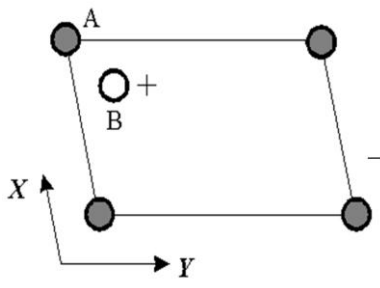
Question sheet 1

Q1. Look at the picture of the Main building of Moscow State University. What symmetry elements can you find? Explain whether the crystal to have the same set of symmetry elements.

Q2. Tell what the crystal is. List its main macroscopic properties (homogeneity, anisotropy, symmetry). Give the definition of these concepts. Do it verbally in a presentation format.



Cell parameters

$a \neq b \neq c$

$\alpha = \beta = 90^0$

$\gamma \neq 90^0$

Atom coordinates

A $0, 0, 0$

B x, y, z

Q3. ***W***rite down a structural class of crystal structure. Consider two different situations:

1. A and B - atoms of different elements,
2. A and B - atoms of one element.

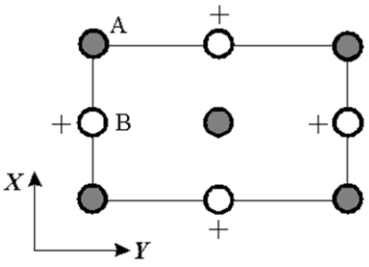
Specify lattice type (write an explanation). Justification of the decision is the image of an arrangement of the major elements of symmetry against an arrangement of atoms (if at the same time drawing is overloaded, it is possible to represent an arrangement of elements of symmetry separately).

Q4. Describe how to index a lattice plane.

Question sheet 2

Q1. Look at the photo of the building of the Ministry of Defence of the USA (Pentagon). Estimate its symmetry. Whether the crystal can have such symmetry? Why&

Q2. Calculate packing factor of simple cubic lattice and **present the method** of calculation.



Cell parameters

$a \neq b \neq c$

$\alpha = \beta = \gamma = 90^0$

Atom coordinates

A $0, 0, 0;\ \frac{1}{2}, \frac{1}{2}, 0$

B $\frac{1}{2}, 0, z;\ 0, \frac{1}{2}, z$

Q3. ***W***rite down a structural class of crystal structure. Consider two different situations:

1. A and B - atoms of different elements,
2. A and B - atoms of one element.

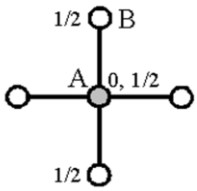
Specify lattice type (write an explanation). Justification of the decision is the image of an arrangement of the major elements of symmetry against an arrangement of atoms (if at the same time drawing is overloaded, it is possible to represent an arrangement of elements of symmetry separately).

Q4. Describe how to draw your own lattice planes. For example $(2\bar{1}3)$

Question sheet 3

Q1. What is the order of elements of symmetry in the symbols of Bravais. Write full and abbreviated form of the symmetry class of the Egyptian pyramids.

Q2. List general steps that we should take to calculate packing efficiency. **Make small presentation** of the calculations of packing factor for CsCl structure.



The chain axis Z is perpendicular to the plane of the drawing

Q3. ***W***rite a structural class of chain. Consider two different situations:

1. A and B - atoms of different elements,
2. A and B - atoms of one element.

Specify lattice type (write an explanation). Justification of the decision is the image of an arrangement of the major elements of symmetry against an arrangement of atoms (if at the same time drawing is overloaded, it is possible to represent an arrangement of elements of symmetry separately).

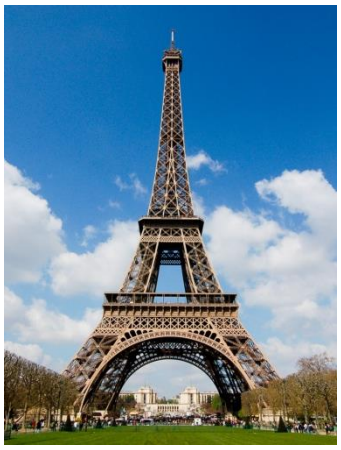
Q4. Describe how to find the angle between two planes (121) and $(21\bar{1})$.

Question sheet 4

Q1.What is a crystal system? Look at the pictures below and decide to which the crystal system the figure of a) a man, b) high-rise Moscow State University building, c) the Eiffel tower are related?

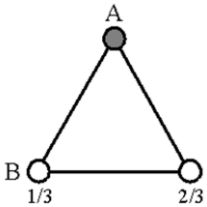
A

b



c

Q2. What is the fundamental difference between single crystal, polycrystalline and amorphous solids. ***Make a mini-presentation of*** some of the possible applications of materials showing optical anisotropy



The chain axis Z is perpendicular to the plane of the drawing

Q3. ***W***rite a structural class of chain. Consider two different situations:

1. A and B - atoms of different elements,
2. A and B - atoms of one element.

Specify lattice type (write an explanation). Justification of the decision is the image of an arrangement of the major elements of symmetry against an arrangement of atoms (if at the same time drawing is overloaded, it is possible to represent an arrangement of elements of symmetry separately).

Q4. Describe how to find the angle between two directions (121) and (210).