form of the states of matter.
   a) liquid b)gases c) solid d) both a and b
3. When describing the color, size, shape, or smell of an object, you are describing the
   a) properties of matter c) volume of matter
   b) states of matter d) mass of matter
4. Mass is __________.
   a) the measure of how much material an object is made of
   b) anything that takes up space and has mass
   c) the color or shape of an object
   d) both b and c

Read the text and answer the questions.

WHAT MAKES UP MATTER?

Matter is made up of tiny particles. These particles are called atoms. Atoms are the smallest unit of matter. You can't see atoms because they are so tiny. Two or more atoms can join together to make larger particles of matter. These larger particles can join other particles to make up the matter you can see. Atoms join together to make up different kinds of matter. Oxygen is made up of just one kind of atom. Water has two atoms that join together to make water.

Questions:

1. What is an atom?
2. Why can't you see an atom?
3. How many kinds of atoms does water have?
4. How many kinds of atoms does oxygen have?

Read the text and answer the question:

DOES MATTER CHANGE?

Matter changes. When you play with clay and change its shape, it is still clay. This is called a physical change. Changes in the size and shape of an object are physical changes. If you take a cup of water and place it in the freezer, the water changes from a liquid to a solid when its temperature reaches 0 degrees Celsius. Water in its solid form is ice. Ice can change from a solid to a liquid when it is heated. Heat speeds up the moving particles in ice and the particles move farther apart. Water that is left in a container in the sun will disappear after time. This is called evaporation. Evaporation is when a liquid changes into to a gas. Water in its gas form is called water vapor. Water will quickly change to a gas when the water is heated to 100 degrees Celsius. Cooling air causes water vapor to change to a liquid. This is called condensation. If you take a glass of water and add ice to it, small drops of water will form on the outside of the glass. This is condensation.

Questions:

1. What are physical changes in matter?
2. Water will freeze at ______________________________.
3. What does heat do to the particles in ice?
4. What is evaporation?
5. What is water vapor?
6. What happens to water when it is heated to 100 degrees Celsius?

Read the text about time:

TIME

A time scale must be based on some happening which takes place regularly. The regular rotation of the Earth, which governs the rising and setting of the Sun or the passage of a star across the true north-south line (meridian), gives us our time-unit, the day, which is subdivided into hours, minutes and seconds. The time between successive transits of a star across the meridian is known as a sidereal day (sider, sideris, a star), and standard clocks are checked against this time.

Although sidereal time is of great importance to the astronomer, it is the mean solar day (the average time between successive transits of the Sun across the meridian) which is the unit on which the hours, minutes and seconds of daily life are based.

The division of the day into its parts is brought about by means of clocks. The Egyptians made use of the rate at which water or sand flowed through a hole in a vessel, while some people used the regular burning of a candle or oil-lamp. Most modern clocks are based on some type of oscillating system. A pendulum swings to and fro in a time which is almost independent of the extent of the swings.

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Write down words according to transcription:

[ˈkæn.dl̩]		[ˈsɪstəm]	
[dɪˈvɪʒn]		[ˌɪndɪˈpendənt]	
[əˈstrɒn.ə.mər]		[ˈmɪnɪt]	
[ˈaʊə(r)]		[ˈves.əl]	
[ɪˈdʒɪp.ʃən]		[ˈpiːpl]	
[ˈregjələ(r)]		[skeɪl]	

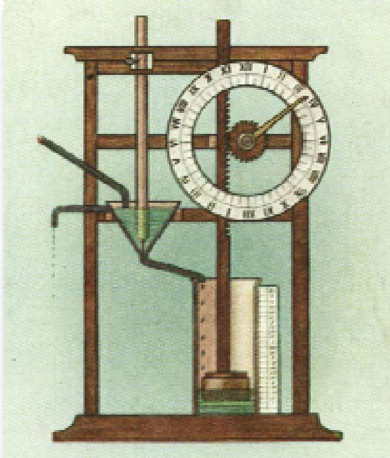
Read the text translating words in brackets and make two questions according to the text.

MEASURING TIME

Knowledge of the correct (время) is important in many walks of life. It allows the communications industries, from airlines to broadcasting, to coordinate their business; it is vital to navigators, who need to know time precisely to establish their exact positions. Indeed, it was the (рост) of long-distance sea travel from the late 15th (век) that led to the (развитие) of accurate clocks and chronometers.

The (измерение) of time (зависит от) the observation of an event that occurs at regular intervals. From the dawn of (цивилизация), time has been linked inextricably with astronomy – the (восход) and the setting of the Sun and stars, and the waxing and waning of the Moon, are regular phenomena. The sundial, which was in use several centuries BC, gives a measure of daytime, marked by the passage of a (тень) across a dial as the Sun moves across the (небо).

As more and more accurate clocks have been devised, so the (определение) of the basic unit of time has become more precise. The clocks of antiquity, such as the water-clock or clepsydra, were not very accurate. In the 14th century AD, the first (механические) clocks were made, driven by falling weights with a (механизм) to transfer their pull slowly and regularly to the clock train. Then in 1581, the Italian (математик) Galileo Galilei (1564-1642) (открыл) that the natural swing of a pendulum (повторяется) at regular intervals, depending not on the (угол) of the swing but on the length of the string that holds the bob. A pendulum about 990 millimeters long marks out seconds with its swing. Transferring this time unit to the clock train was the next step.



A WATER-CLOCK OR CLEPSYDRA

Read the text about pressure of the atmosphere.

