WEEKLY TEST RANKER'S BATCH TEST - 12 RAJPUR
SOLUTION Date 15-12-2019

[PHYSICS]

1. EMF of the main battery = 2 Volt
Internal resistance of the main battery = 0
Length of the potentiometer wire = 4 meter

Potential gradient, $K = \frac{2}{4}$ Volt/meter

$= 0.5$ Volt/meter

Let r be the internal resistance of the given cell and E_c be its emf.

(i) First case :

$E_c = Kl_1 = K \times 3$ (i) $[\because l_1 = 3\text{m}]$

(ii) Second case :

Potential drop across the given cell (which is now balanced by the potentiometer)

$$V_c = E_c - i \times r = E_c - \frac{E_c}{r+R}r = E_c - \frac{E_c r}{r+9.5}$$

$$= E_c\left[1 - \frac{r}{r+9.5}\right] = E_c \times \frac{9.5}{r+9.5}$$

According to question —

$V_c = Kl_2 = K \times 2.85$ $[\because l_2 = 2.85\text{ m}]$

or $\frac{E_c \times 9.5}{r+9.5} = K \times 2.85$ ...(ii)

Dividing eq. (ii) by (i)

$$\frac{9.5}{r+9.5} = \frac{2.85}{3}$$

or $\frac{1}{r+9.5} = \frac{2.85}{28.5} = \frac{1}{10}$

or $r + 9.5 = 10$ or $r = 0.5\Omega$

2. Total potential difference across the potentiometer wire $= (10^{-3} \times 400)$ volt

$= 0.4$ volt.

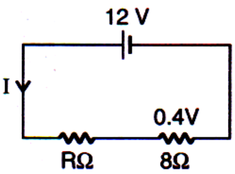


Fig. S-25.22

Hence, according to circuit shown in figure,

$$\frac{2}{R+8} = \frac{0.4\text{V}}{8\Omega} = \frac{1}{20}$$

or $R + 8 = 40$

or $R = 32\Omega$

3. Total resistance of the circuit

$$R = 1\,\Omega + 2\,\Omega + 3\,\Omega = 6\,\Omega$$

Current, $I = \dfrac{10-4}{6} = 1$ amp

The direction of the current would be from a to b *via e.*

4. The resistance of 1 m length wire will be,

$$R = (40\times10^{-8})/(8\times10^{-6}) = 5\times10^{-2}\Omega$$

$$\frac{\Delta V}{\Delta x} = (5\times10^{-2})\times0.2 = 10^{-2}\text{ V/m}$$

5.
$$R_1 = \frac{\rho l_1}{A_1}; \quad R_2 = \frac{\rho l_2}{A_2}$$

$$R_1 = \frac{\rho l_1}{A_1}\times\frac{l_1}{l_1} = \frac{\rho l_1^2}{V}$$

$$R_2 = \frac{\rho l_2}{A_2}\times\frac{l_2}{l_2} = \frac{\rho l_2^2}{V}$$

$\therefore \quad \dfrac{R_1}{R_2} = \dfrac{l_1^2}{l_2^2}$

For maximum resistance, $l_1 = 4$ cm

For minimum resistance, $l_2 = 2$ cm

$\therefore \quad \dfrac{R_1}{R_2} = \dfrac{16}{4} = 4$

6. Given that $\dfrac{P}{Q} = \dfrac{5}{R}$

In first case, $\dfrac{5}{R} = \dfrac{l_1}{100-l_1}$, ...(i)

In second case, when R is shunted with an equal resistance R, then

$$\frac{5}{\frac{R\cdot R}{R+R}} = \frac{1.6l_1}{100-1.6l_1}$$

7. As resistance are in parallel,

$$\frac{1}{R_{eq.}} = \frac{1}{220\,\Omega} + \frac{1}{220\,\Omega} + \ldots 5000$$

$$\frac{1}{R_{eq.}} = \frac{5000}{220}$$

or $\quad R_{eq.} = \dfrac{220}{5000}$

Now, $\quad V = 220$ V

$\therefore \quad I = \dfrac{220}{\frac{220}{5000}} = 5000$ A

8. Resultant resistance of three resistors of 3 Ω each,

$$R_s = 3 + 3 + 3 = 9\,\Omega$$

When connected in parallel,

$$\frac{1}{R_{||}} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1\,\Omega$$

