DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 10

Topic :- WORK ENERGY AND POWER

1 **(d)**

Given $F = 2x$,

Work done $W = \int F\, dx$

$\therefore W = \int_{x_1}^{x_2} 2x\, dx = 2\left[\frac{x^2}{2}\right]_{x1}^{x2}$

$=(x_2^2 - x_1^2)$

3 **(b)**

Here $t = \sqrt{x} + 3$

or $x = (t - 3)^2 = t^2 - 6t + 9$

$v = \frac{dx}{dt} = 2t - 6$

At $t = 0$ s, $v = 2 \times 0 - 6 = -6$

At $t = 6$ s, $v = 2 \times 6 - 6 = +6$

Initial and final KE are same hence no work is done

$W = \frac{1}{2}m(v_1^2 - v_2^2) = 0$

4 **(a)**

Given, m=2kg, v=20ms^{-1}, $\theta = 60°$

Power(P)is given as

$P = F \cdot v = Fv \cos\theta$

$P = mgv \cos\theta$

$\therefore P = 2 \times 20 \times 10 \times \cos 60°$

$P = 2 \times 20 \times 10 \times \frac{1}{2}$

$\Rightarrow P = 200$ W

6 **(d)**

Kinetic energy of ball=potential energy of spring

i.e., $B \; \frac{1}{2}mv^2 = \frac{1}{2}kx^2$

$\therefore \quad 16 \times 10^{-3} \times v^2 = \frac{90}{10^{-2}} \times (12 \times 10^{-2})^2$

Or $v^2 = \frac{90 \times 144 \times 10^{-4}}{10^{-2} \times 16 \times 10^{-3}}$

Or $v = 90 ms^{-1}$

7 **(b)**

$\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \Rightarrow x = v\sqrt{\frac{m}{k}} = 10\sqrt{\frac{0.1}{1000}} = 0.1\ m$

8 **(d)**

$P = v\cos\theta = mg\ v\cos 90° = 0$

9 **(c)**

Initial momentum of the system $= mv - mv = 0$

As body sticks together $\therefore$ final momentum $= 2mV$

By conservation of momentum $2mV = 0 \therefore V = 0$

10 **(a)**

$P = \sqrt{2mE} \therefore P \propto \sqrt{E}$ *i.e.*, if kinetic energy becomes four times then new momentum will become twice

11 **(b)**

Let Mbe the mass of body moving with velocity v and m be mass of each broken part, velocity of one part which retraces back is v and that of second part is v'.

Momentum before breaking=momentum after breaking

$Mv = m(-v) + mv'$

Or $v' = \frac{Mv + mv}{m}$

Since, M=2m,therefore

$v' = \frac{(2m + m)v}{m} = 3v$

12 **(b)**

Potential energy=Kinetic energy

Ie, $mgh = \frac{1}{2}mv^2$

Or $v = \sqrt{2gh}$

If h_1 and h_2 are initial and final heights, then

$v_1 = \sqrt{2gh_1},\ \ v_2 = \sqrt{2gh_2}$

Loss in velocity

$\Delta v = v_1 - v_2 = \sqrt{2gh_1} - \sqrt{2gh_2}$

$\therefore$ Fractional loss in velocity $= \frac{\Delta v}{v_1}$

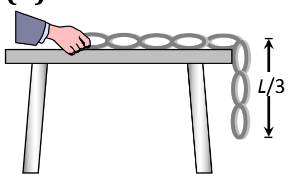
$= \frac{\sqrt{2gh_1} - \sqrt{2gh_2}}{\sqrt{2gh_1}}$

$\frac{\Delta v}{v_1} = 1 - \sqrt{\frac{h_2}{h_1}}$

$= 1 - \sqrt{\frac{1.8}{5}}$

$= 1 - \sqrt{0.36} = 1 - 0.6 = 0.4 = \frac{2}{5}$

13 **(d)**



$W = \frac{MgL}{2n^2} = \frac{MgL}{2(3)^2} = \frac{MgL}{18}$ [$n = 3$ Given]

14 **(a)**

In head on elastic collision velocity get interchanged (if masses of particle are equal) *i.e.* the last ball will move with the velocity of first ball *i.e.* 0.4 m/s

15 **(d)**

Area between curve and displacement axis

$= \frac{1}{2} \times (12 + 4) \times 10 = 80\,J$

In this time body acquire kinetic energy $= \frac{1}{2} mv^2$

By the law of conservation of energy

$\frac{1}{2} mv^2 = 80\,J$

$\Rightarrow \frac{1}{2} \times 0.1 \times v^2 = 80 \Rightarrow v^2 = 1600 \Rightarrow v = 40\,m/s$

16 **(a)**

$\frac{1}{2} kS^2 = 10\,J$ [Given in the problem]

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

17 **(a)**

Given a=$-kx$

$a = \frac{dv}{dt} = \frac{dv}{dx} . \frac{dx}{dt} = -kx$

Or $\frac{vdv}{dx} = -kx$

Or $v\,dv = -kx\,dx$

Let for any displacement from 0 to x,the velocity changes from $v_0 to\ v$.

$\Rightarrow \int_{v0}^{v} vdv = -\int_{0}^{x} k\ \ x\,dx$

Or $\frac{v^2 - v_0^2}{2} = -\frac{kx^2}{2}$

$or\ \ m\left(\frac{v^2 - v_0^2}{2}\right) = -\frac{mkx^2}{2}$

Or $\Delta K \propto x^2$ $\quad$ (ΔK *is loss in* KE)

18 **(d)**

Here, $m_1 = 20$ kg,

$m_2 = 0.1$ kg,

$v_1 =$ velocity of recoil of gun,

$v_2 =$ velocity of bullet

As $m_1 v_1 = m_2 v_2$

$$v_1 = \frac{m_2}{m_1} v_2 = \frac{0.1}{20} v_2 = \frac{v_2}{200}$$

Recoil energy of gun $= \frac{1}{2} m_1 v_1^2$

$$= \frac{1}{2} \times 20 \left(\frac{v_2}{200}\right)^2$$

$$804 = \frac{10 v_2^2}{4 \times 10^4} = \frac{v_2^2}{4 \times 10^3}$$

$v_2 = \sqrt{804 \times 4 \times 10^3}$ ms^{-1}

19 **(c)**

According to law of conservation of momentum

Momentum of neutron = Momentum of combination

$\Rightarrow 1.67 \times 10^{-27} \times 10^8 = (1.67 \times 10^{-27} + 3.34 \times 10^{-27}) v$

$\therefore v = 3.33 \times 10^7\ m/s$

20 **(d)**

According to law of conservation of energy

$$\frac{1}{2} m u^2 = \frac{1}{2} m v^2 + mg\text{h}$$

$490 = 245 + 5 \times 9.8 \times h$

$$\text{h} = \frac{245}{49} = 5m$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	D	B	B	A	B	D	D	C	A	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	B	D	A	D	A	A	D	C	D