PRESSURE OF THE ATMOSPHERE

By pressure we mean the force or weight acting on unit area. From many years of observations and experiments scientists have formulated a theory about the structure of gases; the theory is known as the Kinetic Theory of Gases. The theory draws a picture of a gas as being made up of a large number of very small particles, which are called molecules. The actual volume of the molecules is very small compared with the volume of the gas. They are moving at high speeds in all directions in straight lines, and collide both with each other and with the walls of the containing vessel. Since the molecules are perfectly elastic no energy is lost in these collisions. The continual bombardment of the walls of the containing vessel creates the pressure which the gas exerts on these walls. The pressure will depend upon the number of impacts on unit area per second. If the volume of the vessel increases, the number of impacts on unit area per second decreases, so the pressure decreases. Conversely the pressure will increase as the number of impacts increases if the volume of the vessel decreases.

Connect words and their definitions:

pressure	a scientific test to find out what happens to someone or something in particular conditions
observation	the way in which the parts of something are organized or arranged into a whole
particle	the process of watching someone or something carefully, in order to find something out
vessel	the smallest part of an element or compound that is capable of independent existence. It consists of two or more atoms
experiment	a bowl or other open container for liquids
volume	the amount of force that a gas or liquid produces in an area or container
molecule	a form of power such as electricity, heat, or light that is used for making things work

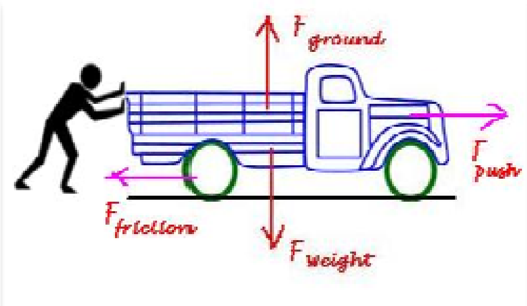
energy	the amount of space something fills, or the amount of space in a container
structure	an extremely small piece or amount of something

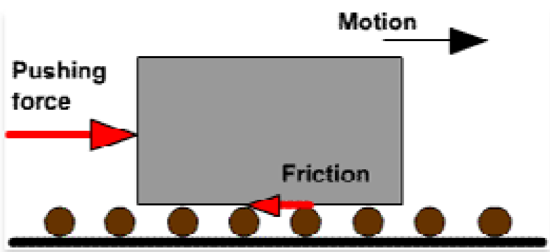
Read the text about friction:

FRICTION

Whenever a body slides along another body, a resisting force is called into play which is known as the force of friction.

This is a very important force and serves many useful purposes, for a person could not walk without it, or a car could not propel itself along the road without the friction between the tires and the road. On the other hand, friction is very wasteful because it reduces the efficiency of machines, since work must be done to overcome it, and this energy is wasted as heat. The purpose of this experiment is to study the laws of sliding friction and to determine the coefficient of friction between two surfaces.



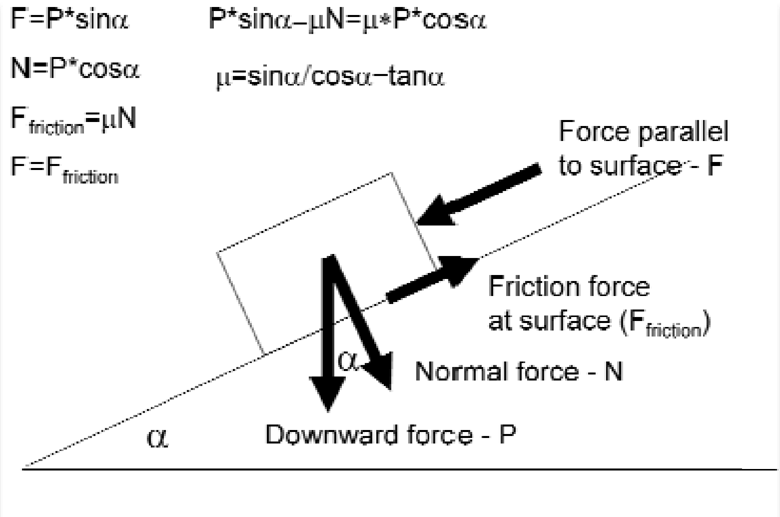


Friction is the resisting force encountered when one tries to slide one surface over another; this force acts along the tangent to the surface in contact. The force necessary to overcome friction depends on the nature of the materials in contact, their roughness or smoothness, and on the normal force, but not on the area of contact, within wide limits. It is found experimentally that the force of friction is directly proportional to the normal force. The constant of proportionality is called the coefficient of friction.

The coefficient of friction is equal to the force of friction divided by the total normal force pressing the surfaces together. Thus $K = F / N$ or $F = KN$ where F is the force of friction to be overcome. N is the total normal force, or the perpendicular component of the force holding the two surfaces together, and K is the coefficient of friction.

To determine the above relation the substances must be in the form of a plane placed horizontally, with a pulley fastened at one end. The other substance is made in the form of a block to which a cord passing over the pulley and carrying weights is attached; these may be varied until the block moves uniformly when given a very slight push. The normal force between the two surfaces can be changed by placing weights on top of the block, and the relation between the coefficient of friction, the force of friction, and the normal force can thus be tested.

The limiting angle of repose is the angle at which a body will just begin to slide down an inclined plane. The coefficient of friction is equal to the tangent of the angle of repose. It is found that the frictional force acting when actual sliding is taking place is slightly lower than the maximum frictional force that can act just before the body begins to slide. Thus the kinetic coefficient of friction is somewhat lower than the static coefficient of friction.



Derivation of the Coefficient of Friction

Read the text about sound.

SOUND

Every source of sound is in a state of vibration.

Sometimes the vibration is of short duration as in the crack of a whip or the bang of a gun, in many instances the vibration is clearly visible, as in the case of a taut wire. The vibratory origin of many common sounds is not so obvious, often because the vibrating system is gaseous and therefore invisible – the moaning of wind, the note of whistle, the thunderous noise which succeeds a lightning flash, but experiments have been devised which prove the vibratory nature of all such sounds.

