DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 9

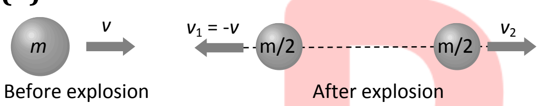
Topic :- WORK ENERGY AND POWER

1 **(a)**

Spring constant $k = \frac{F}{x} =$ Slope of curve

$\therefore k = \frac{4-1}{30} = \frac{3}{30} = 0.1\ kg/cm$

2 **(b)**



Let the initial mass of body $= m$

Initial linear momentum $= mv$ ...(i)

When it breaks into equal masses then one of the fragment retrace back with same velocity

$\therefore$ Final linear momentum $= \frac{m}{2}(-v) + \frac{m}{2}(v_2)$ ...(ii)

By the conservation of linear momentum

$\Rightarrow mv = \frac{-mv}{2} + \frac{mv_2}{2}$

$\Rightarrow v_2 = 3v$

i.e., other fragment moves with velocity $3v$ in forward direction

3 **(a)**

Effective height through which man moves up

$= 1 - h$

4 **(d)**

Work done $(W) =$ Area under curve of F-x graph

= Area of triangle $OAB = \frac{1}{2} \times 5 \times 1 = 2.5$ J

5 **(c)**

According to work-energy theorem,

$W = \Delta K = 0$

$(\because$ Initial and final speeds are zero)

$\therefore$ work done by friction +work done by gravity=0

$-(\mu mg \cos\phi)\frac{l}{2} + mgl \sin\phi = 0$

or $\frac{\mu}{2}\cos\phi = \sin\phi$

$\therefore \mu = 2\tan\phi$

6 **(c)**

Force produced by the engine $F = \frac{P}{v} = \frac{30 \times 10^3}{30} = 10^3 N$

Acceleration = $\frac{\text{Forward force by engine} - \text{resistive force}}{\text{mas of car}}$

$= \frac{1000 - 750}{1250} = \frac{250}{1250} = \frac{1}{5}\ m/s^2$

9 **(c)**

The work done in stretching a sprig by a length x,

$W_1 = \frac{1}{2}kx^2$ ...(i)

The work done in stretching the spring by a further length$x$.

$W_2 = \frac{1}{2}k(2x)^2 - \frac{1}{2}kx^2$

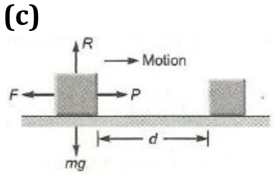
Or $W_2 = \frac{1}{2}k \times 4x^2 - \frac{1}{2}kx^2$

Or $W_2 = 3 \times \frac{1}{2}kx^2$ ...(ii)

From Esq. (i) and (ii)we have

$W_2 = 3W_1$

10 **(c)**



As shown a block of mass M is lying over rough horizontal surface. Let μ be the coeeficient of kinetic friction between the two surfaces in contact. The force Of friction between the block and horizontal surface is given by

$F = \mu R = \mu Mg$ $(\because R = Mg)$

To move the block without acceleration, the force (P)required will be just equal to the force of friction , ie ,

$P = F = \mu R$

If d is the distance moved , then work done is given by

$W = P \times d = \mu Rd$

11 **(a)**

Kinetic energy of the block is

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

This kinetic energy is equal to the work done by the block before coming to rest. The work done in compressing the spring through a distance x from its normal length is

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

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

$\Rightarrow \quad x = v\sqrt{\frac{m}{k}}$

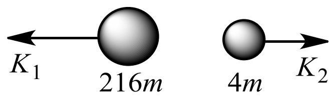
Given, $v = 4 m/s, m = 16 kg, k = 100$ N/m

$\therefore x = 4 \times \sqrt{\frac{16}{100}} = 1.6\ m$

12 **(b)**

Given that,

$K_1 + K_2 = 5.5\ MeV \quad ...(i)$



From conservation of linear Momentum

Or $\quad \sqrt{2K_1(216m)} = \sqrt{2k_2(4m)}$

Or $\quad k_2 = 54\ K_1 \quad ...(ii)$

Solving Eq.(i)& (ii),we get

$k_2 = KE$ of α - $particle = 5.4 Me\ V$.

