PHYSICS – CLASS XI

Chapter 5 : Work, Energy and Power

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.

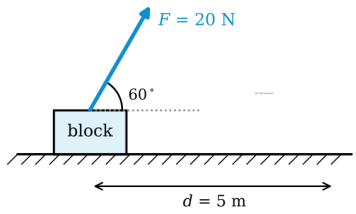
(d) Use of calculators is not permitted. Take g = 10 m s^{-2} unless a different value is given in the question.

(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. A force of 20 N acts on a block at 60° to the horizontal and moves it through 5 m along a horizontal floor (figure). The work done by the force is **(1)**

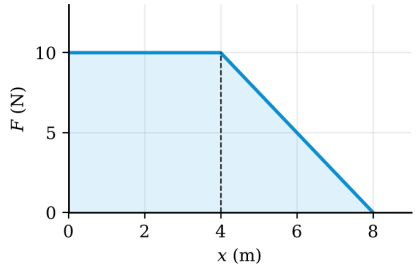


(a) 100 J
(b) 50 J
(c) 25 J
(d) zero

2. The angle between the vectors $\mathbf{A} = 2\hat{\mathbf{i}} + 3\hat{\mathbf{j}}$ and $\mathbf{B} = 3\hat{\mathbf{i}} - 2\hat{\mathbf{j}}$ is **(1)**

(a) 0°
(b) 45°
(c) 90°
(d) 180°

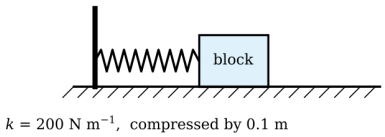
3. The graph shows how the force acting on a body varies with its displacement (figure). The work done by the force in the first 8 m is **(1)**



(a) 40 J
(b) 60 J
(c) 80 J
(d) 50 J

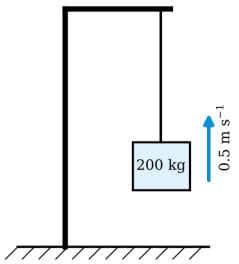
4. **Assertion (A):** No potential energy can be associated with the force of friction. **(1)**
Reason (R): The work done by friction over a closed path is not zero.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

5. A block compresses a spring of force constant 200 N m^{-1} by 0.1 m (figure). The potential energy stored in the spring is **(1)**

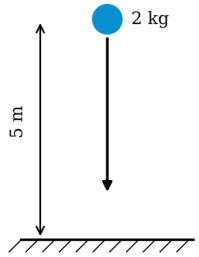


(a) 0.5 J
(b) 1 J
(c) 2 J
(d) 10 J

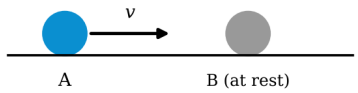
6. A crane lifts a load of 200 kg vertically upwards at a constant speed of 0.5 m s^{-1} (figure). Find the power delivered by the crane. **(1)**



7. A ball of mass 2 kg is released from rest at a height of 5 m above the ground (figure). Using the conservation of mechanical energy, find the speed with which it reaches the ground. **(1)**



8. A ball A moving with speed v makes a head-on elastic collision with an identical ball B at rest (figure). After the collision the velocities of A and B are respectively **(1)**

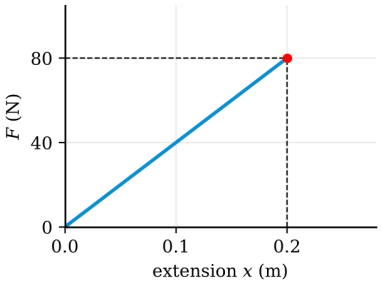


(a) $v/2$ and $v/2$
(b) zero and v
(c) v and zero
(d) $-v$ and zero

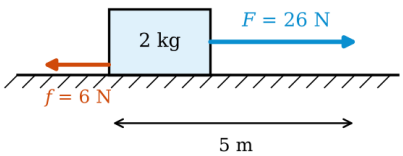
SECTION B

Questions 9 to 12 carry 2 marks each.

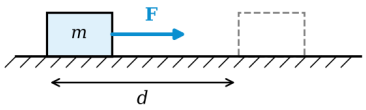
9. The graph shows the restoring force of a spring against its extension (figure). (i) Find the force constant of the spring. (ii) Find the work done in stretching the spring from $x = 0$ to $x = 0.2$ m. **(2)**



10. A block of mass 2 kg, initially at rest on a rough horizontal floor, is pulled by a horizontal force of 26 N. The force of kinetic friction is 6 N and the block moves through 5 m (figure). Using the work–energy theorem, find the speed of the block after 5 m. **(2)**



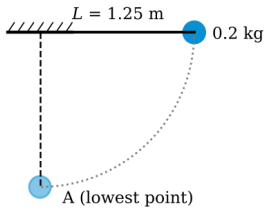
11. A constant force **F** acts on a body of mass m and produces a displacement d in its direction (figure). Starting from $v^2 - u^2 = 2as$, prove the work–energy theorem for this case. **(2)**



OR

A bullet of mass 20 g moving at 300 m s^{-1} penetrates 3 cm into a wooden block before stopping. Find the average resistive force exerted by the block.

