Physicsaholics

DPP – 1 (Work, Energy & Power)

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Q 1. A man pushes a wall and fails to displace it. He does
(a) Negative work (b) Positive but not maximum work
(c) No work at all (d) Maximum work

Q 2. A body of mass 5 kg at rest is under the action of a force which gives it a velocity given by v=3t m/s, here t is time in seconds. The work done by the force in two seconds will be:
(a) 90 J (b) 45 J
(c) 180 J (d) 30 J

Q 3. A force $\vec{F} = (5\hat{\imath} + 3\hat{\jmath} + 2\hat{\jmath})$N is applied over a particle which displaces it from its origin to the point $\vec{P} = (2\hat{\imath} - \hat{\jmath})$m. The work done the particle in joules is:
(a) 10 J (b) 7 J
(c) -7 J (d) 13 J

Q 4. A force of $(4x^2 + 3x)$N acts on a particle which displaces it from $x = 2m$ to $x = 3m$. The work done by the force is
(a) 32.8 J (b) 3.28 J
(c) 0.328 J (d) zero

Q 5. A constant force F = $(\hat{\imath} + 3\hat{\jmath} + 4\hat{k})$ N acts on a particle and displace it from (-1m ,2m ,1m) to (2m ,-3m ,1m):
(a) 10 J (b) 13 J
(c) -7 J (d) -12 J

Q 6. If force $\vec{F} = (3x\,\hat{\imath} + y^2\,\hat{\jmath})$ N is acting on a body and body moves from (1m, 2m, 1m) to (3m, 3, 8m), then find the work done due to the force
(a) $\frac{55}{3}$ J (b) $\frac{22}{3}$ J
(c) $\frac{11}{3}$ J (d) $\frac{31}{3}$ J

Q 7. A constant force $\vec{F} = (\hat{\imath} + 3\hat{\jmath} + 4\hat{k})$N acts on a particle and displace it from (-1m, 2m, 1m) to (2m, -3m, 1m)
(a) 8 J (b) -12 J
(c) -4 J (d) 11 J

Q 8. Calculate work done in moving the object from x=2 to x=3m from the graph shown here

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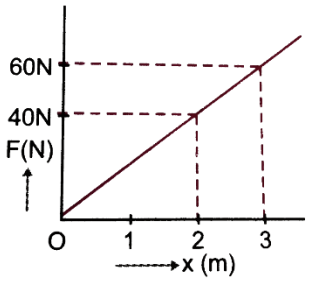
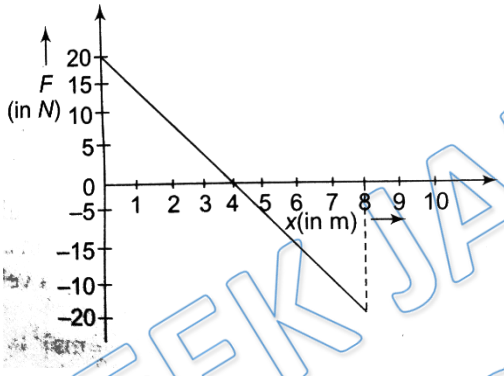


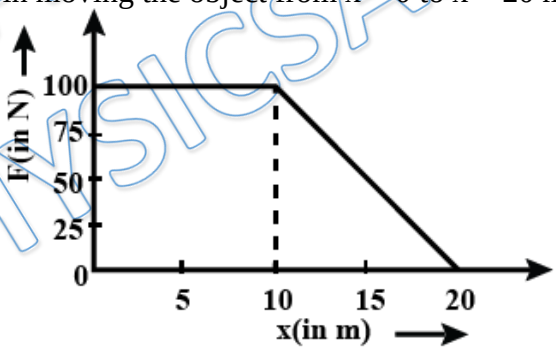
(a) 20 J (b) 90 J
(c) 40 J (d) 50 J

Q 9. A Force F acting on an object varies with distance x as shown in the figure. The work done by the force in moving the object from x=0 to x=8m is



