WEEKLY TEST TYM -01 TEST - 11
SOLUTION Date 30-06-2019

[PHYSICS]

1. Average speed $= \dfrac{\text{total distance covered}}{\text{total time taken}}$

$$v_{av.} = \frac{\frac{x}{2}+\frac{x}{2}}{\frac{x/2}{40}+\frac{x/2}{60}} = \frac{x}{\left(\frac{x}{80}+\frac{x}{120}\right)}$$

$$= \frac{80\times 120}{(120+80)} = 48 \text{ km/h}$$

2. 200 = u × 2 – (1/2) a(2)^2 or u – a = 100 ....(i)

200 + 220 = u(2 + 4) – (1/2) (2 + 4)^{2}a

or u – 3a = 70 .....(ii)

Solving eqns. (i) and (ii), we get; a = 15 cm/s^2 and u = 115 cm/s.

Further, v = u – at = 115 – 15 × 7 = 10 cm/sec.

3. When a body slides on an inclined plane, component of weight along the plane produces an acceleration

$$a = \frac{mg\sin\theta}{m} = g\sin\theta = \text{constt.}$$

If s be the length of the inclined plane, then

$$s = 0 + \frac{1}{2}at^2 = \frac{1}{2}g\sin\theta \times t^2$$

$\therefore$ $\dfrac{s'}{s} = \dfrac{t'^2}{t^2}$ or $\dfrac{s}{s'} = \dfrac{t^2}{t'^2}$

Given t = 4 sec and $s' = \dfrac{s}{4}$

$\therefore$ $t' = t\sqrt{\dfrac{s'}{s}} = 4\sqrt{\dfrac{s}{4s}} = \dfrac{4}{2} = 2\,\text{sec}$

4. Given that; a = 3t + 4 or $\dfrac{dv}{dt} = 3t+4$

$\therefore$ $\int_0^v dv = \int_0^t (3t+4)dt$ or $v = \dfrac{3}{2}t^2 + 4t$

$$v = \frac{3}{2}(2)^2 + 4(2) = 14 \text{ ms}^{-1}$$

5. **For first body** :

$\frac{1}{2}gt^2 = 176.4$ or $t = \sqrt{\frac{176.4 \times 2}{10}}$

or t = 5.9 s

For second body : t = 3.9 s

$$u(3.9) + \frac{1}{2}g(3.9)^2 = 176.4$$

$$3.9u + \frac{10}{2}(3.9)^2 = 176.4$$

or u = 24.5 m/s

6. The resultant velocity of the boat and river is 1.0 km/0.25 h = 4 km/h.

Velocity of the rive $= \sqrt{5^2 - 4^2} = 3\ \text{km/h}$

7. Let he be the height of the tower.

Using $v^2 - u^2 = 2as$, we get;

Here, u = u, a = – g, s = – h and v = – 3u (upward direction + ve)

∴ $9u^2 - u^2 = 2gh$ or $h = 4u^2/g$

8. $t = \sqrt{\frac{2h}{g}}$

$$s = 10 \times \frac{t}{2} - \frac{1}{2}g \times \frac{t^2}{4} = 5\sqrt{\frac{2h}{g}} - \frac{g}{8}\frac{2h}{g}$$

$v^2 - u^2 = 2gh$ or $100 = 2gh$ or $10 = \sqrt{2gh}$

$$s = \sqrt{\frac{2gh \times 2h}{4 \times g}} - \frac{h}{4} = h - \frac{h}{4} = \frac{3h}{4}$$

9. $t = \frac{1}{u + v} = \frac{1}{\frac{l}{t_1} + \frac{l}{t_2}}$

or $\frac{1}{t} + \frac{1}{t_1} + \frac{1}{t_2}$ or $t = \frac{t_1 t_2}{(t_1 + t_2)}$

10. **For first body** :

$v^2 = u^2 + 2gh$ or $(3)^2 = 0 + 2 \times 9.8 \times h$

or $h = \frac{(3)^2}{2 \times 9.8} = 0.46\ \text{m}$

For second body :

$v^2 = (4)^2 + 2 \times 9.8 \times 0.46$

∴ $v = \sqrt{(4)^2 + (2 \times 9.8 \times 0.46)} = 5\ \text{m/s}$

11. Given y = 0

Distance travelled in 10 s,

$$S_1 = \frac{1}{2}a \times 10^2 = 50a$$

Distance travelled in 20 s,

$$S_2 = \frac{1}{2}a \times 20^2 = 200a$$

∴ $S_2 = 4S_1$

12. During the first 5 seconds of the motion, the acceleration is – ve and during the next 5 seconds it becomes positive. (Example : a stone thrown upwards, coming to momentary rest at the highest point). The distance covered remains same during the two intervals of time.

