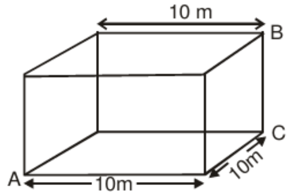
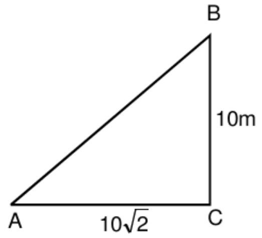
S1. (2)



Fly start from A and reaches at B.

$\therefore (AB)^2 = (AC)^2 + (BC)^2$

$AC = \sqrt{10^2 + 10^2} = 10\sqrt{2}$



$AB = \sqrt{(10\sqrt{2})^2 + 10^2} = 10\sqrt{3}m.$

S2. (1)

Relative error in A is given by

$\frac{\Delta A}{A} = \frac{3\Delta P}{P} + \frac{2\Delta Q}{Q} + \frac{1}{2}\frac{\Delta R}{R} + \frac{\Delta S}{S}$

The maximum percentage error in the value of A will be

$\frac{\Delta A}{A} \times 100 = 3 \times 0.5 + 2 \times 1 + \frac{1}{2} \times 3 + 1.5 = 6.5\%.$

S3. (3)

let the acceleration of the body is $'a'$ and $u = 0$

then $x_1 = \frac{1}{2}at^2 = \frac{1}{2}a(10)^2$

$x_2 = \frac{1}{2}a(20)^2 - x_1$

$= \frac{1}{2}a(20)^2 - \frac{1}{2}a(10)^2$

$= \frac{1}{2}a(10)(30)$

$x_3 = \frac{1}{2}a(30)^2 - \frac{1}{2}a(20)^2$

$= \frac{1}{2}a(10)(50)$

$\therefore x_1 : x_2 : x_3 = 1:3:5.$

S4. (4)

$y = m^2 r^{-4} g^x l^{-3/2}$

% error in $y = 18$, % error in $m = 1$

% error in $r = 0.5$, % error in $l = 4$

% error in $g = p$.

$\frac{\Delta y}{y} \times 100 = \left(2\frac{\Delta m}{m} + 4 \cdot \frac{\Delta r}{r} + x \cdot \frac{\Delta g}{g} + \frac{3}{2}\frac{\Delta l}{l}\right) \times 100$

$18 = 2 \times 1 + 4(0.5) + x(p) + \frac{3}{2}(4)$

$\therefore\ 8 = xp.$

S5. (2)

Stone is dropped

So time taken by stone to reach the bottom of the wall t_1

$\therefore h = \frac{1}{2}gt_1^2$

$= t_1 = \sqrt{\frac{2\,h}{g}}$ –(i)

time taken by sound to comes from bottom to upper end

$t_2 = \frac{h}{v}\ \ \ldots$(ii)

$\therefore$ Total time $= t_1 + t_2 = \sqrt{\frac{2\,h}{g}} + \frac{h}{v}.$

S6. (2)

1MSD = 5.15 cm − 5.10 cm

= 0.05 cm

50 VSD = 2.45 cm

1VSD $= \frac{2.45}{50}$ cm = 0.049 cm

Least count of vernier,

LC = 1MSD − 1VSD

= 0.05 cm − 0.049 cm = 0.001 cm

Diameter of the cylinder = main scale reading + vernier scale reading × least count $= 5.10 + (24)(0.001) = 5.124$ cm.

S7. (3)

$\vec{F} = 2\sin 3\pi t\hat{\imath} + 3\cos 3\pi t\,\hat{\jmath}$

$a = \frac{dv}{dt} = 2\sin 3\pi t\,\hat{\imath} + 3\cos 3\pi t\,\hat{\jmath}$

$\int_0^v dv = 2\int_0^t \sin 3\pi t\, dt\,\hat{\imath} + 3\int_0^t \cos 3\pi t \cdot dt\hat{\jmath}$

$v = -\frac{2}{3\pi}[\cos 3\pi t]_0^t\hat{\imath} + \frac{3}{3\pi}[\sin 3\pi t]_0^t\hat{\jmath}$

$\int_0^r dx = \int_0^t \left[\frac{-2}{3\pi}[\cos 3\pi t - 1]\hat{\imath} + \frac{1}{\pi}\sin\ 3\pi t\hat{\jmath}\right] \cdot dt$

$\vec{r} = -\frac{2}{3\pi}\left[\int_0^t\ \cos 3\pi t - \int_0^t \mathrm{dt}\right]\hat{\imath} + \frac{1}{\pi}\int_0^t \sin 3\pi t\,\hat{\jmath}dt$

$= -\frac{2}{(3\pi)^2}[\sin 3\pi t]_0^t\hat{\imath} + \frac{2}{3\pi}t\hat{\imath} - \frac{1}{3\pi^2}[\cos 3\pi t]_0^t\hat{\jmath}$

For $t = 1\,sec$

$\vec{r} = \frac{2}{3\pi}\hat{\imath} + \frac{2}{3\pi^2}\hat{\jmath}.$

S8. (3)

$\left[X + \frac{a}{Y^2}\right][Y - b] = RT$

As, X is pressure then its dimensions are $[\mathrm{ML^{-1}\ T^{-2}}]$ then $\frac{a}{Y^2}$ should also have the same units. same units.

