DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 6

Topic :- WORK ENERGY AND POWER

1 **(b)**

Kinetic energy, $K = \frac{P^2}{2m}$

Where P is the momentum and m is the mass. When momentum is increased by 20%, then

$\rho' = P + \frac{20}{100}P = 1.2P$

$\therefore K' = \frac{(1.2P)^2}{2m} = \frac{1.44P^2}{2m} = 1.44K$

$K' = K + 0.44K \Rightarrow \frac{K' - K}{K} = 0.44$

Percentage increase in kinetic energy is

$\frac{K' - K}{K} \times 100 = 0.44 \times 100 = 44\%$

2 **(c)**

Loss of kinetic energy $= \frac{1}{2}\frac{m_1 m_2}{m_1 + m_2}(v_1 - v_2)^2$

$= \frac{1}{2} \times \frac{M \times M}{M + M}(V_1 - V_2)^2$

$= \frac{M \, . \, M}{2(2M)}(V_1 - V_2)^2$

$= \frac{M}{4}(V_1 - V_2)$

3 **(a)**

No work is done while covering the horizontal distance because $\vec{\mathbf{F}}.\vec{\mathbf{s}} = 0(\therefore \theta = 90°)$

But work is done during vertical displacement which is given by

$F\mathrm{h} = 60 \times 5 = 300$ J

4 **(c)**

$P = \frac{mg\mathrm{h}}{t} = \frac{80 \times 10 \times 1.5}{2}$

$= 600$ W $= 0.6$ kW

5 **(c)**

The displacement of body is

$\overrightarrow{\mathbf{AB}} = \overrightarrow{\mathbf{r}}_B - \vec{\mathbf{r}}_A$

$= (3\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 5\hat{\mathbf{k}}) - (2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 4\hat{\mathbf{k}})$

$= \hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$

$\therefore\ W = \vec{\mathbf{F}}.\overrightarrow{\mathbf{AB}} = (2\hat{\mathbf{i}} - 4\hat{\mathbf{j}}).(\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}})$

$= 2 - 4 = -2$ J

6 **(b)**

Let the constant acceleration of body of mass m is a,

From equation of motion

$v_1 = 0 + at_1$

Or $a = \frac{v_1}{t_1}$ ...(i)

At an instant t, the velocity v of the body

$v = 0 + at$

$v = \frac{v_1}{t_1}t$ ...(ii)

Therefore, instantaneous power

$p = Fv = mav$

$= m\left(\frac{v_1}{t_1}\right) \times \left(\frac{v_1}{t_1}.t\right)$ [From Eqs.(i)and (ii)]

$= \frac{mv_1^2 t}{t_1^2}$

7 **(d)**

Due to the same mass of A and B as well as due to elastic collision velocities of spheres get interchanged after the colision

8 **(a)**

Power $= Fv = v\left(\frac{m}{t}\right)v = v^2(\rho A v)$

$= \rho A v^3 = (100)(2)^3 = 800\ W$

9 **(b)**

Impulse = change in momentum

$mv_2 - mv_1 = 0.1 \times 40 - 0.1 \times (-30)$

10 **(d)**

Kinetic energy of particle ,$k = \frac{p_1^2}{2m}$

$p_1^2 = 2mk'$

When kinetic energy =2k

$p_2^2 = 2m \times 2k, p_2^2 = 2p_1^2, p_2 = \sqrt{2p_1}$

11 **(b)**

Gravitational potential energy of ball gets converted into elastic potential energy of the spring $mg(\mathrm{h} + d) = \frac{1}{2}Kd^2$

Net work done $= mg(\mathrm{h} + d) - \frac{1}{2}Kd^2 = 0$

12 **(a)**

$dW = Fdl$

$$W = \int_0^l F\,dl \quad Y = \frac{FL}{dl}$$

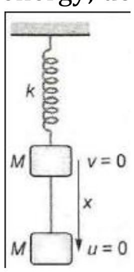
or $W = \int_0^l \frac{Y\,al}{L} dl$ or $F = \frac{Y\,al}{L}$

or $W = \frac{Ya}{L}\int_0^l dl$ or $W = \frac{Ya}{L}\left(\frac{l^2}{2}\right)$

or $W = \frac{1}{2}\frac{Y\,al}{L} l = \frac{1}{2}Fl$

13 **(b)**

Let x be the maximum extension of the spring, figure. From conservation of mechanical energy; decreases in gravitational potential energy = increase in elastic potential energy



$$Mg\,x = \frac{1}{2}k\,x^2$$

$$x = \frac{2\,Mg}{k}$$

14 **(b)**

$$a = \frac{10-0}{5}\text{ms}^{-2} = 2\text{ms}^{-2};$$

$F = ma$ or $F = 1000 \times 2$ N = 2000 N

Average velocity $= \frac{0+10}{2}\text{ms}^{-1} = 5\text{ms}^{-1}$

Average power $= 2000 \times 5$ W $= 10^4$ W

Required horse power is $\frac{10^4}{746}$

15 **(a)**

Work done=area between the graph force displacement curve and displacement

$$W = \frac{1}{2} \times 6 \times 10 - 5 \times 4 + 5 \times 4 - 5 \times 2$$

$W = 20\,J$

According to work energy theorem

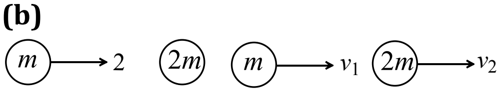
$\Delta = K_E = W$

$K_{Ef} = W + \Delta K$

=20+25

=45J

16 **(b)**



Initial condition Final condition

By conservation of linear momentum

$2m = mv_1 + 2mv_2 \Rightarrow v_1 + 2v_2 = 2$

By definition of e,$e = \frac{1}{2} = \frac{v_2 - v_1}{2 - 0}$

$\Rightarrow v_2 - v_1 = 1 \Rightarrow v_1 = 0$ and $v_2 = 1ms^{-1}$

17 **(b)**

Potential energy of water = kinetic energy at turbine

$mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 19.6} = 19.6\ m/s$

18 **(c)**

$U(x) = \frac{a}{x^{12}} - \frac{b}{x^6}$

$U(x = \infty) = 0$

As $\quad F = -\frac{dU}{dx} = -\left[\frac{12a}{x^{13}} + \frac{6b}{x^7}\right]$

At equilibrium, $F = 0$

$X^6 = \frac{2a}{b}$

$\therefore U_{at\ equilibrium} = \frac{a}{\left(\frac{2a}{b}\right)^2} - \frac{b}{\left(\frac{2a}{b}\right)} = -\frac{b^2}{4a}$

$\therefore D = \left[U(x - \infty) - U_{at\ equilibrium}\right] = \frac{b^2}{4a}$

20 **(c)**

$m_1v_1 - m_2v_2 = (m_1 + m_2)v$

$\therefore 2 \times 3 - 1 \times 4 = (2 + 1)v$

Or $\ v = \frac{2}{3}ms^{-1}$

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