Mere vibration, however, is not in itself sufficient to produce the sensation of sound; there must be some material medium to transmit the effects of the vibration to the ear of the listener – sound cannot travel through a vacuum. This can be proved by hanging an electric bell in a glass jar from which air can be withdrawn by an exhaust pump.

Read the text about gravity.

GRAVITY

Gravity is a force which pulls objects together. If you drop something, gravity makes it fall to the ground. Without gravity, it would just hang in the air.

Everything that has mass has gravity too, but you only notice the gravity of really massive objects, like the Sun, the Earth or other planets, which pull everything towards them.

Gravity in space is almost non-existent. You might have seen videos of astronauts in spaceships spinning around and chasing after floating objects. If it wasn't for the Earth's gravity pulling us down, we'd float around all the time too.

Translate into Russian:

- The most important information for cosmology must have been collected by telescopes that gather visible and near-visible light.
- Clusters of galaxies may have been members of still larger aggregates, namely super-clusters.
- Matter must have been more or less evenly dispersed before coalescence began.
- They can't have encountered serious difficulties in developing this theory.
- You should have paid more attention to the problem of explaining the emergence and distribution of aggregates of matter in the Universe.
- Individual member galaxies moving at random velocities cannot have crossed more than a fraction of a super-cluster's diameter in the billions of years.
- They ought to have accomplished large-scale surveys to verify the existence of super-clusters of galaxies.

6. Read the text about force:

A force is a push or a pull. You can't see a force, but you can see what it does. Forces can get things moving, or make them change direction. They can speed things up and slow them down, too. Forces can squeeze things, or change their shape. But, what ever they do, forces always act in a straight line.

Forces act on all of us all the time. Often forces balance and cancel each other out, so you don't notice them. But when they don't balance, they become more obvious. There are different kinds of forces.

Imagine you're pushing a trolley in a supermarket. That push is a force. The result of the force is that the trolley moves. If you push harder – in other words, apply a greater force – the trolley will move faster. Its speed will increase. But exactly how fast is the trolley moving? And how fast are moving yourself?

Speed is a measure of the *distance* something travels in a certain *time*. Physiciasts measure speed in metres per second (m/s) – how many metres something travels in a second. You can work speed out using this formular:

$$\text{speed } (s) = \frac{\text{distance } (d)}{\text{time } (t)}.$$

Imagine that you are in the market and you want the last packet of biscuits. You skid 12 metres down the aisle and reach it in 3 second. Work out your speed and explain it to others

The thing about forces is that they always act in a straight line. Physicists use the word **velocity (v)** to describe how fast something is moving in a particular direction. Like speed, it's measured in m/s.

Something can change velocity by changing direction, even if it doesn't change speed. It can also change velocity by speeding up (or accelerating) or slowing down (or decelerating).

Acceleration and deceleration are measured in metres per second, which is written m/s^2 (now much velocity changes in a second).

You can work out acceleration using this formula:

$$\text{acceleration} = \frac{\text{end velocity} - \text{start velocity}}{\text{time}}.$$

Suppose, trying to outrun the security guard, the shoplifter runs faster, increasing his velocity from 0m/s to 4 m/s in 5 seconds (without changing direction) Find out what the shoplifter's acceleration is.

Read the text about different kinds of forces:

The force you use to get an object going is an example of a «push» force. If you wanted to open a cupboard door, you'd use a pull force. Here are some of the main kinds of forces...

... elastic

Elastic force makes something bounce back when you've stretched it – like elastic.

... compression

Compression is the force you exert when you squash something.

... twist

When you turn a door handle or twist the lid of a jar, you're using a twisting force.

... electrical

Electrical force is caused by changed particles attracting or repelling each other. static electricity is an example of electrical force. This is what makes your hair stand on end when it's rubbed by a ballon.

... magnetic

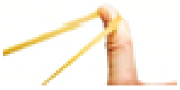
This is the force that makes magnets attract or repel each other.

... tension

Tension is the force that things have when they're pulled tight, like a rope in a tug-of-war.

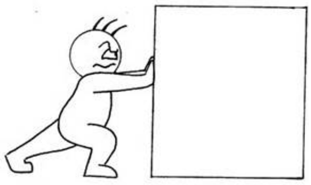
Connect the picture with the definite kind of force:

twist force



compression force

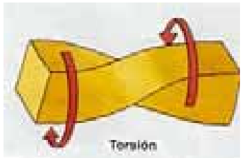
electrical force



tension force

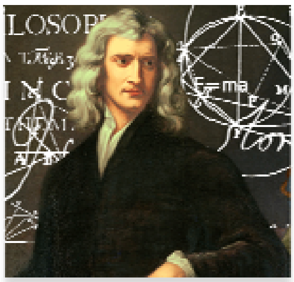
elastic force

magnetic force



7. Read the following text, answer the questions after it.

NEWTON



Mathematician and physicist, one of the foremost scientific intellects of all time.

Born at Woolsthorpe, near Grantham in Lincolnshire, where he attended school, he entered Cambridge University in 1661; he was elected a Fellow of Trinity College in 1667, and Lucasian Professor of Mathematics in 1669. He remained at the university, lecturing in most years, until 1696. Of these Cambridge years, in which Newton was at the height of his creative power, he singled out 1665–1666 as «the prime of my age for invention». He was forced to leave Cambridge when it was closed because of the plague and it was during this period that he made some of his most significant discoveries that he was reluctant to publish at the time.