$X = \frac{a}{Y^2} \Rightarrow [\mathrm{ML^{-1}\ T^{-2}}] = \frac{a}{[\mathrm{L^6}]}$

$a = [\mathrm{ML^5\ T^{-2}}]$

Same for $Y = b. [\mathrm{L^3}] = b$

The ratio, $\frac{a}{b} = \frac{[\mathrm{ML^5\ T^{-2}}]}{[\mathrm{L^3}]} = [\mathrm{ML^2\ T^{-2}}].$

$[\mathrm{ML^2\ T^{-2}}]$ is the dimension of energy.

S9. (2)

$a = \frac{B}{m}e^{-ct}$

$\Rightarrow \int_0^v dv = \int_0^t \frac{B}{m} e^{-ct} dt$

$v = -\frac{B}{mc}[a^{-ct} - 1]_0^t$

At $t = \infty$ $\quad v = \frac{B}{mc}$.

S10. (1)

Given, Young's modulus

$Y = c^{\alpha} h^{\beta} G^{\gamma}$

$[\mathrm{ML^{-1}\ T^{-2}}] =$

$[\mathrm{LT^{-1}}]^{\alpha}[\mathrm{ML^2\ T^{-1}}]^{\beta}[\mathrm{M^{-1}\ L^3\ T^{-2}}]^{\gamma}$

$[\mathrm{ML^{-1}\ T^{-2}}] = \left[\mathrm{M}^{\beta-\gamma} \underset{\mathrm{L}}{\alpha+2\beta+3\gamma}\ \mathrm{T}^{-\alpha-\beta-2\gamma}\right]$

$\beta - \gamma = 1$ (i)

$\alpha + 2\beta + 3\gamma = -1$ (ii)

$-\alpha - \beta - 2\gamma = -2$ (iii)

On solving eq. (i), (ii) and (iii), we have

$\alpha = 7, \beta = -1, \gamma = -2$.

S11. (3)

$\frac{dv}{dt} = bt \Rightarrow dv = bt\, dt \Rightarrow v = \frac{bt^2}{2} + K_1$

At $t = 0, v = v_0 \Rightarrow K_1 = v_0$

We get $v = \frac{1}{2}bt^2 + v_0$

Again $\frac{dx}{dt} = \frac{1}{2}bt^2 + v_0 \Rightarrow x = \frac{1}{2}\frac{bt^2}{3} + v_0 t +$ K_2

At $t = 0, x = 0 \Rightarrow K_2 = 0$

$\therefore x = \frac{1}{6}bt^3 + v_0 t$

S12. (1)

Given $r = 0.5t$

$\frac{dr}{dt} = 0.5$

$V = \frac{4}{3}\pi r^3$

$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

At $t = 4\ sec$

$r = 0.5(4) \Rightarrow r = 2$

So $\left(\frac{dv}{dt}\right)_{t=4} = 4\pi(2)^2(0.5) = 8\pi\ unit/s$

S13. (4)

$= \int x^2 dx - \int \cos\cos x\, dx +$

$\int \frac{1}{x} dx$

$= \frac{x^{2+1}}{2+1} - \sin x + lnx + c$

$= \frac{x^3}{3} - \sin x + lnx + c$

S14. (2)

Using $\left\{\log\log(A) - \log\log(B) = \log\log\left(\frac{A}{B}\right)\right\}$

We can write $\log\log\left(\frac{3x+2}{3x-2}\right) = \log\log 5$

Comparing both sides

$\frac{3x+2}{3x-2} = 5$

$3x + 2 = 15x - 10$

$x = 1$.

S15. (4)

Let the initial velocity be u

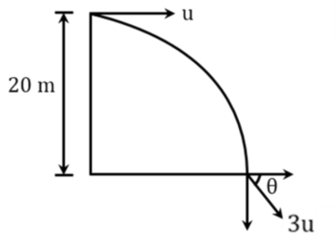
Let the ball touches the ground at an angle θ

Final velocity $= 3u$ (Acc. to ques.)

Hence $3u \cos\cos\theta = u$ or $\cos\cos\theta = 1/3$ or $\sin\sin\theta = \sqrt{8}/3$

The vertical component of velocity at the ground

$= 3u \sin\sin\theta = \frac{3\sqrt{8}}{3}u = \sqrt{8}u$



For a freely falling body it covers 20 m to acquire velocity $\sqrt{8}u$

$\therefore \left(\sqrt{8}u\right)^2 - 0 = 2 \times 9.8 \times 20$

So, $u = 7\ m/s$.

S16. (3)

Net acceleration of a body when thrown upward is given by

$a_{eff} =$ acceleration of body − acceleration due to gravity $= a - g$

S17. (2)

$ax^2 - bx + c = 0$

Sum of roots $= -\frac{b}{a}$

For $(2x^2 - 4x + 5) = 0$

Sum of roots $= -\frac{(-4)}{2} = 2$

S18. (2)

$\frac{F_1+F_2}{F_1-F_2} = \frac{7}{3}$

Applying componendo – dividendo rule

$\Rightarrow \frac{F_1}{F_2} = \frac{10}{4} = \frac{5}{2}$.

