WEEKLY TEST MEDICAL PLUS -02 TEST - 04 Balliwala SOLUTION Date 28-07-2019

3.

Initial velocity is zero. After dropping, velocity increases in negative (downward) direction. Just before collision with the ground velocity is negative and just after collision velocity is positive (upward). Final velocity becomes zero. This all is best represented by option (d).

4.

Initial relative velocity $= v_1 - v_2$,

Final relative velocity $= 0$

Now, $v^2 = u^2 - 2as \Rightarrow 0 = (v_1 - v_2)^2 - 2 \times a \times s$

$$\Rightarrow \quad s = \frac{(v_1 - v_2)^2}{2a}$$

If the distance between two cars is 's' then collision will take place. To avoid collision $d > s$

$$\therefore\ d > \frac{(v_1 - v_2)^2}{2a}$$

where d = actual initial distance between two cars.

5.

For P, in t sec.

$$x_1 = \frac{1}{2} X\, t^2 = \frac{Xt^2}{2} \quad \Rightarrow \quad v_1 = Xt$$

$$x_2 = (Xt)t + \frac{1}{2} 2Xt^2 \quad \Rightarrow \quad x_2 = 2Xt^2$$

$$x_p = x_1 + x_2 = \frac{5}{2} X + 2$$

For Q,

$$y_1 = \frac{1}{2}(2X)t^2 = Xt^2 \quad \Rightarrow \quad v_2 = 2Xt$$

$$y_2 = (2Xt)t + \frac{1}{2} Xt^2 = \frac{5}{2} Xt^2$$

$$y_Q = y_1 + y_2 = \frac{7}{2} Xt^2 \quad \Rightarrow \quad y_Q > x_P$$

6.

Distance travelled from time '$t-1$' sec to 't' sec is

$$S = u + \frac{a}{2}(2t-1) \quad \ldots(i)$$

from given condition $S = t$ ...(ii)

from (i) and (ii), $t = u + \frac{a}{2}(2t-1)$

$\Rightarrow \quad u = \frac{a}{2} + t(1-a).$

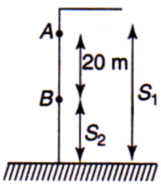
Since u and a are arbitrary constants, and they must be constant for every time.

So, coefficient of t must be equal to zero.

$\Rightarrow \quad 1 - a = 0 \Rightarrow a = 1$ for $a = 1, u = \frac{1}{2}$unit

Initial speed = $\frac{1}{2}$ unit

7.



Velocity of 1st stone when passing at A

$$V^2 = 0 + 2.10.5 \Rightarrow V = 10 \text{ m/s}$$

And $S_1 - S_2 = 20$ m.

$$\Rightarrow \quad \left(10 \cdot t + \frac{1}{2}10 \cdot t^2\right) - \left(\frac{1}{2} \cdot 10 \cdot t^2\right) = 20$$

At $t = 2$ s, $S_2 = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times 2^2 = 20$ m

Hence height of the tower,

$$H = S_1 + S_2 = 25 + 20 = 45 \text{ m.}$$

8.

$v_0 \rightarrow$ maximum speed

$$s = \frac{v_0 + 0}{2}t_1 \Rightarrow t_1 = \frac{25}{v_0}$$

$$t_2 = \frac{35}{v_0}$$

$$5s = \frac{v_0 + 0}{2}t_3 \Rightarrow t_3 = \frac{10s}{v_0}$$

$$v_{av} = \frac{s + 3s + 5s}{t_1 + t_2 + t_3}$$

$$v_{av} = \frac{9s}{\frac{2s}{v_0} + \frac{3s}{v_0} + \frac{10s}{v_0}} \Rightarrow \frac{v_{av}}{v_0} = \frac{3}{5}$$

9.