As a firm opponent of the attempt by King James II to make the universities into Catholic institutions, Newton was elected Member of Parliament for the University of Cambridge to the Convention Parliament of 1689, and sat again in 1701–1702. Meanwhile, in 1696 he had moved to London as Warden of the Royal Mint. He became Master of the Mint in 1699, and was still in office at his death. He was elected a Fellow of the Royal Society of London in 1671, and in 1703 he became President, being annually re-elected for the rest of his life. His major work, Optics, appeared the next year; he was knighted in Cambridge in 1705.

As Newtonian science became increasingly accepted on the Continent, and especially after a general peace was restored in 1714, following the War of the Spanish Succession, Newton became the most highly esteemed natural philosopher in Europe. Newton refined Galileo's experimental method, creating the compositional method of experimentation still practiced today. In fact, the description of the experimental method from Newton's Optics could easily be mistaken for a modern statement of current methods of investigation, if not for Newton's use of the words «natural philosophy» instead of the term «the physical sciences».'

His last decades were passed in revising his major works, polishing his studies of ancient history, and defending himself against critics, as well as carrying out his official duties. Newton also devoted a majority of his free time later in life (after 1678) to fruitless alchemical experiments, research and trying to date events in the Bible. He was extremely sensitive to criticism, and even ceased publishing until the death of his arch-rival Hooke.

Questions:

1. The text tells us that Newton did a lot of reading during his time at Cambridge University.
   A. True
   B. False

2. According to the article, 1665–1666 was the period
   A. when he started inventing
   B. when he was at his best when creating
   C. when Science was beginning to flourish
   D. when he was single

3. He was forced to leave Cambridge because:
   A. he had the plague
   B. he couldn't publish anything
   C. there was an epidemic
   D. he was unwilling to publish the results of his discoveries

4. The text tells us that Newton opposed King James II when he made the universities into Catholic institutions.
   A. True
   B. False

5. Which of the following is true?
   A. he was a Member of Parliament for 13 years
   B. he was a Member of Cambridge Parliament
   C. he was a Member of Parliament from 1689 to 1702
   D. he was a Member of Parliament twice

6. «He was still in office at his death» means that:
   A. he was still Master of the Mint when he died
   B. he died in church
   C. he died as soon as he had become Master of the Mint
   D. he died in an office in 1727

7. Newton was the first to use the term «the physical sciences»:
   A. True
   B. False

8. Which of the following can be implied from the last paragraph? (More than one answer is possible):
   A. Hooke died before Newton did
   B. Hooke was a better scientist than Newton
   C. Newton published again after Hooke's death
   D. Newton stopped publishing when Hooke died

8. Read the text about the Newton's laws, explain words in bald and answer the questions:

Over 300 years ago, Isaak Newton studied forces and came up with a set of laws to explain how things move. These laws apply just as much to the latest sports car as to the first ball that was ever kicked across the ground.

They are known as Newton's Laws of Motion.

Newton's first observation was that an object which isn't moving won't start moving unless a force is applied to it. A football lying on the ground won't score a goal on its own – someone has to kick it.

This seems pretty obvious. But the first law also states that, once an object is moving, it won't stop unless another force makes it stop.

So the football will carry on sailing through the air unless it hits the back of the net, or the goalkeeper catches it, or the Earth's gravity drags it down and friction stops it rolling across the grass.

In other words, objects resist changing velocity – they won't speed up, slow down or change direction on their own. This is called **inertia**.

Newton's second law defines what a force is, and says that the force needed to change something's velocity depends on its mass. That's really just another way of saying **force = mass x acceleration**.

It will get moving much faster if you give it a bigger push. Things accelerate quicker if the force pushing them is greater.

Newton's third law states that whenever there is a force acting on something in one direction, another force of the same size is acting on it in the opposite direction.

According to the laws of physics, when you use a force to move something you're doing work. The bigger the force, or the further you move an object, the more work you do.

As well as defining what work is, physicists have also come up with a way to measure amounts of work. They use joules (J), which are also called newton metres (Nm). You can calculate the amount of work done using the formula:

$$\text{Work}(W) = \text{Force}(F) \times \text{distance}(d).$$

Task: *How much work do you do when you use a force of 0,5N to lift a pen 40 cm (0,4 m) to scratch your head*?

Questions:

1. What was Newton's first observation?
2. Why does an object start or stop moving?

3. Can an object change its direction on its own?
4. What is force?
5. How many Newton's laws do you know? Can we observe these laws in everyday life? Give examples.

9. Remember the following rules and fill in the gaps:

Forces and Motion unit of **Distance**: m, «*metre*». unit of time: s, «*second*» **Speed** = Distance / Time **Velocity** is speed in a certain direction. Velocity = Distance / Time unit of Velocity: m/s, «metres per second» Acceleration: a change in velocity.	**Acceleration = Change in Velocity / Time.** $\boldsymbol{a = (v - u) / t}$ ***a* = acceleration** ***v* = final velocity** ***u* = initial velocity** ***t* = time** **unit of acceleration: m / s^2, «metres per second squared»** **Distance is the area under the velocity time graph.**
Newton's laws 1. **Velocity** remains constant unless acted on by a resultant force 2. **Force = mass × acceleration** $\boldsymbol{F = m \times a}$ 3. If *A* applies a force to *B*, *B* applies an equal but opposite force on *A*. Unit of force: N, «Newton» N =kg × **m / s^2**. **Mass (*m*)** is an amount of substance. Unit kg «kilograms». **Gravity** is a force of attraction between masses. The acceleration due to gravity on earth (*g*) is aprox. 10 m/s^2 **Weight (*W*)** is the force of gravity pulling on a mass. $\boldsymbol{W = m g}$ **Friction** is a force that opposes motion due to passing objects rubbing off each other. **Density** = mass / volume **ρ = m / v**.	

