Physicsaholics

DPP – 3 (Work, Energy & Power)

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Q 1. If a body of mass 200 g falls from a height 200 m and its total P.E. is converted into K.E. at the point of contact of the body with earth surface, then what is the decrease in P.E. of the body at the contact ($g = 10\ m/s^2$)

(a) 200 J (b) 400 J
(c) 600 J (d) 900 J

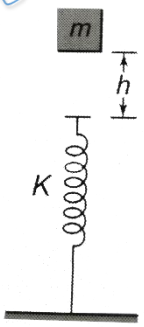
Q 2. On a rough horizontal surface, a body of mass 2 kg is given a velocity of 10 m/s. If the coefficient of friction is 0.2 and g = 10 m/s^2, the body will stop after covering a distance of

(a) 10 m (b) 25 m
(c) 50 m (d) 250 m

Q 3. The decrease in the potential energy of a ball of mass 20 kg which falls from a height of 50 cm is

(a) 968 J (b) 98 J
(c) 1980 J (d) None of these

Q 4. A block of mass m initially at rest is dropped from a height h on to a spring of force constant k. The maximum compression in the spring is x then



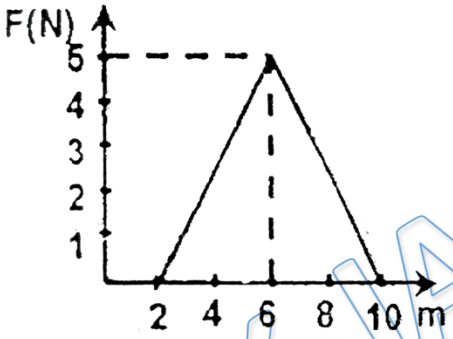
(a) $mgh = \frac{1}{2}kx^2$
(b) $mg(h + x) = \frac{1}{2}kx^2$
(c) $mgh = \frac{1}{2}k(x + h)^2$
(d) $mg(h + x) = \frac{1}{2}k(x + h)^2$

Q 5. The kinetic energy of a body of mass 2 kg and momentum of 2 Ns is

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

Q 6. Calculate the increase in potential energy as a block of 2kg is lifted through 2m ($g = 10\ m/s^2$)
(a) 10 J (b) 20 J
(c) 40 J (d) 80 J

Q 7. A force shown in the F-x graph is applied to a 2kg block horizontal as shown in figure. The change in kinetic energy is



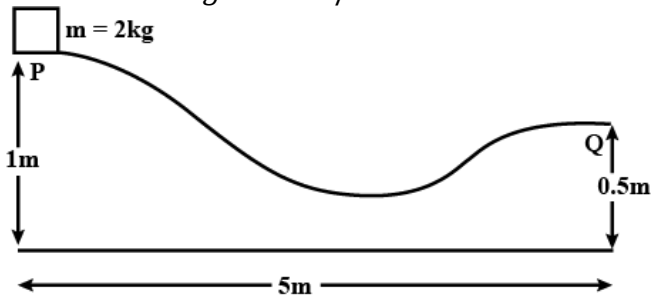
(a) 15 J (b) 20 J
(c) 25 J (d) 30 J

Q 8. Two bodies of masses 2m and m have their K.E. in the ratio 8 : 1, then their ratio of momenta is
(a) 1 : 1 (b) 2 : 1
(c) 4 : 1 (d) 8 : 1

Q 9. A 4 kg mass and a 1 kg mass are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is
(a) 1 : 2 (b) 1 : 1
(c) 2 : 1 (d) 4 : 1

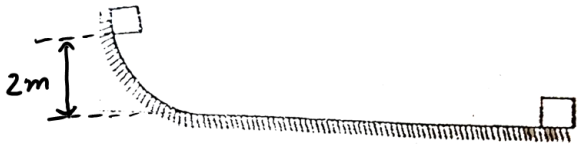
Q 10. If the momentum of a body decreases by `30%`, then kinetic energy decreases by
(a) 60% (b) 51%
(c) 69% (d) 90%

