Part 1: Listening

You will hear some information about alternative sources of energy. Fill in the gaps in the text below according to what you hear. Use 1-3 words for each gap:

Solar and wind energies are two excellent options of renewable energy. But where is green energy successfully implemented? We take a look at four countries and four examples.

A building with a façade covered entirely in solar sounds. Right now it's still a demonstration model. But Portugal hopes to equip all the houses with solar panels so that home owners can meet their own energy needs. Today about 18% of country's electricity is taken from _____. Solar power can supply entire communities' energy needs.

In Chile growing economy is the cause for celebration, but electricity consumption is also growing. So the industrializing country has come up with a plan. One solution is _____. Here on Pacific Ocean coast wind conditions are favorable all year round. Engineers know that wind energy is _____. They say it would be foolish today not to use modern technologies to produce clear energy and protect environment. Theoretically wind energy can supply 100% of Chile's energy needs. At the moment it covers just 22%.

On the African continent Morocco has an ambitious plan for alternative energy. Although _____ is still in its infancy here scientists hope that with European help they'll obtain 40% of the country's energy needs from renewable resources within a few years. We need to keep in mind that Northern Africa in particular has a massive energy deficit. At the moment Morocco import electricity from Europe but they want to become energy independent. Two solar power plants are due for completion by 2015. Morocco hopes to export electricity to Europe.

Denmark is a global leader in renewable energy. The residents of a small island operate their own heating plant which burns straw. And typical for Denmark is a solar plant right next door. Two factors account for Denmark's success. There's a political intention towards _____. And there's a framework of

enterprises working on behalf of the public interest. These enterprises lay the ground for renewable energy initiatives. Today green energy covers 19% of country's need.

Converting to alternative energy requires investments and that requires political and popular will.

Part 2: Reading

Read the text and answer the multiple choice questions 6-10 below.

Electro kinetic phenomena

Electro kinetic phenomena are a family of several different effects that occur in heterogeneous fluids, or in porous bodies filled with fluid, or in a fast flow over a flat surface. The term heterogeneous here means a fluid containing particles. Particles can be solid, liquid or gas bubbles with sizes on the scale of a micrometer or nanometer. There is a common source of all these effects — the so-called interfacial 'double layer' of charges. Influence of an external force on the diffuse layer generates tangential motion of a fluid with respect to an adjacent charged surface. This force might be electric, pressure gradient, concentration gradient, or gravity. In addition, the moving phase might be either continuous fluid or dispersed phase.

A basic electro kinetics remediation site contains an external direct current source, a positively charged electrode (or anode) and a negatively charged electrode (or a cathode) placed into the ground. Placement of electrodes are based on size and shape of known contaminant plumes. The removal of contaminants and prevention of plume migration are big influences in determining the arrangement of electrodes. Each electrode is encased in a reservoir well in which an electrolytic solution can be injected. The electrolytic solutions serve both as a conducting media (or pore fluid) and as a means to extract contaminants and introduce chemicals or biological entities. Another use of the electrolytic solution is for control and/or depolarization of electrode reactions. Immersed in a solution the electrodes can result in oxidation at the anode site and the reduction at the cathodic site. The oxidation and formation of an acidic front are by products of the

process and cause varying degree of influence to the system. By pumping, processing and testing the electrolytic solution at each electrode site you can extend the life and efficiency of the system.

When current is applied, by the direct power source, to the electrodes, migrations occur beneath the soil surface. Although there are many types of migrations that occur in tandem with the current there are two driving migrations within electrokinetics; ionic migration and electrophoresis. When the electrolytic solution is injected within the soil part of the ionic solution forms a diffuse double layer with soils and contaminants. This diffused double layer will aid in the ionic drift that will occur as the current passes though the soil and surrounding liquid, this process is called electroosmosis. The thickness of the diffused double layer is a function of ionic composition of bulk solution and the average charge density of hydration products. As the electrolyte concentration increases the diffuse double layer thickness decreases. Electrophoresis is the mass flux of charged particles under an electric field. Both processes work at the same time but in a counter current manner. The charged particles driven by electrophoresis flow from the cathode to the anode while electrolytic solution flows from the anode to the cathode. Of the two main processes electrophoresis (or electromigration) is more dominant than electroosmosis. Electrophoresis servies as the driving factor that induces the flow of electroosmosis in the opposite direction. Electromigration also serves as the major component for ionic contaminant removal. For electromigration to occur absorbed material must be dissolved to an ionic form whether they are metals, organic or inorganic particles. Electroosmotic flow between the electrodes promotes the development of a low-pH environment in the soil. This low pH environment inhibits metallic contaminants from being sorbed onto soil particle surfaces which aids in the formation of compounds making electrokinetics possible. By this thought it is possible to acidify the soil and induce the release of absorbed heavy metals.