From $S = ut + \frac{1}{2}at^2$

$$S_1 = \frac{1}{2}a(P-1)^2 \text{ and } S_2 = \frac{1}{2}a\,P^2 \qquad [\text{As } u = 0]$$

From $S_n = u + \frac{a}{2}(2n-1)$

$$S_{(P^2-P+1)^{\text{th}}} = \frac{a}{2}[2(P^2 - P + 1) - 1]$$

$$= \frac{a}{2}[2P^2 - 2P + 1]$$

It is clear that $S_{(P^2-P+1)^{\text{th}}} = S_1 + S_2$

10.

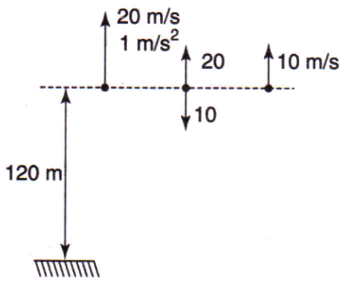
Between time interval 20 sec to 40 sec, there is non-zero acceleration and retardation.

Hence, distance travelled during this interval

= Area between time interval 20 sec to 40 sec

$= \frac{1}{2} \times 20 \times 3 + 20 \times 1 = 30 + 20 = 50$ m.

11.

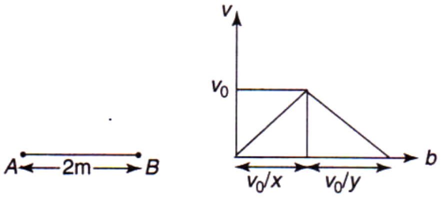


$$-120 = 10t\,\frac{1}{2} - \times 10 \times t^2$$

$$t^2 - 2t - 24 = 0$$

$$t = 6 \text{ sec}$$

12.



Total time taken = 4 min

(i) $\frac{v_0}{x} + \frac{v_0}{y} = 4$ min.

(ii) Total distance travelled = 2 km

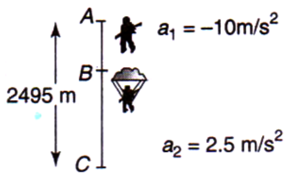
$\Rightarrow$ Area under v-t graph = 2 km

$$\frac{1}{2} \times \frac{v_0}{x} \times v_0 + \frac{1}{2} \times \frac{v_0}{y} \times v_0 = 2 \text{ km}$$

From (i) and (ii), $\frac{1}{x} + \frac{1}{y} = 4$

13.

Suppose the man drops at A, from A to B he is falling freely and then at B parachute opens out and he falls with a retardation of 2.5 m/s^2.



$\therefore \quad AB = \frac{1}{2} \times 10 \times 10^2 = 500$ m

$\therefore \quad BC = AC - AB = 2495 - 500 = 1995$ m.

Velocity at B,

$V_B = gt = 10 \times 10 = 100$ m/s$\downarrow$

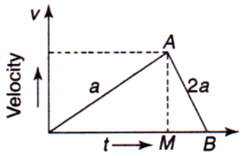
Velocity at C, $V_C = \sqrt{V_B^2 + 2ay}$

$= \sqrt{100^2 + 2 \times 2.5 \times (-1995)}$

$= \sqrt{25} = 5$ m/s $\downarrow$.

14.

Let OAB be the velocity-time graph of the lift. The ordinate at A (i.e., AM) represents maximum velocity.



Total distance travelled

$= \text{area of the } \Delta OAB = \frac{1}{2} \times OB \times AM$

$AM = v,\ OM = t_1,\ t_1 + t_2 = OB = t,\ MB = t_2$

$\therefore \quad \Delta OAB = \frac{1}{2} \times tv = h$

or $\quad vt = 2h \quad$ ...(i)

Now $\quad \frac{v}{t_1} = a$ or $t_1 = \frac{v}{a} \quad$ ...(ii)

and $\quad \frac{v}{t_2} = 2a$ or $t_2 = \frac{v}{2a} \quad$ ...(iii)

Adding (ii) and (iii)

$$t = t_1 + t_2 = \frac{v}{a} + \frac{v}{2a} = \frac{3v}{2a} = \frac{3}{2a} \times \frac{2h}{t}$$

or $\quad at^2 = 3h \quad \Rightarrow \quad h = \frac{at^2}{3}$

15.

