CHAPTER

05

Work, Energy & Power

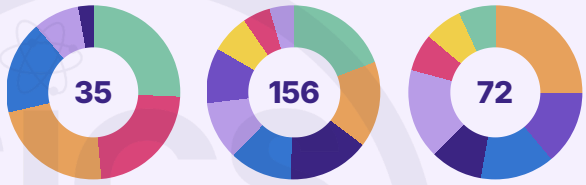
MHT CET · JEE · NEET Physics

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EXAM WEIGHTAGE



	CET	JEE	NEET
Power	8 (23%)	25 (16%)	18 (25%)
Conservation of Energy	9 (26%)	30 (19%)	5 (7%)
Spring & Elastic Energy	6 (17%)	18 (12%)	10 (14%)
Work-Energy Theorem	1 (3%)	24 (15%)	7 (10%)
Work by a Variable Force	0 (0%)	16 (10%)	10 (14%)
Work by a Constant Force	3 (9%)	17 (11%)	5 (7%)
Kinetic Energy & Momentum	8 (23%)	8 (5%)	5 (7%)
Potential Energy & Equilibrium	0 (0%)	11 (7%)	5 (7%)
Collisions	0 (0%)	7 (4%)	7 (10%)

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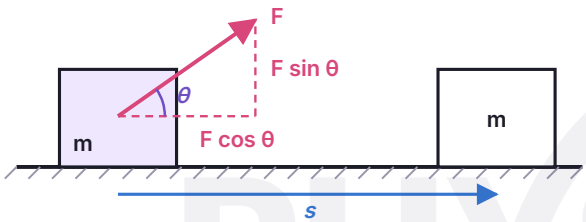
01 CONCEPT Work by a Constant Force

IN ONE LINE

Work is done when a force moves a body: only the **part of the force along the displacement** counts.

5.1.1 Work by a constant force

- A force F at angle θ has two parts: F cos θ along the displacement and F sin θ across it.
- Only F cos θ does work.



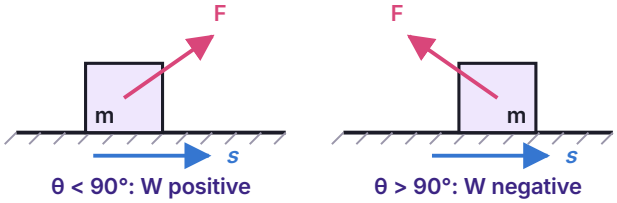
Force F moves the body through s

$$W = Fs\cos\theta$$

$$W = \mathbf{F}\cdot\mathbf{s} = F_x s_x + F_y s_y + F_z s_z$$

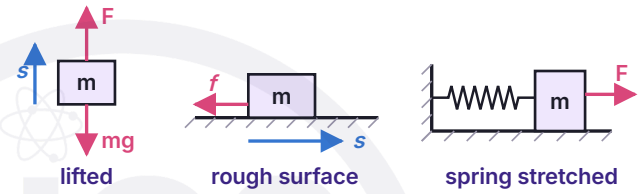
- Work is a scalar, the dot product of force and displacement.
- Given two positions: s = final position − initial position.
- Several forces: add them first, then take the dot product with s.

5.1.2 Positive, negative and zero work



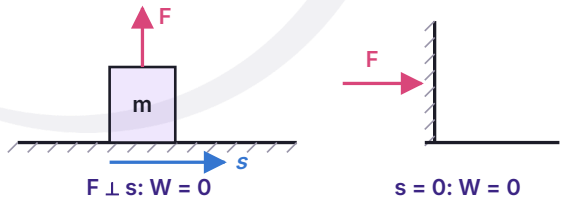
The angle between F and s decides the sign

Angle	Work	Example
$0° \le \theta < 90°$	positive, $W_{max} = Fs$ at 0°	lifting force on a body; pull on a lawn roller; stretching a spring
$90° < \theta \le 180°$	negative, $W_{min} = -Fs$ at 180°	gravity on a body lifted up; friction on a sliding body
$\theta = 90°$	zero	coolie walking on a level platform; centripetal force; magnetic force on a charge



Lifting force and stretching force do positive work; gravity and friction here do negative work

- Zero work has three cases: F ⊥ s, or s = 0, or F = 0.
- Pushing a wall that does not move: W = 0.
- Holding a weight up: W = 0. Only lifting it takes work.

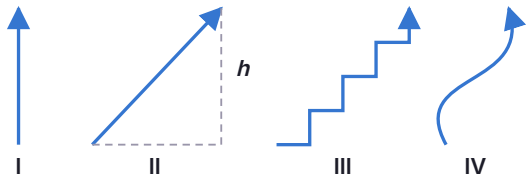


Two ways to get zero work

5.1.3 Work against gravity and friction

$$\text{against gravity: } W = mgh$$

- h is the vertical rise. The path does not matter.



Same rise h on all four paths: same work mgh

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against friction: $W = \mu mg\, s$

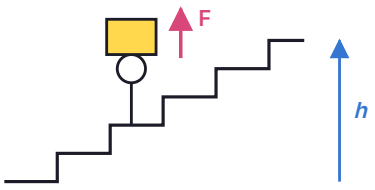
- Force at an angle: R changes. Pull at θ: $R = mg - F \sin\theta$.
- On an incline: $f = \mu mg \cos\theta$.
- Uniform velocity: applied force along the motion = friction.
- Total work on a slope = mgh + work against friction.

5.1.4 Units and frame of reference

$$[W] = [ML^2T^{-2}]$$

Unit	Value
1 J	$1\ N \times 1\ m = 10^7$ erg
1 kg-m	9.81 J
1 g-cm	981 erg
1 eV	1.6×10^{-19} J
1 kWh	3.6×10^6 J
1 cal	4.18 J

- Work depends on the frame, because displacement does.
- Porter climbing stairs: the work of his lifting force is zero in his own frame and mgh for a person on the ground.



Porter with a suitcase on a staircase

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Solved Examples 01 Work by a Constant Force

SOLVED 1 MHT CET 2026 · 13 May · Shift 1

A particle moves from position $3\hat{i} + 2\hat{j} - 6\hat{k}$ to $14\hat{i} + 13\hat{j} + 9\hat{k}$ due to uniform force of $(4\hat{i} + \hat{j} + 3\hat{k})$ N. If displacement is in metre then work done will be

(a) 100 J (b) 200 J
(c) 300 J (d) 250 J

STEP 1 $\mathbf{s} = 11\hat{i} + 11\hat{j} + 15\hat{k}$
STEP 2 $W = \mathbf{F}\cdot\mathbf{s} = 44 + 11 + 45$
STEP 3 $W = \mathbf{100\ J}$

Answer: **(a)**

SOLVED 2 MHT CET 2025 · 23 Apr · Shift 2

A particle is displaced from point P(3 m, 4 m, 5 m) to a point Q(2 m, 3 m, 4 m) under a constant force $\mathbf{F} = (3\hat{i} + 4\hat{j} + 5\hat{k})$ N. The work done by the force in this process is

(a) +10 J (b) +4 J
(c) −8 J (d) −12 J

STEP 1 $\mathbf{s} = -\hat{i} - \hat{j} - \hat{k}$
STEP 2 $W = -3 - 4 - 5$
STEP 3 $W = \mathbf{-12\ J}$

Answer: **(d)**

SOLVED 3 MHT CET 2019 · 2 May · Shift 2

A force $(F) = -5\hat{i} - 7\hat{j} + 3\hat{k}$ acting on a particle causes a displacement $(s) = 3\hat{i} - 2\hat{j} + a\hat{k}$ in its own direction. If the work done is 14 J, then the value of 'a' is

(a) 0 (b) 5
(c) 15 (d) 1

STEP 1 $W = (-5)(3) + (-7)(-2) + 3a = -1 + 3a$
STEP 2 $-1 + 3a = 14$
STEP 3 $a = \mathbf{5}$

Answer: **(b)**

SOLVED 4 NEET 2016 · Phase 2

A particle moves from a point $(-2\hat{i} + 5\hat{j})$ to $(4\hat{j} + 3\hat{k})$ when a force of $(4\hat{i} + 3\hat{j})$ N is applied. How much work has been done by the force?