Fill in the gaps:

unit of **Distance**: ________________ unit of **time**: ________________
Speed = ________________
Velocity is speed in a certain direction.
Velocity = ________________ unit of Velocity: ________________
Acceleration: a change in velocity.
Acceleration = ________________ *a* = ________________
unit of acceleration: ________________
Distance is ________________ the velocity time graph.
Newton's laws

1. Velocity remains ________________ unless acted on by a ________________
2. Force = ________________ ***F*** = ________________

3) If *A* applies a force to *B*, ____
Unit of force: ________________
Mass (*m*) is ________________. Unit ________________
Gravity is ________________________________

The acceleration due to gravity on earth (g) is aprox. ________________
Weight (W) is _________________________________ $W =$ ________________
Friction is a force that ________________due to passing objects rubbing off each other.
Density = _______________

10. Read about forces and motion and fill in the gaps:

Forces and Motion At terminal velocity the gravitational force down equals the air resistance force up. Vehicle stopping distance depends on the speed squared. moment = force × perpendicular distance from pivot Weight of a body acts through its centre of gravity Principle of moments: in equilibrium clockwise moments equal anticlockwise Hooke's law: the force is proportional to the extension	True for the initial linear region of a force – extension graph pressure = force / Area unit: (P) Pascal pressure at a point in a gas or liquid acts equally in all directions pressure in a liquid = height × density × g $p = h \times \rho \times g$

At terminal velocity the _______________ down equals the _______________force up.
Vehicle stopping distance depends on the speed _______________.
moment = _______________________________
weight of a body acts through its _______________
principle of moments: in equilibrium _______________equal _______________
Hooke's law: the force is proportional to _______________
True for the initial _______________ of a force – extension graph
pressure = _______________ unit: _______________
pressure at a point in a gas or liquid acts _______________
pressure in a liquid = _______________
$p =$ _______________

11. Read the text and fill in each of the blanks in the text with an appropriate preposition, selected from one of the prepositions shown below (note: each of the provided prepositions is used at least once, and some are used multiple times)

after	**as**	**by**	**for**	**in**	**into**	**of**	**on**	**with**

Edward Cussler and Brian Gettelfinger made Ig Nobel history ___ wearing swimming suits when they accepted the Chemistry prize. They had good reason, because their prize-winning study settled the longstanding scientific question: will humans swim faster or slower ___ syrup? Just imagine. ___ a beautiful day, two scientists pour 310 kg ____ guar gum (a food thickener, known ___ Europe ___ E412) ___ a 650 m^3 swimming pool, stir well ___ 36 hours, and then ask 10 swimmers to swim two lengths ___ the syrup and (___ a shower and three minutes ___ rest) two lengths ___ an adjacent pool filled ___ water. They record each swimmer's lap time and number ___ strokes, and publish their results

___ the November 2004 issue ___ the prestigious American Institute of Chemical Engineers Journal. Their findings? They discovered that there was no difference ___ speed.

Match the words or expressions on the right to their definitions on the left. Then make three sentences with them and ask your classmate to translate them into Russian.

A minimum point in a wave or an alternating signal.	wave crest
Any system for specifying the precise location of objects in space	lens
Field created by any object with mass, extending outward in all directions, which determines the influence of that object on all others	a trough
Mass times velocity; a quantity that determines the potential force that an object can impart to another object by collision	transverse wave
The highest part of a wave	field of gravitation
The force of gravity acting on a body, equal to the mass of the body multiplied by the acceleration of gravity	particle collider
A wave in which the vibrations of the medium are perpendicular to the direction the wave is moving.	frame of reference
The distance measured from crest to crest of one complete wave or cycle.	momentum
An accelerator in which two beams of particles are forced to collide head on	dark matter
The matter in the universe that is not directly observable as it emits no light	wavelength
A curved, ground and polished piece of glass or other transparent material used for the refraction of light	weight

4.3. PRODUCTION

Solve the following problem.

1. What is jello? Solid or liquid? For your answer, select either solid or liquid and convince your partner or your teacher of the answer you chose. Can both answers be correct? Why?
2. Is temperature related to the form that water is in? Explain.
3. Do you think that the temperature of matter is related to whether it is in solid, liquid or gas form? Why do you think that might be true?
4. Working in teams, design a different demonstration that will show that air takes up room; in other words that air, which is a gas, takes up space. Use any of the materials in this box to make your demonstration.

Make presentations:
Students should describe Newton's First, Second, and Third Laws of Motion and identify examples of these laws at work in the world around them.

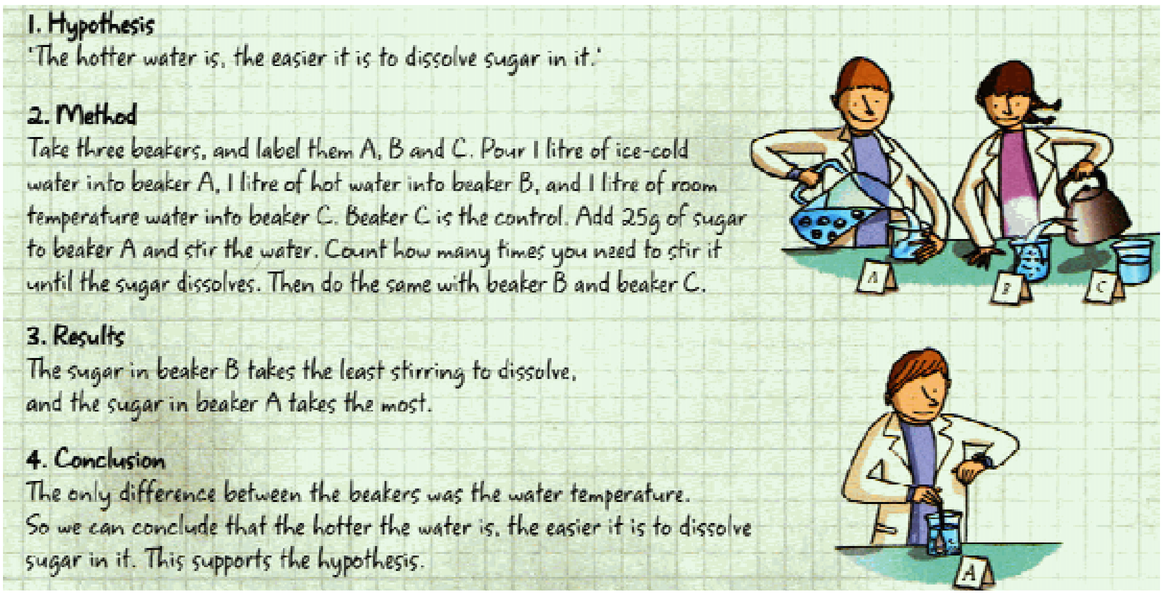
Answer the following questions using physical laws.

