

****PHYSICS (Code No. 042) CLASS XII (2024-25) - SAMPLE QUESTION PAPER****

****Time Allowed: 3 hours**

Maximum Marks: 70**

****General Instructions:****

1. All questions are compulsory. There are 37 questions in total.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. Section A contains ten Multiple Choice Questions (MCQs) and six Assertion-Reasoning questions of 1 mark each, Section B contains five questions of 2 marks each, Section C contains seven questions of 3 marks each, Section D contains two case-study based questions of 4 marks each and Section E contains three questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Use of calculators is not permitted. You may use the provided list of physical constants.

****Physical Constants:**** (A list of relevant constants like G, k, e, etc. would be provided here in an actual exam)

****SECTION A (16 Marks)****

****(1 Mark each)****

****1-10. Multiple Choice Questions (MCQs):****

1. Which of the following is a fundamental unit in the SI system?
(a) Newton (b) Joule (c) Kilogram (d) Watt
2. The dimensional formula for force is:
(a) $[MLT^{-1}]$ (b) $[ML^2T^{-2}]$ (c) $[MLT^{-2}]$ (d) $[ML^{-1}T^{-2}]$
3. A projectile launched at an angle of 30° has a maximum range R. What will be its maximum range if it is launched at an angle of 60° ?
(a) $R/2$ (b) R (c) $3R/2$ (d) 2R
4. The unit of angular momentum is:
(a) Nm (b) Js (c) kg m/s (d) kg m²/s
5. The escape velocity from the earth's surface is:
(a) 11.2 m/s (b) 11.2 km/s (c) 9.8 m/s (d) 9.8 km/s

6. Which of the following is NOT a characteristic of an elastic collision?
(a) Momentum is conserved (b) Kinetic energy is conserved (c) Total energy is conserved (d) Objects stick together after collision
7. What is the SI unit for surface tension?
(a) N/m^2 (b) N/m (c) Nm (d) Nm^2
8. Which heat transfer process involves the movement of fluids?
(a) Conduction (b) Convection (c) Radiation (d) None of these
9. The time period of a simple pendulum is independent of:
(a) Length (b) Acceleration due to gravity (c) Mass of the bob (d) Amplitude (for small amplitudes)
10. The phenomenon of beats is due to:
(a) Reflection (b) Interference (c) Diffraction (d) Polarization

****11-16. Assertion-Reasoning Questions:****

****(Each question carries 1 mark. Choose the correct option from the following: (a) Both assertion and reason are true and the reason is the correct explanation of the assertion. (b) Both assertion and reason are true but the reason is not the correct explanation of the assertion. (c) Assertion is true but reason is false. (d) Assertion is false but reason is true.)****

11. ****Assertion:**** The work done by a conservative force is path-independent.
****Reason:**** The work done by a conservative force depends only on the initial and final positions of the object.
12. ****Assertion:**** A body can be in equilibrium even when acted upon by several forces.
****Reason:**** The vector sum of all the forces acting on the body must be zero.
13. ****Assertion:**** Viscosity is a measure of a fluid's resistance to flow.
****Reason:**** Higher viscosity means the fluid flows more easily.
14. ****Assertion:**** The velocity of sound in a gas increases with temperature.
****Reason:**** The kinetic energy of gas molecules increases with temperature.
15. ****Assertion:**** Electromagnetic waves are transverse in nature.
****Reason:**** Electromagnetic waves do not require a medium for propagation.
16. ****Assertion:**** In Young's double-slit experiment, the fringe width is inversely proportional to the distance between the slits.

****Reason:**** The fringe width depends on the wavelength of light used.

****SECTION B (10 Marks)****

**** (2 Marks each) ****

17. State Newton's second law of motion. Give its vector form.
18. Define the terms 'stress' and 'strain'. What is Hooke's law?
19. A body is projected vertically upwards with a velocity of 20 m/s. Find the maximum height reached and the time taken to reach the maximum height. ($g = 10 \text{ m/s}^2$)
20. (a) Define potential energy. Give an example.
OR
(b) Explain the concept of conservative and non-conservative forces with examples.
21. State Kepler's laws of planetary motion.

****SECTION C (21 Marks)****

**** (3 Marks each) ****

22. Derive the expression for the time period of a simple pendulum. State the conditions for its validity.
23. Explain the concept of centripetal force. Derive an expression for the centripetal force acting on a body moving with uniform speed v in a circle of radius r .
24. Explain the working of a hydraulic lift with a neat diagram.
25. Explain the concept of thermal equilibrium and state the zeroth law of thermodynamics.
26. Derive the equation of state for a perfect gas.
27. What is the Doppler effect? Explain it with respect to sound waves.
28. (a) Derive the expression for the fringe width in Young's double slit experiment.
OR
(b) Explain the phenomenon of diffraction of light. What is the width of the central maximum in single slit diffraction?

****SECTION D (8 Marks)****

**** (4 Marks each) ****

****29. Case Study:**** A simple pendulum is a simple harmonic oscillator for small angular displacements. Its time period is given by $T = 2\pi\sqrt{\frac{l}{g}}$

- (a) What is the effect on the time period if the length of the pendulum is doubled?
- (b) What is the effect on the time period if the mass of the bob is doubled?
- (c) What is the effect on the time period if the pendulum is taken to a place where the acceleration due to gravity is higher?
- (d) If the pendulum completes 10 oscillations in 20 seconds, what is its time period?

****OR****

- (a) What is meant by a simple harmonic motion? Give an example.
- (b) What is the expression for the total energy of a simple harmonic oscillator?
- (c) What is the phase difference between the displacement and velocity of a simple harmonic oscillator?
- (d) A simple harmonic oscillator has a time period of 2 seconds. What is its frequency?

****30. Case Study:**** A projectile is launched with an initial velocity u at an angle θ to the horizontal.

- (a) Derive the expression for the time of flight of the projectile.
- (b) Derive the expression for the maximum height reached by the projectile.
- (c) Derive the expression for the horizontal range of the projectile.
- (d) At what angle of projection will the range be maximum?

****OR****

- (a) Define projectile motion.
- (b) What are the horizontal and vertical components of the initial velocity of a projectile?
- (c) What is the shape of the trajectory of a projectile?
- (d) What factors affect the range of a projectile?

****SECTION E (15 Marks)****

**** (5 Marks each) ****

31. (a) Explain the principle of superposition of waves. Explain the formation of

stationary waves in a stretched string. Draw diagrams to illustrate your answer.

OR

(b) Explain the formation of beats. Derive the expression for the beat frequency.

32. (a) Explain the photoelectric effect. Describe Einstein's photoelectric equation and explain how it supports the particle nature of light.

OR

(b) Explain de Broglie's hypothesis of matter waves. Derive the expression for de Broglie wavelength.

33. (a) Explain the working of a p-n junction diode as a rectifier. Draw a circuit diagram and explain its working with waveforms.

OR

(b) Briefly describe energy bands in solids. Explain how the energy band structure of a material determines whether it is a conductor, an insulator, or a semiconductor.

This is a sample question paper. The actual question paper may vary slightly in terms of specific questions asked but will follow the same pattern and marking scheme as described in the instructions. Remember to consult your textbook and class notes for thorough preparation.