$\therefore$ $R_{||} = 1\,\Omega$

Given internal resistance $r = 1\,\Omega$. When R_s is in series with the cell,

$$I_1 = \frac{E}{R_s + r} = \frac{E}{9+1} = \frac{E}{10}$$

When $R_{||}$ is in series with the cell,

$$I_2 = \frac{E}{R_{||} + r} = \frac{E}{2}$$

$\therefore$ $$\frac{I_1}{I_2} = \frac{E/10}{E/2} = \frac{1}{5}$$

9. For equal currents in the resistances, their values should be the same.

$$\frac{\rho_1 l_1}{\pi r_1^2} = \frac{\rho_2 l_2}{\pi r_2^2}$$

or $$\frac{r_1^2}{r_2^2} = \frac{\rho_1}{\rho_2} = \frac{1.0 \times 10^{-7}}{1.7 \times 10^{-8}}$$

$\therefore$ $$\frac{r_1}{r_2} = \sqrt{\frac{100}{17}} \simeq 2.4$$

10. P.D. across wire $= \frac{3}{3+2} \times 10\text{ V} = 6\text{ V}$

Potential gradient $K = \frac{V}{l} = \frac{6\text{ V}}{500}$ cm

$$= \frac{12}{1000}\text{ V/cm} = 12\text{ mV/cm}$$

11. **[In the question, the length 110 cm and 100 cm are interchanged as $\varepsilon > \frac{\varepsilon R}{R+r}$]**

Without being short circuited through R, only the battery ε is balanced.

$$\varepsilon = \frac{V}{L} \times l_1 = \frac{V}{L} \times 110\text{ cm} \qquad ...(i)$$

12.

$$q = \int_0^t I\,dt$$

$$= \int_0^5 (1.2t + 3)\,dt$$

$$= \left[1.2\frac{t^2}{2} + 3t\right]_0^5$$

$$= 1.2 \times \frac{25}{2} + 3 \times 5 = 15 + 15 = 30\text{ C}$$

13. From balanced Wheatstone bridge concept,

$$\frac{55\,\Omega}{R} = \frac{20}{80}$$

or $R = 220\,\Omega$

14. Potential across potentiometer wire

$$= \frac{(0.2 \times 10^{-3})\text{V} \times 1\text{m}}{10^{-2}\text{m}} = 0.02 \text{ V}$$

Also, $0.02 = \frac{R}{r + R} \times 2$

(Where R is resistance of potentiometer wire and r is resistance connected in series.)

$0.02\ (490 + R) = 2R$

On solving, $R = 4.9\ \Omega$

15. The drift velocity v_d is given by:

$$v_d = \frac{I}{neA} = \frac{V}{neAR}$$

or $v_d \propto V$

So, when the potential difference is doubled, the drift velocity will be doubled.

16. For maximum current,

$mR = nr$ ...(i)

Given that $mn = 45$ ...(ii)

Hence, $m \times 2.5 = n \times 0.5$

or $n = 5m$ ...(iii)

From equations (ii) and (iii), $5m^2 = 45$ or $m = 3$

$\therefore$ $n = 15$

17. Resistance of each bulb $= \frac{1.5}{3} = 0.5\ \Omega$

Let $R\ \Omega$ be the required series resistance. Then,

$$3 = \frac{6}{R + 0.5 + 0.5}$$

$\therefore$ $R = 1\ \Omega$

18. $$0.6 = \frac{n \times 1.5}{n \times 0.5 + 20}$$

Solving, we get; $n = 10$.

19. $$I_g = \left(\frac{S}{S + G}\right) I$$

or $\frac{I_g}{I} = \frac{S}{S + G}$ or $\frac{1}{34} = \frac{S}{S + G}$

$\therefore$ $S = \frac{G}{33} = \frac{3663}{33} = 111\ \Omega$

20.

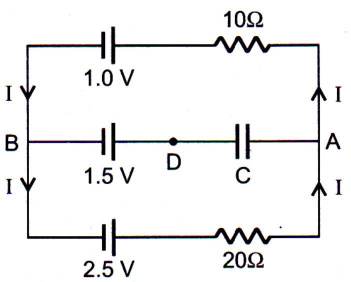


Fig. S-25.2

Current I is given by:

$$20I + 10I = 2.5 - 1.0 \quad \text{or} \quad I = \frac{1}{20}\text{amp}$$

$\therefore \quad V_A - V_B = 2.5 - I \times 20 = 1.5$ volt

But $\quad (V_A - V_D) + (V_D - V_B) = V_A - V_B = 1.5$

Since, there is no current through 1.5 volt cell, so,

$$V_D - V_B = 1.5 \text{ volt}$$

Hence, $\quad V_A - V_D = 0$ volt

21. Initially the current will pass through resistance between AB and capacitor C. The current will not pass through the resistance which is in parallel to C. The only resistance in the circuit $= R_{AB} = 1000\ \Omega$

$$\therefore \quad \text{Current} = \frac{2 \text{ volt}}{1000\ \Omega} = 2 \text{ mA}$$

