PHYSICS – CLASS XI

Chapter 4 : Laws of Motion

PRACTICE PAPER (Chapter-wise Test)

Time : 1½ Hours **Max. Marks : 35**

General Instructions

(a) All questions are compulsory.

(b) There are 17 questions in total. Section A: Q. 1 to 8 carry 1 mark each. Section B: Q. 9 to 12 carry 2 marks each. Section C: Q. 13 to 15 carry 3 marks each. Section D: Q. 16 and 17 carry 5 marks each.

(c) There is no overall choice. An internal choice is given in one 2-mark question (Q. 11), one 3-mark question (Q. 14) and both 5-mark questions (Q. 16, Q. 17). Attempt only one of the given choices.

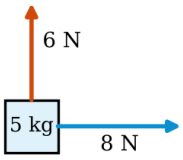
(d) Use of calculators is not permitted. Take g = 10 m s^{-2} unless a different value is given in the question.

(e) Figures are schematic and not drawn to scale. Write the unit with every numerical answer.

SECTION A

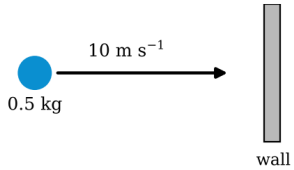
Questions 1 to 8 carry 1 mark each.

1. Two mutually perpendicular forces of 8 N and 6 N act on a block of mass 5 kg lying on a smooth horizontal surface (figure). The magnitude of the acceleration of the block is **(1)**



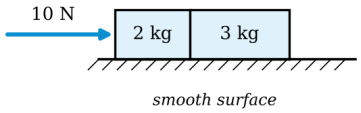
(a) 1.4 m s^{-2}
(b) 2 m s^{-2}
(c) 2.8 m s^{-2}
(d) 5 m s^{-2}

2. A ball of mass 0.5 kg moving at 10 m s^{-1} strikes a rigid wall normally and rebounds with the same speed (figure). The magnitude of the change in its momentum is **(1)**



(a) zero
(b) 5 kg m s^{-1}
(c) 10 kg m s^{-1}
(d) 20 kg m s^{-1}

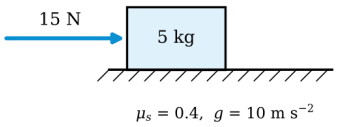
3. Two blocks of masses 2 kg and 3 kg are in contact on a smooth horizontal surface. A horizontal force of 10 N is applied on the 2 kg block (figure). The force exerted by the 2 kg block on the 3 kg block is **(1)**



(a) 4 N
(b) 6 N
(c) 10 N
(d) 2 N

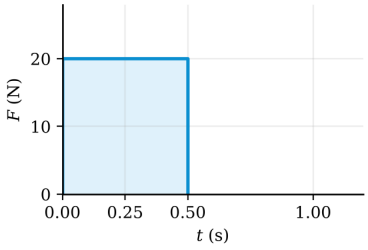
4. **Assertion (A):** The action and reaction forces of Newton's third law do not cancel each other. **(1)**
Reason (R): The action and reaction forces act on two different bodies.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

5. A block of mass 5 kg rests on a rough horizontal floor with $\mu_s = 0.4$. A horizontal force of 15 N is applied to it (figure). The force of friction acting on the block is **(1)**

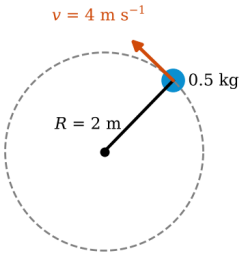


(a) 20 N
(b) 15 N
(c) zero
(d) 5 N

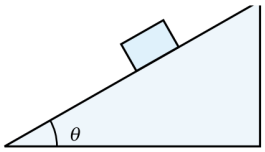
6. The graph shows a constant force acting on a body for a short time (figure). Find the impulse imparted to the body and the change in its momentum. **(1)**



7. A stone of mass 0.5 kg is whirled in a horizontal circle of radius 2 m at a constant speed of 4 m s^{-1} (figure). Find the tension in the string. **(1)**



8. A block placed on an inclined plane just begins to slide when the angle of inclination is 30° (figure). The coefficient of static friction between the block and the plane is **(1)**

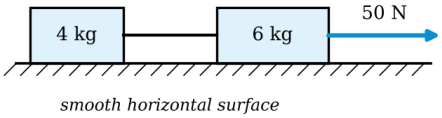


(a) 1/√3
(b) √3
(c) 1/2
(d) 1/√2

SECTION B

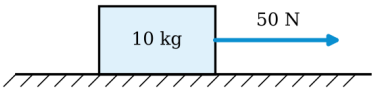
Questions 9 to 12 carry 2 marks each.

9. Two blocks of masses 4 kg and 6 kg are connected by a light string and lie on a smooth horizontal surface. A horizontal force of 50 N pulls the 6 kg block (figure). Find (i) the acceleration of the blocks and (ii) the tension in the string. **(2)**



smooth horizontal surface

10. A block of mass 10 kg is pulled along a rough horizontal floor by a horizontal force of 50 N (figure). The coefficient of kinetic friction is 0.3. Find (i) the force of kinetic friction and (ii) the acceleration of the block. **(2)**



$\mu_k = 0.3$

11. Two bodies A and B collide, as shown in the figure, with no external force acting on them. Using Newton's second and third laws, show that the total momentum of the two bodies is conserved. **(2)**

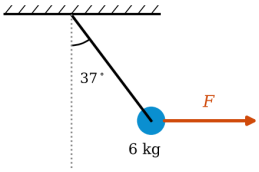


two bodies colliding on a smooth surface

OR

A gun of mass 5 kg fires a bullet of mass 25 g with a speed of 400 m s^{-1}. Find the recoil speed of the gun.

