Model questions
Grade XI

Attempt all questions

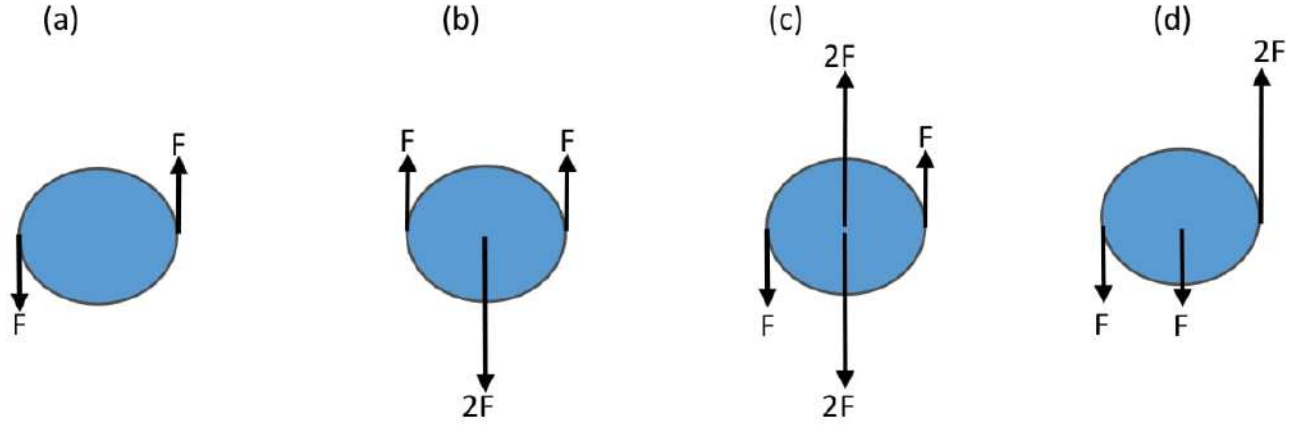
Group 'A'

Circle the best alternative to the following questions. **(11×1 = 11)**

1. A metre rule is used to measure the length of a piece of string in a certain experiment. It is found to be 20 cm long to the nearest millimeter. How should this result be recorded in a table of results?

   (a) 0.2000m (b) 0.200m (d) 0.20m (d) 0.2m

2. Forces are applied to a rigid body. The forces all act in the same plane. In which diagram is the body in equilibrium?



3. An athlete makes a long jump and follows a projectile motion. Air resistance is negligible.

   Which one of the following statements is true about the athlete?

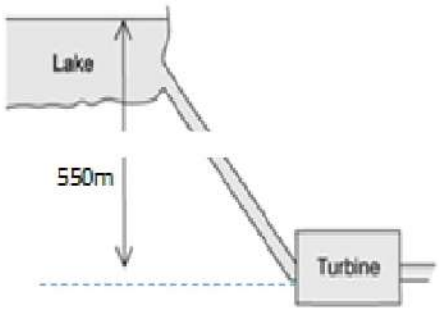
   (a) The athlete has a constant horizontal and vertical velocities.

   (b) The athlete has a constant horizontal velocity and constant downward acceleration.

   (c) The athlete has a constant upward acceleration followed by a constant downward acceleration.

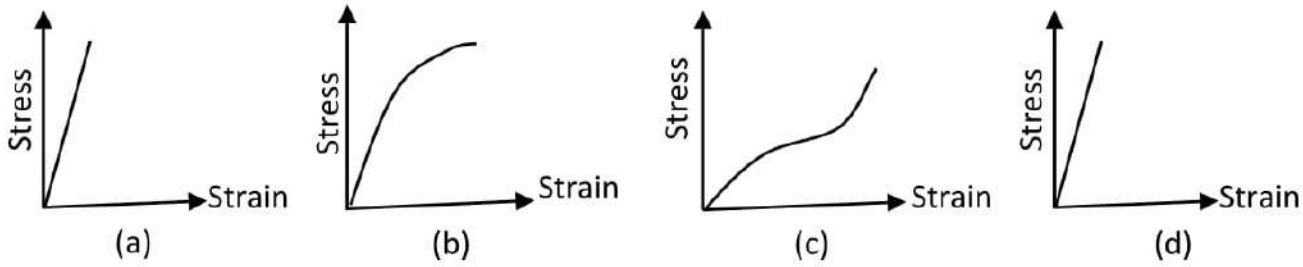
   (d) The athlete has a constant upward velocity followed by a constant downward velocity.