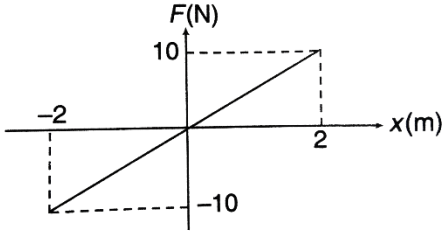
(a) Zero J (b) 80 J
(c) -40 J (d) 40 J

Q 10. A force F acting on an object varies with distance x as shown in the figure. The work done by the force in moving the object from x = 0 to x = 20 m is



(a) 500 J (b) 1000 J
(c) 1500 J (d) 2000 J

Q 11. A force (F) acting on a particle varies with the position x as shown in figure. Find the work done by force in displacing the particle from x = -2m to x = 0?



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(a) 10 J (b) -10 J
(c) 4 J (d) -4 J

Q 12. A body of mass 3 kg is under a force, which causes a displacement in it is given by $S = \frac{t^3}{3}$ (in m). Find the work done by the force in first 2 seconds
(a) 2 J (b) 3.8 J
(c) 5.2 J (d) 24 J

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Answer Key

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

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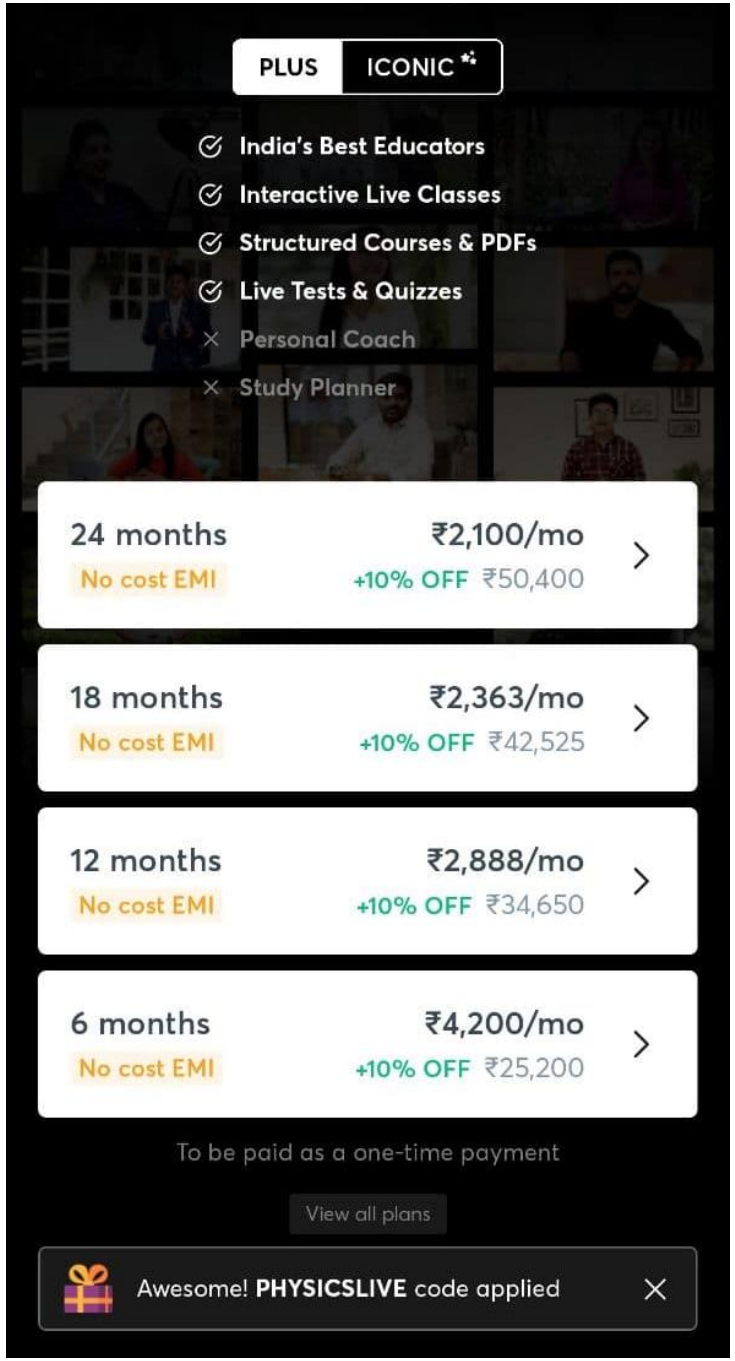

