

Physics 1 (Biological Chemistry)

List of possible questions (8 will be selected – max. one from each group):

- 1a: List all basic units of the SI system (with their exact [older] definitions).
- 1b: Describe basic 4 physical interactions (forces) together with their force carriers.
- 1c: Explain the role of basic physical constants and give their approx. values (universal gravitational constant, electric permittivity of vacuum, magnetic permeability of vacuum, speed of light, Boltzman constant, Avogadro constant).
- 2a: Explain the first Newton's law of motion.
- 2b: Explain the second Newton's law of motion.
- 2c: Explain the third Newton's law of motion.
- 3a: Define basic parameters in mechanics – velocity, acceleration, angular velocity, force, momentum, moment of force.
- 3b: Define basic parameters in mechanics – force, pressure, work, power, moment of inertia.
- 3c: Define and describe fundamental types of mechanical energy.
- 4a: Explain three Kepler's laws.
- 4b: Explain Newton's gravitational law
- 4c: Explain properties of free fall (basic equations, shapes of orbits in gravitational field).
- 5a: Describe various mechanical oscillators.
- 5b: Describe mechanical waves, write the basic form of wave equation.
- 5c: Describe Huygens principle, interference of waves and Doppler effect.
- 6a: Explain the basic properties of ideal gas and list its state variables.
- 6b: Write the state equation for ideal gas (ideal gas law) and explain all parameters.
- 6c: Explain three laws of thermodynamics.
- 7a: Explain thermodynamic temperature and other temperatures scales.
- 7b: Explain basic processes in ideal gas (isothermal, isochoric, isobaric and adiabatic).
- 7c: Explain basic mechanisms of heat transfer (give examples from nature).

8a: Define Coulomb's law and explain all parameters. Explain the triboelectric effect.

8b: Define the electric voltage and potential. Define the unit volt.

8c: Define the electric current and current density. Define the basic SI unit ampere.

9a: Define electric flux and Gaussian law.

9b: Describe electrical dipole and give the formula for its potential.

9c: Give Ohm's law, explain electric resistance and conductance.

10a: Explain electric resistivity and conductivity, give the continuum equation.

10b: Explain properties of dielectric material and function of a capacitor.

10c: Explain impedance and admittance for alternating current (and basic properties of AC).

11a: Describe magnetic dipole and the character of its field. Define the magnetic flux.

11b: Define magnetic intensity and induction, give the basic relation between them.

11c: Explain basic magnetic property of the material (permeability) and explain basic types of material – diamagnetic, paramagnetic and ferromagnetic.

12a: Explain magnetic hysteresis.

12b: Explain concept of magnetic domains.

12c: Explain Curie's temperature.

13a: Write the Lorentz force (law) for a particle with charge q and velocity \mathbf{v} .

13b: Explain the right-hand rule for Lorentz force (law).

13c: Describe the Biot-Savart law.

14a: Faraday's law of induction – define the electromotive force (and its unit).

14b: Faraday's law of induction – define the inductance).

14c: Describe the difference between a DC dynamo and AC alternator.

continuation on the next page – list of possible exercises

List of possible exercises (2 from the list will be selected, with a numerical content):

(a home-made paper list of basic physical constants can be used, and also a calculator - but NOT a mobile-phone!)

1. Evaluate maximum height and appropriate timings in a case, when a body was thrown up with some initial speed.
2. Find amplitude, period, frequency and amplitude – from a given equation for a case of harmonic oscillator.
3. A liquid is transported in a pipeline with a given circular cross-section and velocity. calculate the mass of the liquid, transported in a given amount of time.
4. Find the molar mass of gas when there are given its temperature, pressure and density (try to estimate the type of gas).
5. Calculate the forces acting between two electrically charged spheres, if these are placed in various environments (electric charges and distance between them are given).
6. Calculate the magnetic induction in vacuum in a small distance from very long straight wire, when the current is given?