$\because v = 0 + na \Rightarrow a = \frac{v}{n}$

Now, distance travelled in n sec.

$\Rightarrow \quad S_n = \frac{1}{2}an^2$

and distance travelled in $(n-2)$ sec

$\Rightarrow \quad S_{n-2} = \frac{1}{2}a(n-2)^2$

$\therefore$ Distance travelled in last two seconds,

$$= S_n - S_{n-2}$$

$$= \frac{1}{2}an^2 - \frac{1}{2}a(n-2)^2$$

$$= \frac{a}{2}\left[n^2 - (n-2)^2\right]$$

$$= \frac{a}{2}[n + (n-2)][n - (n-2)]$$

$$= a(2n-2)$$

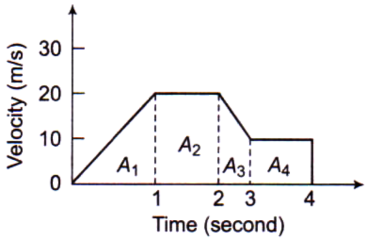
$$= \frac{v}{n}(2n-2)$$

$$= \frac{2v(n-1)}{n}$$

16.

Distance = Area under $v-t$ graph

$= A_1 + A_2 + A_3 + A_4$



$$= \frac{1}{2}\times 1\times 20 + (20\times 1) + \frac{1}{2}(20+10)\times 1 + (10\times 1)$$

$= 10 + 20 + 15 + 10 = 55$ m

17.

Average velocity = 0 because net displacement of the body is zero.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Time of flight}}$$

$$= \frac{2H_{max}}{2u/g}$$

$$\Rightarrow \quad v_{av} = \frac{2u^2/2g}{2u/g} \quad \Rightarrow v_{av} = \frac{u}{2}$$

Velocity of projection = v (given)

$$\therefore \quad v_{av} = \frac{v}{2}$$

18.

$$V_{avg} = \frac{x_f - x_i}{t_f - t_i}$$

$$= \frac{(1\times 5^2+1)-(1\times 3^2+1)}{5-3} = \frac{16}{2} = 8 \text{ ms}^{-1}$$

19.

Let the initial velocity of ball be u.

Time of rise $t_1 = \frac{u}{g+a}$ and height reached $h = \frac{u^2}{2(g+a)}$

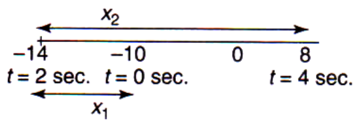
Time of fall t_2 is given by

$$\frac{1}{2}(g-a)t_2^2 = \frac{u^2}{2(g+a)}$$

$$\Rightarrow \quad t_2 = \frac{u}{\sqrt{(g+a)(g-a)}} = \frac{u}{(g+a)}\sqrt{\frac{g+a}{g-a}}$$

$$\therefore \quad t_2 > t_1 \text{ because } \frac{1}{g+a} < \frac{1}{g-a}$$

20.



$$x = t^3 - 3t^2 - 10$$

$$v = \frac{dx}{dt} = 3t^2 - 6t$$

Now, $v = 0$ gives

$t = 0$ and $t = 2$ sec.

Velocity will become zero at $t = 2$ sec., so particle will change direction after $t = 2$ sec.

At $t = 0$

$$x_{(0\text{ sec})} = -10$$

At $t = 2$ sec.

$$x_{(2\text{ sec})} = 2^3 - 3(2)^2 - 10 = 8 - 12 - 10 = -14$$

At $t = 4$ sec.

$$x_{(4\text{ sec})} = 4^3 - 3(4)^2 - 10$$

$$= 64 - 48 - 10 = 6$$

Distance travelled $= x_1 + x_2$

$$= |-14 - (-10)| + |6 - (-14)| = 4 + 20 = 24$$

Distance Travelled = 24 units.