Q 11. Find the horizontal velocity of the particle when it reach the point Q. Assume the block to be frictionless. Take $g = 10\ m/s^2$



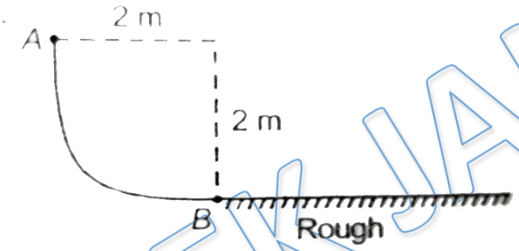
(a) 4 m/s (b) 5 m/s
(c) 3.13 m/s (d) 3.6 m/s

Q 12. A block is released from rest from top of a rough curved track as shown in figure. It comes to rest at some point on the horizontal part. If its mass is 200 gm, calculate work by friction in joules



(a) +2 J (b) -2J
(c) +4J (d) -4J

Q 13. A block is released at A and slides on smooth surface in shape of quarter circle. The horizontal part is rough if the block comes to rest 1.0 m away from B, then what is the coefficient of kinetic friction?



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

Q 14. Work done by the conservative force on a system is equal to :
(a) the change in kinetic energy of system
(b) negative of the change in potential energy of system
(c) the change in total mechanical energy of system
(d) None of the above

Q 15. The potential energy of a particle under a conservative force is given by $U(x) = (x^2 - 3x)$ J. The position of F = 0 is at
(a) 1.5 m (b) 2 m
(c) 2.5 m (d) 3m

Answer Key

Q.1 b	**Q.2 b**	**Q.3 b**	**Q.4 b**	**Q.5 a**
Q.6 c	**Q.7 b**	**Q.8 c**	**Q.9 c**	**Q.10 b**
Q.11 c	**Q.12 d**	**Q.13 b**	**Q.14 b**	**Q.15 a**

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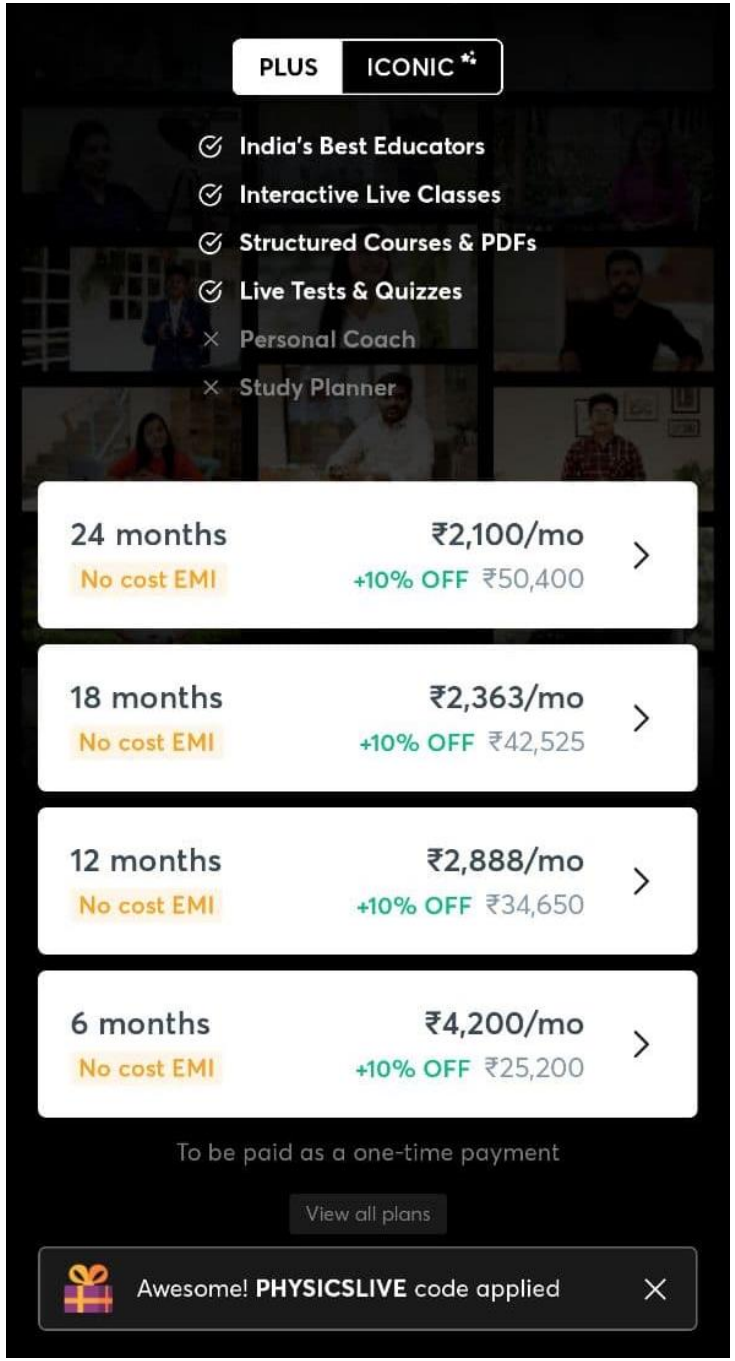


