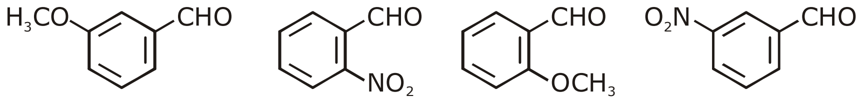
CHEMISTRY
JEE-MAIN (September-Attempt)
2 September (Shift-1) Paper

SECTION - A

1. The increasing order of the following compounds towards HCN addition is:

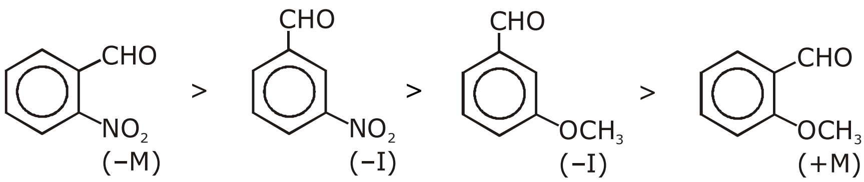


(i) (ii) (iii) (iv)

(1) (iii) < (i) < (iv) < (ii)
(2) (iii) < (iv) < (i) < (ii)
(3) (i) < (iii) < (iv) < (ii)
(4) (iii) < (iv) < (ii) < (i)

Sol. **1**

In HCN, CN^- is acts as nucleophile, attack first that –CHO group which has maximum positive charge. The magnitude of the (+ve) charge increases by –M and –I group. So reactivity order will be



So, option (1) is correct answer.

2. Which of the following is used for the preparation of colloids?

(1) Van Arkel Method
(2) Ostwald Process
(3) Mond Process
(4) Bredig's Arc Method

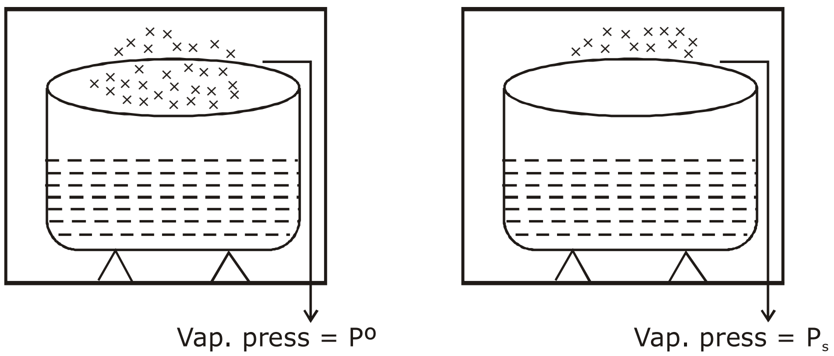
Sol. **4**

Bredig's Arc method
Chapter name surface chemistry

3. An open beaker of water in equilibrium with water vapour is in a sealed container. When a few grams of glucose are added to the beaker of water, the rate at which water molecules:

(1) leaves the vapour increases
(2) leaves the solution increases
(3) leaves the vapour decreases
(4) leaves the solution decreases

Sol. **1**



$H_2O(l) \rightleftharpoons H_2O(g)$ $\quad$ $H_2O(\ell) \rightleftharpoons H_2O(g)$

$K_p = P^o$ $\quad$ $K_P = P_s$

Backward shift
vapours ↓

Hence Rate at which water molecules leaves the vap. increases.

4. For octahedral Mn(II) and tetrahedral Ni(II) complexes, consider the following statements:

(I) both the complexes can be high spin.

(II) Ni(II) complex can very rarely be low spin.

(III) with strong field ligands, Mn(II) complexes can be low spin.

(IV) aqueous solution of Mn(II) ions is yellow in colour.

The correct statements are:

(1) (I), (III) and (IV) only
(2) (I), (II) and (III) only
(3) (II), (III) and (IV) only
(4) (I) and (II) only

Sol. 2

Mn^{2+} $[Ar]3d^5$ it can form low spin as well as high spin complex depending upon nature of ligand same of Ni^{2+} ion with coordination no 4. It can be dsp^2 or sp^3 i:e low spin or high spin depending open nature of ligand.