S19. (3)

If a stone is dropped from height h

Then $h = \frac{1}{2}gt^2$ ...(i)

If a stone is thrown upward with velocity u then $h = -ut_1 + \frac{1}{2}gt_1^2$ ...(ii)

If a stone is thrown downward with velocity u then

$h = ut_2 + \frac{1}{2}gt_2^2$ ...(iii)

From (i), (ii) and (iii) we get

$-ut_1 + \frac{1}{2}gt_1^2 = \frac{1}{2}gt^2$ ....(iv)

$ut_2 + \frac{1}{2}gt_2^2 = \frac{1}{2}gt^2$ ...(v)

Dividing (iv) and (v) we get

$\therefore \frac{-ut_1}{ut_2} = \frac{\frac{1}{2}g(t^2-t_1^2)}{\frac{1}{2}g(t^2-t_2^2)}$

Or $-\frac{t_1}{t_2}=\frac{t^2-t_1^2}{t^2-t_2^2}$

By solving we get $t=\sqrt{t_1t_2}$

S20. (3)

$\vec{A}=\vec{P}+\vec{Q}=5\hat{\imath}-4\hat{\jmath}+3\hat{k}$

For x-axis $\vec{B}=\hat{\imath}$

$\vec{A}.\vec{B}=|\vec{A}||\vec{B}|\, cos\, cos\, \theta$

$5=\sqrt{50} cos\, \theta$

$\theta=\cos^{-1}(\frac{5}{\sqrt{50}})$

S21. (1)

The distance covered by the ball during the last t seconds of its upward motion = Distance covered by it in first t seconds of its downward motion.

From $h=ut+\frac{1}{2}gt^2$

$h=\frac{1}{2}gt^2$ [As $u=0$ for its downward motion]

S22. (3)

Let the velocity at point P

$\overrightarrow{v_1}=v\hat{\imath}$

So the velocity at point Q will be

$\overrightarrow{v_2}=v\, cos\, cos\, 40°\, \hat{\imath}-v\, sin\, sin\, 40°\, \hat{\jmath}$

Change in velocity:

$$\Delta\vec{v}=\overrightarrow{v_2}-\overrightarrow{v_1}$$

$\Delta\vec{v}=(v\, cos\, cos\, 40°\ -v)$

$\hat{\imath}+(v\, sin\, sin\, 40°\,)\hat{\jmath}$

$|\Delta\vec{v}|=$

$\sqrt{(v\, cos\, cos\, 40°\ -v)^2+(v\, sin\, sin\, 40°\,)^2}$

On solving we get

$\Delta v=2\, v sin\, 20°$

S23. (1)

$\vec{R}=\vec{A}+\vec{B}=3\hat{\imath}+6\hat{\jmath}-2\hat{k}$

Unit vector parallel to $\vec{R}$ is

$\hat{R}=\frac{3\hat{\imath}+6\hat{\jmath}-2\hat{k}}{\sqrt{3^2+6^2+2^2}}=\frac{1}{7}(3\hat{\imath}+6\hat{\jmath}-2\hat{k})$

S24. (4)

Component of $\vec{A}$ along $\vec{B}=Acos\,\theta=\frac{\vec{A}.\vec{B}}{B}$

In vector from $=\left(\frac{\vec{A}.\vec{B}}{B}\right)\hat{B}=\left(\frac{\vec{A}.\vec{B}}{B^2}\right)\vec{B}$

$\vec{A}.\vec{B}=(3\hat{\imath}+4\hat{\jmath}).(\hat{\imath}+\hat{\jmath})=7$

$B^2=\left(\sqrt{1^2+1^2}\right)^2=2$

Required component $=\frac{7}{2}(\hat{\imath}+\hat{\jmath})$

S25. (3)

Coefficient of friction is unitless & dimensionless.

S26. (4)

θ in $cos\,\theta$ and $sin\,\theta$ is dimensionless

$Bx=M^0L^0T^0\Rightarrow BL^1=M^0L^0T^0$

$\Rightarrow B=M^0L^{-1}T^0$

$Dt=M^0L^0T^0\Rightarrow DT^1=M^0L^0T^0$

$\Rightarrow D=M^0L^0T^{-1}$

$\therefore\frac{D}{B}=M^0LT^{-1}.$

S27. (4)

According to the rules of significant figures $0.007\, m^2$ has one significant figure. $2.64\times10^{24}kg$ has three significant figures. $0.0006032\, m^2$ has four significant figures. 6.3200 J has five significant figures.

S28. (2)

$PV^{3/2}=K\Rightarrow P=\frac{K}{V^{3/2}}$

$\%\,\Delta P=1\times\%\,\Delta K-\frac{3}{2}\times\%\Delta V$

$\%\,P=1(0)-\frac{3}{2}(-0.5)=0.75\%$

S29. (3)

$40\, VSD\ =\ 38\, MSD$

$1\, VSD=\frac{38}{40}MSD$

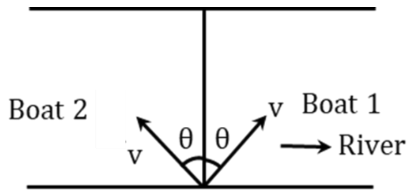
$LC.=1\, MSD-1\, VSD$

$0.1\, mm=1\, MSD-\frac{38}{40}\ MSD$

$\therefore 1\, MSD=2\, mm.$

S30. (1)

If components of velocities of boat relative to river is in direction normal to river flow is same (as shown in figure) both boats reach another bank simultaneously since this component is responsible for reaching the other bank of the river.



