SAMPLE PAPER 1

XI – PHYSICS

Time: Three Hours **Maximum Marks: 70**

General Instructions

(a) All questions are compulsory.

(b) 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 questions 28 to 30 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.

$$e = 1.6 \times 10^{-19} C$$
$$c = 3 \times 10^{8} ms^{-1}$$
$$h = 6.6 \times 10^{-34} JS$$
$$\mu_o = 4\pi \times 10^{-7} NA^{-2}$$
$$k_B = 1.38 \times 10^{23} JK^{-1}$$
$$N_A = 6.023 \times 10^{23} / mole$$
$$m_n = 1.6 \times 10^{-27} kg$$

1. Will the momentum remain constant if some external force acts on the system? (1)

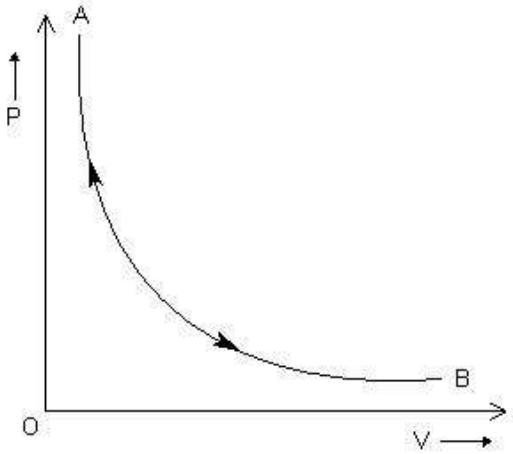
2. The Earth moving round the Sun in a circular orbit is acted upon by a force, and hence work must be done on the Earth by this force. Do you agree with this statement? (1)

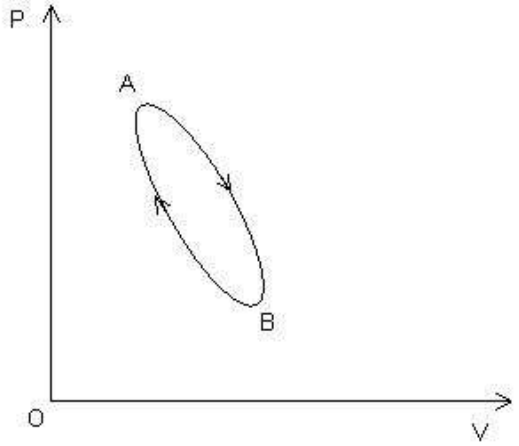
3. Suppose a cyclist is negotiating a curve of radius r with speed v. Write the conditions under which skidding will occur. (1)

4. Why does a cricket player lower his hands while catching a ball? (1)

5. Why do small bubbles have excess of pressure? (1)

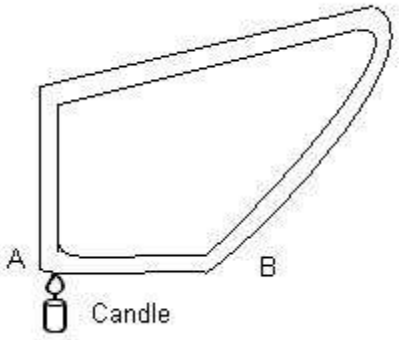
6. Which of the following processes shown here is reversible? Name the other process. (1)



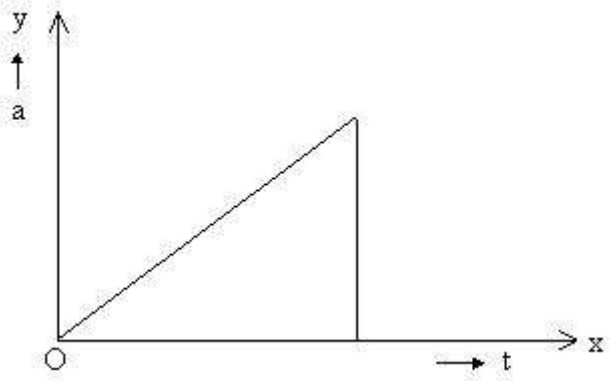


7. Can a simple pendulum experiment be conducted inside a satellite? (1)

8. Water in a closed tube is heated with one arm vertically placed above an arc lamp. The water will begin to circulate along the tube in the counter – clockwise direction. Is it true or false? (1)



9. The acceleration- time graph for a body is shown in the given figure. Plot the corresponding velocity-time graph. (2)



10. A body of mass 5 kg is acted upon by two perpendicular forces of magnitude 8 N and 6 N. Find the magnitude and direction of the acceleration. (2)

11. A ball is dropped vertically from rest at a height of 12 m. After striking the ground, it bounces to a height of 9 m. What fraction of kinetic energy does it loose on striking the ground? (2)

12. If the angular momentum is conserved in a system whose moment of inertia is decreased. Will its rotational kinetic energy be also conserved? (2)

13. Assuming that the Earth's orbit is a circle of radius $1.5\times10^{8}\,km$. Calculate the mass of the sun. (2)

OR

The change in the value of g at a height h above the Earth is same as at a depth d below it. If h and d are compared to the radius of the earth. What is the ratio (h/d)? (2)

14. (i) Distinguish between an isothermal and an adiabatic process.