Physics DPP

DPP-1 WEP: Work Done by Constant & Variable Forces and Work done by F-X Curve

By Physicsaholics Team

Solution: 1

Displacement = 0

$W = \vec{F} \cdot d\vec{s}$

$\boxed{W = 0}$ Ans.

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Ans. c

Solution: 2

$V = 3t \quad m/s$

$a = \frac{dv}{dt} = 3 \ m/s^2$

$F = ma = 5 \times 3 = 15 \ N$

$\boxed{F = 15 \ N}$

displacement in two sec.

$s = ut + \frac{1}{2}at^2$

$at \ t = 0, \ v = u = 0$

$s = 0 + \frac{1}{2} \times 3 (2)^2$

$\boxed{s = 6 \ m}$

$W = F \cdot S$

$W = 15 \times 6$

$\boxed{W = 90 \ J}$ Ans

Ans. a

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Solution: 3

displacement $\overrightarrow{OP} = 2\hat{i} - \hat{j}$

$\vec{F} = 5\hat{i} + 3\hat{j} + 2\hat{k}$

$\omega = \vec{F} \cdot \vec{\Delta Y}$

$\omega = (5\hat{i} + 3\hat{j} + 2\hat{k}) \cdot (2\hat{i} - \hat{j})$

$\omega = 10 - 3$

$\omega = 7\ J$ Ans.

Ans. b

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Solution: 4

$$F = (4x^2 + 3x)\ N$$

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

$$W = \int_{2}^{3} (4x^2 + 3x)\,dx$$

$$= \left[\frac{4x^3}{3} + \frac{3x^2}{2}\right]_2^3$$

$$= \left[\left(4 \times \frac{3^3}{3} + 3 \times \frac{3^2}{2}\right) - \left(4 \times \frac{2^3}{3} + 3 \times \frac{2^2}{2}\right)\right]$$

$$= \left[36 + \frac{27}{2} - \frac{32}{3} - 6\right] = 30 + 2.8 = 32.8\ J$$

$$\boxed{W = 32.8\ J}$$ Ans.

Ans. a

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Solution: 5 $\vec{F} = (\hat{i} + 3\hat{j} + 4\hat{k})$ N

$\vec{r}_1 = (-\hat{i} + 2\hat{j} + \hat{k})$ m

$\vec{r}_2 = (2\hat{i} - 3\hat{j} + \hat{k})$ m

Displacement ; $\vec{\Delta r} = \vec{r}_2 - \vec{r}_1 = (3\hat{j} - 5\hat{j})$

$W = \vec{F} \cdot \vec{\Delta r}$

$W = (\hat{i} + 3\hat{j} + 4\hat{k}) \cdot (3\hat{j} - 5\hat{j})$

$W = 3 - 15$

$\boxed{W = -12 \text{ J}}$ Ans.