5. The statement that is not true about ozone is:

(1) in the stratosphere, it forms a protective shield against UV radiation.

(2) in the atmosphere, it is depleted by CFCs.

(3) in the stratosphere, CFCs release chlorine free radicals (Cl) which reacts with O_3 to give chlorine dioxide radicals.

(4) it is a toxic gas and its reaction with NO gives NO_2.

Sol. 3

$$\dot{Cl} + O_3 \longrightarrow Cl\dot{O} + O_2$$

Chlorine monoxide

Hence option (3)

6. Consider the following reactions:

(i) $\text{Glucose} + \text{ROH} \xrightarrow{\text{dry HCl}} \text{Acetal} \xrightarrow[(CH_3CO)_2O]{\text{x eq. of}} \text{acetyl derivative}$

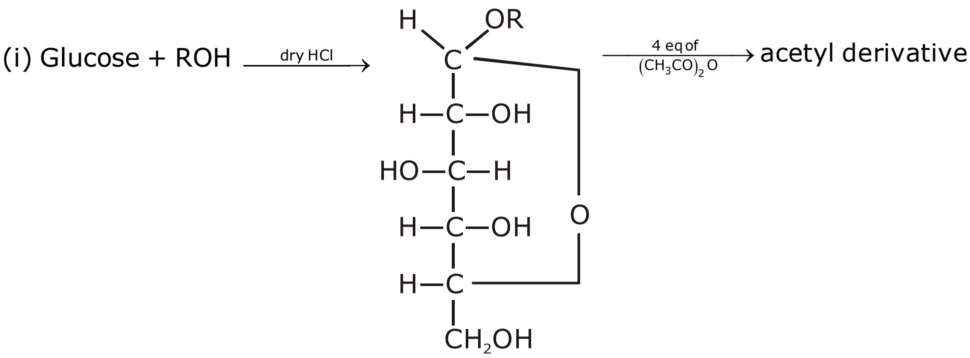
(ii) $\text{Glucose} \xrightarrow{Ni/H_2} \text{A} \xrightarrow[(CH_3CO)_2O]{\text{y eq. of}} \text{acetyl derivative}$

(iii) $\text{Glucose} \xrightarrow[(CH_3CO)_2O]{\text{z eq. of}} \text{acetyl derivative}$

'x', 'y' and 'z' in these reactions are respectively.

(1) 4, 5 & 5
(2) 5, 4 & 5
(3) 5, 6 & 5
(4) 4, 6 & 5

Sol. **4**



α–& β-alkyl
Glucose

(ii) Glucose $\xrightarrow{Ni/H_2}$ $CH_2OH-(CHOH)_4-CH_2OH$ $\xrightarrow[(CH_3CO)_2O]{6\text{ eq of}}$ acetyl derivative

(iii) Glucose $\xrightarrow[(CH_3CO)_2O]{5\text{ eq. of}}$ Acetyl derivative

$(CH_3CO)_2O$ reacts with –OH group to form acetyl derivative, so as the no. of –OH group no. of eq. of $(CH_3CO)_2O$ will be used

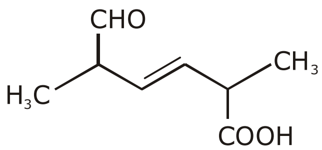
So, x = 4

y = 6

z = 5

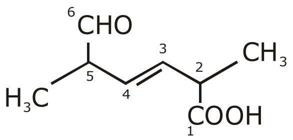
So, option (4) will be correct answer.

7. The IUPAC name for the following compound is:



(1) 2,5-dimethyl-5-carboxy-hex-3-enal
(2) 2,5-dimethyl-6-oxo-hex-3-enoic acid
(3) 6-formyl-2-methyl-hex-3-enoic acid
(4) 2,5-dimethyl-6-carboxy-hex-3-enal

Sol. **2**



2,5–Dimethyl–6–oxohex–3–enoic acid

8. For the following Assertion and Reason, the correct option is

Assertion (A): When Cu (II) and sulphide ions are mixed, they react together extremely quickly to give a solid.