Physics DPP

DPP-3 WEP: Conservative & Non Conservative Forces, Potential Energy, Law of Conservation of Energy

By Physicsaholics Team

Solution: 1

decrease in P.E.

$= mgh = \left(\frac{200}{1000}\right) \times 10 \times 200$

$= 400\,J$

Ans. b

Solution: 2

$$W_{all} = \Delta K$$

$$\Rightarrow \quad W_N + W_{mg} + W_{fr} = K_f - K_i$$

$$\Rightarrow \quad 0 + 0 - \mu mgx = 0 - \frac{1}{2}mv^2$$

$$\frac{1}{2}mv^2 = \mu mgx$$

$$x = \frac{v^2}{2\mu g} = \frac{(10)^2}{2(0.2)\times 10} = \frac{100}{4}$$

$$\boxed{x = 25\ m}$$

$4mg$

Ans. b

Solution: 3

$$\text{decrease in P.E.} = mgh$$

$$= 20 \times 9.8 \times \frac{50}{100}$$

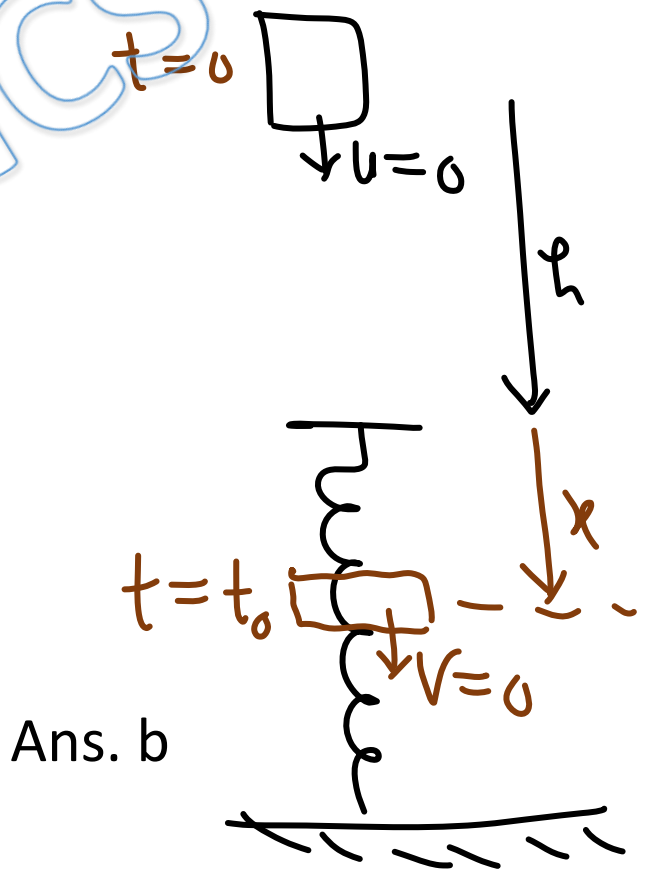
$$= 98\ \text{J}$$

Ans. b

Solution: 4 by Conservation of machenical energy →

loss in gravitational P.E. = gain in spring P.E.

