ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

Chapter 02 Contents

JEE (MAIN)
TOPICWISE SOLUTION OF TEST PAPERS
JANUARY & APRIL 2019

CHEMISTRY

PHYSICAL CHEMISTRY

ORGANIC CHEMISTRY

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

Chapter 02 Contents

JEE (MAIN)
TOPICWISE SOLUTION OF TEST PAPERS
JANUARY & APRIL 2019

ORGANIC CHEMISTRY

INORGANIC CHEMISTRY

JANUARY & APRIL 2019 ATTEMPT (PC)

ATOMIC STRUCTURE

1. Ans.(3)

$h\nu = \phi + h\nu^{\circ}$

$$\frac{1}{2}mv^2 = hc\left(\frac{1}{\lambda}-\frac{1}{\lambda_0}\right)$$

$$h\nu=\phi+\frac{1}{2}mv^2$$

$$\phi=\frac{6.626\times10^{-34}\times3\times10^{8}}{4000\times10^{-10}}-\frac{1}{2}\times9\times10^{-31}\times(6\times10^{5})^2$$

$\phi = 3.35 \times 10^{-19}$ J $\Rightarrow$ $\phi \simeq 2.1$ eV

2. Ans. (2)

According to de-broglie's hypothesis

$$2\pi r_n = n\lambda \Rightarrow 2\pi \cdot a_0\frac{n^2}{z} = n\times1.5\pi a_0$$

$$\frac{n}{z}=0.75$$

3. Ans.(4)

Ozone protects most of the medium freequnecies ultravoilet light from 200 - 315 nm wave length.

4. Ans. (2)

5. Ans. (2)

For electron

$$\lambda_{DB} = \frac{\lambda}{\sqrt{2mK.E.}}$$ (de broglie wavelength)

By photoelectric effect

$h\nu = h\nu_0 + KE$

$KE = h\nu - h\nu_0$

$$\lambda_{DB}=\frac{h}{\sqrt{2m\times(h\nu-h\nu_0)}}$$

$$\lambda_{DB}\propto\frac{1}{(\nu-\nu_0)^{1/2}}$$

6. Ans. (1)

$$(E)_{n^{th}} = (E_1)_H\cdot\frac{Z^2}{n^2}$$

Second excited state, n = 3

$$E_{3^{rd}}(He^+)=(-13.6\,eV)\cdot\frac{2^2}{3^2}=-6.04\ eV$$

7. Ans.(1)

Sol. In 'K', 2s orbital feel maximum attraction from nucleus (So having less energy) due to more Z_{eff}.

8. Ans. (3)

Number of ejected electrons are independent of frequency of light , & kinetic energy of electrons is independent of intensity of light.

K.E. = $h\nu + (-h\nu_0)$

y = mx + C

9. Ans. (4)

Refer Theory

10. Ans.(4)

$$\frac{1}{\lambda}=\bar{\nu}=R_H z^2\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)$$

$$\bar{\nu}=R_H\times\left(\frac{1}{n_1^2}-\frac{1}{8^2}\right)$$

$$\bar{\nu}=R_H\times\frac{1}{n^2}-\frac{R_H}{8^2}$$

$$\bar{\nu}=R_H\times\frac{1}{n^2}-\frac{R_H}{64}$$

$m = R_H$

Linear with slope R_H

11. Ans.(4)

Sol. $h\nu-\phi=KE$

$$\Rightarrow\left(\frac{hc}{\lambda}\right)_{incident}=KE+\phi$$

$$\left(\frac{hc}{\lambda}\right)_{incident}\simeq KE$$

$$KE=\frac{p^2}{2m}=\frac{hc}{\lambda_{incident}}=\frac{hc}{\lambda} \quad ...(1)$$

$$\Rightarrow\frac{p^2\times(1.5)^2}{2m}=\frac{hc}{\lambda'} \quad ...(2)$$

divide (1) and (2)

$$(1.5)^2=\frac{\lambda}{\lambda'}$$

$$\Rightarrow\lambda'=\frac{4\lambda}{9}$$

12. Ans.(4)

Sol. For Lyman

$$\bar{\nu}_{max} = R_H\left(\frac{1}{1^2}-\frac{1}{\infty^2}\right) = R_H$$

$$\bar{\nu}_{min} = R_H\left(\frac{1}{1^2}-\frac{1}{2^2}\right) = \frac{3}{4}R_H$$

$$\Delta\bar{\nu}_{Lyman} = \frac{R_H}{4}$$

For Balmer

$$\bar{\nu}_{max} = R_H\left(\frac{1}{2^2}-\frac{1}{\infty^2}\right) = \frac{R_H}{4}$$

$$\bar{\nu}_{min} = R_H\left(\frac{1}{2^2}-\frac{1}{3^2}\right) = \frac{5}{36}R_H$$

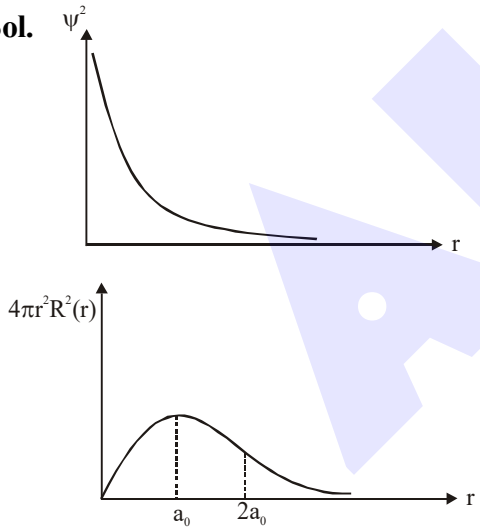
$$\Delta\bar{\nu}_{Balmer} = \frac{R_H}{4}-\frac{5R_H}{36} = \frac{4R_H}{36} = \frac{R_H}{9}$$

$$\frac{\Delta\bar{\nu}_{Lyman}}{\Delta\bar{\nu}_{Balmer}} = \frac{R_H/4}{R_H/9} = \frac{9}{4}$$

$\therefore$ Ans. is (4)

13. Ans.(4)

Sol.



14. Ans.(4)

Sol. Graph of $|\psi^2|$ v/s r, touches r axis at 1 point so it has one radial node and since at r = 0, it has some value so it should be for 's' orbital.

$\therefore$ n – ℓ – 1 = 1 where $\ell = 0 \Rightarrow$ n – 1 = 1

$\therefore$ n = 2 $\Rightarrow$ '2s' orbital

15. Ans. (2)

Sol.
$$\frac{\frac{1}{\lambda_2} = R_H\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right)Z^2}{\frac{1}{\lambda_1} = R_H\left(\frac{1}{m_1^2}-\frac{1}{m_2^2}\right)Z^2}$$

as for shortest wavelengths both n_2 and m_2 are ∞

$$\therefore \quad \frac{\lambda_1}{\lambda_2} = \frac{9}{1} = \frac{m_1^2}{n_1^2}$$

Now if $m_1 = 3$ & $n_1 = 1$ it will justify the statement hence Lyman and Paschen (2) is correct.

16. Ans.(2)

Sol. $P(x) = 4\pi x^2 \times [\Psi(x)]^2$

Probability will be maximum at a and c

CHEMICAL KINETICS

1. Ans.(1)

Rate constant (K) = 0.05 μg/year

means zero order reaction

$$t_{1/2} = \frac{a_0}{2K} = \frac{5\mu g}{2\times 0.05\mu g/year} = 50 \text{ year}$$

2. Ans. (1)

3. Ans. (1)

For zero order

$[A_0]-[A_t] = kt$

$0.2 - 0.1 = k\times 6$

$$k = \frac{1}{60} \text{ M/hr}$$

and $0.5-0.2 = \frac{1}{60}\times t$

t = 18 hrs.

4. Ans. (4)

On increasing E_a, k decreases.

In plot II initially k is shown to be almost constant with temperature while as in moderate temperature range increase of k is very sharp, therefore plot II is incorrect.

5. Ans. (3)

Ans.(3)

$$A_2 \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} 2A$$

$$\frac{d[A]}{dt} = 2k_1[A_2] - 2k_{-1}[A]^2$$

6. Ans. (1)

$r = K[A]^x[B]^y$

$\Rightarrow 8 = 2^3 = 2^{x+y}$

$\Rightarrow x + y = 3$ ...(1)

$\Rightarrow 2 = 2^x$

$\Rightarrow x = 1, y = 2$

Order w.r.t. A = 1

Order w.r.t. B = 2

7. Ans.(2)

$$\ell n\frac{K_2}{K_1} = \frac{E_a}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$2.303\log\frac{K_2}{10^{-5}} = 4606\left[\frac{1}{400} - \frac{1}{500}\right]$$

$\Rightarrow K_2 = 10^{-4}\ s^{-1}$

8. Ans. (2)

$6.93 \times 10^{-3} = K \times (0.1)^x\ (0.2)^y$

$6.93 \times 10^{-3} = K \times (0.1)^x\ (0.25)^y$

So y = 0

and $1.386 \times 10^{-2} = K \times (0.2)^x\ (0.30)^y$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x \quad \boxed{x = 1}$$

So $r = K \times (0.1) \times (0.2)^0$

$6.93 \times 10^{-3} = K \times 0.1 \times (0.2)^0$

$$\boxed{K = 6.93\times10^{-2}}$$

$$t_{1/2} = \frac{0.693}{2K} = \frac{0.693}{0.693\times10^{-1}\times2} = \frac{10}{2} = 5$$

9. Ans.(3)

Sol. $r = K\ [A]^x\ [B]^y$

$0.045 = K\ (0.05)^x\ (0.05)^y$ ....(1)

$0.090 = K\ (0.10)^x\ (0.05)^y$ ....(2)

$0.72 = K\ (0.20)^x\ (0.10)^y$ ....(3)

From (1) ÷ (2), $\frac{0.045}{0.090} = \left(\frac{0.05}{0.10}\right)^x \Rightarrow x = 1$

From (2) ÷ (3), $\frac{0.090}{0.720} = \left(\frac{0.10}{0.20}\right)^x \cdot \left(\frac{0.05}{0.10}\right)^y \Rightarrow y = 2$

Hence, $r = K\ [A]\ [B]^2$

Correct option : (3)

10. Ans.(1)

Sol. $A \xrightarrow{K_1} B \xrightarrow{K_2} C$

$$\frac{d[B]}{dt} = 0 = K_1[A] - K_2[B]$$

$$\Rightarrow [B] = \frac{K_1}{K_2}[A]$$

11. Ans.(1)

Sol. (i) $\ln[R] = \ln[R]_0 - Kt$ (I^{st} order)

$[R] = [R]_0 - Kt$ (zero order)

$\therefore$ Ans.(1)

12. Ans.(2)

Sol. $H_2(g) + I_2(g) \rightarrow 2HI(g)$

Apply Arrhenius equation

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{1}{600} - \frac{1}{800}\right)$$

$$\log\frac{1}{2.5\times10^{-4}} = \frac{E_a}{2.303\times8.31}\left(\frac{200}{600\times800}\right)$$

$\therefore E_a \approx 166$kJ/mol

13. Ans.(2)

Sol. $$\log\frac{-d[A]}{dt} = \log\frac{d[B]}{dt} + 0.3010$$

$$\frac{-d[A]}{dt} = 2\times\frac{d[B]}{dt}$$

$$\frac{1}{2}\times\frac{-d[A]}{dt} = \frac{d[B]}{dt}$$

$2A \longrightarrow B$

$2C_2H_4 \longrightarrow C_4H_8$

14. Ans.(4)

Sol. $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$

t=0 3.0M

t=30 2.75 M

$$\frac{-\Delta[N_2O_5]}{\Delta t} = \frac{0.25}{30}$$

$$\frac{1}{2}\times\frac{-\Delta[N_2O_5]}{\Delta t} = \frac{1}{4}\times\frac{\Delta[NO_2]}{\Delta t}$$

$$\frac{\Delta[NO_2]}{\Delta t} = \frac{0.25}{30}\times2 = 1.66 \times 10^{-2}\ M/min$$

THERMODYNAMICS-01

1. Ans.(2)

$$w = -nRT\ln\frac{V_2}{V_1}$$

$$w = -nRT\ln\frac{V_b}{V_i}$$

$$|w| = nRT\ln\frac{V_b}{V_i}$$

$$|w| = nRT(\ln V_b - \ln V_i)$$

$$|w| = nRT\ln V_b - nRT\ln V_i$$

$Y = m\,x - C$

So, slope of curve 2 is more than curve 1 and intercept of curve 2 is more negative then curve 1.

2. Ans. (2)

Work done on isothermal irreversible for ideal gas

$= -P_{ext}(V_2 - V_1)$

$= -4\ N/m^2\ (1m^3 - 5m^3)$

$= 16$ Nm

Isothermal process for ideal gas

$\Delta U = 0$

$q = -w$

$= -16$ Nm

$= -16$ J

Heat used to increase temperature of Aℓ

$q = n\,C_m\,\Delta T$

$$16\ J = 1 \times 24\ \frac{J}{mol.K} \times \Delta T$$

$$\Delta T = \frac{2}{3}K$$

3. Ans.(3)

For cyclic process : $\Delta U = 0 \Rightarrow q = -w$

For isothermal process : $\Delta U = 0 \Rightarrow q = -w$

For adiabatic process : $q = 0 \Rightarrow \mathbf{\Delta U = W}$

For isochoric process : $w = 0 \Rightarrow \Delta U = q$

Correct option : (3)

4. Ans.(4)

Sol. $$\Delta H = n\int_{T_1}^{T_2} C_{p,m}dT = 3\times\int_{300}^{1000}(23+0.01T)dT$$

$$= 3\left[23(1000-300) + \frac{0.01}{2}(1000^2 - 300^2)\right]$$

$= 61950\ J \approx 62$ kJ

Correct option : (4)

5. Ans.(1)

Sol. $n = 5$; $T_i = 100$ K; $T_f = 200$ K;

$C_V = 28$ J/mol K; Ideal gas

$\Delta U = nC_V\Delta T$

$= 5$ mol $\times$ 28 J/mol K $\times$ (200 – 100) K

$= 14{,}000$ J $= 14$ kJ

$\Rightarrow C_p = C_v + R = (28 + 8)$ J/mol K

$= 36$ J/mol K

$\Rightarrow \Delta H = nC_p\Delta T = 5$ mol $\times$ 36 J/mol K $\times$ 100 K

$= 18000$ J $= 18$ kJ

$\Delta H = \Delta U + \Delta(PV)$

$\Rightarrow \Delta(PV) = \Delta H - \Delta U = (18 - 14)$ kJ $= 4$ kJ

6. Ans.(3)

Sol. (A) $q + w = \Delta U \leftarrow$ definite quantity

(B) $q \rightarrow$ Path function

(C) $w \rightarrow$ Path function

(D) $H - TS = G \rightarrow$ state function

$\therefore$ Ans.(3)

7. Ans.(1)

$\Delta U = q + w$

$q = -2$kJ, $W = 10$kJ

$\Delta U = 8$kJ

8. Ans.(3)

$W = -P_{ext}(V_2 - V_1)$

$= -1$bar $\times$ (10–1)lit

$= -9$ bar–lit

$= -900$ J

$= -0.9$ kJ

THERMODYNAMICS-02

1. Ans.(3)

$$\boxed{1}_{T_1}\ \boxed{2}_{T_2} \rightleftharpoons \boxed{1}_{T_F}\ \boxed{1}_{T_F}$$

Heat lost by block - I = Heat gained by block - II $Cm(T_f - T_1) = C_m(T_2 - T_f)$

$$T_f = \frac{T_1 + T_2}{2}$$

$$\Delta S_1 = Cp\ln\frac{T_f}{T_1}$$

$$\Delta S_T = Cp \ln\left(\frac{T_f}{T_1}\right) + Cp \ln\left(\frac{T_f}{T_2}\right)$$

$$\Delta S_T = Cp \ln\left(\frac{T_f^2}{T_1 . T_2}\right)$$

2. Ans. (1)

At equilibrium

$$120 - \frac{3}{8}T = 0$$

$\Rightarrow T = 320$ K

If $T < 320$ K $\Rightarrow \Delta G = +ve \Rightarrow$ X is major product

If $T > 320$ K $\Rightarrow \Delta G = -ve \Rightarrow$ Y is major product.

3. Ans.(1)

$\Delta G^\circ = -RT \ln k$

if $K < 1 \Rightarrow \Delta G^\circ > 0$

4. Ans.(2)

$\Delta G = \Delta H - T\Delta S$

for spontaneous process at all temp. $\Delta G < 0$ and it is possible when $\Delta H < 0$ and $\Delta S > 0$.

5. Ans. (4)

$2H_2O = H_3O^+ + OH^-$ $K = 10^{-14}$

$\Delta G^\circ = -RT \ell n\ K$

$$= \frac{-8.314}{1000} \times 298 \times \ell n 10^{-14}$$

$= 80$ KJ/Mole

6. Ans. (4)

Compare with $\Delta G = \Delta H - T\Delta S$

7. Ans. (2)

$$T_{eq} = \frac{\Delta H}{\Delta S}$$

$$= \frac{491.1 \times 1000}{198}$$

$= 2480.3$ K

8. Ans. (1)

$\Delta G = \Delta H - T\Delta S$

$$T = \frac{\Delta H}{\Delta S} = \frac{200}{40} = 5K$$

9. Ans. (4)

$$H_2O(s) \xrightarrow[273K]{\Delta S_1} H_2O(\ell) \xrightarrow[273K]{\Delta S_2} H_2O(\ell) \xrightarrow[373K]{\Delta S_3} H_2O(g) \xrightarrow[373K]{\Delta S_4} H_2O(g) \quad (383K)$$

$$\Delta S_1 = \frac{\Delta H_{fusion}}{273} = \frac{334}{273} = 1.22$$

$$\Delta S_2 = 4.2 \ell N\left(\frac{373}{273}\right) = 1.31$$

$$\Delta S_3 = \frac{\Delta H_{vap}}{373} = \frac{2491}{373} = 6.67$$

$$\Delta S_4 = 2.0 \ell n\left(\frac{383}{373}\right) = 0.05$$

$\Delta S_{total} = 9.26$ kJ kg^{-1} K^{-1}

IONIC EQUILIBRIUM

1. Ans. (2)

$$Ag_2CO_3\ (s) \rightleftharpoons 2Ag^+(aq.) + CO_3^{-2}(aq)$$

$(0.1 + 2S)$ M $\qquad$ S M

$Ksp = [Ag^+]^2[CO_3^{-2}]$

$8 \times 10^{-12} = (0.1 + 2S)^2\ (S)$

$S = 8 \times 10^{-10}$ M

2. Ans. (1)

HCl with Na_2CO_3

Eq. of HCl = Eq. of Na_2CO_3

$$\frac{25}{1000} \times M \times 1 = \frac{30}{1000} \times 0.1 \times 2$$

$$M = \frac{6}{25} M$$

Eq of HCl = Eq. of NaOH

$$\frac{6}{25} \times 1 \times \frac{V}{1000} = \frac{30}{1000} \times 0.2 \times 1$$

$V = 25$ ml

3. Ans. (3)

$Ca(OH)_2 + Na_2SO_4 \longrightarrow CaSO_4 + 2NaOH$

100 m mol 14 m mol — —

— — 14 m mol 28 m mol

$w_{CaSO_4} = 14\times10^{-3}\times136 = 1.9gm$

$[OH^-] = \frac{28}{100} = 0.28M$

4. Ans. (3)

pH of rain water is approximate 5.6

5. Ans. (3)

20 ml 0.1 M H_2SO_4 $\Rightarrow$ $\eta_{H^+} = 4$

30 ml 0.2 M NH_4OH $\Rightarrow$ $\eta_{NH_4OH} = 6$

$NH_4OH + H^+ \rightleftharpoons NH_4^{\oplus} + H_2O$

$\Rightarrow$ 6 4 0 0

$\Rightarrow$ 2 0 4 4

Solution is basic buffer

$$pOH = pK_b + \log\frac{NH_4^+}{NH_4OH}$$

$= 4.7 + \log 2$

$= 4.7 + 0.3 = 5$

$pH = 14 - 5 = 9$

6. Ans.(4)

Sol. $Zr_3(PO_4)_4(s) \rightleftharpoons 3Zr^{4+}(aq.) + 4PO_4^{3-}(aq.)$

3S M 4S M

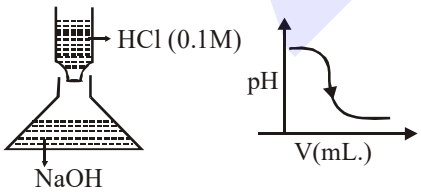
$K_{sp} = [Zr^{4+}]^3[PO_4^{3-}]^4 = (3S)^3.(4S)^4 = 6912\,S^7$

$\therefore S = \left(\frac{K_{sp}}{6912}\right)^{1/7}$

Correct option : (4)

7. Ans. (1)

Sol.