The charging of capacitor takes place. Soon after the capacitor is fully charged, no current will pass through C. The current will now flow through 1000 Ω across C. Total resistance of the circuit will be, $1000 + 1000 = 2000\ \Omega$.

Hence, new current $= \dfrac{2 \text{ volt}}{2000\ \Omega} = 1$ mA

22. Current in the circuit will be,

$$I = \frac{(n-4)E}{nr}$$

Hence, potential difference across A and B is,

$$V = E + Ir = E + \frac{(n-4)E}{nr} \cdot r$$

$$= 2E\left(1 - \frac{2}{n}\right)$$

23. Let x be the desired length.

Potential gradient in the first case $= \dfrac{E_0}{l}$

$$\therefore \quad E = \left(\frac{l}{3}\right)\left(\frac{E_0}{l}\right) = \frac{E_0}{3} \quad \text{...(i)}$$

Potential gradient in the second case

$$= \frac{E_0}{3l/2} = \frac{2E_0}{3l}$$

$$\therefore \quad E = (x) \cdot \frac{2E_0}{3l} \quad \text{...(ii)}$$

From equations (i) and (ii),

$$\frac{E_0}{3} = \frac{2E_0}{3l} \cdot x \quad \text{or} \quad x = \frac{l}{2}$$

24. The current through the circuit before the battery of emf E_2 is short circuited is,

$$I_1 = \frac{E_1 + E_2}{R + r_1 + r_2}$$

After short circuiting the battery of emf E_2, current through resistance R would be,

$$I_2 = \frac{E_1}{R + r_1}$$

Now, $\quad I_2 > I_1$

$$\therefore \quad \frac{E_1}{R + r_1} > \frac{E_1 + E_2}{R + r_1 + r_2} \quad \text{or} \quad E_1 r_2 > E_2(R + r_1)$$

25.
$$\alpha = \frac{1}{R}\frac{dR}{dt}$$
$$= \frac{R_0(a + 2bt)}{R_0(1 + at + bt^2)} = \frac{a + 2bt}{1 + at + bt^2}$$

26. Given resistances in four arms $R_1 = R_2 = R_3 = R_4 = R$ and resistance of galvanometer $(G) = R$. We know that in a Wheatstone bridge, the resistance of galvanometer is ineffective. Now, resistances in upper arm are in series combination. Therefore, their equivalent resistance $(R_U) = R_1 + R_2 = R + R = 2R$. Similarly, equivalent resistance of lower arm $(R_L) = R_3 + R_4 = R + R = 2R$. Now, the equivalent resistances R_U and R_L are in parallel combination. Therefore, equivalent resistance of the combination as seen by the battery is,
$$(R_{eq.}) = \frac{R_U R_L}{R_U + R_L} = \frac{2R \times 2R}{2R + 2R} = R$$

27.
$$R_{t_1} = R_1[1 + \alpha_1 t]$$
$$R_{t_2} = R_2[1 + \alpha_2 t]$$
$$R_{t_s} = R_{t_1} + R_{t_2}$$
$$= R_1[1 + \alpha_1 t] + R_2[1 + \alpha_2 t]$$
$$= (R_1 + R_2) + (R_1\alpha_1 + R_2\alpha_2)\,t$$
$$= R_s + (R_1\alpha_1 + R_2\alpha_2)\,t$$
$$\therefore \quad \alpha_s = \frac{R_{t_s} - R_s}{R_s\, t}$$
$$= \frac{(R_1\alpha_1 + R_2\alpha_2)}{R_1 + R_2}$$