Electrokinetic remediation is applied to many contaminants that can be dissolved within groundwater. Heavy metals are one of the main contaminants that are removed by the electrokinetics process. Some metals like cadmium can be removed with high consequences on energy expenditure. Chromium can be

removed but with low efficiency because of the ease of hydrolysis allowing it to sorb to other substances. Chromium is also a candidate for electrokinetics removal although chromium migration is retarded in the presence of sulfur because it will break down into chromium . Other heavy metal species that are tested and reported to be treatable include; mercury, zinc, iron, lead, copper, and magnesium.

6. Electro kinetic phenomena can occur in the following EXCEPT

a. porous bodies filled with fluid.
b. heterogeneous fluids.
c. homogeneous fluids.

7. To be encased in a reservoir well means

a. to be set in.
b. to be covered by.
c. to be pulled out.

8. Immersed in a solution the electrodes can result in oxidation

a. at the anode site.
b. at the cathodic site.
c. at solution site.

9. When current is applied, by the direct power source, to the electrodes, migrations occur

a. above the soil surface.
b. inside the soil surface.
c. beneath the soil surface.

10. As the electrolyte concentration increases the diffuse double layer thickness

a. increases.
b. decreases.
c. compresses.

Материал текущего контроля по дисциплине «Иностранный язык (английский)» 2014-2015 уч. г.		Уровень высшего образования подготовки научно-педагогических кадров в аспирантуре

Part 3: Use of English

In the text below fill in each gap 11-15 with the appropriate word a-h from the right column. There are 3 words you DO NOT NEED to use.

Electrokinetics is also possible with alkali and alkaline (11) _____ metals which travel faster in most mediums than heavy metals. At tests between 20 to 30 volts, alkali metals were known to move between 50 to 60 cm per day per volts whereas heavy metal moved at (12)_____ between 10 and 20 cm per day per volts. It is possible that this difference could be because of the slow desorption and desolution of heavy metals. Electrokinetics can also be used to treat polar organic (13)_____ (phenol and acetic acid) and radionucleotides (radium), toxic anions (nitrates and sulfates), dense, non-aqueous-phase liquids (DNAPLs), cyanide, petroleum hydrocarbons (diesel fuel, gasoline, kerosene and lubricating oils), halogenated pollutants, explosives, halogenated and polynuclear aromatic hydrocarbons. One of the advantages of electrokinetics is that the remediation can be conducted (14)_____ (within the remediation site) to treat contaminants in low permeability zones to overcome accessibility of contaminants or delivery of treatment. Remediation can also occur ex situ (removed from the natural site) to have contaminants tested and treated within a laboratory. This versatility of treatment location can be very cost effective. Electrokinetics has the advantage of use in saturated or (15)_____ soils because of the insertion of pore fluid. Remediation can also occur despite soil stratifications or homogeneity. For soils that are low in permeability like kaolite and clayey sands it is possible to remove up to 90% of heavy metal contaminants. In many cases pretreatment of soil should be made to determine appropriate working conditions of the soil.	Organic Velocities Unsaturated Contaminants Earth Local Compounds In situ

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For questions 16-20 choose the correct answer:

16. Theorists seek _____ mathematical models that both agree with existing experiments and successfully predict future results.

a. develop
b. to develop
c. developed

17. Theoretical physics _____ historically _____ inspiration from philosophy.

a. had taken
b. was taken
c. has taken

18. Experimental physics informs, and _____ by, engineering and technology.

a. is informed
b. be informed
c. is informing

19. Contemporary research in physics can be broadly _____ into condensed matter physics; atomic, molecular, and optical physics; particle physics; astrophysics; geophysics and biophysics.

a. dividing
b. division
c. divided

20. Physicists who work at the interplay of theory and experiment are called phenomenologists.

a. who
b. which
c. whose