- Describe the reaction of the rubber band when it was cut.
- Astronauts grow taller in space. Why?
- Hold hands with a friend and spin around in a circle. You might notice that your hair flies out behind you and you feel as if you're being pulled outwards. Why?
- If you dive down into water, your ears may hurt. Why?
- You always hear thunder after you've seen lightning. Why?

How do experiments work?

1. **HYPOTHESIS**
   This is where you explain what your idea is. It also usually includes predictions of what you expect the results of the experiment to be.
2. **METHOD**
   This describes how you're going to do the experiment. It includes a control, which is the «normal» situation; and the experiment which is like the control but with one key difference. That way, if the results vary, you know it must be because of that one thing.
3. **RESULTS**
   These record the outcome of the experiment (including the control).
4. **CONCLUSION**
   This is where you interpret the results. Did they support the hypothesis? Have you changed or rejected your hypothesis after seeing the results?

Here is an example of a simple scientific experiment:



Task: Give your own simple scientific experiment.

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APPENDIX 1

Here is a list of starter topic ideas for research essays.

1. What are the long term effects of living in a technological world? Are these negative or positive?
2. Are the children now under 12 growing up in a different world than their older college age siblings? How is it different and what does that mean for them?
3. What is the most important new technology for solving world problems?
4. How has social media helped solve and create problems in countries outside the U.S.?
5. Will governments like China continue to be able to control access to the Internet and social media among their citizens?
6. How do social media, texting, cell phones and the Internet make the world bigger? Smaller?
7. What are the implications of ever increasing globalization through technology to our global economy?
8. Technology is moving so quickly that we are frequently using computers, software programs and other technologies that have frustrating glitches and problems. Is there a solution?
9. How does our experience of social interactions with other humans influence the way we interact with machines?
10. When does it become morally wrong to genetically engineer your child?
11. What are new ways people can use digital tools to change the world?
12. How is digital learning going to change schools and education?
13. Does the Internet need controls or censorship? What kind?
14. Do digital tools make us more or less productive at work?
15. To what extent is the development of new technologies having a negative effect on us?
16. How will technology developments change our lives in 20 years?
17. Should people get an identity chip implanted under their skin?
18. Should people in all countries have equal access to technological developments?
19. Can video gaming really help solve world problems?
20. How our brains different than a computer?
21. Is Organic food really better for you than genetically modified foods?
22. What are genetically modified food technologies able to do? How does this compare with traditional plant breeding methods?
23. Should genetically modified food technologies be used to solve hunger and nutritional issues in poorer nations?
24. Since it is now possible to sequence human genes to find out information about possible future health risks, is that something everyone should have done? What are the advantages or disadvantages?
25. If people have genetic testing, who has the right to that information? Should health care companies and employers have access to that information?
26. If parents have genetic information about their children, when and how should they share it with the child?

27. What sort of genetic information should parents seek to get about their children and how might this influence raising that child?
28. Would having cars that drive themselves be a good or bad idea?
29. How might travel in the future be different?
30. Should information technologies and Internet availability make work from home the norm?

http://hubpages.com/hub/100-Technology-Topics-for-Research-Pape

APPENDIX 2

ADDITIONAL TEXTS (LATEST SCIENCE GADGETS)

Retro Diner Slush Maker

What better gadget to spend your Christmas cash on than this Slush Maker. Create delicious, retro slush at home with the Retro Diner Slush Maker. Easy to use, simply add ice and salt to one compartment and pour your choice of fruit juice or soft drink into the other, then watch the machine spin into action. In just 15 minutes, your slush will be ready to drink, and the controlled pour spout will allow you to professionally dispense your slush into your glass. Designed to make up to 4 glasses of slush simultaneously, the device exhibits a nostalgic design, and is also easy to clean after usage.

Features:

Retro Diner Slush Maker
Makes up to four glasses at once
Creates slush drinks in 10–15 minutes
2 compartments: One for water and salt, and the other for your choice of fruit juice or soft drink
Controlled pour spout
Easy to assemble, disassemble and clean
Retro design

Pioneer rearview mirror telematics unit

Car technology is progressing quicker than ever, unfortunately only a select few at the top end of the market can afford to pack the latest gadgetry in. The Pioneer rearview mirror telematics unit allows for any car to pack in more technology via a wireless information module which fits casually into the car's rearview mirror.

The unit is equipped with an LTE communication module which links to the company's Mobile Telematics Center. This link provides information on local facilities, weather, news, traffic reports and navigation controls.

The details are displayed on a 5-inch LCD touchscreen. There is also a built in front view camera with wide angle lens which acts as a driving recorder. The camera monitors cars detecting possible dangerous scenarios, and providing audio / visual warnings. A rear view camera can also be used wirelessly.

Pioneer claim the module can be used in fleet management via the Global Navigation Satellite System (GNSS).

