PHYSICS (Code No. 042) - Class XI

Time: 3 Hours   Max. Marks: 70

General Instructions:

1. All sections are compulsory.
2. There are internal choices in some questions.
3. Use of calculators is not allowed.
4. Physical constants: g = 9.8 m/s², etc. (Provide a list of relevant constants)

Section A (16 marks)

(1 mark each; No internal choice)

Instructions: Answer ALL questions.

1. What is the dimensional formula for force?
2. A body covers equal distances in equal intervals of time. What type of motion is this?
3. State Newton's second law of motion.
4. Define kinetic energy.
5. What is the principle of conservation of linear momentum?
6. What are conservative forces? Give one example.
7. Define center of mass.
8. State Kepler's third law of planetary motion.
9. Define stress and strain.
10. What is Pascal's law?
11. Define surface tension.
12. Define specific heat capacity.
13. **Assertion:** The volume of a gas increases with an increase in temperature at constant pressure.
    Reason: Gas molecules move faster at higher temperatures.
14. **Assertion:** Heat transfer by conduction requires a medium.
    Reason: Conduction involves the transfer of energy through molecular vibrations.
15. **Assertion:** Simple harmonic motion is a periodic motion.
    Reason: In SHM, the restoring force is directly proportional to the displacement from the mean position.
16. What is the difference between transverse and longitudinal waves?

Section B (10 marks)

(2 marks each; Internal choice in one question)

Instructions: Attempt any FIVE questions.

1. Explain the concept of significant figures with an example.
2. Derive the equation of motion: v = u + at graphically.
3. Distinguish between scalar and vector quantities. Give two examples of each.
4. State and explain the law of conservation of energy.
5. Explain the concept of rolling friction and its significance.
6. (OR) A body of mass 5 kg is moving with a velocity of 10 m/s. Calculate its kinetic energy.

Section C (21 marks)

(3 marks each; Internal choice in one question)

Instructions: Attempt any SEVEN questions.

1. Explain the different systems of units. Why is the SI system preferred?
2. Derive the equations of motion for uniformly accelerated motion using calculus.
3. A projectile is launched at an angle ;, v—F, F†R †÷ izontal. Derive expressions for its time of flight, range, and maximum height.
4. Explain the concept of impulse and its relation to momentum.
5. A spring has a force constant of 100 N/m. How much work is done in stretching it by 5 cm?
6. (OR) Discuss elastic and inelastic collisions.
7. Explain the concept of moment of inertia. What are its units?
8. Explain the variation of acceleration due to gravity with altitude and depth.
9. Describe the three types of moduli of elasticity.
10. Explain Bernoulli's theorem and its applications.
11. Explain the different modes of heat transfer.

Section D (8 marks)

(4 marks each; Internal choice in each question)

Instructions: Attempt any TWO questions.

1. **Case Study:** A car is moving on a circular track. Discuss the forces acting on the car, considering both a level track and a banked track. Explain the role of friction and centripetal force.
    (OR) **Case Study:** A simple pendulum is used to demonstrate simple harmonic motion. Explain the factors affecting the time period of the pendulum and derive the expression for its time period.

2. **Case Study:** A hot air balloon rises because of the difference in densities between hot air and the surrounding cooler air. Explain the principle behind this using the concepts of buoyancy and Archimedes' principle.

   (OR) **Case Study:** Two waves are superimposed. Describe the phenomenon of interference and beats. Give examples of each.

Section E (15 marks)

(5 marks each; Internal choice in each question)

Instructions: Attempt any THREE questions.

1. Explain Newton's laws of motion with examples. Discuss their applications.
    (OR) Derive the expression for the kinetic energy of a rotating body.
2. Explain the concept of gravitational potential energy. Derive an expression for the escape velocity of a body from the surface of the earth.
    (OR) Discuss the properties of bulk matter, with emphasis on the mechanical properties of solids and fluids.
3. Explain the kinetic theory of gases. Derive an expression for the pressure exerted by an ideal gas.
    (OR) Discuss the characteristics of SHM. Derive the expression for the time period of a simple pendulum.

(Note: This is a sample question paper. The actual question paper may vary slightly in terms of specific questions, but the overall structure, marking scheme, and difficulty level will remain consistent with the given guidelines.)