TOPPER SAMPLE PAPER 5

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. Why we use a platinum iridium alloy in making prototype meter and kilogram? (1)

2. Define coefficient of restitution or coefficient of resilience. (1)

3. Radius of gyration is a constant quantity. (1)

4. Why is ploughing of fields essential? (1)

5. What is Magnus effect? (1)

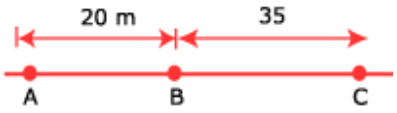
6. How does internal energy of gas changes in an adiabatic process? (1)

7. Where is the centre of mass of a meter stick? (1)

8. Give two examples of intensive variables. (1)

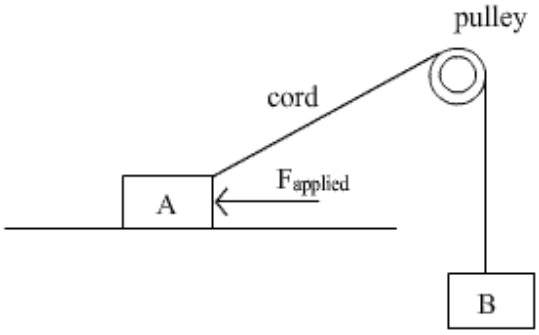
9. The length of the rod as measured in an experiment was found to be 3.23 m, 3.25 m, 3.27 m, 3.22. Find the absolute error. (2)

10. There is a bug who moves from point A to point B and then finally to C in 5 seconds. Are the speed and velocity of the bug different?



(2)

11. Two wooden blocks A and B are connected to a chord, passing through a frictionless pulley. Block A is pushed to the left on a surface by a horizontal force. Draw the free body diagram of both the blocks.



(2)

12. Explain that gravitational force is a conservative force. (2)

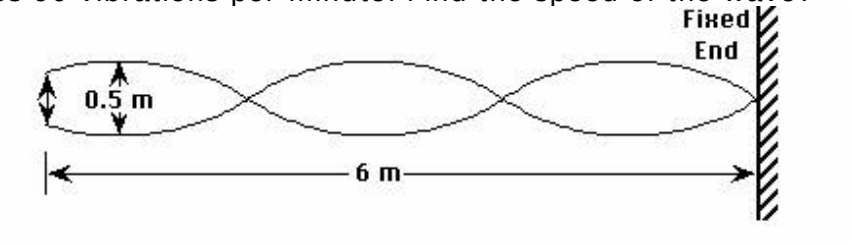
13. Name a polar satellite. State its uses. (2)

14. Smoothening of surface beyond the limit increases the friction. Why? (2)

15. Potential energy of a particle with mass m is $U=k\ x^3$, where k is a positive constant. The particle is oscillating about the origin on x-axis. How is time period of oscillation (T) related with amplitude of oscillation (a)? (2)

16. If the kinetic energy of one mole of an ideal gas is $E=3/2\ RT$, what will be its C_p? (2)

17. In an experiment to find the speed of waves in a rope, a standing wave pattern is established as shown in diagram below. The vibrating end of rope makes 90 vibrations per minute. Find the speed of the wave?



(2)

18. Two point masses of 3 Kg and 2 Kg are attached at the two ends of a horizontal spring with spring constant $k=200Nm^{-m}$. Find the natural frequency of vibration of the system. (2)

19. If a body A of mass 'M' is thrown with velocity u at an angle 30^0 with the horizontal and another body B is of the same mass be projected with the same velocity at angle 60^0 to the horizontal, then prove that the ratio of horizontal ranges will be 1:1 and that of maximum height will be 1:3. (3)

20. Calculate the recoil velocity V of the gun of mass M when a bullet of mass m is fired with a horizontal velocity v. (3)

21. Derive equation for loss of kinetic energy in case of a completely inelastic collision in one dimension? (3)

22. Consider two bodies X and Y with mass m_1 and m_2 separated by distance 'r' meters. Suppose mass of X is doubled and mass of Y is tripled also the

distance between them is doubled. Find the ratio of the gravitational force before and after changing the masses and distance. (3)

23. A circular track of radius 100 m is banked at an angle of 30°. If the coefficient of friction between the wheels of a car and the road is 0.5, then what is the (i) optimum speed of the car to avoid wear and tear on its tires, and (ii) maximum permissible speed to avoid slipping? (3)

24. What are thermal radiations? Give some of its basic characteristics. (3)

25. State the law of equipartition of energy. Show that the ratio of specific heat at constant pressure to specific heat at constant volume is 7/5 for a rigid diatomic molecule. (3)

26. If the r.m.s speed of oxygen at NTP is x m/s. If the gas is heated at constant pressure till its volume is four fold, what will be its final temperature and r.m.s speed? (3)

27. State and prove Work-energy theorem. (3)

28. A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/h passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed 600 m s^{-1} to hit the plane? At what minimum altitude should the pilot fly the plane to avoid being hit? (Take g = 10 m s^{-2}). (5)

OR

A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at the constant rate of 0.50 m/s every second. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn? (5)

29. A solid disc and a ring, both of radius 10 cm are placed on a horizontal table simultaneously, with initial angular speed equal to 10 π rad s^{-1}. Which of the two will start to roll earlier? The co-efficient of kinetic friction is μ_k = 0.2. (5)

OR

Read each statement below carefully, and state, with reasons, if it is true or false;

(a) During rolling, the force of friction acts in the same direction as the direction of motion of the CM of the body.

(b) The instantaneous speed of the point of contact during rolling is zero.

(c) The instantaneous acceleration of the point of contact during rolling is zero.

(d) For perfect rolling motion, work done against friction is zero.

(e) A wheel moving down a perfectly frictionless inclined plane will undergo slipping (not rolling) motion. (5)

30. (a) What is the largest average velocity of blood flow in an artery of radius 2×10^{-3} m if the flow must remain laminar? (b) What is the corresponding flow rate? (Take viscosity of blood to be 2.084×10^{-3} P_a s). (5)

OR

In Millikan's oil drop experiment, what is the terminal speed of an uncharged drop of radius 2.0×10^{-5} m and density 1.2×10^{3} kg m^{-3}? Take the viscosity of air at the temperature of the experiment to be 1.8×10^{-5} Pa s. How much is the viscous force on the drop at that speed? Neglect buoyancy of the drop due to air. (5)