CBSE Board
Class XI Physics
Sample Paper-9

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.

$$e = 1.6\times10^{-19} C$$
$$c = 3\times10^{8} ms^{-1}$$
$$h = 6.6\times10^{-34} JS$$
$$\mu_o = 4\pi\times10^{-7} NA^{-2}$$
$$k_B = 1.38\times10^{23} JK^{-1}$$
$$N_A = 6.023\times10^{23} / mole$$
$$m_n = 1.6\times10^{-27} kg$$

1. Find the dimension of α in the following equation:
F =α/x +ν
Where, F = force applied, x = distance covered, α and ν are constants. (1)

2. Can a body undergo change in speed or direction due to internal forces? (1)

3. An impulse is applied to a moving object with a force at an angle of 20° w.r.t velocity vector. What is the angle between the impulse vector and change in momentum vector? (1)

4. In a tug of war, one team is slowly giving way to the other. What work is being done and by whom? (1)

5. What are the factors on which the position of centre of mass of a body depends? (1)

6. Will Bernoulli's principle be applicable in case of a parachute falling through atmosphere? (1)

7. What is thermal conductivity of a perfect heat conductor and a perfect heat insulator? (1)

8. Write the differential equation for SHM. (1)

9. The nearest star to our solar system is 4.29 light year away. How much is this distance in terms of parsecs? (2)

10. Define speed. How is it different from velocity? (2)

OR

Distinguish between damped and forced oscillations. What do you mean by resonant oscillations? (2)

11. A bomb is released from a horizontally flying bomber when it is vertically above the target. Will it hit the target? (2)

12. A 120 g mass has a velocity of $\vec{v} = \left(2\hat{i} + 5\hat{j}\right)$ m/s at a certain instant t. What is its K.E.? (2)

13. A wheel rotates with a constant angular acceleration of 3.6 rad/s^2. If the angular velocity of the wheel rotate is 4.0 rad/s^2 at t_o=0, what angle does the wheel rotate in 1s? What will be its angular velocity at t = 1s? (2)

14. If a planet existed whose mass and radius were both half that of the earth, what would be the value of the acceleration due to gravity on its surface as compared to what it is on the earth's surface? (2)

15. Define efficiency of a heat engine. Also draw the symbolic representation of a heat engine. (2)

16.

(a) In equation, PV = RT, what does V stand for?

(b) In the equation, PV/2 = RT, what does V stand for? (2)

17. State with reasons, whether the following algebraic operations with scalars and vectors are meaningful:

(a) adding any two scalars,

(b) adding a scalar to a vector of same dimension,

(c) multiplying any vector by any scalar,

(d) multiplying any two scalars,

(e) adding any two vectors, and

(f) adding a component of a vector to the same vector. (3)

18. Two masses m_1 and m_2 are connected at the ends of a light inextensible string that passes over frictionless pulley. Find the acceleration, tension in the string and thrust on the pulley when the masses are released. (3)

19. Does the expression K.E = ½ mv^2 hold for a variable force? Prove it. (3)

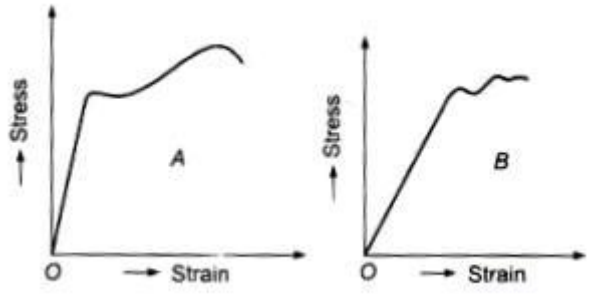
20. Calculate the work done in blowing a soap bubble of radius 10 cm, surface tension being 0.06 Nm^{-1}. What additional work will be done in further blowing it so that its radius is doubled? (3)

21. Assume that the thermal conductivity of copper is four times that of brass. Two rods of copper and brass, of the same length and cross section are joined end to end. The free end of the copper rod is kept it 0^oC and the free end of the brass rod at 100^oC. Calculate the temperature at junction of the two rods at equilibrium. Ignore radiation losses. (3)

OR

Show that for small oscillations the motion of a simple pendulum is simple harmonic. Drive an expression for its time period. Does it depend on the mass of the bob? (3)

22.



The stress versus strain graphs for two materials A and B are shown in fig. The graphs are to the same scale.

