
EXAMINATION PAPER : 2011

Time : 3 hours

Maximum Marks : 70

General Instructions :

- (i) All questions are compulsory.
- (ii) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and question 28 to 30 carry five marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in the 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 choices in such questions.
- (iv) Use of calculators is not permitted.
- (v) Please write down the serial number of question before attempting it.
- (vi) You may use the following values of physical constants wherever necessary.

Boltzmann's constant $K = 1.38 \times 10^{-23} \text{ JK}^{-1}$

Avogadro's number $N_A = 6.022 \times 10^{23}/\text{mol}$

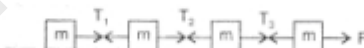
Radius of Earth $R_E = 6400 \text{ km}$.

$= 1.013 \times 10^5 \text{ Pa}$

1 Atmospheric Pressure $g = 9.8 \text{ m/s}^2$

$R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$

- 1. Write the dimensional formula of torque. 1
- 2. Draw velocity-time graph for an object, starting from rest. Acceleration is constant and remains positive. 1
- 3. Arrange increasing order the tension T_1 , T_2 and T_3 in the figure.



- 4. Why there is lack of atmosphere on the surface of moon? 1
- 5. The triple point of carbon dioxide is 216.55 K . Express this temperature on Fahrenheit scale. 1

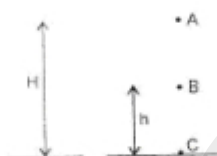
6. In an open organ pipe, third harmonic is 450 Hz. What is the frequency of fifth harmonic? 1
7. Which type of substances are called elastomers? Give one example 1
8. A simple harmonic motion is described by $a = -16x$ where a is acceleration, $x \rightarrow$ displacement in m. What is the time period? 1
9. Percentage error in the measurement of height and radius of cylinder are x and y respectively. Find percentage error in the measurement of volume. Which of the two measurements height or radius need more attention? 2

OR

The length and breadth of a rectangle are measured as $(a \pm \Delta a)$ and $(b \pm \Delta b)$ respectively. Find (i) relative error. (ii) absolute error in the measurement of area. 2

10. An object moving on a straight line covers first half of the distance at speed v and second half of the distance at speed $2v$. Find (i) average speed, (ii) mean speed. 2
11. An object moving on a circular path in horizontal plane. Radius of the path is r and constant speed is v . Deduce expression for centripetal acceleration. 2
12. Find the height from the surface of earth at which weight of a body of mass m will be reduced by 36% of its weight on the surface. ($R_e = 6400$ km) 2
13. Define gravitational potential. Give its S.I. unit. 2
14. An engine has been designed to work between source and sink at temperature 177°C and 27°C respectively. If energy input is 3600 J. What is the work done by the engine? 2
15. Explain : 2
 - (i) Why does the air pressure in a car tyre during driving increase?
 - (ii) Why coolant used in a chemical plant should have high specific heat?
16. Calculate the work done in blowing a soap bubble from a radius of 2 cm to 3 cm. The surface tension of the soap solution is 30 dynes cm^{-1} . 2

17. Show that Newton's second law of motion is the real law of motion. 2
18. A block initially at rest breaks into two parts of masses in the ratio 2 : 3. The velocity of smaller part is $(8\hat{i} + 6\hat{j})$ m/s. Find the velocity of bigger part. 2
19. A body of mass m is released in vacuum from the position A at a height H above the ground. Prove that sum of kinetic and potential energies at A, B and C remains constant. 3



20. Give two points of difference between elastic and inelastic collisions. Two balls A and B with A in motion initially and B at rest. Find their velocities after collision (perfectly elastic). Each ball is of mass " m ". 3



21. A liquid is in streamlined flow through a tube of non-uniform cross-section. Prove that sum of its kinetic energy, pressure energy and potential energy per unit volume remains constant. 3
22. Give reason :
 (i) fog particles appear suspended in atmosphere.
 (ii) two boats being moved parallel to each other attract.
 (iii) bridges are declared unsafe after long use. 3
23. State Kepler's law of Planetary motion. Name the physical quantities which remain constant during the planetary motion. 3
24. What is the law of equipartition of energy? Determine the value of γ for diatomic gas N_2 at moderate temperature. 3
25. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Drive an expression for its time period. Does it depend on the mass of the bob? 3

evidyarthi