SOF - NSO - STAGE-1_11TH STD

ANSWER SHEET

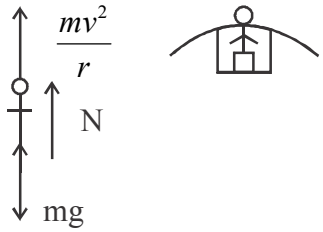
1.	(A)	2.	(D)	3.	(A)	4.	(C)	5.	(B)
6.	(C)	7.	(A)	8.	(B)	9.	(A)	10.	(B)
11.	(B)	12.	(B)	13.	(C)	14.	(D)	15.	(A)
16.	(B)	17.	(B)	18.	(C)	19.	(D)	20.	(B)
21.	(A)	22.	(A)	23.	(A)	24.	(C)	25.	(A)
26.	(A)	27.	(C)	28.	(D)	29.	(B)	30.	(B)
31.	(A)	32.	(B)	33.	(A)	34.	(A)	35.	(C)
36.	(B)	37.	(C)	38.	(B)	39.	(D)	40.	(A)
41.	(D)	42.	(C)	43.	(B)	44.	(C)	45.	(A)
46.	(B)	47.	(B)	48.	(B)	49.	(B)	50.	(C)

BIOLOGY

31.	(A)	32.	(D)	33.	(B)	34.	(B)	35.	(D)
36.	(D)	37.	(D)	38.	(A)	39.	(D)	40.	(B)
41.	(A)	44.	(B)	45.	(D)	47.	(B)	48.	(B)
49.	(D)	50.	(B)						

1. (A)

at E

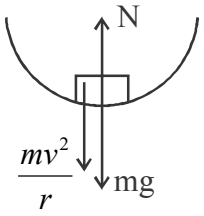


$$\frac{mv^2}{r} + N_2 = mg$$

$$\Rightarrow \frac{m \cdot gr}{r} + n = mg$$

$$\Rightarrow \boxed{N_E = 0}$$

at A



$$N = mg + \frac{mv^2}{2}$$

$$\Rightarrow N = mg + \frac{m}{r} + g$$

$$\Rightarrow N = 2mg$$

$$\Rightarrow \boxed{N_A = 2W}$$

2. (D)

$$F_d = -kv$$

$$F_{net} = mg - kv$$

$$\Rightarrow Ma = mg - kv$$

$$\Rightarrow m \cdot \frac{dv}{dt} = mg - kv$$

$$\Rightarrow m\int_0^v \frac{dv}{mg - kv} = \int_0^t dt$$

$$\Rightarrow \frac{m}{k}\log\left(\frac{mg - kv}{mg}\right) = -t$$

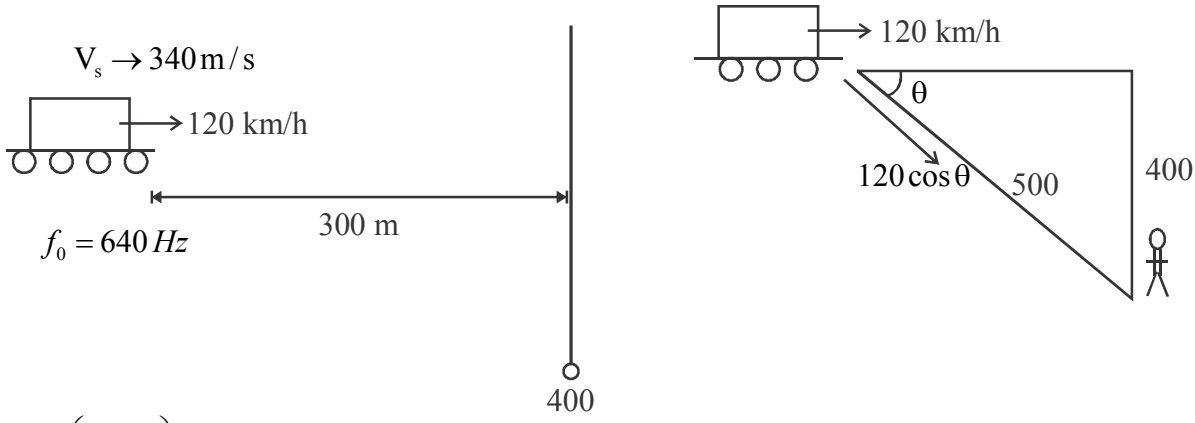
$$\Rightarrow \log\left(\frac{mg - kv}{\log}\right) = \frac{t}{\tau}$$

$$\Rightarrow \frac{mg - kv}{mg} = e^{-t/\tau}$$

$$\Rightarrow \left(1 - e^{-t/\tau}\right)mg = kv$$

$$\Rightarrow \boxed{v = \tau g\left(1 - e^{-t/\tau}\right)}$$

3. (A)



$$f' = \left(\frac{v}{v - v_s}\right) f_0$$

$$= \frac{340}{340 - 20} \times 640$$

$$= \frac{340}{320} \times 640$$

$$= 680\,Hz$$

4. (C)

There is no external force, hence centre of mass of a system (C_2) will not change but due to conservation of linear momentum C_1 will move.

5. (B)

When light is coming from infinite then image will form at focus. So in tensity in the regions PQ and RS will be smaller than the intensity in the region QR.

6. (C)

$$P = k\rho^a \ell v^b d^c \eta$$

$$\left[ML^{-1}T^{-2}\right] = [1]\left[ML^{-3}\right]^a L^{-1}\left[LT^{-1}\right]^b \cdot [L]^c \left[ML^{-1}T^{-1}\right]$$

$$\Rightarrow \left[ML^{-1}T^{-2}\right] = M^{a+1}L^{-3a+1+b+c-1}T^{-b-1}$$

$$\Rightarrow \left[ML^{-1}T^{-2}\right] = M^{a+a}L^{-3a+b+c}T^{-b-t}$$

$a + 1 = 1 \qquad -b - 1 = -2$

$\Rightarrow a = 0, \qquad \Rightarrow -b = -1$

$\Rightarrow b = 1$

$\& \quad -3a + b + c = -1$

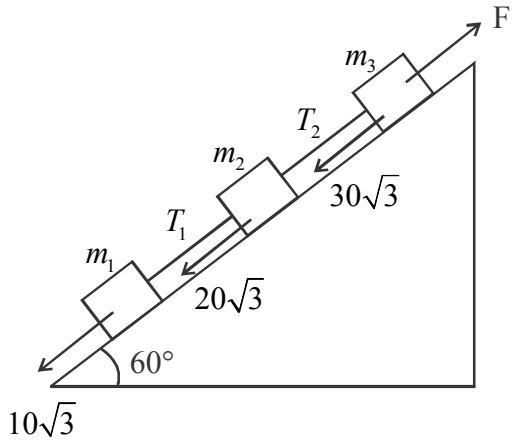
$\Rightarrow 0 + 1 + c = -1$

$\Rightarrow c = -2$

$a + b - c = 0 + 1 - (-2)$

$= 3$

7. (A)

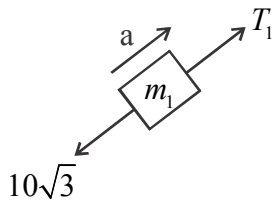


$F - 60\sqrt{3} = 12a$

$\Rightarrow 120 - 60\sqrt{3} = 12a$

$\Rightarrow a = \dfrac{\left(120 - 60\sqrt{3}\right)}{12} = \left(10 - 5\sqrt{3}\right) m/s^2$