21.

$u = 200$ m/s, $v = 100$ m/s, $s = 0.1$ m

$$a = \frac{u^2 - v^2}{2s}$$

$$= \frac{(200)^2 - (100)^2}{2 \times 0.1} = 15 \times 10^4 \text{ m/s}^2$$

22.

Velocity acquired by body in 10 s

$$v = 0 + 2 \times 10 = 20 \text{ m/s}$$

and distance travelled by it in 10 s

$$S_1 = \frac{1}{2} \times 2 \times (10)^2 = 100 \text{ m}$$

then it moves with constant velocity (20 m/s) for 30 s

$$S_2 = 20 \times 30 = 600 \text{ m}$$

After that due to retardation (4 m/s^2) it stops

$$S_3 = \frac{v^2}{2a} = \frac{(20)^2}{2 \times 4} = 50 \text{ m}$$

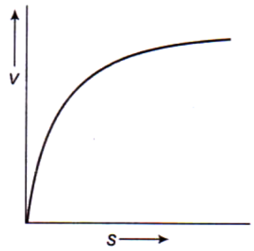
Total distance travelled $S_1 + S_2 + S_3 = 750$ m

23.

Since, body starts from rest $u = 0$

$\therefore \quad v^2 = 2as$

Which is general equation of parabola



$y^2 = 4ax$, i.e., graph should be parabola symmetric to displacement axis.

As ball is thrown upwards velocity decreases as

24.

When two spheres are dropped they will acquire the same acceleration which is due to gravitational effect. And also the acceleration due to gravity is independent of mass of the body. Hence, the two spheres have the same acceleration

25.

The two cars (say A and B) are moving with same velocity, the relative velocity of one (say B) with respect to the other

$$A,\ \vec{v}_{BA} = \vec{v}_B - \vec{v}_A = v - v = 0$$

So the relative separation between them (= 5 km) always remains the same.

Now if the velocity of car (say C) moving in opposite direction to A and B, is $\vec{v}_C$ relative to ground then the velocity of car C relative to A and B will be $\vec{v}_{rel.} = \vec{v}_C - \vec{v}$

But as $\vec{v}$ is opposite to v_C, so $v_{rel} = v_c - (-30) = (v_C + 30)$ km/hr

So, the time taken by it to cross the cars A and B

$$t = \frac{d}{v_{rel}} \Rightarrow \frac{4}{60} = \frac{5}{v_C + 30}$$

$\Rightarrow \quad v_C = 45$ km/hr

26.

If the particle is moving in a straight line under the action of a constant force or under constant acceleration (a)

Using, $s = ut + \frac{1}{2}at^2$.

Since the body starts from the rest $u = 0$

$\therefore \quad s = \frac{1}{2}at^2$

Now, $s_1 = \frac{1}{2}a(10)^2$ ...(i)

and $s_2 = \frac{1}{2}a(20)^2$ ...(ii)

Dividing Eq. (i) and Eq. (ii), we get

$$\frac{s_1}{s_2} = \frac{(10)^2}{(20)^2} \Rightarrow s_2 = 4s_1$$

27.

Using $\vec{v} = \vec{u} + \vec{a}t$

$$\vec{v} = (3\hat{i} + 4\hat{j}) + (0.4\hat{i} + 0.3\hat{j}) \times 10$$

$$\Rightarrow \quad \vec{v} = 7\hat{i} + 7\hat{j}$$

hence speed $|v| = 7\sqrt{2}$

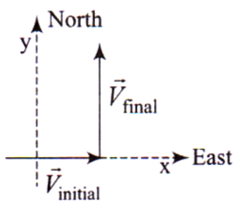
28.