4. At Kulekhani-I Hydro-power station, water flows from Indra Sarowar into the turbines that are a vertical distance of 550 m below the lake, as shown in the diagram. Generally, 780 000 kg of water flows into the turbines every minute. The turbines have the efficiency of 85%. What is the output power of the turbines?



(a) 71 MW (b) 60MW (c) 4.2 GW (d) 3.6 GW

5. Graphs of stress-strain for four different materials are shown below. Which graph represents the stiffest material?



6. A boy walks towards a stationary plane mirror at a speed of 1.2 ms^{-1}. What is the relative speed of approach of the boy and his image?
(a) zero (b) 1.2 ms-1 (c) 2.4 ms-1 (d) 1.44 ms-1
7. The critical angle between an equilateral prism and air is 45°. What happens to the incident ray perpendicular to the refracting surface?
(a) It is reflected totally from the second surface and emerges perpendicular from the third. surface.
(b) It gets reflected from second and third surfaces and emerges from the first surface
(c) It keeps reflecting from all the three sides of the prism and never emerges out.
(d) After deviation, it gets refracted from the second surface.
8. In the formation of a rainbow, the light from the sun on water droplets undergoes which of the following phenomenon/phenomena?

(a) dispersion only (b) only total reflection.
(c) dispersion and total internal reflection (d) scattering

9. In what unit is the power of lens measured?
(a) watt (b) metre (c) dioptre (d) Hertz

10. A piece of wire of resistance R is bent through 180° at mid-point and the two halves are twisted together. What is the resistance of the wire thus formed?
(a) R/4 (b) R/2 (c) R (d) 2R

11. What are the elementary particles with half spin called?
(a) quarks (b) bosons (c) fermions (d) hadrons

Group 'B'

Answer the following questions. **(8 × 5 = 40)**

1. (a) State the law of conservation of momentum. [2]

(b) A jumbo jet of mass 4 x10^5 kg travelling at a speed of 5000 m/s lands on the airport. It takes 2 minutes to come to rest. Calculate the average force applied by the ground on the aeroplane. [2]

(c) After landing the aeroplane's momentum becomes zero. Explain how the law of conservation holds here. [1]

OR

(a) State Hook's law. [2]

(b) The walls of the tyres on a car are made of a rubber compound. The variation with stress of the strain of a specimen of this rubber compound is shown in Fig. 1.2.

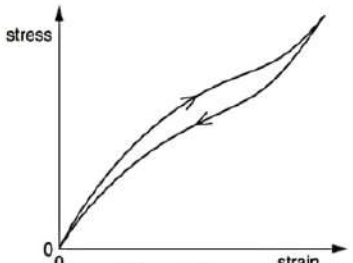


Fig. 1.2.

As the car moves, the walls of the tyres end and straighten continuously. Use Fig. 1.2 to explain why the walls of the tyres become warm. [3]

2. (a) What is meant by specific latent heat of vaporization of water = 2.26MJkg^{-1}? [1]

(b) A 1.0kW kettle contains 500g of boiling water. Calculate the time needed to evaporate all the water in the kettle. (Specific latent heat of vaporization of water = 2.26MJkg^{-1}). [3]

(c) Explain why the actual time needed is a little longer than the time calculated in 2(b). [1]

3. (a) Sate any three properties of an ideal gas as assumed by the kinetic theory of gas. [3]

(b) A student needed to use the ideal gas for a certain experiment. But, the ideal gas does not exist. Suggest what two different things this student could do to solve his problem. [2]

4. (a) Define temperature gradient in an object. [1]

(b) An electric kitchen range has a total wall area of 1.40 m^2 and is insulted with a layer of fiber glass that has a temperature of 175°C and its outside surface is 35 °C. The fiber glass has a thermal conductivity of 0.040 $Wm^{-1}K^{-1}$. Calculate the rate of flow of heat through the insulation, assuming the fibre as a flat slab of area of 1.40 m^2. [3]

(c) How might the rate of conduction be affected if the fiber absorbs moisture? Justify your answer. [1]

5. Figure 5.1 shows a ray of light is entering and emerging through a part of a convex lens.

(i) Define 'convex lens', and state one daily application of it. [2]

(i) Explain why this lens is also called converging lens? [1]

(ii) Calculate the refractive index of the material of the lens shown in the figure. [2]

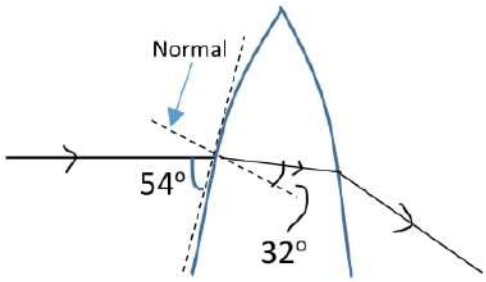


Fig. 5.1

OR

(a) Define 'concave mirror' and state on daily application of it. [2]

(b) A certain projector uses a concave mirror for projecting an object's image on a screen. It produces an image that is 5 times bigger than the object and the screen is 5m away from the mirror as shown in Fig. 5.2.

