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CLASS 11 PHYSICS · NCERT CHAPTER 5 · IMU CET PRACTICE

Work, Energy and Power

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Questions: 46 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 A force $F = (3\hat{i} + 4\hat{j})$ N displaces a body by $s = (2\hat{i} + 3\hat{j})$ m. The work done is
(A) 18 J (B) 12 J
(C) 6 J (D) 25 J
- 2 Work done by the centripetal force on a body in uniform circular motion is
(A) positive (B) zero
(C) mv^2 (D) negative
- 3 A body of mass 2 kg moving at 10 m/s has kinetic energy
(A) 200 J (B) 100 J
(C) 50 J (D) 20 J
- 4 If the momentum of a body is doubled, its kinetic energy becomes
(A) unchanged (B) half
(C) double (D) four times
- 5 Two bodies of masses 1 kg and 4 kg have equal kinetic energies. The ratio of their momenta is
(A) 1 : 1 (B) 2 : 1
(C) 1 : 2 (D) 1 : 4
- 6 A body of mass 5 kg is raised to a height of 10 m. The gain in potential energy is ($g = 10 \text{ m/s}^2$)
(A) 50 J (B) 500 J
(C) 250 J (D) 5000 J
- 7 The work-energy theorem states that the work done by the net force on a body equals the change in its
(A) potential energy (B) momentum
(C) kinetic energy (D) total mechanical energy
- 8 A spring of spring constant 200 N/m is stretched by 10 cm. The potential energy stored is
(A) 1 J (B) 20 J
(C) 2 J (D) 10 J



- 9 A spring is stretched from 2 cm to 4 cm ($k = 500 \text{ N/m}$). The work done is
(A) 0.3 J (B) 0.5 J
(C) 0.1 J (D) 0.4 J
- 10 A ball is dropped from 20 m. Its speed just before hitting the ground is ($g = 10 \text{ m/s}^2$)
(A) 14 m/s (B) 40 m/s
(C) 20 m/s (D) 10 m/s
- 11 Which of the following is a non-conservative force?
(A) Spring force (B) Electrostatic force
(C) Gravitational force (D) Friction
- 12 Work done by a conservative force in a closed path is
(A) zero (B) always negative
(C) depends on the path (D) always positive
- 13 The SI unit of power is
(A) newton (B) joule
(C) watt (D) kilowatt-hour
- 14 1 horsepower is approximately equal to
(A) 100 W (B) 500 W
(C) 746 W (D) 1000 W
- 15 A pump lifts 100 kg of water to a height of 10 m in 20 s. Its power is ($g = 10 \text{ m/s}^2$)
(A) 1000 W (B) 500 W
(C) 200 W (D) 50 W
- 16 A car of mass 1000 kg moves at constant 20 m/s against a resistive force of 500 N. The power delivered by the engine is
(A) 1 kW (B) 20 kW
(C) 5 kW (D) 10 kW
- 17 In a perfectly elastic collision, which of the following is conserved?
(A) Only momentum (B) Neither
(C) Only kinetic energy (D) Both momentum and kinetic energy
- 18 In a perfectly inelastic collision,
(A) the bodies stick together after collision
(B) momentum is not conserved
(C) kinetic energy is conserved
(D) the coefficient of restitution is 1
- 19 A 2 kg body moving at 6 m/s collides with a stationary 4 kg body and they stick together. Their common velocity is
(A) 2 m/s (B) 6 m/s
(C) 4 m/s (D) 3 m/s



- 20 In the previous question (2 kg at 6 m/s sticks to stationary 4 kg), the loss of kinetic energy is
(A) 36 J (B) 18 J
(C) 12 J (D) 24 J
- 21 In a one-dimensional elastic collision of two equal masses, one initially at rest,
(A) both move together
(B) the moving body stops and the other moves with the initial velocity
(C) both stop
(D) the moving body rebounds with the same speed
- 22 A light body and a very heavy body have the same kinetic energy. Which has greater momentum?
(A) The heavy body (B) The light body
(C) Both have equal momentum (D) Cannot be decided
- 23 The coefficient of restitution for a perfectly elastic collision is
(A) infinity (B) between 0 and 1
(C) 1 (D) 0
- 24 A ball dropped from height h rebounds to height $h/4$. The coefficient of restitution is
(A) 1 (B) 0.75
(C) 0.25 (D) 0.5
- 25 A body is moved along a closed path under friction. The total work done by friction is
(A) positive (B) negative
(C) depends on mass only (D) zero
- 26 A force $F = 5x$ N (x in metres) acts on a body. The work done in moving it from $x = 0$ to $x = 2$ m is
(A) 5 J (B) 20 J
(C) 2.5 J (D) 10 J
- 27 A body of mass 4 kg is acted on by a force that changes its speed from 2 m/s to 6 m/s. The work done is
(A) 64 J (B) 72 J
(C) 32 J (D) 16 J
- 28 A man of 60 kg climbs 20 stairs, each 0.2 m high, in 12 s. His power is ($g = 10 \text{ m/s}^2$)
(A) 100 W (B) 2400 W
(C) 200 W (D) 400 W
- 29 A pendulum bob is released from a height of 0.2 m above its lowest point. Its speed at the lowest point is ($g = 10 \text{ m/s}^2$)
(A) 1 m/s (B) 4 m/s
(C) 2 m/s (D) $\sqrt{2}$ m/s
- 30 Potential energy of a system increases when
(A) kinetic energy increases
(B) work is done against a conservative force
(C) work is done by a conservative force
(D) work is done against friction



