WEEKLY TEST TYJ -1 TEST - 14 RAJPUR ROAD
SOLUTION Date 21-07-2019

[PHYSICS]

1.

Because the body is revolving in a circle with constant speed, hence acceleration acting on it is exactly perpendicular to direction of its motion, *i.e.*, the body possesses normal acceleration.

2.

Because the particle moving in a circle describes equal angles in equal times, hence both ω and r are constant. Thus, magnitude of velocity vector remains constant but the direction changes from point to point.

3.

$$\text{Acceleration} = \omega^2 r = (2\pi f)^2 r = 4\pi^2 f^2 r$$
$$= 4\pi^2 \times 1 \times (2\times 10^4) = 8\times 10^5 \text{m/s}^2.$$

4.

Displacement, velocity and acceleration change continuously with respect to time because of change in direction.

5.

The required retardation is given by:

$$a = \frac{v^2}{2x} = \frac{20\times 20}{2\times 20} = 10 \text{ m s}^{-2}$$

The centripetal acceleration required to describe a circle of radius 20 m is,

$$\frac{v^2}{R} = \frac{20\times 20}{20} = 20 \text{ m s}^{-2}$$

Thus, it is better to apply the brakes.

6.

In circular motion, centripetal force acting on the body is always perpendicular to the velocity vector or displacement vector. Hence, work done $(=\vec{F}\cdot\vec{d})$ is always zero whatever may be the displacement along the circular path.

7.

Because the particle is moving in a circle with uniform speed, hence kinetic energy $\left(=\frac{1}{2}mv^2\right)$ will remain constant. Acceleration, velocity and displacement will change from point to point due to change in direction.

8.

Acceleration of a point at the tip of the blade

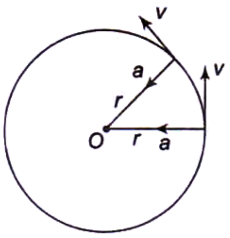
$$= \text{centripetal acceleration} = \omega^2 R = (2\pi f)^2 R$$

$$= \left(2 \times \frac{22}{7} \times \frac{1200}{60}\right)^2 \times \frac{30}{100} = 4740 \text{ m/sec}^2$$

9.

10.

In a uniform circular motion, the acceleration is directed towards the centre while velocity is acting tangentially.



11.

$r = 25 \times 10^{-2}$ m, f=2 /sec

$$\omega = 2\pi f = 4\pi \text{ rad/sec}$$

$$\text{Acceleration} = \omega^2 r = (4\pi)^2 \times 25 \times 10^{-2}$$

$$= 16 \times 25 \times 10^{-2}\pi^2 \text{ m/s}^2$$

$$= 4\pi^2 \text{ m/s}^2$$

12.

Tangential acceleration, $a_t = r\alpha = 4$ m/s^2.

Radial acceleration

$$a_t = \omega^2 r = \frac{v^2}{r} = \frac{60 \times 60}{1200} = 3 \text{ m/s}^2$$

Hence, resultant acceleration of the car

$$a = \sqrt{a_t^2 + a_r^2} = \sqrt{4^2 + 3^2} = 5 \text{ m/s}^2$$

13.

For a particle performing uniform circular motion, magnitude of the acceleration remains constant.

14.

Here, $v = 27 \text{ km h}^{-1} = 27 \times \frac{5}{18} \text{ms}^{-1}$

$v = \frac{15}{2} = 7.5 \text{ ms}^{-1}$

$r = 80 \text{ m}$

Centripetal acceleration, $a_c = \frac{v^2}{r}$

$$a_c = \frac{(7.5 \text{ ms}^{-1})^2}{80 \text{ m}} = 0.7 \text{ ms}^{-2}$$

Tangential acceleration, $at = 0.5 \text{ m s}^{-2}$

Magnitude of the net acceleration is

$$a = \sqrt{(a_c)^2 + (a_t)^2} = \sqrt{(0.7)^2 + (0.5)^2} = 0.86 \text{ ms}^{-2}$$

15.

The change in velocity when the particle completes half revolution is given by

$\Delta v = 5 \text{ m/s} - (-5 \text{ m/s}) = 10 \text{ m/s}$

Time taken to complete half revolution

$$t = \frac{\pi r}{v} = \frac{\pi \times 5}{5} = \pi \text{ sec}$$

Average acceleration $= \frac{\Delta v}{t} = \frac{10}{\pi} \text{m/s}^2$

[CHEMISTRY]

16. $\frac{1}{\lambda} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R \times 2^2\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

$\Rightarrow$ 3R; $\lambda = \frac{1}{3R}$

17. For hydrogen atom

$\frac{1}{\lambda} = R_H\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right];$

$\lambda = 2170 \text{ nm} = 2170 \times 10^{-9} \text{ m};$

$R_H = 1.09677 \times 10^7 \times \text{m}^{-1}$

$\therefore \frac{10^9}{2170} = 1.09677 \times 10^7\left[\frac{1}{n_1^2} - \frac{1}{7^2}\right];$ $n_1 = 4$

So, electron transition from n = 7 to n = 4 will produce infrared light of wavelength 2170 nm.

18.

19.

20.

21. $v = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{10^{-6} \times 10} = 6.63 \times 10^{-29}$ m

22.

23. The ionic radii follow the order : $C^{4-} > N^{3-} > O^{2-}$ and therefore, N^{3-} would have value between 2.60 and 1.40 Å.

24.

25.

26.

27.

28.

29. The configuration corresponds to that of Cl, which has the highest negative electron gain enthalpy.

30. The general electronic configuration of d-block elements is $(n-1)d^{1-10}, ns^{1-2}$. They show variable oxidation state because d-electrons also take part in bond formation. They have take part in bond formation. They have degenerated orbitals. s and p-block elements in general do not show variable oxidation states.