FBD of m_1



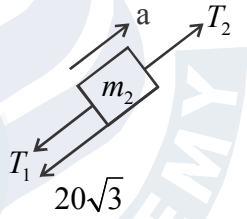
$T_1 - 10\sqrt{3} = m_1 a$

$\Rightarrow T_1 = 10\sqrt{3} + 2\left(10 - 5\sqrt{3}\right)$

$\Rightarrow T_1 = 10\sqrt{3} + 20 - 10\sqrt{3}$

$\Rightarrow \boxed{T_1 = 20\,N}$

FBD pf m_2



$T_2 - T_1 - 20\sqrt{3} = m_2 a$

$\Rightarrow T_2 = T_1 + 20\sqrt{3} + 4\left(10 - 5\sqrt{3}\right)$

$\Rightarrow T_2 = 20 + 20\sqrt{3} + 40 - 20\sqrt{3}$

$\Rightarrow T_2 = 20 + 20\sqrt{3} + 40 - 20\sqrt{3}$

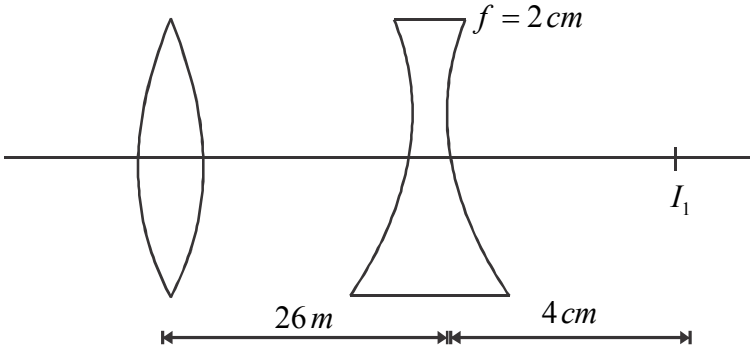
$\Rightarrow \boxed{T_2 = 60\,N}$

8. (B)

$f = 30\,cm,\ hi = 2\,cm,\ u = \infty$

$v = f = 30\,cm$

For, concave lens



$u = -4\,cm$

$f = -20\,cm$

$\dfrac{1}{v} + \dfrac{1}{u} = \dfrac{1}{f}$

$\Rightarrow \dfrac{1}{v} = \dfrac{1}{f} - \dfrac{1}{u}$

$\Rightarrow v = \dfrac{uf}{u - f}$

$\Rightarrow v = \dfrac{(-4)(-w) - 4 + 20}{16} = \dfrac{4 \times 20}{16} = 5\,cm$

$$Now: \frac{hi}{ho} = \frac{v}{u}$$

$$\Rightarrow \frac{hi}{(-2)} = \frac{(5)}{(-4)}$$

$$\Rightarrow \boxed{hi = 2.5\,cm}$$

9. (A)

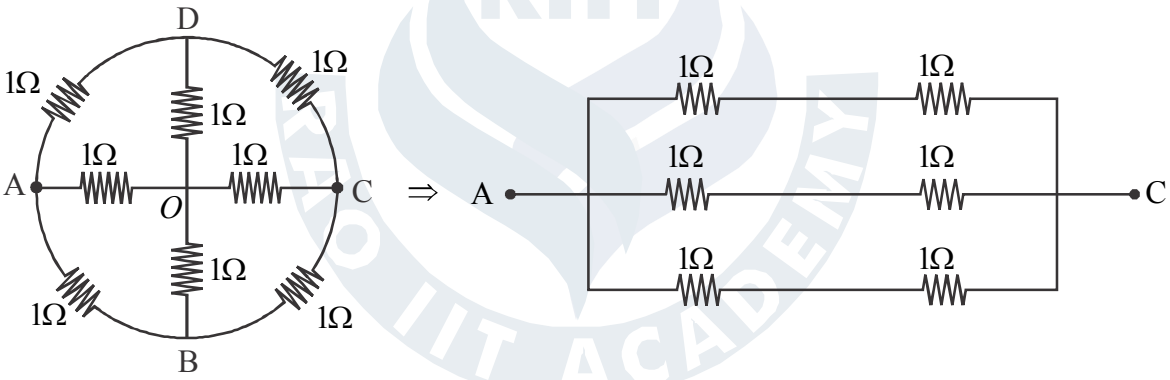
$$F_{net} = 0$$

$$\Rightarrow \frac{dp}{dt} = 0$$

$$\Rightarrow \Delta p = \text{constant}$$

$$\boxed{p_f = p_i}$$

10. (B)



Due to symmetry in branch DO & OB current will not flow

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$$

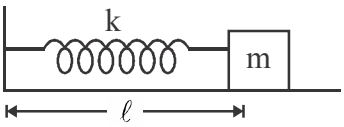
$$\Rightarrow \frac{1}{R_{eq}} = \frac{1+1+1}{2} = \frac{3}{2}$$

$$\Rightarrow \boxed{R_{eq} = \frac{2}{3}\Omega}$$

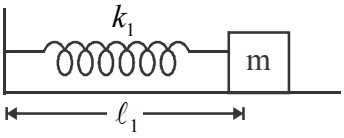
11. (B)

Statement 1 and 2 are correct but 2 is not the correct explanation of statement 1. Since in any conductor number of positive charge is equal to number of negative charge, so net charge is zero. But magnetic field is due to some moving charge.

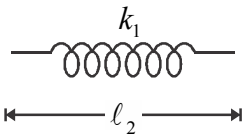
12. (B)



$$T = 2\pi\sqrt{\frac{m}{k}}$$



$\ell_1 = 2\ell_2$



Also, $\ell_1 + \ell_2 = \ell$

$$\Rightarrow \ell_1 + \frac{\ell_1}{2} = \ell$$

$$\Rightarrow \frac{3\ell_1}{2} = \ell \qquad \Rightarrow \ell_1 = \frac{2\ell}{3}$$

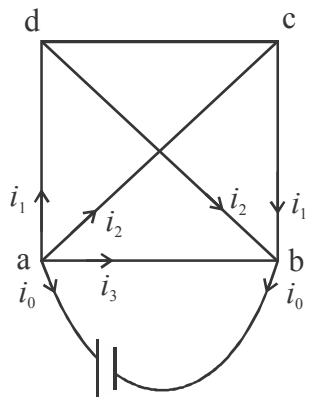
$$k_1 = \frac{\ell_1 + \ell_2}{\ell_1} k = \frac{\ell}{2\ell} \times 3k$$

$$= \frac{3}{2}k$$

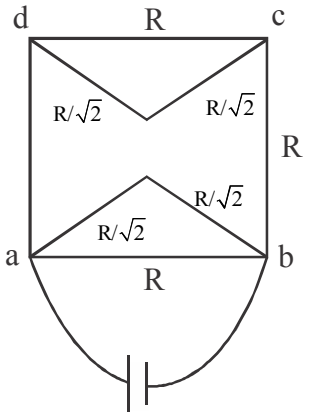
$$T' = 2\pi\sqrt{\frac{m}{k_1}} \qquad = 2\pi\sqrt{\frac{m\times 2}{3k}} = 2\pi\sqrt{\frac{\mathrm{m}}{\mathrm{k}}} = \sqrt{\frac{2}{3}}$$