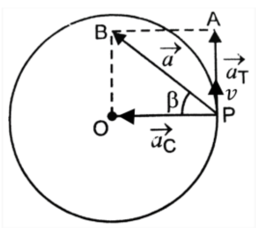
S31. (1)

Total reading $(T.R.)=MSD+CSR\times LC$

$(T.R.)=(3mm)+25\times(0.01\, mm)=$

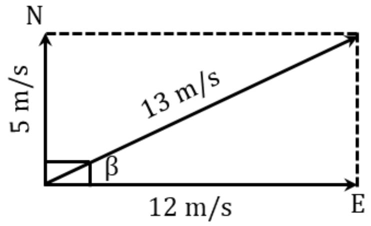
$3.25\, mm$

S32. (1)



In non – uniform circular motion acceleration vector makes some angle with radius hence it is not perpendicular to velocity vector.

S33. (1)
Velocity of ship w.r.t sea $= \vec{v_1} = 12\, m/s$ along east
Velocity of woman w.r.t ship $= \vec{v_2} = 5$ m/s along north
Velocity of woman w.r.t sea $= \vec{v_1} + \vec{v_2}$



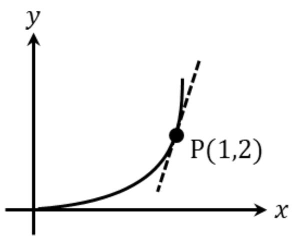
$$\vec{v}_{ws} = \sqrt{(12)^2 + (5)^2} = 13\, m/s$$

S34. (4)
$y = 2cos\left(\sqrt{x}\right)$

$\frac{dy}{dx} = -2sin\left(\sqrt{x}\right).\frac{1}{2\sqrt{x}}$

$\frac{dy}{dx} = -sin\left(\sqrt{x}\right).\frac{1}{\sqrt{x}}.$

S35. (4)



$y = 3x^2$
$\frac{dy}{dx} = 6x$
Point P (1,2)
$\frac{dy}{dx} = 6(1) = 6$

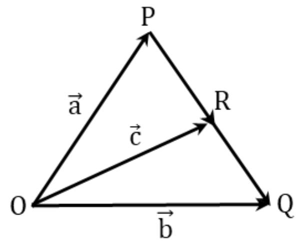
S36. (1)
For Body A
$s = \frac{1}{2}at^2 \ldots..(1)$

For Body B
$s = vt \ldots..(2)$

On comparing (1) and (2) we get
$t = \frac{2v}{a}$

S37. (4)
The negative slope of position time graph represents that the body is moving towards the negative direction. Thus, statement-1 is correct.
But if the slope of the graph decreases with time, then it represents the decrease in speed i.e. retardation in motion. So, the constant negative slope of the position-time graph cannot represent the decrease in speed. Therefore, statement-2 is incorrect.

S38. (1)



From triangle law in ΔOPR
$\vec{a} + \overrightarrow{PR} = \vec{c}$
$\Rightarrow \overrightarrow{PR} = \vec{c} - \vec{a}$
From triangle law in ΔORQ
$\vec{c} + \overrightarrow{RQ} = \vec{b} \Rightarrow \overrightarrow{RQ} = \vec{b} - \vec{c}$
Since R is the midpoint so $\overrightarrow{PR} = \overrightarrow{RQ}$
$\therefore \vec{c} - \vec{a} = \vec{b} - \vec{c}$
So, $2\vec{c} = \vec{a} + \vec{b}$

S39. (2)
$(1.005)^{12} = (1 + 0.005)^{12}$

Using $\{(1+x)^n = 1 + nx; when\, x \ll R\}$
$(1.005)^{12} = 1 + 12(0.005) = 1.060$

S40. (2)
Magnitude of Component of $\vec{v}$ along $\vec{a} = (\vec{v}.\hat{a})$
$= \left(6\hat{\imath} + 2\hat{\jmath} - 2\hat{k}\right).\frac{(\hat{\imath}+\hat{\jmath}+\hat{k})}{\sqrt{3}}$
$= \frac{6+2-2}{\sqrt{3}} = \frac{6}{\sqrt{3}} = 2\sqrt{3}$
In vector from $= \left(2\sqrt{3}\right)\hat{a}$
$= 2\sqrt{3}\frac{(\hat{\imath}+\hat{\jmath}+\hat{k})}{\sqrt{3}}$
$= 2(\hat{\imath} + \hat{\jmath} + \hat{k}).$

S41. (2)
Time $= \frac{Total\ length}{Relative\ velocity} = \frac{50+50}{10+15} = \frac{100}{25} = 4\, sec$

S42. (3)
$T \propto P^\alpha d^\beta E^\gamma$
$T = CP^\alpha\, d^\beta\, E^\gamma$
$M^0L^0T =$
$(ML^{-1}T^{-2})^\alpha (M^1L^{-3}T^0)^\beta (ML^2T^{-2})^\gamma$
$= M^\alpha L^{-\alpha}T^{-2\alpha}M^\beta L^{-3\beta}M^\gamma L^{2\gamma}T^{-2\gamma}$
$M^0L^0T = (M^{\alpha+\beta}L^{-\alpha-3\beta+2\gamma}T^{-2\alpha-2\gamma}$
$\alpha + \beta + \gamma = 0 \quad \ldots(1)$
$-\alpha - 3\beta + 2\gamma = 0 \quad \ldots(2)$
$-2\alpha - 2\gamma = 1 \quad \ldots(3)$
$\alpha + \gamma = -\frac{1}{2}$
$\beta = \frac{1}{2}$