(a) 8 J (b) 11 J
(c) 5 J (d) 2 J

STEP 1 $\mathbf{s} = 2\hat{i} - \hat{j} + 3\hat{k}$
STEP 2 $W = 8 - 3 + 0$
STEP 3 $W = \mathbf{5\ J}$

Answer: **(c)**

SOLVED 5 JEE Main 2025 · 22 Jan · Shift 2

A force $\mathbf{F} = 2\hat{i} + b\hat{j} + \hat{k}$ is applied on a particle and it undergoes a displacement $\hat{i} - 2\hat{j} - \hat{k}$. What will be the value of b, if work done on the particle is zero.

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$
(c) 0 (d) 2

STEP 1 $W = 0$ means $F\cdot s = 0$
STEP 2 $2 - 2b - 1 = 0$
STEP 3 $b = \mathbf{\frac{1}{2}}$

Answer: **(b)**

SOLVED 6 AIPMT 1997

A body moves a distance of 10 m along a straight line under the action of a 5 N force. If the work done is 25 J, then angle between the force and direction of motion of the body is

(a) 60° (b) 75°
(c) 30° (d) 45°

STEP 1 $W = Fs\cos\theta \Rightarrow 25 = 5 \times 10 \times \cos\theta$
STEP 2 $\cos\theta = \frac{1}{2}$
STEP 3 $\theta = \mathbf{60°}$

Answer: **(a)**

SOLVED 7 AIPMT 2006

300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Work done against friction is (Take $g = 10\ m/s^2$)

(a) 1000 J (b) 200 J
(c) 100 J (d) zero

STEP 1 Work against gravity $= mgh = 2 \times 10 \times 10 = 200$ J
STEP 2 Total work = gravity part + friction part
STEP 3 Friction part $= 300 - 200 = \mathbf{100\ J}$

Answer: **(c)**

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Solved Examples 01 Work by a Constant Force (contd.)

SOLVED 8 JEE Main 2023 · 29 Jan · Shift 2

Identify the correct statements from the following:
A. Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket is negative.
B. Work done by gravitational force in lifting a bucket out of a well by a rope tied to the bucket is negative.
C. Work done by friction on a body sliding down an inclined plane is positive.
D. Work done by an applied force on a body moving on a rough horizontal plane with uniform velocity is zero.
E. Work done by the air resistance on an oscillating pendulum is negative.

(a) A and C only
(b) B and D only
(c) B, D and E only
(d) B and E only

STEP 1 A: man pulls along the motion ⇒ positive. C: friction opposes motion ⇒ negative.
STEP 2 D: applied force has a component along the motion ⇒ positive.
STEP 3 True: **B and E only**

Answer: **(d)**

SOLVED 9 AIPMT 1994

When a body moves with a constant speed along a circle

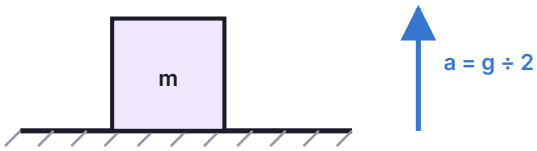
(a) no work is done on it
(b) no acceleration is produced in it
(c) its velocity remains constant
(d) no force acts on it

STEP 1 The force on it is always perpendicular to the displacement
STEP 2 $\cos 90° = 0$, so $W = 0$
STEP 3 **No work is done on it**

Answer: **(a)**

SOLVED 10 JEE Main 2019 · 10 Jan · Shift 1

A block of mass m is kept on a platform which starts from rest with constant acceleration $\frac{g}{2}$ upward, as shown in figure. Work done by normal reaction on block in time t is



(a) $\frac{mg^2t^2}{8}$
(b) $\frac{3mg^2t^2}{8}$
(c) $-\frac{mg^2t^2}{8}$
(d) 0

STEP 1 $N - mg = m\frac{g}{2} \Rightarrow N = \frac{3mg}{2}$
STEP 2 $s = \frac{1}{2}(\frac{g}{2})t^2 = \frac{gt^2}{4}$
STEP 3 $W = Ns = \frac{\mathbf{3mg^2t^2}}{\mathbf{8}}$

Answer: **(b)**

SOLVED 11 JEE Main 2021 · 22 Jul · Shift 2

A porter lifts a heavy suitcase of mass 80 kg and at the destination lowers it down by a distance of 80 cm with a constant velocity. Calculate the work done by the porter in lowering the suitcase. (take g = 9.8 m s^{-2})

(a) +627.2 J
(b) −62720.0 J
(c) −627.2 J
(d) 784.0 J

STEP 1 Constant velocity ⇒ porter's force = mg, upward
STEP 2 Displacement is downward, so the work is negative
STEP 3 $W = -80 \times 9.8 \times 0.8 =$ **−627.2 J**

Answer: **(c)**

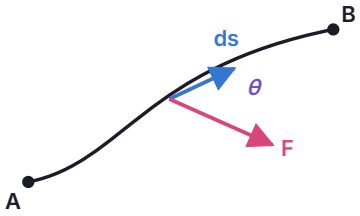
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02 CONCEPT Work by a Variable Force

IN ONE LINE

When the force changes with position, **integrate**: the work is the area under the F-x graph.

5.2.1 Work as an integral



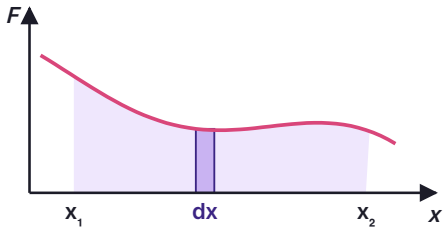
Small work over each small step ds

$$dW = F \cdot ds$$

$$W = \int_{x_1}^{x_2} F\,dx$$

- Put the force as a function of x and integrate between the two positions.
- A constant term adds to the answer as constant × distance.

5.2.2 F-x graph



Each strip has area F dx

W = area under the F-x graph

- Split the area into rectangles and triangles.
- Area below the x-axis counts as negative work.
- Starting from rest: K at the end = total area.

JEE · NEET Corner

Force in two or three dimensions

$$W = \int F_x\,dx + \int F_y\,dy + \int F_z\,dz$$

- Integrate each component over its own limits.
- A force with only $F_x(x)$ and $F_y(y)$ gives the same work on every path.

Retardation or friction that varies

- Retardation $a = kx$: loss in $K = \int mkx\,dx$, so loss $\propto x^2$.
- $\mu = \mu_0 - \alpha x$: replace μ in $f = \mu mg$ and integrate over x.
- Average of a linear force = half the sum of its end values.