We have $v = \sqrt{2gh}$

$$= \sqrt{2 \times 10 \times 20} = \sqrt{400} = 20 \text{ ms}^{-1}$$

29.

$$\text{Average acceleration} = \frac{\text{Change in velocity}}{\text{Total time}}$$



$\overrightarrow{v_L} = 30\hat{i}$ m/s and $\overrightarrow{v_i} = 40\hat{j}$ m/s

$$\Delta\vec{v} = \overrightarrow{v_f} - \overrightarrow{v_i} = 40\hat{j} - 30\hat{i} \text{ m/s}$$

$$|\Delta\vec{v}| = \sqrt{30^2 + 40^2} = \sqrt{900 + 1600} = 50 \text{ m/s}$$

$$\vec{a} = \frac{|\overrightarrow{V_f} - \overrightarrow{V_i}|}{\Delta t} = \frac{\sqrt{50}}{10} = 50 \text{ ms}^{-2}$$

30.

Velocity $v = \frac{s}{t} \Rightarrow s = vt$

The average speed of particle $v_{av} = \dfrac{s + s}{\dfrac{s}{v_1} + \dfrac{s}{v_2}}$

$$\Rightarrow \quad v_{av} = \frac{2v_1 v_2}{v_1 + v_2}$$

31.

For a particle released from a certain height the distance covered by the particle in relation with time is given by, $h = \frac{1}{2}gt^2$

For first 5 sec, $h_1 = \frac{1}{2}g(5)^2 = 125$

Further next 5 sec, $h_1 + h_2 = \frac{1}{2}g(10)^2 = 500$

$\Rightarrow \quad h_2 = 375$

$h_1 + h_2 + h_3 = \frac{1}{2}g(15)^2 = 1125$

$\Rightarrow \quad h_3 = 625$

$h_1 = 3h_1, h_3 = 5h_1$

or $\quad h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

32.

$$V = At + Bt^2 \Rightarrow \frac{dx}{dt} = At + Bt^2$$

$$\Rightarrow \int_0^x dx = \int_1^2 (At + Bt^2)\,dt$$

$$\Rightarrow x = \frac{A}{2}(2^2 - 1^2) + \frac{B}{3}(2^3 - 1^3) = \frac{3A}{2} + \frac{7B}{3}$$

33.

According to problem
Distance travelled by body A in 5[th] sec and distance travelled by body B in 3[rd] sec of its motion are equal.

$$0 + \frac{a_1}{2}(2 \times 5 - 1) = 0 + \frac{a_2}{2}[2 \times 3 - 1]$$

$$9a_1 = 5a_2 \Rightarrow \frac{a_1}{a_2} = \frac{5}{9}$$

34.

$$H_{\max} = \frac{u^2}{2g} \Rightarrow H_{\max} \propto \frac{1}{g}$$

On planet B value of g is 1/9 times to that of A. So value of $H_{\max}$ will become 9 times, i.e., $2 \times 9 = 18$ metre

35.

Effective speed of the bullet

= speed of bullet + speed of police jeep

= 180 m/s + 45 km/h = (180 + 12.5) m/s

= 192.5 m/s

Speed of thief 's jeep = 153 km/h = 42.5 m/s
Velocity of bullet w.r.t thief 's car

= 192.5 – 42.5 = 150 m/s

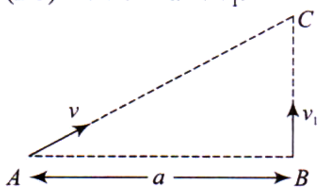
36.

Let two boys meet at point C after time 't' from the starting. Then $AC = vt$, $BC = v_1 t$

$$(AC)^2 = (AB)^2 + (BC)^2 \Rightarrow v^2t^2 = a^2 + v_1^2 t^2$$

By solving we get

$$\sqrt{\frac{a^2}{v^2 - v_1^2}}$$



37.

We are given

$$x = ae^{-\alpha t} + be^{\beta t}$$

Velocity $v = \frac{dx}{dt} = \frac{d}{dt}(ae^{-\alpha t} + be^{\beta t})$

$$= a \cdot e^{-\alpha t}(-\alpha) + be^{\beta t} \cdot \beta$$

$$= -a\alpha e^{-\alpha t} + b\beta e^{\beta t}$$

Acceleration $= -a\alpha e^{-\alpha t}(-\alpha) + b\beta e^{\beta t} \cdot \beta$

$$= a\alpha^2 e^{-\alpha t} + b\beta^2 e^{\beta t}$$

Acceleration is positive so velocity goes on increasing with time.

