DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 3

Topic :- MOTION IN A PLANE

1 **(b)**

Maximum height $H=\frac{u^2\sin^2\theta}{2g}$

and times of flight $T=\frac{2u\sin\theta}{g}$

or $T^2=\frac{4u^2\sin^2\theta}{g^2}$

$\therefore\ \frac{T^2}{H}=\frac{8}{g}$

or $T=\sqrt{\frac{8H}{g}}=2\sqrt{\frac{2H}{g}}$

2 **(d)**

$\frac{mv^2}{r}=10\Rightarrow\frac{1}{2}\ mv^2=10\times\frac{r}{2}=1\ J$

3 **(c)**

In a vertical circular motion, centripetal force remains same at all points on circular path and always directed towards the centre of circular path

4 **(b)**

Given , $|\vec{A}\times\vec{B}|=\sqrt{3}\vec{A}\cdot\vec{B}$

$AB\sin\theta=\sqrt{3}\ \ AB\cos\theta$

or $\tan\theta=\sqrt{3}$

$\theta=60°$

5 **(d)**

The resultant of 5 N along OC and 5 N along OA is

$R=\sqrt{6^2+6^2}$

$=\sqrt{72}$ N along OB

The resultant of $\sqrt{72}$ N along OB and $\sqrt{72}$ N along OG is

$R'=\sqrt{72+72}=12$N along OE.

6 **(a)**

Here, $r=7$ m,$v=5$ ms^{-1},$\theta=?$

$$\tan\theta = \frac{v^2}{rg} = \frac{5 \times 5}{7 \times 9.8} = 0.364$$

$\theta = \tan^{-1}(0.364) = 20°$

7 **(b)**

$$H = \frac{v^2\cos^2\beta}{2g} \text{ or } v\cos\beta = \sqrt{2gH}$$

$$t = \frac{v\cos\beta}{g} = \frac{\sqrt{2gH}}{g} \text{ or } t = \sqrt{\frac{2H}{g}}$$

8 **(c)**

As seen from the cart, the projectile moves vertically upward and comes back

The time taken by cart to cover 80 m

$$\frac{s}{v} = \frac{80}{30} = \frac{8}{3}\, s$$

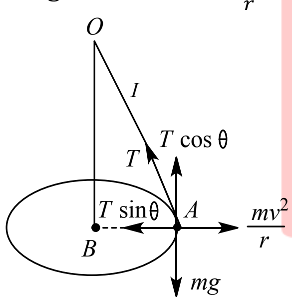
For a projectile going upward , $a = -g = -10\ m/s^2, v = 0$

And $t = \frac{8/3}{2} = \frac{4}{3}\, s$

$$\therefore v = u + a\,t \Rightarrow 0 = u - 10 \times \frac{4}{3} \Rightarrow u = \frac{40}{3}\ ms^{-1}$$

9 **(a)**

In figure, $T\sin\theta = \frac{mv^2}{r}; T\cos\theta = mg;$



So, $\tan\theta = \frac{v^2}{rg} = \frac{r}{\sqrt{l^2 - r^2}}$

$$v = \left[\frac{r^2 g}{(l^2 - r^2)^{1/2}}\right]^{1/2} = \left[\frac{0.09 \times 10}{(0.25 - 0.09)^{1/2}}\right]^{1/2}$$

$= 1.5\ ms^{-1}$

10 **(c)**

$\tan 90° = \frac{B\sin\theta}{A + B\cos\theta}$ or $A + B\cos\theta = 0$

or $\cos\theta = -A/B$ ....(i)

$$R = \frac{B}{2} = [A^2 + B^2 + 2AB\cos\theta]^{1/2}$$

or $\frac{B^2}{4} = A^2 + B^2 + 2AB(-A/B) = B^2 - A^2$

or $\frac{A^2}{B^2} = \frac{3}{4}$ or $\frac{A}{B} = \frac{\sqrt{3}}{2}$

From (i), $\cos\theta = -\frac{\sqrt{3}}{2} = \cos 150°$

11 **(b)**

From, $\tan\theta = \frac{v^2}{rg}$

$$r = \frac{v^2}{g\tan\theta} = \frac{10\times 10}{10\times \tan 45°} = 10 \text{ m}$$

13 **(d)**

For looping the loop minimum velocity at the lowest point should be $\sqrt{5gl}$

14 **(b)**

$$a_{resultant} = \sqrt{a_{radial}^2 + a_{tangential}^2} = \sqrt{\frac{v^4}{r^2} + a^2}$$

15 **(b)**

$\vec{P} + \vec{Q} = \hat{i}$

$\vec{Q} = \hat{i} - \hat{i} + \hat{j} - \hat{k}$

$= \hat{j} - \hat{k}$

16 **(b)**

Let the angle of projection be α.

$\therefore$ Range, $R = \frac{u^2\sin 2\alpha}{g}$

and maximum height $H = \frac{u^2\sin^2\alpha}{2g}$

Now, it is given that,

$(\text{Range})^2 = 48(\text{maximum height})^2$

$\therefore \left(\frac{u^2\sin 2\alpha}{g}\right)^2 = 48\left(\frac{u^2\sin^2\alpha}{2g}\right)^2$

or $\frac{u^2\sin 2\alpha}{g} = 4\sqrt{3}\left(\frac{u^2\sin^2\alpha}{2g}\right)$

or $\frac{2\sin\alpha\cos\alpha}{4\sqrt{3}} = \frac{\sin^2\alpha}{2}$

or $\tan\alpha = \frac{4}{4\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\therefore \alpha = 30°$

17 **(d)**

There is no loss of energy. Therefore the final velocity is the same as the initial velocity

18 **(a)**

The velocity should be such that the centripetal acceleration is equal to the acceleration due to gravity *ie*, $v^2/R = g$ or $v = \sqrt{gR}$

19 **(c)**

Here, $m = 2$ kg, $r = 1$ m, $v = 4$ ms^{-1}

Tension at the bottom of the circle,

$$T_L = mg + \frac{mv^2}{r}$$

$$= 2 \times 10 + \frac{2 \times 4^2}{1} = 52\text{N}$$

20 **(c)**

Here, $h = \frac{u^2 \sin^2 \theta}{2g}$ or $\sqrt{\frac{2h}{g}} = \frac{u \sin \theta}{g}$

Time of flight, $T = \frac{2u \sin \theta}{g} = 2\sqrt{\frac{2h}{g}}$

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