The module also boasts gyro and acceleration sensors, acts as a WiFi hotspot, and can also work as a conventional rearview mirror.

The module is expected to be available within the next year, with pricing yet to be announced.

Inch curved TV

This new TV looks insane. And by insane, we mean amazing. Boasting a ridiculous 105" screen, LG have put their curved Ultra HD TV up for pre-sale. Pricing is sketchy, as it differs massively by location. The TV is available for pre-order in South Korea, with a resolution of more than 11 million pixels (5120 × 2160), coupled with a CinemaScope 21:9 aspect ratio for the ultimate viewing experience.

This TV measures more than five times the resolution of a regular Full HD TV, resulting in a series of images that are so rich in both clarity and sharpness that the only way to fully appreciate the quality is to view it with your own eyes.

As well as fantastic viewing, the sound is equally impressive. With a built in 7.2 channel and new 150W sound system, the TV relies on LG's own ULTRA Surround concept, which is developed in conjunction with Harman Kardon, a renowned audio manufacturer. This all adds up to an incredible sound.

This whole set-up will certainly meet the expectations of any die hard TV fanatic, and rivals the power that could, before now, only be found in movie theatres. In case this TV is too big for you, there is a smaller version measuring 77". The future of TV is evolving at an incredible pace, and it feels like only a matter of time before we all have full blown home cinema systems in our homes.

APPENDIX 3

FAMOUS PHYSICISTS

Archimedes

The great scientist of ancient times Archimedes was born at Syracuse in Sicily in the year 287 BC. He was educated in Alexandria. After he had completed his course there, he returned to his native town where he spent the rest of his life and earned the high respect of its citizens. Archimedes discovered many laws of mathematics. He used to say: «Give me but one firm spot on which to stand, and I will move the Earth.» Archimedes was not only a mathematician. Many stories are told of his assistance to his city. Once he destroyed the enemy ships by focusing the Sun’s rays upon them by means of lenses. On another occasion, when the builders were unable to launch a ship, Archimedes did it using some mechanism. The King of Syracuse had high respect for Archimedes. It happened that a goldsmith made a gold crown for the king but the king suspected the gold to have been alloyed with some baser metal. The king asked Archimedes to test the gold of the crown. One day when Archimedes was having his bath, the method to test the crown came into his mind. And the astonished people saw Archimedes run through the streets of Syracuse shouting «Eureka! Eureka! (I have found it! I have found it!)» «This day, if we knew which it was, must be celebrated as the birthday of mathematical physics», an English scientist says.

Faraday

Michael Faraday, the great English physicist, was born in 1791 into a family of a blacksmith. At the age of thirteen he began to work at a bookbinder's shop. He read many books he had to bind and once he came across an article on electricity. Since that time he took a great interest in electricity and even tried to make some experiments. A well-known physicist Humphry Davy whose lectures Faraday used to attend helped him to become an assistant at the laboratory of the Royal Institute in London. Michael worked hard and with enthusiasm. He studied physics and chemistry and even lectured. He helped Davy to construct a safety lamp for miners. Then he was working on the problem of turning gases into liquids. One of the most important Faraday's discoveries of that time was the discovery of benzol which finds a wide application all over the world now. He succeeded in improving optical glass but above all he was interested in the problems of electricity and magnetism. In 1831 he made one of the most important discoveries – the electromagnetic induction. This discovery laid the foundation for the development of electrical engineering. Faraday was the first who measured the electric current and made a number of very important discoveries in the sphere of conductivity of different materials. Everybody who studies physics knows Faraday's Law. Faraday died in 1867 more than hundred years ago but we consider him one of those great scientists who laid foundations for the future age of electricity.

James Maxwell

James Clerk Maxwell was a remarkable physicist and mathematician of the 19^{th} century. He was born in Edinburgh on November 13, 1831. When Maxwell was a little boy, he was fond of making things with his own hands. At school Maxwell became interested in mathematics and when he was 14, he won a mathematical medal. After school Maxwell studied at the University of Edinburgh. While studying he read many books, made chemical, magnetic and other experiments and attended meetings of the Royal Society. Two of his papers were read before the Society and published in the Transactions. In 1850 Maxwell went to the University of Cambridge. He studied hard and joined in social and intellectual activities at the University. In 1854 he got the degree and for two years he stayed at Trinity College where he studied, lectured and did some experiments on optics. In 1856 he became a professor of natural philosophy at Marischal College, Aberdeen, and in 1860 professor of physics and astronomy at King's College in London. He remained there for five years. Those five years were the most productive for Maxwell. He continued his work on gases and the theory of electricity. One of Maxwell's greatest works was «On the Physical Lines of Force» which was published in London. Maxwell asserts the identity of the two phenomena – electric disturbances and light. After 20 years of thought and experiments he published his famous paper on Electricity and Magnetism. In 1871 he was appointed professor of experimental physics in Cambridge. In 1876 his classic Matter and Motion appeared. Maxwell died on November 5, 1879. His contribution to the kinetic theory of gases, the theory of heat, dynamics, and the mathematical theory of electricity are the best monuments to his great genius.