$$\boxed{T' = \sqrt{\frac{2}{3}}T}$$

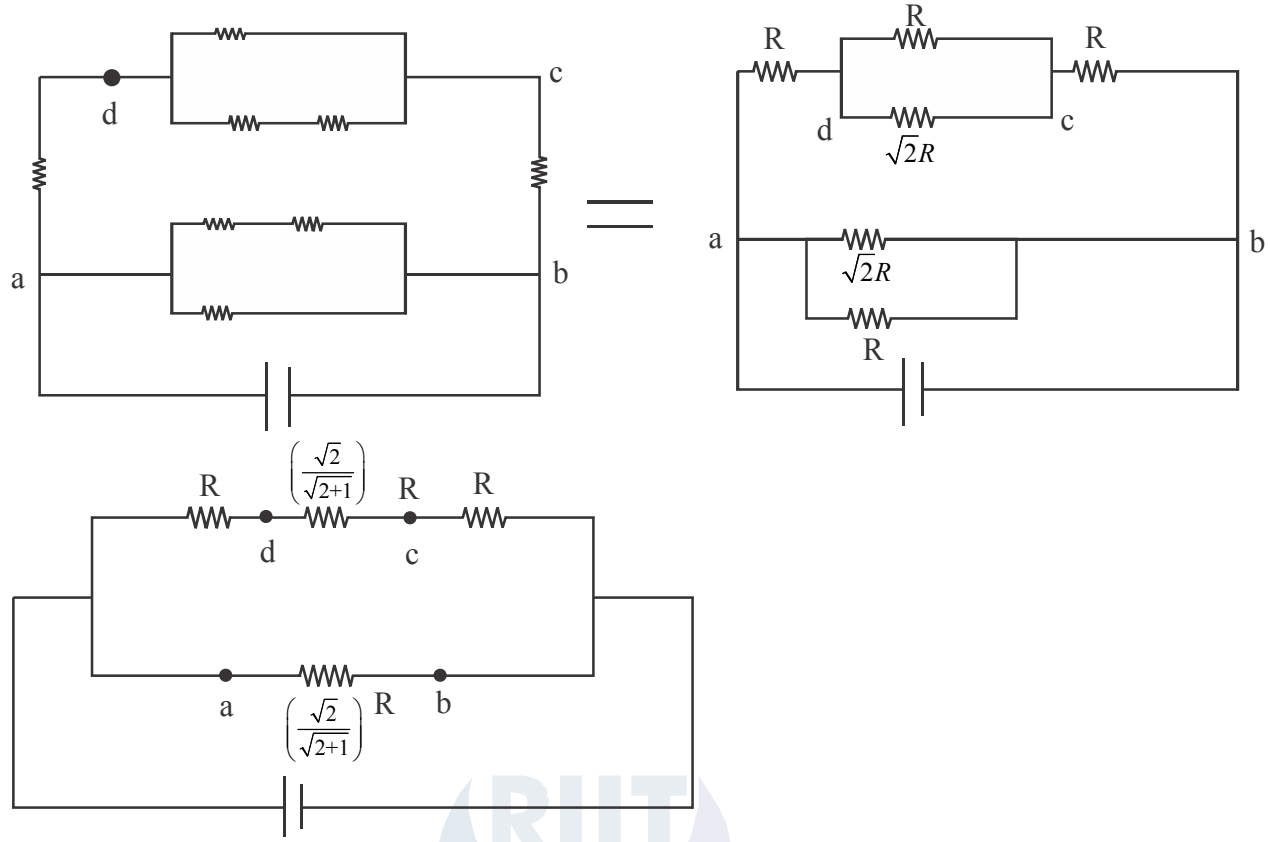
13. (C)



Due to symettry,



So circuit can be reduced to



$$V_{dc} = \left(R_{dc}\right)$$

$$= \left(\frac{\sqrt{\sqrt{2}}}{\sqrt{2}+1}\right)\left(\frac{V_0}{2+\frac{\sqrt{2}}{\sqrt{2}+1}}\right) \Rightarrow \frac{V_0}{3+\sqrt{2}}$$

$$\frac{P_{ab}}{P_{cd}} = \frac{V_{ab}^2/R_{ab}}{V_{cd}^2/R_{cb}} = \frac{V_0^2}{V_0^2}\left(3+\sqrt{2}\right)^2$$

$$= 9+6\sqrt{2}+2 \quad \Rightarrow 11+6\sqrt{2}$$

14. (D)

Mixture of AgCl and AgBr weight 0.4355 g

$$\underset{2x}{2AgBr} + \underset{x}{Cl_2} \longrightarrow \underset{2x}{2AgCl} + \underset{x}{Br_2}$$

Mass of AgCl formed $= (2x)\times(143.5\,g)$

$$2x(188g) - 2x(143.5) = 0.0782$$

$$2x(44.5) = 0.0782$$

$$x = \frac{0.0782}{89} = 0.00088g$$

Mass of AgBr in the mixture $= 2\times 0.00088\times 188 = 0.330\,g$

Mass of AgCl in the initial mixture $= 0.4355 - 0.330 = 0.014\,g$

$$\text{Moles of AgCl} = \frac{0.014}{143.5} = 0.00072$$

$$\text{Mass of Cl} = 0.00072 \times 35.5 = 0.0257$$

$$\%\text{ of } Cl = \frac{0.0257}{0.4355} \times 100 = 5.97\%(\text{approx})$$

15. (A)

$$I^{\ominus} + \overset{+5}{Cl}O_3^- + H_2\overset{+6}{S}O_4 \longrightarrow \overset{-1}{Cl}^{\ominus} + H\overset{+6}{S}O_4^{\ominus} + \overset{0}{I}_2$$

(I) Iodine oxidation number change from - 1 to 0, so iodine is oxidised.

(III) Oxidation number of sulphur is not change, so it is neither oxidised nor reduced.

(V) Oxidation number of chlorine changes from (+5) to (-1) means gain of $6e^{\ominus}$'s hence Cl is reduced.

$$\underset{2}{\underbrace{2I^{\ominus}}} + \overset{+5}{\overset{6}{\overbrace{ClO_3^-}}} + H_2SO_4 \longrightarrow Cl^{\ominus} + HSO_4^{\ominus} + I_2$$

By oxidation number method

$$5H^{\oplus} + 6I^{\ominus} + ClO_3^{\ominus} + H_2SO_4 \longrightarrow Cl^{\ominus} + HSO_4^{\ominus} + 3I_2 + 3H_2O$$

I, II, V are correct.

So option (A) is correct.

16. (B)

(I) is correct.

(II) is wrong [Reduction $\rightarrow$ cathode, oxidation-anode]

(III) Ion's starts moving randomly because cell is incomplete.

So I and III are correct means option (B) is the answer.

17. The electronegativity difference between

$Al - F = 2.37$

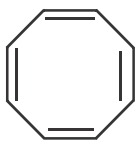
$Al - cl = 1.55$

So $AlCl_3$ is covalent and AlF_3 is ionic.

18.  $\longrightarrow$ $4\pi e^{\ominus}1S$ mean non-aromatic for a compound to be aeromatic there must be

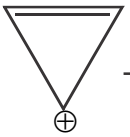
$P\,sp^3$

$(un+2)\pi e^{\ominus}1S$. One carbon is sp^3 hybridised that's way it is non-planar.

(1)  $\longrightarrow$ Number of $\pi - e^{\ominus}1S = 8\left(un\,\pi\, e^{\ominus}1S\right)$ means non-aeromatic.

