SECTION – 1 : (Maximum Marks : 80)

Straight Objective Type

This section contains **20 multiple choice questions.** Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **Only One** is correct.

1. The dipole moments of CCl_4, $CHCl_3$ and CH_4 are in the order :

(1) $CH_4 < CCl_4 < CHCl_3$ (2) $CCl_4 < CH_4 < CHCl_3$
(3) $CHCl_3 < CH_4 = CCl_4$ (4) $CH_4 = CCl_4 < CHCl_3$

Ans. **(4)**

Sol. $\mu_{CCl_4} = \mu_{CH_4} = 0$ but $\mu_{CHCl_3} \neq 0$

2. The theory that can completely/properly explain the nature of bonding in $[Ni(CO)_4]$ is:
(1) Crystal field theory (2) Werner's theory
(3) Molecular orbital theory (4) Valence bond theory

Ans. **(3)**

3. Consider the following reactions :

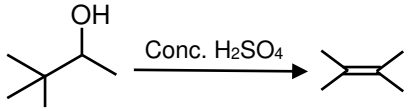
(a) $(CH_3)_3CCH(OH)CH_3 \xrightarrow{Conc.H_2SO_4}$ (b) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{Alc.KOH}$

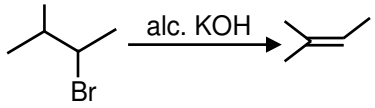
(c) $(CH_3)_2CHCH(Br)CH_3 \xrightarrow{(CH_3)_2O^{\ominus}K^{\oplus}}$ (d) $(CH_3)_2\underset{\underset{OH}{|}}{C} - CH_2 - CHO \xrightarrow{\Delta}$

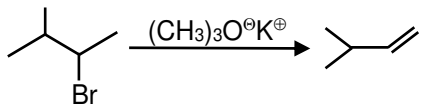
Which of these reaction(s) will not produce Saytzeff product ?
(1) (b) and (d) (2) (a), (c) and (d)
(3) (d) only (4) (c) only

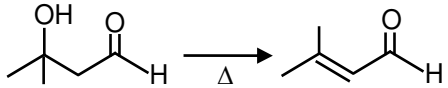
Ans.(4)

Sol. C gives Hofmann product.

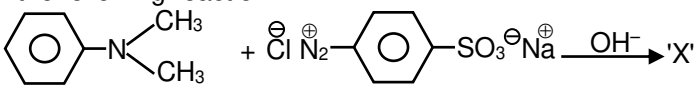
(a) 

(b) 

(c) 

(d) 

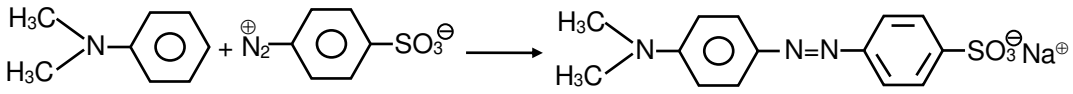
4. Consider the following reaction :



The product 'X' is used :
(1) in laboratory test for phenols
(2) in protein estimation as an alternative to ninhydrin
(3) in acid base titration as an indicator
(4) as food grade colourant

Ans. (3)

Sol.



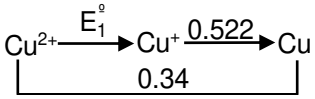
Methyl orange

Methyl orange is used as an indicator in acid base titration.

5. Given that the standard potentials (E°) of Cu^{2+}/Cu and Cu^{+}/Cu are 0.34 V and 0.522 V respectively, the E° of Cu^{2+}/Cu^{+} is:

Ans. (1)

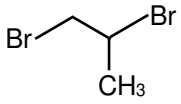
Sol.

