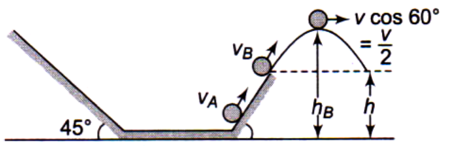
WEEKLY TEST MEDICAL PLUS -02 TEST - 06 Balliwala
SOLUTION Date 11-08-2019

[PHYSICS]

1.

After collision the balls exchange their velocities, i.e.,

$$v_A = \sqrt{2gh} \text{ and } v_B = \sqrt{2g(4h)} = 2\sqrt{2gh}$$

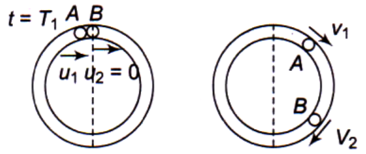


Height attained by A will be: $h_A = \frac{v_A^2}{2g} = h$

But path of B will be first straight line and then parabolic as shown in figure. After calculations we can show that: $h_B = \frac{13}{4}h$ and $\frac{h_A}{h_B} = \frac{4}{13}$

2.

$$T_1 = \frac{\pi R}{u_1} \qquad (1)$$



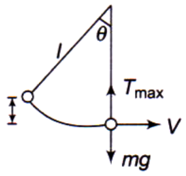
Time taken to collide A and B again:

$$T_2 - T_1 = \frac{2\pi R}{v_2 - v_1} \Rightarrow T_2 - T_1 = \frac{2\pi R}{eu_1} \qquad (2)$$

$$(2) \div (1) \qquad \Rightarrow \frac{T_2}{T_1} = \frac{2+e}{e}$$

3.

Maximum tension in the string is in its lowest position.



$\therefore$ Speed of mass m in its lowest position is

$$v^2 = 2gh = 2gl(1 - \cos\theta)$$

$$T_{max} - mg = \frac{mv^2}{l}$$

$$T_{max} = mg + 2mg(1 - \cos\theta)$$

$$= mg(3 - \cos\theta)$$

Block of mass 4m does not move.

So $\quad \mu(4mg) \geq T_{max}$

or $\quad 5\mu mg \geq mg(3 - \cos\theta)$ or $\mu \geq \left(\frac{3 - \cos\theta_0}{4}\right)$

4.

Let required angle is θ.

Work done = change in KE

$\Rightarrow \quad Fs\cos\theta = 40 - 0$

$\Rightarrow \quad 20 \times 4\cos\theta = 400 \Rightarrow \theta = 60°$

5.

$KE + PE = \text{constant} \Rightarrow \frac{1}{2}mv^2 + mgh = C$

$\Rightarrow \quad \frac{v^2}{2} + gh = \frac{C}{m} = \text{constant}$

6.

$P = \frac{mgh}{t}$ or $m = \frac{P \times t}{g \times h}$

$m = \frac{3000\ \text{W} \times 60\ \text{s}}{10\ \text{ms}^{-2} \times 10\ \text{m}} = 1200\ \text{kg} = 1200\ \text{litre}$

7.

$F = \frac{-dU}{dx}$ it is clear that slope of $U - x$ curve is zero at point B and C. $\therefore F = 0$ for point B and C

8.

Let tension at lowest point is T_L and at highest point is T_H. Given $\dfrac{T_L}{T_H} = 4$

We know that $T_L - T_H = 6$ mg

Solve there equation to find T_H and then apply

$T_H = -mg + \dfrac{mv_H^2}{l}$ to get the value of v_H

9.

Let, M = mass of man, m = mass of boy

V = speed of man, v = speed of boy

Given: $\dfrac{1}{2}MV^2 = \dfrac{1}{2}\left(\dfrac{1}{2}mv^2\right)$, As $m = \dfrac{M}{2}$

So $\quad \dfrac{1}{2}MV^2 = \dfrac{1}{2}\left(\dfrac{1}{2} \times \dfrac{M}{2}v^2\right)$

Hence, $v^2 = 4V^2$ or $v = 2$ V

When the man speeds up by 1 m/s, then we get

$$\frac{1}{2}M(V+1)^2 = \frac{1}{2}mv^2 = \frac{1}{2}\frac{M}{2}(4V^2)$$

or $\quad (V+1)^2 = 2V^2$ or $V^2 - 2V - 1 = 0$

Solving we get: $V = 2.4\ \text{ms}^{-1}$ and $v = 2\text{V} = 4.8\ \text{ms}^{-1}$

10.

