# CBSE Class 11 Physics Set 3

**Time: 3 hrs** **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.

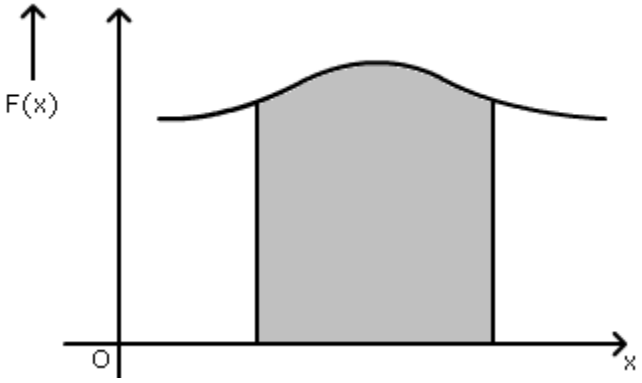
$$e = 1.6 \times 10^{-19} C$$
$$c = 3 \times 10^{8} ms^{-1}$$
$$h = 6.6 \times 10^{-34} JS$$
$$\mu_o = 4\pi \times 10^{-7} NA^{-2}$$
$$k_B = 1.38 \times 10^{23} JK^{-1}$$
$$N_A = 6.023 \times 10^{23} / mole$$
$$m_n = 1.6 \times 10^{-27} kg$$

Q1. Can a physical quantity have units but still be dimensionless? (1)

Q2. Give an example to show that the direction of velocity of a body can change even when its acceleration is constant. (1)

Q3. Two vectors $\vec{A}$ and $\vec{B}$ are directed along y-axis and z-axis respectively. What is the direction of the vector $(\vec{B} \times \vec{A})$? (1)

Q4. What does the area of the shaded portion of the graph represent? (1)




Q5. Why do we prefer to use a wrench (spanner) of longer arm? (1)

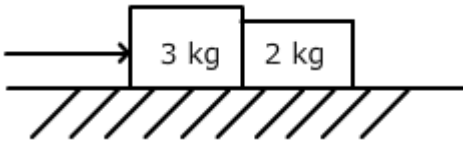
Q6. What is the degree of freedom of a monoatomic gas? (1)

Q7. For an ideal gas, show the nature of $\frac{PV}{nT}$ versus P graph, where the symbols have their usual meaning. (1)

Q8. State the Kelvin-Planck statement of the second law of thermodynamics. (1)

Q9. Differentiate between systematic errors and random errors. (2)

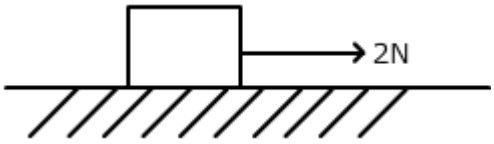
Q10. Two blocks of mass 3 kg and 2 kg are in contact with each other on a frictionless table. Find the force exerted by the smaller block on bigger block if a force of 5 N is applied on the bigger block.




(2)

OR

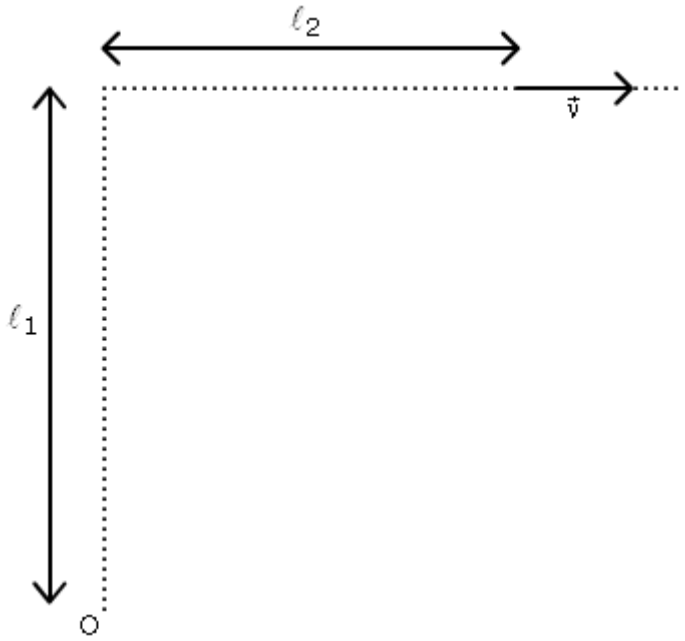
Mention two ways in which static friction is a self adjusting force. How much force of static friction is acting on the block of mass 2 kg shown in figure below if the coefficient of static friction between the block and the surface is 0.2?




(2)

Q11. The kinetic energy of a body is increased by 21%. What is the percentage increase in the linear momentum of the body? (2)

Q12. Find the magnitude and direction of angular momentum of the body of mass m (about point O) which is moving with velocity $\vec{v}$ as shown.




