UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY ZVORNIK

PHYSICS

COLLECTION OF ENTRANCE EXAM QUESTIONS

Dr Svetlana S. Pelemiš

Zvornik, Faculty of Technology
2025

Preface

This collection of problems and theoretical questions in Physics is intended to assist candidates in preparing for the entrance examination at the Faculty of Technology, University of East Sarajevo.

It includes carefully selected problems that cover fundamental concepts of classical and modern physics, adapted to the level of understanding required for prospective students.

PART I: QUESTIONS

Mark the Letter in Front of the Correct Statement

1. A – A nanometer is one billionth of a meter.
   B – One millionth of a farad is a picofarad.
   C – A microvolt is one millionth of a volt.
   D – The name for a thousand pascals is gigapascal.
   E – A megawatt equals one billion watts.

2. A – There are a total of seven SI base units.
   B – In addition to the unit for mass, there is also one for the amount of substance.
   C – The ampere is a base SI unit.
   D – The coulomb (C) is a base SI unit.

3. A – Power is defined as the rate of doing work.
   B – The unit for power is newton (N).
   C – Power is the same as force, but only in mechanical processes.
   D – Power is always equal to the product of force and velocity.
   E – Mechanical power is measured in watts (W).

4. A – The law of gravitation is equally applicable to particles and celestial bodies.
   B – Earth's gravitational acceleration is not equal to the acceleration due to gravity.
   C – Earth's gravitational force is not the same as the force of gravity.
   D – The law of gravitation and Newton's second law are linked by the equation: $ma = \gamma\frac{mM}{r^2}$

5. A – Due to viscosity, water does not flow at the same speed at all points of a pipe's cross-section.
   B – The viscosity coefficient is expressed in Pa•s.
   C – Some insects can walk on the water surface solely due to its high viscosity.
   D – The spherical shape of liquid droplets is due to surface tension.
   E – The surface tension coefficient is expressed in J/m.

6. A – Relative humidity is measured with a hydrometer.

B – As temperature increases in a closed room, relative humidity decreases.
C – In a saturated environment, evaporation equals condensation.
D – Relative humidity is expressed as a percentage.
E – When humidity saturation occurs, relative humidity is at its lowest.

7. A – Radiation intensity is the energy emitted by a source per unit time.
   B – The unit for radiation energy transfer is specific radiation capacity.
   C – The unit of radiation intensity is W/m2.
   D – The intensity unit of the acoustic part of the radiation spectrum is the decibel.
   E – For sound, defining intensity level is more suitable than defining absolute intensity.

8. A – A mathematical pendulum performs harmonic oscillations.
   B – The period of harmonic oscillations linearly decreases with time.
   C – Harmonic oscillations are described using sine or cosine time functions.
   D – During a harmonic oscillation, elongations are linearly proportional to the restor- ing force.

9. A – Heat is a physical property of a system; its quantitative measure is heat quantity.
   B – Surface tension is expressed in joules (J), and its coefficient in J•m2.
   C – Heat quantity is expressed in joules (J).
   D – Sound intensity level is in dB, and sound intensity in W/m2.
   E – Electric current is expressed in A, and its unit is W.

10. A – Sound waves propagate in only one direction.
    B – Acoustic waves in water cannot be transverse.
    C – Sound waves propagate in only one direction.
    D – Mechanical waves in solids can be both transverse and longitudinal.
    E – Airborne waves are always linearly polarized.

11. A – A gas can become a liquid without a temperature change.
    B – Sometimes a gas directly becomes a solid without condensation.
    C – During condensation, e.g., of water vapor, the system's temperature rises due to released heat.
    D – Water vapor consists of condensed air droplets.
    E – Some substances are denser in liquid than in solid state.

12. A – The charge of a body is exactly equal to an integer multiple of the elementary charge.
    B – Charging a glass or plastic rod means adding or removing electrons.
    C – The unit of electric charge is A•s.
    D – A metal cannot be charged by electrostatic induction.

13. A – The total electrical resistance of a combination of two resistors can be either smaller or greater than their individual resistances.
    B – Passing a stronger electric current through a long metal conductor increases its electrical resistance.
    C – The electrical resistance of an electrolyte decreases when the temperature is lowered.
    D – For metallic conductors, the electrical resistance is approximately linearly dependent on temperature.

14. A – Liquids and gases do not conduct electric current.
    B – Ions are charged atoms, molecules, or groups of atoms.
    C – The velocity of ions during electrolysis is close to the speed of light.
    D – The speed of negative ions, due to their smaller mass, is always much higher than that of positive ions.
    E – The speed of directed ion movement during electrolysis depends on the size of the ions and the type of electrolyte.