38.

Distance travelled by the particle is $x = 40 + 12\,t - t^3$

We know that velocity is rate of change of distance

i.e., $v = \frac{dx}{dt}$.

$\therefore$ $v = \frac{d}{dt}(40 + 12t - t^3) = 0 + 12 - 3t^2$

but final velocity $v = 0$

$$12 = 3t^2 = 0 \text{ or } t^2 = \frac{12}{3} = 4$$

or $t = 2\,s$

Hence, distance travelled by the particle before coming to rest is given by

$$x = 40 + 12(2) - (2)^3 = 56 \text{ m}$$

39.

We define

$$\text{Average speed} = \frac{\text{Distance travelled}}{\text{Time taken}} = \frac{d}{T}$$

Let t_1 and t_2 be times taken by the car to go from X to Y and then from Y to X respectively.

Then, $t_1 + t_2 = \left[\frac{XY}{v_u}\right] + \left[\frac{XY}{v_d}\right] = XY\left(\frac{v_u + v_d}{v_u v_d}\right)$

Total distance travelled $d = XY + XY = 2XY$

Therefore, average speed of the car for this round trip is

$$v_{av} = \frac{2XY}{XY\left(\frac{v_u + v_d}{v_u v_d}\right)} \quad \text{or} \quad v_{av} = \frac{2v_u v_d}{v_u + v_d}$$

40.

Distance travelled by the particle in nth second,

$$S_{n\text{th}} = u + \frac{1}{2}a(2n-1)$$

Where u is initial speed and a is acceleration of the particle.

Here, $n = 3, u = 0, a = \frac{4}{3}$ m/s^2

$\therefore \quad S_{3\text{rd}} = 0 + \frac{1}{2} \times \frac{4}{3} \times (2 \times 3 - 1) = \frac{10}{3}$ m

41.

Let u and v be the first and final velocities of particle and a and s be the constant acceleration and distance covered by it.

Using $v^2 = u^2 + 2as$

$\Rightarrow \quad (20)^2 = (10)^2 + 2a \times 135$

or $\quad a = \frac{300}{2 \times 135} = \frac{10}{9}$ ms^{-2}

Now using, $v = u + at$

$$t = \frac{v-u}{a} = \frac{20-10}{(10/9)} = \frac{10 \times 9}{10} = 9 \text{ s}$$

42.

The relative velocity of scooter w.r.t. bus,

$$\overrightarrow{v_{S,B}} = \overrightarrow{v_S} - \overrightarrow{v_B} = \overrightarrow{v_S} - 10 \quad \ldots\text{(i)}$$

$$\text{Relative velocity} = \frac{\text{Relative displacement}}{\text{time}}$$

$$v_S - 10 = \frac{1000}{100} = 10 \quad \Rightarrow \quad v_S = 20 \text{ m/s}$$

43.

All other motions are not along the straight line except (d).

44.

$$s = 2t^2 + 2t + 4,\ a = \frac{d^2s}{dt^2} = 4\ \text{m/s}^2$$

45.

$$t = \sqrt{\frac{2h}{g}} \Rightarrow \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$$

[CHEMISTRY]

46. $$\frac{E_2}{E_1} = \frac{\frac{1}{4}}{\frac{1}{1}} \Rightarrow E_2 = -\frac{13.6\text{eV}}{4} = -3.4\ \text{eV}$$