$-\left(-\frac{1}{2}-\gamma\right)-3\left(\frac{1}{2}\right)+2\gamma=0$

$\frac{1}{2}+\gamma-\frac{3}{2}+2\gamma=0$

$3\gamma=1$

$\gamma=\frac{1}{3}$

$\alpha=-\frac{1}{2}-\frac{1}{3}=\frac{3-2}{6}=\frac{-5}{6}$

$T \propto P^{-5/6}d^{1/2}E^{1/3}$

S43. (3)

In 5 rotation distance moved = 5 mm

In 1 rotation distance moved = 1 mm = Pitch

$LC=\frac{Pitch}{Total\ circular\ divisions}=\frac{1\ mm}{100}$

$LC=0.01\ mm=0.001\ cm$

S44. (2)

Given, that $y=\sqrt{3}x-\left(\frac{1}{2}\right)x^2\ldots$(i)

The above equation is similar to equation of trajectory of the projectiles

$y=\tan\tan\theta x-\frac{1}{2}\frac{g}{u^2\cos^2\theta}x^2$ ... (2)

Comparing (1) & (2) we get

$\tan\tan\theta=\sqrt{3}\Rightarrow\theta=60°$

And $\frac{1}{2}=\left(\frac{1}{2}\right)\frac{g}{u^2\theta}$

$\Rightarrow u^2\theta=g\Rightarrow u^2 60°=10$

$\Rightarrow u^2\left(\frac{1}{4}\right)=10\Rightarrow u^2=40$

$\Rightarrow u=2\sqrt{10}m/s.$

S45. (1)

Given line have positive intercept but negative slope So its equation can be written as

$v=-mx+v_0$ ...(i) [Where $m=\tan\tan\theta=\frac{v_0}{x_0}$]

By differentiating with respect to time we get

$\frac{dv}{dt}=-m\frac{dx}{dt}=-mv$

Now substituting the value of v from eq. (i) we get

$\frac{dv}{dt}=-m[-mx+v_0]=m^2x-mv_0$

$\therefore a=m^2x-mv_0$

i.e the graph between a and x should have positive slope but negative intercept on a-axis

So, graph 1 is correct.

S46. (4)

4th ionization energy is very high means the element X has 3 valence electrons.

S47. (3)

Let total pressure be P_T

Then, $P_{H_2}=P_T\,x_{H_2}$

Where, $x_{H_2}=\frac{n_{H_2}}{n_{H_2}+n_{O_2}}$

$n_{H_2}=\frac{2g}{2g\ mol^{-1}}=1$ mol

$n_{SO_2}=\frac{32g}{64g\ mol^{-1}}=\frac{1}{2}$ mol

$\therefore x_{H_2}=\frac{1}{1+\frac{1}{2}}=\frac{2}{3}$

$P_{H_2}=\frac{2}{3}P_T$ i.t., $\left(\frac{2}{3}\right)$rd of total pressure.

S48. (2)

Number of moles of H_2O(n) = $\frac{weight}{M_w}=\frac{1.8}{18}$

= 0.1 mol

Number of molecules of H_2O = 0.1 N_A

∵ 1 molecule of H_2O contain = 3 atoms

∴ 0.1 N_A molecules of

H_2O contain = 3 × (0.1 N_A) = 0.3 N_A atoms

S49. (1)

A-Q, B-R, C-S, D-P

S50. (3)

Given:

$\frac{(Vapour\ Density)_1}{(Vapour\ Density)_2}=\frac{1}{3}$

We know,

Molecular Mass = 2 × Vapour Density

$\frac{\frac{(Mol\ mass)_1}{2}}{\frac{(Mol\ mass)_2}{2}}=\frac{1}{3}$

$\frac{(Molecular\ mass)_1}{(Molecular\ mass)_2}=\frac{1}{3}$ or 1 : 3

S51. (3)

$F^{\ominus}>Na^{+}>Mg^{+2}>Al^{+3}$ [NCERT pg. 87]

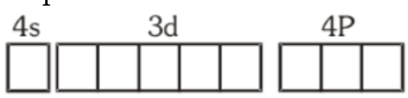
S52. (3)

Element	X	Y
%	75.8%	24.2%
Atomic weight	24	16
% Atomic weight	$\frac{75.8}{24}$ = 3.1	$\frac{24.2}{16}$ = 1.5
Simplest ratio	$\frac{3.1}{1.5}$ = 2.06	$\frac{1.5}{15}$ = 1
Ratio	2	1

Empirical formula = X_2Y

S53. (2)

IV period:



Number of orbitals = 9

(One orbital occupy 3 electron)

then number of elements = 9 × 3 = 27

S54. (4)

$m = \frac{1000 \cdot x_B}{x_A \cdot m_A}$ {$m = molality;\ x_B =$ $mole\ fraction\ of\ solute;\ x_A =$ $mole\ fraction\ of\ solvent$ }