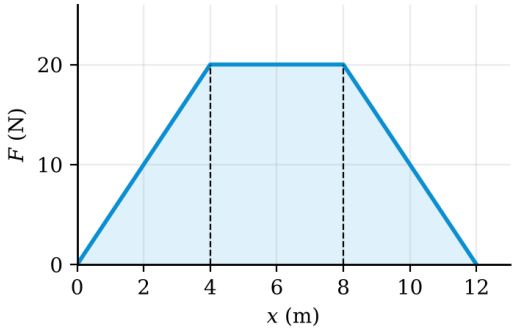
12. A pendulum bob of mass 0.2 kg is released from the horizontal position of a string of length 1.25 m (figure). Find (i) the speed of the bob at the lowest point A and (ii) the tension in the string at A. **(2)**



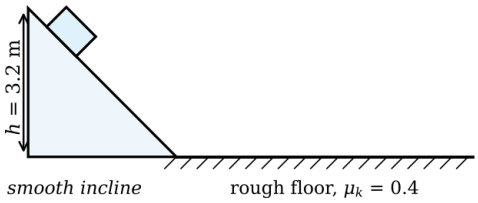
SECTION C

Questions 13 to 15 carry 3 marks each.

13. A variable force acts on a 5 kg body, initially at rest on a smooth horizontal surface, as shown in the force–displacement graph (figure). Find (i) the work done by the force in the displacement intervals 0–4 m, 4–8 m and 8–12 m, (ii) the total work done and (iii) the speed of the body after 12 m. **(3)**

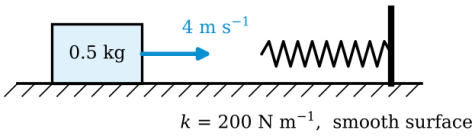


14. A block slides from rest from the top of a smooth inclined plane of height 3.2 m and then moves on a rough horizontal floor with $\mu_k = 0.4$ (figure). Find (i) the speed of the block at the bottom of the incline, (ii) the distance it travels on the floor before stopping. **(3)**

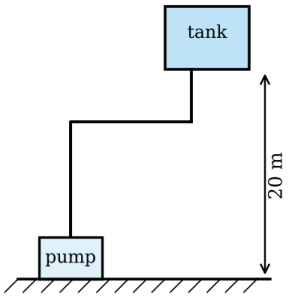


OR

A block of mass 0.5 kg moving at 4 m s^{-1} on a smooth horizontal surface hits a spring of force constant 200 N m^{-1} fixed to a wall (figure). Find (i) the initial kinetic energy of the block, (ii) the maximum compression of the spring, and (iii) the kinetic energy and the potential energy of the system when the compression is half the maximum.



15. A pump raises 600 kg of water every minute from the ground to a tank 20 m above it (figure). The pump is 50% efficient. Find (i) the useful power delivered to the water, (ii) the electrical power consumed by the pump and (iii) the electrical energy used in 1 hour, in kWh. **(3)**



SECTION D

Questions 16 and 17 carry 5 marks each.

16. A particle A of mass 2 kg moving at 6 m s^{-1} collides head-on with a stationary particle B of mass 4 kg on a smooth horizontal surface. The collision is elastic (figure). **(5)**

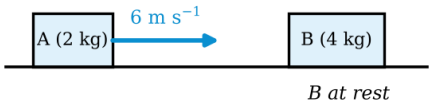
(a) What is meant by an elastic collision? Name the quantity that is conserved in every type of collision. (1)

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

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

(d) Verify that the total kinetic energy is conserved. (1)

(e) In which direction does A move after the collision and why? (1)



OR

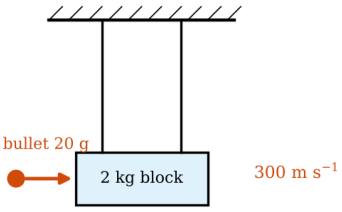
A bullet of mass 20 g moving horizontally at 300 m s^{-1} embeds itself in a suspended wooden block of mass 1.98 kg (figure).

(a) What type of collision is this? (1)

(b) Find the common velocity of the block and bullet just after the impact. (1)

(c) Find the maximum height to which the block rises. (1)

(d) Find the initial kinetic energy of the bullet and the kinetic energy just after the impact, and the percentage of kinetic energy lost. (2)



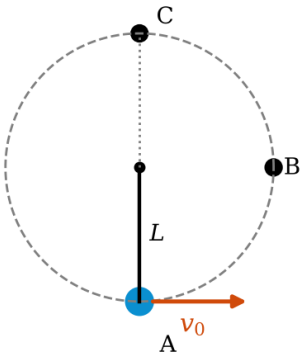
17. A bob of mass 0.2 kg is tied to a light string of length $L = 0.5$ m and is given a horizontal velocity v_0 at the lowest point A so that it just completes the vertical circle (figure). **(5)**

(a) Why does the tension do no work on the bob? (1)

(b) What is the tension at the topmost point C, and hence the speed there in terms of L and g? (1)

(c) Use conservation of mechanical energy to find v_0. (2)

(d) Find the tension in the string at the lowest point A. (1)



OR

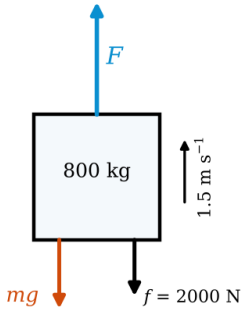
A lift of mass 800 kg is carried upwards at a constant speed of 1.5 m s^{-1} against a constant frictional force of 2000 N (figure).

(a) Find the upward force exerted by the cable. (1)

(b) Find the power delivered by the cable. (1)

(c) If the motor is 80% efficient, find the electrical power it draws. (1)

(d) Find the electrical energy used in 2 minutes, in kWh. (2)



— END OF QUESTION PAPER —