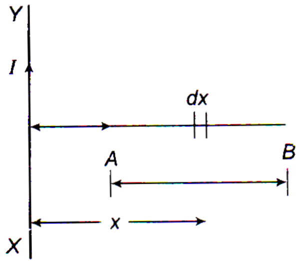
28. The current
$$I = \frac{6}{400 + 800} = \frac{6}{1200}$$
$$= \frac{1}{200} = 5 \times 10^{-3}\ \text{A}$$
$\therefore$ Voltage drop across 400 Ω $= 5 \times 10^{-3} \times 400$
$$= 2000 \times 10^{-3} = 2\ \text{V}$$
Because of the presence of the voltmeter having resistance $G = 10{,}000\ \Omega$ in parallel with 400 Ω, the effective resistance is,
$$\frac{400 \times 10{,}000}{10{,}400} = \frac{10{,}000}{26}\ \Omega$$
$\therefore$ Voltage measured $= \frac{10{,}000}{26} \times 5 \times 10^{-3} = \frac{50}{26}$ V

$\therefore$ Relative error in the measurement
$$= \frac{2 - (50/26)}{2} = \frac{1}{26} = 0.04\ \text{volt}$$

29.
$$\rho = \rho_0[1 + \alpha\Delta\theta]$$
$$\frac{\rho}{\rho_0} - 1 = \alpha\Delta\theta$$
$$\therefore \quad \rho_0 = \frac{\rho - \rho_0}{\alpha\Delta\theta} = \frac{2 \times 10^{-8}}{4 \times 10^{-4} \times 50}$$
$$= 100 \times 10^{-8} \text{ ohm-metre}$$

30. **(b)** Each and every pair of loop elements located symmetrically *w.r.t* central line experiences zero net force. So total magnetic force experienced by loop is zero.

31 **(b)** Consider an element of length dx on AB at a distance x from XY.



Force on this element, $dF = \frac{\mu_0 I}{2\pi x} idx$

Total force on $dF = \frac{\mu_0 I}{2\pi x} idx$

$$= \frac{\mu_0 Ii}{2\pi} \int_{\ell/2}^{3\ell/2} \frac{1}{x} dx = \frac{\mu_0 Ii}{2\pi} \log_e 3$$

32. **(a)** Consider an elementary strip of width dx on the sheet at a distance x from the wire.

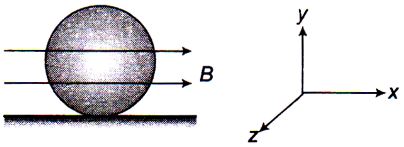
Force on this element is: $dF = \frac{\mu_0 I_1}{2\pi x} I_2 dx$

Total force on unit length of sheet is

$$F = \int_a^{a+b} \frac{\mu_0 I_1}{2\pi x} I_2 dx$$

$$F = \frac{\mu_0 I_1 I_2}{2\pi} \int_a^{a+b} \frac{1}{x} dx = \frac{\mu_0 I_1 I_2}{2\pi a} \log \frac{(a+b)}{b}$$

33. **(a)** Magnetic moment of loop



$\vec{M} = i\vec{A} = 4 \times \pi\,(0.5)^2\,(-\hat{k})$

$= -4\pi\,(0.5)^2\,\hat{k}$

$\tau = \vec{M} \times \vec{B}$

$\tau = (-\pi\hat{k}) \times (10\hat{i}) = -10\pi\,\hat{j}$

So, axis of rotation is along $\vec{\tau}$, i.e., along negative y-direction.

Moment of inertia of ring about y-axis

$$I = \frac{1}{2}MR^2 = \frac{1}{2} \times 2 \times (0.5)^2 = \frac{1}{4}\,\text{kg m}^2$$

$\tau = I\alpha$ so $\alpha = \frac{\tau}{I} = \frac{10\pi}{1/4} = 40\pi\ \text{rad/s}^2$

$\alpha = 40\pi\ \text{rad/s}^2$

34. **(a)** Magnetic field due to revolution of electron

$$B = \frac{\mu_0}{4\pi}.\frac{2\pi i}{r} = \frac{\mu_0}{4\pi}.\frac{2\pi.\left(\frac{e\omega}{2\pi}\right)}{r} = 10^{-7} \times \frac{e\omega}{r}$$

$$\Rightarrow 16 = 10^{-7} \times \frac{1.6 \times 10^{-19}\,\omega}{1 \times 10^{-10}} \Rightarrow \omega = 10^{17}\ \text{rad/sec}$$

35. **(c)** $B = \frac{\mu_0}{4\pi}\cdot\frac{2\pi(qv)}{r}$

$$= 10^{-7} \times \frac{2 \times 3.14 \times (1.6 \times 10^{-19} \times 6.6 \times 10^{15})}{0.53 \times 10^{-10}}$$