$x_A + x_B = 1$

$\therefore x_A = (1 - x_B)$

$m = \frac{1000 \cdot x_B}{(1-x_B)18}$

Putting m = 3

M_A = 18 because aqueous solution is present

$3 = \frac{1000 \cdot x_B}{(1-x_B)18} \Rightarrow 54(1 - x_B) = 1000\ x_B$

$= 54 - 54\ x_B = 1000\ x_B$

$x_B = \frac{54}{1054} \Rightarrow x_B = 0.05$

$\therefore x_A = (1 - x_B) = (1 - 0.05) = 0.95$

S55. (1)

$C_4H_{10}(g) + \frac{13}{2}O_2(g) \longrightarrow 4CO_2(g) + 5H_2O$

1.12 L

Volume of $H_2O(g)$ at

STP = 5 × 1.12 = 5.6L

Volume of $CO_2(g)$ at

STP = 4 × 1.12 = 4.48L

S56. (3)

Br ⟶ 4th period

S and Cl ⟶ 3rd period ($S^{-2} > Cl^{-1}$) for isoelectronic species

N ⟶ 2nd period

S57. (3)

$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(g)$

2g 32g

$n = \frac{2}{2} = 1$ mol $n = \frac{32}{32} = 1$

So, hydrogen will be the limiting reagent

Moles of $H_2O(g)$ = 1 mol = $\frac{V}{22.4}$

Volume of $H_2O(g)$ at STP = 22.4 × 1

= 22.4 litre

S58. (4)

Molecules of CO_2 left $= 2.8 \times 10^{-3} \times 6.02 \times 10^{23} = 1.69 \times 10^{21}$ molecules

Initial molecules of CO_2 = Number of CO_2 molecules left + Number of CO_2 molecules removed

$= 1.69 \times 10^{21} + 10^{21}$

$= 2.69 \times 10^{21}$ molecules

Initial moles of $CO_2 = \frac{2.69 \times 10^{21}}{6.02 \times 10^{23}}$

$= 4.468 \times 10^{-3}\ mol$

Mass of CO_2 = Mole × Molar mass

$= 4.468 \times 10^{-3}\ mol \times 44\ g/mol$

$= 0.196592\ g = 196.6\ mg$

S59. (2)

Number of e^- of $CH_4 = \frac{1.6}{16} \times 10 \times N_A = N_A$

Number of e^- of $H_2O = \frac{1.8}{18} \times 10 \times N_A = N_A$

S60. (2)

$v = 2.18 \times 10^6 \times \frac{z}{n}$

For Li^{2+} $z_1 = z_2 = 3$

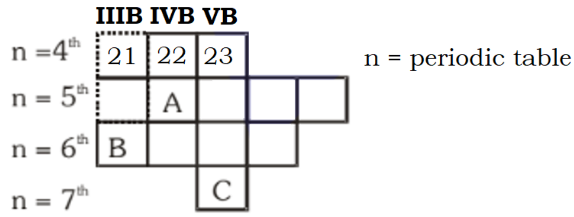
$\left(\frac{v_3}{v_5}\right) Li^{2+} = \left(\frac{z_1}{z_2}\right) \times \frac{n_2}{n_1}$

$= \frac{3}{3} \times \frac{5}{3} = \frac{5}{3}$

S61. (4)

Lanthanide contraction is due to poor shielding of one of 4f electron by another in the sub-shell.

S62. (3)



$21 \rceil 18$, 39, $57 \rfloor 18$; $22 \rceil 18$, 40, $72 \rfloor 32$; $23 \rceil 18$, $41 \rceil 32$, $73 \rceil 32$, 105

A = 40, B = 57, C = 105

S63. (4)

A will be a non-metal as it will be in the right of the periodic table and B belongs to group I so, it's an alkali metal.

S64. (4)

Screening effect is observed in multielectron system.

S65. (1)

Higher the value of electronegativity difference, more polar is the bond.

S66. (1)

Metalloids are those elements whose property lies between metal and non-metals.

S67. (2)

Due to presence of most penetrating one s-electron, hydrogen ($1s^1$) shows maximum IP out of list.

S68. (3)

$\frac{1}{\lambda} = RZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = R \times 3^2\left[\frac{1}{3^2} - \frac{1}{\infty^2}\right]$

$\Rightarrow$ R or $\lambda = 1/R$

S69. (3)

For H-like particles, the radii of nth orbit is given by, $r_n = \frac{a_0 n^2}{Z}$ where $a_0 = 52.9$ pm; n = energy level and Z = atomic number

For Li^+ ion, $(r_{Li^{2+}})_{n=4} - (r_{Li^{2+}})_{n=3} = \frac{52.9\,(16-9)}{3} = \Delta R_1$

For He^+ ion, $(r_{He^+})_{n=4} - (r_{He^+})_{n=3} = \frac{52.9\,(16-9)}{2} = \Delta R_2$

$\therefore \frac{\Delta R_1}{\Delta R_2} = \frac{2}{3}$ or $\Delta R_1 : \Delta R_2 = 2 : 3$

S70. (3)
Maximum number of electrons with same spin is equal to maximum number of orbitals, i.e., $(2l + 1)$.

S71. (4)
$r = 212.6$ pm $= 2.12\ \dot{A}$
$r = 0.529 \times \frac{n^2}{Z} = 2.12\ \dot{A} \quad (Z = 1)$
$n^2 = \frac{2.12}{0.529} = 4$
$\therefore n^2 = 4 \Rightarrow n = 2$
In Balmer series, transition of electron occurs from higher orbitals to orbital of $n = 2$.