$$\Rightarrow \quad mg(h+x) = \frac{1}{2} k x^2$$



Ans. b

Solution: 5

$$KE = \frac{p^2}{2m}$$

$$KE = \frac{(2)^2}{2(2)}$$

$$\boxed{KE = 1\ J}$$ Ans.

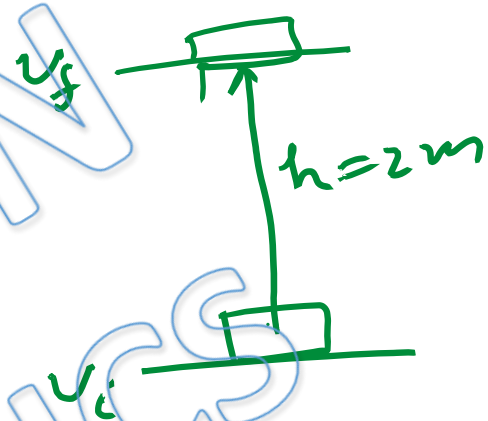
Ans. a

Solution: 6

$U_f - U_i = mgh$

$\Delta U = 2 \times 10 \times 2$

$\boxed{\Delta U = 40\ J}$ Ans



Ans. c

Solution: 7

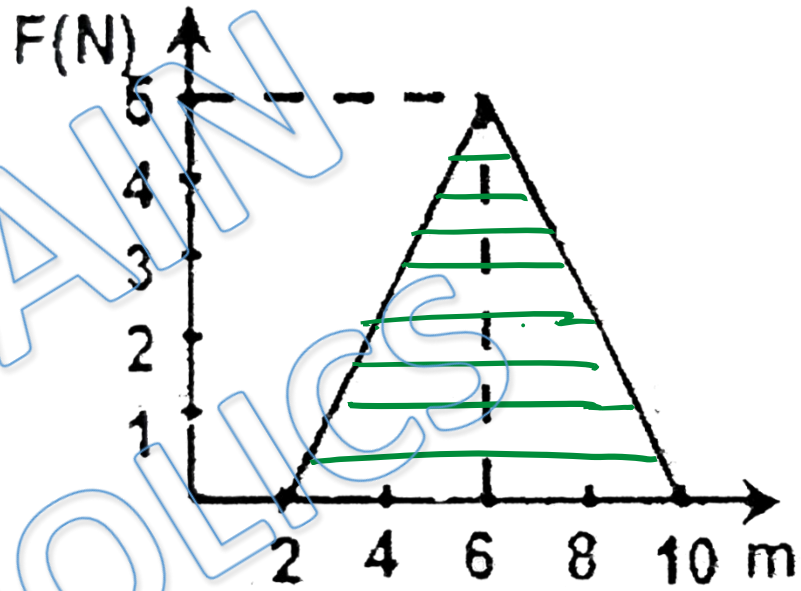
$W = \Delta KE$

So, $\Delta KE = W =$ Area under F-x curve

$\Delta KE = \frac{1}{2} \times (10-2) \times (5)$

$\Delta KE = \frac{1}{2} \times 8 \times 5$

$\Delta KE = 20\,J$ Ans.