Ernest Rutherford

Ernest Rutherford, a great English physicist, was born in 1871 in New Zealand. His grandparents were among the first English settlers on the Island. In his early childhood Rutherford used to work at his father's farm. When he was five, he was sent to primary school. Later at the University he revealed great abilities in physics. He took a deep interest in physical experiments. His work on «The Magnetizations of Iron by High frequency Discharges» was a great success. In 1895 Rutherford came to Cambridge. Here at the famous University he began his work at the laboratory led by professor Thomson. After discovering X-rays many scientists started to work with the new rays. Rutherford was among them. Together with professor Thomson he found that the X-rays have positive and negative ions in the gas. In 1898 Rutherford came to Canada to work at a research chair of physics at the Montreal University. He studied the structure of the atom and the processes of radioactivity. In 1899 he discovered that radioactive radiation consists of two parts, which he called Alpha and Beta rays. Rutherford's discoveries made a great impression upon the scientists all over the world and he was invited to many universities both in the US and Europe to lecture on these interesting problems. Later he worked at the University of Manchester where he continued to study the structure of the atom. His work «The Scattering of Alpha and Beta Particles of Matter and the Structure of the Atom» was the result of his numerous experiments. During World War I he worked on the problem of submarine detection. In 1918 he resumed his work and in 1919 he first split the atom (atom fission). Rutherford died in 1937. His research work is of great importance and is continued by many scientists all over the world. Our country has many achievements in this field of science.

Edward M. Purcell

Edward Mills Purcell died on 7 March 1997 at his home in Cambridge, Massachusetts, from respiratory failure. The last time he participated in a scientific meeting was in December 1995, when the Golden Jubilee of the demonstration of nuclear magnetic resonance (NMR) in condensed matter was celebrated at Harvard University. Fifty years earlier, Purcell. H. C Torrey and R. V. Pound had observed the magnetic resonance absorption of hydrogen nuclei in paraffin (caused by a transition from one spun state of the nucleus to another), for which Purcell shared the 1952 Nobel prize for physics with Felix Bloch. The latter had led the group at Stanford University, which independently and almost simultaneously detected nuclear induction in water.

Purcell and Bloch first met, and first discussed NMR, at the April 1946 meeting of the American Physical Society m Cambridge, Massachusetts. They realized that they were studying the same physical phenomenon, albeit with somewhat different methods. While there was a spirit of healthy competition, their cordial relations are apparent from the telegram that Purcell received hours after the announcement of the Nobel Prize, «I think it is swell for Ed Purcell to share the shock with Felix Bloch».

A year earlier, Purcell and Harold L. Ewan had discovered that the microwave emission from atomic hydrogen in our Galaxy corresponds to the atom's hyperfine transition at 1,420 MHz (also a consequence of nuclear spin). This experiment was carried out on a shoestring budget. A small, horn antenna pointed out of a window on the top floor of the Lyman Physics Laboratory at Harvard University, and a microwave receiver at a wavelength of 21 cm measured the variation in the effective radiation temperature of the Milky Way as it rotated overhead past the aperture of the fixed horn. In the last year of his life, Purcell confided that he considered this and later contributions to radio astronomy at least as significant as his NMR work. Edward Purcell was born on 30 August 1912, in Taylorville, Illinois. His father worked for a local telephone company. Ed enrolled as an electrical engineering student at Purdue University, where he assisted a faculty member in a project on electron diffraction, and so acquired a taste for physics. He spent a year as an exchange student in Karlsruhe, Germany, before going to Harvard for a PhD working on a spherical electrostatic mass spectrometer, under the guidance of K.T. Bainbridge.

In the fall of 1940, the MIT radiation laboratory was established to further the development of radar technology. I.I. Rabi, the associate director, soon invited Purcell to join, and he became the head of the scientific development group in 1942e He was involved with the successes of X-band radar at a wavelength of 3 cm, and also learned that K-band radar, at 1.25 cm, had not been a military success because of strong absorption by water molecules in the atmosphere.

In the summer of 1945, the scientists of the radiation laboratory could all turn their attention to the question of what physics to do in peacetime. The problem of nuclear magnetic resonant absorption presented itself. Transitions between nuclear spin levels in a magnetic field had been studied in molecular beams, but hadn't been seen in solids. Purcell, Torrey and Pound were still engaged full time at the radiation laboratory, but during evenings and weekends they assembled equipment around a large electromagnet at Harvard, which had been used for cosmic-ray research in pre-war days, they borrowed a radio-frequency generator and receiver, and built a resonant cavity filled with paraffin. They observed proton magnetic resonance on 15 December 1945. Purcell described in his Nobel lecture how he had gained a new insight into the natural world: passing heaps of snow on his way home after the discovery, he wondered about all the protons processing quietly in the Earth’s magnetic field.

In February 1946 Purcell accepted me as a laboratory assistant. He, Pound and Torrey were still employed full time writing volumes of the MIT radiation laboratory series. Having spent the war in the Netherlands, occupied by Hitler’s forces, I now had the good fortune to find myself in the right place at the right time. Purcell was most helpful in getting me started – he knew what it was like to be a foreign exchange student from his days in Germany. Purcell, Pound and I concentrated on problems of nuclear magnetic relaxation. We introduced the concept of motional averaging of local magnetic fields, which results in extremely sharp resonances in fluids. We did not foresee the widespread applications that were to follow, including the use of high-resolution NMR spectroscopy in chemical analysis and the development of magnetic resonance imaging in medical diagnostics.

In the 1950s and early 1960s, Purcell served on a number of high-level government committees. As a member of the Presidential Scientific Advisory Committee he twice made a presentation to President Eisenhower on the issues of space technology and space exploration. He was happier, however, when he could again devote all his professional time to teaching and research. He wrote a well-known textbook on electricity and magnetism for a Berkeley physics series, He was artistic, and carefully prepared his own drawings and figures. He did theoretical and experimental work on the search for a magnetic monopole, analyzed the motion of interstellar dust particles and studied the locomotion of bacteria in fluids – which resulted in the popular lecture and publication Life at High Reynolds Number.

From 1960 on, Purcell no longer wanted to be responsible for a laboratory or graduate students. He preferred to discuss broad scientific issues with colleagues, and work out the details on his own. He was a deep thinker and valued his private life. He was modest and never actively sought recognition, although he enjoyed receiving the honours that were deservedly bestowed on him. It is a privilege to have known him as a person and as a scientist.

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