

Placement Exam - Basic Principles of Physics Sample Questions

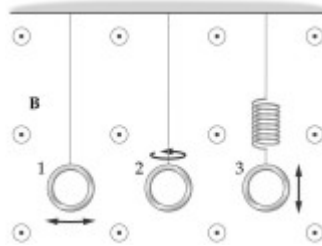
1. Newtonian Physics

Which of the following objects will reach the ground sooner if they are all dropped at the same time in a 2 m vacuum tube?

- A) A 2 kg Lead (Pb) block.
- B) A feather (weight ~5 g).
- C) A spoon (weight ~25 g).
- D) Not enough information on shape and size of objects.
- E) All objects will reach the ground at the same time, regardless of shape, size and weight.

2. Magnetism and Magnetic Induction

The three loops of wire shown in the figure are all subject to the same uniform magnetic field \vec{B} that does not vary with time. Loop 1 oscillates back and forth as the bob in a pendulum, loop 2 rotates about a vertical axis, and loop 3 oscillates up and down at the end of a spring. Which loop, or loops, will have an emf induced in them?



- A) loop 1 only
- B) loop 2 only
- C) loop 3 only
- D) loops 1 and 2
- E) loops 2 and 3

3. Electrodynamics

As more resistors are connected in a parallel circuit, the current in the power source:

- A) Increases
- B) Decreases
- C) Remains much the same
- D) Need more information

4. Optical phenomena

In a double-slit experiment, if the slit separation is increased, which of the following happens to the interference pattern shown on the screen?

- A) The minima get closer together.
- B) The maxima stay at the same position.
- C) The minima and maxima stay at the same position.
- D) The minima stay at the same position.
- E) The maxima get further apart.

5. Quantum Physics

The quantum mechanical formulation of a harmonic oscillator transforms into a classical problem for:

- A) The timescale of the observation is significantly longer than an oscillation period.
- B) The ground state's energy is zero.
- C) The total number of particles occupying states is above one mole.
- D) The oscillator's eigenfrequency is equal to the Planck constant.

6. Thermodynamics

If you wanted to know how much heat you need to supply to a particular piece of material to rise its temperature by a certain value, which of the following would be most helpful to know?

- A) The initial temperature.
- B) The coefficient of linear expansion.
- C) The specific heat capacity.
- D) The thermal conductivity.

7. Molecular Gas Theory

According to the ideal gas equation:

- A) The pressure p is proportional to the temperature T .
- B) The volume V is inversely proportional to the temperature T and the molar amount n .
- C) The volume V is proportional to the molar amount n and the temperature T .
- D) Gas molecules can undergo both elastic and inelastic collisions.
- E) V defines the total volume occupied by the gas molecules.
- F) Two statements are correct.
- G) Statements A, C and D are correct.

8. Quantum Mechanics

The Heisenberg uncertainty principle states a certainty limit on fundamental physical variables. Which of the following sentences are correct?

- A) The time uncertainty is proportional to the energy of the system.
- B) The location of a particle cannot be determined to lengths smaller than the Planck-constant.
- C) The two formulas $\Delta x \Delta p \geq h$ and $\Delta E \Delta t \geq \frac{\hbar}{2}$ are equivalent.
- D) None of the answers is correct.

9. Oscillations and Waves

A spaceship is travelling away from Earth at $1.8 \times 10^8 \text{ m s}^{-1}$. The time interval between consecutive ticks of a clock on board the spaceship is 0.50 s. Each time the clock ticks, a radio pulse is transmitted back to Earth. What is the time interval between consecutive radio pulses, as measured on Earth?

- A) 0.40 s.
- B) 0.50 s.
- C) 0.63 s.
- D) 0.78 s.

10. Photoelectric Effect

Monochromatic light strikes a metal surface and electrons are ejected from the metal. If the intensity of the light is increased, what will happen to the ejection rate and maximum energy of the electrons?

- A) greater ejection rate; same maximum energy
- B) same ejection rate; greater maximum energy
- C) greater ejection rate; greater maximum energy
- D) same ejection rate; same maximum energy

Physics Sample Questions Key

1. E
2. B
3. A
4. A
5. D
6. C
7. F
8. D
9. B
10. A