Ans. b

Solution: 8

$$\frac{KE_1}{KE_2} = \frac{8}{1}$$

$\because KE = \frac{p^2}{2m}$ $\quad p = mv$ = linear momentum

$$\frac{KE_1}{KE_2} = \frac{p_1^2/2m_1}{p_2^2/2m_2} \Rightarrow \frac{8}{1} = \frac{p_1^2}{p_2^2} \times \frac{m_2}{m_1} = \frac{p_1^2}{p_2^2} \times \frac{m}{2m}$$

$$\frac{p_1^2}{p_2^2} = \frac{16}{1} \Rightarrow \boxed{\frac{p_1}{p_2} = \frac{4}{1}} \quad \text{Ans.}$$

Ans. c

Solution: 9

$$KE = \frac{p^2}{2m}$$

$$p^2 = (KE)(2m)$$

$$p^2 \propto m \quad (\text{when } ; KE = \text{constant})$$

$$\therefore \quad \frac{p_1^2}{p_2^2} = \frac{4}{1} \Rightarrow \boxed{\frac{p_1}{p_2} = \frac{2}{1}} \quad \text{Ans.}$$

Ans. c

Solution: 10

$$KE = \frac{p^2}{2m}$$

when, $p' = p - \frac{30}{100}p = 0.7p$

$$KE_2 = \frac{(p')^2}{2m} = \frac{(0.7p)^2}{2m} = \frac{0.49p^2}{2m}$$

$$\Delta KE\% = \frac{KE - KE_2}{KE} \times 100 = \frac{\frac{p^2}{2m} - \frac{0.49p^2}{2m}}{\frac{p^2}{2m}} \times 100$$

$$\Delta KE\% = \frac{1 - 0.49}{1} \times 100 = 51\%$$

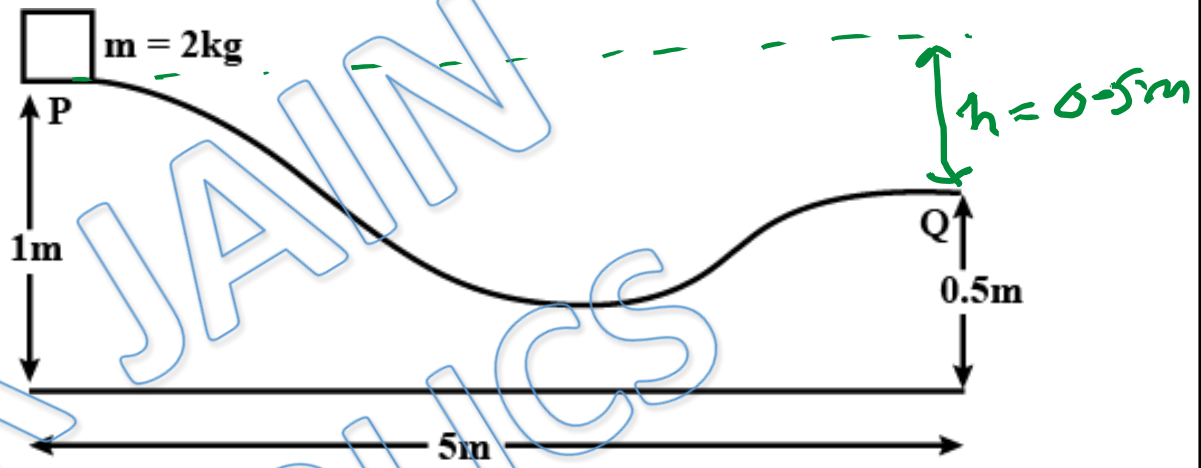
$$\boxed{\Delta KE\% = 51\%} \quad \text{Ans.}$$

Ans. b

Solution: 11

by Conservation of machanical energy

loss in P.E. = gain in K.E.



$2 \times 10 \times (0.5) = \frac{1}{2} \times 2 \times v^2$

$v^2 = 10$

$v = 3.13 \text{ m/s}$ Ans.