Let v be the velocity with which the bullet will emerge. Now, change in kinetic energy = work done

For first case: $\dfrac{1}{2}m(100)^2 - \dfrac{1}{2}m(0)^2 = F \times 1 \quad$ (i)

For second case: $\dfrac{1}{2}m(100)^2 - \dfrac{1}{2}mv^2 = F \times 0.5 \quad$ (ii)

Dividing equation (ii) by (i), we get

$$\frac{(100)^2 - v^2}{(100)^2} = \frac{0.5}{1} = \frac{1}{2} \text{ or } v = \frac{100}{\sqrt{2}} = 50\sqrt{2}\ \text{m/s}$$

11.

Suppose F be the resistance force offered by the plank. Let thickness of plank be x.

For first case: $Fx = \dfrac{1}{2}m[(100)^2 - (80)^2] \quad$ (i)

For second case, let V be the final velocity of bullet;

then $Fx = \dfrac{1}{2}m[(80)^2 - V^2] \quad$ (ii)

From (i) and (ii) $80^2 - \text{V}^2 = 100^2 - 80^2$

or $\quad V = 20\sqrt{7}$ m/s

12.

Let ball rebound with speed v, so

$$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 20} = 20 \text{ m/s}$$

Energy just after rebound

$$E = \frac{1}{2} \times m \times v^2 = 200 \text{ m}$$

50% energy loses in collision means just before collision energy is 400 m

By using energy conservation,

$$\frac{1}{2} mv_0^2 + mgh = 400 \text{ m}$$

$$\Rightarrow \quad \frac{1}{2} mv_0^2 + m \times 10 \times 20 = 400 \Rightarrow v_0 = 20 \text{ m/s}$$

13.

Pressure = 150 mm Hg

Pumping rate $= \frac{dV}{dt} = \frac{5 \times 10^{-3}}{60} \text{ m}^3/\text{s}$

Power of heart $P \cdot \frac{dV}{dt} = \rho gh \times \frac{dV}{dt}$

$$= (13.6 \times 10^3 \text{ kg/m}^3)(10) \times (0.15) \times \frac{5 \times 10^{-3}}{60}$$

$$= \frac{13.6 \times 5 \times 0.15}{6} = 1.70 \text{ watt}$$

14.

When minimum speed of body is $\sqrt{5gR}$, then no matter from where it enters the loop, it will complete full vertical loop.

15.

Both fragments will possess the equal linear momentum

$$m_1v_1 = m_2v_2 \Rightarrow 1 \times 80 = 2 \times v_2 \Rightarrow v_2 = 40 \text{ m/s}$$

$\therefore$ Total energy of system

$$= \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

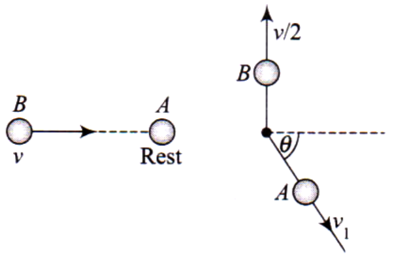
$$= \frac{1}{2} \times 1 \times (80)^2 + \frac{1}{2} \times 2 \times (40)^2$$

$$= 4800 \text{ J} = 4.8 \text{ kJ}$$

16.

17.

Let velocity of A is v_1 at angle θ with initial direction of motion of B.



Before collision After collision

$$m_1 v_1 \cos\theta = m_2 v \quad ...(i)$$

$$m_1 v_1 \sin\theta = m_2 v/2 \quad ...(ii)$$

Divide: (ii) by (i) $\tan\theta = \frac{1}{2} \Rightarrow \theta = \tan^{-1}\frac{1}{2}$

18.