Reason (R): The equilibrium constant of Cu^{2+} (aq) + S^{2-} (aq) $\rightleftharpoons$ CuS (s) is high because the solubility product is low.

(1) **(A)** is false and **(R)** is true.

(2) Both **(A)** and **(R)** are false.

(3) Both **(A)** and **(R)** are true but **(R)** is not the explanation for **(A)**.

(4) Both **(A)** and **(R)** are true but **(R)** is the explanation for **(A)**.

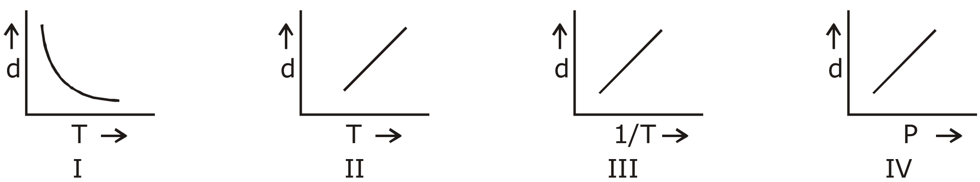
Sol. **4**

(A) is (B) true &

(R) is correct explanation of (A)

Ans. 4

9. Which one of the following graphs is not correct for ideal gas?



d = Density, P = Pressure, T = Temperature

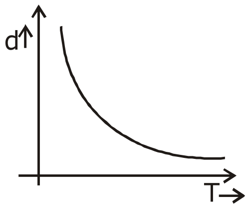
(1) I (2) IV (3) III (4) II

Sol. **4**

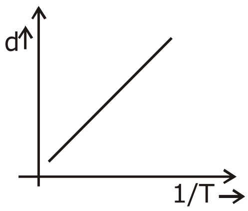
For ideal Gas

$$d = \frac{P \times M}{RT}$$

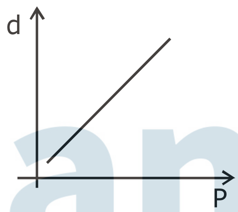
d v/s T $\rightarrow$ Hyperbolic



d v/s $\frac{1}{T} \rightarrow$ St. line



d v/s p $\rightarrow$ St line



$\therefore$ 'II' Graph is incorrect

Ans (4)

10. While titrating dilute HCl solution with aqueous NaOH, which of the following will not be required?

(1) Bunsen burner and measuring cylinder
(2) Burette and porcelain tile
(3) Clamp and phenolphthalein
(4) Pipette and distilled water

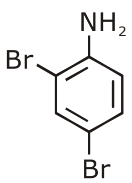
Sol. **1**

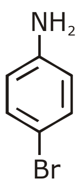
Bunsen Burner & measuring cylinder are not Required. As titration is already on exothermic pro cess

Ans.(1)

11. In Carius method of estimation of halogen, 0.172 g of an organic compound showed presence of 0.08 g of bromine. Which of these is the correct structure of the compound?

(1) H_3C-Br

(2) 

(3) 

(4) H_3C-CH_2-Br

Sol. **3**

carius method

$$\text{mass \% of 'Br'} = \frac{0.08}{0.172} \times 100 = \frac{8000}{172} = 46.51\%$$

$$\text{option (1) mass \%} = \frac{80}{95} \times 100$$

$$\text{(2) mass \%} = \frac{2 \times 80 \times 100}{252}$$

$$\text{(3) mass \%} = \frac{1 \times 80 \times 100}{80 + 72 + 6 + 14} = \frac{8000}{172}\%$$

$$\text{(4) mass \%} = \frac{1 \times 80 \times 100}{109}\%$$

Option (3) matches with the given mass percentage value

Ans (3)

12. On heating compound (A) gives a gas (B) which is a constituent of air. This gas when treated with H_2 in the presence of a catalyst gives another gas (C) which is basic in nature. (A) should not be:

(1) $(NH_4)_2Cr_2O_7$ (2) NaN_3 (3) NH_4NO_2 (4) $Pb(NO_3)_2$

Sol. **4**

The gas (B) is N_2 which is found in air

$N_2 + 3H_2 \xrightleftharpoons{Fe/Mo} 2NH_3$ (Haber's process)
(Basic in nature)

$NH_3 + H_2O \rightarrow NH_4OH$ (weak base)

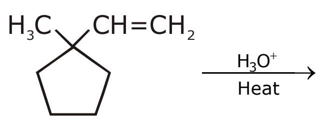
$(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + H_2O$

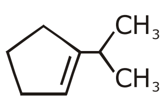
$NaN_3 \longrightarrow N_2 + Na$

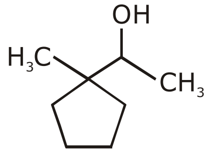
$NH_4NO_2 \longrightarrow N_2 + H_2O$

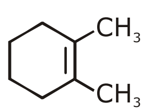
$Pb(NO_3)_2 \longrightarrow PbO + NO_2 + O_2$

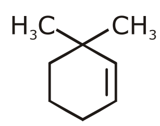
13. The major product in the following reaction is:



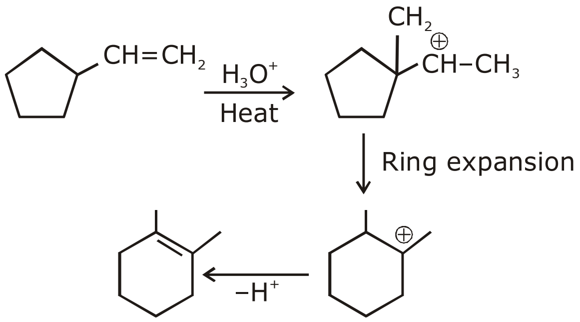
(1) 

(2) 

(3) 

(4) 

Sol. **3**



Option (3) is correct answer.

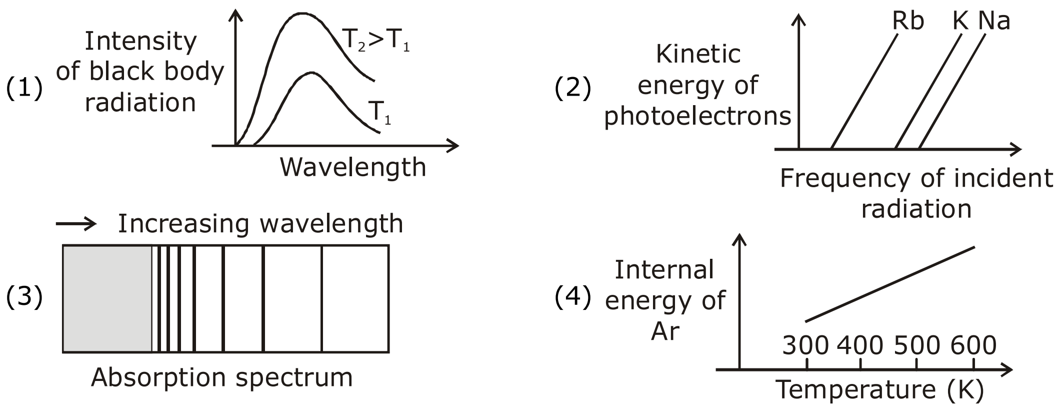
14. In general, the property (magnitudes only) that shows an opposite trend in comparison to other properties across a period is:

(1) Ionization enthalpy
(2) Electronegativity
(3) Atomic radius
(4) Electron gain enthalpy

Sol. **3**

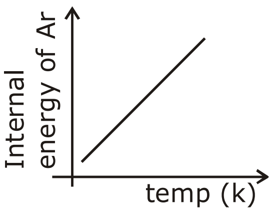
Ionisation energy, electronegativity & electron gain enthalpy increase across a period but atomic radius decreases

