NEET ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 11th **PAPER CODE :- CWT-6**
CHAPTER :- WORK,POWER,ENERGY

ANSWER KEY

1.	(B)	**2.**	(A)	**3.**	(A)	**4.**	(C)	**5.**	(C)	**6.**	(B)	**7.**	(A)
8.	(A)	**9.**	(D)	**10.**	(A)	**11.**	(B)	**12.**	(A)	**13.**	(B)	**14.**	(C)
15.	(A)	**16.**	(B)	**17.**	(C)	**18.**	(D)	**19.**	(B)	**20.**	(D)	**21.**	(D)
22.	(C)	**23.**	(A)	**24.**	(C)	**25.**	(C)	**26.**	(A)	**27.**	(C)	**28.**	(A)
29.	(C)	**30.**	(A)	**31.**	(C)	**32.**	(C)	**33.**	(B)	**34.**	(B)	**35.**	(A)
36.	(D)	**37.**	(D)	**38.**	(B)	**39.**	(B)	**40.**	(A)	**41.**	(B)	**42.**	(A)
43.	(B)	**44.**	(D)	**45.**	(A)	**46.**	(D)	**47.**	(C)	**48.**	(D)	**49.**	(A)
50.	(D)												

SOLUTIONS

SECTION-A

1. (B)

Sol. Work done by centripetal force is always zero, because force and instantaneous displacement are always perpendicular.

$W = \vec{F}.\vec{s} = Fs\cos\theta = Fs\cos(90°) = 0$

2. (A)

Sol. $v = \frac{dx}{dt} = 3 - 8t + 3t^2$

$\therefore\ v_0 = 3\, m/s$ and $v_4 = 19\, m/s$

$W = \frac{1}{2}m(v_4^2 - v_0^2)$ (According to work energy theorem)

$= \frac{1}{2} \times 0.03 \times (19^2 - 3^2) = 5.28\ J$

3. (A)

Sol. h = $\frac{1}{2}$ gt^2, W = mgh = mg $\frac{gt^2}{2}$, W = K$_f$ – K$_i$

$\frac{mg^2t^2}{2}$ = K$_f$ – $\frac{1}{2}$ mu^2, K$_f$ = $\frac{1}{2}$ mu^2 + $\frac{mg^2t^2}{2}$

Hence Ans. is (A)

4. (C)

Sol. $W = (3\hat{i} + c\hat{j} + 2\hat{k}).(-4\hat{i} + 2\hat{j} + 3\hat{k}) = 6\,J$

$W = -12 + 2c + 6 = 6 \Rightarrow c = 6$

5. (C)

Sol. When a force of constant magnitude which is perpendicular to the velocity of particle acts on a particle, work done is zero and hence change in kinetic energy is zero.

6. (B)

Sol. $W \int_0^{x_1} F.dx = \int_0^{x_1} Cx\ dx = C\left[\frac{x^2}{2}\right]_0^{x_1} = \frac{1}{2}Cx_1^2$

7. (A)

Sol. $\frac{1}{2}kS^2 = 10\ J$ (given in the problem)

$\frac{1}{2}k\left[(2S)^2 - (S)^2\right] = 3 \times \frac{1}{2}kS^2$ = 3 × 10 = 30 J

8. (A)

Sol. $U = \frac{F^2}{2k} = \frac{T^2}{2k}$

9. (D)

Sol. Condition for stable equilibrium

$F = -\frac{dU}{dx} = 0$

$\Rightarrow -\frac{d}{dx}\left[\frac{a}{x^{12}} - \frac{b}{x^6}\right] = 0 \Rightarrow$

$-12ax^{-13} + 6bx^{-7} = 0$

$\Rightarrow \frac{12a}{x^{13}} = \frac{6b}{x^7} \Rightarrow \frac{2a}{b} = x^6 \Rightarrow x = \sqrt[6]{\frac{2a}{b}}$

10. (A)

Sol. $E = \frac{P^2}{2m}$ if *P* = constant then $E \propto \frac{1}{m}$

11. (B)

Sol. Let *h* is that height at which the kinetic energy of the body becomes half its original value *i.e.* half of its kinetic energy will convert into potential energy

$\therefore$ *mgh* = $\frac{490}{2} \Rightarrow 2 \times 9.8 \times h = \frac{490}{2} \Rightarrow$

$h = 12.5m.$

12. (A)

Sol. Let initial kinetic energy, $E_1 = E$

Final kinetic energy, $E_2 = E + 300\%$ of *E* = 4*E*

As $P \propto \sqrt{E} \Rightarrow \frac{P_2}{P_1} = \sqrt{\frac{E_2}{E_1}} = \sqrt{\frac{4E}{E}} = 2 \Rightarrow$

$P_2 = 2P_1$

$\Rightarrow P_2 = P_1 + 100\%$ of P_1

i.e. Momentum will increase by 100%

13. (B)

Sol. $P = \sqrt{2mE}$ if E are equal then $P \propto \sqrt{m}$
i.e. heavier body will possess greater momentum.