15. A – The basic characteristic of a magnetic field is its induction.
    B – A magnetic field is "produced" only by electric current.
    C – The induction of a magnetic field changes with the shape of the conductor.
    D – Magnetic induction in the SI system is expressed in A•m.
    E – The strength of the magnetic field is expressed in A/m.

16. A – Radio and television waves belong to the electromagnetic spectrum of relatively high frequency.
    B – The Sun is a source of electromagnetic waves.
    C – Atoms are actual (micro) sources of electromagnetic waves.
    D – The waves of an inductive magnetic field are defined by the vectors of electric and magnetic field strength.
    E – Unlike visible light waves, X-rays propagate more slowly.

17. A – A photon is a charged elementary particle.
    B – A photon is a particle with negative charge.
    C – A photon is an energy quantum of X-ray radiation.

18. A – The photoelectric effect is caused by electrons.
    B – The photoelectric effect can be caused by photons.
    C – It is explained by the energy and number of photons.
    D – It only occurs on metallic surfaces.
    E – It can be obtained using ultraviolet radiation.

19. A – Frequency is the number of full oscillations performed in a unit of time.
    B – When multiplied by the period of the process, it gives a value of 2π.
    C – In wave processes, it is proportional to the wavelength.
    D – It can be expressed in megahertz, i.e., millions of hertz.
    E – In acoustic processes, it defines the limit of sound audibility.

20. A – Ultraviolet radiation comes from the Sun.
    B – It can be generated by various low-frequency devices.
    C – It is invisible but can be recorded on a photo plate.
    D – It can be detected through fluorescence.
    E – It belongs to the domain of thermal radiation.

21. A – The electromagnetic spectrum includes thermal rays.
    B – The electromagnetic spectrum includes beta rays.
    C – The electromagnetic spectrum includes X-rays.
    D – The electromagnetic spectrum includes ultrasound.
    E – The electromagnetic spectrum includes visible light.

22. A – Gamma rays have the same nature as visible light.
    B – Gamma rays are photons of the highest energies.
    C – Gamma rays cannot ionize air.
    D – Gamma rays cannot be detected with a Geiger-Müller counter.
    E – Gamma rays are formed in radioactive processes.

23. A – Protons and neutrons are related elementary particles like positrons and neutrinos.
    B – Protons and neutrons can attract each other.
    C – They transform into each other during gamma decay.
    D – They appear in a free state during radioactive processes.
    E – They equally affect the chemical properties of elements.

24. A – Cosmic rays consist of various elementary particles.
    B – Cosmic rays do not include electromagnetic radiation (photons).
    C – Cosmic rays arrive at the Sun as protons.
    D – Cosmic rays include both particles and antiparticles.
    E – Cosmic rays include particles of very high energies, exceeding those generated in accelerators.

25. A – A helium nucleus can consist of two protons and one neutron.
    B – A helium nucleus can consist of two neutrons and one proton.
    C – A helium nucleus consists of two protons and two neutrons.

D – A helium nucleus consists of three protons and one neutron.
E – A helium nucleus consists only of two protons.

26. A – Radioactivity is the phenomenon of atomic nucleus decay.
B – Radioactivity is a property only of heavier elements ($Z > 83$).
C – It manifests simultaneously with alpha and beta radiation.
D – It depends on whether the element is in pure or compound form.
E – It can arise under the influence of other radioactive radiation.

27. A – Elementary particles form every substance.
B – None of the known elementary particles form substances.
C – Atoms and ions are elementary particles.
D – In some cases, elementary particles can transform into one another.
E – In some cases, two elementary particles transform into two photons.

28. A – Electrons are positron equivalents.
B – Electrons are baryons.
C – Electrons are electro-negative.
D – Electrons are elementary particles.
E – Electrons can bind with protons.

29. A – Neutrons are electron equivalents.
B – Neutrons are mesons.
C – Neutrons are electro-neutral.
D – Neutrons are components of cosmic rays.

30. A – Protons are equivalent in charge to positrons.
B – Protons are nucleons.
C – Protons are electro-negative.
D – Protons are elementary particles.

PART II: PROBLEMS

Mark the Letter in Front of the Correct Answer

1. How many times does the centripetal force increase if the speed of uniform circular motion is doubled?
   A – 1, B – 2, C – 4, D – 8, E – 16.

2. What is the weight of a body with mass 100 kg on Earth's equator?
   A – 981 N, B – 983 N, C – 0.098 N, D – 978 N, E – 97.8 N.

3. How much work does a constant force do if it moves a 2 kg ball along a 12 m path in 3 seconds?
   A – 6 J, B – 10 Nm, C – 16 J, D – 32 Nm, E – 64 J.