8. Ans. (2)

Sol. (a) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

400×.1=40 400×.1=40

20 0

$\therefore [H^+] = \frac{20\times2}{800} = \frac{1}{20} \Rightarrow pH = -\log\left(\frac{1}{20}\right)$

$\therefore$ pH = 1.3 so (a) is correct

(b) $\log\left(\frac{Kw_2}{Kw_1}\right) = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

so ionic product of water is temp. dependent hence (b) is correct.

(c) $K_a = 10^{-5}$, pH = 5 $\Rightarrow [H^+] = 10^{-5}$

$K_a = \frac{c\alpha^2}{(1-\alpha)} \Rightarrow K_a = \frac{[H^+].\alpha}{(1-\alpha)}$

$\therefore 10^{-5} = \frac{10^{-5}.\alpha}{(1-\alpha)} \Rightarrow 1-\alpha = \alpha \Rightarrow \alpha = \frac{1}{2} =$ 50%

so (c) is correct.

(d) Le-chatelier's principle is applicable to common –Ion effect so option (d) is wrong

$\therefore$ correct answer (2)

9. Ans. (2)

Sol. For the salt of strong acid and weak base

$$H^+ = \sqrt{\frac{K_w\times C}{K_b}}$$

$$\left[H^+\right] = \sqrt{\frac{10^{-14}\times2\times10^{-2}}{10^{-5}}}$$

$$-\log\left[H^+\right] = 6 - \frac{1}{2}\log 20$$

$\therefore$ pH = 5.35

10. Ans. (4)

Sol. $Al(OH)_3 \rightleftharpoons Al^{+3} + 3OH^-$

S' 0.2 + 3(S') $\simeq$ 0.2

$S' \times (0.2)^3 = k_{sp} = 2.4\times10^{-24}$

$(S') = 3\times10^{-22}$ M

11. Ans. (4)

Sol. $K_{sp} = 4\,(s)^3$

$= 4\times(1.84\times10^{-5})^3$

$Cd(OH)_2 \rightleftharpoons Cd^{+2} + 2OH^-$

S' S' $(10^{-2} + S') \simeq 10^{-2}$

$S'\times(10^{-2})^2 = 4\times(1.84\times10^{-5})^3$

$S' = 4\times(1.84)^3\times10^{-11}$

$(S') = 2.491\times10^{-10}$ M

REAL GAS

1. Ans. (1)

$V_A = 2V_B$

$Z_A = 3Z_B$

$$\frac{P_A V_A}{n_A R T_A} = \frac{3 \cdot P_B \cdot V_B}{n_B . R T_B}$$

$2P_A = 3P_B$

2. Ans. (1)

Sol. $T_c = \frac{8a}{27Rb}$

Greater value of $\frac{a}{b} \Rightarrow$ higher is 'T_c'

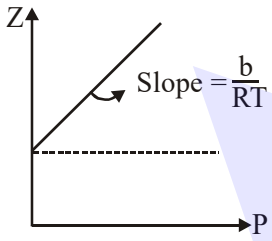
Gas	a/b
Ar	$\frac{1.3}{3.2} = 0.406$
Ne	$\frac{0.2}{1.7} = 0.118$
Kr	$\frac{5.1}{1} = 5.1$
Xe	$\frac{4.1}{5} = 0.82$

$\therefore$ T_c has order : Kr > Xe > Ar > Ne

$\therefore$ Ans. is (1)

3. Ans. (3)

Sol.



As b ↑ $\Rightarrow$ slope ↑

Hence, Xe, will have highest slope

4. Ans. (3)

Sol.
- Gas A and C have same value of 'b' but different value of 'a' so gas having higher value of 'a' have more force of attraction so molecules will be more closer hence occupy less volume.
- Gas B and D have same value of 'a' but different value of 'b' so gas having lesser value of 'b' will be more compressible.

so option (3) is correct.

LIQUID SOLUTION

1. Ans. (2)

For same freezing point, molality of both solution should be same.

$m_x = m_y$

$$\frac{4 \times 1000}{96 \times M_x} = \frac{12 \times 1000}{88 \times M_y}$$

or, $M_y = \frac{96 \times 12}{4 \times 88} M_x = 3.27\ A$

Closest option is 3A.

2. Ans. (2)

$$2(C_6H_5COOH) \xrightarrow[(30g)]{C_6H_6} (C_6H_5COOH)_2$$

(Wg: $2(C_6H_5COOH)$; diner: $(C_6H_5COOH)_2$)

$\Delta_f T = i\ k_f\ m$

$$2 = 0.6 \times 5 \times \frac{w \times 1000}{122 \times 30}$$

$(i = 1 - 0.8 + 0.4 = 0.6)$

$w = 2.44$ g

3. Ans. (3)

4. Ans. (1)

For $K_2[HgI_4]$

$i = 1 + 0.4\ (3-1)$

$= 1.8$

5. Ans. (2)

$$y_A = \frac{P_A}{P_{Total}} = \frac{P_A^o x_A}{P_A^o x_A + p_B^o x_B}$$

$$= \frac{7 \times 10^3 \times 0.4}{7 \times 10^3 \times 0.4 + 12 \times 10^3 \times 0.6} = \frac{2.8}{10} = 0.28$$

$y_B = 0.72$

6. Ans. (4)

$\Delta T_f = K_f . m$

$$10 = 1.86 \times \frac{62/62}{W_{kg}}$$

$W = 0.186$ kg

$\Delta W = (250 - 186) = 64$ gm

7. Ans. (2)

Liquid solution

$P_{gas} = K_H \times X_{gas}$

More is K_H less is solubility, lesser solubility is at higher temperature. So more is temperature more is K_H.

8. Ans. (2)

$$\frac{\Delta T_b}{\Delta T_f}=\frac{i.m\times k_b}{i\times m\times k_f}$$

$$\frac{2}{2}=\frac{1\times 1\times k_b}{1\times 2\times k_f}$$

$k_b = 2k_f$

9. Ans. (4)

$P_{total} = X_A.P_A^0 + X_B.P_B^0 = 0.5 \times 400 + 0.5 \times 600$
$= 500$ mmHg
Now, mole fraction of A in vapour,

$$Y_A = \frac{P_A}{P_{total}}=\frac{0.5\times 400}{500} = 0.4$$

and mole fraction of B in vapour,
$Y_B = 1 - 0.4 = 0.6$
Correct option : (4)

10. Ans. (3)

$$p = k_H\times\left(\frac{n_{gas}}{n_{H_2O}+n_{gas}}\right)$$

$$= k_H\left(1-\frac{n_{H_2O}}{n_{H_2O}+n_{gas}}\right)$$

$$\Rightarrow p = k_H - k_H \times \chi_{H_2O}$$

$$p = (-k_H) \times \chi_{H_2O} + k_H$$

11. Ans. (1)

$\pi_{XY} = 4\pi_{BaCl_2}$
$2 \times [XY] = 4 \times 3 \times 0.01$
(Assuming same temperature)
$\Rightarrow [XY] = 0.06$ M
$\therefore$ Ans. is (1)

12. Ans. (3)

$\because P_N^\circ > P_M^\circ$

$\therefore y_N > X_N$

& $X_M > y_M$

Multiply we get

$y_N X_M > X_N y_M$

$\therefore$ Ans. is (3)

13. Ans. (2)

Sol. $K_f = 4$ K-kg/mol

$m = 0.03$ mol/kg

$i = 3$

$\Delta T_f = iK_f \times m$

$\Delta T_f = 3 \times 4 \times 0.03 = 0.36$K

14. Ans. (3)

Sol. Lowering of vapour pressure $= p^0 - p = p^0.x_{solute}$

$$\therefore \Delta p = 35 \times \frac{0.6/60}{\frac{0.6}{60}+\frac{360}{18}}$$

$$= 35 \times \frac{.01}{.01+20}=35\times\frac{.01}{20.01}$$

$= .017$ mm Hg

15. Ans. (1)

Sol. $$\Pi = \frac{\left(\frac{0.6}{60}+\frac{1.8}{180}\right)}{0.1} \times 0.08206 \times 300$$

$\Pi = 4.9236$ atm

16. Ans. (3)

Sol. $\Delta T_b = K_b \times m$

$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}}=\frac{K_{b(A)}}{K_{b(B)}} \text{ as } m_A = m_B$$

$$\therefore \frac{\Delta T_{b(A)}}{\Delta T_{b(B)}}=\frac{1}{5}$$

CHEMICAL EQUILIBRIUM

1. Ans.(2)

	A	+	2B	$\rightleftharpoons$	2C	+	D
t=0	a_0		$1.5a_0$		0		0
$t = t_{eq}$	$a_0 - x$		$1.5a_0 - 2x$		$2x$		x

At equilibrium [A] = [B]

$a_0 - x = 1.5a_0 - 2x \Rightarrow x = 0.5a_0$

$t = t_{eq}$	$0.5a_0$	$0.5a_0$	a_0	$0.5a_0$

$$K_C=\frac{[C]^2[D]}{[A][B]^2}=\frac{(a_0)^2\ (0.5a_0)}{(0.5a_0)\ (0.5a_0)^2}=4$$

2. Ans. (3)

$A(s) \rightleftharpoons B(g) + C(g)$ $K_{P_1} = x = P_B \cdot P_C$

$P_1 \quad P_1 \quad x = P_1(P_1 + P_2)$ ...(1)

$D(s) \rightleftharpoons C(g) + E(g)$ $K_{P_2} = y = P_C \cdot P_E$

$P_2 \quad P_2 \quad y = (P_1 + P_2)(P_2)$ ...(2)

Adding (1) and (2)

$x + y = (P_1 + P_2)^2$

Now total pressure

$P_T = P_C + P_B + P_E$

$= (P_1 + P_2) + P_1 + P_2 = 2(P_1 + P_2)$

$P_T = 2\left(\sqrt{x + y}\right)$

3. Ans. (2)

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ $\quad \frac{1}{K_P}$

$t = 0 \quad P_1 \quad - \quad -$

$t = t \quad P_1 - 2P_2 \quad P_2 \quad 3P_2$

$(P1 - 2P^2) + P_2 + 3P_2 = P$

As $(P_1 - 2P_2) <<< P$

$P_2 = \frac{P}{4}$

$\frac{1}{K_P} = \frac{(P/4)(3P/4)^3}{P_{NH_3}^2}$

4. Ans. (2)

$A_2(g) + B_2(g) \overset{k_1}{\rightleftharpoons} 2AB$ ...(1)

$\Rightarrow$ eq. (1) $\times$ 3

$6\,AB(g) \rightleftharpoons 3A_2(g) + 3B_2(g)$

$\Rightarrow \left(\frac{1}{k_1}\right)^3 = k_2 \Rightarrow k_2 = (k_1)^{-3}$

5. Ans. (3)

$NH_4SH(s) \rightleftharpoons NH_3(g) + H_2S(g)$

$n = \frac{5.1}{51} = 0.1\,\text{mole} \quad 0 \quad 0$

$0.1(1-\alpha) \quad 0.1\alpha \quad 0.1\alpha$

$\alpha = 30\% = .3$

so number of moles at equilibrium

$.1\,(1 - .3) \quad .1 \times .3 \quad .1 \times .3$

$= \quad .07 \quad = .03 \quad = .03$

Now use PV = nRT at equilibrium

$P_{total} \times 3$ lit $= (.03 + .03) \times .082 \times 600$

$P_{total} = .984$ atm

At equilibrium

$P_{NH_3} = P_{H_2S} = \frac{P_{total}}{2} = .492$

So $k_p = P_{NH_3} \cdot P_{H_2S} = (.492)(.492)$

$k_p = 0.242\ atm^2$

6. Ans. (4)

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

$\frac{k_p}{k_c} = (RT)^{\Delta n_g} = (RT)^0 = 1$

$N_2O_4(g) \rightleftharpoons 2NO_2(g)$

$\frac{k_p}{k_c} = (RT)^1 = 24.62$

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$\frac{k_p}{k_c} = (RT)^{-2} = \frac{1}{(RT)^2} = 1.65 \times 10^{-3}$

7. Ans. (3)

Sol. $S(s) + O_2(g) \rightleftharpoons SO_2(g)$ $K_1 = 10^{52}$ ...(1)

$2S(s) + 3O_2(g) \rightleftharpoons 2SO_3(g)$ $K_2 = 10^{129}$ ...(2)

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ $K_3 = x$

multiplying equation (1) by 2;

$2SO(s) + 2O_2(g) \rightleftharpoons 2SO_2(g)$ $K_1' = 10^{104}$ ...(3)

$\Rightarrow$ Substracting (3) from (2); we get

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$;

8. Ans. (1)

Sol. In option (2)- Δn_g is –ve therfore increase in pressure will bring reaction in forward direction.

In option (3)- as the reaction is exothermic therefore increase in temperature will decrease the equilibrium constant.

In option (4)- Equillibrium constant changes only with temperature.

Hence, option (2), (3) and (4) are correct therefore option (1) is incorrect choice.

9. Ans. (4)

Sol. if $\Delta n_g \neq 0$

$Kp \neq Kc$

SURFACE CHEMISTRY

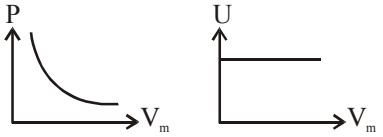
1. Ans. (1)

Colloidal solution fo rubber are negatively charged.

2. Ans. (3)

Isothermal expansion $PV_m = K$(Graph-C)

$$P = \frac{K}{V_m} \text{ (Graph-A)}$$



3. Ans. (2)

4. Ans. (4)

	Dispersed Phase	Dispersion Medium
Cheese	Liquid	Solid
Milk	Liquid	Liquid
Smoke	Solid	Gas

5. Ans. (4)

$$\frac{x}{m} = K \times P^{1/n}$$

$$\log\frac{x}{m} = \log K + \frac{1}{n}\log P$$

$$m = \frac{1}{n} = \frac{2}{4} = \frac{1}{2} \Rightarrow n = 2$$

So, $\frac{x}{m} = K \times P^{1/2}$

6. Ans.(4)

Haemoglobin $\longrightarrow$ positive sol

Gold sol $\longrightarrow$ negative sol

7. Ans. (3)

Sol. $\frac{x}{m} = K.p^{1/n}$

$$\therefore \log\frac{x}{m} = \log K + \frac{1}{n}.\log P$$

slope = $\frac{1}{n} = \frac{2}{3}$

$$\therefore \frac{x}{m} = K.p^{2/3}$$

Correct option : (3)

8. Ans. (2)

Aerosol is suspension of fine solid or liquid particles in air or other gas.

Ex. Fog, dust, smoke etc

$\therefore$ Ans.(2)

9. Ans. (3)

Freundlich adsorption isotherm $\frac{x}{m} = Kp^{0.5}$

so on increasing pressure, $\frac{x}{m}$ increases

physical adsorption decreases with increase in temperature so option (3) is correct.

10. Ans. (1)

Sol. In electrophoresis precipitation occurs at the electrode which is oppositely charged therefore (1) is correct.

11. Ans. (2)

12. Ans. (4)

Colligative properties of colloidal solution are smaller than true solution

13. Ans. (1)

Millimoles $= 10 \times 10^{-3} = 10^{-2}$

Moles $= 10^{-5}$

No. of molecules $= 6 \times 10^{23} \times 10^{-5} = 6 \times 10^{+18}$

surface area occupied by one molecule

$$= \frac{0.24}{6\times10^{18}} = 0.04\times10^{-18}\text{cm}^2$$

$4 \times 10^{-20} = a^2$

$a = 2 \times 10^{-10}$cm = 2pm

14. Ans. (1)

Sulphide is –ve charged colloid so cation with maximum charge will be most effective for coagulation.

$Al^{3+} > Ba^{2+} > Na^{+}$ coagulating power.

MOLE CONCEPT

1. Ans. (2)

$2NaHCO_3 + H_2C_2O_4 \rightarrow Na_2C_2O_4 + 2H_2O +$

$2CO_2$ moles of $CO_2 = \frac{0.25\times10^{-3}}{25} = 10^{-5}$

moles of $NaHCO_3 = 10^{-5}$ mol

mass of $NaHCO_3 = 10^{-5} \times 84$ gm

$\%$ of $naHCO_3 = \frac{84\times10^{-5}}{10\times10^{-3}} = 100$

$= 8.4\%$

2. Ans. (1)

moles of $C_{57}H_{110}O_6(s) = \frac{445}{890} = 0.5$ moles

$2C_{57}H_{110}O_6(s) + 163\,O_2(g) \rightarrow 114\,CO_2(g) + 110\,H_2O(l)$

$n_{H_2O} = \frac{110}{4} = \frac{55}{2}$

$m_{H_2O} = \frac{55}{2}\times18$

$= 495$gm

3. Ans. (4)

$[C_xH_yN_z] \xrightarrow[\text{Method}]{\text{Duma}} 6CO_2 + 4H_2O + N_2$

Hence, $C_6H_8N_2$

4. Ans. (4)

CH_4

$\%$ by mole of carbon $= \frac{1\,\text{mol atom}}{5\,\text{mol atom}}\times100$

$= 20\%$

5. Ans. (3)

$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

(1) 0.5 mol (LR) 2 mol

(2) 1 mol 3 mol (completion)

(3) 2 mol 5 mol (LR)

(4) 1.25 mol (LR) 4 mol

$\therefore$ Ans.(3)

6. Ans. (3)

$\frac{w}{w}\% = 20$

100 gm solution has 20 gm KI

80 gm solvent has 20 gm KI

$m = \frac{\frac{20}{166}}{\frac{80}{1000}} = \frac{20\times1000}{166\times80} = 1.506 \simeq 1.51\,\text{mol/kg}$

7. Ans. (4)

$C_xH_y + \left(x+\frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$

10 $10\left(x+\frac{y}{4}\right)$ $10x$

By given data, $10\left(x+\frac{y}{4}\right) = 55$ .... (1)

$10x = 40$ .... (2)

$\therefore$ $x = 4$, $y = 6 \Rightarrow C_4H_6$

8. Ans. (3)

Sol. $C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(\ell)$

Each 1g of C_3H_8 requires 3.63 g of O_2

$P_4(s) + 5O_2(g) \longrightarrow P_4O_{10}(s)$

Each 1g of P_4 requires 1.29 g of O_2

$4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$

Each 1g of Fe requires 0.428 g of O_2

$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$

Each 1g of Mg requires 0.66 g of O_2

therefore least amount of O_2 is required in option (3).