Applied force $\vec{F} = 3\hat{i} + \hat{j}$

Displacement $\vec{S} = \vec{r}_2 - \vec{r}_1 = 2\hat{i} + 3\hat{j} - 2\hat{k}$

Hence work done $W = \vec{F}\cdot\vec{S} = 6 + 3 + 0 = 9$ J

19.

Initial linear momentum $= P_i = 0$

Final momentum $P_f = 0 = m\upsilon\hat{i} + m\upsilon\hat{j} + \vec{P}_3$

$\Rightarrow \quad P_3 = m\upsilon\sqrt{2}$

$$\text{Total KE } = \frac{P_3^2}{2\times 2m} + \frac{1}{2}m\upsilon^2 + \frac{1}{2}m\upsilon^2$$

$$= \frac{2\,m^2\upsilon^2}{4m} + m\upsilon^2 = \frac{3\,m\upsilon^2}{2}$$

20.

Power $k = F\cdot v = (ma)v = m\frac{dv}{dt}v = mv\frac{dv}{dt}$

Rearranging we get, $vdv = \frac{k}{m}dt$

Integrating both side,

$$\int_0^v vdv = \frac{k}{m}\int_0^t dt \Rightarrow \frac{v^2}{2} = \frac{k}{m}t$$

$$\Rightarrow \quad v = \sqrt{\frac{2\,kt}{m}} \qquad \text{(i)}$$

Force acting on particle $F = m\dfrac{dv}{dt}$ (ii)

Differentiating equation (i) w.r.t time

$$\frac{dv}{dt} = \left(\sqrt{\frac{2k}{m}}\right)\frac{dt^{1/2}}{dt} = \left(\sqrt{\frac{2k}{m}}\right)\frac{1}{2}t^{-1/2}$$

$$= \left(\sqrt{\frac{k}{2m}}\right)t^{-1/2}$$

Subsituting the value of $\dfrac{dv}{dt}$ in equation (ii) we get

$$F = m\frac{dv}{dt} = m\left(\sqrt{\frac{k}{2m}}\right)t^{-1/2} = \left(\sqrt{\frac{mk}{2}}\right)t^{-1/2}$$

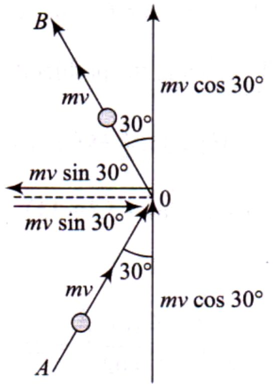
21.

The vector $\vec{OA}$ represents the momentum of the object before the collision, and the vector $\vec{OB}$ that after the collision. The vector $\vec{AB}$ represents the change in momentum of the object $\Delta\vec{P}$. As the magnitudes of $\vec{OA}$ and $\vec{OB}$ are equal, the components of $\vec{OA}$ and $\vec{OB}$ along the wall are equal and in the same direction, while those perpendicular to the wall are equal and opposite. Thus, the change in momentum is due only to the change in direction of the perpendicular components.

Hence, $\Delta p = OB \sin 30° - (-OA \sin 30°)$

$= mv \sin 30° - (-mv \sin 30°)$

$= 2mv \sin 30°$



Its time rate will appear in the form of average force acting on the wall.

$$F \times t = 2\,mv \sin 30^\circ$$

Or $$F = \frac{2\,mv \sin 30^\circ}{t}$$

Given, $m = 0.5$ kg, $v = 12$ m/s, $t = 0.25$ s

$$\theta = 30^\circ$$

Hence, $F = \dfrac{2 \times 0.5 \times 12 \sin 30^\circ}{0.25} = 24$ N

22.

Net work done in sliding a body up to a height h on inclined plane

= Work done against gravitational force

+ Work done against frictional force

$\Rightarrow \quad W = W_g + W_f \qquad$ (i)

but $\quad W = 300$ J

$$W_g + mgh = 2 \times 10 \times 10 = 200 \text{ J}$$

Putting in Eq. (i), we get

$$300 = 200 + W_f$$

$$W_f = 300 - 200 = 100 \text{ J}$$

23.