13. Gain in angular KE = loss in PE

If l = length of the pole, moment of inertial of the pole about the edge $= M\left[\frac{l^2}{12}+\frac{l^2}{4}\right] = \frac{Ml^2}{3}$

Loss in potential energy $= \frac{Mgl}{2}$

Gain in angular $KE = \frac{1}{2}I\omega^2 = \frac{1}{2}\times\frac{Ml^2}{3}\times\omega^2$

$\therefore \quad \frac{1}{2}\frac{Ml}{3}\omega^2 = \frac{Mgl}{2}$ or $(l\omega)^2 = 3gl$

or $l\omega = v = \sqrt{3gl}$

$= \sqrt{3\times10\times30} = 30 ms^{-1}$

14. Let the velocity of the scooter be v ms^{-1}. Then (v – 10)100 = 100 or v = 20 ms^{-1}

15. Let x be the distance between the particles after t second. Then

$x = vt - \frac{1}{2}at^2$ .....(i)

For x to be maximum,

$\frac{dx}{dt} = 0$

or v – at = 0

or $t = \frac{v}{a}$

Putting this value in eqn. (i), we get;

$x = v\left(\frac{v}{a}\right) - \frac{1}{2}a\left(\frac{v}{a}\right)^2 = \frac{v^2}{2a}$

[CHEMISTRY]

16.

17. Charge/mass for n = 0, for $\alpha = \frac{2}{4}$, for $p = \frac{1}{1}$, for $e^- = \frac{1}{1/1837}$

18.

19. When an electron of charge e and mass m is accelerated with a potential difference V volts. K.E. = eV

$\Rightarrow \quad \frac{1}{2}mv^2 = eV$ or $v^2 = \frac{2eV}{m}$

$\Rightarrow \quad v = \sqrt{\frac{2eV}{m}}$

20.

21.

Species	$_{19}K^+$	$_{20}Ca^{2+}$	$_{21}Sc^{3+}$	$_{17}Cl^-$
No. of electrons	18	18	18	18

22. Energy of a photon, E = hν

E = 6.626 × 10^{-34} H s × 5 × 10^{14} s^{-1} = 3.313 × 10^{-19} J

∴ Energy of 1 mole of photons

= 3.313 × 10^{-19} J × 6.022 × 10^{23} mol^{-1} = 199.51 kJ mol^{-1}

23. We know that, $E = hv = hc/\lambda$

$$E = E_1 + E_2 \Rightarrow \frac{hc}{\lambda} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$$

$$\Rightarrow \frac{1}{\lambda} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} \Rightarrow \frac{1}{355} = \frac{1}{680} + \frac{1}{\lambda_2}$$

$$\therefore \lambda_2 = \frac{355 \times 680}{680 - 355} = 742.769\text{K} \approx 743 \text{ nm}$$

24. The energies of two photons are in the ratio 3 : 2, their wavelengths will be in the ratio of 2 : 3, because

$E \propto \frac{1}{\lambda}$ (according to Planck's quantum theory)

$$\therefore \frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} \Rightarrow \lambda_1 : \lambda_2 = 2 : 3$$

25. Smallest and largest amount of energy is eV and lit-atm.
1 cal = 4.184 J, 1 eV = 1.6×10^{-19} J, 1 J = 10^7 erg.
1 lit-amt = (1 L) × (1 atm)
= $(1 \times 10^{-3}\ m^3)\ (101.325 \times 10^3\ Pa)$ = 101.325 J

26. Work function = 4.0 eV = $4.0 \times 1.6 \times 10^{-19}$ J

$$= hv_0 = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{\lambda} \text{ or } \lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{4.0 \times 1.6 \times 10^{-19}} = 330 \times 10^{-9} \text{ m}$$

27. Threshod frequency $v_0 = \frac{\text{work function}}{h}$

$$= \frac{3.3 \times 1.6 \times 10^{-19}\text{ J}}{6.6 \times 10^{-34}\text{ Js}} = 8 \times 10^{14}\ s^{-1}$$

28. From $\lambda_0 = \frac{12375}{W_0}$

The maximum wavelength of light required for the photoelectron emission, $(\lambda_0)_{Li} = \frac{12375}{2.3} = 5380 Å$. Similarly

$(\lambda_0)_{Cu} = \frac{12375}{4}$ = 3094 Å.

Since the wavelength 3094 Å does not in the visible region, but it is in the ultraviolet region. Hence to work with visible light, lithium metal will be used for photoelectric cell.

29. Photo current (i) directly proportional to light intensity (I) falling on a photosensitive plate. $\Rightarrow i \propto I$

30. Stopping potential equals to maximum kinetic energy.
Since stopping potential is varying linearly with the frequency. There fore max. *KE* for both the metals also vary linearly with frequency.