(ii) Distinguish between an isochoric and isobaric processes. (2)

15. A person is measuring the velocity of sound in an experiment. He found that velocity of sound increases by $61 cm/s$ for every 1^{o} C. Show this mathematically. (2)

16. A waterfall is 100 m high. How much warmer will the water be after the fall? Assume that all the work gets converted into the heat energy. Take the average value of g to be $980\,cm/s^{2}$. (2)

17. During an experiment, an ideal gas is found to obey an additional law VP^{2} = constant. The gas is initially at a temperature T and volume V. When it expends to a volume $2V$, what does new temperature become. (2)

18. A narrow sound pulse is sent across a medium. (i) Does the pulse have a definite (a) wavelength (b) frequency (c) speed of propagation?

(ii) If the pulse rate is 1 after every 20 sec, is the frequency of the note produced 0.05 Hz? (2)

19. It has been suggested that for liquids $s^{3}\beta^{4}=K$, is a constant, with s being the surface tension and β the compressibility, show that K is not a dimensionless constant. (3)

20. It is easier to pull a lawn roller than to push it. Explain using the resolution of forces. (3)

21. Two billiard balls, each of mass 0.05 kg moving in opposite directions with speed $6ms^{-1}$ collide and rebound with the same velocity. What is the impulse imparted to each ball due to the other? (3)

22. A long playing record revolves with a speed of $33\frac{1}{3}\text{rev}/\text{min},$ and has a radius of 15 cm. Two coins are placed at 4 cm and 14 cm away from the centre of the record. If the coefficient of friction between the coins and the record is 0.15. Which of the two coins will revolve with the record? (3)

23. A car drives along the straight level frictionless road by an engine delivering constant power. How is velocity of the car related to time elapsed? (3)

24. Prove that the impulse received during an impact is equal to the total change in momentum produced during the impact. (3)

25. While approaching a planet circling a distant star, a space traveller determines the planet's radius to be half that of the Earth. After landing on the surface he finds the acceleration due to gravity to be twice that on the surface of the Earth. Find the ratio of the mass of the planet to that of the Earth. (3)

26. Oil spreads over the surface of water, whereas water does not spread over the surface of oil. Why? (3)

27. Two vessels of the same size are at the same temperature. One of them holds 1 kg of N_2 gas.

    (i) Which of the vessels contains more molecules?

    (ii) Which of the vessels is under greater pressure and why?

    (iii) In which vessel is the average molecular speed greater? How many times is it greater? (3)

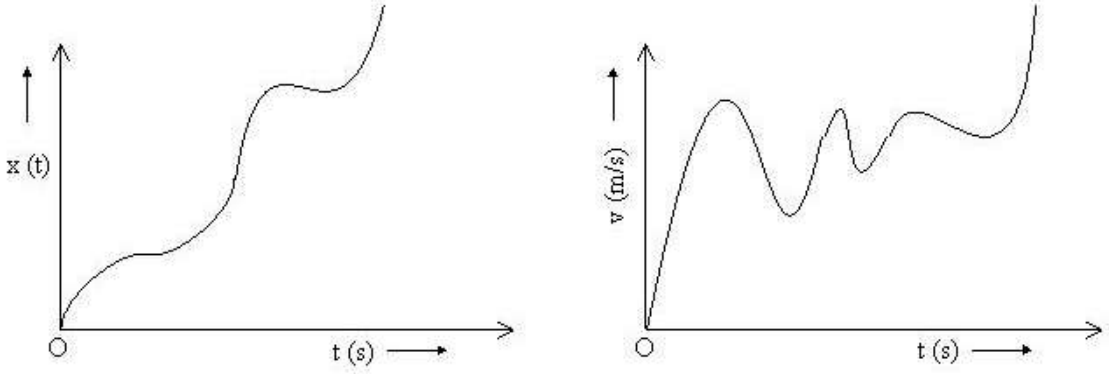
28. A particle is thrown over a triangle from one end of a horizontal base that grazing the vertex falls on the other end of the base. If $\alpha \text{ and } \beta$ be the base angles and θ the angle of projection, prove that

$$\tan\theta = \tan\alpha + \tan\beta$$ (5)

OR

(a) A balloon is ascending at the rate of 14 ms^{-1} at a height of 98 m above the ground, when a packet is dropped from it. After how much time and with what velocity does it reach the ground?

(b) Do the following two graphs represent same types of motion? Name the motion.



(5)

29. (i) Prove that the isothermal elasticity of a gas is equal to its pressure.

(ii) Prove that the adiabatic elasticity of the gas = $\gamma \times P$, where P is pressure of the gas and $\gamma = C_p / C_v, C_p \text{ and } C_v$ being the specific heats of the gas at constant pressure and constant volume respectively. (5)

OR

The difference between the length of a certain brass rod and that of steel rod is claimed to be constant at all temperatures. Is it possible?(5)

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

OR

(i) Derive an expression for finding the velocity of an approaching aeroplane using radar waves.

(ii) An ultrasonic wave of frequency 45, 000 Hz sent out by sonar shows a frequency rise of 600 Hz on reflection from an approaching submarine. If the velocity of sound in water is 1500 ms^{-1}. Calculate the speed of the submarine. (5)