It has a tub-shaped structure.

(R)  (R) $\longrightarrow$ Number of $\pi - e^{\ominus} 1S = 4e^{\ominus}\left(un\,\pi\, e^{\ominus}\right)$ and there is conjugation due to the presence of positive charge hence this compound is anti-aeromatic.

(S)  $\longrightarrow$ Number of $\pi - e^{\ominus}$ is $\hat{2}(un+2)\pi e^{\ominus}$ and there is conjugation due to positive charge hence it is an aeromatic compound and all carbons are sp^2 hybridised hence it is planar.

So, (C) is wrong because R is anti-aromatic.

19. (D)

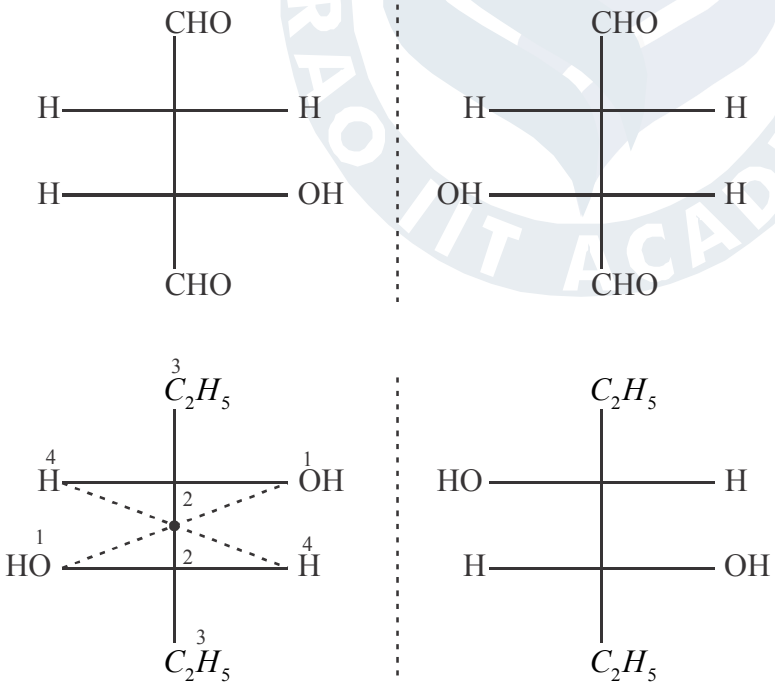
$N_1V_1 = N_2V_2$

$\Rightarrow 0.2\times100 = 0.25\times2\times V$

$\Rightarrow V = 40\,mL$

Temp. wil rise till 40mL of H_2SO_4 for complete neutralisation and then it will remain constant.

20. (B)



In compound B there is a centre of symettery so it doesn't show optical activity.

21. (A)

$C_nH_{2n} + H_2 \longrightarrow C_nH_{2n+2}$

Hydrocarbon molecular mass $(54g) = C_4H_6$

$C = C - C = C$ or $C - C - C \equiv C$

$\underset{0.185\,\text{mole}}{C_4H_6} + \underset{0.37\,\text{mole}}{2H_2} \longrightarrow C_4H_{10}$

Twice the mole oc hydrocarbon is required hence their is two double bond.

22. (A)

Order of rate of reactino of alkenes with HCl.

(A) A is correct because more than electron donating group is attached, more the rate of reaction and $NH_2 > CF_3$

(B) $CH_3 - CH_2 - (CCH_3) \equiv CH_3 \rightarrow$ hence more number of $\alpha - H$ hence rate of reaction is more.

23. (A)

(I) Metallic character decreases across a period.

(II) Number of vallence $e^{\ominus}1S$ increases

(III) Acidic character of oxidise increases.

(IV) because size increases, ionization energy decreases

(V) As size increases, electropositive character increases

(VI) Number of valence remains same in a group.

(II), (III) and (IV) are correct.

24. (C)

	A	+	B	$\rightleftharpoons$	C	
$At.eq.$	n_1		n_1		n_2	$\rightarrow Volume = V$
$At\ new\ eq.$	$n_1 - x$		$n_1 - x$		$n_2 + x$	$\rightarrow Volume = 2V$

$$K_c = \frac{\left(\frac{n_2}{V}\right)}{\left(\frac{n_1}{V}\right)^2} = \frac{\left(\frac{n_2}{V}\right)}{(16)^2} \Rightarrow \frac{n_2}{V} = 256\,K_c \qquad K_c^1 = \frac{\frac{(n_2 + x)}{2V}}{\left(\frac{n_1 - x}{2V}\right)^2} = K_c \ \{\text{Temp. Same}\}$$

$$\frac{n_1 - x}{2V} = 10(\text{given}) \ \& \ \frac{n_1}{V} = 16(\text{given}) \quad \Rightarrow \boxed{\frac{x}{2V} = -2}$$

$$\therefore \quad K_c = \frac{128K_c - 2}{10 \times 10} \Rightarrow K_c = \frac{2}{28} = 0.07$$

25. (A)

Values of 'b'	Values of 'a'
$He - 0.0238$	$Cl_2 = 6.579$
$H_2 \to 0.02661$	$H_2 = 0.2476$
$CO_2 = 0.04267$	$O_2 = 1.382$
$O = 0.03186$	

Value of b for $CO_2 > O_2 > H_2 > He$

Values of a for $Cl_2 > O_2 > H_2$

Achiever's section

$P \to CO_2$ gas turns lime water milky.

$H_2 \to$ turns anhydrous copper sulphate blue.

$$\underset{42g}{X} \longrightarrow \underset{11g}{CO_2} + \underset{5g}{H_2} + \underset{26}{R}$$

X is $NaHCO_3$ and R is Na_2CO_3

$$\underset{\frac{1}{2}mole}{2NaHCO_3} \longrightarrow \underset{\frac{1}{4}mole}{CO_2} + \underset{\frac{1}{4}mole}{H_2O} + \underset{\frac{1}{4}mole}{Na_2CO_3}$$

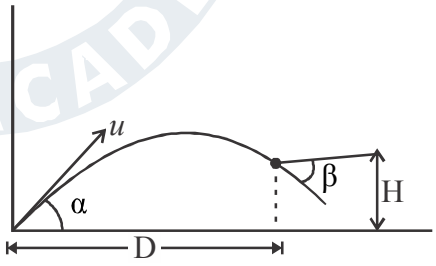
26. (A)