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WORK, ENERGY & POWER

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

117	32	9
questions	concepts	topics

CONTENTS

01	Work by a Constant Force	Q 1–19	19 Qs
02	Work by a Variable Force	Q 20–30	11 Qs
03	Kinetic Energy & Momentum	Q 31–49	19 Qs
04	Work-Energy Theorem	Q 50–61	12 Qs
05	Potential Energy & Equilibrium	Q 62–65	4 Qs
06	Spring & Elastic Energy	Q 66–77	12 Qs
07	Conservation of Energy	Q 78–93	16 Qs
08	Power	Q 94–114	21 Qs
09	Collisions	Q 115–117	3 Qs
	Answer key		

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TOPIC 01

Work by a Constant Force

19 PYQs · Easy 19 · Medium 0 · Difficult 0 | MHT CET 3 · NEET 4 · JEE 12

Concepts covered: Work as a dot product: W = F·s (10) · Work at an angle: W = Fs cosθ (2) · Positive, negative & zero work (3) · Work against gravity (3) · Work against friction (1)

LEVEL 1 · EASY 19 questions

◆ Work as a dot product: W = F·s 10 Qs

1. A particle moves from position $3\hat{i}+2\hat{j}-6\hat{k}$ to $14\hat{i}+13\hat{j}+9\hat{k}$ due to uniform force of $(4\hat{i}+\hat{j}+3\hat{k})$ N. If displacement is in metre then work done will be
MHT CET 2026 · 13 MAY · SHIFT 1
(a) 100 J (b) 200 J (c) 300 J (d) 250 J

2. A particle is displaced from point $\mathrm{P}(3\,\mathrm{m}, 4\,\mathrm{m}, 5\,\mathrm{m})$ to a point $\mathrm{Q}(2\,\mathrm{m}, 3\,\mathrm{m}, 4\,\mathrm{m})$ under a constant force $\vec{\mathrm{F}}=(3\hat{\mathrm{i}}+4\hat{\mathrm{j}}+5\hat{\mathrm{k}})\mathrm{N}$. The work done by the force in this process is
MHT CET 2025 · 23 APR · SHIFT 2
(a) +10 J (b) +4 J (c) -8 J (d) -12 J

3. A force $(F)=-5\hat{\mathbf{i}}-7\hat{\mathbf{j}}+3\hat{\mathbf{k}}$ acting on a particle causes a displacement $(s)=3\hat{\mathbf{i}}-2\hat{\mathbf{j}}+a\hat{\mathbf{k}}$ in its own direction. If the work done is 14 J, then the value of ' a ' is
MHT CET 2019 · 2 MAY · SHIFT 2
(a) 0 (b) 5 (c) 15 (d) 1

4. A particle moves from a point $\left(-2\hat{i}+5\hat{j}\right)$ to $\left(4\hat{j}+3\hat{k}\right)$ when a force of $\left(4\hat{i}+3\hat{j}\right)$ N is applied. How much work has been done by the force?
NEET 2016 · PHASE 2
(a) 8 J (b) 11 J (c) 5 J (d) 2 J

5. A uniform force of $\left(3\hat{i}+\hat{j}\right)$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $\left(2\hat{i}+\hat{k}\right)$ metre to position $\left(4\hat{i}+3\hat{j}-\hat{k}\right)$ metre. The work done by the force on the particle is
NEET 2013
(a) 13 J (b) 15 J (c) 9 J (d) 6 J

6. A force $\vec{\mathrm{F}}=2\hat{i}+\mathrm{b}\hat{j}+\hat{k}$ is applied on a particle and it undergoes a displacement $\hat{i}-2\hat{j}-\hat{k}$. What will be the value of b, if work done on the particle is zero.
JEE MAIN 2025 · 22 JAN · SHIFT 2
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) 0 (d) 2

7. A force $\vec{F}=\left(5\vec{i}+3\vec{j}+2\vec{k}\right)N$ is applied over a particle which displaces it from its origin to the point $\vec{r}=\left(2\vec{i}-\vec{j}\right)m$. The work done on the particle in joules is
AIEEE 2004
(a) +10 (b) +7 (c) −7 (d) +13

8. A 1 kg block subjected to two simultaneous forces $(2\hat{\mathrm{i}}+3\hat{\mathrm{j}}+4\hat{\mathrm{k}})\mathrm{N}$ and $(3\hat{\mathrm{i}}-\hat{\mathrm{j}}-2\hat{\mathrm{k}})\mathrm{N}$ is moved a distance of 25 m along $(3\hat{\mathrm{i}}-4\hat{\mathrm{j}})$ direction. The work done in this process is ____ J.
JEE MAIN 2026 · 4 APR · SHIFT 1 *(Numerical)*

9. A force $(3x^2+2x-5)\mathrm{N}$ displaces a body from $x=2\,\mathrm{m}$ to $x=4\,\mathrm{m}$. Work done by this force is _____ J.
JEE MAIN 2024 · 9 APR · SHIFT 2 *(Numerical)*

10. A small particle moves to position $5\hat{i}-2\hat{j}+\hat{k}$ from its initial position $2\hat{i}+3\hat{j}-4\hat{k}$ under the action of force $5\hat{i}+2j+\hat{}\,7\hat{k}\,\mathrm{N}$. The value of work done will be _____ J.
JEE MAIN 2023 · 1 FEB · SHIFT 1 *(Numerical)*

◆ Work at an angle: W = Fs cosθ 2 Qs

11. A body moves a distance of 10 m along a straight line under the action of a 5 N force. If the work done is 25 J, then angle between the force and direction of motion of the body is
AIPMT 1997
(a) 60° (b) 75° (c) 30° (d) 45°

12. Two persons A and B perform same amount of work in moving a body through a certain distance d with application of forces acting at angle 45° and 60° with the direction of displacement respectively. The ratio of force applied by person A to the force applied by person B is $\frac{1}{\sqrt{x}}$. The value of x is .....
JEE MAIN 2021 · 27 AUG · SHIFT 1 *(Numerical)*

◆ Positive, negative & zero work 3 Qs

13. When a body moves with a constant speed along a circle
AIPMT 1994
(a) no work is done on it
(b) no acceleration is produced in it
(c) its velocity remains constant
(d) no force acts on it

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14. Identify the correct statements from the following:

A. Work done by a man in lifting a bucket out of a well by means of a rope tied to the bucket is negative.

B. Work done by gravitational force in lifting a bucket out of a well by a rope tied to the bucket is negative.

C. Work done by friction on a body sliding down an inclined plane is positive.

D. Work done by an applied force on a body moving on a rough horizontal plane with uniform velocity is zero.

E. Work done by the air resistance on an oscillating pendulum is negative.

Choose the correct answer from the options given below:

JEE MAIN 2023 · 29 JAN · SHIFT 2

(a) A and C only (b) B and D only
(c) B, D and E only (d) B and E only

15. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle, the motion of the particles takes place in a plane. It follows that

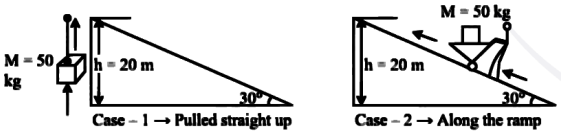
AIEEE 2004

(a) its kinetic energy is constant
(b) is acceleration is constant
(c) its velocity is constant
(d) it moves in a straight line

◆ Work against gravity 3 Qs

16. A body of mass $50\,\text{kg}$ is lifted to a height of $20\,\text{m}$ from the ground in the two different ways as shown in the figures. The ratio of work done against the gravity in both the respective cases, will be:

JEE MAIN 2024 · 5 APR · SHIFT 1



(a) 2 : 1 (b) $\sqrt{3}$: 2 (c) 1 : 1 (d) 1 : 2

17. A porter lifts a heavy suitcase of mass 80 kg and at the destination lowers it down by a distance of 80 cm with a constant velocity. Calculate the work done by the porter in lowering the suitcase. (take g = 9.8 ms^{-}2)

JEE MAIN 2021 · 22 JUL · SHIFT 2

(a) +627.2 J (b) – 62720.0 J
(c) –627.2 J (d) 784.0 J

18. A particle of mass $100g$ is thrown vertically upwards with a speed of $5\ m/s$. The work done by the force of gravity during the time the particle goes up is