(i) Which material has greater Young's modulus?
(ii) Which material is more ductile?
(iii) Which is more brittle?
(iv) Which of the two is the stronger material? (3)

23. State a few statements for second law of thermodynamics. (3)

24. State:

(i) Avogadro's law
(ii) Graham's law of diffusion
(iii) Dalton's law if partial pressure. (3)

25. The motion of a car along y-axis is given by v(t)= -12t + 12 where velocity v is in m/s and time t in seconds. Find the instantaneous position of the car as a function of time if at t = 0 it was at 5 m. Also find its acceleration at t = 2 second. (3)

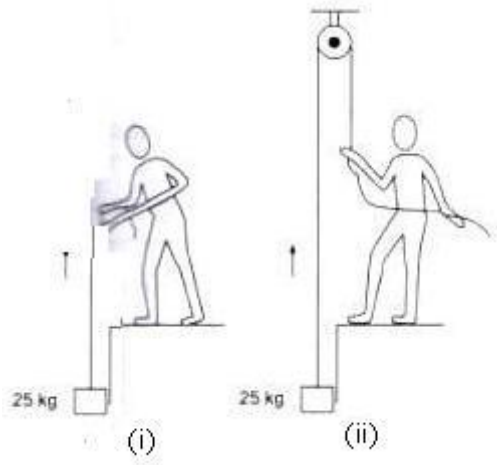
26. Having seen a big stone falling from the top of a tower Ravi pulled his friend Kiran away. The stone hit Ravi slightly and he got hurt. But he was saved from a major accident.

(a) What can you say about values of Ravi?

(b) From the top of a tower 100 m in height, a ball is dropped and at the same time another ball is projected vertically upwards from the ground with a velocity of 25 m/s. Find when and where the two balls meet. Take g = 9.8 m/sec^2. (4)

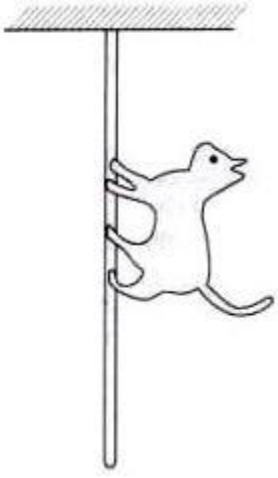
27.

(i)



A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in figure. What is the action on the floor by the man in the two cases? If the floor yields a normal force of 700 N, which mode should the man prefer?

(ii)



An animal of mass 40 kg climbs on a rope which can stand a maximum tension of 600 N. In which of the following cases will the rope break. The animal

(a) climbs up with an acceleration of 6 ms^{-2}
(b) climbs down with an acceleration of 4 ms^{-2}
(c) climbs up with a uniform speed of 5 ms^{-1}
(d) falls down the rope nearly under gravity?
Take g = 10 ms^{-2} and ignore the mass of the rope. (5)

OR

What do you understand by 'laminar flow' and 'streamlined flow'? Water is flowing with a speed of 2 m/s in a horizontal pipe with cross sectional area 2×10^{-2} m^2 at pressure 4×10^4 Pa. What will be the pressure at a smaller cross section where the area decreases to 0.01 m^2? (5)

28. Explain why:
(i) A body with large reflectivity is a power emitter.
(ii) A brass tumbler feels much colder than a wooden tray on a chilly day.
(iii) An optical pyrometer (for measuring high temperatures) calibrated for an ideal black body radiation gives too low a value for the temperature of a red hot piece in the open, but gives a correct value for the temperature when the same piece is in the furnace.
(iv) The earth without its atmosphere would be inhospitably cold.
(v) Heating systems based on circulation of steam are more efficient in warming a building than those based on circulation of hot water. (5)

OR

Two identical springs each of force constant K are connected in (a) series (b) parallel, so that they support a mass m. Find the ratio of the time periods of the mass in the two systems. (5)

29. Obtain an expression for the apparent frequency of a note by an observer when
(a) source alone is in motion towards the observer.
(b) source alone is in motion away from the observer.
(c) observer alone is in motion towards the source.
(d) observer alone is in motion away from the source.
(e) when the source and observer are moving towards each other. (5)

OR

State Hooke's law. Draw a stress-strain curve for a metal and mark the proportional limit, elastic limit and fraction point.
Define each of the terms: proportional limit, elastic limit and fraction point. (5)