13 **(d)**

Work done in raising water $= mg$h

$\therefore W =$ (volume $\times$ density) gh $= (9 \times 1000) \times 10 \times 10$

$\Rightarrow W = 9 \times 10^5\ J$

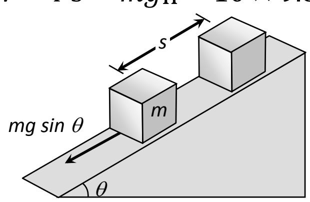
$\therefore$ Useful power $= \frac{\text{work}}{\text{time}} = \frac{9 \times 10^5}{5 \times 60} = 3kW$

$\therefore$ Efficiency $= \frac{3}{10} = 30\%$

14 **(d)**

As the body moves in the direction of force therefore work done by gravitational force will be positive

$W = Fs = mg$h $= 10 \times 9.8 \times 10 = 980\ J$



15 **(a)**

Given that, $S = \frac{1}{3}t^2$

$v = \frac{dS}{dt} = \frac{2}{3}t;\ a = \frac{d^2S}{dt^2} = \frac{2}{3}$

$F = ma = 3 \times \frac{2}{3} = 2\text{N}; \quad \text{Work} = 2 \times \frac{1}{3}t^2$

At t =2

Work $= 2 \times \frac{1}{3} \times 2 \times 2 = \frac{8}{3}$J

16 **(b)**

In elastic collision

$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 + \left(\frac{2m_2}{m_1 + m_2}\right)u_2$$

If the second ball is at rest ,ie $u_2 = 0$,then

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

$\frac{2}{3}u_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 \quad \left[\because v_1 = \frac{2}{3}u_1\right]$

Or $2m_1 + 2m_2 = 3m_1 - 3m_2$

Or $m_1 = 5m_2$

Or $\frac{m_1}{m_2} = \frac{5}{1}$

17 **(a)**

From Newton's second law,

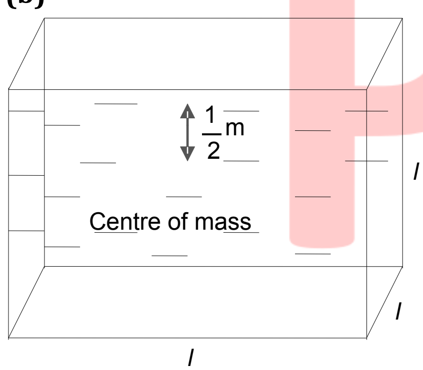
$$F = \frac{dp}{dt}$$

If F=0,then $\frac{dp}{dt} = 0$

$\Rightarrow \quad p = constant$

Thus, if total external force acting on the system is zero, then linear momentum of the system remains conserved.

18 **(b)**



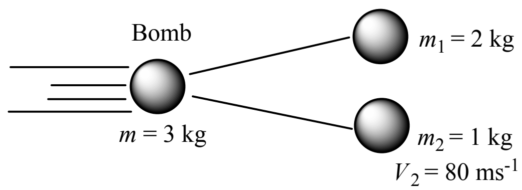
$V = l^3 = 1m^3$

$m = 1 \times 1000 = 1000$kg

$W = mgh = 1000 \times 10 \times \frac{1}{2} = 5000$ J

19 **(d)**

From law of conservation of momentum, when no external force acts upon a system of two (or more) bodies, then the total momentum of the system remains constant.



Momentum before explosion =momentum after explosion.

since bomb v at rest, its velocity is zero, hence,

$mv = m_1v_1 + m_2v_2$

$3 \times 0 = 2v_1 + 1 \times 80$

$or\ v_1 = -\frac{80}{2} = -40ms^{-1}$

Total energy imparted is

$KE = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$

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

=1600+3200=4800J

=4.8kJ

20 **(a)**

Let d_s be the distance travelled by the vehicle before it stops

Here, final velocity $v = 0$, initial velocity $= u$

Using equation of motion $v^2 = u^2 + 2aS$

$\therefore 0^2 = u^2 + 2ad_s$

Or Stopping distance, $d_s = -\frac{u^2}{2a}$

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