14. (C)

Sol. $P = \sqrt{2mE}$. If E are const. then
$\frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}} = \sqrt{\frac{4}{1}} = 2$

15. (A)

Sol. $\frac{1}{2} K_2 x^2 + \frac{1}{2} K_1 x^2 = \frac{1}{2} m v^2$

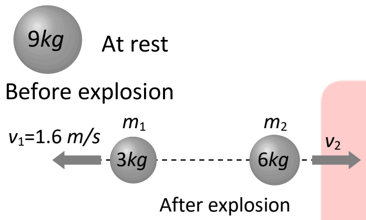
$v = \sqrt{\frac{K_1 + K_2}{m}} x$

16. (B)

Sol. $v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 0.1} = \sqrt{1.96} = 1.4\, m/s$

17. (C)

Sol.



As the bomb initially was at rest therefore
Initial momentum of bomb = 0
Final momentum of system = $m_1v_1 + m_2v_2$
As there is no external force
$\therefore\ m_1v_1 + m_2v_2 = 0 \Rightarrow 3 \times 1.6 + 6 \times v_2 = 0$
velocity of 6 *kg* mass $v_2 = 0.8\, m/s$ (numerically)
Its kinetic energy
$= \frac{1}{2} m_2 v_2^2 = \frac{1}{2} \times 6 \times (0.8)^2 = 1.92\, J$

18. (D)

Sol. Both fragment will possess the equal linear momentum

$m_1v_1 = m_2v_2 \Rightarrow 1 \times 80 = 2 \times v_2 \Rightarrow v_2 = 40\, m/s$

$\therefore$ Total energy of system $= \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$

$= \frac{1}{2} \times 1 \times (80)^2 + \frac{1}{2} \times 2 \times (40)^2$

= 4800 *J* = 4.8 *kJ*

19. (B)

Sol. Change in gravitational potential energy
= Elastic potential energy stored in compressed spring

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

20. (D)

Sol. $P = \vec{F}.\vec{v} = ma \times at = ma^2 t$ [as u = 0]

$= m\left(\frac{v_1}{t_1}\right)^2 t = \frac{m v_1^2 t}{t_1^2}$ $[\text{As}\ a = v_1/t_1]$

21. (D)

Sol. $P = \frac{\text{Workdone}}{\text{Time}} =$

$\frac{mgh}{t} = \frac{300 \times 9.8 \times 2}{3} = 1960\ W$

22. (C)

Sol. $P = \frac{mgh}{t} \Rightarrow \frac{P_1}{P_2} = \frac{m_1}{m_2} \times \frac{t_2}{t_1}$ (As h = constant)

$\therefore \frac{P_1}{P_2} = \frac{60}{50} \times \frac{11}{12} = \frac{11}{10}$

23. (A)

Sol. $P = \frac{\vec{F}.\vec{s}}{t} = \frac{(2\hat{i} + 3\hat{j} + 4\hat{k}).(3\hat{i} + 4\hat{j} + 5\hat{k})}{4}$

$= \frac{38}{4} = 9.5\ W$

24. (C)

Sol. For m, N cos θ = mg

For M , N sin θ = kx

So $\tan\theta = \frac{Kx}{mg}$

so $\frac{1}{2} Kx^2 = \frac{(mg\tan\theta)^2}{2K}$

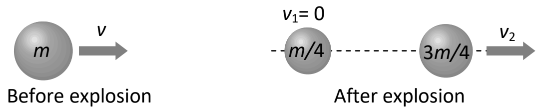
25. (C)

Sol. F – R = ma, F = R + ma,

P = Fv = (R + ma)v

26. (A)

Sol.