9. Ans. (3)

$5[M_A + 2M_B] = 125$

$M_A + 2M_B = 25$ ....(1)

$2M_A + 2M_B = 30$ ....(2)

from eq. (1) & (2)

$M_A = 5$

$M_B = 10$

10. Ans. (2)

$$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$$

$\left(\frac{25}{M}\right)$ $\quad x \times \frac{25}{M} = 2 \quad \frac{y}{2} \times \frac{25}{M} = 0.5$

C $\quad x \times \frac{25}{M} = 2$

H $\quad y \times \frac{25}{M} = 1$

$C_{2y}H_y \equiv 24y$ gm C + y gm H

or

24 : 1 ratio by mass

IDEAL GAS

1. Ans. (3)

$n_T = (0.5 + x)$

PV = n × R × T

200 × 10 = (0.5 + x) × R × 1000

2 = (0.5 + x) R

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

$$\frac{4}{R} - 1 = 2x$$

$$\boxed{\frac{4-R}{2R} = x}$$

2. Ans. (4)

$\frac{2}{5}$ air escaped from vessel,

$\therefore \frac{3}{5}$ air remain is vessel. P, V constant

$n_1T_1 = n_2T_2$

$$n_1(300) = \left(\frac{3}{5}n_1\right)T_2 \Rightarrow T_2 = 500 \text{ K}$$

3. Ans. (4)

$$V_{mp} = \sqrt{\frac{2RT}{M}} \Rightarrow V_{mp} \propto \sqrt{\frac{T}{M}}$$

For N_2, O_2, H_2

$$\sqrt{\frac{300}{28}} < \sqrt{\frac{400}{32}} < \sqrt{\frac{300}{2}}$$

V_{mp} of N_2(300K) < V_{mp} of O_2(400K) < V_{mp} of H_2(300K)

CONCENTRATION TERMS

1. Ans. (2)

1L – 1M H_2O_2 solution will produce 11.35 L O_2 gas at STP.

2. Ans. (1)

8g NaOH, mol of NaOH = $\frac{8}{40} = 0.2\text{mol}$

18g H_2O, mol of H_2O = $\frac{18}{18} = 1\text{mol}$

$$\therefore \ X_{NaOH} = \frac{0.2}{1.2} = 0.167$$

Molality = $\frac{0.2 \times 1000}{18} = 11.11$ m

3. Ans. (3)

$$n_{Na^+} = \frac{92}{23} = 4$$

So molality = 4

4. Ans. (1)

Molarity = $\frac{(n)_{solute}}{V_{solution}\text{ (in lit)}}$

$$0.1 = \frac{\text{wt.}/342}{2}$$

wt $(C_{12}H_{22}O_{11})$ = 68.4 gram

5. Ans. (2)

Volume strength = 11.2 × molarity = 11.2

⇒ molarity = 1 M

⇒ strength = 34 g/L

$$\Rightarrow \%\ \text{w/w} = \frac{34}{1000} \times 100 = 3.4\%$$

6. Ans. (3)

$X_{solvent} = 0.8$

If $n_T = 1$

$n_{Solvent} = 0.8$

$n_{Solute} = 0.2$

$$\text{molality} = \frac{0.2}{\frac{0.8\times18}{1000}} = 13.88$$

ELECTROCHEMISTRY

1. Ans. (1)

$\Delta G = \Delta H - \Delta S$

$$-nFE_{cell} = \Delta H - nFT\frac{dE_{cell}}{dT}$$

(n = 2)

2. Ans. (2)

$$\Lambda_m^0(HA) = \Lambda_m^0(HCl) + \Lambda_m^0(NaA) - \Lambda_m^0(NaCl)$$

= 425.9 + 100.5 - 126.4

= 400 S cm^2 mol^{-1}

$$\Lambda_m = \frac{1000K}{M} = \frac{1000\times5\times10^{-5}}{10^{-3}} = 50 \text{ S cm}^2 \text{ mol}^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{50}{400} = 0.125$$

3. Ans. (2)

Higher the oxidation potential better will be reducing power.

4. Ans. (1)

$$Pt(s)\left|H_2(g,1bar)\right|HCl(aq)\left|AgCl(s)\right|Ag(s)\left|Pt(s)\right.$$

10^{-6} m

Anode: $H_2 \longrightarrow 2H^+ + 2e \times 1$

Cathode : $e^- + AgCl(s) \longrightarrow Ag(s) + Cl^-(aq) \times 2$

$$H_2(g)+2AgCl(s)\longrightarrow 2H^+ + 2Ag(s) + 2Cl^-(aq)$$

$$E_{cell} = E_{cell}^0 - \frac{0.06}{2}\log_{10}\left((H^+)^2\cdot(Cl^-)^2\right)$$

$$0.92 = \left(E^0_{H_2/H^+} + E^0_{AgCl/Ag,Cl^-}\right) - \frac{0.06}{2}\log_{10}\left((10^{-6})^2(10^{-6})^2\right)$$

$$0.92 = 0 + E^0_{AgCl/Ag,Cl^-} - 0.03\log_{10}(10^{-6})^4$$

$$E^0_{AgCl}/Ag, Cl^- = .92 + .03 \times (-24) = 0.2 \text{ V}$$

5. Ans. (3)

(A) $PbSO_4(s) + 2OH^- \rightarrow PbO_2 + H_2SO_4 + 2e^-$

0.05/2 mole 0.05F

(C) $PbSO_4 + 2e^- + 2H^+ \longrightarrow Pb(s) + H_2SO_4$

0.05/2 mole 0.05 F

$n_T(PbSO_4) = 0.05$ mole

$m_{PbSO_4} = 0.05\times303 = 15.2$ gm

6. Ans. (2)

(1) $3Zn_{(s)} + 2Au^{+3}_{(aq)} \xrightarrow{n=6} 3Zn^{+2}_{(aq)} + 2Au_{(s)}$

$$\frac{E^0_{cell}}{n} = 0.36$$

(2) $Zn_{(s)} + 2Ag^+_{(aq)} \xrightarrow{n=2} Zn^{+2}_{(aq)} + 2Ag_{(s)}$

$$\frac{E^0_{cell}}{n} = 0.78$$

(3) $Zn_{(s)} + 2Fe^{+3}_{(aq)} \xrightarrow{n=2} Zn^{+2}_{(aq)} + 2Fe^{+2}_{(aq)}$

$$\frac{E^0_{cell}}{n} = 0.765$$

(4) $Zn_{(s)} + Fe^{+2}_{(aq)} \xrightarrow{n=2} Zn^{+2}_{(aq)} + Fe_{(s)}$

$$\frac{E^0_{cell}}{n} = 0.16$$

We have maximum value of $\left(\frac{E^0_{cell}}{n}\right)$ for reaction (2)

7. Ans. (1)

$\Delta G^\circ = -RT \ln k = -nFE^\circ_{cell}$

$$\ln k = \frac{n\times F\times E^o}{R\times T} = \frac{2\times96000\times2}{8\times300}$$

$\ln k = 160$

$k = e^{160}$

8. Ans. (2)

$$E_{cell} = E^{o}_{cell} - \frac{0.059}{n}\log Q$$

At equilibrium

$$E^{\circ}_{Cell} = \frac{0.059}{2}\log 10^{16}$$

$= 0.059\times 8$

$= 0.472$ V

$\simeq 0.4736$ V

9. Ans. (3)

For strongest oxidising agent, standard reduction potential should be highest.

Correct option : (3)

10. Ans. (1)

Sol. $Fe^{+2}(aq) + Ag^{+}(aq) \rightarrow Fe^{+3}(aq) + Ag(s)$

Cell reaction

anode : $Fe^{+2}(aq) \rightarrow Fe^{+3}(aq) + e^{\Theta}$;

$$E^{o}_{Fe^{+2}/Fe^{+3}} = mV$$

cathode : $Ag^{+}(aq) + e^{\Theta} \rightarrow Ag(s)$;

$$E^{o}_{Ag^{+}/Ag} = xV$$

$\Rightarrow$ cell standard potential = (m + x)V

$\therefore$ to find 'm';

$Fe^{+2} + 2e^{\Theta} \rightarrow Fe$;

$$E^{o}_{1} = yV \Rightarrow \Delta^{o}_{1}G = -(2Fy)$$

$Fe^{+3} + 3e^{\Theta} \rightarrow Fe$;

$$E^{o}_{2} = zV \Rightarrow \Delta^{o}_{2}G = -(3Fz)$$

$Fe^{+2}(aq) \rightarrow Fe^{+3}(aq) + e^{\Theta}$;

$$E^{o}_{3} = mV \Rightarrow \Delta^{o}_{3}G = -(1Fm)$$

$\Delta^{o}_{3}G = \Delta G^{o}_{1} - \Delta G^{o}_{2}$ = (–2Fy + 3Fz) = –Fm

$\Rightarrow$ m = (2y – 3z)

$\Rightarrow E^{o}_{cell}$ = (x + 2y – 3z)V

11. Ans. (1)

$\Delta G^{\circ} = -nFE^{\circ}_{cell}$

$= -2 \times 96000 \times 2$

$= -384000$ J

$= -384$ kJ

$\therefore$ Ans. is (1)

12. Ans. (2)

0.1 eq. of Ni^{+2} will be discharged.

No. of eq = (No of moles) × (n-factor)

0.1 = (No. of moles) × 2

$$\text{No. of moles of Ni} = \frac{0.1}{2} = 0.05$$

13. Ans. (2)

On dilution, no. of ions per ml decreases so conductivity decreases hence S1 is wrong.

$$\wedge_{M} = \frac{1000\times\kappa}{C}$$

On dilution C and κ both decreases but effect of C is more dominating so $\wedge_{M}$ increases hence S2 is right.

14. Ans. (2)

Both NaCl and KCl are strong electrolytes and as Na^{+}(aq.) has less conductance than K^{+}(aq.) due to more hydration therefore the graph of option (2) is correct.

15. Ans. (4)

$E^{\circ}_{Red} \uparrow \Rightarrow$ oxidizing power $\uparrow$

16. Ans. (3)

Order of acidic strength

A > C > B

Acidic strength $\uparrow \Rightarrow$ degree of ionization $\uparrow$

REDOX

1. Ans. (1)

ppm of $CaCO_3$

$(10^{-3} \times 10^{3}) \times 100 = 100$ ppm

2. BONUS

$H_2C_2O_4 + 2NaOH \longrightarrow Na_2C_2O_4 + 2H_2O$

m_{eq} of $H_2C_2O_4$ = m_{eq} NaOH

$50 \times 0.5 \times 2 = 25 \times M_{NaOH} \times 1$

$\therefore \quad M_{NaOH} = 2$ M

Now 1000 ml solution = 2 × 40 gram NaOH

$\therefore$ 50 ml solution = 4 gram NaOH

3. Ans. (3)

$$2\overset{+7}{M}nO_4 + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2\overset{+2}{M}n^{2+} + 10CO_2 + 8H_2O$$

10 e^- transfer for 10 molecules of CO_2 so per molecule of CO_2 transfer of e^- is '1'

4. Ans. (2)

H_2O_2 act as oxidising agent and reducing agent in acidic medium as well as basic medium.

H_2O_2 Act as oxidant :-

$H_2O_2 + 2H^{\oplus} + 2e^{\ominus} \rightarrow 2H_2O$ (In acidic medium)

$H_2O + 2e^{\ominus} \rightarrow 2OH^{\ominus}$ (In basic medium)

H_2O_2 Act as reductant :-

$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^{\ominus}$ (In acidic medium)

$H_2O_2 + 2OH^{\ominus} \rightarrow 2H_2O + O_2 + 2e^{\ominus}$ (In basic medium)

5. Ans. (2)

Sol. $n_{eq.}KMnO_4 = n_{eq.}[FeC_2O_4 + Fe_2(C_2O_4)_3 + FeSO_4]$

or $n \times 5 = 1 \times 3 + 1 \times 6 + 1 \times 1$

$\therefore$ n = 2

Correct option : (2)

6. Ans. (2)

Sol. $n_{eq.}CaCO_3 = n_{eq}Ca(HCO_3)_2 + n_{eq}Mg(HCO_3)_2$

or , $\frac{W}{100}\times 2 = \frac{0.81}{162}\times 2 + \frac{0.73}{146}\times 2$

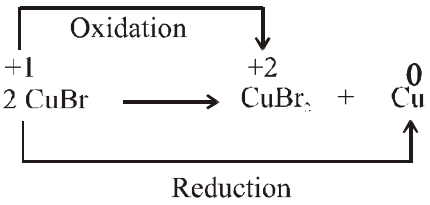
$\therefore$ w = 1.0

$\therefore$ Hardness = $\frac{1.0}{100}\times 10^6 = 10000 ppm$

Correct option : (2)

7. Ans. (3)

Sol.



SOLID STATE

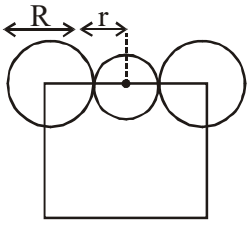
1. Ans. (4)

In Triclinic unit cell

$a \neq b \neq c$ & $\alpha \neq \beta \neq \gamma \neq 90°$

2. Ans. (2)

3. Ans. (3)



$a = 2(R + r)$

$\frac{a}{2} = (R + r)$ ...(1)

$a\sqrt{3} = 4R$ ...(2)

Using (1) & (2)

$\frac{a}{2} = \frac{a\sqrt{3}}{4} = r$

$a\left(\frac{2-\sqrt{3}}{4}\right) = r$

r = 0.067 a

4. Ans. (4)

FCC unit cell Z = 4

$d = \frac{63.5\times 4}{6\times 10^{23}\times x^3\times 10^{-24}}$ g/cm^3

$d = \frac{63.5\times 4\times 10}{6}$ g/cm^3

$d = \frac{423.33}{x^3} \simeq \left(\frac{422}{x^3}\right)$

5. Ans. (2)

Sol. Generally interstitial compounds are chemicaly inert.

6. Ans. (3)

Sol. $p.f. = \frac{\left(z_{eff}\times\frac{4}{3}\pi r_A^3\right)_A + \left(z_{eff}\times\frac{4}{3}\pi r_B^3\right)_B}{a^3}$

$2(r_A + r_B) = \sqrt{3}a$

$\Rightarrow 2(r_A + 2r_A) = \sqrt{3}a$

$\Rightarrow 2\sqrt{3}\,r_A = a$

$\Rightarrow p.f. = \frac{1\times\frac{4}{3}\pi r_A^3 + \frac{4}{3}\pi\left(8r_A^3\right)}{8\times 3\sqrt{3}\,r_A^3} = \frac{9\times\frac{4}{3}\pi}{8\times 3\sqrt{3}} = \frac{\pi}{2\sqrt{3}}$

p. efficiency = $\frac{\pi}{2\sqrt{3}}\times 100 \simeq 90\%$

7. Ans. (1)

Sol. Distance between two nearest tetrahedral void = $\left(\frac{a}{2}\right)$

8. Ans. (1)

Sol. SC : BCC : FCC

1 : 2 : 4

9. Ans. (2)

A_2B_3 has HCP lattice

If A form HCP, then $\frac{3}{4}^{th}$ of THV must occupied by B to form A_2B_3

If B form HCP, then $\frac{1}{3}^{th}$ of THV must occupied by A to form A_2B_3

THERMOCHEMISTRY

1. Ans. (3)

$$C_{(graphite)} + O_2(g) \rightarrow CO_2(g) \Delta_r H^\circ = x kJ/mol \quad ...(1)$$

$$C_{(graphite)} + \frac{1}{2}O_2(g) \rightarrow CO(g) \Delta_r H^\circ = y kJ/mol \quad ...(2)$$

$$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g) \Delta_r H^\circ = z kJ/mol \quad ...(3)$$

(1) = (2) + (3)

x = y + z

2. Ans. (2)

At higher temperature, rotational degree of freedom becomes active.

$$C_P = \frac{7}{2}R \quad \text{(Independent of P)}$$

$$C_V = \frac{5}{2}R \quad \text{(Independent of V)}$$

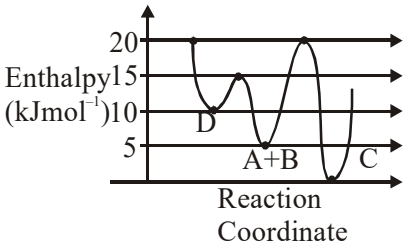
Variation of U vs T is similar as C_V vs T

3. Ans. (2)

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta n_g < 0$

4. Ans. (4)

Sol. $A + B \rightarrow C + D$



Activation enthalpy for C = 20 – 5 = 15kJ/mol

Activation enthalpy for D = 15 – 5 = 10kJ/mol.

5. Ans. (4)

Sol. $I_{2(s)} \rightarrow I_{2(g)}$: ΔH_1 = 24 cal/g at 200°C

$\Delta H_2 = \Delta H_1 + \Delta C_{P_{rxn}} (T_2 - T_1)$

= 24 + (0.031 –0.055) × 50

= 24–1.2

= 22.8 Cal/g

6. Ans. (3)

Sol. $C_7H_{16}(\ell) + 11O_2(g) \longrightarrow 7CO_2(g) + 8H_2O(\ell)$

$\Delta n_g = n_p - n_r = 7 - 11 = -4$

$\because \Delta H = \Delta U + \Delta n_g RT$

$\therefore \Delta H - \Delta U = -4\ RT$

RADIOACTIVITY

1. Ans. (1)

Sol. From 0 to 1 hour, $N' = N_0 e^t$

From 1 hour onwards $\frac{dN}{dt} = -5N^2$

So at t = 1 hour, $N' = eN_0$

$$\frac{dN}{dt} = -5N^2$$

$$\int_{eN_0}^{N} N^{-2}\, dN = -5\int_{1}^{t} dt$$

$$\frac{1}{N} - \frac{1}{eN_0} = 5(t - 1)$$

$$\frac{N_0}{N} - \frac{1}{e} = 5N_0\ (t - 1)$$

$$\frac{N_0}{N} = 5N_0(t - 1) + \frac{1}{e}$$

$$\frac{N_0}{N} = 5N_0 t + \left(\frac{1}{e} - 5N_0\right)$$

which is following y = mx + C

JANUARY 2019 ATTEMPT (OC)

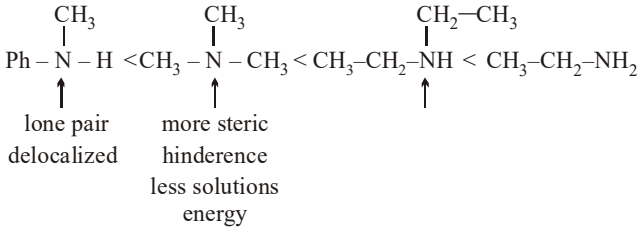
GOC

1. Ans. (3)

Do not have (4n + 2) π electron It has 4n π electrons

So it is Anti aromatic.