4. A body of mass 10 kg is in free fall. At the end of a 5 m fall, its kinetic energy is approximately:
   A – 10 J, B – 50 J, C – 100 J, D – 500 J, E – 1000 J.

5. A 40 kg body moves at a constant speed of 2 m/s. Its kinetic energy is:
   A – 40 J, B – 80 N, C – 80 J, D – 160 N.

6. What is the height of an alcohol column (density 800 kg/m3) that balances a 240 mm water column?
   A – 0.3 m, B – 0.2 m, C – 0.192 m, D – 3 m.

7. In a liquid, 100 mm below the surface, the hydrostatic pressure is 1 kPa. What is the density of the liquid?
   A – 1000 kg/m3, B – 1 kg/m3, C – 10 kg/m3, D – 100 kg/m3, E – 0.1 kg/m3.

8. The speed of a wave with frequency 1 kHz and wavelength 1 mm is:
   A – 0.01 m/s, B – 0.1 m/s, C – 1 m/s, D – 10 m/s, E – 100 m/s.

9. If the period of harmonic oscillation is 30 s, the frequency is approximately:
   A – 33 Hz, B – 0.3 Hz, C – 3 mHz, D – 33 mHz.

10. A circuit contains three resistors. Two of them are 100 and connected in parallel. A third 50 resistor is connected in series with the combination. The total resistance is:
A – 150 , B – 250 , C – 50 , D – 125 , E – 100 .

11. A fuse of 10 A is in a circuit. What is the maximum power allowed on a 20 resistor?
A – 0.1 kW, B – 0.2 kW, C – 1 kW, D – 2 kW, E – 2 W.

12. In 20 μs, light in a vacuum travels a distance of:
A – 6 mm, B – 6 m, C – 6 light-years, D – 6 km.

13. What is the speed of electromagnetic waves of wavelength 0.4 μm and frequency $5 \cdot 10^{14}$ Hz?
A – 200 Mm/s, B – 0.5 Mm/s, C – 20 Mm/s, D – 2 Mm/s.

14. What is the energy of a visible light photon of frequency $5 \cdot 10^{14}$ Hz?
A – 0.33 aJ, B – 0.33 fJ, C – 1.32 hJ, D – 1.32 sJ, E – 0.43 aJ.

15. Electromagnetic wave power through a surface of 0.5 m2 is 0.1 W. The wave intensity is:
A – 0.1 W/m2, B – 0.2 W/m2, C – 1 W/m2, D – 2 W/m2, E – 0.05 W/m2.

16. Approximately what is the energy of a photon that causes the photoelectric effect on a metal if the corresponding wavelength is 400 nm?
A – 24 GJ, B – 0.24 nJ, C – 0.5 aJ, D – $6 \cdot 10^{34}$ J.

17. What is the power of radiation consisting of 10 photons per second with a frequency of $3 \cdot 10^{12}$ Hz?
A – 60 fW, B – 0.6 PW, C – 0.02 aW, D – 200 EW, E – 1.8 PW.

18. A radioactive isotope has a half-life of 8 s. If there are 40 nuclei, how long will it take for only 10 to remain?
A – 2 s, B – 4 s, C – 8 s, D – 16 s, E – 24 s.

19. A radioactive sample with a half-life of 120 s initially has $32 \cdot 10^6$ nuclei. After 10 minutes, the remaining number of nuclei is:
A – $32 \cdot 10^5$, B – $32 \cdot 10^3$, C – 10^6, D – $6.4 \cdot 10^8$, E – 32000.

20. A radioactive sample with a half-life of 30 s initially contains $1.6 \cdot 10^6$ atoms. How many atoms remain after 2 minutes?
A – $4 \cdot 10^5$, B – $8 \cdot 10^5$, C – 10^6, D – 10^5, E – $2 \cdot 10^5$.

ANSWERS (PART I)

Q	Answer	Q	Answer
1	A, C	16	B, C, D
2	A, B, C	17	C
3	A, E	18	B, C, E
4	A, D	19	A, D, E
5	A, B, D	20	A, C, D
6	B, C, D	21	A, C, E
7	C, E	22	A, B, E
8	A, C, D	23	B, D
9	C, D	24	A, D, E
10	B, D	25	A, C
11	A, B, E	26	A, E
12	A, B, C	27	A, D, E
13	A, D	28	C, D, E
14	B, E	29	C, D
15	A, C, E	30	A, B

ANSWERS (PART II)

Q	Answer	Q	Answer
1	C	11	D
2	D	12	D
3	E	13	A
4	D	14	A
5	C	15	B
6	A	16	C
7	A	17	C
8	C	18	D
9	D	19	C
10	E	20	D