In the given problem, conservation of linear momentum and energy hold good.

Conservation of momentum yields.

$$m_1v_1 + m_2v_2 = 0$$

or $\quad 4v_1 + 0.2\,v_2 = 0 \qquad$ (i)

Conservation of energy yields

$$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = 1050$$

or $\quad \dfrac{1}{2} \times 4v_1^2 + \dfrac{1}{2} \times 0.2 \times v_2^2 = 1050$

or $\quad 2v_1^2 + 0.1\,v_2^2 = 1050 \qquad$ (ii)

Solving Eqs. (i) and (ii), we have

$$v_1 = 100 \text{ m/s}$$

24.

Apply law of conservation of linear momentum,

Momentum of first part $= 1 \times 12 = 12$ kg ms^{-1}

Momentum of the second part $= 2 \times 8 = 16$ kg ms^{-1}

$\therefore$ Resultant momentum

$$= \sqrt{(12)^2 + (16)^2} = 20 \text{ kg ms}^{-1}$$

The third part should also have the same momentum.

Let the mass of the third part be M, then

$$4 \times M = 20$$

$$M = 5 \text{ kg}$$

25.

If two bodies collide head on with coefficient of restitution

$$e = \frac{v_2 - v_1}{u_1 - u_2} \qquad \text{...(i)}$$

From the law of conservation of linear momentum

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$\Rightarrow \quad v_1 = \left[\frac{m_1 - em_2}{m_1 + m_2}\right]u_1 + \left[\frac{(1+e)\,m_2}{m_1 + m_2}\right]u_2$$

Substiuting $u_1 = 2$ ms^{-1}, $u_2 = 0$, $m_1 = m$ and $m_2 = 2\,m$, $e = 0.5$

We get $v_1 = \dfrac{m - m}{m + 2m} \times 2$

$$\Rightarrow \quad v_1 = 0$$

Similarly, $v_2 = \left[\dfrac{(1+e)\,m_1}{m_1 + m_2}\right]u_1 + \left[\dfrac{m_2 - em_1}{m_1 + m_2}\right]u_2$

$$= \left[\frac{1.5 \times m}{3m}\right] \times 2 = 1 \text{ ms}^{-1}$$

26.

Amount of water flowing per second from the pipe

$$= \frac{m}{\text{time}} = \frac{m}{l} \cdot \frac{l}{t} = \left(\frac{m}{l}\right)v$$

Power = KE of water flowing per second

$$= \frac{1}{2}\left(\frac{m}{l}\right)v \cdot v^2 = \frac{1}{2}\left(\frac{m}{l}\right)v^3$$

$$= \frac{1}{2} \times 100 \times 8 = 400 \text{ W}$$

27.

We know $P = \vec{F} \cdot \vec{v} = Fv \cos\theta$

So just before hitting θ is zero and both F and v are maximum.

28.

$\frac{1}{2}kS^2 = 10\ \text{J}$ (given in the problem)

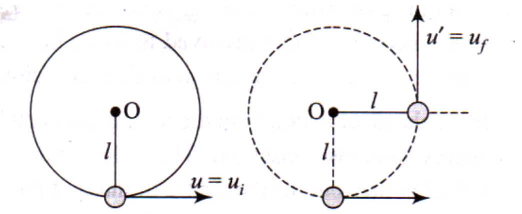
$\frac{1}{2}k[(2S)^2 - (S)^2] = 3 \times \frac{1}{2}kS^2 = 3 \times 10 = 30\ J$

29.

$U \propto x^2$

$\Rightarrow \quad \frac{U_2}{U_1} = \left(\frac{x_2}{x_1}\right)^2 = \left(\frac{0.1}{0.02}\right)^2 = 25 \quad \therefore \ U_2 = 25\ U$

30 Using conservation of mechanical energy at initial and final position.



$\Delta K + \Delta U = 0$

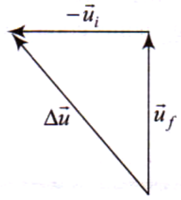
$\left(\frac{1}{2}mu'^2 - \frac{1}{2}mu^2\right) + (mgl) = 0$

or $\quad u'^2 = u^2 - 2gl$

or $\quad u' = \sqrt{u^2 - 2gl} \quad$ (i)

So, the magnitude of change in velocity

$\Delta\vec{u} = \vec{u}_f - \vec{u}_i = \vec{u}_f + (\vec{u}_i)$



$|\Delta\vec{u}| = \sqrt{u'^2 + u^2} = \sqrt{(u^2 - 2gh) + u^2}$

$= \sqrt{2(u^2 - gl)}$

31.