2. Ans. (1)

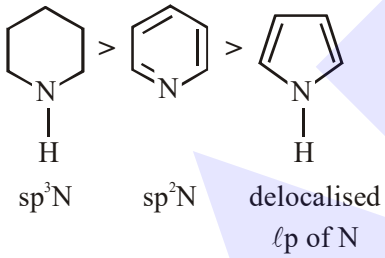


3. Ans. (4)

CN makes anino most stable so answer is $CH(CN)_3$

4. Ans. (4)

Order of basic strength :



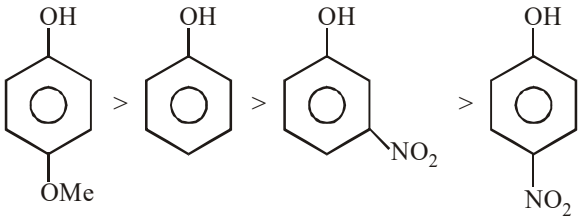
5. Ans. (1)

EWG increasea acidic strength

$NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > ClCH_2COOH$

6. Ans. (4)

Acidic strength is inversely proportional to pka.



7. Ans. (1)

Localised lone pair e^-.

8. Ans. (2)

out of the given options only  is aromatic.

Hence (B), (C) and (D) are not aromatic

9. Ans. (2)

$CH{\equiv}CH > CH_3{-}C{\equiv}CH > CH_2{=}CH_2$

(Acidic strength order)

10. Ans. (1)

M.P. of Napthalene $\simeq$ 80°C

11. Ans. (1)

Sol. Basic strength order

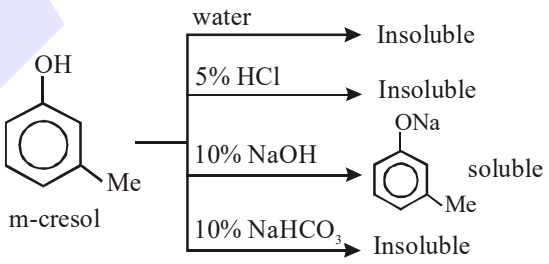
$(CH_3CH_2)_2NH > CH_3CH_2NH_2 > NH_3$

2° amine 1°amine

Correct option : (1)

12. Ans. (1)

Sol.



* Oleic acid is also soluble in $NaHCO_3$

* o-toluidine is not soluble in NaOH as well as $NaHCO_3$

* Benzamide is also not soluble in NaOH & $NaHCO_3$.

Correct option : (1)

13. Ans. (2)

Sol. B < D < A < C

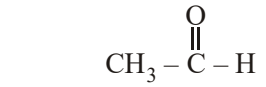
$$\text{Basicity} \propto +R \propto \frac{1}{-R}$$

$$\propto +H \propto \frac{1}{-H}$$

CARBONYL COMPOUND

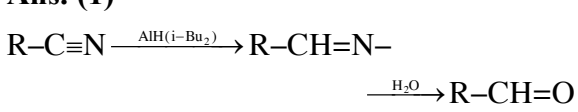
1. Ans. (1)

Aldehyde reacts at a faster rate than keton during aldol and stericall less hindered anion will be a better nucleophile so sefl aldol at



will be the major product.

2. Ans. (1)



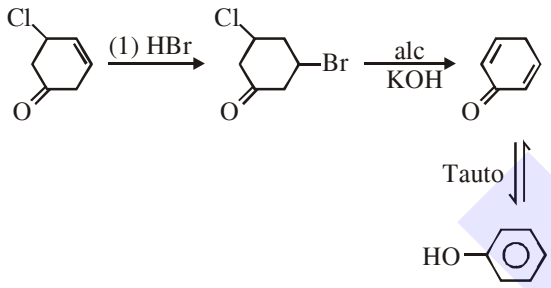
3. Ans.(3)

4. Ans.(4)

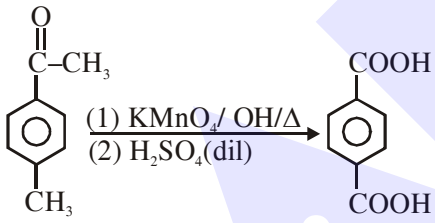
5. Ans.(2)

6. Ans.(4)

7. Ans. (1)

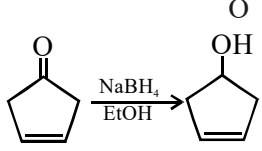


8. Ans. (2)

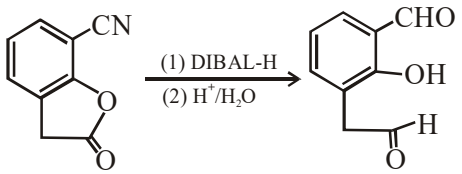


9. Ans. (4)

$NaBH_4$ can not reduce C=C but can reduce $-\overset{\overset{O}{\|}}{C}-$ into OH.

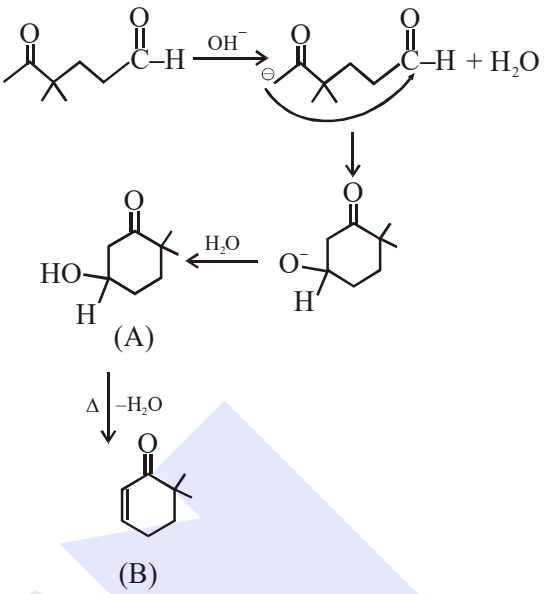


10. Ans. (3)

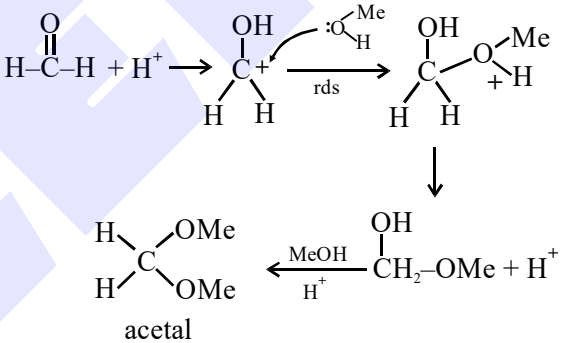


DIBAL-H will reduce cyanides & esters to aldehydes.

11. Ans. (4)



12. Ans. (1)



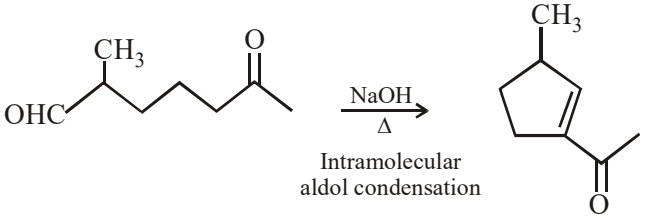
acetal

$$\text{rate} \propto \frac{1}{\text{steric crowding of aldehyde}}$$

t-butanol can show formation of carbocation in acidic medium.

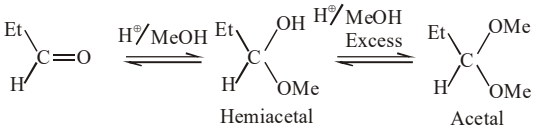
13. Ans. (4)

Sol.



14. Ans. (4)

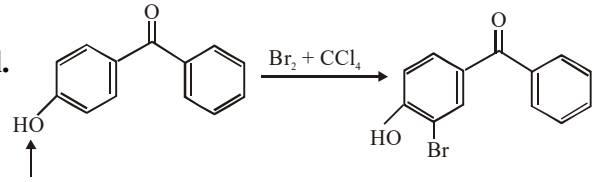
Sol.



Acetone as substrate is less rective than propanal towards neucleophilic addition.

15. Ans. (4)

Sol.

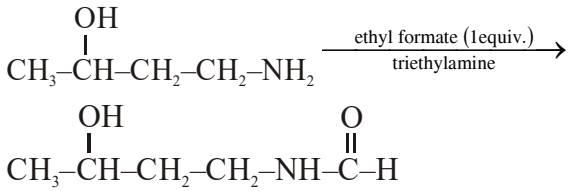


⊕M group

OH is activating and ortho para directing group towards ESR

16. Ans. (1)

Sol.

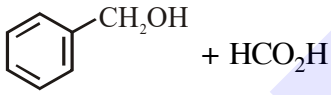


as NH_2 is a better nucleophile than OH.

17. Ans. (4)

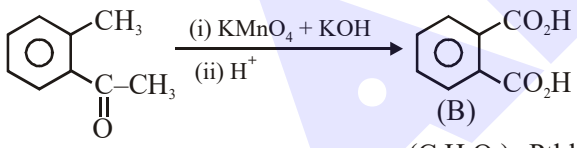
Sol.

This is cross cannizaro reaction so more reactive carbonyl compound is oxidized and less reactive is reduced so answer is

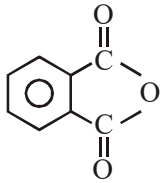


18. Ans. (1)

Sol.



+ve iodoform test

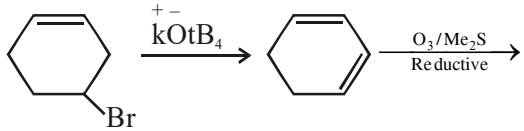


is used for prepareation of phenolphthalein indicator

Pthleic anhydride

19. Ans. (2)

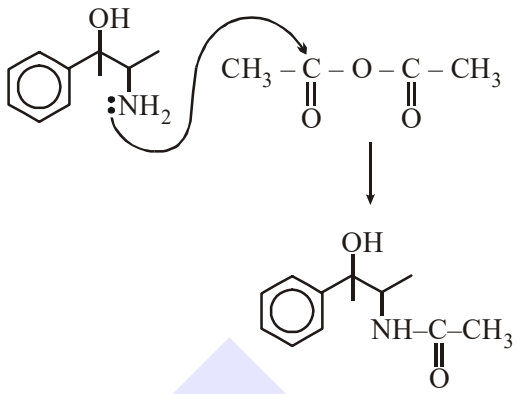
Sol.



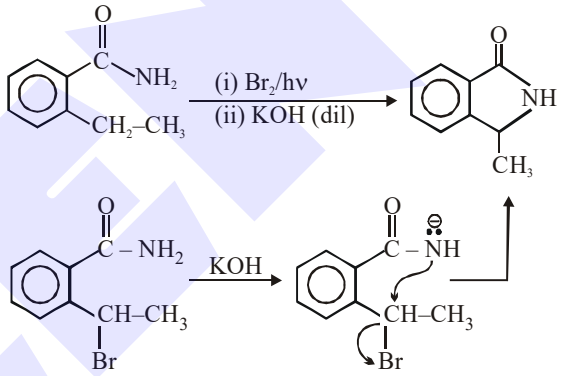
$CHO–CH_2–CH_2–CHO + OHC–CHO$

CAD

1. Ans. (3)



2. Ans.(3)



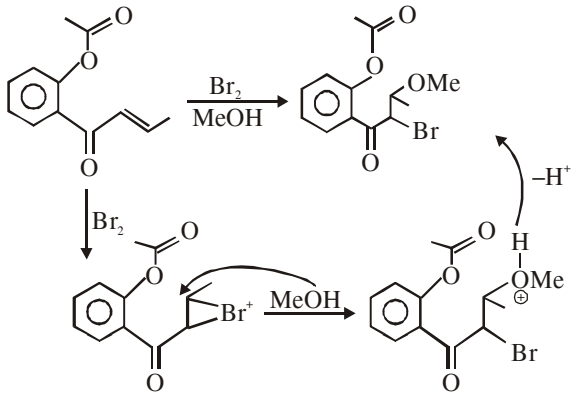
3. Ans.(4)

Adipic acid $CO_2H–(CH_2)_4–CO_2H$ $\xrightarrow[\text{agent}]{\text{dehydrating}}$ 7 membered cyclic anhydride (Very unstable)

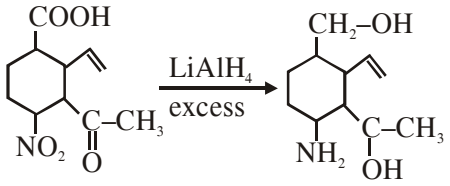
4. Ans. (2)

More is the electrophilic character of carbonyl group of ester faster is the alkaline hydrolysis.

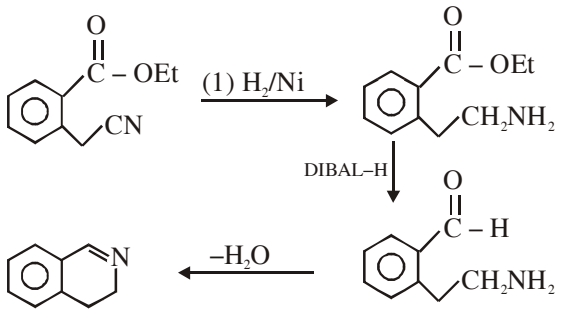
5. Ans. (2)



6. Ans. (2)

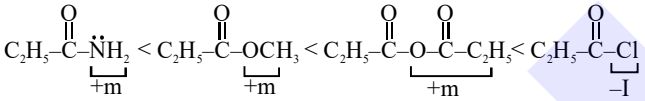


7. Ans. (2)

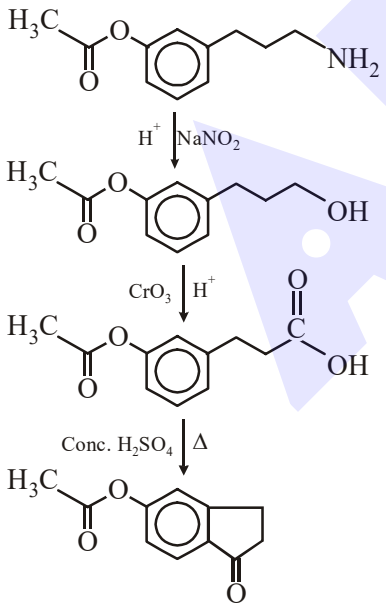


8. Ans. (1)

Rate of nucleophilic attack on carbonyl $\propto$ Electrophilicity of carbonyl group

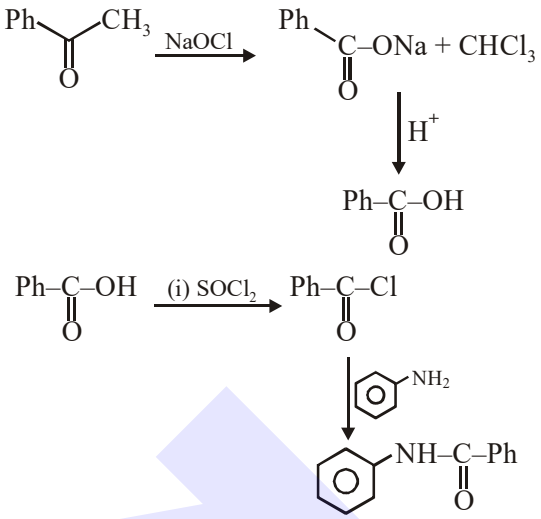


9. Ans. (4)



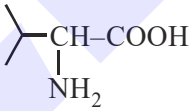
10. Ans. (1)

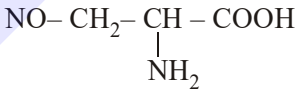
Sol.

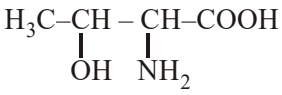


BIOMOLECULE

1. Ans. (4)

Leusine 

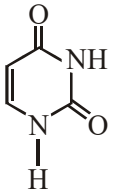
Serine 

Thrconine 

2. Ans.(3)

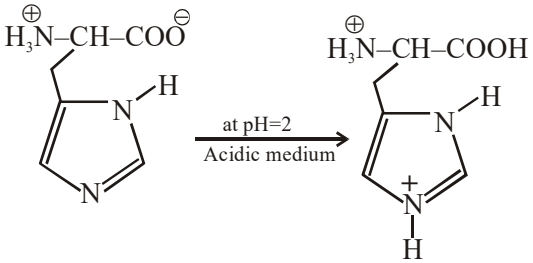
3. Ans.(3)

For the given structure 'uracil' is found in RNA



4. Ans. (1)

Histidine is

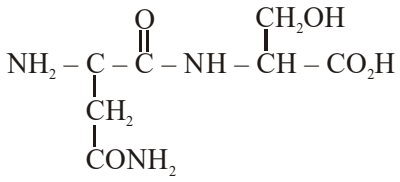


Zwitter ionic form

pIn = 7.59

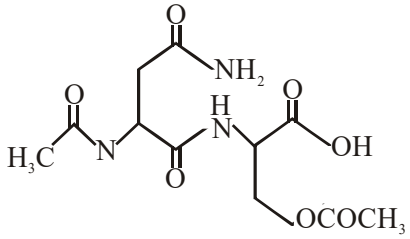
5. Ans. (1)

Asn–Ser is dipeptide having following structure



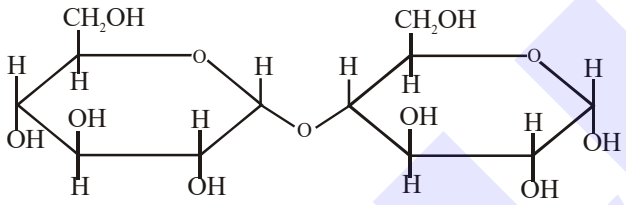
$$\text{Asn} - \text{Ser} + (CH_3CO)_2O \xrightarrow[\text{excess}]{NEt_3} P$$

P is



6. Ans. (2)

Sol.



Maltose

$\xrightarrow{H_3O^+}$

2 D-glucose

7. Ans. (4)

Sol. Seliwanoff's test is used to distinguished aldose and ketose group.

8. Ans. (2)

Sol. Sucrose $\xrightarrow{H_2O}$ α-D-glucose + β-D-fructose also named as invert sugar & it is a example of non-reducing sugar.

The glycosidic linkage is present between C_1 of α-glucose & C_2 of β-fructose.

