

ATOMIC ENERGY CENTRAL SCHOOL, INDORE
SAMPLE PAPER XI – PHYSICS

Time: 3Hrs

Maximum Marks: 70

General Instructions

- (a) All questions are compulsory.
- (b) There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each, questions 23 Carry four marks and questions 24 to 26 carry five marks each.
- (c) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (d) Use of calculator is not permitted.
- (e) You may use the following physical constants wherever necessary.

1. Two vectors \vec{A} and \vec{B} are directed along y-axis and z-axis respectively. What is the direction of the vector $\vec{A} \times \vec{B}$? 1
2. A motor cyclist is going in a vertical circle. What is the necessary condition so that he may not fall down? 1
3. Why do we prefer to use a wrench (spanner) of longer arm? 1
4. Can a physical quantity have units but still be dimensionless? 1
5. Define angle of friction? 1
6. At what points is the energy entirely kinetic and potential in S.H.M? What is the total distance travelled by a body executing S.H.M in a time equal to its time period, if its amplitude is A? 2
7. Show that Newton's third law of motion follows from the Newton's second law of motion. 2
8. What is geostationary satellite? State the conditions necessary for a satellite to appear stationary?

OR

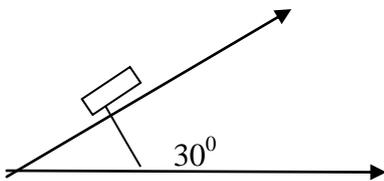
- Define Escape velocity? Why moon has no atmosphere? 2

9. A wave travelling along a string is described by $Y(x, t) = 0.005 \sin(80.0x - 3.0t)$ in which the numerical constants are in SI units (0.005 m, 80.0 rad m⁻¹, and 3.0 rad s⁻¹). 2

Calculate (a) Wavelength (b) Period of the wave. 2

10. If the earth were to suddenly contract to half of its present radius without any external torque on it, by what duration would the day be decreased? Assume earth to be a perfect solid sphere of moment of inertia $\frac{2}{5}MR^2$. 2

11. A block of mass 3 kg slides down an incline of angle 30° with acceleration g/4.



find the coefficient of kinetic friction. 3

12. The Frequency (ν) of transverse wave on a string may depend upon (i) length l of string (ii) tension T in the string and (iii) mass per unit length m of the string. Derive the formula for frequency with the help of dimensions. 3

13. Using Theorem of parallel axis and Perpendicular axis find moment of inertia of a disc about (i) its diameter (ii) a tangent in its own plane. 3

14 A body weighs 63N on the surface of the Earth. What is the gravitational force on it due to the Earth at a height equal to half the radius of Earth? 3

15. What is terminal velocity? Derive an expression for it.

OR

State Pascal's law of transmission of fluid pressure. Explain working of Hydraulic Lift with the help of a diagram? 3

16. (i) Explain Why the colour of a piece of iron heated in hot flame changes its colour from dull red to reddish yellow?

(ii) What kind of thermal conductivity and specific heat requirements would you specify for a cooking utensil? 3

17. Define coefficient of performance of a refrigerator. A Carnot heat engine has an efficiency of 10%. If the same engine is worked backwards to obtain a refrigerator, then find its coefficient of performance. 3

18. Define internal energy of a gas. Explain whether it is an Extensive or Intensive Variable? How internal energy of a gas can be changed? 3

19. Derive an expression for the apparent frequency of sound as heard by a stationary observer in a still medium, when the source is moving towards the observer with a uniform velocity. 3

20. Show that the average kinetic energy per molecule is directly proportional to the absolute temperature of the gas. Hence give kinetic interpretation of temperature. 3

21. Draw the following graphs between distance and time of an object in case of
(i) For a body at rest (ii) For a body moving with uniform velocity (iii) For a body moving with uniform acceleration. 3

22. What is Simple Harmonic Motion? What is phase difference between displacement and acceleration in S.H.M. A Simple harmonic motion is described by $a = -25x$ where a is acceleration (ms^{-2}) and x is displacement (m). What is the time period? 3

23. A group of boys were playing cricket in a park. The match started with team A which had experienced players and was very famous for its batting line. They batted brilliantly and made a good score. Team B which had some new players tried to come up to the mark but got all out with 2 runs short and were very disappointed. At the prize ceremony the captain of Team A praised team B for their excellent effort and said winning does not matter but efforts do.

(i) What values of captain of team A do you appreciate?

(ii) A cricket ball of mass 150 g is moving with a velocity of 12 m/s and is hit by a bat so that the ball is turned back with a velocity of 20 m/s. If the duration of contact between ball and the bat is 0.01 s, find the impulse and the average force exerted on the ball by the bat.

(iii) What is the force acting between bat and ball called? Why?

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24. What is perfectly elastic collision? Obtain an expression for the final velocities for the bodies undergoing elastic collision in one dimension. Also prove that if the masses are equal after collision the velocities get interchanged.

OR

(i) State and prove Work-Energy Theorem?

(ii) A light and a heavy body have the same momentum. Which one will have greater kinetic energy? 5

25. For an object projected with velocity u at an angle of θ from the horizontal direction, deduce expressions for (a) Time of flight (b) Horizontal range (c) Maximum height reached by the object.

(ii) A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flight in the two cases, then prove that $t_1 t_2 = \frac{2R}{g}$

OR

(i) Derive an expression for the centripetal acceleration of a body moving with uniform speed v along a circular path of radius r .

(ii) A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 25 seconds, what is the magnitude and direction of acceleration of the stone?

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26. (i) State and Prove Bernoulli's theorem.

(ii) In streamline flow, water entering a pipe having diameter of 2 cm and the speed of water is 1.0 ms^{-1} . Eventually, the pipe tapers to a diameter of 1 cm. calculate the speed of water where diameter of pipe is 1 cm.

OR

(i) What is the phenomenon of Capillarity?

(ii) Derive an expression for the rise of the liquid in a capillary tube.

(iii) What will happen if length of the capillary tube is smaller than the height to which the liquid rise?

Explain briefly.

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