$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) u_1 + \frac{2m_2u_2}{m_1 + m_2}$

Substituting m_1 = 0, $v_1 = -u_1 + 2u_2$

$\Rightarrow v_1 = -6 + 2(4) = 2 m/s$

i.e. the lighter particle will move in original direction with the speed of 2 *m/s*.

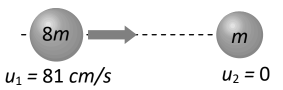
27. (C)

Sol. Ratio in radius of steel balls = 1/2

So, ratio in their masses $= \frac{1}{8}$

[As $M \propto V \propto r^3$]

Let $m_1 = 8m$ and $m_2 = m$



$$v_2 = \frac{2m_1u_1}{m_1+m_2} = \frac{2\times 8m\times 81}{8m+m} = 144\ cm/s$$

28. (A)

Sol. From F = $-\frac{dU}{dx}$

$$\int_0^{U(x)} dU = -\int_0^x Fdx = -\int_0^x (kx)\,dx$$

$\therefore$ U(x) = $-\frac{kx^2}{2}$

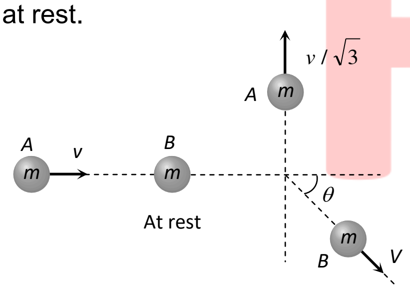
as U(0) = 0

Therefore, the correct option is (A).

29. (C)

30. (A)

Sol. Let mass *A* moves with velocity *v* and collides inelastically with mass *B*, which is at rest.



According to problem mass *A* moves in a perpendicular direction and let the mass *B* moves at angle θ with the horizontal with velocity *v*.

Initial horizontal momentum of system (beforecollision)=*mv* ....(i)

Final horizontal momentum of system (after collision) = *Mv* cosθ ...(ii)

From the conservation of horizontal linear momentum *mv* = *mV* cos$\theta \Rightarrow$ *v* = *V* cosθ ...(iii)

Initial vertical momentum of system (before collision) is zero.

Final vertical momentum of system

$$\frac{mv}{\sqrt{3}} - mV\sin\theta$$

From the conservation of vertical linear momentum $\frac{mv}{\sqrt{3}} - mV\sin\theta = 0$

$$\Rightarrow \frac{v}{\sqrt{3}} = V\sin\theta \qquad ...(iv)$$

By solving (iii) and (iv)

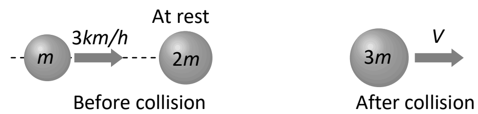
$$v^2 + \frac{v^2}{3} = V^2(\sin^2\theta + \cos^2\theta)$$

$$\Rightarrow \frac{4v^2}{3} = V^2 \Rightarrow V = \frac{2}{\sqrt{3}}v.$$

31. (C)

32. (C)

Sol.



Initial momentum = $m\times 3 + 2m\times 0 = 3m$

Final momentum = $3m \times V$

By the law of conservation of momentum

$3m = 3m \times V \Rightarrow V = 1\ km/h$

33. (B)

Sol. $v = 36\ km/h = 10\ m/s$

By law of conservation of momentum

$2\times 10 = (2+3)V \Rightarrow V = 4\ m/s$

Loss in K.E. $= \frac{1}{2}\times 2\times(10)^2 - \frac{1}{2}\times 5\times(4)^2 = 60\ J$

34. (B)

Sol. Here $\frac{mv^2}{r} = \frac{K}{r^2}$ $\therefore$ K.E. $= \frac{1}{2}mv^2 = \frac{K}{2r}$

$$U = -\int_\infty^r F.dr = -\int_\infty^r\left(-\frac{K}{r^2}\right)dr = -\frac{K}{r}$$

Total energy $E = \text{K.E.} + \text{P.E.} = \frac{K}{2r} - \frac{K}{r} = -\frac{K}{2r}$

35. (A)

Sol. Work done = area under curve and displacement axis

$= 1\times 10 - 1\times 10 + 1\times 10 = 10\ J$

SECTION-B

36. (D)

Sol. Rate of change of momentum is proportional to external forces acting on the system. The total momentum of whole system remain constant when no external force is acted upon it.

Internal forces can change the kinetic energy of the system.