15. The figure that is not a direct manifestation of the quantum nature of atoms is:



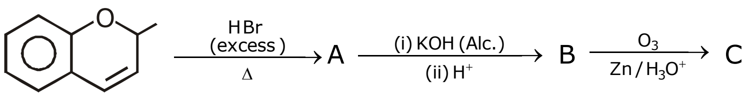
Sol. **4**

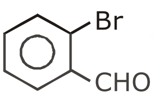
Internal energy of 'Ar' or any gas, has nothing to do with Quantum nature of atom hence

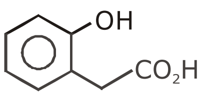


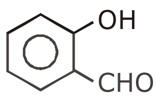
Ans. option (4)

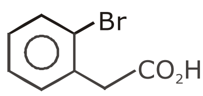
16. The major aromatic product C in the following reaction sequence will be :



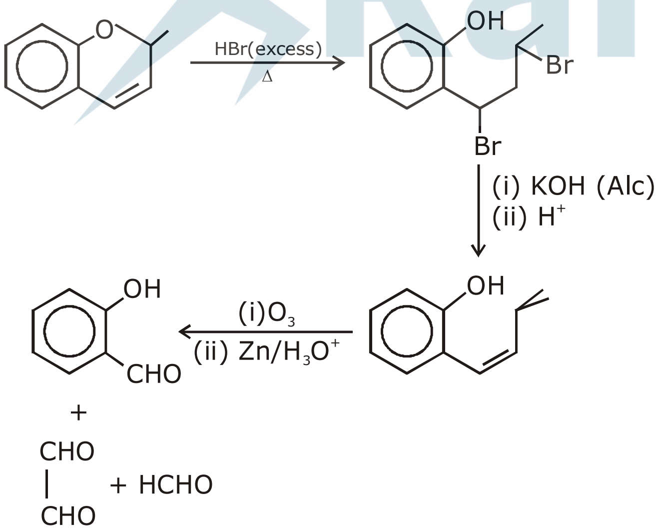
(1) 

(2) 

(3) 

(4) 

Sol. **3**



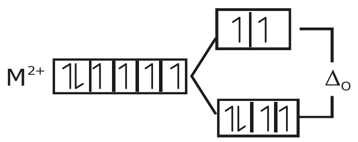
Option (3) is correct answser.

17. Consider that a d^6 metal ion (M^{2+}) forms a complex with aqua ligands, and the spin only magnetic moment of the complex is 4.90 BM. The geometry and the crystal field stabilization energy of the complex is:

(1) tetrahedral and $-0.6\Delta_t$ (2) tetrahedral and $-1.6\Delta_t + 1P$

(3) octahedral and $-1.6\Delta_0$ (4) octahedral and $-2.4\Delta_0 + 2P$

Sol. **1**

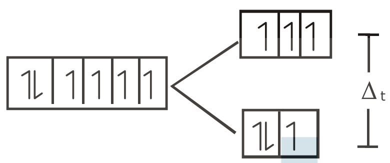


μ spin = 4.9 BM CFSE = $-0.4 \times 4\Delta_0 + 0.6 \times 2\Delta_0$

$= [1.6 + 1.2\,]\Delta_0$

$= -\,0.4\,\Delta_0$

$\Rightarrow$



CFSE $= -0.6 \times 3\Delta_t + 0.4 \times 3\Delta_t$

$= -1.8\,\Delta_t + 1.2\Delta_t$

$= -\,0.6\,\Delta_t$

18. If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is:

(1) Square planar (2) Tetrahedral

(3) Square pyramidal (4) Rectangular planar

Sol. 1

Incorrect question Option 1 is more appropriate with respect to given option

(Chemical bonding)

(Options are incorrect)

19. Which of the following compounds will show retention in configuration on nucleophilic substitution by OH^- ion?

(1) $CH_3-CH(C_2H_5)-CH_2Br$ (2) $CH_3-CH(CH_3)-Br$ (3) $CH_3-C(Br)(C_6H_{13})-H$ (4) $CH_3-CH(C_6H_5)-Br$

Sol. **1**

In $CH_3-\underset{\underset{C_2H_5}{|}}{CH}-CH_2Br$ attack of OH^- is not on chiral carbon, it is adjacent to chiral carbon, so configuration of chiral carbon remains constant.

