

Sample Paper-03 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:
- k)

$$c = 3x10^{8} m / s$$

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

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

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

$$\frac{1}{4\pi\varepsilon_{0}} = 9x10^{9} Nm^{2} C^{-2}$$

$$m_{e} = 9.1x10^{-31} kg$$

- 1. If one mass of one electron is 9.11×10^{-31} kg, then how many electrons would weigh in 1 kg?
- 2. What do you understand by the term conservative force?
- 3. Give reason: "Liquid set in rotation comes to rest after some line".
- 4. What is the number of degree of freedom of a molecule of a diatomic gas at room temperature?
- 5. What is the slope of stress-strain body within the elastic limit?
- 6. Give the limitations of the first law of Thermodynamics?

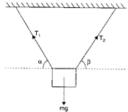
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If work required blowing a soap bubble of radius r is W, then what additional work is required to be done below it to a radius 3r?

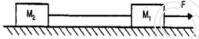
- 7. The measured quantities a, b, c and x is calculated by using the relation $x = \frac{ab^2}{c^3}$. If the percentage errors in measurements of a, b, and c are \pm 1%, \pm 2% and \pm 1.5 %, then calculate the maximum percentage error in value of x obtained.
- 8. What would be the velocity of the top end at the time of touching the ground if a rod of length *l* and mass M held vertically is let go down, without slipping at the point of contact?
- 9. State the laws of limiting friction.
- 10. If $1A^0 = 10^{-10}$ m and the size of a hydrogen atom is about 0.5 A^0 , then what is the total atomic volume in m^3 of a mole of hydrogen atoms?



- 11. What is the average speed during the whole journey, if a body covers half of its journey with a speed of 40 m/s and other half with a speed of 60 m/s.
- 12. Find the height to which it rises above the earth's surface if a particle is projected vertically upwards from the surface of earth of radius R with kinetic energy equal to half of the minimum value needed for it to escape.
- 13. If the density of hydrogen at S.T.P is 0.09 kg m^{-3} , then calculate
 - (i) RMS velocity
 - (ii) Mean kinetic energy E of one gram molecule of hydrogen at S.T.P.
- 14. The planet Mars has two moons, A and B
 - (i) How would you calculate the mass of Mars, A has a period 7 hours, 39 minutes and an orbital radius of 9.4×10^3 km
 - (ii) Assuming that Earth and Mars move in circular orbits around the sun with the Martian orbit being 1.52 times the orbital radius of the earth, then what is the length of the Martian year in days?
- 15. Deduce the height at which the value of g is the same as at a depth of $\frac{R}{2}$?
- 16. A body of mass m is suspended by two strings making angles α and β with the horizontal. Calculate the tensions in the two strings.



- 17. (i) Calculate the angular momentum and rotational kinetic energy of earth about its own axis.
 - (ii) How long could this amount of energy supply one KW power to each of the 3.5×10^9 persons on earth?
- 18. A diagram below is a light inextensible string. If a force F as shown acts upon M_1 , find the acceleration of the system and tension in string.



- 19. (i) State ideal gas equation.
 - (ii) Draw graph to check whether a real gas obeys this equation.
 - (iii) What is the conclusion drawn?
- 20. A uniform disc of radius R and mass M is mounted on an axis supported in fixed frictionless bearing. A light chord is wrapped around the rim of the wheel and supposes that we hang a body of mass m from the chord. Find the angular of the disc and tangential acceleration of point on the rim.
- 21. The following equation represents standing wave set up in medium $y=4\cos\frac{\pi x}{5}\sin 40\,\pi t$, where x and y are in cm and t in seconds. Find out the amplitude and the velocity of the two component waves and calculate the distance between adjacent nodes. What is the velocity of a medium particle at x = 3cm at time $\frac{1}{8}$ second?



22. Uniform spring whose upstretched length is l has a force constant k. the spring is cut into two pieces of upstretched lengths, l_1 and l_2 , where $l_1 = n l_2$ and n is an integer. What are the corresponding force constant k_1 and k_2 in terms of n and k?

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If a steel rod has a radius of 10 mm and a length of 1.0 m. A 100 kN force stretches it along its length, then calculate [Given $Y = 2.0 \times 10^{11} \text{N/m}^2$]

- (a) Stress
- (b) Elongation
- (c) Strain of the rod
- 23. Radha was 70 kg at the age of 16 years. She then decided to lose weight. She started walking daily for 30 minutes and started taking only milk and fruits. Her parents advised her not to cut off her meal so drastically. She showed the result of losing 30 kg but she was feeling weak. So her parents took her to doctor who advised her to take proper balanced diet and exercise regularly.
 - (a) Is taking crash diet advisable? Why?
 - (b) Give the relation between SI and CGS unit of heat.
 - (c) What would be her rise in temperature, if Radha weighing 40 kg now was advised to take 4000 kcal diet in a day and this energy was to be used in heating her without any losses? [Given: Sp. Heat of human body = $0.83 \text{ cal g}^{-10}\text{C}^{-1}$
- 24. Tunnel is dug through the earth from one side to the other side along with a diameter. The motion of a particle into the tunnel is simple harmonic motion. Find the time period, neglect all the frictional forces and assume that the earth has a uniform density. Assume that $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$; density of the earth = $5.51 \times 10^3 kgm^{-3}$.

Or

Explain the following:

- (a) In a sound wave, the displacement node is a pressure antinode and vice versa
- (b) Bats can ascertain distance, direction, nature and sizes of the obstacles without any eyes.
- (c) Solids can support both longitudinal and transverse waves, but only longitudinal waves can properties in gases
- (d) The shape of a pulse gets distorted during propagation in a dispersive medium
- 25. An artificial diamond crystal has been manufactured by subjecting carbon in the form of graphite to a pressure of $1.55 \times 10^{10} \, Nm^{-2}$ at a high temperature. What must have been the original volume of the diamond, whose mass before cutting was about 175g? Assuming that natural diamonds were formed at similar high pressure within the earth, the density of the diamond = $3.5g \, cm^{-3}$ and its bulk modulus = $62 \times 10^{10} \, Nm^{-2}$.

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Derive the expression for excess pressure inside:

- (a) A liquid drop.
- (b) A liquid bubble.
- (c) An air bubble.
- 26. A SHM is expressed by the equation $x = A\cos(\omega t + \varphi)$ and the phase angle $\varphi = 0$. Draw graphs to show variation of displacement, velocity and acceleration for one complete cycle in SHM.

Or

If two tuning forks A and B give 9 beats in 3 seconds and a sound with a closed column of air 15 cm long and B with an open column 30.5 cm long, then calculate their frequencies