S72. (1)
By n + l rule

S73. (3)
Angular nodes $= l$;
Radial nodes $= (n - l - 1)$

Orbital	Angular nodes	Radial node
$4f$	$l = 3$	$4 - 3 - 1 = 0$
$4d$	$l = 2$	$4 - 2 - 1 = 1$
$5d$	$l = 2$	$5 - 2 - 1 = 2$
$3p$	$l = 1$	$3 - 1 - 1 = 1$

S74. (1)
Power to attract shared pair of electron so stable configuration does not affect electronegativity.

S75. (1)
For a metal to show photoelectric effect, the energy of photon should be higher than the work function of metal.
Given: $\lambda = 400$ nm
Energy of photon
$E_p = \frac{1240}{\lambda\,(nm)}\ eV$
$E_p = \frac{1240}{400} = 3.1\ eV$
As the work function of Li, Na and K is lower than energy of photon thus, these will show photoelectric effect.

S76. (3)
Hund's Rule states that:
(A) Every orbital in a sublevel is singly occupied before any orbital is doubly occupied.
(B) All of the electrons in singly occupied orbitals have the same spin (to maximize total spin).

S77. (3)
$\because \lambda = \frac{h}{\sqrt{2m\,K.E.}}$
Therefore, $\lambda \propto \frac{1}{\sqrt{K.E.}}$
$K.E. \longrightarrow 4\,K.E.$
Now, $\lambda \propto \frac{1}{\sqrt{4\,K.E.}}$
So, $\lambda \longrightarrow \frac{1}{2}\lambda$
Half times.

S78. (4)
Orbital angular momentum
$= \sqrt{l(l+1)}\frac{h}{2\pi}$; $l = 1$ for p-orbital

S79. (1)
For A, $n = 3, l = 2 \Rightarrow 3d$
For B, $n = 5, l = 0 \Rightarrow 5s$
The energy of orbital 'B' is more than orbital 'A'
If two orbitals have the same $(n + l)$, then the one with higher n will have higher energy.

S80. (4)
Left to Right electronegativity decreases.

S81. (2)
$C_xH_y(g) + \left(x + \frac{y}{4}\right) O_2(g) \rightarrow xCO_2(g) + \frac{y}{2} H_2O(l)$
$x + \frac{y}{4} = 6$
$x = 4$
$y = 8$

S82. (2)
Electronic configuration of
M = [Ar] $3d^{10}\,4s^2\,4p^3$
M^{+3} = [Ar] $3d^{10}\,4s^2$

S83. (2)
$M = \frac{(\%w/w \times d \times 10)}{molar\ mass}$
$M \times molar\ mass = \%w/w \times d \times 10$
$14 \times 63 = \%w/w \times 1.4 \times 10$
$\%w/w = 63$

S84. (2)
As %s character increases electronegativity increases

$CH \equiv CH$	$CH_2 = CH_2$	$CH_3 - CH_3$
↓	↓	↓
sp	sp^2	sp^3

S85. (2)

$4A$ +	$2B$ +	$3C$ ⟶	$A_4B_2C_3$
1	0.6	0.72	
$\frac{1}{4} = 0.25$	$\frac{0.6}{2} = 0.30$	$\frac{0.72}{3} = 0.24$ (L.R.)	$\frac{1}{3} \times 0.72 = 0.24$

4 mol A ⟶ 1 mol product ⟹ 1 mol A makes 1/4 = 0.25 mol product
2 mol B ⟶ 1 mol product ⟹ 0.6 mol B makes 0.6/2 = 0.3 mol product
3 mol C ⟶ 1 mol product ⟹ 0.72 mol C makes 0.72/3 = 0.24 mol product

C = 0.24 is present in smallest amount so, called limiting reagent.

S86. (1)
Due to increase in number of shall down the group atomic radius increases.

S87. (1)
1 mol PH_3 gives $\frac{3}{2}$ mol H_2
So, 100 mL PH_3 gives $\frac{3}{2} \times 100 = 150$ mL of H_2.
Initial gas volume = 100 mL (PH_3)
Final gas volume = 150 mL (H_2)
Change in volume = 150 − 100
$= \boxed{50\ mL\ \text{increase}}$

S88. (2)
EN ∝ Zeff
IP ∝ Zeff
EA ∝ Zeff

S89. (4)
$\boxed{m = \frac{1000 \cdot M}{d \cdot 1000 - M \cdot M_1}}$
Where,
m = molality (mol/kg)
M = molarity (mol/L)
d = density of solution (g/mL)
M_1 = molar mass of solute (g/mol)

S90. (2)
n = 5 with l = 3 means $5f$ as it contains 14.