Ans. d

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Solution: 6

$$\vec{F} = (3x\hat{i} + y^2\hat{j})\,N$$

$$W = \int_{r_1}^{r_2} \vec{F}\cdot d\vec{r} = \int_{(1,2,1)}^{(3,3,8)} (3x\hat{i} + y^2\hat{j})\cdot(dx\hat{i} + dy\hat{j} + dz\hat{k})$$

$$W = \int_{(1,2,1)}^{(3,3,8)} (3x\,dx + y^2 dy) = \left[\frac{3x^2}{2} + \frac{y^3}{3}\right]_{(1,2,1)}^{(3,3,8)}$$

$$W = \left[\frac{3(3)^2}{2} + \frac{3^3}{3} - \frac{3(1)^2}{2} - \frac{(2)^3}{3}\right] = \frac{27}{2} + 9 - \frac{3}{2} - \frac{8}{3}$$

$$= \frac{81 + 54 - 9 - 16}{6} = \frac{110}{6} = \frac{55}{3}$$

$$\boxed{W = \frac{55}{3}\,J} \quad \text{Ans.}$$

Ans. a

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Solution: 7

$$\vec{F} = (\hat{i} + 3\hat{j} + 4\hat{k})$$

$$\vec{\Delta r} = (2-(-1))\hat{j} + (-3-2)\hat{j} + (1-1)\hat{k}$$

$$\vec{\Delta r} = 3\hat{j} - 5\hat{j}$$

$$W = \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r} = \vec{F} \cdot \vec{\Delta r} = (\hat{i} + 3\hat{j} + 4\hat{k}) \cdot (3\hat{j} - 5\hat{j})$$

$$W = 3 - 15$$

$$\boxed{W = -12\ J}$$ Ans.

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Ans. b

Solution: 8

$$W = \int_{x_1}^{x_2} F \cdot dx = \text{Area under } F\text{-}x \text{ curve}$$

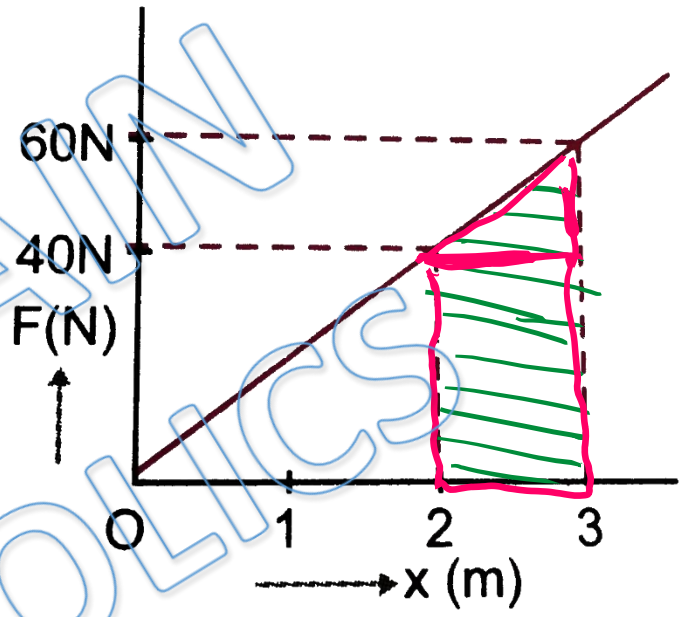
W = Area shown in graph

(for $x = 2$ to $x = 3$ m)

$$W = \left[\frac{1}{2} \times 1 \times (60-40)\right] + (1 \times 40)$$

$$W = 10 + 40$$

$$\boxed{W = 50 \text{ J}}$$ Ans.