AIEEE 2006

(a) $-0.5J$ (b) $-1.25J$ (c) $1.25J$ (d) $0.5J$

◆ Work against friction 1 Q

19. A block of mass $100\,\text{kg}$ slides over a distance of $10\,\text{m}$ on a horizontal surface. If the co-efficient of friction between the surfaces is 0.4, then the work done against friction (in J) is:

JEE MAIN 2024 · 29 JAN · SHIFT 1

(a) 3900 (b) 4500 (c) 4200 (d) 4000

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TOPIC 02

Work by a Variable Force

11 PYQs · Easy 11 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 7 · JEE 4

Concepts covered: Force as a function of x: W = ∫F dx (8) · F-x graph: area = work (3)

LEVEL 1 · EASY 11 questions

◆ Force as a function of x: W = ∫F dx 8 Qs

20. A force F = 20 + 10y acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle from y = 0 to y = 1 m is:
NEET 2019
(a) 5 J (b) 25 J (c) 20 J (d) 30 J

21. A block of mass 10 kg, moving in x direction with a constant speed of 10 m s^{-1}, is subjected to a retarding force F = 0.1x J/m during its travel from x = 20 m to 30 m. Its final KE will be
AIPMT 2015 · CANCELLED PAPER
(a) 275 J (b) 250 J (c) 475 J (d) 450 J

22. A body, constrained to move in y -direction, is subjected to a force given by $\vec{F} = (-2\hat{i} + 15\hat{j} + 6\hat{k})$ N . The work done by this force in moving the body through a distance of $10\hat{j}$ m along y-axis, is
AIPMT 1994
(a) 150 J (b) 20 J (c) 190 J (d) 160 J

23. A position dependent force, $F = (7 - 2x + 3x^2)$ N acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$ m. The work done in joule is
AIPMT 1994
(a) 135 (b) 270 (c) 35 (d) 70

24. A position dependent force, $F = (7 - 2x + 3x^2)$ N acts on a small body of mass 2 kg and displaces it from $x = 0$ to $x = 5$ m. The work done in joule is
AIPMT 1992
(a) 135 (b) 270 (c) 35 (d) 70

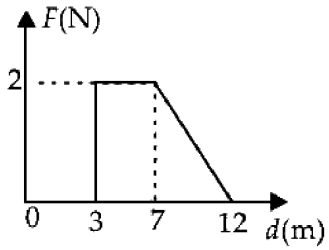
25. A force $\vec{F} = (2 + 3x)\hat{i}$ acts on a particle in the x direction where F is in newton and x is in meter. The work done by this force during a displacement from $x = 0$ to $x = 4$ m, is _____ J.
JEE MAIN 2023 · 11 APR · SHIFT 1 *(Numerical)*

26. A force $F = (5 + 3y^2)$ acts on a particle in the y-direction, where F is in newton and y is in meter. The work done by the force during a displacement from $y = 2$ m to $y = 5$ m is _____ J.
JEE MAIN 2023 · 1 FEB · SHIFT 2 *(Numerical)*

27. A force of F = (5y + 20)$\hat{j}$ N acts on a particle. The work done by this force when the particle is moved from y = 0 m to y = 10 m is _____ J.
JEE MAIN 2021 · 25 JUL · SHIFT 2 *(Numerical)*

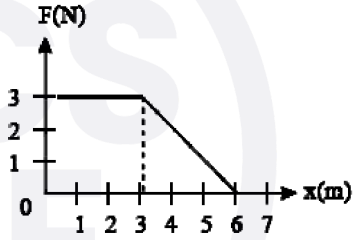
◆ F-x graph: area = work 3 Qs

28. Force F on a particle moving in a straight line varies with distance d as shown in figure.



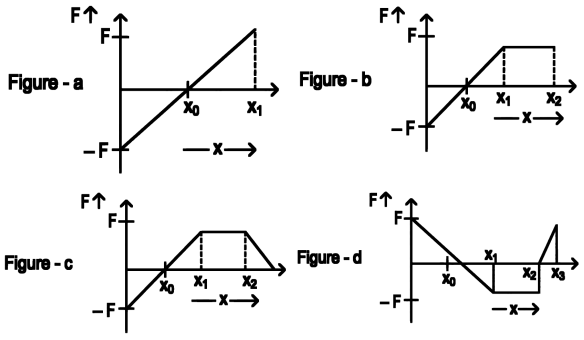
The work done on the particle during its displacement of 12 m is
AIPMT 2011 · PRELIMS
(a) 18 J (b) 21 J (c) 26 J (d) 13 J

29. A force F acting



on an object varies with distance x as shown here. The force is in N and x in m. The work done by the force in moving the object from x = 0 to x = 6 m is
AIPMT 2005
(a) 18.0 J (b) 13.5 J (c) 9.0 J (d) 4.5 J

30. Arrange the four graphs in descending order of total work done; where W1, W2, W3 and W4 are the work done corresponding to figure a, b, c and d respectively.
JEE MAIN 2022 · 26 JUN · SHIFT 2



(a) W3 > W2 > W1 > W4 (b) W3 > W2 > W4 > W1
(c) W2 > W3 > W4 > W1 (d) W2 > W3 > W1 > W4

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TOPIC 03

Kinetic Energy & Momentum

19 PYQs · Easy 19 · Medium 0 · Difficult 0 | MHT CET 7 · NEET 5 · JEE 7

Concepts covered: K = p²/2m and percentage change (6) · Equal KE: heavier body has more momentum (9) · Equal momentum: lighter body has more KE (4)

LEVEL 1 · EASY 19 questions

◆ K = p²/2m and percentage change 6 Qs

31. If 'm' is the mass of the body moving with velocity 'v' having kinetic energy 'E', then the linear momentum of the body is

MHT CET 2026 · 20 MAY · SHIFT 1

(a) $E\sqrt{m}$ (b) $m\sqrt{E}$ (c) $2E\sqrt{m}$ (d) $\sqrt{2mE}$

32. If the momentum of a body of mass ' m ' is increased by 20% then its kinetic energy increases by

MHT CET 2024 · 10 MAY · SHIFT 1

(a) 44% (b) 55% (c) 66% (d) 77%

33. When kinetic energy of a body becomes 36 times of its original value, the percentage increase in the momentum of the body will be:

JEE MAIN 2024 · 6 APR · SHIFT 2

(a) 60% (b) 500% (c) 6% (d) 600%

34. A boy is rolling a 0.5 kg ball on the frictionless floor with the speed of 20 ms-1. The ball gets deflected by an obstacle on the way. After deflection it moves with 5% of its initial kinetic energy. What is the speed of the ball now?

JEE MAIN 2021 · 17 MAR · SHIFT 1

(a) 14.41 ms^{-1} (b) 19.0 ms^{-1}
(c) 4.47 ms^{-1} (d) 1.00 ms^{-1}

35. An athlete in the Olympic games covers a distance of 100 m in 10 s. His kinetic energy can be estimated to be in the range

AIEEE 2008

(a) $200J - 500J$ (b) $2 \times 10^5 J - 3 \times 10^5 J$
(c) $20,000J - 50,000J$ (d) $2,000J - 5,000J$

36. A car accelerates from rest to u m/s. The energy spent in this process is E J. The energy required to accelerate the car from u m/s to 2um/s is nE J. The value of n is _____.