S91. (4)
NCERT Pg.no 04

S92. (4)
NCERT Pg.no 15

S93. (1)
Hint: Statement P and S are correct
NCERT Pg.no 07

S94. (4)
NCERT Pg.no 14

S95. (4)
NCERT Pg.no 06

S96. (3)
NCERT Pg.no 17 & 18

S97. (4)
NCERT Pg.no 07

S98. (3)
NCERT Pg.no 14

S99. (1)
Hint: Chl. d, Floridean starch, oogamous reproduction, complex post fertilization development is associated with members of red algae
NCERT Pg.no 27 & 28

S100. (2)
NCERT Pg.no 15

S101. (3)
Old NCERT Pg.no 04

S102. (1)
NCERT Pg.no 33

S103. (1)
NCERT Pg.no 18

S104. (4)
NCERT Pg.no 24

S105. (2)
NCERT Pg.no 23

S106. (3)
NCERT Pg.no 18

S107. (4)
NCERT Pg.no 13

S108. (2)
NCERT Pg.no 27

S109. (4)
NCERT Pg.no 18

S110. (1)
Hint: (a) and (c) features are related to mosses
NCERT Pg.no 30

S111. (4)
XIth NCERT Pg. No. (44)

S112. (2)
XIth Old NCERT (Animal Tissue)

S113. (2)
XIth NCERT Pg. No. (40)

S114. (1)
XIth Old NCERT (Animal Tissue)

S115. (1)
XIth NCERT Pg. No. (82)

S116. (2)
XIth NCERT Pg. No. (44)

S117. (3)
XIth NCERT Pg. No. (82)

S118. (1)
XIth NCERT Pg. No. (49)

S119. (3)
XIth NCERT Pg. No. (46)

S120. (2)
XIth Old NCERT (Animal Tissue)

S121. (2)
XIth Mixed Animal kingdom

S122. (3)
XIth NCERT Pg. No. (47)

S123. (2)
XIth Old NCERT (Animal tissue)

S124. (3)
XIth NCERT Pg. No. (50)

S125. (4)
XIth Old NCERT (Cockroach)

S126. (3)

XIth NCERT Pg. No. (43)

S127. (1)

XIth Old NCERT (Animal Tissue)

S128. (2)

XIth Old NCERT (Cockroach)

S129. (2)

XIth NCERT Pg. No. (42)

S130. (3)

XIth Old NCERT (Animal Tissue)

S131. (3)

Animal		**Genera**	
Wheat	–	*Triticum*	
Brinjal & Potato	–	*Solanum*	⇒ Four genera
Lion & Tiger	–	*Panthera*	
Dog	–	*Canis*	

S132. (4)

Orders have less similarities than family, genus and species

S133. (4)

Animal	–	**Order**
Lion	–	Carnivora
Man	–	Primata
Housefly	–	Diptera

S134. (2)

Potato and Brinjal are a group of related species.

S135. (2)

Biological names originate from the Latin language and are printed in italics.

S136. (1)

The anthropocentric view focused mainly on how organisms served human needs, ignoring the broader study of biodiversity. This limited the growth of biological knowledge. Hence, the reason correctly explains the assertion.

S137. (1)

In Linnaeus two kingdom classification, all photosynthetic organisms come in Kingdom plantae.

S138. (4)

Refer to NCERT page no.18

S139. (3)

Liverworts are linked to the substratum by unicellular rhizoids.

S140. (2)

Refer to NCERT page no. 26

S141. (2)

Refer to NCERT page no. 14 & 15

S142. (2)

Ascocarp is a fruiting body in ascomycetes which is a diploid and multicellular structure and bears haploid ascospores.

S143. (3)

Refer to NCERT page no. 18

S144. (2)

Pink mould is the common name for Neurospora, which belongs to class ascomycetes.

S145. (3)

Refer to NCERT page no. 32

S146. (3)

Refer to NCERT page no. 24 & 27

S147. (2)

Refer to NCERT page no. 13

S148. (2)

Refer to NCERT page no. 17

S149. (4)

Refer to NCERT page no. 15 & 16, Fig. 2.4

S150. (1)

Refer to NCERT page no. 26

S151. (2)

Refer to NCERT page no. 15

S152. (3)

Refer to NCERT page no. 14

S153. (4)

Refer to NCERT page no. 24 & 28

S154. (3)

Refer to NCERT page no. 29

S155. (4)

Refer to NCERT page no. 21

S156. (2)

Refer to NCERT page no. 21

S157. (3)

Refer to NCERT page no. 30 & 32

S158. (4)

Refer to NCERT page no. 27

S159. (3)

NCERT Page No. 47

S160. (2)

NCERT Page No. 49

S161. (2)

NCERT Page No. 38

S162. (4)

Old NCERT

S163. (1)

NCERT Page No. 4

Hemichordates have a rudimentary structure in the collar region called stomochord, a structure similar to notochord.

S164. (1)
NCERT Mixed Chapter

S165. (3)
Old NCERT

S166. (3)
Old NCERT

S167. (1)
NCERT Page No. 41

S168. (4)
NCERT Page No. 49
Calotes -Garden lizard.

S169. (1)
NCERT Page No. 50
The unique features of mammals are the presence of mammary glands and hairs on the skin.

S170. (1)
Old NCERT

S171. (3)
NCERT Page No. 42

S172. (3)
NCERT: Phylum Hemichordata and Chordata

S173. (1)
NCERT Page No. 43
They are bilaterally symmetrical, triploblastic and pseudocoelomate animals

S174. (3)
NCERT Page No. 40-51

S175. (1)
NCERT Page No. 39

S176. (4)
NCERT Page No. 46. All given statements are correct.

S177. (2)
NCERT Page No. 83 & 84

S178. (4)
Old NCERT
In females, the 7th sternum is boat shaped and together with the 8th and 9th sterna forms a brood or genital pouch whose anterior part contains female gonopore, spermathecal pores and collateral glands.

S179. (3)
Old NCERT
The entire body is covered by a hard chitinous exoskeleton.

S180. (2)
Old NCERT