Work done = Area enclosed by $F-x$ graph

$$= \frac{1}{2} \times (3+6) \times 3 = 13.5 \text{ J}$$

32.

Work done by the force

= Force × Displacement

or $\quad W = F \times s \qquad$ (i)

But from Newton's 2nd law, we have

Force = Mass × Acceleration

i.e., $\quad F = ma \qquad$ (ii)

Hence, from Eqs. (i) and (ii), we get

$$W = mas = m\left(\frac{d^2s}{dt^2}\right)s \qquad \text{(iii)}$$

$$\left(\therefore\ a = \frac{d^2s}{dt^2}\right)$$

Now, we have, $s = \frac{1}{3}t^2$

$$\frac{d^2s}{dt^2} = \frac{d}{dt}\left[\frac{d}{dt}\left(\frac{1}{3}t^2\right)\right]$$

$$= \frac{d}{dt} \times \left(\frac{1}{3}t\right) = \frac{2}{3}\frac{dt}{dt} = \frac{2}{3}$$

Hence, Eq. (iii) becomes

$$W = \frac{2}{3}ms = \frac{2}{3}m \times \frac{1}{3}t^2 = \frac{2}{9}mt^2$$

We have given $m = 3$ kg, $t = 2s$

$$\therefore \quad W = \frac{2}{9} \times 3 \times (2)^2 = \frac{8}{3} \text{ J}$$

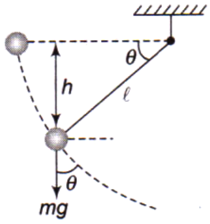
33.

From conservation of energy $\Delta K + \Delta U = 0$

$$mgh = \frac{1}{2}mv^2\ mgl \sin\theta = \frac{1}{2}mv^2$$

$$\Rightarrow \quad a_C = 2g \sin\theta = \frac{v^2}{l} = \text{radial acceleration}$$

$g \cos\theta = a_t$ = tangential acceleration



Total acceleration

$$a = \sqrt{a_c^2 + a_t^2} = g\sqrt{\cos^2\theta + (2\sin\theta)^2}$$
$$= g\sqrt{(1-\sin^2\theta) + 4\sin^2\theta} = g\sqrt{1 + 3\sin^2\theta}$$

34.

$$mgl = \frac{1}{2}mu^2 \Rightarrow u^2 = 2g \qquad \text{(i)}$$
$$v^2 = u^2 + 2as \Rightarrow 0 = 2g - 2a(3)$$
$$\Rightarrow \quad a = \frac{g}{3} \Rightarrow \mu_k g = a$$
$$\therefore \quad \mu_k g = \frac{g}{3} \quad \therefore \mu_k = \frac{1}{3}$$

35.

$$W_{\text{spring}} + W_{100\text{ N}} = \Delta k \text{ (on A)}$$
$$W_{\text{spring}} + (100)\left(\frac{10}{100}\right) = \frac{1}{2}(2)(2)^2$$
$$W_{\text{spring}} = 4 - 10 = -6 \text{ J}$$

36.

Total energy at the time of throwing the ball

$$= mgh + \frac{1}{2}mv_0^2$$

Energy after collision with ground

$$= \frac{1}{2}\left(mgh + \frac{1}{2}mv_0^2\right)$$

The ball again rises to height h.

$$\therefore \quad \frac{1}{2}\left(mgh + \frac{1}{2}mv_0^2\right) = mgh$$

or $\quad mgh + \frac{1}{2} = 2mgh$

or $\quad \frac{1}{2}mv_0^2 = mgh$ or $v_0 = \sqrt{2gh}$

37.