JEE MAIN 2023 · 13 APR · SHIFT 2 *(Numerical)*

◆ Equal KE: heavier body has more momentum 9 Qs

37. The kinetic energy of light body and a heavy body is same. Which one of the following statement is true?

MHT CET 2026 · 20 MAY · SHIFT 1

(a) Both bodies have same momentum
(b) Heavy body has greater momentum
(c) Lighter body has greater momentum
(d) A body having high velocity has greater momentum

38. A 6 kg mass and 1.5 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) 4 : 1 (b) 2 : 1 (c) 1 : 1 (d) 1 : 3

39. If a lighter body of mass 'M_1' and velocity 'V_1' and a heavy body (mass M_2 and velocity V_2) have the same kinetic energy then

MHT CET 2023 · 10 MAY · SHIFT 1

(a) $M_2V_2 < M_1V_1$ (b) $M_2V_2 = M_1V_1$
(c) $M_2V_1 < M_1V_2$ (d) $M_2V_2 > M_1V_1$

40. The kinetic energy of a light body and a heavy body is same. Which one of them has greater momentum?

MHT CET 2021 · 24 SEP · SHIFT 2

(a) A body having high velocity.
(b) Heavy body.
(c) Light body.
(d) A body having large displacement.

41. Three bodies P, Q and R have masses 'm' kg, '2m' kg and '3m' kg respectively. If all the bodies have equal kinetic energy, then greater momentum will be for body/bodies.

MHT CET 2021 · 21 SEP · SHIFT 2

(a) Q (b) R (c) P and Q (d) P

42. Two bodies of masses m and $4m$ are moving with equal kinetic energies. The ratio of their linear momenta is

AIPMT 1997

(a) 1 : 2 (b) 1 : 4 (c) 4 : 1 (d) 1 : 1

43. Two masses of 1 g and 9 g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momenta is

AIPMT 1993

(a) 1 : 9 (b) 9 : 1 (c) 1 : 3 (d) 3 : 1

44. Two bodies of masses m and $4m$ are moving with equal kinetic energies. The ratio of their linear momenta is

AIPMT 1989

(a) 1 : 2 (b) 1 : 4 (c) 4 : 1 (d) 1 : 1

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45. Three bodies A, B and C have equal kinetic energies and their masses are $400\,\text{g}, 1.2\,\text{kg}$ and $1.6\,\text{kg}$ respectively. The ratio of their linear momenta is:

JEE MAIN 2024 · 8 APR · SHIFT 1

(a) $1:\sqrt{3}:2$ (b) $\sqrt{3}:\sqrt{2}:1$
(c) $1:\sqrt{3}:\sqrt{2}$ (d) $\sqrt{2}:\sqrt{3}:1$

◆ Equal momentum: lighter body has more KE 4 Qs

46. A particle of mass m1 is moving with a velocity v1 and another particle of mass m2 is moving with a velocity v2. Both of them have the same momentum but their different kinetic energies are E1 and E2 respectively. If m1 > m2 then:

AIPMT 2004

(a) E1 < E2 (b) $\frac{\cdot}{E_2} = \frac{\cdot}{m_2}^{E_1\ m_1}$
(c) E1 > E2 (d) E1 = E2

47. Two bodies with kinetic energies in the ratio 4 : 1 are moving with equal linear momentum. The ratio of their masses is

AIPMT 1999

(a) 1 : 2 (b) 1 : 1 (c) 4 : 1 (d) 1 : 4

48. Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is:

JEE MAIN 2024 · 6 APR · SHIFT 1

(a) B (b) C (c) D (d) A

49. Two bodies are having kinetic energies in the ratio 16: 9. If they have same linear momentum, the ratio of their masses respectively is:

JEE MAIN 2023 · 13 APR · SHIFT 1

(a) 3 : 4 (b) 4 : 3 (c) 9 : 16 (d) 16 : 9

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TOPIC 04

Work-Energy Theorem

12 PYQs · Easy 12 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 6 · JEE 6

Concepts covered: Net work = change in KE (2) · Work from v(x), x(t) or a v-t graph (1) · Work by air resistance (5) · Stopping distance & braking (1) · Bullet penetration (3)

LEVEL 1 · EASY 12 questions

◆ Net work = change in KE 2 Qs

50. The kinetic energy acquired by a mass m in travelling distance d, starting from rest, under the action of a constant force is directly proportional to

AIPMT 1994

(a) m (b) m^0 (c) $\sqrt{m}$ (d) $1/\sqrt{m}$

51. A particle which is experiencing a force, given by $\vec{F} = 3\hat{i} - 12\hat{j}$, undergoes a displacement of $\vec{d} = 4\vec{i}$ particle had a kinetic energy of 3 J at the beginning of the displacement, what is its kinetic energy at the end of the displacement?

JEE MAIN 2019 · 10 JAN · SHIFT 2

(a) 9 J (b) 10 J (c) 12 J (d) 15 J

◆ Work from v(x), x(t) or a v-t graph 1 Q

52. A body of mass 3 kg is under a constant force which causes a displacement s in metres in it, given by the relation s = $\frac{1}{3}$t2, where t is in seconds. Work done by the force in 2 seconds is

AIPMT 2006

(a) $\frac{19}{5}J$ (b) $\frac{5}{19}J$ (c) $\frac{3}{8}J$ (d) $\frac{8}{3}J$

◆ Work by air resistance 5 Qs

53. Consider a drop of rain water having mass 1 g falling from a height of 1 km. It hits the ground with a speed of 50 m s^{-}1. Take 'g' constant with a value 10 m s^{-}2. The work done by the (i) gravitational force and the (ii) resistive force of air is

NEET 2017

(a) (i) 1.25 j (ii) –8.25 J
(b) (i) 100 j (ii) 8.75 J
(c) (i) 10 j (ii) –8.75 J
(d) (i) –10 j (ii) –8.25 J

54. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 m/s2)

AIPMT 2009

(a) 30 J (b) 40 J (c) 10 J (d) 20 J

55. A bullet of mass $10\,\text{g}$ leaves a rifle at an initial velocity of $1000\,\text{m/s}$ and strikes the earth at the same level with a velocity of $500\,\text{m/s}$. The work done in joule overcoming the resistance of air will be

AIPMT 1989

(a) 375 (b) 3750 (c) 5000 (d) 500

56. The rain drop of mass 1 g, starts with zero velocity from a height of 1 km. It hits the ground with a speed of $5\,\text{m/s}$. The work done by the unknown resistive force is ____ J.
(take $g = 10\,\text{m/s}^2$)

JEE MAIN 2026 · 6 APR · SHIFT 1

(a) -8.75 (b) -8.35 (c) -9.55 (d) -9.98

57. A body of mass 'm' dropped from a height 'h' reaches the ground with a speed of 0.8 $\sqrt{gh}$. The value of work done by the air-friction is:

JEE MAIN 2021 · 1 SEP · SHIFT 2

(a) -0.68 mgh (b) mgh
(c) 1.64 mgh (d) 0.64 mgh

◆ Stopping distance & braking 1 Q

58. The kinetic energies of two similar cars A and B are 100 J and 225 J respectively. On applying brakes, car A stops after 1000 m and car B stops after 1500 m. If F_A and F_B are the forces applied by the brakes on cars A and B respectively, then the ratio of $\frac{F_A}{F_B}$ is

NEET 2025

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) $\frac{2}{3}$

◆ Bullet penetration 3 Qs

59. A bullet of mass 50 g is fired with a speed $100\,\text{m/s}$ on a plywood and emerges with $40\,\text{m/s}$. The percentage loss of kinetic energy is:

JEE MAIN 2024 · 6 APR · SHIFT 1

(a) 44% (b) 16% (c) 84% (d) 32%

60. A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further it will penetrate before coming to rest assuming that it faces constant resistance to motion?

AIEEE 2005

(a) 2.0 cm (b) 3.0 cm (c) 1.0 cm (d) 1.5 cm

61. If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

AIEEE 2002

(a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm

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TOPIC 05

Potential Energy & Equilibrium

4 PYQs · Easy 4 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 2 · JEE 2

Concepts covered: Conservative & non-conservative forces (3) · U-x graphs & allowed region (1)

LEVEL 1 · EASY 4 questions

◆ Conservative & non-conservative forces 3 Qs

62. The potential energy of a system increases if work is done

AIPMT 2011 · PRELIMS

(a) upon the system by a nonconservative force
(b) by the system against a conservative force.
(c) by the system against a nonconservative force.
(d) upon the system by a conservative force.

