Physics Exam Question Paper - 3

Grade: VII
Duration: 2 hours
Maximum Marks: 80

Instructions:

- You will not be allowed to write during the first 15 minutes. Use this time to read the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers.
- Attempt all questions in Section A. Attempt as instructed in Section B.
- The intended marks for questions are given in brackets **[ ]**.

SECTION A (Objective & Short Answer)

Q1. Choose the correct answers from the given options: [10]

1. The work done by a force is negative when:
   (i) The force is perpendicular to displacement
   (ii) The force is in the direction of displacement
   (iii) The force is opposite to the direction of displacement
   (iv) The object is at rest
2. The refractive index of a medium is given by the ratio of:
   (i) Speed of light in vacuum to speed of light in the medium
   (ii) Speed of light in the medium to speed of light in vacuum
   (iii) Speed of light in vacuum to speed of sound in the medium
   (iv) Wavelength in vacuum to wavelength in the medium
3. A perfectly elastic collision is characterized by:
   (i) Conservation of momentum only
   (ii) Conservation of kinetic energy only
   (iii) Conservation of both momentum and kinetic energy
   (iv) No loss in gravitational potential energy
4. The unit of power in terms of base SI units is:
   (i) kg m^2/s^3 (ii) kg m/s^2 (iii) kg m/s^3 (iv) kg m^2/s^2
5. The apparent weight of a body submerged in a liquid is:
   (i) More than actual weight

(ii) Less than actual weight
(iii) Equal to actual weight
(iv) Zero

6. The internal energy of an ideal gas depends on:
   (i) Pressure only
   (ii) Temperature only
   (iii) Volume only
   (iv) Both pressure and volume
7. When a convex lens forms an image at infinity, the object is located:
   (i) At infinity
   (ii) Between the optical center and focal point
   (iii) At the focal point
   (iv) Beyond 2F
8. Which of the following phenomena proves that light has a wave nature?
   (i) Photoelectric effect
   (ii) Compton scattering
   (iii) Diffraction
   (iv) Black-body radiation
9. A transformer works on the principle of:
   (i) Electrostatic induction
   (ii) Mutual induction
   (iii) Electromagnetic force
   (iv) Self-induction
10. If a pendulum is taken to the moon, its time period will:
    (i) Increase
    (ii) Decrease
    (iii) Remain the same
    (iv) Become zero

Q2. Fill in the blanks with appropriate terms: [5]

1. The torque acting on a body is the product of __ and perpendicular distance from the axis of rotation.
2. A Carnot engine operates between two temperatures (T_1) and (T_2), where (T_1 > T_2). Its efficiency is given by __.
3. The unit of electric flux is __.
4. The force exerted by a magnetic field on a moving charge is given by __.
5. The escape velocity of a body on Earth is approximately __.

Q3. State whether the following statements are True or False: [5]

1. The center of mass of an object always lies within the object.
2. Sound waves can be polarized.
3. Inertia depends only on the mass of an object.
4. A transformer can increase power.
5. When a liquid is heated, its density increases.

Q4. Name the following: [5]

1. The scientist who proposed the uncertainty principle.
2. The quantity that remains constant in an isolated system.
3. The process by which heavy nuclei split into lighter nuclei, releasing energy.
4. The property of a body that resists changes in its state of motion.
5. The lowest possible temperature at which a substance has zero thermal energy.

SECTION B (Descriptive & Numerical)

Q5. Answer all the following questions: [10]

1. Define impulse and derive its relation with momentum.
2. Explain how the concept of moment of inertia is related to rotational motion.
3. Derive an expression for the acceleration due to gravity at a depth (d) inside the Earth.
4. Why do astronauts appear weightless in a spacecraft?
5. Explain how a moving coil galvanometer works.
6. Convert 100 K to Celsius and Fahrenheit.
7. Derive the formula for kinetic energy in terms of momentum.

Q6. Distinguish between the following: [10]

1. Elastic and Inelastic collisions
2. Angular velocity and Linear velocity
3. Isothermal and Adiabatic processes
4. Magnetic flux and Magnetic field strength

5. Gravitational potential energy and Elastic potential energy

Q7. Solve the following numerical problems: [20]

1. **(a)** A block of mass 5 kg moving with velocity 10 m/s collides elastically with another block of mass 10 kg at rest. Find the velocities of both blocks after the collision.
   (b) A ball is thrown upwards with a velocity of 20 m/s. Calculate the maximum height it will reach.
2. **(a)** A solid sphere of radius 0.2 m and mass 3 kg is rolling without slipping. Find its total kinetic energy if its center of mass moves at 4 m/s.
   (b) A force of 40 N acts on a body for 2 seconds. Find the impulse imparted to the body.
3. **(a)** Explain the working principle of an AC generator with a labeled diagram.
   (b) A parallel plate capacitor has a plate area of 0.01 m^2 and a separation of 1 mm. Find its capacitance if the dielectric constant is 5.
4. **(a)** A satellite orbits the Earth at an altitude of 500 km. Find its orbital speed assuming Earth's radius to be 6370 km.
   (b) Convert 200 J of energy into electron volts (1 eV = (1.6 × 10^{-19}) J).

End of the Question Paper