- 31 The relation between force and potential energy for a conservative force is
(A) $F = U/x$ (B) $F = -dU/dx$
(C) $F = dU/dx$ (D) $F = -U \cdot x$
- 32 The potential energy of a particle is $U = 3x^2 - 6x$ (SI). The equilibrium position is
(A) $x = 1$ m (B) $x = 0$
(C) $x = 2$ m (D) $x = 3$ m
- 33 A body falls freely. Its total mechanical energy (neglecting air resistance)
(A) increases (B) decreases
(C) remains constant (D) first increases then decreases
- 34 A bullet of mass 20 g moving at 400 m/s penetrates 10 cm into a wooden block. The average resistive force is
(A) 1600 N (B) 32000 N
(C) 16000 N (D) 8000 N
- 35 The kinetic energy of a body is increased by 300%. Its momentum increases by
(A) 200% (B) 300%
(C) 73% (D) 100%
- 36 A machine does 1000 J of work in 5 s. Its power is
(A) 2000 W (B) 200 W
(C) 5000 W (D) 50 W
- 37 1 kWh equals
(A) 3600 J (B) 3.6×10^3 J
(C) 1000 J (D) 3.6×10^6 J
- 38 Power is the scalar product of
(A) force and velocity (B) momentum and velocity
(C) force and acceleration (D) force and displacement
- 39 A block of mass 2 kg slides down a rough incline of height 5 m and reaches the bottom with speed 8 m/s. The work done against friction is ($g = 10 \text{ m/s}^2$)
(A) 28 J (B) 100 J
(C) 36 J (D) 64 J
- 40 A body of mass m moving with velocity v collides elastically head-on with a body of mass $2m$ at rest. The velocity of the first body after collision is
(A) $v/3$ (B) $-v/3$
(C) $-v$ (D) zero
- 41 In the elastic collision of m (moving at v) with $2m$ at rest, the velocity of $2m$ after collision is
(A) $v/3$ (B) v
(C) $v/2$ (D) $2v/3$



- 42 A spring compressed by x stores energy E . If it is compressed by $2x$, the stored energy becomes
- (A) $8E$ (B) $2E$
(C) $E/2$ (D) $4E$
-
- 43 A body of mass 1 kg is thrown upward with 20 m/s and reaches a maximum height of 18 m . The energy lost to air resistance is ($g = 10\text{ m/s}^2$)
- (A) 20 J (B) 180 J
(C) 200 J (D) 2 J
-
- 44 A constant force does 50 J of work on a body which moves 5 m along the force direction. The magnitude of the force is
- (A) 5 N (B) 10 N
(C) 45 N (D) 250 N
-
- 45 A force F acts at 60° to the displacement s . The work done is
- (A) $\sqrt{3}Fs/2$ (B) $Fs/2$
(C) Fs (D) zero
-
- 46 The work done in holding a 20 kg suitcase stationary at a height of 1 m for 5 min is
- (A) zero (B) 60000 J
(C) 6000 J (D) 200 J
-

Answer Key

1	2	3	4	5	6	7	8	9	10
A	B	B	D	C	B	C	A	A	C
11	12	13	14	15	16	17	18	19	20
D	A	C	C	B	D	D	A	A	D
21	22	23	24	25	26	27	28	29	30
B	A	C	D	B	D	A	C	C	B
31	32	33	34	35	36	37	38	39	40
B	A	C	C	D	B	D	A	C	B
41	42	43	44	45	46				
D	D	A	B	B	A				