63. Given below are two statements:

Statement I: An object moves from position r_1 to position r_2 under a conservative force field $\vec{F}$. The work done by the force is $W = -\int_{r_1}^{r_2} \vec{F} \cdot \overrightarrow{dr}$.

Statement II: Any object moving from one location to another location can follow infinite number of paths. Therefore, the amount of work done by the object changes with the path it follows for a conservative force.

In the light of the above statements, choose the correct answer from the options given below:

JEE MAIN 2026 · 22 JAN · SHIFT 2

(a) Statement I is true but Statement II is false
(b) Statement I is false but Statement II is true
(c) Both Statement I and Statement II are false
(d) Both Statement I and Statement II are true

64. Which one of the following forces cannot be expressed in terms of potential energy?

JEE MAIN 2025 · 7 APR · SHIFT 2

(a) Frictional force (b) Coulomb's force
(c) Restoring force (d) Gravitational force

◆ U-x graphs & allowed region 1 Q

65. A particle with total energy E is moving in a potential energy region U(x). Motion of the particle is restricted to the region when

NEET 2013

(a) $U(x) < E$ (b) $U(x) = 0$ (c) $U(x) \leq E$ (d) $U(x) > E$

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TOPIC 06

Spring & Elastic Energy

12 PYQs · Easy 12 · Medium 0 · Difficult 0 | MHT CET 2 · NEET 6 · JEE 4

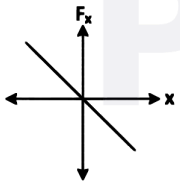
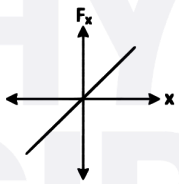
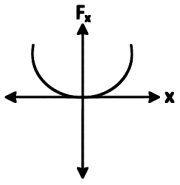
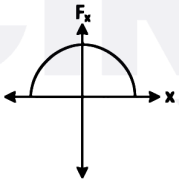
Concepts covered: Hooke's law & U = ½kx² (6) · Stretching from x1 to x2 (2) · Same force or same stretch (1) · Block hits a spring (3)

LEVEL 1 · EASY 12 questions

◆ Hooke's law & U = ½kx² 6 Qs

66. The potential energy of a long spring when it is stretched by 3 cm is 'U'. If the spring is stretched by 9 cm, potential energy stored in it will be
MHT CET 2024 · 9 MAY · SHIFT 1
(a) 3U (b) 4U (c) 5U (d) 9U

67. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, potential energy stored in it will be:
NEET 2023
(a) 4U (b) 8U (c) 16U (d) 2U

68. The restoring force of a spring with a block attached to the free end of the spring is represented by
NEET 2022 · PHASE 2
(a) 
(b) 
(c) 
(d) 

69. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm the potential energy stored in it is
AIPMT 2006
(a) U/4 (b) 4U (c) 8U (d) 16U

70. When a long spring is stretched by 2 cm, its potential energy is U. If the spring is stretched by 10 cm, the potential energy stored in it will be
AIPMT 2003
(a) U/5 (b) 5U (c) 10U (d) 25U

71. A block is fastened to a horizontal spring. The block is pulled to a distance $x = 10$ cm from its equilibrium position (at $x = 0$) on a frictionless surface from rest. The energy of the block at $x = 5$ cm is 0.25 J. The spring constant of the spring is _____ Nm^{-1}
JEE MAIN 2023 · 1 FEB · SHIFT 2 *(Numerical)*

◆ Stretching from x1 to x2 2 Qs

72. A spring of spring constant $5 \times 10^3\ N/m$ is stretched initially by 5 cm from the unstretched position. Then the work required to stretch it further by another 5 cm is
AIEEE 2003
(a) 12.50 N-m (b) 18.75 N-m
(c) 25.00 N-m (d) 625 N-m

73. A spring of force constant 800 N/m has an extension of 5 cm. The work done in extending it from 5 cm to 15 cm is
AIEEE 2002
(a) 16J (b) 8J (c) 32J (d) 24J

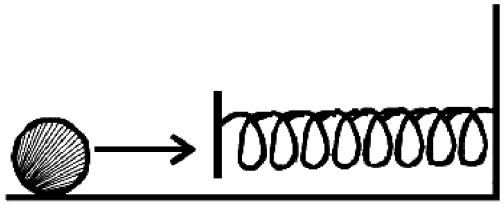
◆ Same force or same stretch 1 Q

74. Two springs A and B having spring constant KA and KB (KA = 2KB) are stretched by applying force of equal magnitude. If energy stored in spring A is EA then energy stored in B will be
AIPMT 2001
(a) 2EA (b) EA/4 (c) EA/2 (d) 4EA

◆ Block hits a spring 3 Qs

75. A block of mass 'm' moving on a frictionless horizontal surface collides with a spring of spring constant 'K' and compresses it through a distance 'x'. The maximum momentum of the block after collision is
MHT CET 2026 · 16 APR · SHIFT 1
(a) zero (b) $\sqrt{\text{km}}\ x$ (c) mx^2/K (d) $\text{Kx}^2/2\text{m}$

76. A mass of 0.5 kg moving with a speed of 1.5 m/s on horizontal smooth surface, collides with a nearly weightless spring of force constant k = 50 N/m. The maximum compression of the spring would be
AIPMT 2004



(a) 0.15 m (b) 0.12 m (c) 1.5 m (d) 0.5 m

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77. A ball of mass 4 kg, moving with a velocity of 10 ms^{-1}, collides with a spring of length 8 m and force constant 100 Nm^{-1}. The length of the compressed spring is x m. The value of x, to the nearest integer, is _____.

JEE MAIN 2021 · 18 MAR · SHIFT 2 *(Numerical)*

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TOPIC 07

Conservation of Energy

16 PYQs · Easy 16 · Medium 0 · Difficult 0 | MHT CET 1 · NEET 4 · JEE 11

Concepts covered: Free fall: K and U at a height (1) · Projectile: KE & PE at the top (8) · Tracks, hills & pulleys (4) · Pendulum & swing (1) · Chain, cable & carpet (2)

LEVEL 1 · EASY 16 questions

◆ Free fall: K and U at a height 1 Q

78. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of
AIPMT 2004
(a) $\sqrt{2}$: 1 (b) 1: 4 (c) 1: 2 (d) 1: $\sqrt{2}$

◆ Projectile: KE & PE at the top 8 Qs

79. A stone is projected with kinetic energy E, making an angle θ with the horizontal. When it reaches a highest point, its kinetic energy is
MHT CET 2025 · 19 APR · SHIFT 2
(a) $E^2 \sin^2\theta$ (b) $E \sin\theta$ (c) $E\cos^2\theta$ (d) $E\cos\theta$

80. A particle is projected making an angle of 45° with horizontal having kinetic energy K. The kinetic energy at highest point will be
AIPMT 2001
(a) $\frac{K}{\sqrt{2}}$ (b) $\frac{K}{2}$ (c) 2K (d) K

81. A particle is projected making an angle of 45° with horizontal having kinetic energy K. The kinetic energy at highest point will be
AIPMT 1997
(a) $\frac{K}{\sqrt{2}}$ (b) $\frac{K}{2}$ (c) $2K$ (d) K