$= 12.5\ \text{Wb/m}^2$

36. **(c)** $B_{AB} = \frac{\mu_0 I}{4\pi(OC)}[2\sin\theta]$

But $OC = r\cos\theta$

or $B_{AB} = \frac{\mu_0 I}{2\pi r}\tan\theta$

Magnetic field due to circular portion.

$$B_{AB}' = \frac{\mu_0 I}{2r}\frac{2\pi - 2\theta}{2\pi} = \frac{\mu_0 I}{2\pi r}(\pi - 0)$$

Total magnetic field

$$= \frac{\mu_0 I}{2\pi r}\tan\theta + \frac{\mu_0 I}{2\pi r}(\pi - \theta)$$

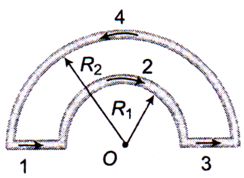
$$= \frac{\mu_0 I}{2\pi r}[\tan\theta + \pi - \theta]$$

37. **(b)** The given shape is equivalent to the following diagram The field at O due to straight part of conductor is $B_1 = \frac{\mu_o}{4\pi}.\frac{2i}{r}\odot$. The field at O due to circular coil is $B_2 = \frac{\mu_0}{4\pi}.\frac{2\pi i}{r}\otimes$. Both fields will act in the opposite direction, hence the total field at O.

i.e., $B = B_2 - B_1 = \left(\frac{\mu_o}{4\pi}\right)\times(\pi-1)\frac{2i}{r} = \frac{\mu_o}{4\pi}.\frac{2i}{r}(\pi-1)$

38. **(d)** $B = \frac{\mu_0}{4\pi}\frac{(2\pi-\theta)i}{R} = \frac{\mu_0}{4\pi}\frac{\left(2\pi - \frac{\pi}{2}\right)\times i}{R} = \frac{3\mu_0 i}{8R}$

39. **(a)** In the following figure, magnetic fields at O due to sections 1, 2, 3 and 4 are considered as B_1, B_2, B_3 and B_4 respectively.



$B_1 = B_3 = 0$

$B_2 = \frac{\mu_0}{4\pi}.\frac{\pi i}{R_1}\otimes$

$B_4 = \frac{\mu_0}{4\pi}.\frac{\pi i}{R_2}\odot$ As $|B_2| > |B_4|$

So $B_{net} = B_2 - B_4 \Rightarrow B_{net} = \frac{\mu_0 i}{4}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)\otimes$

40. **(b)** $B = \frac{3}{4}\left[\frac{\mu_0 I}{2a}\right] + \frac{1}{4}\left[\frac{\mu_0 I}{2b}\right]$

$B = \frac{3\mu_0 I}{8a} + \frac{\mu_0 I}{8b}$

41. **(c)** The magnetic induction due to both semicircular parts will be in the same direction perpendicular to the paper inwards.

$\therefore B = B_1 + B_2 = \frac{\mu_0 i}{4r_1} + \frac{\mu_0 i}{4r_2} = \frac{\mu_0 i}{4}\left(\frac{r_1 + r_2}{r_1 r_2}\right) \otimes$

42. **(b)** Distance of straight conductor from

$$B = \frac{\mu_0 I \times \sqrt{2}}{2\pi r} + \frac{\mu_0 I}{2r}\frac{\pi}{2\times 2\pi}$$

Or $$B = \frac{\mu_0 I}{4\pi} + \frac{2I}{r}\left[\sqrt{2}\frac{\pi}{4}\right].$$

43. **(a)** $r_1 : r_2 = 1 : 2$ and $B_1 : B_2 = 1 : 3$ We know that

$$B = \frac{\mu_0}{4\pi}.\frac{2\pi ni}{r} \Rightarrow \frac{i_1}{i_2} = \frac{B_1 r_1}{B_2 r_2} = \frac{1\times 1}{3\times 2} = \frac{1}{6}$$

44. **(b)** We shall use $\oint \vec{B}.d\vec{l} = \mu_0 I$ where I is the current enclosed by loop.

Net current enclosed by path a is zero.

Net current enclosed by path c is A.

Net current enclosed by path d is 3A.

Net current enclosed by path b is 5A.