D=ucos$\alpha \cdot$ t

$$\Rightarrow t = \frac{D}{u\cos t}$$

$$Also,\ H = D\tan\alpha - \frac{g D^2}{2u^2\cos^2\alpha}$$

$$\Rightarrow \frac{g D^2}{2u^2\cos^2\alpha} = D\tan\alpha - H \qquad .....(i)$$



$$\Rightarrow \frac{2u^2\cos^2\alpha}{g D^2} = \frac{1}{D\tan\alpha - H}$$

$$\Rightarrow u = \sqrt{\frac{g D^2}{2\cos^2\alpha \cdot D\left(\tan\alpha - \frac{H}{D}\right)}} \qquad \Rightarrow u = \sqrt{\frac{g D}{2\cos^2\alpha\left(\tan\alpha - \frac{H}{D}\right)}}$$

$$\therefore v_y = u_y - gt$$

$$v_y = u\sin\alpha - g\frac{D}{u\cos\alpha}$$

$$\tan\beta = \frac{v_y}{v_\alpha}$$

$$\Rightarrow \frac{u\sin\alpha - \frac{gD}{u\cos\alpha}}{u\cos\alpha}$$

$$from\ (1),\ \frac{gD}{u\cos\alpha} = \frac{(D\tan\alpha - H)2\cdot u\cos\alpha}{D}$$

$$\therefore \tan\beta = \frac{u\sin\alpha - \frac{(D\tan\alpha - H)2u\cos\alpha}{D}}{u\cos\alpha}$$

$$= \frac{uD\sin\alpha - D\tan\alpha\cdot 2u\cos\alpha + H\cdot 2u\cos\alpha}{uD\cos\alpha}$$

$$= \frac{uD\sin\alpha - 2Du\sin\alpha + 2Hu\cos\alpha}{uD\cos\alpha}$$

$$= \frac{-Du\sin\alpha + 2Hu\cos\alpha}{uD\cos\alpha}$$

$$= -\tan\alpha + \frac{2H}{D}$$

$$\tan\beta = \frac{2H}{D} - \tan\alpha$$

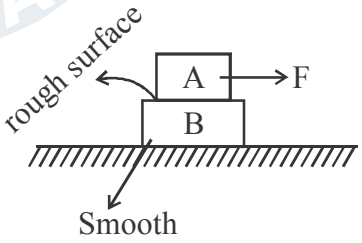
$$\Rightarrow \beta = \tan^{-1}\left[\frac{2H}{D} - \tan\alpha\right]$$

27. (C)

till, F = f, both blocks move together

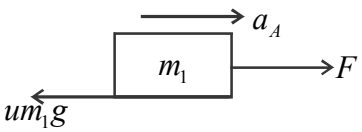
or, $f_{s\max} \geq f_{req}$, both block move together

When, $f_{req} > f_{s\max}$, then relative motion taken place.



Now, when, $f_{req} > f_{s\max}$

FBD of A

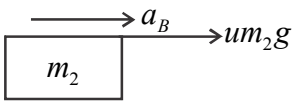


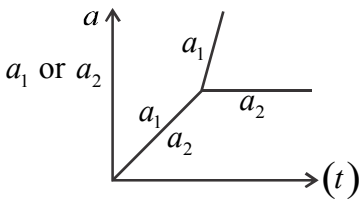
$$f - umg = m_1 a$$

$$\Rightarrow a_A = \frac{F}{m_1} - ug,$$ & F is function of time

$\therefore$ a_A is function of time.

FBD of B,





$um_2g = m_2a_B$

$\Rightarrow a_B = ug = \text{constant}$

28. The metal present is Na and its weight is 23.

29. (B)

X is $NaHCO_3$ by the above reaction R is Na_2CO_3

30. (B)

Process xy,

Work done on the gas $\Delta w > O$

$\Delta U < O$

$\Delta U = q + w$

$q = \Delta U - w$

Hence Δq is negative.

Process y-z

$T_z > T_y$

$\boxed{\Delta U_{y-z} > O}$

Work done on the gas $w_{yz} < O,\ \Delta Q_{y-z} > 0,\ \Delta U = q + w$

Process w_{zxy}

w_{zxy} = work done on the gas in xyz process.

$\boxed{W_{xyz} > O}$

Option (B) is correct.

31. (A)

Total distance travelled is 370 km

1st case :

Distance travelled by train = 250 km

$\therefore$ Distance travelled by car = (370 - 250) km = 120 km

2nd case :

Distance travelled by train = 130 km

$\therefore$ Distance travelled by car = (370 - 130) km = 240 km

Let, the speed of train be V_1 & the speed of car be V_2

$\text{time} = \dfrac{\text{distance}}{\text{speed}}$

So, $\dfrac{250}{V_1} + \dfrac{120}{V_2} = 4$ .....(1)

$\dfrac{130}{V_1} + \dfrac{240}{V_2} = 4 + \dfrac{18}{60}$

$= 4 + \dfrac{3}{10}$

$= \dfrac{43}{10}$ .....(2)

Multiplying equation (1) with (2) and subtraction from (2),

$\dfrac{500}{V_1} + \dfrac{240}{V_2} = 8$

$-\dfrac{130}{V_1} - \dfrac{240}{V_2} = -\dfrac{43}{10}$

$\dfrac{370}{V_1} = 8 - \dfrac{43}{10} = \dfrac{80-43}{10} = \dfrac{37}{10}$

$\Rightarrow V_1 = 100\,km/hr$

Substituting V_1 in equation (1), we get,

$\dfrac{250}{100} + \dfrac{120}{V_2} = 4 \qquad \Rightarrow \dfrac{120}{V_2} = 4 - \dfrac{5}{2}$

$\Rightarrow \dfrac{120}{V_2} = \dfrac{8-5}{2} \qquad \Rightarrow \dfrac{120}{V_2} = \dfrac{3}{2}$

$\Rightarrow V_2 = 80\,km/hr$

So, $V_1 = 100\,km/hr$ and $V_2 = 80\,km/hr$

32. (B)

$^{100}C_{50}\, P^{50} \cdot (1-P)^{50} = {}^{100}C_{51}\, P^{51} (1-P)^{49}$

$\dfrac{100!}{50!50!}(1-P) = \dfrac{100!}{51!49!}P$

$\dfrac{1-P}{50} = \dfrac{P}{51}$

$\Rightarrow 51 = 51P + 50P \qquad \Rightarrow 51 = 101P$

$\Rightarrow P = \dfrac{51}{101}$

33. (A)

Number of green dyes = 5

Number of blue dyes = 4

Number of blue dyes = 3

Total number of combination

$= {}^5C_1 \cdot {}^4C_1 \cdot {}^3C_1 + {}^5C_2 \cdot {}^4C_1 \cdot {}^3C_1 + {}^5C_3 \cdot {}^4C_1 \cdot {}^3C_1 + {}^5C_4 \cdot {}^4C_1 \cdot {}^3C_1 + {}^5C_5 {}^4C_1 + {}^3C_1 + \ldots\ldots$

$= \left({}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_1 + {}^5C_5\right) \cdot {}^4C_1 \cdot {}^3C_1$

$= \left({}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5\right) \cdot {}^4C_2 \cdot {}^3C_1$

$= \left({}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5\right) \cdot {}^4C_3$

$= \left({}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5\right)\left({}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4\right)\left({}^3C_0 + {}^3C_1 + {}^3C_2 + {}^3C_3\right)$

$= \left(5 + \frac{5\times4}{2} + \frac{5\times4}{2} + 5 + 1\right)\left(4 + \frac{4\times3\times2\times1}{2} + 4 + 1\right)(1+3+3+1)$

$= (5+10+10+5+1)(4+6+4+1)(1+3+3+1)$

$= (31)(15)(8)$

$= 3720$

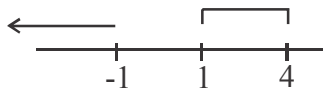
34. (A)

$f(x) = \sqrt{4-x} + \frac{1}{\sqrt{x^2-1}}$

$\Rightarrow 4 - x \geq 0$ & $x^2 - 1 > 0$

$\Rightarrow x - 4 \leq 0$ $(x-1) > 0$ & $(x+1) > 0$

$\Rightarrow x \leq 4$ $x > 1$ & $x < -1$

$\Rightarrow$ 

$\Rightarrow (-\infty, -1] \cup (1, 4]$

35. (C)

(S) $\left[\frac{\tan\theta}{1+\sec\theta} - \frac{\tan\theta}{(1-\sec\theta)}\right] = \frac{\tan\theta(1-\sec\theta) - \tan\theta(1+\sec\theta)}{(1+\sec\theta)(1-\sec\theta)}$

$= \frac{\tan\theta - \tan\theta\cdot\sec\theta - \tan\theta - \tan\theta\cdot\sec\theta}{1-\sec^2\theta}$

$= \frac{-2\tan\theta\cdot\sec\theta}{-\tan^2\theta} = \frac{-2}{-\cos\theta} \times \frac{\cos\theta}{\sin\theta} = 2\text{cosec}\,\theta$

$= 2$

36. (B)

$(p \wedge q) \to p$

p	d	$(p \wedge q)$	$(p \wedge q) \to p$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	T

$\Rightarrow (p \wedge q) \to p$ is a tautology

37. (C)

Let $L_1 : 3x - 4y - 7 = 0$

$L_2 : 2x - 3y - 5 = 0$ and if they are the diameter.