(i) Give reason why is the image larger than the object? [1]

(ii) Calculate the focal length of the mirror. [2]

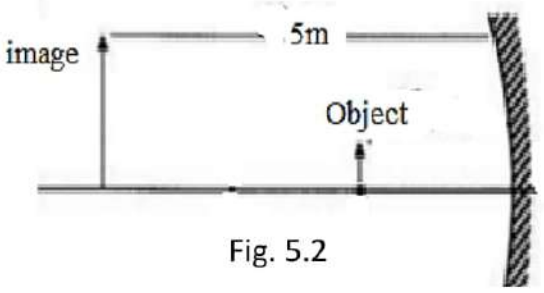


Fig. 5.2

6. (a) Sketch an electric field pattern around two identical negative point charges shown below. [2]

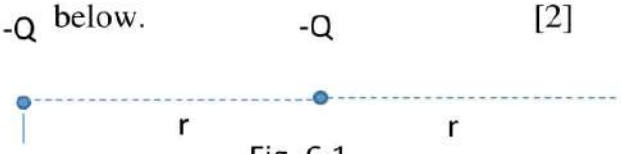


Fig. 6.1

(b) Obtain an equation, in terms of Q and r, for the field strength at point X due to two charges shown in shown in Fig. 6.1 [3]

7. (a) Define capacitance of a parallel plate capacitor and state one application of it in electric circuit. [2]

(b) Three capacitors each of 1000μF are connected in an electric circuit as shown below.

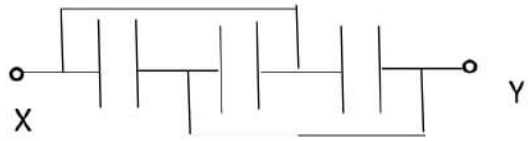


Fig. 7.1

(i) Identify the type of combination shown in Fig. 7.1, and calculate the effective capacitance of the combination. [1+2]

8. (a) What is it meant by power of a heater is 2 kW? [1]

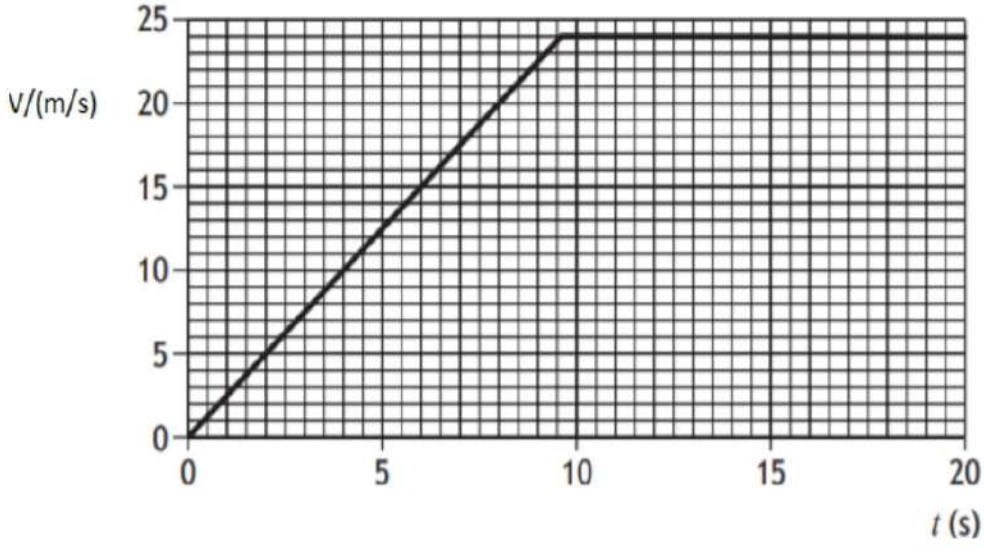
(b) Calculate the resistance of the above mentioned heater when it is connected to 220V source. [2]

(c) Suggest what changes must be done to the heater so that it gives more heat. Justify your answer. [2]

Group 'C'

Give long answer to the following questions. **(3 × 8 = 24)**

9. A box at rest is accelerated by a rope attached with a motor as shown in the Fig 2.1. The velocity-time graph given below shows the pattern of its motion for 20 s.