By energy conservation

$$mgR(1 + \cos 30°) = \frac{1}{2}k\left(\frac{\pi R}{6}\right)^2$$

$$\Rightarrow \quad k = \frac{36mg(2+\sqrt{3})}{\pi^2 R}$$

38.

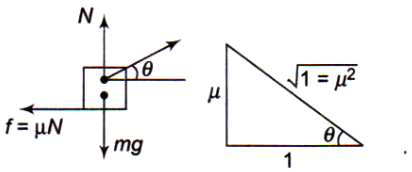
We applying force F therefore tension in string is $T = F$, Hence force acting on weight is $2F$ upward, and displacement is h upward.

Hence $W = 2Fh$ (work done on weight)

39.

The work done by the force F is

$$W = F_{\min}\, x \cos\theta \qquad \text{(i)}$$



$$\cos\theta = \frac{1}{\sqrt{1+\mu^2}}, \qquad \sin\theta = \frac{\mu}{\sqrt{1+\mu^2}}$$

F is minimum when $\tan\theta = \mu$ **(ii)**

$$F_{\min} = mg\sin\theta \qquad \text{(iii)}$$

Using equations (i) and (iii),

$$W = (mg\sin\theta) \times \cos\theta$$

$$= mg \cdot \frac{\mu}{\sqrt{1+\mu^2}}\, x \,\frac{1}{\sqrt{1+\mu^2}} = \frac{\mu mgx}{1+\mu^2}$$

40.

Initial velocity of the particle, $v_1 = 20$ m/s
Final velocity of the particle, $v_f = 0$

From work energy theorem

$$W_{\text{net}} = \Delta\text{K.E.} = K_f - K_i$$

$$= \frac{1}{2}m(v_f^2 - v_i^2) = \frac{1}{2}(2)(0-400) = -400 \text{ J}$$

41.

Let x be the extension in the spring when 2 kg block leaves the contact with ground.

Then, $kx = 2$ g

$$x = \frac{2g}{k} = \frac{2 \times 10}{40} = \frac{1}{2} \text{m}$$

Now from conservation of mechanical energy

$$mgx = \frac{1}{2}kx^2 + \frac{1}{2}mv^2 \qquad (m = 5 \text{ kg})$$

$$v = \sqrt{2gx - \frac{kx^2}{m}}$$

Substituting the values

$$v = \sqrt{2 \times 10 \times \frac{1}{2} - \frac{(40)}{4 \times 5}} = 2\sqrt{2} \text{ m/s}$$

42.

Increase in height of block, $h = a \sin \theta$

Increase in length of spring, $x = a\,\theta$

Work done by $p = mgh + \ p = mgh + \frac{1}{2}kx^2$

$$= Wa \sin \theta + \frac{1}{2}ka^2\theta^2$$

43.

44.

$$m_1 V = m_2 V_2 - m_1 \frac{V}{10} \qquad \text{(i)}$$

$$e = 1 = \frac{V_2 - (-V/10)}{V - 0}$$

or $\quad V_2 + \frac{V}{10} = V \qquad$ (ii)

From eqn. (i), $\frac{m_1}{m_2}V = V_2 - \frac{V}{10}\frac{m_1}{m_2}$

From eqn. (ii), $\frac{m_1}{m_2}V = \left(V - \frac{V}{10}\right) - \frac{V}{10}\frac{m_1}{m_2}$

or $\quad 11m_1 = 9m_2 \Rightarrow m_2 > m_1$

45.