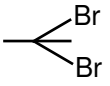


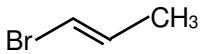
$2 \times 0.34 = E_1^\circ + 1 \times 0.522$

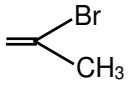
$E_1^\circ = 0.68 - 0.522 \Rightarrow E_1^\circ = 0.158\,V$

6. 1-methyl-ethylene oxide when treated with an excess of HBr produces :

(1) 

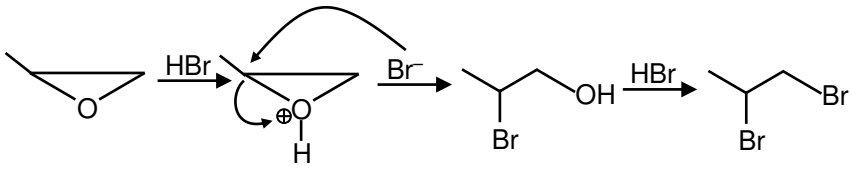
(2) 

(3) 

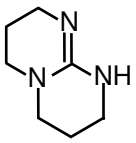
(4) 

Ans. (1)

Sol.



7. The increasing order of pK_b for the following compounds will be :

(A) $NH_2–CH=NH$, (B)  (C) $CH_3–NH–CH_3$

(1) (A) < (B) < (C) (2) (B) < (C) < (A) (3) (B) < (A) < (C) (4) (C) < (A) < (B)

Ans. **(3)**

Sol. Option "B" represent Guanadine, the conjugate acid of which is resonance stabilised. The option 'C' is aliphatic amine, here the 'N' is sp^3 whereas in option 'A' the 'N' is sp^2, hence C is more basic than A.)

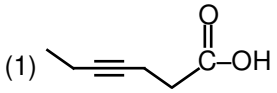
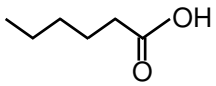
8. Oxidation number of potassium in K_2O, K_2O_2 and KO_2, respectively, is:

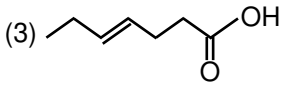
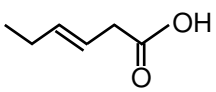
(1) +1, +2 and +4 (2) +1, +4 and +2 (3) +1, +1 and +1 (4) +2, +1 and $+\frac{1}{2}$

Ans. **(3)**

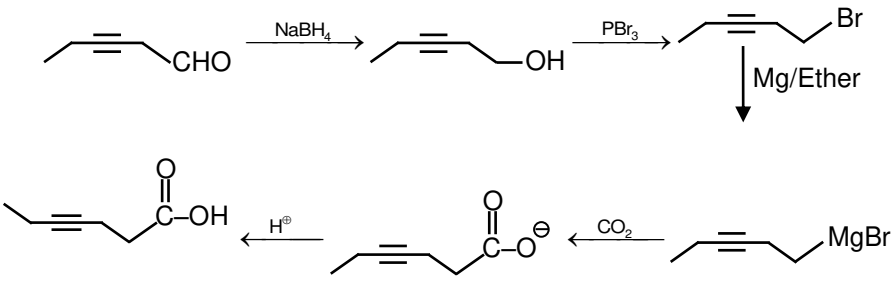
9. What is the product of following reaction ?

Hex-3-ynal $\xrightarrow[\text{(ii) } PBr_3 \\ \text{(iii) Mg/ether} \\ \text{(iv) } CO_2/H_3O^+]{\text{(i) } NaBH_4}$?

(1)  (2) 

(3)  (4) 

Ans. **(1)**

Sol. 

10. At 35°C, the vapour pressure of CS_2 is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

(1) heat must be absorbed in order to produce the solution at 35°C

(2) Raoult's law is not obeyed by this system

(3) a mixture of 100 mL CS_2 and 100 mL acetone has a volume < 200 mL

(4) CS_2 and acetone are less attracted to each other than to themselves.

Ans. (3)

Sol. Above mixture of liquids show positive deviation from Raoult's Law

11. A solution of m-chloroaniline, m-chlorophenol and m-chlorobenzoic acid in ethyl acetate was extracted initially with a saturated solution of $NaNCO_3$ to give fraction A. The left over organic phase was extracted with dilute NaOH solution to give fraction B. The final organic layer was labelled as fraction C. Fraction A, B and C, contain respectively :