OR

W = Area under curve

$$= \frac{1}{2}(3-2)[60+40]$$

$$= 50 \text{ J}$$

Ans. d

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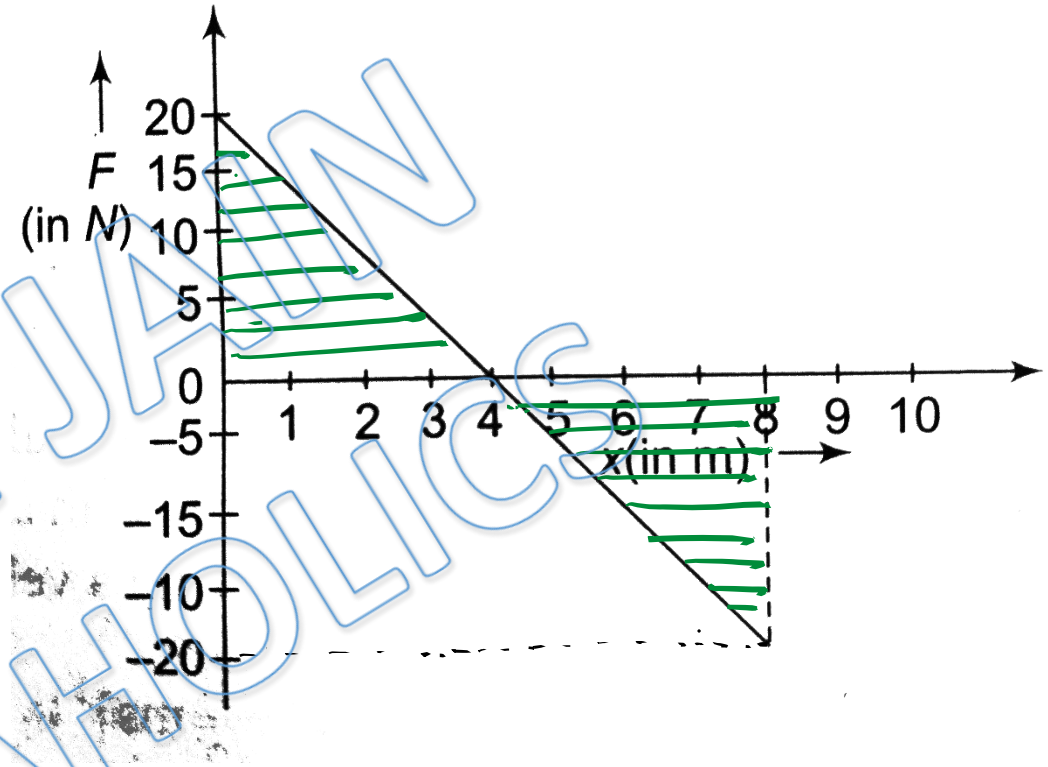
Solution: 9

W = Area under F–x curve

$W = \frac{1}{2} \times 4 \times 20 - \frac{1}{2} \times (8-4) \times 20$

$= 40 - 40$

W = zero J. Ans.



Ans. a

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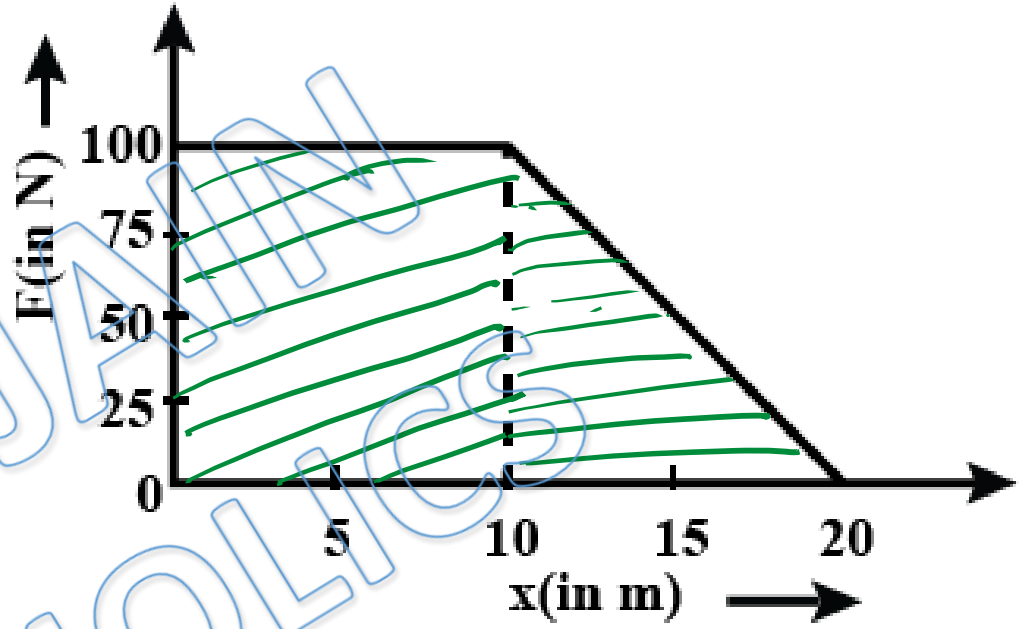
Solution: 10