Fraction of KE lost in collision

$$\Delta K\% = \frac{\frac{1}{2}mu^2 - \frac{1}{2}mv^2}{\frac{1}{2}mu^2} = 1 - \left(\frac{v}{u}\right)^2 = \frac{1}{4}\text{(given)}$$

$$v = u\sqrt{\frac{3}{4}} \qquad \text{(i)}$$

The ball strikes at 45°. Component of velocity parallel to wall (u cos 45°) will not change while component of velocity normal to wall will change.

$$v_x = u\cos 45° = \frac{u}{\sqrt{2}}$$

$$v_y = eu\cos 45° = \frac{eu}{\sqrt{2}}$$

$$v = \sqrt{v_x^2 + v_y^2} = \left[\left(\frac{u}{\sqrt{2}}\right)^2 + \left(\frac{eu}{\sqrt{2}}\right)^2\right]^{\frac{1}{2}}$$

$$\Rightarrow \quad v = u\left[\frac{1}{2} + \frac{e^2}{2}\right]^{\frac{1}{2}} \qquad \text{(ii)}$$

Solving (i) and (ii), we get

$$e = \frac{1}{\sqrt{2}}$$

[CHEMISTRY]

47. Within a group IE_1 decreases from top to bottom.
48. After the removal of second electron, the ion acquires noble gas configuration and it becomes difficult to remove the third electron.
49. Be has fully filled 2s sub-shell ($2s^2$) and, therefore, show little tendency to accept an electron.
54. All have 18 electrons.
59. These are isoelectronic ions and the size decreases with increase in nuclear charge as $S^{2-} > Cl^- > K^+ > Ca^{2+}$ (all have 20 electrons)
60. With negative sign the chlorine has highest electron gain enthalpy (in magnitude)
61. Nitrogen has half fileld stable configuration so that its ionization enthalpy is greater than that of oxygen. So, correct order of increasing first ionization enthalpy is :
    B < C < O, N
63. All have 18 electrons.
64. 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.
73. The configuration corresponds to that of Cl, which has the highest negative electron gain enthalpy.
74. AI–Alkali metals
    IIA–Alkaline earth metals
    IB–Coinage metals
75. 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.
76. All physical and chemical properties of elements are periodic function of atomic number-Modern Periodic Law.

77. Noble gases have fully filled valence shell electronic configuration. Therefore, it represents ns^2np^6.

78. Coinage metals are transition metals but they cannot work as transition metal because they have completely filled d-orbital. Group 1B have elements are called coinage metals. (Cu, Ag, Au). Their general outer electronic configuration is $(n-1)d^{10}ns^1$.

79. Electronic configuration reveals that the p-orbital of the element is not complete. Therefore, it is a p-block element. Moreover, the atomic number of the element is 33(As). Therefore, it is a metalloid

80. $117 = [Rn]5f^{14}, 6d^{10}, 7s^2 7p^5$

81. Electronic configuration of Cu is $1s^2, 2s^2, 2p^6, 3s^2 3p^6, 4s^1, 3d^{10}$ and electronic configuration of Cu^{2+} is $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^9$. Hence, the given configuration represents metallic cation.

82. The element is p-block
Its group = 10 + no. of electrons in $4s^2 4p^4$ = 10 + 6 = 16
Its period is four

85. The given element belongs to third period whose atomic number is = 15. Below this element in the periodic table should belong to 4th period. Fourth period contains 18 elements. Thus atomic number of this element is 15 + 18 = 33.

86. The electronic configuration of M is
$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^5$
Thus M belongs to halogen family (ns^2np^5)

87. The atom contains 133 nucleons and 78 neutrons (133 – 55 = 78)
The electrons configuration
$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^1$

88. Radius of isoelectronic species

$$\propto \frac{1}{\text{oxidation number}}$$

$$\xrightarrow{O^{2-},\quad F^-,\quad Na^+,\quad Mg^{2+},}$$

- oxidation order number in increasing
- radius in decreasing order

Thus radius of Ne should be more than F^- but less than Na^+ i.e., in between 1.34 and 0.95º

90. All the electron belong to d-Block. For d-block elements electron is removed first from ns than from (n – 1) d-orbitals.

$_{24}Cr = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^5$
$_{24}Cr^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

↑	↑	↑	↑	

Four unpaired electrons

$_{26}Fe = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
$Fe^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

↑↓	↑	↑	↑	↑

Four unpaired electrons

$_{27}CO = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$
$_{27}CO^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$

↑↓	↑↓	↑	↑	↑

Three unpaired electrons

$_{28}Ni = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8$
$_{28}Ni^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$

↑↓	↑↓	↑↓	↑	↑

Two unpaired electrons