(1) m-chlorobenzoic acid, m-chlorophenol and m-chloroaniline

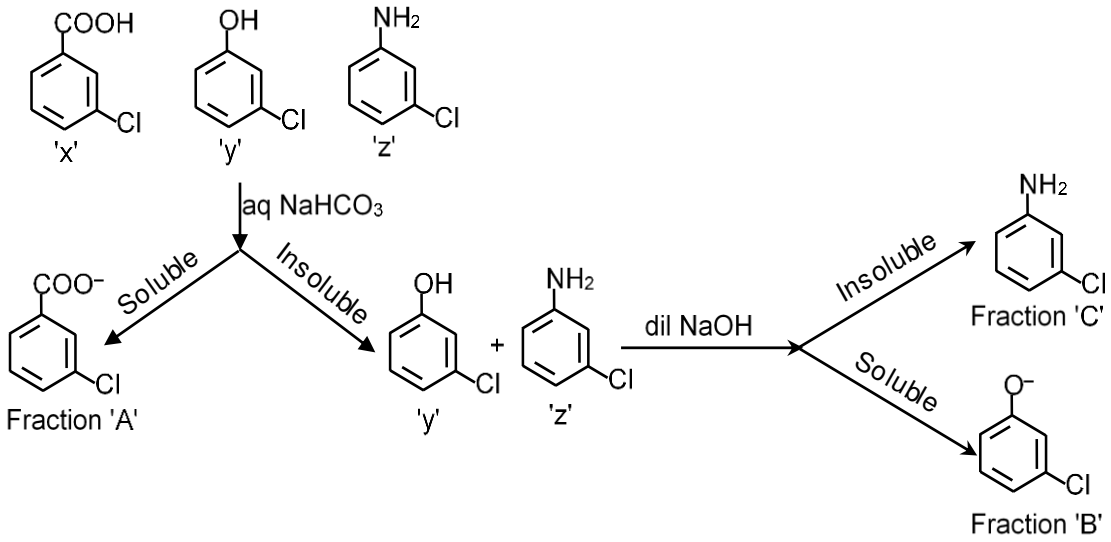
(2) m-chlorophenol, m-chlorobenzoic acid and m-chloroaniline

(3) m-chloroaniline, m-chlorobenzoic acid and m-chlorophenol

(4) m-chlorobenzoic acid, m-chloroaniline and m-chlorophenol

Ans. (1)

Sol.



12. In comparison to the zeolite process for the removal of parmanent hardness, the synthesis resins method is:
(1) more efficient as it can exchange both cations as well as anions
(2) less efficient as it exchanges only anions
(3) more efficient as it can exchange only cations
(4) less efficient as the resins cannot be regenerated

Ans. **(1)**

13. The atomic radius of Ag is closest to :
(1) Au (2) Hg
(3) Ni (4) Cu

Ans. **(1)**

14. The IUPAC name of the complex $[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$ is :
(1) Bisammine(methanamine)chloridoplatinum(II)chloride
(2) Diammine(methanamine)chloridoplatinum(II)chloride.
(3) Diamminechlorido(methanamine)platinum(II)chloride
(4) Diamminechlorido(amminomethane)platinum(II)chloride

Ans. **(3)**

15. The electron gain enthalpy (in kJ/mol) of fluorine, chlorine, bromine and iodine, respectively are :
(1) –296, –325, –333 and –349 (2) –333, –349, –325 and –296
(3) –349, –333, –325 and –296 (4) –333, –325, –349 and –296

Ans. (2)

16. Match the following

(i) Riboflavin	(a) Beriberi
(ii) Thiamine	(b) Scurvy
(iii) Pyridoxine	(c) Cheilosis
(iv) Ascorbic acid	(d) Convulsions

(1) (i) - (c); (ii) - (a); (iii) - (d); (iv) - (b)
(2) (i) - (c); (ii) - (d); (iii) - (a); (iv) - (b)
(3) (i) - (a); (ii) - (d); (iii) - (c); (iv) - (b)
(4) (i) - (d); (ii) - (b); (iii) - (a); (iv) - (c)

Ans. (1)
Sol.

Vitamins	**Deficiency Diseases**
Vitamin B_1 (Thiamine)	Beri Beri
Vitamin B_2 (Riboflavin)	Cheilosis
Vitamin B_6 (Pyridoxine)	Convulsions
Vitamin C (Ascorbic acid)	Scurvy

17. Amongst the following statements, that which was not proposed by Dalton was :
(1) When gases combine or reproduced in a chemical reaction they do so in a simple ratio by volume provided all gases are at the same T & P.
(2) Matter consists of indivisible atoms
(3) Chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.
(4) All the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass.