Then their intersection will be the centre.

$3x - 4y = 7 \quad ....(1)$

& $2x - 3y = 5 \quad .....(2)$

Multiply equation (i) with (2) & equation (2) with (3) & substrats

$$\begin{array}{r} 6x - 8y = 14 \\ -6x + 9y = -15 \\ \hline y = -1 \end{array}$$

$\Rightarrow$ Centre (1, -1)

If $y = -1$ & $x = 1$

Equation will be

$x^2 + y^2 - 2x + 2y - 47 = 0$

38. (B)

$L_1 : x - 2y - 3 = 0$

$L_2 : 3x - 2y - 5 = 0$

$M_1 = \frac{1}{2}$

$M_2 = \frac{3}{2}$

$\frac{m_1 - m_2}{1 + m_1 m_2} = \frac{m_2 - m}{1 + m_2 m}$

$$\frac{-4}{4+3}=\frac{\frac{3}{2}-m}{1+\frac{3m}{2}}$$

$$\frac{-4}{7}=\frac{\frac{3}{2}-m}{1+\frac{3}{2}m}$$

$$-3-6m=\frac{21}{2}-7m$$

$$m=\frac{21+4}{2}$$

$$y=mc+C$$

$$y=\frac{29}{2}x+C$$

And the point of intersection of L_1 & L_2 is

$$\begin{array}{l} -x+2y+3=0 \\ \underline{\&\ \ 3x-2y-5=0} \\ 2x-2=0 \end{array}$$

$$\Rightarrow x=1 \ \ \& \ \ y=-1$$

Subtracting : $(1,-1)$, is $y=\frac{29x}{2}+C$

$$\Rightarrow -1=\frac{29}{2}+C$$

$$\Rightarrow C=-1-\frac{29}{2}$$

$$=-\frac{31}{2}$$

$\Rightarrow$ Equation of line is $y=\frac{29x}{2}-\frac{31}{2}$

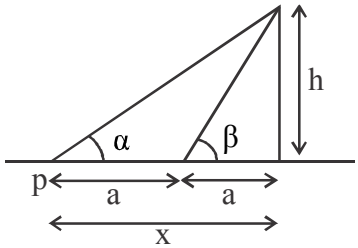
$$\Rightarrow 2y=29x-31$$

$$\Rightarrow 29x-2y-31=0$$

39. (D)

$$\frac{x+d}{h}=\cot\alpha,\ \frac{x}{h}=\cot\alpha$$

$$\cot\beta+\frac{d}{h}=\cot\alpha\Rightarrow\frac{d}{h}=\cot\alpha-\cot\beta$$



$$h=\frac{d}{\cot\alpha-\cot\beta}$$

40. (A)

$$\lim_{x\to\frac{\pi}{2}} \frac{\cot x - \cos x}{(\pi - 2x)^3}$$

since, $x \to \frac{\pi}{2}$

$x - \frac{\pi}{2} \to 0$

$2x - \pi \to 0$

$\pi - 2x \to 0$

Let, $\pi - 2x = y$

$x = \frac{\pi}{2} - \frac{y}{2}$

$\therefore y \to 0$

$$\therefore \lim_{y\to 0} \frac{\cot\left(\frac{\pi}{2} - \frac{y}{2}\right) - \cos\left(\frac{\pi}{2} - \frac{y}{2}\right)}{y^3} \quad \Rightarrow \lim_{x\to 0} \frac{\sin\frac{y}{2}\left(1 - \cos\frac{y}{2}\right)}{\cos\frac{y}{2}\, y^3} \Rightarrow \lim_{y\to 0} \frac{2\sin^2\frac{y}{2}}{\sin y} \frac{\left(2\sin^2\frac{y}{4}\right)}{y^3}$$

$$\Rightarrow \lim_{x\to 0} 4\frac{\sin^2\frac{y}{2}}{y^2} \cdot \frac{\sin^2\frac{y}{4}}{y^2} \cdot \frac{y}{\sin y} \quad \Rightarrow 4\lim_{y\to 0}\left(\frac{\sin\frac{y}{2}}{y}\right)^2 \lim_{y\to 0}\left(\frac{\sin\frac{y}{4}}{y}\right)^2 \lim_{y\to 0}\frac{y}{\sin y}$$

$$= 4 \times \frac{1}{4} \times \frac{1}{16} \times 1 = \frac{1}{16}$$

41. (D)

Given, class intervals of width 10

The medium group is 161 - 170

We call it "161 - 170" but it really includes values from 160.5 upto (but not including) 170.5

$$\therefore \text{ Estimated medium } = L + \frac{\frac{n}{2} - B}{G} \times w$$

$$= 160.5 + \frac{\frac{120}{2} - 34}{48} \times 10$$

$$= \boxed{165.92\, g}$$

where,

L = Lower class boundary of the group containing medium.

n = The total number of values

B = Cumulative frequency of the groups before the medium group.

G = Frequency of the medium group.

w = Group width.

42. (C)

$y^2+4y+4x+2=0$

$\Rightarrow y^2+4y+4-4+4x+2=0$

$\Rightarrow (y+4)^2+4x-2=0$

$\Rightarrow (y+4)^2=-4\left(x+\frac{1}{2}\right)$

Comparing it with $y^2=4AX$

$\Rightarrow A=-1$

& $X=x+\frac{1}{2}$

The equation of direction is $X=+a$

$x+\frac{1}{2}=-1$

$\Rightarrow x=\frac{-3}{2}$

43. $Q_1=90-\frac{D}{2}+90-\frac{C}{2}$

$Q_2=90-\frac{C}{2}+90-\frac{B}{2}$

$Q_3=90-\frac{B}{2}+90-\frac{A}{2}$

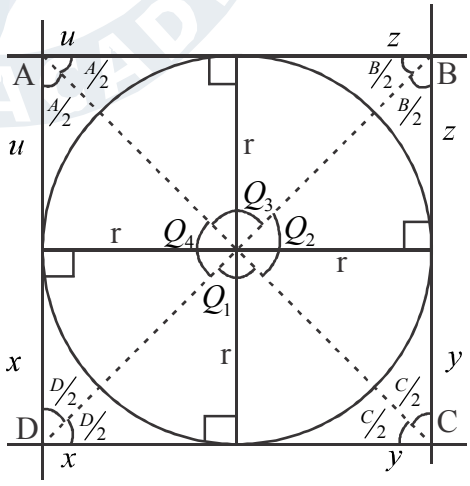
$Q_4=90-\frac{A}{2}+90-\frac{D}{2}$

$Q_1+Q_2+Q_3+Q_4=720^o-(A+B+C+D)$

$=720^O-360^O=360^O$

$Q_1=90^o+90^o-\frac{C}{2}-\frac{D}{2}$

$=180-\left(\frac{C+D}{2}\right)$



But, $A+B+C+D=360^o$

$\frac{C+D}{2}=180^o-\left(\frac{A+B}{2}\right)$ $\quad =180-180+\left(\frac{A+B}{2}\right)=\frac{A+B}{2}$

$Q_3=180-\left(\frac{A+B}{2}\right)$ $\quad \therefore Q_1,Q_3$ & Q_2,Q_4 are supplementary.