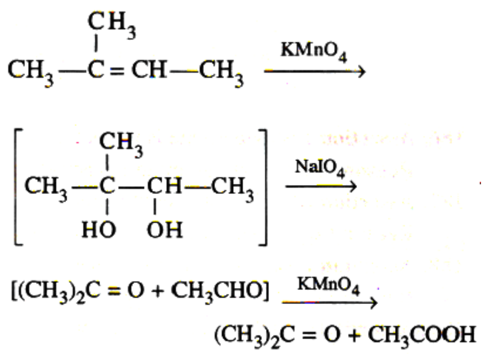
45. **(b)** Applying Ampere's law $\oint B.dl = \mu_0 i$ to any closed path inside the pipe we find no current is enclosed. Hence $B = 0$.

[CHEMISTRY]

46.

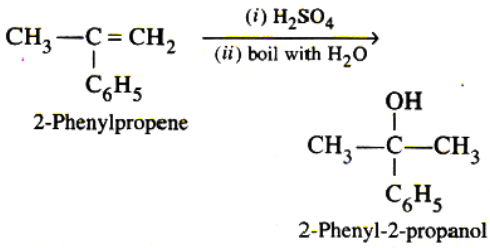
Reactivity towards electrophilic substitution decreases as the electron density in the benzene ring decreases. Thus, option (a) is correct, *i.e.*, III > I > II > IV.

47.



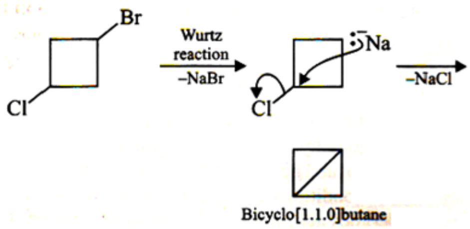
48.

49.



50.

Since bromides are more reactive than chlorides, therefore, Wurtz reaction occurs on the side of Br atom



51.

52.

Since, CH_3 group is electron-donating, therefore, electron density in toluene is higher than in benzene and hence polysubstitution occurs during F.C. alkylation when the benzene ring contains electron- donating groups. All other groups (*i.e.*, CH_3CO, NO_2 and SO_3H) are electron withdrawing and hence in these cases polysubstitution does not occur.

53.

Both OCH_3 and CH_3 are *o, p*- directing groups. The possible position of attack which are facilitated by both OCH_3 and CH_3 are shown by arrows below :

Since, OCH_3 group is bulkier than CH_3 group, therefore, due to steric hindrance the reaction does not occur at positions 2 and 6 but instead occurs at position 4.

54.

In a homologous series, higher the number of C-atoms, higher is the b.p.

55.

Acidic hydrogen is present in alkynes, attached to the triply bonded C-atoms. They can be easily removed by means of a strong base.

56.

For isomeric alkanes, th one having longest straight chain has highest b.p. because of larger surface area.

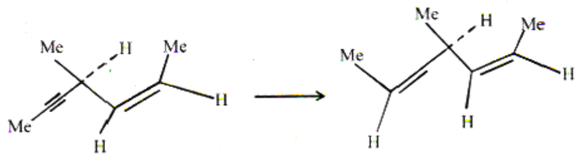
57.

58.

TIPS/Formulae :

Addition on triple bond takes place by the *syn*-addition of hydrogen.

Since the configuration of the double bond already present is *cis*, the compound formed will have a plane of symmetry and hence optically inactive.



59.

Greater the extent of branching, lesser is the boiling point of the hydrocarbon, so order of b.p is III > II > I.

60.

Alkenes combine with hydrogen under pressure and in presence of a catalyst (Ni, Pt or Pd) and form alkanes.

$$\text{Butene - 1} \xrightarrow{H_2/Pd} \text{Butane}$$

61.

$$CH_3-\overset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2-CH_3 \xrightarrow[\text{sunlight}]{Br_2} CH_3-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2CH_3$$

2–bromo–2–methyl butane

Ease of replacement of H-atom 3° > 2° > 1°.

62.

$CH_3-\overset{CH_3}{\overset{|}{CH}}-\overset{CH_3}{\overset{|}{CH}}-CH_3$. Since it contains only two types of H-atoms hence it will give only two mono chlorinated compounds viz. $Cl.CH_2-\overset{CH_3}{\overset{|}{CH}}-\overset{CH_3}{\overset{|}{CH}}-CH_3$

1–chloro–2,3–dimethyl butane

and $CH_3-\underset{Cl}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-\overset{CH_3}{\overset{|}{CH}}-CH_3$

2–chloro–2,3–dimethyl butane

63.