Excitation energy = – 3.4 – (–13.6) = 10.2 eV

47. $$\Delta x = \Delta P \Rightarrow (\Delta P)^2 = \frac{h}{4\pi} \Rightarrow \Delta P = \frac{1}{2}\sqrt{\frac{h}{\pi}}$$

$$\Delta V = \frac{\Delta P}{m} = \frac{1}{2m}\sqrt{\frac{h}{\pi}}$$

48. $$\frac{E_1}{E_2} = \frac{\frac{hc}{\lambda_1}}{\frac{hc}{\lambda_2}} = \frac{\lambda_2}{\lambda_1}$$

$$\Rightarrow \frac{\lambda_2}{\lambda_1} = \frac{25}{50} \Rightarrow \lambda_1 = 2\lambda_2$$

49. Order of difference of energy $E_2 - E_1 > E_3 - E_2 > E_4 - E_3 > \ldots$
So, $E_6 - E_1 > E_5 - E_3 > E_5 - E_4 > E_6 - E_5$

50. All have isotopic number = 1

51. $$\bar{v} = \frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) = \frac{R}{4}$$

$$\lambda = \frac{4}{R} = 4 \times 9.11 \times 10^{-8}\ \text{m} = 4 \times 9.11 \times 100 \times 10^{-10}\ \text{m} = 3644\text{Å}$$

52. $$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right),$$ for the first spectral line

$$= R\left(\frac{1}{4} - \frac{1}{9}\right) = R \times \frac{5}{36}\text{cm}^{-1}$$

$$\lambda = \frac{36}{5R}\text{cm}$$

53. $\frac{m_A}{m_B} = \frac{1}{4}$

$$\frac{\lambda_A}{\lambda_B} = \frac{\left(\frac{h}{mv}\right)_A}{\left(\frac{h}{mv}\right)_B} = \frac{m_B}{m_A} = 4$$

$\lambda_A : \lambda_B = 4 : 1$

54. $\lambda = \frac{h}{mv}; KE = \frac{1}{2}mv^2 \quad \Rightarrow \quad KE = \frac{h^2}{2m\lambda^2}$

For h and λ being constant, $KE \propto \frac{1}{m}$

55. No. of spectral lines $\Sigma\Delta n = \Sigma(6 - 3)$ S3 = 3 + 2 + 1 = = 6. There is no line in Balmer series as the electron comes to 3r shell.

56. E = 1eV = 1.6×10^{-19} J

$$E = hv = \frac{hc}{\lambda} \quad \Rightarrow \quad \lambda = \frac{hc}{E}$$

$$\lambda = \frac{6.6 \times 10^{-34}\ Js \times 3 \times 10^8\ ms^{-1}}{1.6 \times 10^{-19}\ J} = 12.375 \times 10^{-7}\ m = 12375 Å$$

57. h and mvr have same units kg m^2s^{-1}.

58. $\frac{\text{Ionisation energy of } Li^{2+}}{\text{Ionisation energy of } Be^{3+}} = \frac{\text{Ionisation energy of H} - \text{atom} \times (3)^2}{\text{Ionisation energy of H} - \text{atom} \times (4)^2} = \frac{9}{16}$

59.

60. New energy = – 13.6 + 12.1 = – 1.5 eV

$$E_n = \frac{-13.6}{n^2} \quad \Rightarrow n^2 = \frac{-13.6}{-1.5} = 9 \quad \Rightarrow \quad n = 3$$

Number of spectral lines in Balmer series for $3 \rightarrow 2$ transition would be one only

61.

62. $\frac{(\Delta x.m.\Delta x)_e}{(\Delta x.m.\Delta x)_p} = \frac{h/4\pi}{h/4\pi} = 1$

$$\frac{m_e - \Delta v_e}{m_p.\Delta v_p} = 1$$

$$\frac{\Delta v_e}{\Delta v_p} = \frac{m_p}{m_e} = 1836.1$$

63. $KE = \frac{1}{2}mv^2; KE = eV$

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

64. n^{th} shell has n wavelengths, i.e., $n\lambda = 2\pi r_3$

$$\lambda = \frac{2\pi r^3}{n} = \frac{2\pi}{3}\left(\frac{r_1 \times 3^2}{Z}\right) \qquad \left[\because r_n = \frac{r_1 \times n^2}{Z}\right]$$

$$= \frac{6\pi r_1}{Z}$$

65.