9. Ans. (2)

Sol. Serine ⇒ $HO-\underset{\underset{O}{\|}}{C}-\underset{\underset{NH_2}{|}}{CH}-CH_2-OH$

Lysine ⇒ $H_2N-CH_2-CH_2-CH_2-CH_2-\underset{\underset{NH_2}{|}}{CH}-\overset{\overset{O}{\|}}{C}-OH$

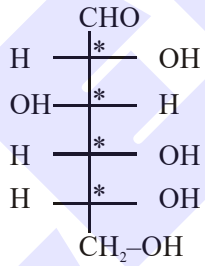
Lysine has $-NH_2$ group hence gives ⊕ve carbyl amine test and serine has –OH group hence gives ⊕ve serric ammonium nitrate test

10. Ans. (1)

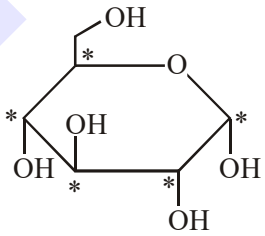
Sol. Amylopetcin is a homopolymer of α-D-glucose where C_1-C_4 linkage and C_1-C_6 linkage are present.

11. Ans. (1)

Sol.



D–Glucose
(Linear structure)



α-D–Glucose
(cyclic structure)

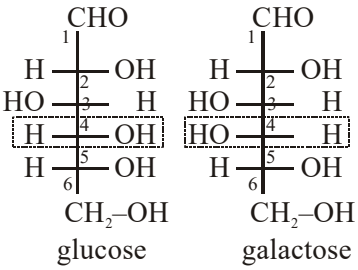
* :- Stereocenter

12. Ans. (1)

Sol. RNA is a single stranded structure.

13. Ans. (3)

Sol. Glucose and galactose are C-4 Epimer's



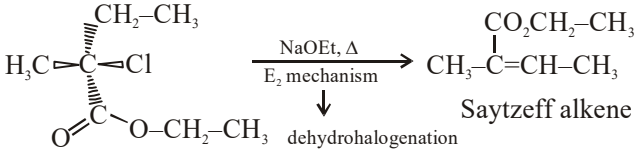
glucose galactose

14. Ans. (1)

Sol. Glycogen is an animal starch.
It consists of α-amylose and amylopectin.
Amylopectin is branched chain polysaccharide
Hence statement (1) is incorrect.

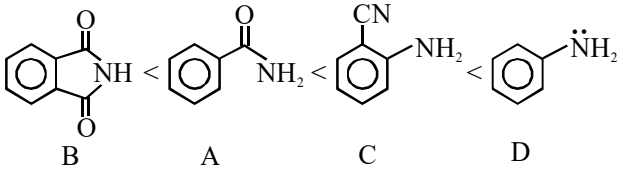
HALOGEN DERIVATIVE

1. Ans. (3)



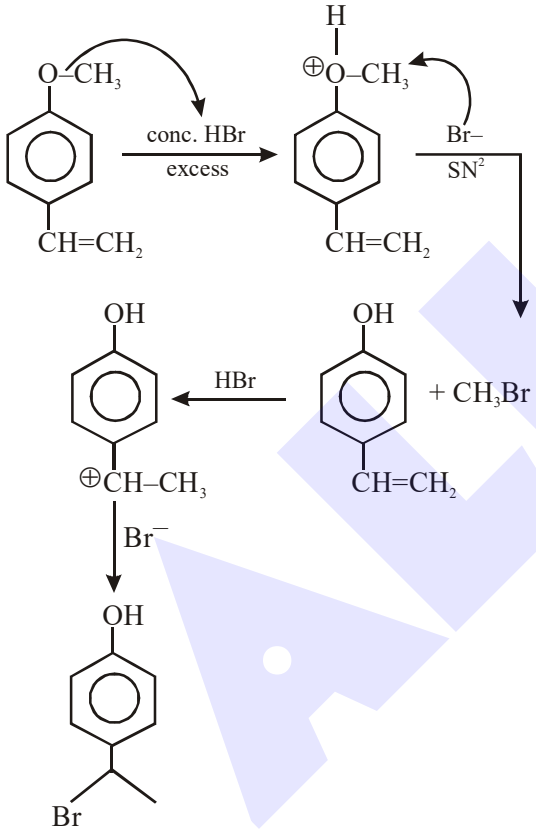
2. Ans. (2)

Nucleophilicity order



3. Ans. (4)

Sol.



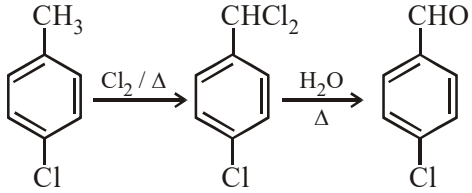
Correct option : (4)

4. Ans. (Bonus)

Sol. because one double bond is missing in all given option. So aromaticity is lost in both the ring.

5. Ans. (4)

Sol.



6. Ans. (1)

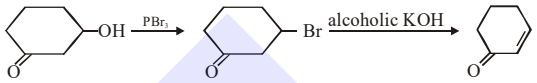
Sol. $CF_3–CH=CH_2 \xrightarrow{HCl} CF_3–\overset{H}{\underset{|}{C}}H–\overset{\oplus}{C}H_2 \rightarrow CF_3–\overset{H}{\underset{|}{C}}H–\overset{Cl}{\underset{|}{C}}H_2$

Due to higher e^- withdrawing nature of CF_3 group.

It follow anti markovnikoff product

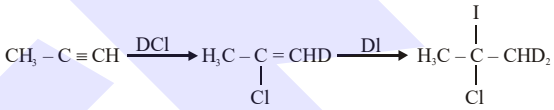
7. Ans. (4)

Sol.



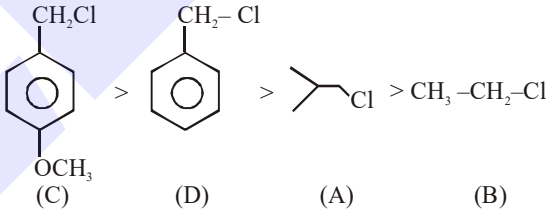
8. Ans. (4)

Sol.



9. Ans. (3)

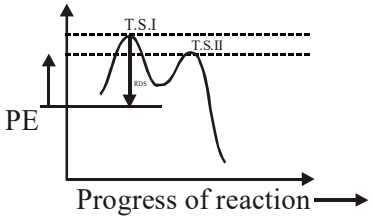
Sol. S_N1 Reactivity order



Order C> D> A> B

10. Ans. (4)

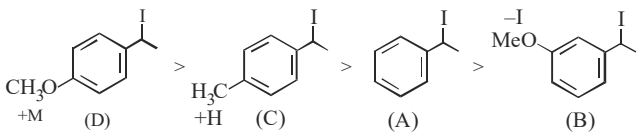
Sol. PE diagram for S_N1



$S_N1$is two step reaction where in step (1) formation of carbocation is RDS

11. Ans. (3)

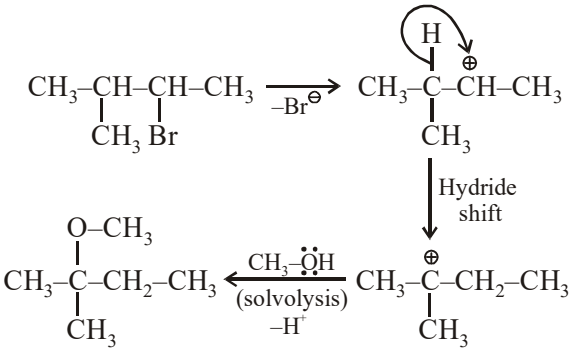
Sol. Rate of $S_{N'}$ is directly proposional to stability of first formed carbocation so answer is



12. Ans. (3)

Sol. $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{CH_3OH} ?$

In polar protic solvent S_{N^1} mechanism is favourable hence reaction complete via S_{N^1} mechanism

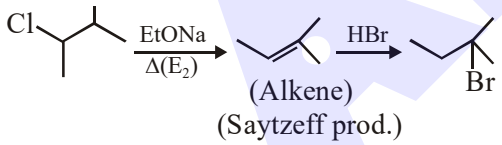


13. Ans. (1)

Sol. $\underset{\text{Charged ion}}{\bar{O}H > CH_3-\overset{O}{\overset{\|}{C}}-O^- > CH_3-\overset{O}{\overset{\|}{\underset{O}{\underset{\|}{S}}}}-O^-} > \underset{\text{neutral system}}{H_2O}$

ione pair donating tendency on oxygen is reduced, nucleophilicity reduced b < c < a < d

14. Ans. (3)

Sol. 

(Alkene)
(Saytzeff prod.)

15. Ans. (2)

Sol. $CH_3-CH=CH_2 \xrightarrow{Cl_2/H_2O} CH_3-\overset{\oplus}{\underset{}{Cl}}-CH-CH_2$

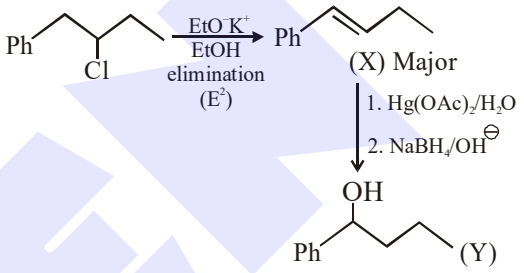
$\xrightarrow{H_2\ddot{O}:}$ $CH_3-\underset{\underset{OH}{|}}{CH}-\underset{\underset{Cl}{|}}{CH_2}$

16. Ans. (4)

Sol. Vinyl halide $CH_2=CH-Cl$ do not undergo SN reaction

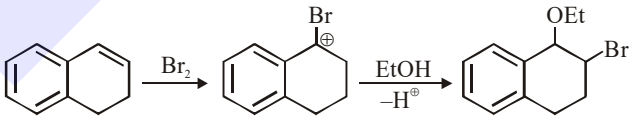
This is due to formation of highly unstable carbocation $(CH_2=\overset{\oplus}{C}H)$; which cannot be delocalised by the π-electron, also C–Cl has double bond character because of resonance

17. Ans. (4)

Sol. 

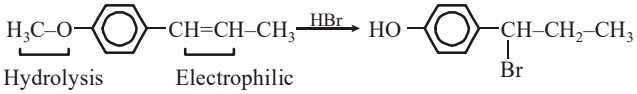
HYDROCARBON

1. Ans. (4)



2. Ans. (2)

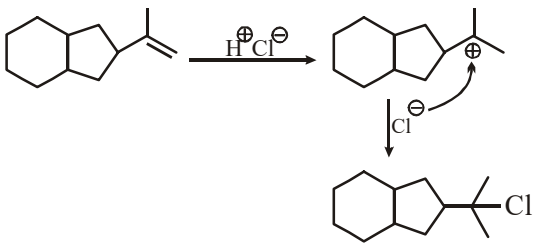
3. Ans. (2)



Hydrolysis of ether

Electrophilic addition acc. to markonikoff's Rule

4. Ans. (1)



5. Ans. (2)

Sol. $CH_3-C\equiv CH \xrightarrow[\Delta]{Ag_2O} CH_3-C\equiv C-Ag\downarrow$
(terminal alkyne) (ppt)

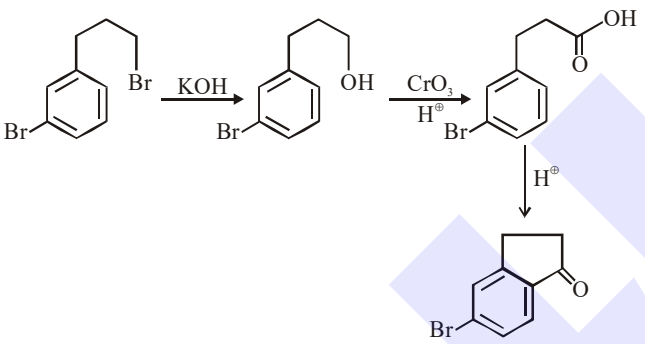
$CH_3-C\equiv CH \xrightarrow[\text{dil.}H_2SO_4]{Hg^{2+}} CH_3-\overset{OH}{\overset{|}{C}}=CH_2 \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow{NaBH_4} CH_3-\underset{OH}{\underset{|}{CH}}-CH_3$ (2° alcohol)

(terminal alkyne; Kucherov reaction)

$\xrightarrow{\text{Conc. HCl+ZnCl}_2}$ Turbidity within 5 min. (Lucas Reagent Test)

AROMATIC

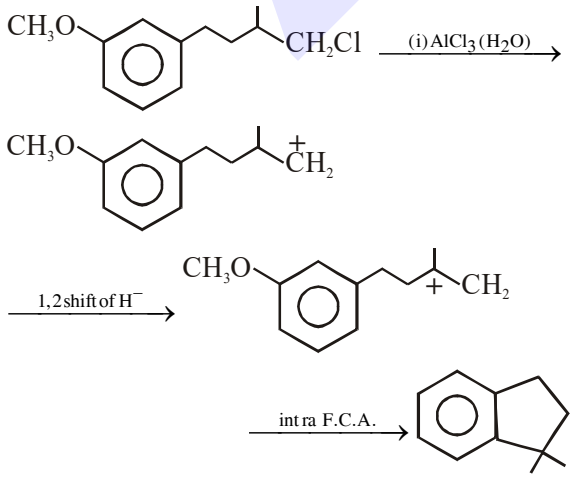
1. Ans. (2)



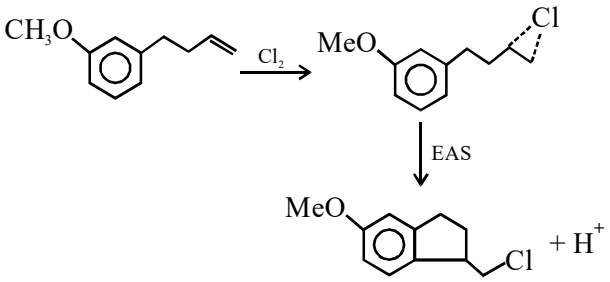
During AES Br is o/p directing and major product will be formed on less hindrance p position :

2. Ans. (3)

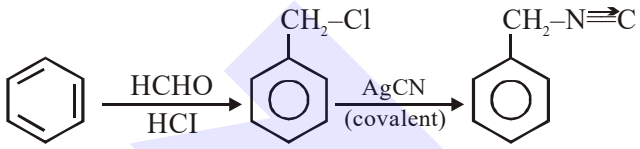
3. Ans. (2)



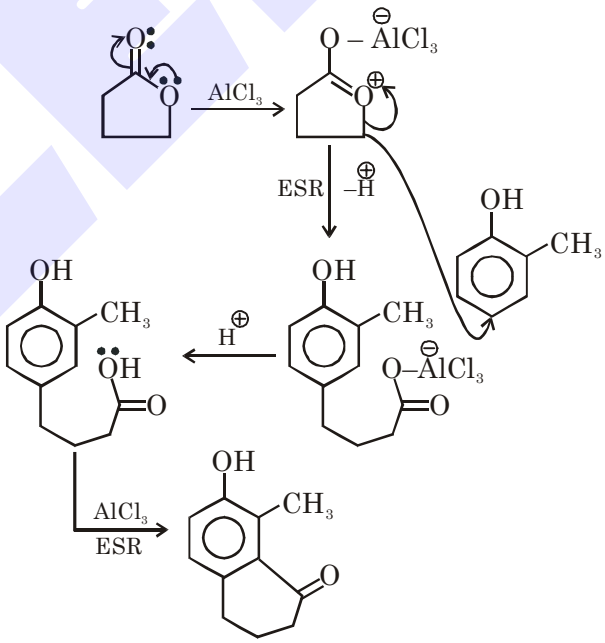
4. Ans.(4)



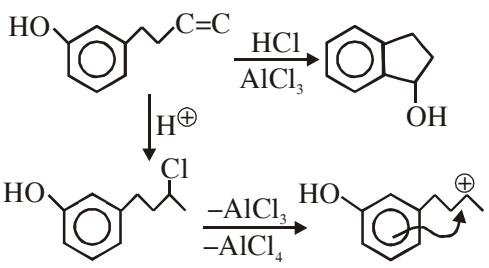
5. Ans. (4)



6. Ans. (1)

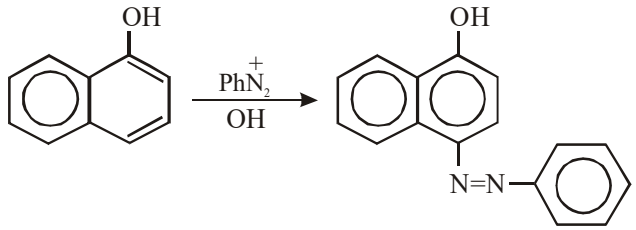


7. Ans. (2)



8. Ans. (3)

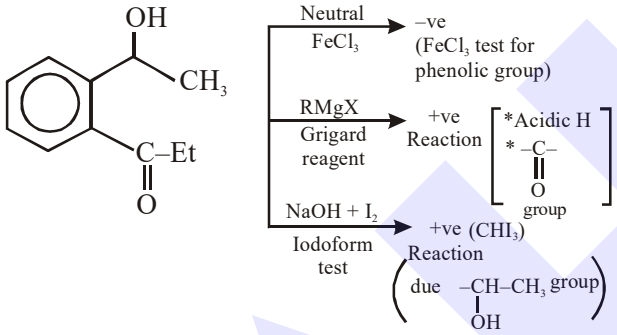
Sol.



α-naphthol (1-naphthol) — orange red dye

9. Ans. (1)

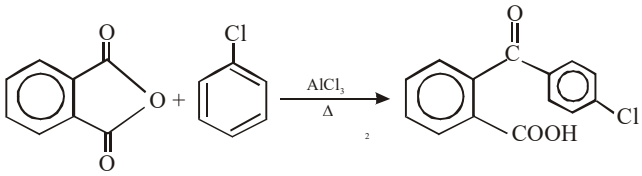
Sol.



Correct option : (1)

10. Ans. (3)

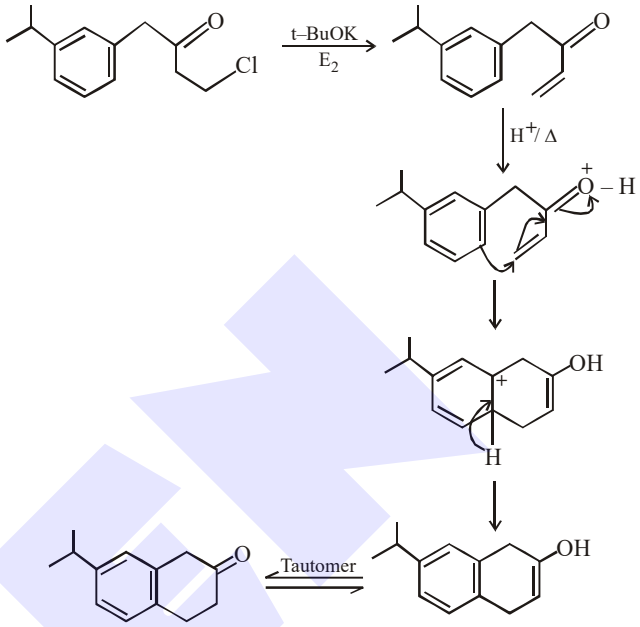
Sol.