W = Area under F-x curve

$W = 10 \times 100 + \frac{1}{2} \times 10 \times 100$

$W = 1000 + 500$

$\boxed{W = 1500\ J}$ Ans.



Ans. c

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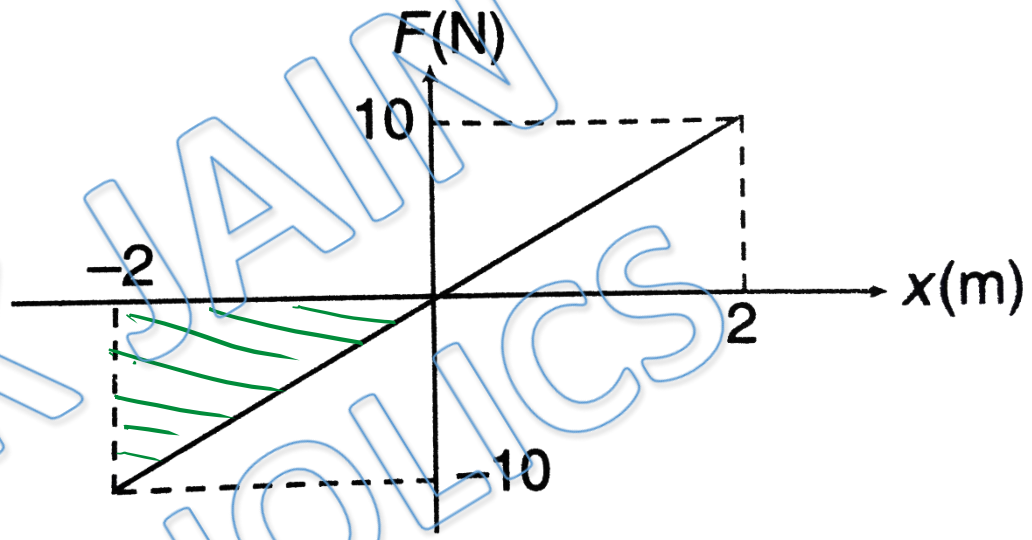
Solution: 11

W = Area shaded in graph

$W = -\frac{1}{2} \times (10) \times (2)$

$W = -10\ J$ Ans.



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Ans. b

Solution: 12

$s = \frac{t^3}{3}$ (in m) $\Rightarrow$ $ds = \frac{3t^2}{3}dt \Rightarrow$ $\boxed{ds = t^2 dt}$

$v = \frac{3t^2}{3} = t^2$ (in m/s)

$a = 2t$ (in m/s^2)

$F = ma = 3 \times (2t) = 6t$ (in m)

$$W = \int_{r_1}^{r_2} F \cdot ds = \int_{t_1}^{t_2} (6t)(t^2 dt) = \int_0^2 6t^3 dt$$

$$W = \left(\frac{6t^4}{4}\right)_0^2 = \left[\frac{3t^4}{2}\right]_0^2 = \frac{3}{2}[2^4 - 0^4]$$

$W = \frac{3}{2} \times 2^4 = 3 \times 2^3 = 24$ J

$\boxed{W = 24\ J}$ Ans.

Ans. d

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