

CBSE Board
Class XI Physics
Sample Paper-7

Time: - 3
Marks: - 70 Marks
General Instructions

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each and questions 27 to 29 carry five marks each.
- (c) Question 26 is a value based question carrying four marks.
- (d) 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.
- (e) Use of calculator is not permitted.
- (f) You may use the following physical constants wherever necessary.

$$e = 1.6 \times 10^{-19} C$$

$$c = 3 \times 10^8 ms^{-1}$$

$$h = 6.6 \times 10^{-34} JS$$

$$\mu_o = 4\pi \times 10^{-7} NA^{-2}$$

$$k_B = 1.38 \times 10^{23} JK^{-1}$$

$$N_A = 6.023 \times 10^{23} / mole$$

$$m_n = 1.6 \times 10^{-27} kg$$

1. What is the fundamental unit of time and define it? (1)
2. Why does a cricket player lower his hands while catching the ball? (1)
3. Is friction an evil? (1)
4. What is the ratio of SI to CGS unit of work done? (1)
5. If there is no external force acting on a non rigid body, which of the following quantities must remain constant?
 Angular momentum, Linear momentum, Kinetic energy, Moment of Inertia (1)
6. Which is more elastic, steel or rubber? Why? (1)
7. Is it possible that there is no increase in the temperature of a body despite being heated? (1)

8. What is the maximum value of P.E in case of SHM? (1)
9. If the size of a nucleus is scaled up to the tip of a sharp pin, what roughly is the size of an atom? (2)
10. A body covers half of its journey with a speed of 40 ms^{-1} and the other half with a speed of 60 ms^{-1} . What is the average speed during the whole journey? (2)
11. A particle has a displacement of 12m towards east and 5m towards north and 6m vertically upwards. Find the magnitude of the sum of these displacements. (2)
12. Give two examples of zero work done. (2)
13.
 (a) What is the present accepted value of G ?
 (b) Define G in terms of the gravitational force between two masses. (2)
14.
 (a) Write the isothermal relation between pressure and volume.
 (b) Write an expression for work done during isothermal change. (2)
- OR**
- During an experiment, an ideal gas is found to obey an additional law $VP^2 = \text{constant}$. The gas is initially at a temperature T and volume V . When it expands to a volume $2V$, what does new temperature become. (2)
15. A graph was plotted taking $\log_{10}T$ vs $\log_{10}l$ for a simple pendulum. What is the nature of the graph and what is its slope? (2)
16. What do you mean by a closed organ pipe? (2)
17. It is easier to pull a lawn roller than to push it. Explain using the resolution of forces. (3)
18. Define coefficient of restitution. In an elastic collision of two bodies are the momentum and energy of each body conserved? Why is heavy water chosen in a nuclear reactor to slow down fast moving neutrons? (3)
19. A ball is dropped from rest at a height of 12 m. If it loses 25% of its kinetic energy on striking the ground, what is the height to which it bounces? How do you account for the loss in K.E? (3)

20. A uniform ladder of mass 10 kg leans against a smooth vertical wall making an angle of 53° with it. The other end rests on a rough horizontal floor. Find the normal force and the frictional force that the floor exerts on the ladder. (3)

21.

- (i) What is a geo-stationary satellite? Is it same as synchronous satellite?
- (ii) What is the height of a geostationary satellite?
- (iii) What do you mean by a parking orbit? (3)

OR

A 400kg satellite is in a circular orbit of radius $2R_E$ about the earth. How much energy is required to transfer it to an orbit of radius $4R_E$? What are the changes in its kinetic and potential energies? (3)

22. Define terminal velocity and show that the velocity v of a sphere of radius r and density ρ falling through a viscous fluid of density σ and coefficient of viscosity η is given by

$$v = \frac{2}{9} \frac{r^2 g (\rho - \sigma)}{\eta}$$

23.

- (a) Does the first law of thermodynamics violate the law of conservation of energy?
- (b) Write the limitations of the first law of thermodynamics. (3)

24. The absolute temperature of a gas is made four times. How many times will be

- (a) its total kinetic energy?
- (b) root mean-square velocity of its molecules?
- (c) How will pressure change? (3)

25. State Pascal's law. What is the pressure on a swimmer 10m below the surface of a lake? (3)

26. Sita, a student of class XII, was suffering from malaria. The area where she lived was full of mosquitoes. She was not having mosquito net. Her friend Gita had an extra net. She gave it to Sita. Also she took Sita to a Doctor, got her medicines. After a week Sita became normal.

- (a) Comment upon the qualities of Gita.
- (b) The mosquito net over a 7 m x 4m bed is 3m high. The net has a hole at one corner of the bed through which a mosquito enters the net. It flies and sits at the diagonally opposite upper corner of the net.
 - (i) Find the magnitude of the displacement of the mosquito.
 - (ii) Taking the hole as the origin, the length of the bed as the x-axis, its width as the y-axis and vertically up as the z-axis, write the components of the displacement vector. (4)

27.

(i)

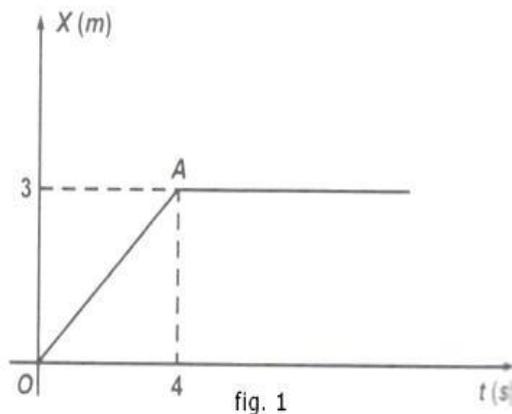


Figure 1 shows the position-time graph of a particle of mass 4 kg. What is the

(a) force on the particle for $t < 0$, $t > 4s$, $0 < t < 4s$?

(b) impulse at $t = 0$ and $t = 4s$?

(ii) Consider one-dimensional motion only.

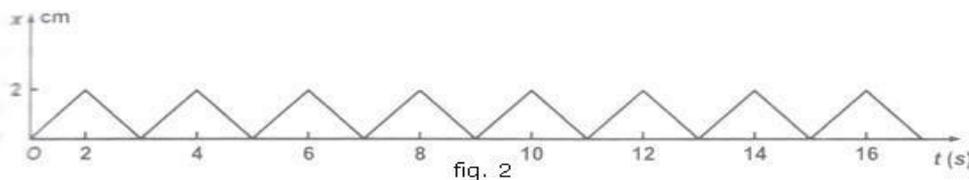


Figure 2 shows the position-time graph of a particle of mass 0.04 kg. Suggest a suitable physical constant for this motion. What is the time between two consecutive impulses received by the particle? What is the magnitude of each impulse? (5)

OR

Show that for a particle in linear SHM the average kinetic energy over a period of oscillation equals the average potential energy over the same period. (5)

28. Derive the Bernoulli's equation. (5)

OR

Explain the Magnus effect with respect to the motion of a moving ball. What do you understand by 'viscosity'? Give its dimensions and SI unit. On what factors does the coefficient of viscosity of a liquid depend? (5)

29. Explain the following:

- (i) free vibrations
- (ii) damped oscillations
- (iii) maintained oscillations
- (iv) forced oscillation
- (v) resonant or sympathetic vibrations. (5)

OR

If the earth were a homogeneous sphere and a straight hole bored in it through its centre. Show that if a body were dropped into the hole, it would execute a simple harmonic motion. Also find its time period. (5)