37. (D)

Sol. (D) $s = \frac{t^2}{4}$ $\therefore ds = \frac{t}{2}dt$

$$F = ma = \frac{md^2s}{dt^2} = \frac{6d^2}{dt^2}\left[\frac{t^2}{4}\right] = 3N$$

Now

$$W = \int_0^2 F\,ds = \int_0^2 3\frac{t}{2}dt = \frac{3}{2}\left[\frac{t^2}{2}\right]_0^2 = \frac{3}{4}\left[(2)^2 - (0)^2\right] = 3J$$

38. (B)

Sol. Gravitational force is conservative

so $W_1 = W_2 = W_3$

39. (B)

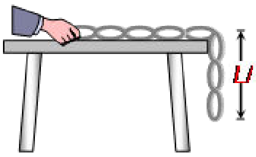
Sol. Fraction of length of the chain hanging from the table

$= \frac{1}{n} = \frac{60\,cm}{200\,cm} = \frac{3}{10} \Rightarrow n = \frac{10}{3}$

Work done in pulling the chain on the table

$W = \frac{mgL}{2n^2}$

$= \frac{4 \times 10 \times 2}{2 \times (10/3)^2} = 3.6\,J$



40. (A)

Sol. Here ,

Mass per unit length of water, μ = 100 kg/m

Velocity of water, v = 2m/s

Power of engine, P = $\frac{1}{2}mv^2 = \frac{1}{2} \times 200 \times 2$

= 400W

41. (B)

Sol. $W = \frac{1}{2}kx^2$

If both wires are stretched through same distance then $W \propto k$. As $k_2 = 2k_1$ so $W_2 = 2W_1$

42. (A)

Sol. The kinetic energy of mass is converted into potential energy of a spring

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$\Rightarrow x = \sqrt{\frac{mv^2}{k}} = \sqrt{\frac{0.5 \times (1.5)^2}{50}} = 0.15\,m$

43. (B)

Sol. Constant power of car P_0 = F.V. = ma.v

$P_0 = m\frac{dv}{dt}.v$

$P_0\,dt = mvdv$

$P_0.t = \frac{mv^2}{2}$

$v = \sqrt{\frac{2P_0 t}{m}}$

$v \propto \sqrt{t}$

44. (D)

Sol. $P = \frac{mgh}{t} \Rightarrow m = \frac{p \times t}{gh} = \frac{2 \times 10^3 \times 60}{10 \times 10} = 1200$ kg

As volume = $\frac{\text{mass}}{\text{density}}$

$\Rightarrow v = \frac{1200\,kg}{10^3\,kg/m^3} = 1.2m^3$

Volume = $1.2m^3 = 1.2 \times 10^3\,litre = 1200\ litre$

45. (A)

Sol. $W = \vec{F}.\vec{s} = 40 \times 8 \times \cos 60° = 160\ J$

46. (D)

Sol. Work done = $F \times s = ma \times \frac{1}{2}at^2$

$\left[\text{from } s = ut + \frac{1}{2}at^2\right]$

$\therefore W = \frac{1}{2}ma^2t^2 = \frac{1}{2}m\left(\frac{v}{t_1}\right)^2 t^2 \qquad \left[\text{As } a = \frac{v}{t_1}\right]$

47. (C)

Sol. $E = \frac{1}{2}mv^2$. Differentiating *w.r.t. x*, we get

$\frac{dE}{dx} = \frac{1}{2}m \times 2v\frac{dv}{dx} = mv \times \frac{dv}{dt} \times \frac{dt}{dx} = mv \times \frac{a}{v} = ma$

48. (D)

Sol. Kinetic energy for first condition

$= \frac{1}{2}m\left(v_2^2 - v_1^2\right) = \frac{1}{2}m\left(20^2 - 10^2\right) = 150\ mJ$

K.E. for second condition = $\frac{1}{2}m\left(10^2 - 0^2\right) = 50mJ$

$\therefore \frac{(K.E.)I}{(K.E.)II} = \frac{150m}{50m} = 3$

49. (A)

Sol. By conservation of energy, $mgh = \frac{1}{2}mv^2$

$\Rightarrow v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 1} = \sqrt{19.6} = 4.43\ m/s$

50. (D)

Sol. When a body does work against friction, its kinetic energy its kinetic energy is decreases.

Work done by a body is dependent of time

Power of a body varies inversely as time

When work done over a closed path is zero force must be conservative.

Thus option D is correct.