82. A ball having kinetic energy KE, is projected at an angle of 60° from the horizontal. What will be the kinetic energy of ball at the highest point of its flight?
JEE MAIN 2025 · 23 JAN · SHIFT 2
(a) $\frac{(KE)}{2}$ (b) $\frac{(KE)}{8}$ (c) $\frac{(KE)}{4}$ (d) $\frac{(KE)}{16}$

83. A stone is projected at angle 30° to the horizontal. The ratio of kinetic energy of the stone at point of projection to its kinetic energy at the highest point of flight will be -
JEE MAIN 2023 · 29 JAN · SHIFT 1
(a) 1: 4 (b) 1: 2 (c) 4: 3 (d) 4: 1

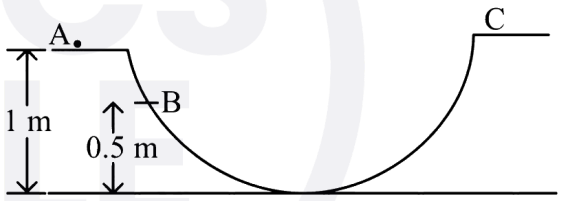
84. A ball is projected with kinetic energy E, at an angle of 60° to the horizontal. The kinetic energy of this ball at the highest point of its flight will become:
JEE MAIN 2022 · 29 JUL · SHIFT 1
(a) Zero (b) $\frac{E}{2}$ (c) $\frac{E}{4}$ (d) E

85. A particle is projected at 60° to the horizontal with a kinetic energy K. The kinetic energy at the highest point is
AIEEE 2007
(a) K/2 (b) K (c) Zero (d) K/4

86. A ball whose kinetic energy is E, is projected at an angle of 45° to the horizontal. The kinetic energy of the ball at the highest point of its flight will be
AIEEE 2002
(a) E (b) $\frac{E}{\sqrt{2}}$ (c) $\frac{E}{2}$ (d) zero

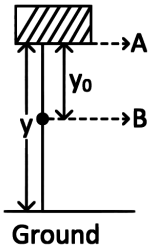
◆ Tracks, hills & pulleys 4 Qs

87. A particle is placed at the point A of a frictionless track ABC as shown in figure. It is gently pushed towards right. The speed of the particle when it reaches the point B is:
(Take $g = 10\,\text{m/s}^2$).
JEE MAIN 2024 · 30 JAN · SHIFT 1



(a) $2\sqrt{10}\,\text{m/s}$ (b) $10\,\text{m/s}$
(c) $\sqrt{10}\,\text{m/s}$ (d) $20\,\text{m/s}$

88. In the given figure, the block of mass m is dropped from the point 'A'. The expression for kinetic energy of block when it reaches point 'B' is
JEE MAIN 2022 · 29 JUN · SHIFT 2



(a) $\frac{1}{2}mg{y_0}^2$ (b) $\frac{1}{2}mgy^2$
(c) $mg(y - y_0)$ (d) mgy_0

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89. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It rolls down a smooth surface to the ground, then climbs up another hill of height 30 m and finally rolls down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is

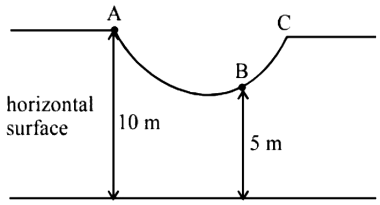
AIEEE 2005

(a) 20 m/s (b) 40 m/s
(c) $10\sqrt{30}$ m/s (d) 10 m/s

90. As shown in the figure, a particle of mass 10 kg is placed at a point A. When the particle is slightly displaced to its right, it starts moving and reaches the point B. The speed of the particle at B is x m/s. (Take g = 10 m/s2)

The value of 'x' to the nearest integer is _____.

JEE MAIN 2021 · 18 MAR · SHIFT 1 *(Numerical)*



◆ Pendulum & swing 1 Q

91. A child is sitting on a swing. Its minimum and maximum heights from the ground 0.75 m and 2 m respectively, its maximum speed will be

AIPMT 2001

(a) 10 m/s (b) 5 m/s (c) 8 m/s (d) 15 m/s

◆ Chain, cable & carpet 2 Qs

92. A uniform cable of mass 'M' and length 'L' is placed on a horizontal surface such that its (1/n)th part is hanging below the edge of the surface. To lift the hanging part of the cable upto the surface, the work done should be:

JEE MAIN 2019 · 9 APR · SHIFT 1

(a) $\frac{2MgL}{n^2}$ (b) nMgL
(c) $\frac{MgL}{2n^2}$ (d) $\frac{MgL}{n^2}$

93. A uniform chain of length 2 m is kept on a table such that a length of 60 cm hangs freely from the edge of the table. The total mass of the chain is 4 kg. What is the work done in pulling the entire chain on the table?

AIEEE 2004

(a) 12 J (b) 3.6 J (c) 7.2 J (d) 1200 J

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TOPIC 08

Power

21 PYQs · Easy 21 · Medium 0 · Difficult 0 | MHT CET 3 · NEET 10 · JEE 8

Concepts covered: Average power: P = W/t (8) · Instantaneous power: P = F·v (5) · Conveyors, jets & wind (1) · Constant power: how v and s grow with t (7)

LEVEL 1 · EASY 21 questions

◆ Average power: P = W/t 8 Qs

94. A constant force $\vec{F} = 3\hat{i} - 2\hat{j} - \hat{k}$ newton has a displacement $\vec{r} = 2\hat{i} - 3\hat{j} - 3\hat{k}$ metre in 2 second. The work done and the power are respectively

MHT CET 2025 · 25 APR · SHIFT 2

(a) 20 joule, 10 watt (b) 15 joule, 7.5 watt
(c) 13 joule, 6.5 watt (d) 10 joule, 5 watt

95. A body of mass 1 kg starts from rest and moves with uniform acceleration. In 2 seconds, its velocity is 10 m/s. The power exerted on the body in one second is

MHT CET 2024 · 15 MAY · SHIFT 1

(a) 20 W (b) 25 W (c) 50 W (d) 100 W

96. The power of a crane, which lifts a mass of 1000 kg to a height of 20 m in 10 s is: $\left(g = 9.8\ \mathrm{m/s^2}\right)$

NEET 2026

(a) 19.6 W (b) 39.2 W (c) 19.6 kW (d) 39.2 kW

97. The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is

NEET 2022 · PHASE 1

(a) 36×107 J (b) 36×104 J
(c) 36×105 J (d) 1×105 J

98. Water falls from a height of 60m at the rate of 15 kg/s to operate a turbine. The losses due to frictional force are 10% of the input energy. How much power is generated by the turbine? (g = 10 m/s2)

NEET 2021

(a) 7.0 kW (b) 10.2 kW (c) 8.1 kW (d) 12.3 kW

99. One coolie takes 1 minute to raise a suitcase through a height of 2 m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio

NEET 2013

(a) 1: 3 (b) 2: 1 (c) 3: 1 (d) 1: 2

100. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine? (g = 10 m/s2)

AIPMT 2008

(a) 12.3 kW (b) 7.0 kW (c) 8.1 kW (d) 10.2 kW

101. How much water a pump of 2 kW can raise in one minute to a height of 10 m? (take $g = 10\ \mathrm{m/s^2}$)

AIPMT 1990

(a) 1000 litres (b) 1200 litres
(c) 100 litres (d) 2000 litres

◆ Instantaneous power: P = F·v 5 Qs

102. At any instant of time t, the displacement of any particle is given by $2t - 1$ (SI unit) under the influence of force of 5 N. The value of instantaneous power is (in SI unit):

NEET 2024

(a) 10 (b) 5 (c) 7 (d) 6

103. A particle moves with a velocity $(5\hat{i} - 3\hat{j} + 6\hat{k})\ \mathrm{ms^{-1}}$ horizontally under the action of constant force $(10\hat{i} + 10\hat{j} + \hat{} 20\hat{k})$N. The instantaneous power supplied to the particle is:

NEET 2023

(a) 200 W (b) Zero (c) 100 W (d) 140 W

104. If $\vec{F} = \left(60\hat{i} + 15\hat{j} - 3\hat{k}\right)$ N and $\vec{v} = \left(2\hat{i} - 4\hat{j} + 5\hat{k}\right)$ m/s, then instantaneous power is

AIPMT 2000

(a) 195 watt (b) 45 watt
(c) 75 watt (d) 100 watt.