$CH_2=CH-C\equiv CH$;

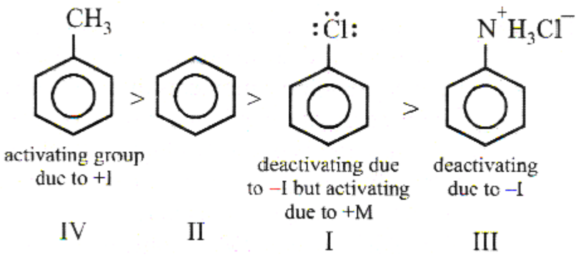
No of σ bonds = 2 + 1 + 1 + 1 + 1 +1 = 7;

No of π bonds = 1 + 2 = 3

64.

$$\mathrm{HC \equiv \overset{sp}{C} - \overset{sp^2}{C}H = CH_2}$$

65.

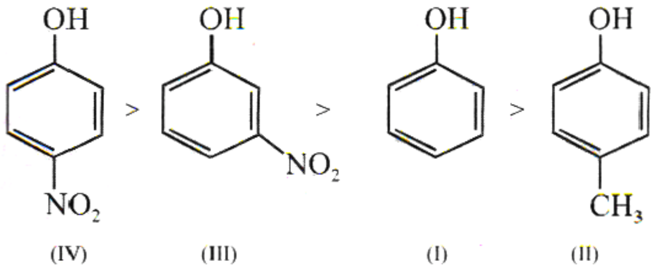


66.

NOTE : $-NO_2$ is an electron-attracting group where as $-CH_3$ is an electron-releasing group.

An electron - attracting substituent tends to disperse the negative charge of the phenoxide ion and thus, makes it more stable. This, in turn, **increases the acid strength of phenol.** The substituent in para position is more effective than in the meta position as the former involves a resonating structure bearing negative charge on the carbon attached to the electron - withdrawing substituent.

An **electron - releasing substituent tends to** intensify the negative charge of the phenoxide ion and thus makes it more unstable. This, in turn, **decreases the acid strength of phenol.** Hence, the order of acid strength is



67.

$$\mathrm{\overset{sp^2}{H_2C} = \overset{sp^2}{C}H - \overset{sp}{C} \equiv \overset{sp}{N}.}$$

68.

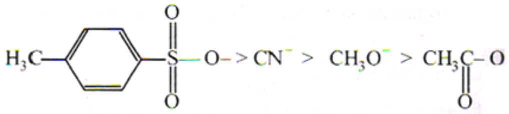
The ring to which –NH group is attached is activated due to the lone pairs on N (+M and +E effects); while the ring to which –C = O is attached is deactivated. Hene, the electrophile would go to the *para*-position of the activated ring.

69.

Due to similar charges on adjacent atoms, the structure (a) is least stable.

70.

In moving down a group, the basicity and nucleophilicity are inversely related, *i.e.* nucleophilicity increases while basicity decreases. In going from left to right across a period, the basicity and nucleophilicity are directly related. Both of the characteristics decrease as the electronegativity of the atom bearing lone pair of electrons increases. If the nucleophilic centre of two or more species is same, nucleophilicity parallels basicity, *i.e.* more basic the species, stronger is its nucleophilicity. Hence based on the above facts, the correct order of nucleophilicity will be



(D) (C) (B) (A)

71.

Unsaturated hydrocarbons decolourise alk. $KMnO_4$ solution; C_2H_4 ($H_2C = CH_2$) is an alkene.

72.

73.

Peroxide affects only the addition of HBr; addition of HCl and HI on alkenes proceeds through usual ionic mechanism in presence or absence of peroxide. Further (d) being 2° carbocation is more stable than (a), hence more likely to be formed.

74.

TIPS/Formulae :

The relative rates of hydrogenation decreases with increase of steric hinderance.

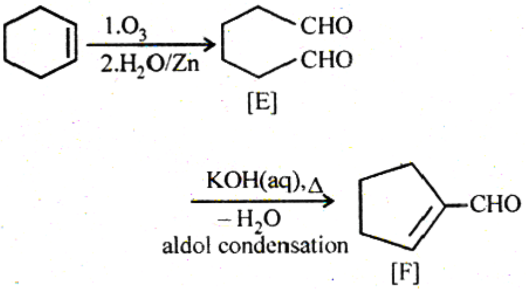
$R_2C = CH_2 > RCH = CHR > R_2C = CHR > R_2C = CR_2$

Among the four olefins, (a) and (b) are less stable (Saytzeff rule). Further in (a), the bulky alkyl groups are on same side (*cis*-isomer), hence it is less stable.