Hints & Solutions

- (A) $W = F \cdot s = 3 \times 2 + 4 \times 3 = 18 \text{ J}$.
- (B) Centripetal force is always perpendicular to the displacement, so $W = 0$.
- (B) $K = \frac{1}{2}mv^2 = \frac{1}{2} \times 2 \times 100 = 100 \text{ J}$.
- (D) $K = p^2/2m \rightarrow K \propto p^2$. Doubling p gives $4K$.
- (C) $p = \sqrt{2mK} \propto \sqrt{m} \rightarrow 1:2$.
- (B) $U = mgh = 5 \times 10 \times 10 = 500 \text{ J}$.
- (C) $W_{\text{net}} = \Delta K$.
- (A) $U = \frac{1}{2}kx^2 = \frac{1}{2} \times 200 \times 0.01 = 1 \text{ J}$.
- (A) $W = \frac{1}{2}k(x_2^2 - x_1^2) = 250 \times (0.0016 - 0.0004) = 0.3 \text{ J}$.
- (C) $v = \sqrt{2gh} = \sqrt{400} = 20 \text{ m/s}$.
- (D) Work done by friction depends on the path and is dissipated as heat, so it is non-conservative.
- (A) For conservative forces, W around any closed loop = 0.
- (C) Power = work/time; SI unit watt (J/s).
- (C) $1 \text{ hp} = 746 \text{ W}$.
- (B) $P = mgh/t = 100 \times 10 \times 10/20 = 500 \text{ W}$.
- (D) At constant speed, engine force = $500 \text{ N} \rightarrow P = Fv = 500 \times 20 = 10 \text{ kW}$.
- (D) Elastic collisions conserve both linear momentum and kinetic energy.
- (A) Bodies move together after a perfectly inelastic collision; $e = 0$ and KE loss is maximum, but momentum is conserved.
- (A) $2 \times 6 = 6 \times v \rightarrow v = 2 \text{ m/s}$.
- (D) $K_i = \frac{1}{2} \times 2 \times 36 = 36 \text{ J}$; $K_f = \frac{1}{2} \times 6 \times 4 = 12 \text{ J}$. Loss = 24 J .
- (B) For equal masses in a 1-D elastic collision, velocities are exchanged.
- (A) $p = \sqrt{2mK}$; for equal K , the larger mass has larger momentum.



23. (C) $e = (\text{relative velocity of separation})/(\text{relative velocity of approach}) = 1$ for elastic collisions.
24. (D) $e = \sqrt{h'/h} = \sqrt{1/4} = 0.5$.
25. (B) Friction always opposes motion, so the work done by it over any path, open or closed, is negative.
26. (D) $W = \int_0^2 5x \, dx = 5x^2/2 \Big|_0^2 = 10 \, \text{J}$.
27. (A) $W = \frac{1}{2}m(v^2 - u^2) = 2(36 - 4) = 64 \, \text{J}$.
28. (C) $h = 4 \, \text{m}$; $P = mgh/t = 60 \times 10 \times 4/12 = 200 \, \text{W}$.
29. (C) $v = \sqrt{2gh} = \sqrt{4} = 2 \, \text{m/s}$.
30. (B) $\Delta U = -W_{\text{conservative}}$; doing work against a conservative force stores energy as PE.
31. (B) A conservative force equals the negative gradient of the potential energy.
32. (A) $F = -dU/dx = -(6x - 6) = 0 \rightarrow x = 1 \, \text{m}$.
33. (C) Only gravity (conservative) acts, so $K + U$ remains constant.
34. (C) $F \times s = \frac{1}{2}mv^2 \rightarrow F = \frac{1}{2} \times 0.02 \times 160000/0.1 = 16000 \, \text{N}$.
35. (D) $K' = 4K \rightarrow p' = 2p$ (since $p \propto \sqrt{K}$). Increase = 100%.
36. (B) $P = W/t = 1000/5 = 200 \, \text{W}$.
37. (D) $1 \, \text{kWh} = 1000 \, \text{W} \times 3600 \, \text{s} = 3.6 \times 10^6 \, \text{J}$.
38. (A) $P = F \cdot v$.
39. (C) $mgh = 100 \, \text{J}$; KE at bottom = $\frac{1}{2} \times 2 \times 64 = 64 \, \text{J}$. Work against friction = $100 - 64 = 36 \, \text{J}$.
40. (B) $v_1 = (m_1 - m_2)v/(m_1 + m_2) = (m - 2m)v/3m = -v/3$ (it rebounds).
41. (D) $v_2 = 2m_1v/(m_1 + m_2) = 2mv/3m = 2v/3$.
42. (D) $U \propto x^2 \rightarrow 4E$.
43. (A) Initial KE = $200 \, \text{J}$; PE at top = $1 \times 10 \times 18 = 180 \, \text{J}$. Loss = $20 \, \text{J}$.
44. (B) $F = W/s = 50/5 = 10 \, \text{N}$.
45. (B) $W = Fs \cos 60^\circ = Fs/2$.
46. (A) There is no displacement, so mechanical work done is zero.

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