Sample Paper-01
Physics (Theory)
Class – XI

Time allowed: 3 hours   **Maximum Marks: 70**

General Instructions:

a) All the questions are compulsory.
b) There are **26** questions in total.
c) Questions **1** to **5** are very short answer type questions and carry **one** mark each.
d) Questions **6** to **10** carry **two** marks each.
e) Questions **11** to **22** carry **three** marks each.
f) Questions **23** is value based questions carry **four** marks.
g) Questions **24** to **26** carry **five** marks each.
h) 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 in five marks each. You have to attempt only one of the choices in such questions.
i) Use of calculators is **not** permitted. However, you may use log tables if necessary.
j) You may use the following values of physical constants wherever necessary:

$c = 3x10^8 m/s$

$h = 6.63x10^{-34} Js$

$e = 1.6x10^{-19} C$

$\mu_o = 4\pi x10^{-7} TmA^{-1}$

$\frac{1}{4\pi\varepsilon_0} = 9x10^9 Nm^2 C^{-2}$

$m_e = 9.1x10^{-31} kg$

1. What is the slope of stress-strain body within the elastic limit? Comment: "A body at higher temperature contains more heat".
2. What is apparent weight of the floating block, when a block of wood is floating in a lake?
3. Fill in the blanks:
    (a) $6\,ms^{-2}$ = --------------- kmh^{-2}
    (b) 1 m = ------------------ light year
4. What happens to surface tension when impurity is mixed in liquid?
5. Is it possible for the relative velocity of two bodies moving in opposite direction to be greater than the absolute velocity of either?
6. If the velocity at the maximum height of a projectile is half its initial velocity of projection u, then find its range on the horizontal plane.
7. What fraction of its mechanical energy is lost in each bounce, if a ball bounces to 80% of its original height?
8. What is the error in the estimation of g if the length and time period of an oscillating pendulum have errors of 1% and 2%?
9. Give reason: "One should take short steps rather than long steps when walking on ice".
10. A solid sphere of radius 10 cm is subjected to a uniform pressure equal to $5\times10^8 Nm^{-2}$. Calculate the change in volume. [Given: Bulk modulus of the material of the sphere is $3.14\times10^{11} Nm^{-2}$]

Or

A group of boys went for boating as a picnic. They were dancing and singing. Suddenly, their boat lost its balance and the boys fell into the river. By seeing this, many fishermen rushed for their help and provided them pieces of wood so that they could float and save themselves. The alertness of the fishermen saved the life of all the boys.

(a) What would be the density of water if the boys saved themselves with a wood that floats with $\frac{1}{4}th$ of its volume above the water surface?

(b) What is the use of life saving jackets while going on a boat?

11. A Carnot engine whose heat sink is at $27°C$ has an efficiency of 40%. By how many degrees should the temperature of source be changed to increase the efficiency by 10% of the original efficiency?

Or

A flask contains argon and chlorine in the ratio 2:1 by mass. The temperature of the mixture is $27°C$. Obtain the ratio of

(i) Average K.E. per molecule

(ii) Root mean square speed v_{max} of the molecules of the two gases.

Given: Atomic mass of argon = 39.9 u; Molecular mass of chlorine = 70.9 u.

12. Find the pressure required to compress a gas adiabatically at atmospheric pressure to one fifth of its volume (Given: γ = 1.4)

13. If a block of mass M is placed on a frictionless, inclined plane of angle θ. Determine

(i) The acceleration of the block after it is released

(ii) The force exerted by the incline on the block

14. Calculate the rms speed of oxygen molecules at 1092 K, if the density of oxygen at STP = 1.424 kg m^{-3}.

15. Find the centre of mass of the remaining disc, if a circular hole of radius 1 m is cut off from a disc of radius 6 m and the centre of the hole is 3 m from the centre of the disc.

16. If a block of mass 2 kg is pulled up on a smooth incline of angle $30°$ with horizontal and the block moves with an acceleration of 1 m/s^2, then

(a) Find the power delivered by the pulling force at a time 4 seconds after motion starts.

(b) What is the average power delivered during these four seconds after the motion starts?

17. Show the variation of potential energy, K.E and the total energy of a body freely on earth from a height 'h' by using a graph.

18. An automatic manufacturer claims that its super-deluxe sports car will accelerate from rest to a speed of 42.0 ms^{-1} in 8.0 s assuming that the acceleration is constant.

(a) Determine the acceleration of car in ms^{-2}

(b) Find the distance the car travels in 8.0 s

(c) Find the distance the car travels in 8th second.

19. A monkey of mass 40 kg climbs on a rope which stands a maximum tension of 600 N. In which of the following cases will the rope break.

(i) When the monkey climbs up with an acceleration of 6 ms^{-2}

(ii) When the monkey climbs down with an acceleration $4\,ms^{-2}$

(iii) When the monkey climbs up with a uniform speed of 5 ms^{-1}

(iv) When the monkey falls down the rope nearly freely under gravity

20. Find the moment of inertia of the system about the bisector line AB when two uniform thin identical rods, each of mass m and length L are joined so as to form a cross as shown in the diagram?
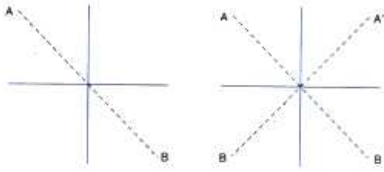
21. Deduce an expression for the orbital velocity of a satellite revolving around the earth in a circular orbit at a height 'h' above earth surface.

22. A thermodynamic system is taken an original state to an intermediate state by the linear process shown in the diagram. If its volume is then reduced to the original value from E to F by an isobaric process, then calculate the total work done by the gas from D to E to F.

23. Vinita went to her grandfather's village for vacation. She saw a bullock cart got struck in wet mud and the driver was not able to push it out by himself. Vinita ran to his help and together they pushed it out, but the iron rim of the wheel came out. They tried to put it on the wheel but it was smaller than diameter of wheel. Suddenly she collected some wood and set them on fire and heated the rim and it slipped on the wheel.

    (a) What nature is shown by Vinita?

    (b) Name the property of solid used here?

    (c) To what temperature had Vinita heated the ring so as to fit the rim of the wheel if the diameter of the rim and ring were 6.243 m and 6.231 m respectively at $27°$? [Coefficient of linear expansion of iron = $1.20 \times 10^{-5} k^{-1}$

24. Find the expression for time period of motion of a body suspended by two springs connected in parallel and series.

    Or

    Calculate the frequency of the first and last fork if a set of 24 tuning forks is arranged in series of increasing frequencies. If each fork gives with the preceding one and the last fork is octave of the first.

25. Explain the kinematic equation for uniformly accelerated motion.

    Or

    A particle is thrown over a triangle from one end of a horizontal base that grazing h vertex fall on the other end of the base. If α and β be the same angles and θ the angle of projection, prove that $\tan \theta = \tan \alpha + \tan \beta$.

26. If a stone is dropped from the top of a mountain and n second later another stone is thrown vertically downwards with a velocity of u m/s, then how far below the top of the mountain will be the second stone overtake the first?

    Or

    A particle is projected horizontally with a speed u from top of a plane inclined at an angle θ with the horizontal direction. How far from the point of projection will the particle strike the plane?