(2)

Q13. Name the satellites which have Sun synchronous orbit. How is their orbit different from that of the satellites used for communication purpose? What is the significance of negative total energy of a satellite? (2)

Q14. Define breaking stress. A heavy wire is suspended from a roof and no weight is attached to its lower end. Is it under stress? (2)

Q15. Calculate the fall in pressure of helium initially at 1600 $P_a$, when it is suddenly expended to 8 times its original volume. Given $\gamma = \frac{5}{3}$

(2)

Q16. What is the change in internal energy of a gas during (i) isothermal expansion and (ii) adiabatic expansion? (2)

Q17. What do you understand by 'stationary wave'? Draw the fourth harmonic produced in a stretched sting tied at two ends and mark the position of the node and one antinode on it. (2)

Q18. Distinguish between damped and forced oscillations. What do you mean by resonant oscillations? (2)

Q19. On a two lane road, car A is travelling with a speed of 36 km/h. Two cars B and C approach car A from opposite directions with speeds of 54 km/h each. At a certain instant, when both car B and C are at a distance of 1 km from A, B decides to overtake car A before C does. What minimum acceleration of B is required to avert an accident? (3)

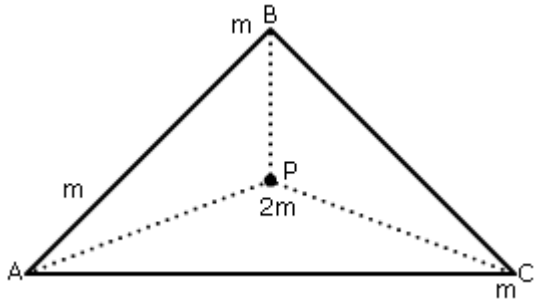
Q20. A particle of mass m moves in a straight line with retardation proportional to its displacement. Find the expression for loss of kinetic energy for any displacement x. (3)

Q21. Give reasons for the following:
(a) A load on a thief's back does not apply any force on him when he jumps from the upper story of a house.
(b) A gun recoils on being fired.
(c) A man falling from a height receives more injury when he falls on cemented floor rather than when he falls on a heap of sand. (3)

Q22. Mention two factors on which the moment of inertia of a body depends. A particle performing uniform circular motion has angular momentum L. What will be the new angular momentum if its angular frequency is doubled and its kinetic energy halved? (3)

Q23. A cubical ice box of thermocole has each side 30 cm long and a thickness of 5 cm. 4 kg of ice is put in the box. If outside temperature is 45°C and the coefficient of thermal conductivity is 0.01 J/S/m/°C, calculate the mass of ice left after 6 hours. Latent heat of fusion of ice = $335 \times 10^3$ J/kg. (3)

Q24. Three equal masses of m kg each are fixed at the vertices of an equilateral triangle ABC. What is the force acting on mass 2 m placed at the centroid P of the triangle? Take AP = BP = CP = 1 m.




(3)

Q25. A tank of volume 0.3 $m^3$ contains 2 moles of helium gas at 20°C. Assuming that helium behaves like an ideal gas.
(a) Find the total thermal energy of the system.
(b) What is the average kinetic energy per molecule?

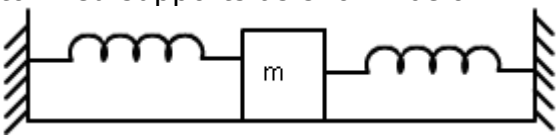
(3)

OR

Nine particles of a gas have speeds of 5.00, 8.00, 12.00, 12.00, 12.00, 14.00, 14.00, 17.00 and 20.00 m/s.
(a) Find the average speed.
(b) What is the rms speed?
(c) What is the most probable speed of the particles? (3)

Q26. (a) Which characteristic of a wave remains constant as it moves from one medium to another and why?
(b) The phase difference between two points on a progressive wave is $\frac{3\pi}{4}$. What will be the corresponding path difference?
(c) Mention one condition for production of beats. (3)

Q27. Two identical springs of spring constant k are attached to a block of mass m and to fixed supports as shown below




Show that the mass executes simple harmonic motion when displaced from its rest position on either side. Also, find the period of oscillations. (3)

Q28. The displacement of a body is given to be proportional to the cube of time elapsed. What is the nature of the acceleration of the body? Justify your answer.

A car accelerates from rest at a constant rate of $\alpha$ for some time; after which it decelerates at constant rate of $\beta$ to come to rest. If the total time elapsed is T second.
(a) Draw a velocity time graph for the motion.
(b) Calculate maximum velocity attained in terms of $\alpha$, $\beta$ and T. (5)

OR

(a) From the top of a building a ball is dropped while another is projected horizontally at the same time.
(i) Which ball will strike the ground first?
(ii) Which will strike the ground with more speed? Justify your answer in each case.

(b) A body is projected with speed u at an angle $\theta$ to the horizontal to have maximum range. What is the velocity at the highest point?

(c) What is the angle of projection of a projectile motion whose range R is n times the maximum height. (5)

Q29. (a) Is the centrifugal force a reaction of the centripetal force? Give reason for your answer.

(b) What is the effect of reversing the sense of revolution on the centripetal force?

(c) What provides the centripetal force to a car taking a turn on level road?

(d) What is 'angle of banking'?

(e) What is the advantage of banking? (5)

OR

(a) A lawn mower is pulled with some external force. Draw a free body diagram of the system to show all the forces acting on it. Why is it easier to pull it rather than push it?

(b) Why vehicles are provided with round tyres only and not any other shape?

(c) Mention two instances when friction between two surfaces is deliberately increased. Justify the action in each case. (5)

Q30. 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)

OR

State Stoke's law for the viscous drag experienced by the spherical body falling through a viscous liquid. Why does a spherical body achieve terminal speed? On what factors does the terminal speed depend? Give one example each of motion around us with
(i) Positive (ii) Negative terminal velocity. (5)