Fridel-craft acylation. –Cl group is an ortho & para directing

11. Ans. (4)

Sol.



12. Ans. (3)

Sol. In Friedal crafts alkylation product obtained is more activated and hence polysubtitution will take place.

13. Ans. (1)

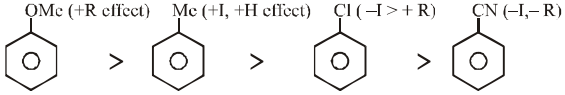
Sol.  is insoluble in dil. HCl but soluble in NaOH to form 

 decolorise Br_2 water to give 

(2,4,6- tribromophenol)

14. Ans. (3)

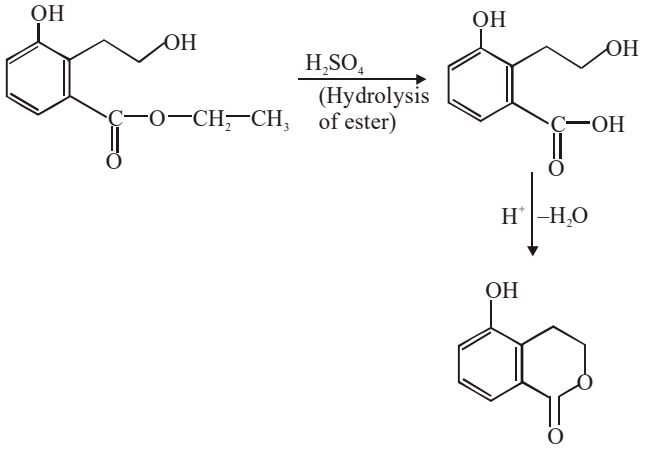
Sol.



(More is the e⁻ density at ring faster is the reaction towards EAS)

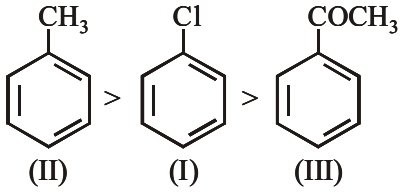
15. Ans. (3)

Sol.



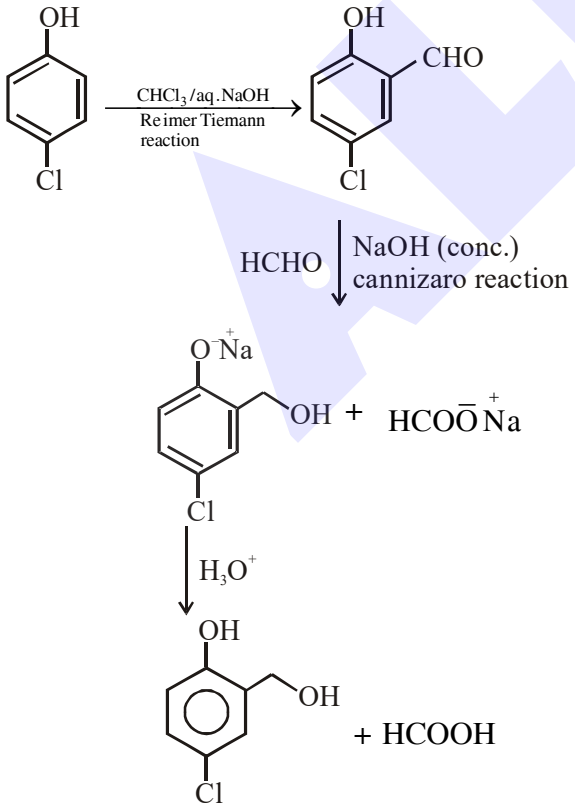
16. Ans. (3)

Sol. Rate of aromatic electophilic substitution is



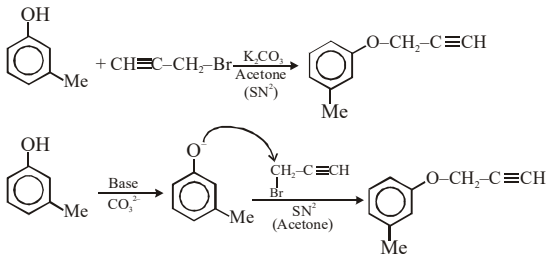
17. Ans. (3)

Sol.



18. Ans. (4)

Sol.



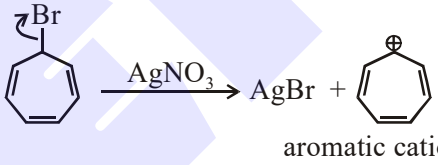
ALKAYLE HALIDE

1. Ans. (4)

2. Ans.(3)

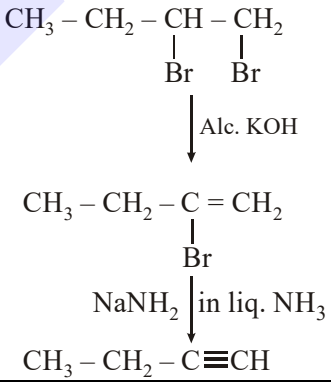
Example of E_2 elimination and conjugated diene is formed with phenyl ring in conjugation which makes it very stable.

3. Ans. (4)



as it can produce aromatic cation so will produce precipitate with $AgNO_3$.

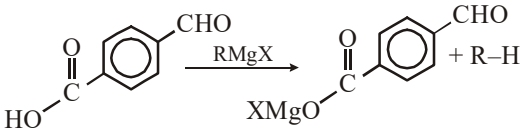
4. Ans. (1)

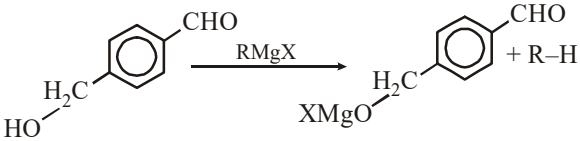


GRIGNARD REAGENT

1. Ans. (2)

Acid-base reaction of G.R are fast.





2. Ans. (1)

(1) $H-\overset{\overset{O}{\|}}{C}-H + Ph-\underset{\underset{CH_3}{|}}{CH}-CH_2MgX \rightarrow Ph-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-OH$

POC

1. Ans. (2)

→ 2,4 – DNP test is given by aldehyde on ketone

→ Iodoform test is given by compound having $CH_3-\overset{\overset{O}{\|}}{C}-$ group.

2. Ans.(1)

3. Ans. (1)

(P) Tyrosine

Tyr OH–C$_6$H$_4$–CH$_2$–CH(NH$_2$)–C(=O)–OH

(Q) Aspartic

ASP H–O–C(=O)–CH$_2$–CH(NH$_2$)–C(=O)–OH Acid

(R) Serine Ser HO–CH$_2$–CH(NH$_2$)–COOH

(S) Lysine

$NH_2-CH_2-CH_2-CH_2-CH_2-CH(NH_2)-COOH$

(A) Ester test (Q) Aspartic acid (Acidic amino acid)

(B) Carbylamine (S) Lysine [NH_2 group present]

(C) Phthalein dye (P) Tyrosine {Phenolic group present)

4. Ans. (1)

Sol. Hinsberg Reagenl ⇒ C$_6$H$_5$–SO$_2$–Cl

[Benzene Sulphonyl chloride]

NOMENCLATURE

1. Ans.(2)

2. Ans. (3)

Sol. $CH_3-\underset{5}{CH_3}-\underset{4}{CH}(CH_3)-\overset{3}{CH}(OH)-\overset{2}{CH_2}-\overset{1}{COOH}$

3-Hydroxy-4-methylpentanoic acid

–COOH principal functional group

3. Ans. (4)

Sol. 2-chloro–1-methyl–4–nitrobenzene

4. Ans. (4)

Sol.

3,5-Dimethyl-4-propylhept-1-en-6-yne

Longest carbon chain, including multiple bonds, and numbering starts from double bond.

POLYMER

1. Ans. (4)

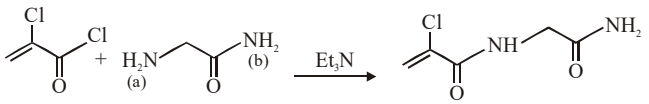
Nylon-6,6 is polymer of

Hexamethylene diamine & Adipic acid

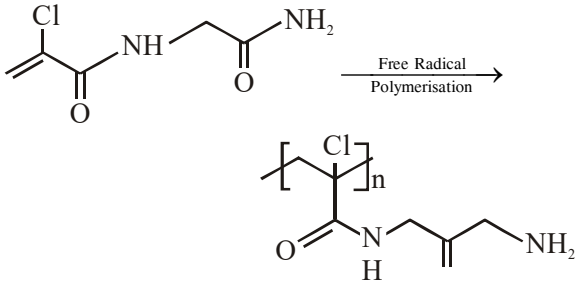
↓ ↓

$H_2N-(CH_2)_6-NH_2$ $HOOC-(CH_2)_4-COOH$

2. Ans. (4)

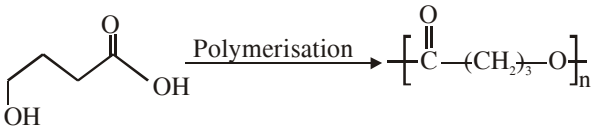


NH_2(a) will wact as nucleophile as (b) is having delocalised lonepair.

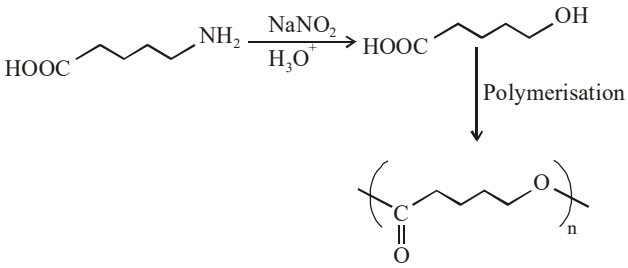


3. Ans.(2)

4. Ans. (1)



5. Ans. (2)

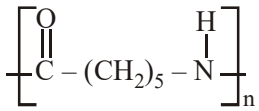


6. Ans. (4)

PHBV is a polymer of 3-hydroxybutanoic acid and 3-Hydroxy pentanoic acid.

7. Ans. (3)

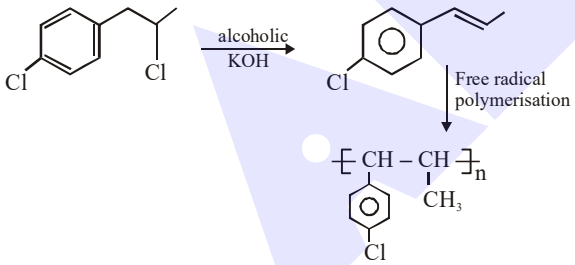
Sol.



Nylon-6

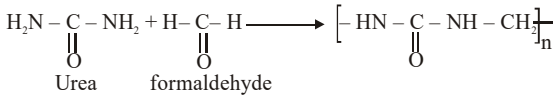
8. Ans. (1)

Sol.



9. Ans. (1)

Sol.



10. Ans. (2)

Sol. Nylon-6,6 is a condensation polymer of hexamethylene diamine and adipic acid.

Buna-S, Teflon and Neoprene are addition polymer.

11. Ans. (4)

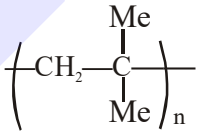
Sol.

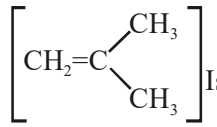
(a)	High density polythene	(III)	Ziegler-Natta Catalyst
(b)	Polyacrylonitrile	(I)	Peroxide catalyst
(c)	Novolac	(IV)	Acid or base catalyst
(d)	Nylon 6	(II)	Condensation at high temperature & pressure

12. Ans. (3)

Sol. Bakelite is thermoselting polymer

13. Ans. (4)

Sol. (X) $\xrightarrow{\text{Poly.}}$  Polyisobutylene

As per the given structure of the polymer the monomer is –  Isobutylene

CHEMISTRY IN EVERYDAY LIFE

1. Ans. (2)

(A) Norethindrone – Antifertility

(B) Ofloaxacin – Anti-Biotic

(C) Equanil – Hypertension (traiquilizer)

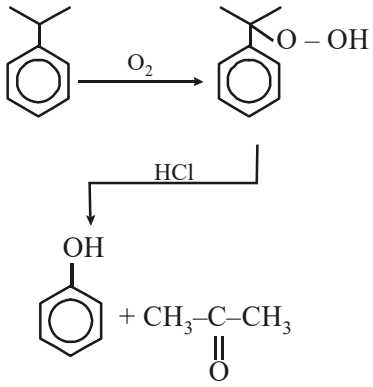
2. Ans. (1)

Sol. Nor adrenaline is a neutro transmitter and it belongs to catecholamine family that fanctions in brain & body as a hermone & neutro transmitter.

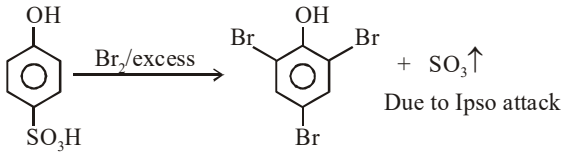
PHENOL

1. Ans. (3)

Cummene hydroperoxide reaction



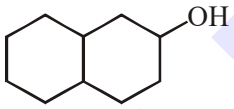
2. Ans. (1)



Due to Ipso attack

AMINE

1. (Bonus)

Answer should be 

2. Ans. (3)

Hoff mann's Bromaide degradation

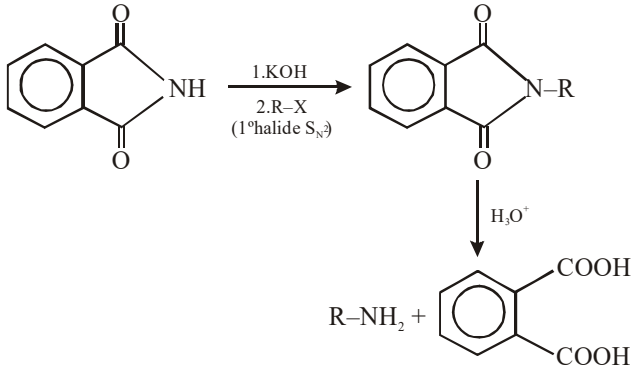
Carbylamine Reaction

Thus [X] must be aride with oen carbon more than is amine.

Thus [X] is $CH_3CH_2CH_2CONH_2$

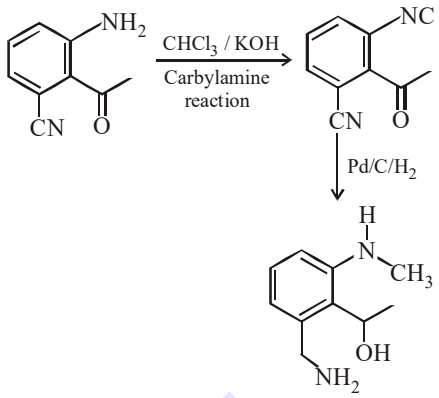
3. Ans. (2)

Sol. Gabriel phthalimide synthesis :



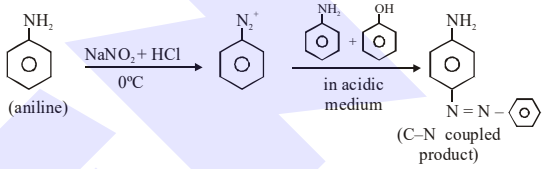
4. Ans. (1)

Sol.



5. Ans. (1)

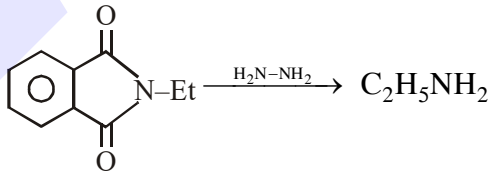
Sol.



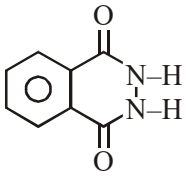
Aniline undergoes diazo coupling in acidic medium with $Ph\overset{+}{N}_2$

6. Ans. (4)

Sol.

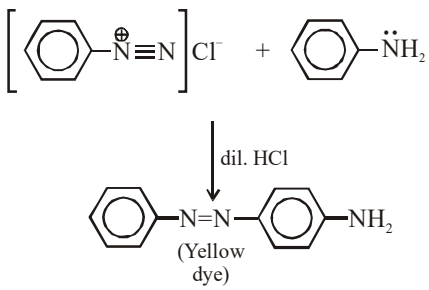


reagent is $NH_2–NH_2$ byproduct will be



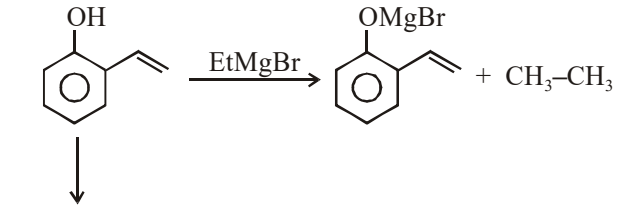
7. Ans. (3)

Sol.



ORGANO METALIC

1. Ans.(4)

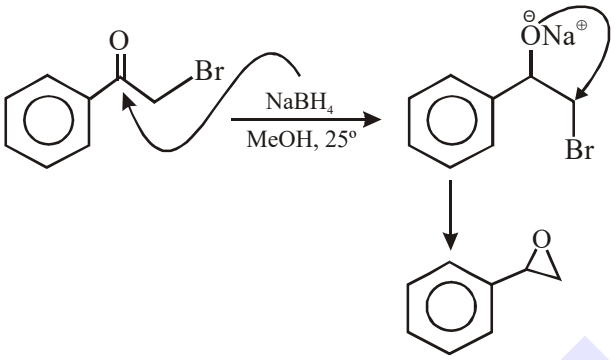


declolourizes Bromin water

REDUCTION

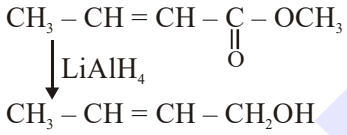
1. Ans. (4)

Sol.



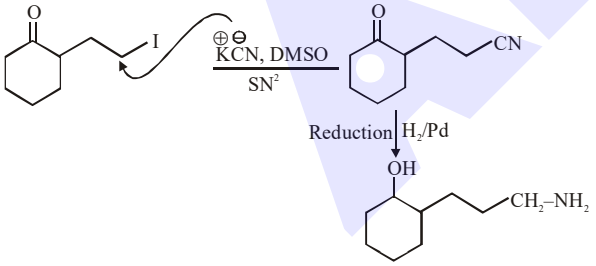
2. Ans. (2)

Sol.



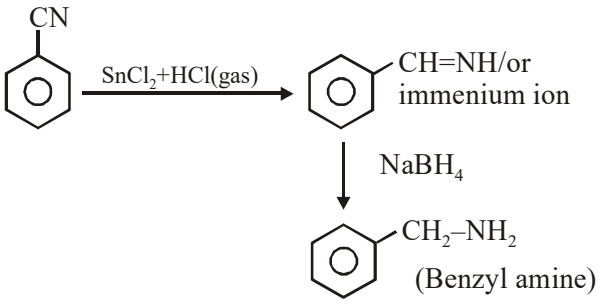
3. Ans. (2)

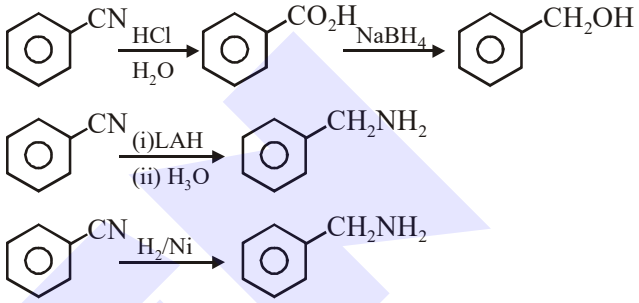
Sol.