20. The metal mainly used in devising photoelectric cells is:

(1) Li (2) Cs (3) Rb (4) Na

Sol. **2**

'Cs' is used in photoelectric cell as its ionisation energy is lowest

Hence Ans (2)

21. The mass of gas adsorbed, x, per unit mass of adsorbate, m, was measured at various pressures, p. A graph between $\log \frac{x}{m}$ and log p gives a straight line with slope equal to 2 and the intercept equal to 0.4771. The value of $\frac{x}{m}$ at a pressure of 4 atm is: (Given log3 = 0.4771)

Sol. 48

$\frac{x}{m} = KP^{1/n}$

$\log (x / m) = \log_{(k)} + \frac{1}{n}\log(p)$

$y = c + mx$

Intercept $C = \log_k = 0.4771$

slop $= \frac{1}{n} = 2$, $k = 3$

$\frac{x}{m} = k(P)^{1/n}$ at P = 4 atm

$= 3(4)^2$

$\frac{x}{m} = 3 \times 16 = 48$ Ans

22. The Gibbs energy change (in J) for the given reaction at $[Cu^{2+}] = [Sn^{2+}] = 1$ M and 298 K is:

$Cu(s) + Sn^{2+}(aq.) \rightarrow Cu^{2+}(aq.) + Sn(s)$

($E^o_{Sn^{2+}|Sn} = -0.16V$, $E^o_{Cu^{2+}|Cu} = 0.34V$, Take F = 96500 C mol^{-1})

Sol. **96500**

$Cu(s) + Sn^{+2}(aq) \rightleftharpoons Cu^{+2}(aq) + Sn(s)$

$E^o_{cell} = -0.16 - 0.34$

$= -0.50$

$\Delta G^o = -nF E^o_{cell}$

$= -2 \times 96500 \times (-0.5)$

$= +96500$

$\Delta G = \Delta G^o + RT \ln Q$

$= 96500 + \frac{25}{3} \times 298 \times 2.303 \log (1)$

$\Delta G = 96500$ Joules

23. The internal energy change (in J) when 90 g of water undergoes complete evaporation at 100º C is __________.

(Given: ΔH_{vap} for water at 373 K = 41 kJ/mol, R = 8.314 $JK^{-1}\ mol^{-1}$)

Sol. $H_2O\ (\ell) \longrightarrow H_2O\ (g)$

$\Delta E_{vap} = \Delta H_{vap} - \Delta ngRT$

$= 41000 \times 5 - 5 \times 8.314 \times 373$

$= 189494.39$

24. The oxidation states of iron atoms in compounds (A), (B) and (C), respectively, are x, y and z. The sum of x, y and z is _____.

$Na_4[Fe(CN)_5(NOS)]$	$Na_4[FeO_4]$	$[Fe_2(CO)_9]$
(A)	(B)	(C)

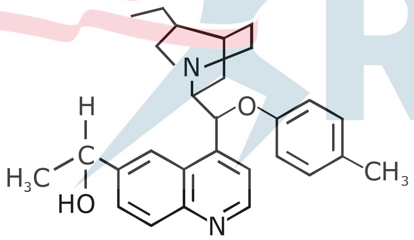
Sol. **6**

$Na_4\ [Fe^{+2}(CN)_5(NOS)]$

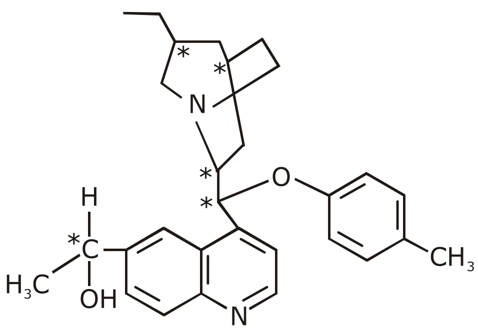
$Na_4[Fe^{+4}O_4]$

$[Fe_2^{\,0}(CO)_9]$

25. The number of chiral carbons present in the molecule given below is _________.



Sol. **5**



Total chiral carbon = 5