105. A body of mass m is accelerated uniformly from rest to a speed v in a time T. The instantaneous power delivered to the body as a function of time is given by

AIEEE 2005

(a) $\frac{mv^2}{T^2} \cdot t^2$ (b) $\frac{mv^2}{T^2} \cdot t$
(c) $\frac{1}{2}\frac{mv^2}{T^2} \cdot t^2$ (d) $\frac{1}{2}\frac{mv^2}{T^2} \cdot t$

106. A body of mass $'m'$, accelerates uniformly from rest to $'v_1'$ in time T. The instantaneous power delivered to the body as a function of time is given by

AIEEE 2004

(a) $\frac{mv_1t^2}{T}$ (b) $\frac{mv_1^2t}{T^2}$ (c) $\frac{mv_1t}{T}$ (d) $\frac{mv_1^2t}{T}$

◆ Conveyors, jets & wind 1 Q

107. A wind-powered generator converts wind energy into electrical energy. Assume that the generator converts a fixed fraction of the wind energy intercepted by its blades into electrical energy. For wind speed v, the electrical power output will be most likely proportional to

JEE MAIN 2013 · 25 APR · SHIFT 1

(a) v^4 (b) v^2 (c) v (d) v^3

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◆ Constant power: how v and s grow with t 7 Qs

108. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

MHT CET 2026 · 19 MAY · SHIFT 2

(a) $t^{1/2}$ (b) $t^{3/4}$ (c) $t^{3/2}$ (d) t^{2}

109. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude P0. The instantaneous velocity of this car is proportional to

AIPMT 2012 · MAINS

(a) t2P0 (b) t1/2 (c) t−1/2 (d) $\frac{t}{\sqrt{m}}$

110. A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to:

JEE MAIN 2024 · 5 APR · SHIFT 2

(a) t2/3 (b) t3/2 (c) t (d) t2

111. A body at rest is moved along a horizontal straight line by a machine delivering a constant power. The distance moved by the body in time 't' is proportional to:

JEE MAIN 2021 · 20 JUL · SHIFT 2

(a) $t^{\frac{3}{2}}$ (b) $t^{\frac{1}{2}}$ (c) $t^{\frac{1}{4}}$ (d) $t^{\frac{3}{4}}$

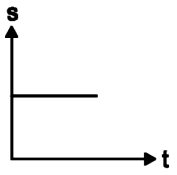
112. A constant power delivering machine has towed a box, which was initially at rest, along a horizontal straight line. The distance moved by the box in time 't' is proportional to :-

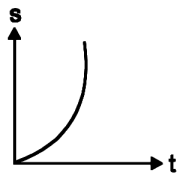
JEE MAIN 2021 · 18 MAR · SHIFT 1

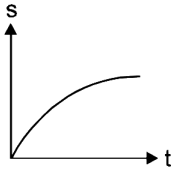
(a) t2/3 (b) t3/2 (c) t (d) t1/2

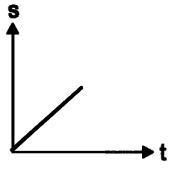
113. A particle is moving unidirectionally on a horizontal plane under the action of a constant power supplying energy source. The displacement (s) - time (t) graph that describes the motion of the particle is (graphs are drawn schematically and are not to scale):

JEE MAIN 2020 · 3 SEP · SHIFT 2

(a) 

(b) 

(c) 

(d) 

114. A body is moved along a straight line by a machine delivering a constant power. The distance moved by the body in time $'t'$ is proportional to

AIEEE 2003

(a) $t^{3/4}$ (b) $t^{3/2}$ (c) $t^{1/4}$ (d) $t^{1/2}$

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TOPIC 09

Collisions

3 PYQs · Easy 3 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 1 · JEE 2

Concepts covered: Rebound from the ground (2) · Perfectly inelastic: bullet in a block (1)

LEVEL 1 · EASY 3 questions

◆ Rebound from the ground 2 Qs

115. An object falls from a height of $10\,\text{m}$ above the ground. After striking the ground it loses 50% of its kinetic energy. The height upto which the object can rebound from the ground is:

NEET 2024

(a) $7.5\,\text{m}$ (b) $10\,\text{m}$ (c) $2.5\,\text{m}$ (d) $5\,\text{m}$

116. If a rubber ball falls from a height h and rebounds upto the height of $h/2$. The percentage loss of total energy of the initial system as well as velocity of ball before it strikes the ground, respectively, are:

JEE MAIN 2024 · 4 APR · SHIFT 1

(a) $50\%, \sqrt{2gh}$ (b) $50\%, \sqrt{gh}$

(c) $50\%, \sqrt{\frac{gh}{2}}$ (d) $40\%, \sqrt{2gh}$

◆ Perfectly inelastic: bullet in a block 1 Q

117. A bag of sand of mass 9.8 kg is suspended by a rope. A bullet of 200 g travelling with speed 10 ms^{-1} gets embedded in it, then loss of kinetic energy will be:

JEE MAIN 2022 · 25 JUL · SHIFT 2

(a) 4.9 J (b) 9.8 J (c) 14.7 J (d) 19.6 J

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ANSWER KEY

Shaded by level: **Easy**

01 Work by a Constant Force

1. (a)	2. (d)	3. (b)	4. (c)	5. (c)	6. (b)	7. (b)	8. 35	9. 58	10. 40
11. (a)	12. 2	13. (a)	14. (d)	15. (a)	16. (c)	17. (c)	18. (b)	19. (d)	

02 Work by a Variable Force

20. (b)	21. (c)	22. (a)	23. (a)	24. (a)	25. 32	26. 132	27. 450	28. (d)	29. (b)
30. (a)									

03 Kinetic Energy & Momentum

31. (d)	32. (a)	33. (b)	34. (c)	35. (d)	36. 3	37. (b)	38. (b)	39. (d)	40. (b)
41. (b)	42. (a)	43. (c)	44. (a)	45. (a)	46. (a)	47. (d)	48. (d)	49. (c)	

04 Work-Energy Theorem

50. (b)	51. (d)	52. (d)	53. (c)	54. (d)	55. (b)	56. (d)	57. (a)	58. (d)	59. (c)
60. (c)	61. (a)								

05 Potential Energy & Equilibrium

62. (b)	63. (c)	64. (a)	65. (c)						

06 Spring & Elastic Energy

66. (d)	67. (c)	68. (a)	69. (d)	70. (d)	71. 67	72. (b)	73. (b)	74. (a)	75. (b)
76. (a)	77. 6								

07 Conservation of Energy

78. (c)	79. (c)	80. (b)	81. (b)	82. (c)	83. (c)	84. (c)	85. (d)	86. (c)	87. (c)
88. (d)	89. (b)	90. 10	91. (b)	92. (c)	93. (b)				

08 Power

94. (b)	95. (b)	96. (c)	97. (a)	98. (c)	99. (d)	100. (c)	101. (b)	102. (a)	103. (d)
104. (b)	105. (b)	106. (b)	107. (d)	108. (c)	109. (b)	110. (b)	111. (a)	112. (b)	113. (b)
114. (b)									

09 Collisions

115. (d)	116. (a)	117. (b)							

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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