4. Ans. (1)

Sol.

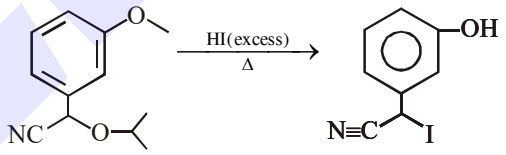




ALCOHOL & ETHER

1. Ans. (1)

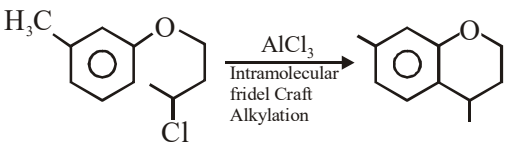
Sol.



Phenolic –OH does not react with HI and benzylic –O– having –CN attached will react with HI by S_N2 mechanism.

2. Ans. (4)

Sol.



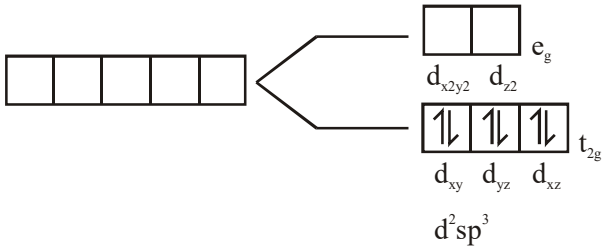
JANUARY+APRIL 2019 ATTEMPT (IOC)

COORDINATION COMPOUND

1. Ans. (4)

$K_3[Co(CN)_6]$

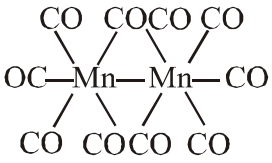
$Co^{+3} \rightarrow [Ar]_{18}\ 3d^6$



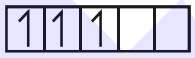
d^2sp^3

2. Ans. (2)

Compounds having at least one bond between carbon and metal are known as organometallic compounds.



3. Ans. (2) V^{2+} and Co^{2+}

$V^{2+} \rightarrow [V(H_2O)_6]Cl_2$; $[Ar]_{18}$ 

$3d^3$

3 unpaired e^-, spin only magnetic moment

= 3.89 B.M.

$Co^{2+} \rightarrow [Co(H_2O)_6]Cl_2$;

$[Ar]_{18}$ 

$3d^7$

3 unpaired e^-, spin only magnetic moment

= 3.89 B.M.

4. Ans. (2)

μ = 5.9 BM $\therefore$ n (no of unpaired.e^-) = 5

Cation Mn^{II} – $3d^5$ confn only possible for relatively weak ligand.

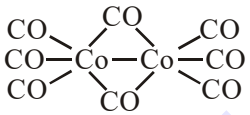
$\therefore$ NCS^-

5. Ans. (2)

$C_2O_4^{2-}$ (oxalato) : bidentate

H_2O (aqua) : Monodentate

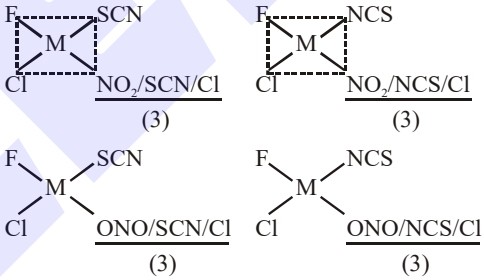
6. Ans. (4)



Bridging CO are 2 and Co – Co bond is 1.

7. Ans. (1)

The total number of isomers for a square planar complex $[M(F)(Cl)(SCN)(NO_2)]$ is 12.



8. Ans. (1)

Wilkinsion catalyst is $[(ph_3P)_3RhCl]$

9. Ans. (2)

Δ_0 order will be compared by spectro chemical series not by energies of violet & yellow light

so Δ_0 order is $[Cr(H_2O)_6]Cl_3 < [Cr(NH_3)_6]Cl_3$

10. Ans. (1)

$\mu = \sqrt{n(n+2)}$ B.M.

n = Number of unpaired electrons

n = Maximum number of unpaired electron = 5

Ex : Mn^{2+} complex.

11. Ans. (1)

As complex $K_3[Co(CN)_6]$ have CN^- ligand which is strongfield ligand amongst the given ligands in other complexes.

12. Ans. (2)

13. Ans. (1)

14. Ans.(1)

(1) EDTA (ethylene diamine tetra acetate) is used for lead poisoning

(2) Cis platin is used as a anti cancer drug

(3) D-penicillamine is used for copper poisoning

(4) desferrioxime B is used for iron poisoning

15. Ans.(3)

en and $C_2O_4^{2-}$ are bidentate ligand. So coordination number of $[Co(Cl)(en)_2]Cl$ is 5 and $K_3[Al(C_2O_4)_3]$ is 6.

16. Ans.(1)

$[Fe(H_2O)_6]Cl_2$, $Fe^{2+} \rightarrow 3d^6 \rightarrow (t_{2g})^4(e_g)^2$

C.F.S.E. $= 4 \times(-0.4\Delta_o) + 2 \times 0.6\Delta_o = -0.4\Delta_o$

$K_2[NiCl_4]$, $Ni^{2+} \rightarrow 3d^8 \rightarrow (e)^4(t_2)^4$

C.F.S.E. $= 4\times(-0.6\Delta_t) + 4 \times (0.4\Delta_t) = -0.8\Delta_t$

17. Ans.(3)

(1) $[Fe(H_2O)_6]^{2+}$, $Fe^{2+} \rightarrow 3d^6 \rightarrow$ 4 unpaired electron

$[Cr(H_2O)_6]^{2+}$, $Cr^{2+} \rightarrow 3d^4 \rightarrow$ 4 unpaired electron

(2) $[Ni(NH_3)_4(H_2O)_2]^{2+} = Ni^{2+} \rightarrow 3d^8$

$\rightarrow$ 2 unpaired electron

μ_m = 2.83 B.M

(3) In gemstone, ruby has Cr^{3+} ion occupying the octahedral sites of aluminium oxide (Al_2O_3) normally occupied by Al^{3+} ion.

(4) Complimenry color of violet is yellow

18. Ans.(1)

Towards common transition element and inner transition metal ion given ligand can have maximum denticities of 6 and 8 respectively.

19. Ans.(2)

cis–$[PtCl_2(NH_3)_2]$ is used in chemotherapy to inhibits the growth of tumors.

20. Ans.(3)

Donating atoms are both nitrogen & oxygen.

Correct option : (3)

21. Ans.(1)

According to question all the complexes are **low spin.**

Complex	Configuration	No. of unpaired electrons
$[V(CN)_6]^{4-}$	$t_{2g}^3e_g^0$	3
$[Cr(NH_3)_6]^{2+}$	$t_{2g}^4e_g^0$	2
$[Ru(NH_3)_6]^{3+}$	$t_{2g}^5e_g^0$	1
$[Fe(CN)_6]^{4-}$	$t_{2g}^6e_g^0$	0

Correct option : (1)

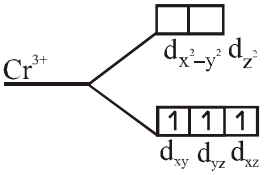
22. Ans.(Bonus)

Complex is $[Fe(H_2O)_6]_2[Fe(CN)_6]$

Complex ion	Configuration	No. of unpaired electrons	Magnetic moment
$[Fe(H_2O)_6]^{2+}$	$t_{2g}^4e_g^2$	4	4.9 BM
$[Fe(CN)_6]^{4-}$	$t_{2g}^6e_g^0$	0	0

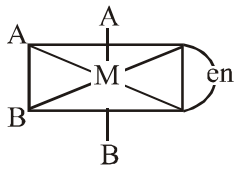
23. Ans.(3)

Degenerate orbitals of $[Cr(H_2O)_6]^{3+}$



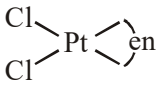
Hence according to the options given, degenerate orbitals are d_{xz} & d_{yz}

24. Ans.(3)

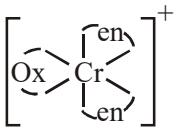


This structure does not contain plane of symmetry hence it is optically active, rest of all options has plane of symmetry and they are optically inactive.

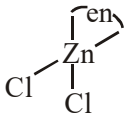
25. Ans.(4)

(1) 

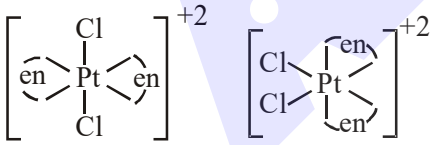
no trans isomer possible because bidentate ligand will be co-ordinating only at 90° angle in square planar complex

(2) 

no trans isomer possible

(3) 

sp^3 hybridized so no trans possible

(4) 

trans and cis both are possible

26. Ans.(2)

A complex having strong field ligand has tendency to absorb light of highest energy.

Among the three complexes.

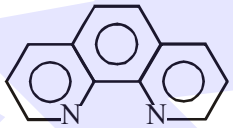
$[Co(NH_3)_6]^{+3}$ will absorb radiation of highest energy and least wavelength.

$[Co(NH_3)_5H_2O]^{+3}$ has field weaker than the above compound and therefore absorb radiation of lesser energy and more wavelength.

$[CoCl(NH_3)_5]^{+2}$ has the weakest field and therefore will absorb light of least energy and highest wavelength.

Strength of ligand $NH_3 > H_2O > Cl$.

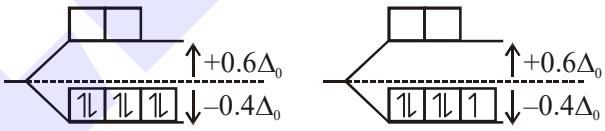
27. Ans.(1)

Phen = 

is a strong field symmetrical bidentate ligand.

(1) $[Fe(phen)_3]^{2+} \xrightarrow{-e^-} [Fe(phen)_3]^{3+}$

$Fe^{2+} : 3d^6$ $Fe^{3+} : 3d^5$



C.F.S.E = $-2.4\,\Delta_0$ C.F.S.E = $-2.0\Delta_0$

By oxidation of Fe^{2+} into Fe^{3+}, the CFSE value decrease.

(2) $[Zn(phen)_3]^{2+} \xrightarrow{-e^-} [Zn(phen)_3]^{3+}$

$Zn^{2+} : 3d^{10}$ $Zn^{3+} : 3d^9$

C.F.S.E = 0 C.F.S.E = $-0.6\Delta_0$

By oxidation of Zn^{2+} into Zn^{3+}, the CFSE value increase.

(3) $[Ni(phen)_3]^{2+} \xrightarrow{-e^-} [Ni(phen)_3]^{3+}$

$Ni^{2+} : 3d^8$ $Ni^{3+} : 3d^7$

C.F.S.E = $-1.2\,\Delta_0$ C.F.S.E = $-1.8\Delta_0$

by oxidation of Ni^{2+} into Ni^{3+}, the CFSE value increase.

(4) $[Co(phen)_3]^{2+} \xrightarrow{-e^-} [Co(phen)_3]^{3+}$

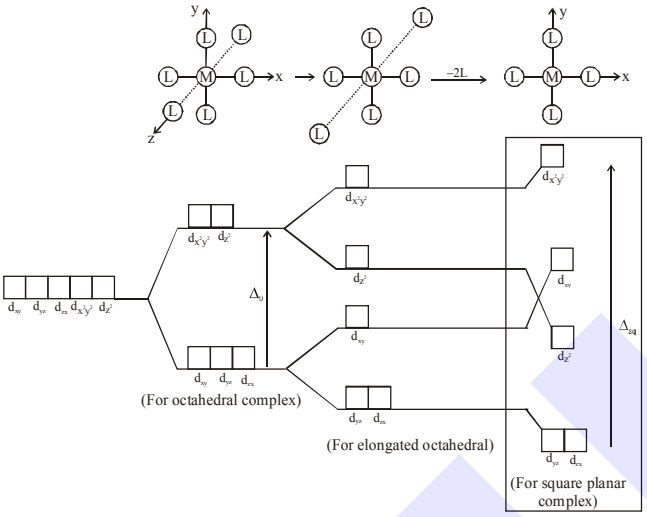
Co^{2+} : $3d^7$ Co^{3+} : $3d^6$

$\boxed{C.F.S.E = -1.8\Delta_0}$ $\boxed{C.F.S.E = -2.4\Delta_0}$

by oxidation of Co^{2+} into Co^{3+}, the CFSE value increase.

28. Ans.(1)

If both ligands present along z-axis removed from octachedral field and converted into square planar field, then



CHEMICAL BONDING

1. Ans. (4)

Carbon atom have 2p orbitals able to form strongest pπ - pπ bonds

2. Ans. (4)

Catenation is not shown by lead.

3. Ans. (4)

CCl_4 cannot get hydrolyzed due to the absence of vacant orbital at carbon atom.

4. Ans. (3)

Due to inert pair effect as we move down the group in 13th group lower oxidation state becomes more stable.

Al < Ga < In < Tℓ

5. Ans. (3)

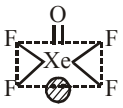
(1) B_2H_6 : Electron deficient

(2) AlH_3 : Electron deficient

(3) SiH_4 : Electron precise

(4) GaH_3 : Electron deficient

6. Ans. (3)



$sp^3d^2 \Rightarrow$ [5σ-bond +1 l.p.]

7. Ans. (1)

$N_2^{\oplus} \Rightarrow BO = 2.5 \Rightarrow \left[\pi - Bond = 2 \,\&\, \sigma - Bond = \frac{1}{2}\right]$

$N_2 \Rightarrow$ B.O. = 3.0 $\Rightarrow$ [π-Bond = 2 & σ-Bond = 1]

$O_2^{\oplus}$ = B.O. $\Rightarrow$ 2.5 $\Rightarrow$ [π-Bond = 1.5 & σ-Bond = 1]

$O_2 \Rightarrow$ B.O. $\Rightarrow$ 2 $\Rightarrow$ [π-Bond $\Rightarrow$ 1 & σ-Bond = 1]

8. Ans. (1)

9. Ans. (4)

Both Li_2^+ and Li_2^- has 0.5 bond order and hence both are stable.

10. Ans.(1)

In C_{60} molecule there are 20 hexagons and 12 pentagons

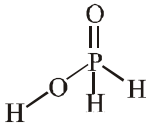
$\therefore$ Ans.(1)

11. Ans. (4)

Inert pair effect is promenent character of p-block element.

12. Ans. (3)

H_3PO_2 is good reducing agent due to presence of two P–H bonds.



13. Ans. (2)

Process	Change in magnetic nature	Bond Order Change
$N_2 \rightarrow N_2^+$	Dia $\rightarrow$ para	$3 \rightarrow 2.5$
$NO \rightarrow NO^+$	Para $\rightarrow$ Dia	$2.5 \rightarrow 3$
$O_2 \rightarrow O_2^{-2}$	Para $\rightarrow$ Dia	$2 \rightarrow 1$
$O_2 \rightarrow O_2^+$	Para $\rightarrow$ Para	$2 \rightarrow 2.5$

14. Ans. (4)

15. Ans.(3)

In diamond C–C bond have only σ bond character while in case of graphite and fullerene (C_{60} and C_{70}) C–C bond contain double bond character. That's why diamond having maximum C–C bond length.

16. Ans.(2)

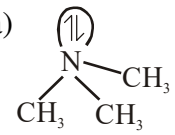
Thermal stability of Alkaline earth metals carbonates increases down the group.

because down the group polarizing power of cation decreases. So thermal stability increases.

Hence, Thermal stability order :

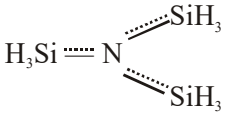
$$MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$$

17. Ans.(4)

(a) 

nitrogen is sp^3 hybrid and pyramidal

no back-bonding i.e.more basic

(b) 

Nitrogen sp^2 hybrid and planar due to back bonding and less basic because lone pair is not available for donation.

18. Ans.(3)

Fledespar - $KAlSi_3O_8 - NaAlSi_3O_8$ - $CaAl_2Si_2O_8$

Zeolites - $NaAlSi_2O_6.H_2O$

mica - $KAl_3Si_3O_{10}(OH)_2$

asbestos - $Mg_3Si_2O_5(OH)_4$

These all are silicates having basic unit $(SiO_4)^{4-}$

19. Ans.(3)

Total No. of pentagons in C_{60} = 12

Total no. of trigons (triangles) in white phosphorus (P_4) = 4

20. Ans.(3)

Chemical species	Hybridisation of central atom
ICl_2^-	sp^3d
IF_6^-	sp^3d^3
ICl_4^-	sp^3d^2
BrF_2^-	sp^3d

21. Ans.(3)

All halides of Be are predominantly covalent in nature.

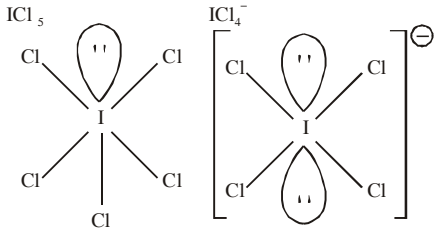
22. Ans.(1)

Chemical Species	Bond Order	Magnetic behaviour
C_2^{2-}	3	diamagnetic
N_2^{2-}	2	paramagnetic
O_2	2	paramagnetic
O_2^{2-}	1	diamagnetic

$$\text{B.O.} \propto \frac{1}{\text{bond length}}$$

23. Ans.(3)

Chemical species	Hybridisation	Shape
ICl_5	sp^3d^2	Square pyramidal
ICl_4^-	sp^3d^2	Square planar



24. Ans.(4)

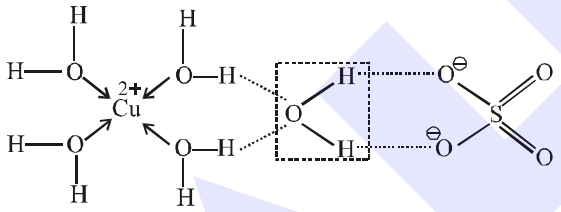
Correct order of oxidation state of nitrogen in oxides of nitrogen is following

$$\overset{+1}{N_2}O < \overset{+2}{N}O < \overset{+3}{N_2}O_3 < \overset{+4}{N}O_2$$

25. Ans.(2)

In case of only C_2, incoming electron will enter in the bonding molecular orbital which increases the bond order and stability too. Whereas rest of all takes electron in their antibonding molecular orbital which decreases bond order and stability.

26. Ans.(3)



One water molecule as shown in the diagram, is not coordinated to copper ion directly.

27. Ans.(4)

O_2,NO,B_2 are paramagnetic according to M.O.T. where as CO is diamagnetic.

