DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 4

Topic :- WORK ENERGY AND POWER

1 **(c)**

Power,

$p = m \times a \times v$

$p = m \times \frac{v^2}{t}$

If p is constant, then for a given body $v^2 \propto \sqrt{t}$

Or $v \propto \sqrt{t}$

2 **(d)**

$W = \int_0^2 F\,ds = \int_0^2 Ma\,ds = \int_0^2 M\frac{d^2s}{dt^2}ds$

$= \int_0^2 M\frac{d^2s}{dt^2}.\frac{ds}{dt}dt$

$= \int_0^2 3\left(\frac{2}{3}\right).\left(\frac{2}{3}t\right)dt$

$= \frac{4}{3}\left[\frac{t^2}{2}\right]_0^2$

$W = \frac{4}{3} \times \frac{4}{2} = \frac{8}{3} = 2.6$ J

3 **(c)**

From the law of conservation of momentum

$3 \times 16 + 6 \times v = 9 \times 0$

Or $v = -8\ ms^{-1}$

$\Rightarrow$ $v = 8 ms^{-1}$ (numerically)

Therefore, its kinetic energy

$k = \frac{1}{2} \times 6 \times (8)^2 = 192$J

4 **(d)**

Loss in PE in spring = gain in KE of ball

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

$$\frac{90}{10^{-2}} \times (12 \times 10^{-2})^2 = 16 \times 10^{-3} v^2 \Rightarrow v = 90\ m/s$$

5 **(b)**

Power delivered to the body

$P = F.v = mav$

Since, body undergoes one dimensional motion and is initially at rest, so

$v = 0 + at$

$\therefore P = ma^2 t$ or $P \propto t$

6 **(c)**

According to law of conservation of linear momentum both pieces should possess equal momentum after explosion. As their masses are equal therefore they will possess equal speed in opposite direction

7 **(c)**

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

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

8 **(b)**

From conservation of energy,

Potential energy at height h = kinetic energy at ground

Therefore, at height h, potential energy of ball A

PE = $m_A g\mathrm{h}$

KE at ground $= \frac{1}{2}m_A v_A^2$

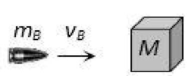
So, $m_A g\mathrm{h} = \frac{1}{2}m_A v_A^2$

$v_A = \sqrt{2\mathrm{gh}}$

Similarly, $v_B = \sqrt{2\mathrm{gh}}$

Therefore, $v_A = v_B$

9 **(b)**



Initial K.E. of system = K.E. of the bullet $= \frac{1}{2}m_B v_B^2$

By the law of conservation of linear momentum

$m_B v_B + 0 = m_{\mathrm{sys.}} \times v_{\mathrm{sys.}}$

$$\Rightarrow v_{\mathrm{sys.}} = \frac{m_B v_B}{m_{\mathrm{sys.}}} = \frac{50 \times 10}{50 + 950} = 0.5\ m/s$$

Fractional loss in K.E. $= \frac{\frac{1}{2}m_B v_B^2 - \frac{1}{2}m_{\mathrm{sys.}} v_{\mathrm{sys.}}^2}{\frac{1}{2}m_B v_B^2}$

By substituting $m_B = 50 \times 10^{-3} kg$, $v_B = 10\ m/s$

$m_{\mathrm{sys.}} = 1 kg$, $v_s = 0.5\ m/s$ we get

Fractional loss $= \frac{95}{100}$ $\therefore$ Percentage loss $= 95\%$

10 **(a)**

Power $= \frac{\text{workdone}}{\text{time}} = \frac{\text{pressure} \times \text{cnahge in volume}}{\text{time}}$

$= \frac{20000 \times 1 \times 10^{-6}}{1} = 2 \times 10^{-2} = 0.02\ W$

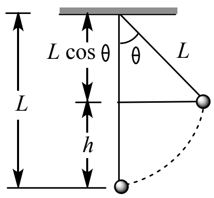
11 **(b)**

Because 50% loss in kinetic energy will affect its potential energy and due to this ball will attain only half of the initial height

12 **(c)**

$W = \Delta K$ or $W_T + W_g + W_F = 0$

(Since, change in kinetic energy is zero)



Here, $W_T =$ work done by tension = 0

$W_g =$ work done by fore of gravity

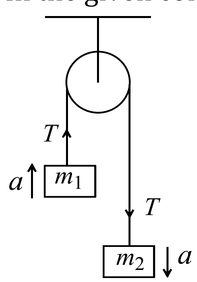
$= -mgh$

$= -mgL(1 - \cos\theta)$

$\therefore\ W_F = -W_g = mgL(1 - \cos\theta)$

13 **(c)**

In the given condition tension in the string



$T = \frac{2m_1m_2}{m_1 + m_2}g = \frac{2 \times 0.36 \times 0.72}{1.08} \times 10$

$T = 4.8\ N$

And acceleration of each block

$a = \left(\frac{m_2 - m_1}{m_1 + m_2}\right)g = \left(\frac{0.72 - 0.36}{0.72 + 0.36}\right)g = \frac{10}{3}\ m/s^2$

Let 'S' is the distance covered by block of mass 0.36 kg in first sec

$S = ut + \frac{1}{2}at^2 \Rightarrow S = 0 + \frac{1}{2}\left(\frac{10}{3}\right) \times 1^2 = \frac{10}{6}\ meter$

$\therefore$ Work done by the string $W = TS = 4.8 \times \frac{10}{6}$

$\Rightarrow W = 8\ Joule$

14 **(c)**

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

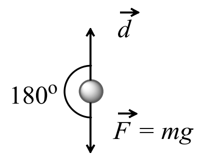
$\Rightarrow 2 \times 3 - 1 \times 4 = (2 + 1)v$

$\Rightarrow v = \frac{2}{3}\ m/s$

15 **(a)**

Maximum height reached by the particle

$H_{\max} = \frac{u^2}{2g} = \frac{(5)^2}{2 \times 10} = 1.25\ m$



Work done $= \vec{F}.\vec{d} = F\,d\cos\theta$

$= mg \times (H_{\max}) \times \cos(180^\circ)$

$= 0.1 \times 10 \times 1.25 \times (-1) = -1.25\ J$

16 **(b)**

Fractional decrease in kinetic energy of neutron

$= -\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2$ [As $m_1 = 1$ and $m_2 = 2$]

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

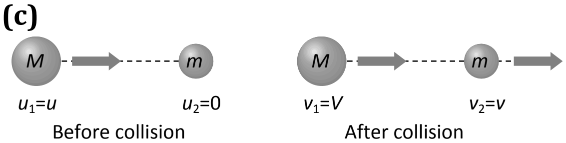
18 **(b)**

Loss of KE = force $\times$ distance $= (ma)x$

As $a \propto x$

$\therefore$ Loss of KE $\propto x^2$

19 **(c)**



$v_2 = \left(\frac{m_2 - m_1}{m_1 + m_2}\right)u_2 + \frac{2m_1u_1}{m_1 + m_2} = \frac{2mu}{M + m} = \frac{2u}{1 + \frac{m}{M}}$

20 **(b)**

Potential energy at the required height

$= \frac{490}{2} = 245$ J

Again, 245=2 $\times$ 10 $\times$ h or $h = \frac{245}{20}$m = 12.25 m

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