Ans. (1)

18. The purest form of commercial iron is:

(1) cast iron
(2) scrap iron and pig iron
(3) pig iron
(4) wrought iron

Ans. (4)
Sol. Purest form is wrought iron.

19. The number of oribtals associated with quantum number n = 5, $m_s = +\frac{1}{2}$ is:

(1) 11 (2) 25 (3) 50 (4) 15

Ans. (2)

20. The relative strength of interionic/intermolecular forces in decreasing order is:

(1) dipole-dipole > ion-dipole > ion-ion
(2) ion-ion > ion-dipole > dipole-dipole
(3) ion-dipole > dipole-dipole > ion-ion
(4) ion-dipole > ion-ion > dipole-dipole

Ans. (2)

SECTION – 2 : (Maximum Marks : 20)

- This section contains **FIVE (05)** questions. The answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto one digit.
- If the numerical value has more than two decimal places **truncate/round-off** the value upto **TWO** decimal places.
  - Full Marks : **+4** If ONLY the correct option is chosen.
  - Zero Marks : **0** In all other cases

21. Two solutions, A and B, each of 100 L was made by dissolving 4g of NaOH and 9.8 g of H_2SO_4 in water, respectively. The pH of the resultant solution obtained from mixing 40 L of solution A and 10 L of solution B is_____.

Ans. **10.60 to 10.60**

Sol. $M_{H_2SO_4} \Rightarrow \frac{9.8}{98 \times 100} = 10^{-3}$

$M_{NaOH} \Rightarrow \frac{4}{40 \times 100} = 10^{-3}$

$= \frac{40 \times 10^{-3} - 10 \times 10^{-3} \times 2}{50} = \frac{20}{50} \times 10^{-3}$

$[OH^-] = \frac{2}{5} \times 10^{-3}$

pOH = 3.397

pH = 10.603

22. For the reaction :

$A(l) \rightarrow 2B(g)$

ΔU = 2.1 kcal, ΔS = 20 cal K^{-1} at 300 K.

Hence ΔG in K.cal is _____

Ans. **–2.70 to –2.70**

Sol. $\Delta H = \Delta U + \Delta ngRT$

$= 2.1 \times 10^3 + 2(2)\ (300)$

$= 2100 + 1200$

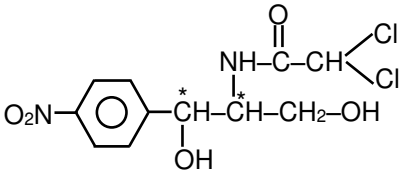
$= 3300$ cal

$\Delta G = \Delta H - T\Delta S = 3300 - (300)\ (20) = 3300 - 6000 = -2700$ cals $= -2.7$ kcal

23. The number of chiral carbons in chloramphenicol is_____.

Ans. **2.00 to 2.00**

Sol.



chloramphenicol

24. Chlorine reacts with hot and concentrated NaOH and produces compounds (X) and (Y). Compound (X) gives white precipitate with silver nitrate solution. The average bond order between Cl and O atoms in (Y) is_____.

Ans. **1.66 to 1.67**

Sol. $3Cl_2 + 6NaOH \xrightarrow[\text{Hot \& conc.}]{} \underset{(X)}{5NaCl} + \underset{(Y)}{NaClO_3} + 3H_2O$

$NaCl + AgNO_3 \longrightarrow \underset{\text{ppt.}}{AgCl} + NaNO_3$

Y is $NaClO_3$ $\quad ClO_3^-$ (bond order) $= \frac{5}{3} = 1.67$

25. During the nuclear explosion, one of the products is ^{90}Sr with half life of 6.93 years. If 1 μg of ^{90}Sr was absorbed in the bones of a newly born baby in place of Ca, how much time, in years, is required to reduce it by 90% if it is not lost metabolically.

Ans. **23.00 to 23.03**

Sol. $\frac{t_{90\%}}{t_{50\%}} = \frac{\ell n \frac{100}{10}}{\ell n 2} = \frac{\ell n 10}{0.693}$

$t_{90\%} = \frac{6.93}{0.693} \times \ell n 10 = 10 \ell n 10 = 23.03 \text{ Years}$