(a) If the box is pulled with constant unbalanced force 10N. Show that the initial acceleration of the box is 2.5 ms^{-2}, and calculate its mass. [2+1]

(b) After 2.0 second the box is being pulled by a constant force 12 N. Determine the size of frictional forces acting on the box at this time. [2]

(c) Determine the distance of the box travels along the ground at 8.0s. [3]

10. A boy is operating a remote-controlled toy car on a horizontal circular track, as shown in Figure.

The track has a radius of 1·8 m and the car travels around the track with a constant speed.

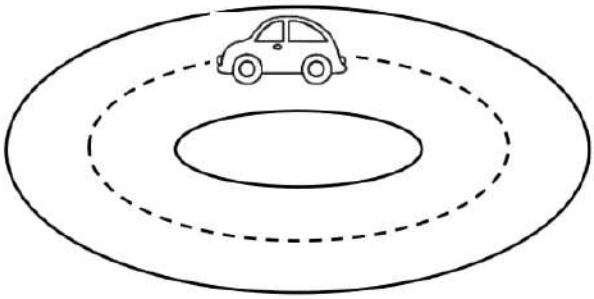


Fig. 10.1

(i) Explain why the car is accelerating, even though it is travelling at a constant speed. [2]

(ii) The car has a mass of 0·50 kg. The boy now increases the speed of the car to 6·0 m s $^{-1}$. The total radial friction between the car and the track has a maximum value of 7.0 N.
Show by calculation that the car cannot continue to travel in a circular path. [3]

(iii) The car is now placed on a track, which includes a raised section. This is shown in Figure 10.2

The raised section of the track can be considered as the arc of a circle, which has radius r of 0·85 m. The car will lose contact with the raised section of track if its speed is greater than v_{max}. Show that v_{max} is given by the relationship $v_{max} = \sqrt{rg}$. [3]

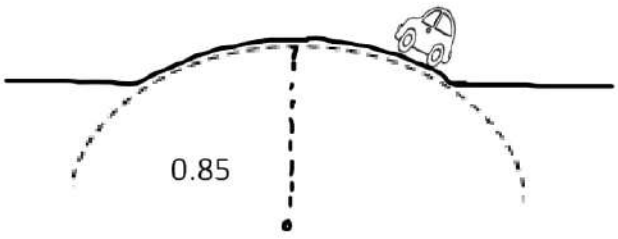
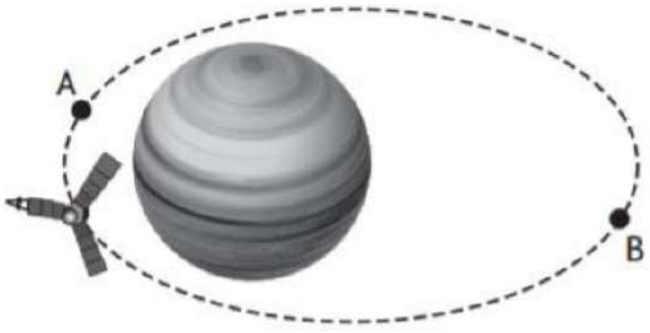


Fig. 10.2

OR

Juno is a NASA orbiter with a mission to survey Jupiter. It is in an elliptical orbit around Jupiter as shown in the figure below.



The gravitational potential at point A in the orbit of Juno is $-1{\cdot}70 \times 10^9$ J kg^{-1}.

(a) State what is meant by a gravitational potential at point A is $-1{\cdot}70 \times 10^9$ J kg^{-1}. [2]

(b) At point B, Juno is $1{\cdot}69 \times 10^8$ m from the centre of Jupiter. If the mass if Jupiter is 1.90×10^{27} kg, calculate the gravitational potential at point B. [3]

(c) The mass of Juno is $1{\cdot}6 \times 10^3$ kg. Determine the change in gravitational potential energy if Juno moves from Point A to Point B. [3]

11. (a) Explain how Rutherford's α-scattering experiment suggested that the nucleus of an atom is very small, very dense and positively charged. [3]

(b) Considering that the α-particles carry average kinetic energy of 2.00×10^{10} J, calculate the maximum size of the gold nucleus. [Atomic number of gold is 79 and $e = 1.60 \times 10^{-19}$C] [3]

(c) Explain why the radius of the gold nucleus must be much smaller than the value calculated in 11(b) above. [2]