44. (C)

$\cot A, \cot B, \cot C$ are in A.P.

$\Rightarrow 2\cot B = \cot A + \cot C$

& $\cot(B-A) = \dfrac{\cot B \cdot \cot A + 1}{\cot A - \cot B}$

& $\cot(B-C) = \dfrac{\cot B \cot C + 1}{\cot C - \cot B}$

$\cot(B-A) + \cot(B-C)$

$= \dfrac{\cot(B)\cdot \cot A + 1}{\cot A - \cot B} + \dfrac{\cot B \cot C + 1}{\cot C - \cot B}$

$= \dfrac{\cot B \cot A \cdot (\cot C - \cot B) + \cot C - \cot B + \cot B \cot C(\cot A - \cot B) + (\cot A - \cot B)}{(\cot A - \cot B)(\cot C - \cot B)}$

$= \cot B \cot A \cot C - \cot^2 B \cot A + \cot C - \cot B + \cot A \cdot \cot B \cot C - \cot^2 B \cot C + \cot A - \cot B$

$= \dfrac{2\cot A \cot B \cdot \cot C - 2\cot B + \cot A + \cot C - \cot^2 B(\cot A + \cot C)}{\cot A \cdot \cot C - \cot A \cdot \cot B - \cot B \cdot \cot C + \cot^2 B}$

$= \dfrac{2\cot B(\cot A \cot C - 1) + (\cot A + \cot C)(1 - \cot^2 B)}{\cot A \cdot \cot C - \cot B(\cot A + \cot C - \cot B)}$

$= \dfrac{2\cot B(\cot A \cdot \cot C - 1) + 2\cos B(1 - \cot^2 B)}{\cot A \cdot \cot C - \cot^2 B}$

$= \dfrac{2\cot B(\cot A \cdot \cot C - \cot^2 B + 1 - 1)}{(\cot A \cdot \cot C - \cot^2 B)}$

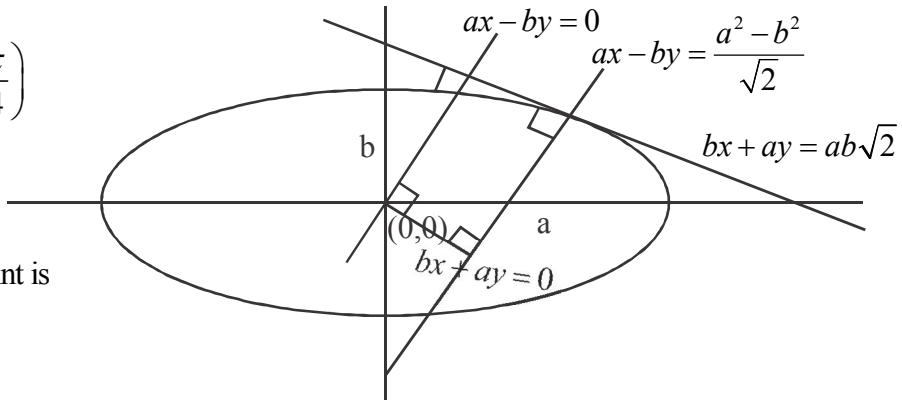
$= 2\cot B$

$\Rightarrow$ they are in A.P.

45. (A)

The point is $\left(a\cos\dfrac{\pi}{4}, b\sin\dfrac{\pi}{4}\right)$

$= \left(\dfrac{a}{\sqrt{2}}, \dfrac{b}{\sqrt{2}}\right)$



Target to the ellipse at this point is

$\dfrac{x\cos\theta}{a} + \dfrac{y\sin\theta}{b} = 1$

$\Rightarrow \boxed{\dfrac{x}{a\sqrt{2}} + \dfrac{y}{b\sqrt{2}} = 1}$

Normal to the ellipse at this pint is $ax\sec\theta - by\,\text{cosec}\,\theta = a^2 - b^2$

$$\boxed{ax\sqrt{2} - by\sqrt{2} = a^2 - b^2}$$

Now, perpendicular from centre of ellipse to these lines are by ax & ay + bx = 0

Now, area of rectangle formed by these lines $= \left|\frac{ab\sqrt{2}}{\sqrt{a^2+b^2}}\right| \times \left|\frac{a^2-b^2}{\sqrt{2}\sqrt{a^2+b^2}}\right|$

$$= \left(\frac{a^2-b^2}{a^2+b^2}\right)ab$$

46. (B)

xy plane $\Rightarrow Z = 0$

So, the point divides in the ratio $\frac{k}{1} = -\left(\frac{Z_1}{Z_2}\right)$

$$= -\left(\frac{3}{-1}\right)$$

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

$\Rightarrow$ Ratio is 3 : 1 internally.

47. (B)

Let the speed of the stream be v

Speed of the boat going upstream = 5-v

& Speed of the boat going downsteam = 5+v

Then the time taken to row upstream (t+1) $= \frac{21}{4(5-v)}$

& time taken to row downsreams (t) $= \frac{21}{4(5+v)}$

$$t+1 = \frac{21}{4(5-v)} \qquad t = \frac{21-4(5-v)}{4(5-v)}$$

$$= \frac{1+4v}{4(5-v)} \qquad \Rightarrow \frac{1+4v}{4(5-v)} = \frac{21}{4(5+v)}$$

$$(1+4v)(5+v) = 21(5-v) \qquad v+5+20V+4v^2 = 105-21v$$

$$4v^2+42v-100=0 \qquad 4v^2+50v-8v-100=0$$

$$2v(2v+25)-5(2v+25)=0 \qquad \Rightarrow (2v-4)(2v+25)=0$$

$$\Rightarrow v = 2 \text{ or } v = \frac{-25}{2} \longrightarrow (\text{Not possible})$$

$$\Rightarrow v = 2\,km/hr$$

48. Let n(A) be the number of people play cricket = 65
n(B) be the number of people play cricket = 40
n(C) be the number of people play cricket = 55

$n(A\cap B)=25, n(B\cap C)=24, n(A\cap C)=22$

$n(A\cup B\cup C)=n(A)+n(B)+n(C)-n(A\cap B)-n(B\cap C)-n(C\cap A)+n(A\cap B\cap C)$

$\Rightarrow 100=65+40+55-25-24-22+n(A\cap B\cap C)$

$\Rightarrow n(A\cap B\cap C)=100+24+25+22-65-40-55=11$

$n(A)=n(A)-n(A\cap B)-n(A\cap C)+n(A\cap B\cap C)$

$=65-25-24+11=29$

49. (B)