75.

In propyne ($CH_3C \equiv CH$), the terminal hydrogen is acidic and reacts with ammonical $AgNO_3$.

76.

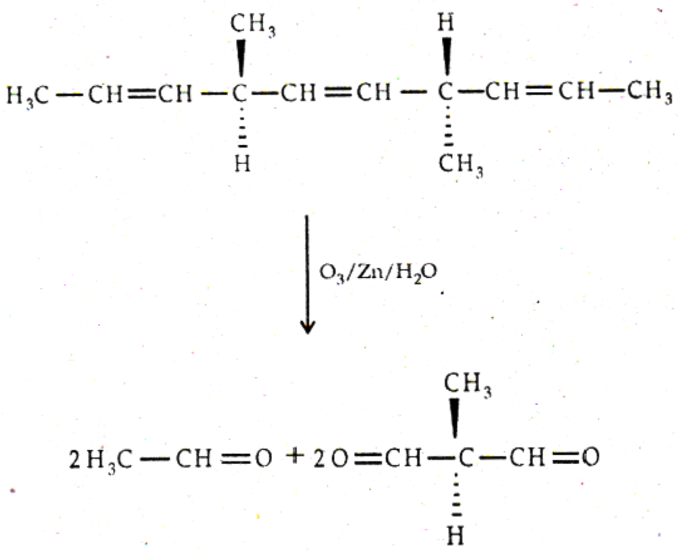


77.

Nitrosyl chloride adds on olefins according to Markovnikof's rule, where NO^+ constitutes the positive part of the addendum.

$$CH_3CH = CH_2 + NOCl \longrightarrow CH_3\underset{\displaystyle Cl}{\underset{|}{C}H}\underset{\displaystyle NO}{\underset{|}{C}H_2}$$

78.

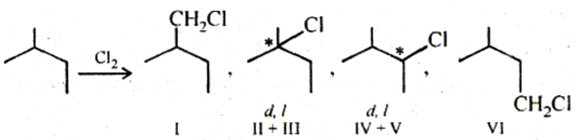


(achiral) (achiral)

79.

Allene (C_3H_4) is $H_2\overset{sp^2}{C} = \overset{sp}{C} = \overset{sp^2}{C}H_2$

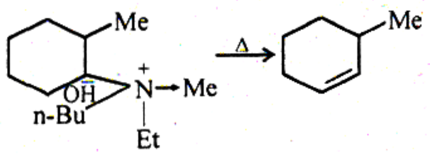
80.



So, the value of N will be 1 + 2 + 2 + 1 = 6.
Since enantiomers have nearly same physical properties, II and III as well as IV and V can't be separated, hence the number of isomers (M) will be
1 + 1 + 1 + 1 = 4.

81.

Hofmann's rule : When theoretically more than one type of alkenes are possible in eliminations reaction, the alkene containing least alkylated double bond is formed as major product. Hence



NOTE : It is less stearically β-hydrogen is removed

82.

Nitro group is electron withdrawing group, so it deactivates the ring towards electrophilic substitution.

83.

Reactivity decreases down the group as the electronegativity or the electrode potential of the halogen **decreases down the group**. Thus, option (*a*) is correct.

84.

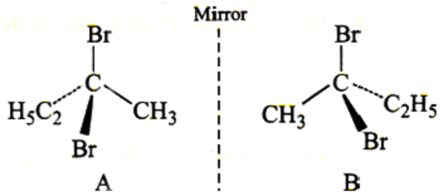
For geometrical isomerism, it is essential that each carbon atom of the double bond must have different substituents. Now option (*d*) does not show geometrical isomerism since it has two CH_3 groups on the same carbon atom of the double bond.

85.

Addition of HBr to 1-butene occurs in accordance with Markovnikov's rule giving I as the major and C as the minor product.

$$\underset{\text{1-Butene}}{CH_3CH_2—CH=CH_2} \xrightarrow[\text{Mark.addn.}]{\text{HBr}} \underset{\text{I}}{CH_3CH_2—\overset{*}{C}H(Br)—CH_3} + \underset{\text{C}}{CH_3CH_2CH_2CH_2—Br}$$

Since I contains a chiral carbon, it exists in two enantiomers (A and B) which are mirror images of each other



Thus, the mixture consists of A and B as major and C as minor product.