Ans. c

Solution: 12

$W_{all} = \Delta K$

$(W_f$ = work done by friction$)$

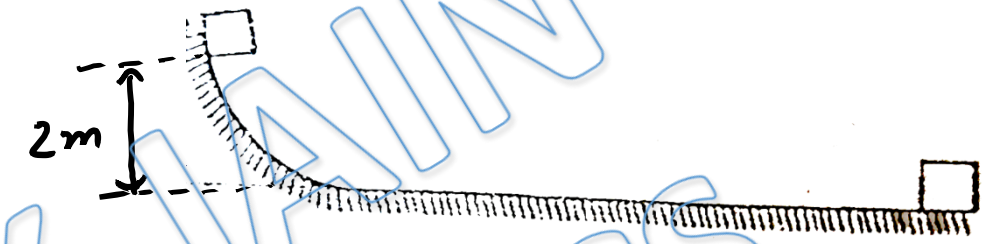
$\Rightarrow \quad W_N + W_{mg} + W_{fr} = K_f - K_i$

$\Rightarrow \quad 0 + mgh + W_{fr} = 0 - 0$

$W_{fr} = -mgh$

$W_{fr} = -(200 \times 10^{-3}) \times 10 \times 2$

$\boxed{W_{fr} = -4\,J}$ Ans.



Ans. d

Solution: 13

Conservation of Energy

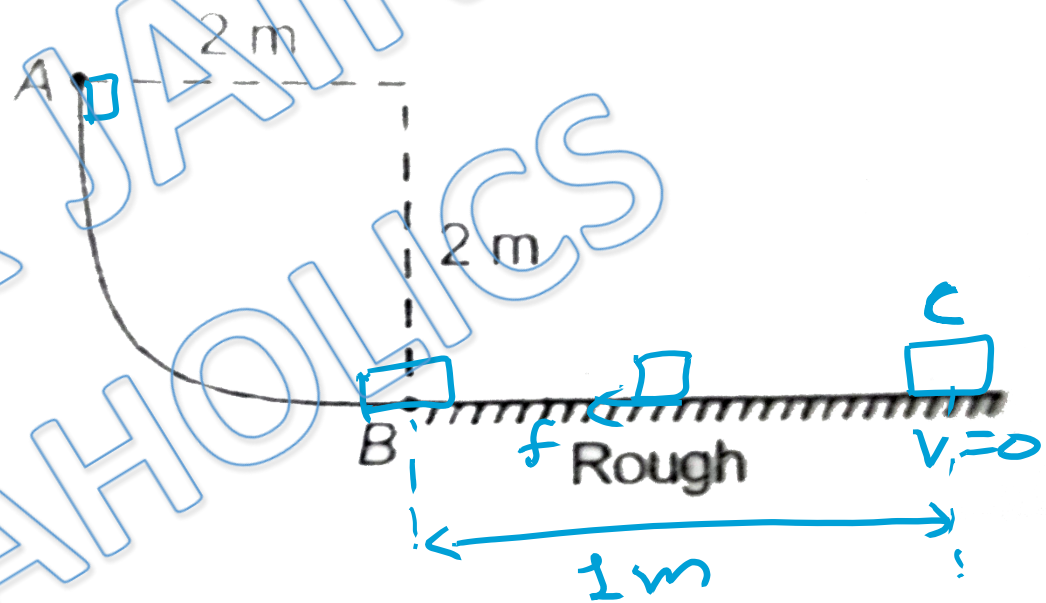
$A \to C$

$(KE + PE)_A + W_f = (KE + PE)_C$

$0 + mg(2) - (\mu mg)(1) = 0 + 0$

$\mu mg = mg(2)$

$\boxed{\mu = 2}$ Ans



Ans. b

Solution: 14 by definition of Potential energy →

work done by conservative force is equal to the negative of the change in potential energy

$dw = -\Delta U$ Ans.

Ans. b

Solution: 15

$U = (x^2 - 3x)\ J$

$F = -\frac{dU}{dx} = -(2x - 3)$

$F = -2x + 3$

For $F = 0$

$-2x = -3$

$\boxed{x = 3/2}$ Ans.

Ans. a

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