$\sec x-1=\left(\sqrt{2}-1\right)\tan x$

$But,\ \tan x=\sqrt{(\sec x+1)(\sec x-1)}$

$\therefore\ \sqrt{\sec x-1}=\left(\sqrt{2}-1\right)\left(\sqrt{\sec x+1}\right)$

Squaring on both sids, we get

$\sec x-1=\left(2+1-2\sqrt{2}\right)(\sec x+1)$

$\sec x\left(1-2-1+2\sqrt{2}\right)=3-2\sqrt{2}+1$

$\sec=\dfrac{4-2\sqrt{2}}{2\sqrt{2}-2}=\dfrac{2\left(2-\sqrt{2}\right)}{2\sqrt{2}-2}$

$=\dfrac{2\sqrt{2}\left(\sqrt{2}-1\right)}{2\left(\sqrt{2}-1\right)}$

$\boxed{\sec x=\sqrt{2}}$

$\therefore$ General solution $=2n\pi+\dfrac{\pi}{4}$

(or) in first step, of $\sqrt{\sec x-1}=0$

Then, $\sec x=1$

another solution $\Rightarrow 2n\pi$

$\therefore$ The general solution are $\boxed{2n\pi,\ 2n\pi+\dfrac{\pi}{4}}$

50. (C)

$$T_6 = {}^mC_5\left[2^{\frac{\log\left(10-3^x\right)}{2}}\right]^{m-5}\left[2^{\frac{(x-2)\log 3}{5}}\right]^5 = 21$$

$${}^mC_5\ 2^{(m-5)\frac{\log\left(10-3^x\right)}{2}+(x-2)\log 3} = 21$$

1st term of ap = ${}^mC_1$

3rd term of ap = ${}^mC_2$

5th term of ap = ${}^mC_3$

$${}^mC_2 - {}^mC_1 = {}^mC_3 - {}^mC_2$$

$$2\,{}^mC_2 = {}^mC_3 + {}^mC_1$$

$$2\frac{m!}{(m-2)!2!} = \frac{m!}{(m-3)!3!} + \frac{m!}{(m-1)!1!}$$

$$\frac{2}{(m-2)!2} = \frac{1}{(m-3)!6} + \frac{1}{(m-1)!}$$

$$\frac{1}{(m-2)!} = \frac{(m-1)(m-2)+6}{(m-1)!6}$$

$$6m-6 = m^2-3m+2+6$$

$$m^2-3m+8-6m+6=0$$

$$m^2-9m+14=0$$

$$(m-7)(m-2)=0$$

$$m = 7\ (\text{or})\ 2$$

m cannot be 2, because

${}^mC_5$ is not possible.

So, m = 7

$$Now,\ {}^7C_5\ 2^{(75)\frac{\log\left(10-3^x\right)}{2}+(x-2)\log 3} = 21$$

$${}^7C_5 = \frac{7!}{5!2!} = 21$$

$$\therefore \log\left(10-3^x\right)+(x-2)\log 3 = 0$$

$$\log\left(10-3^x\right)+\log 3^{(x-2)} = \log 1$$

$$\left(10-3^x\right)\left(3^{(x-2)}\right)=1$$

$$\left(10-3^x\right)\left(3^x\right)=9 \qquad \therefore\ \boxed{x=2}$$

BIOLOGY

31. (A)

Geographical barrir is the major cause of speciation as separated group develop distinct gene pool & they do not interbreed.

32. (D)

P-Pyruvic acid (3C), Q - Oxaloacetate (4C)

R - Oxalosuccinate (6C), S - Succinate(4C)

33. (B)

Bird '1' reproduces twice & produces 5 eggs out of this 3 survives whereas bird '2' reproduces 4 times & produces 6 eggs out of the only one bird survives. The shows that bird '1' is evolutionarily more fit than bird '2'.

34. (B)

In a monohybrid cross of long-winged fruit flies (V_g) & vestigial winged fruit flies (V_g) all F_1 hybrids are heterogygous long winged flies with genotype (V_g vg) In a test cross recessive parent i.e. vestigial winged fruit flies are crossed with heterozygous long winged flies, so the half progeny will be heterozygous long winged & half of the progeny will be with homozygous vestigial wings.

35. (D)

PCBs bioaccumlation depends on species, its habitat and type of PCBs often high in bottom feeding species

36. (D)

Reason not needed.

37. (D)

As the substrate concentration increases number of enzyme molecules also increases & inturn there is more enzyme-substrate complex molecules will be formed which will further increase the rate of enzymatic reaction.

38. (A)

At high altitude DPG is increased and that shift curve to right i.e. there is lower affinity for O_2 at first glance this does not seems good. However at tissues with their lower PO_2, the O_2 is going to be released more easily to tissue DPG. Allosterically promotes the release of oxygen molecule bound to the heamoglobin, thus enhancing the ability of RBCs to release O_2 near tissues that need it most. DPG is an allosteric effector.

39. (D)

When plasma conc of glucose rises above 200 mg / 100 ml, it increases the filtered load. If concentration rises above 260 mg / min, body cannot retain all glucose, leading to glucosuria.

40. (B)

Reason not needed.

41. (A)

Mosses are advanced Bryophytes, Fern is the pteridophyte, pine is gymnosperm & rose is angiosperm. Kingdom plantae is classified into thyllophyta, bryophyta, pteridophyta, gymnosperm & angiosperm as per the advanced characters in plants.

In the given, option (A) explain inferred evolutionary relationship.

44. (B)

The correct pathway for synthesis of carbohydrate in CAM plant is

$$PEPA + CO_2 \longrightarrow OAA \longrightarrow \underset{\downarrow CO_2}{\text{Malic acid}} \longrightarrow \text{Pyruvic acid}$$

Malic acid undergoes decarboxylation & this CO_2 enters in chloroplast & used in C_3 cycle for synthesis of carbohydrate.

45. (D)

In non-cyclic photophosphorylation, electron transport chain occurs in following sequence.

$$PS-II \rightarrow Co-Q \rightarrow PQ \rightarrow Cyt\,b_6 \rightarrow \text{ATP formation } Cyt.f \rightarrow PC \rightarrow PS-I \rightarrow FRS$$

$$\downarrow$$

$$2H_2O \text{ \& } O_2,\ 2NADPH \leftarrow Fd$$

In the given figure, DCMU interfers in ATP formation as it inhibits transfer of electrons to next electron acceptor where there is syntehsis of ATP $\left(Cyt.b_6 - Cyt.f\right)$. So next all steps of non-cyclic photophosphorylation will not occur and there will be no synthesis of ATP, oxygen & NADPH.

In the same way paraquat, inhibits transfer of electron towards NADP so there will not be formation of $NADPH_2$ & O_2 but there will be formation of ATP as paraquat doesn't inhibits electrons transfer between $Cyt \cdot b_6 \rightarrow Cyt \cdot f$.

47. (B)

Kulhs are most reliable & common form of irrigation in hilly areas of Himachal.

Khadin is water harvesting system in Rajasthan.

Kattas - earthen embankment across drainage lines to hold up water for irrigation at karnataka.

Bundhis - Water harresting technique in Madhya Pradesh.

Surangams - Water harvesting technique in Kerala.

48. (B)

In given figure is 'P' is seminal vesicles which is not responsible for neutralizing acidity of male urethra as well as female reproductive tract.

49. (D)

First, large peaked 'T' wave, then ST elevation, then negative T-waves & finally pathologic Q wave is develops when person suffers from myocardial infarction.

50. (B)

No reason needed.