28. Ans.(1)

$BeCl_2$ exist as $(BeCl_2)_n$ polymeric chain in solid form, while $BeCl_2$ exist as dimer $(BeCl_2)_2$ in vapour phase.

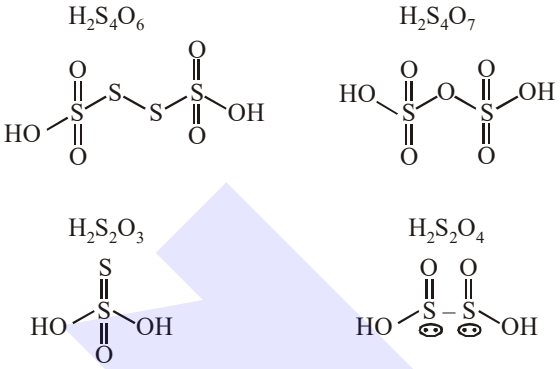
29. Ans.(3)

HF has highest boiling point among hydrogen halides because it has strongest hydrogen bonding

30. Ans.(3)

Based on NCERT, statement of limitations of VBT, I & III are correct

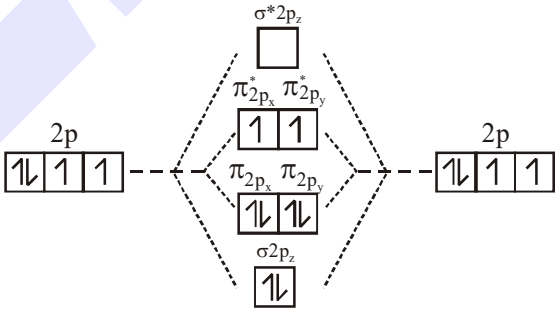
31. Ans.(2)

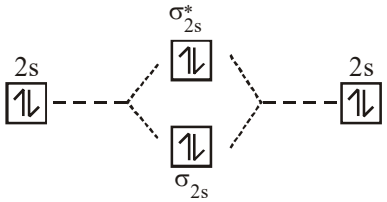


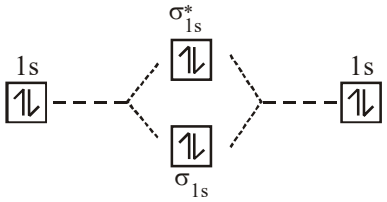
$H_2S_2O_7$ does not contain bond between sulphur atoms.

32. Ans.(3)

Molecular orbital diagram of O_2 is







An incoming electron will go in $\pi^*_{2p_x}$ orbital.

S-BLOCK

1. Ans. (1)

$Rb + O_{2(excess)} \longrightarrow RbO_2$

$2RbO_2 + 2H_2O \longrightarrow 2RbOH + H_2O_2 + O_2$

2. Ans. (2)

$Na_2CO_3.10H_2O \rightarrow$ Solvay process

$Mg(HCO_3)_2 \rightarrow$ Temporary hardness

$NaOH \rightarrow$ Castner-kellner cell

$Ca_3Al_2O_6 \rightarrow$ Portland cement

3. Ans. (4)

"Be" Metal is used in x-ray window is due to transparent to x-rays.

4. Ans. (4)

Smaller in size of center atoms more water molecules will crystallize hence $Ba(NO_3)_2$ is answer due to its largest size of '+ve' ion.

5. Ans. (3)

Only Li react directly with N_2 out of alkali metals

$6Li + N_2 \rightarrow 2Li_3N$

6. Ans. (4)

7. Ans.(3)

$$Mg + \underset{O_2/N_2}{air} \xrightarrow{\Delta} MgO + Mg_3N_2$$

8. Ans.(1)

$$\underset{\text{washing soda}}{\underset{(X)}{Na_2CO_3.10H_2O(s)}} \xrightarrow{\Delta} \underset{(Y)}{Na_2CO_3.H_2O} \xrightarrow{\Delta,\ T > 373k} \underset{\text{(soda ash)}}{\underset{(Z)}{Na_2CO_3}}$$

9. Ans.(3)

Temporary hardness is due to soluble

$Mg(HCO_3)_2$ and $Ca(HCO_3)_2$

$$Mg(HCO_3)_2 \xrightarrow{Boil} Mg(OH)_2 \downarrow + 2CO_2 \uparrow$$

$$Ca(HCO_3)_2 \xrightarrow{Boil} CaCO_3 \downarrow + H_2O + CO_2 \uparrow$$

10. Ans.(4)

$$(4)\ 2LiNO_3 \xrightarrow{\Delta} Li_2O + 2NO_2(g) + \frac{1}{2}O_2(g)$$

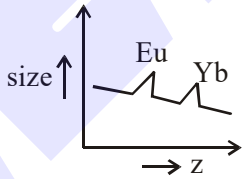
PERIODIC TABLE

1. Ans. (3)

Z = 120

Its general electronic configuration may be represented as [Nobal gas] ns^2 , like other alkaline earth metals.

2. Ans. (3)

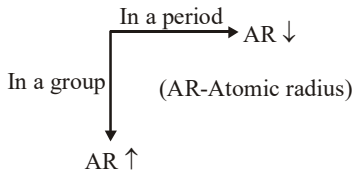


Eu > Ce > Ho > N.

3. Ans. (2)

$Be(OH)_2$ is amphoteric in nature while rest all alkaline earth metal hydroxide are basic in nature.

4. Ans. (4)



Atomic radii order : C < S < Al < Cs

Atomic radius of C : 170 pm

Atomic radius of S : 180 pm

Atomic radius of Al : 184 pm

Atomic radius of Cs : 300 pm

5. Ans. (1)

B C

Al Si

$\boxed{Ga < Ge}$

Along the period electronegativity increases

6. Ans. (1)

Due to Lanthanoid contraction both atomic radii and ionic radii decreases gradually in the lanthanoid series.

7. Ans. (4)

E.N. of Al = (1.5) $\cong$ Be (1.5)

8. Ans. (2)

Electronegativity decreases as we go down the group and atomic radius increases as we go down the group.

9. Ans. (3)

Second electron gain enthalpy is always positive for every element.

$O^{-}_{(g)} + e^{-} \rightarrow O^{-2}_{(g)}$; ΔH = positive

10. Ans.(3)

Mo and W has nearly similar atomic radius due to lanthanoid contraction.

11. Ans.(1)

In case of 'Be' electron remove from '2s' orbital while in case of 'B' electron remove from '2p' orbital. '2s' orbital have greater penetration effect then '2p' orbitals. So 'Be' having more I.E. then 'B'

12. Ans.(3)

Atomic number (Z) = 15 $\Rightarrow$ P $\rightarrow$ [Ne] $3s^2\ 3p^3$

Phosphorus belongs to 15^{th} group

number of valence electrons = 5

and valency = 3 in ground state.

13. Ans.(4)

The highest oxidation state of U and Pu is 6+ and 7+ respectively

14. Ans.(Bonus)

In question noble gas asked, which does not exist in the atmosphere and answer is given Ra.

Ra is a alkaline earth metal not noble gas it should be Rn. It is printing error in JEE Main paper

15. Ans.(2)

Ti $\rightarrow$ |Ar| $3d^2\ 4s^2$

Mn $\rightarrow$ |Ar| $3d^5\ 4s^2$

Ni $\rightarrow$ |Ar| $3d^8\ 4s^2$

Zn $\rightarrow$ |Ar| $3d^{10}\ 4s^2$

Correct order of I.P. is

[Ti < Mn < Ni < Zn]

16. Ans.(1)

Hydration enthalpy depends upon ionic potential (charge / size). As ionic potential increases hydration enthalpy increases.

Correct option : (1)

17. Ans.(4)

Symbol	Atomic number
unh	106
uun	110
une	109
uue	119

18. Ans.(2)

For isoelectronic species the size is compared by nuclear charge.

Correct option: (2)

19. Ans.(2)

K = 2, 8, 8 ,1

After removal of one electron, second electron we have to remove from another shell, hence there is large difference between first and second ionization energies.

METALLURGY

1. Ans. (2) Carbon

In the Hall-Heroult process the cathode is made of carbon.

2. Ans. (1)

ZnO & MgO both are in oxide form therefore no change on calcination.

3. Ans. (3)

Siderite : $FeCO_3$

Kaolinite : $Al_2(OH)_4Si_2O_5$

Malachite : $Cu(OH)_2.CuCO_3$

Calamine : $ZnCO_3$

4. Ans. (4)

Copper pyrites : $CuFeS_2$

Malachite : $Cu(OH)_2 . CuCO_3$

Azurite $Cu(OH)_2 . 2CuCO_3$

Dolomite $CaCO_3 . MgCO_3$

5. Ans. (4)

According to the given diagram Al can reduce ZnO.

$3ZnO+2Al \rightarrow 3Zn+Al_2O_3$

6. Ans. (4)

Calcination in carried out for carbonates and oxide ores in absence of oxygen. Roasting is carried out mainly for sulphide ores in presence of excess of oxygen.

7. Ans. (4)

In Hall-Heroult's process is given by

$2Al_2O_3 + 3C \longrightarrow 4Al + 3CO_2$

$2Al_2O_3(\ell) \rightleftharpoons 4Al^{3+}(\ell) + 6O^{2\ominus}(\ell)$

At cathode :- $4Al^{3+}_{(\ell)} + 12e^{\ominus} \rightarrow 4Al(\ell)$

At Anode : $6O^{2\ominus}_{(\ell)} \rightarrow 3O_2(g) + 12e^{\ominus}$

$3C + 3O_2 \rightarrow 3CO_2 (\uparrow)$

8. Ans.(3)

The idea of froth floatation method came from washerwoman and this process is related to concentration of sulphide ores.

9. Ans.(1)

(1) During leaching when bauxite is treated with concentrated NaOH, then sodium aluminate and sodium silicate is formed in the soluble form, whereas Fe_2O_3 is precipitated

(2) The blistered appearance of copper during the metallurgical process is due to the evolution of SO_2.

(3) Cast iron is obtained from pig iron.

(4) Hall-Heroult process is used for production of only aluminium.

10. Ans.(2)

(1) Zincite is ZnO

(2) Aniline is the forth stablizer.

(3) Zone refining process is not used for refining of 'Ti'

(4) Sodium cyanide is used in the metallurgy of silver

11. Ans.(4)

Ellingham diagram helps in predicting the feasibiltiy of thermal reduction of ores.

Correct option : (4)

12. Ans.(2)

Mond's process is used for the purification of Nickel.

13. Ans.(4)

$Na_3AlF_6 \rightarrow$ Cryolite is the fluoride ore.

Magnetite Fe_3O_4

Sphalerite ZnS

Malachite $Cu(OH)_2.CuCO_3$

14. Ans.(1)

1. Bauxite–$AlO_x(OH)_{3-2x}$ where $0 < x < 1$

2. Siderite – $FeCO_3$

3. Calamine – $ZnCO_3$

4. Malachite – $CuCO_3.Cu(OH)_2$

15. Ans.(3)

Assertion is correct as Haemetite ore is used for extraction of Fe.

Haemetite is an oxide ore so reason is incorrect

16. Ans.(4)

Liquation is used for Sn.

Zone refining is used for Ga.

Mond's process is used for Ni.

Van arkel process is used for Zr.

17. Ans.(3)

Mg – Al alloy is used for construction of aircrafts.

QUANTUM NUMBER

1. Ans. (3)

Total number of isotopes of hydrogen is 3

$\Rightarrow {}_1^1H$, ${}_1^2H$ or ${}_1^2D$, ${}_1^3H$ or ${}_1^3T$

and only ${}_1^3H$ or ${}_1^3T$ is an Radioactive element.

2. Ans. (4)

Isotopes of hydrogen is :

Proteium Deuterium Tritium

3. Ans. (1)

4. Ans.(2)

According to $(n+\ell)$ rule : $3p < 3d < 4p < 4d$

Correct option : (2)

5. Ans.(4)

$N^{-3} \rightarrow 1s^2\ 2s^2\ 2p^6$

$Li^+ \rightarrow 1s^2$

$Mg^{+2} \rightarrow 1s^2\ 2s^2\ 2p^6$

$O^{-2} \rightarrow 1s^2\ 2s^2\ 2p^6$

$F^- \rightarrow 1s^2\ 2s^2\ 2p^6$

$Na^+ \rightarrow 1s^2\ 2s^2\ 2p^6$

N^{-3}, O^{-2}, F^- and Na^+ are isoelectronic

P-BLOCK

1. Ans. (1)

2. Ans. (3)

Then is no catalyst is required for combustion of coal.

3. Ans.(3)

$B_2H_6 + 3H_2O \longrightarrow 2H_3BO_3 + 3H_2$

$B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O$

Correct option : (3)

4. Ans. (1)

Quartz (Information)

5. Ans.(2)

Kieselguhr is amorphous form of silica, it's a fact

6. Ans.(1)

All statements are correct

$B_2O_3 \rightarrow$ acidic

Al_2O_3 & Ga_2O_3 are amphoteric

oxides of In & Tl are basic

7. Ans.(1)

As we move down the group, bond strength decreases, thereby decreasing the catenation tendency.

Hence the order is as expected

$C > Si > Ge \approx Sn$

8. Ans.(3)

water gas = $CO + H_2$

is also called syn gas because it is used for synthesis of methanol.

D-BLOCK

1. Ans. (3)

Usally Sc(Scandium) does not show variable oxidation states.

Most common oxidation states of :

(i) Sc : +3

(ii) V : +2, +3, +4, +5

(iii) Ti : +2, +3, +4

(iv) Cu : +1, +2

2. Ans. (3)

$MnO_2(A) \xrightarrow{4KOH, O_2} 2K_2MnO_4(B) + 2H_2O$

(Green)

$3K_2MnO_4(B) \xrightarrow{4HCl} 2KMnO_4(C) + 2H_2O$

(Purple)

$2KMnO_4(C) \xrightarrow{H_2O, KI} 2MnO_2(A) + 2KOH + KIO_3(D)$

$A \rightarrow MnO_2$

$D \rightarrow KIO_3$

3. Ans. (2)

Since Zn is not a transition element so transition element having lowest atomisation energy out of Cu, V, Fe is Cu.

4. Ans.(2)

V_2O_5 is catalyst $\rightarrow$ contact process for H_2SO_4

$TiCl_4/Al(Me)_3 \rightarrow$ Ziegler Natta salt used as catalyst for polymerisation of ethene.

$PdCl_2 \rightarrow$ used as catalyst for ethanal (Wacker process).

Iron oxide $\rightarrow$ is used as catalyst in Haber's synthesis.

5. Ans.(1)

$Ti^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2$

unpaired electrons = 2.

spin only magnetic moment (μ) = $\sqrt{2(2+2)}$

$= \sqrt{8}$ B.M

$Ti^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^1$

unpaired electrons = 1

$\mu = \sqrt{1(1+2)} = \sqrt{3}$ B.M

$V^{+2} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^3$

$\mu = \sqrt{3(3+2)} = \sqrt{15}$ B.M

$Sc^{+3} = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

$\mu = 0$

HYDROGEN & IT'S COMPOUND

1. Ans. (3)

NaH is an example of ionic hydride which is also known as saline hydride.

2. Ans. (2)

Option (a), (b) & (c) are correct answer (NCERT THEORY BASED)

3. Ans. (1)

$Ca(HCO_3)_2$ is reponsible for temporary hardness of water

4. Ans. (2)

H_2O_2 act as oxidising agent and reducing agent in acidic medium as well as basic medium.

H_2O_2 Act as oxidant :-

$H_2O_2 + 2H^{\oplus} + 2e^{\ominus} \rightarrow 2H_2O$ (In acidic medium)

$H_2O + 2e^{\ominus} \rightarrow 2OH^{\ominus}$ (In basic medium)

H_2O_2 Act as reductant :-

$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^{\ominus}$ (In acidic medium)

$H_2O_2 + 2OH^{\ominus} \rightarrow 2H_2O + O_2 + 2e^{\ominus}$ (In basic medium)

5. Ans.(1)

$Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2 \uparrow$

ENVIRONMENTAL CHEMISTRY

1. Ans. (3)

Clean water would have BOD value of less than 5 ppm whereas highly polluted water could have a BOD value of 17 ppm or more.

2. Ans. (4)

Ozone protects most of the medium freequnecies ultravoilet light from 200 - 315 nm wave length.

3. Ans. (3)

Freons (CFC's) are not common components of photo chemical smog.

4. Ans. (4)

Taj mahal is slowely disfigured and

discoloured due to acid rain.

5. Ans. (1)

Due to acid rain in plants high concentration of SO_2 makes the flower buds stiff and makes them fall.

6. Ans. (2)

Photochemical smog produce chemicals such as formaldehyde, acrolein and peroxyacetyl nitrate (PAN).

7. Ans.(1)

The common component of photochemical smog are ozone,nitric oxide, acrolein, formaldehyde and peroxyacetyl nitrate (PAN).

8. Ans.(1)

Photochemical smog occurs in warm (sunlight) and has high concentration of oxidising agent therefore it is called photochemical smog/oxidising smog.

9. Ans.(1)

The upper stratosphere consists of ozone (O_3), which protect us from harmful ultraviolet (UV) radiations coming from sun.

Correct option : (1)

10. Ans.(3)

Correct option : (3)

11. Ans.(4)

Excessive release of CO_2 into the atmosphere results in **global warming**.

12. Ans.(3)

It's a fact, the layer of atmosphere between 10km to 50km above sea level is called as stratosphere.

13. Ans.(3)

Troposphere is the lowest region of atmosphere bounded by Earth beneath and the stratosphere above where most of the clouds form and where life form exists.

14. Ans.(4)

Nitrogen oxides and hydrocarbons (unburnt fuel) are primary pollutant that leads to photochemical smog.

SALT ANALYSIS

1. Ans. (2)

$3Cl_2 + 6\ OH^- \rightarrow 5Cl^- + ClO_3^- + 3H_2O$

2. Ans. (1)

$I_2 + 10HNO_3 \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$

In HIO_3 oxidation state of iodine is +5.

3. Ans.(4)

The phosphorus containing organic compound are detected by 'Lassaigne's test' by heated with an oxidizing agent (sodium peroxide)

The phosphorus present in the compound in oxidised to phosphate.

The solution is boiled with nitric acid and then treated with ammonium molybdate to produced canary yellow precipitate.

$Na_3PO_4 + 3HNO_3 \rightarrow H_3PO_4 + 3NaNO_3$

$H_3PO_4 + 12\ (NH_4)_2MoO_4 + 21HNO_3 \rightarrow$

(Ammonium molybdate)

$(NH_4)_3PO_4.12MoO_3\downarrow + 21\ NH_4NO_3 + 12\ H_2O$

(Ammonium phosphomolybdate)

(canary yellow precipitate)

4. Ans.(1)

$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-Cl + AgNO_3 \longrightarrow (CH_3)_3C^{\oplus} + \underset{\text{(white ppt)}}{AgCl_{(s)}\downarrow}$$

Reason :- Due to most stable carbocation formation tert-butyl chloride given the ppt immediately

F-BLOCK

1. Ans.(1)

Sm^{3+} $(4f^5)$ = yellow colour

Correct option : (1)

2. Ans.(4)

Np and Pu show maximum no. of oxidations states starting from +3 to +7 all oxidation states.