66. E = Power (watts) × time (seconds) = 10 × 10 = 100 J; λ = 1000 Å = 1000 × 10^{-10} m

$$n = \frac{E}{h\nu} = \frac{E\lambda}{hc} = \frac{100 \times 1000 \times 10^{-10}}{6.6 \times 10^{-34} \times 3 \times 10^{8}} = \frac{100}{19.8} \times 10^{19} = 5.05 \times 10^{19}$$

67. Velocity $\propto \frac{Z}{n}$

68.

The set of quantum number

$n = 3, l = 1, m = -1$

stands for a single p-orbital which will have at the most **2-electrons.**

69.

$m = 0$, represents only **one** orbital.

70.

Cr ($Z = 24$) : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^1$

Total electrons in $l = 1$, *i.e.*, p-subshell = 6 + 6 = **12**

Total electrons in $l = 2$, *i.e.*, d-subshell = **5.**

71.

Cr^{2+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$: d-electrons = 4

Ne : $1s^2 2s^2 2p^6$: s-electrons = 2 + 2 = 4

Fe : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$: d-subshell has 4 unpaired electrons.

O : $1s^2 2s^2 2p^4$: p-electrons = 4

Fe^{3+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$: d-electrons = 5

72.

'$n + l$' rule is not applicable to H-atom. Energy system is

$$1s < 2s = 2p < 3s = 3p = 3d < \ldots .$$

So, energy in H-atom is related with ***n* value** only.

73.

F ($Z = 9$) : $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^2$

9[th] electron is $2p_y^1$, which has $n = 2, l = 1, m = \pm 1$ (By convention, for p_x and p_y),

$s = +\frac{1}{2}$ or $-\frac{1}{2}$.

74.

75.

Ti^{2+} ($Z = 22$), **V^{3+}** ($Z = 23$), **Cr^{4+}** ($Z = 24$) and **Mn^{5+}** ($Z = 25$) have same electronic configuration [Ar] $3d^2$. They have the same number of $3d$-electrons, *i.e.*, 2.

76.

$$\frac{(\Delta x \cdot m \cdot \Delta v)_e}{(\Delta x \cdot m \cdot \Delta v)_p} = \frac{h/4\pi}{h/4\pi} = 1$$

$$\frac{m_e \cdot \Delta v_e}{m_p \cdot \Delta v_p} = \mathbf{1}$$

$$\frac{\Delta v_e}{\Delta v_p} = \frac{m_p}{m_e} = \mathbf{1836:1}$$

77.

78.

79.

80. **Mn^{2+} due to presence of five unpaired ele electrons has maximum magnetic moment**.
81.
82.
83.
84. $\lambda = \frac{h}{mv}; m = lg = 10^{-3}\ kg, v = 100 ms^{-1}, h = 6.626\times10^{-34}\ Js$

$\therefore \quad \lambda \frac{6.626\times10^{-34}\ Js(kgm^2s^{-1})}{10^{-3}\ kg\times100\ ms^{-1}} = 6.626\times10^{-33}\ m$

85.
86. **Number of orbitals in an energy level $n^2 = 4^2 = 16$**
87. **Outermost electron of sodium is $3s^1$.**
88. **${}_{29}Cu = [{}_{18}Ar]3d^{10}4s^1 \quad \therefore \quad Cu^{2+} = [{}_{18}Ar]3d^94s^0$**

98. Species :	**${}_{19}K$**	**${}_{20}Ca^{2+}$**	**${}_{21}Sc^{3+}$**	
No. of es	**19–1 = 18**	**20–2 = 18**	**21–3 = 18**	**17 + 1 = 18**

89. 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)

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

90. **${}_{37}Rb : [Kr]5s^1$**

$\therefore$ **Valence electron in R_b is $5s^1$ and its quantum numbers are :**

n = 5, l = 0, m = 0, $s = +\frac{1}{2}$