12. A mass of 6 kg hangs from a string and is held in equilibrium by a horizontal force F, so that the string makes 37° with the vertical (figure). Find the tension in the string and the force F. (tan 37° = 3/4, cos 37° = 4/5) **(2)**

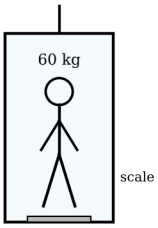


$g = 10\ \text{m s}^{-2}$

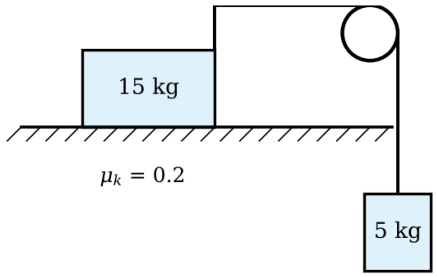
SECTION C

Questions 13 to 15 carry 3 marks each.

13. A man of mass 60 kg stands on a weighing scale in a lift (figure). What will be the reading of the scale (in newton) when the lift is (i) moving upwards with an acceleration of 2 m s^{-2}, (ii) moving downwards with an acceleration of 2 m s^{-2} and (iii) falling freely under gravity? **(3)**

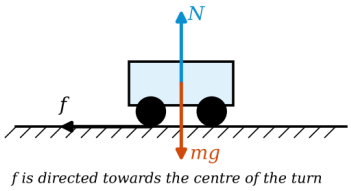


14. A block of mass 15 kg lies on a rough horizontal table and is connected by a light string passing over a smooth pulley to a hanging block of mass 5 kg (figure). The coefficient of kinetic friction between the 15 kg block and the table is 0.2. (i) Draw the free-body diagram of each block. (ii) Find the acceleration of the system and the tension in the string. **(3)**

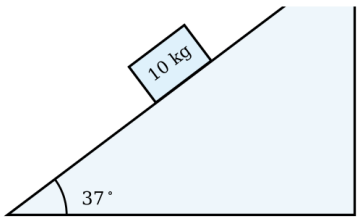


OR

A car of mass m moves in a circular path of radius R on a level road (figure). (i) Name the force that provides the centripetal force. (ii) Show that the maximum speed with which the car can turn without skidding is $v_{max} = \sqrt{(\mu_s Rg)}$. (iii) Find this speed for R = 50 m and μ_s = 0.45.



15. A block of mass 10 kg rests on a rough plane inclined at 37° to the horizontal (figure). The block is just on the verge of sliding. Take sin 37° = 0.6, cos 37° = 0.8. Find (i) the normal reaction of the plane on the block, (ii) the force of friction acting on the block and (iii) the coefficient of static friction. **(3)**



SECTION D

Questions 16 and 17 carry 5 marks each.

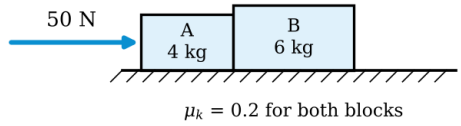
16. Two blocks A (4 kg) and B (6 kg) are in contact on a rough horizontal floor with μ_k = 0.2 for both blocks. A horizontal force of 50 N is applied on A, so that both move together (figure). **(5)**

(a) Find the force of kinetic friction on each block. (1)

(b) Find the acceleration of the blocks. (1)

(c) Find the force exerted by A on B. (2)

(d) State the law which gives the force exerted by B on A, and write its value. (1)



OR

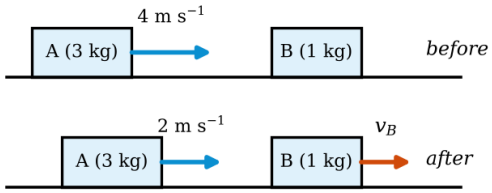
A trolley A of mass 3 kg moving at 4 m s^{-1} collides with a trolley B of mass 1 kg at rest on a smooth horizontal track (figure). After the collision A continues to move in the same direction at 2 m s^{-1}.

(a) State the law of conservation of linear momentum. (1)

(b) Find the velocity of B after the collision. (1)

(c) Find the impulse imparted to each trolley. (2)

(d) If the contact lasted 0.02 s, find the average force on B. (1)



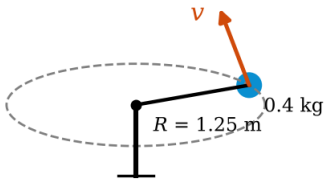
17. A stone of mass 0.4 kg is tied to a string of length 1.25 m and whirled in a horizontal circle at a constant speed of 5 m s^{-1} (figure). **(5)**

(a) What provides the centripetal force on the stone? (1)

(b) Find the tension in the string. (1)

(c) The string can bear a maximum tension of 50 N. Find the maximum speed with which the stone can be whirled. (2)

(d) Describe the path of the stone if the string breaks suddenly. (1)



OR

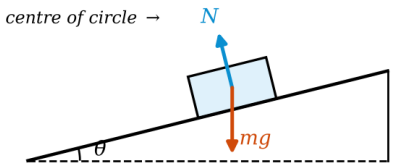
A circular racetrack of radius 90 m is banked at an angle θ with tan θ = 1/4 (figure).

(a) Draw the free-body diagram of a car on the banked track, ignoring friction. (1)

(b) Show that the optimum speed (at which no friction is needed) is $v = \sqrt{(Rg \tan \theta)}$. (2)

(c) Find its value in m s^{-1} and in km h^{-1}. (1)

(d) In which direction does friction act on the car if it moves slower than this speed? (1)



— END OF QUESTION PAPER —