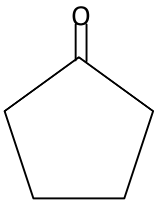
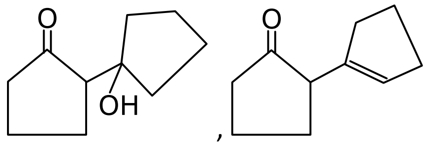
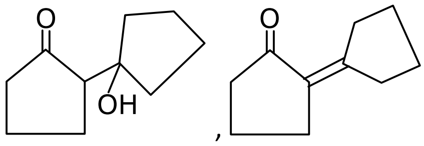
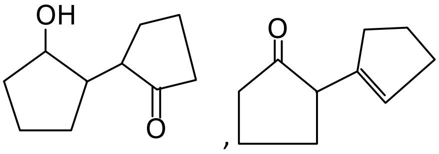
SECTION - A

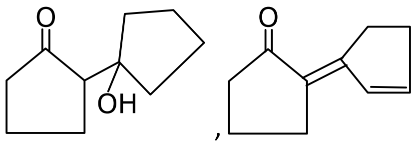
1.  $\xrightarrow{\text{dilNaOH}}$ "X" $\xrightarrow{H^+,\text{Heat}}$ "Y"

Consider the above reaction, the product 'X' and 'Y' respectively are :

(1) 

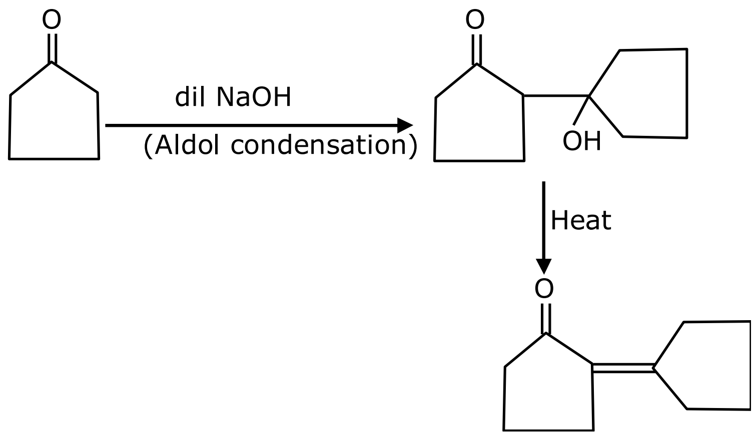
(2) 

(3) 

(4) 

Ans. (2)

Sol.



2. The charges on the colloidal CdS sol and TiO_2 sol are, respectively :

(1) positive and negative (2) negative and negative

(3) negative and positive (4) positive and positive

Ans. (3)

Sol. CdS $\rightarrow$ Sulphide sol. $\rightarrow$ Negative sol.

$TiO_2 \rightarrow$ Oxide sol. $\rightarrow$ Positive sol.

3. The oxide that shows magnetic property is :

(1) SiO_2 (2) Na_2O (3) Mn_3O_4 (4) MgO

Ans. **(3)**

Sol. Mn_3O_4 is paramagnetic due to presence of unpaired electrons.

4. Given below are two statements :

Statement I : Bohr's theory accounts for the stability and line spectrum of Li^+ ion.

Statement II : Bohr's theory was unable to explain the splitting of spectral lines in the presence of a magnetic field.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both statement I and statement II are true.

(2) Statement I is true but statement II is false.

(3) Statement I is false but statement II is true.

(4) Both statement I and statement II are false.

Ans. **(3)**

Sol. S-1 $\rightarrow$ false

S-2 $\rightarrow$ True

Hence option 3

5. Match List-I with List-II :

List-I	List-II
(1) Mercury	(i) Vapour phase refining
(2) Copper	(ii) Distillation Refining
(3) Silicon	(iii) Electrolytic Refining
(4) Nickel	(iv) Zone Refining

Choose the most appropriate answer from the option given below :

(1) (a)-(ii), (b)-(iii), (c)-(i), (d)-(iv) (2) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)

(3) (a)-(ii), (b)-(iv), (c)-(iii),(d)-(ii) (4) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

Ans. **(4)**

Sol. Theory based

6. Match List-I with List-II :

List-I	List-II
(Class of Chemicals)	(Example)
(a) Antifertility drug	(i) Meprobamate
(b) Antibiotic	(ii) Alitame
(c) Tranquilizer	(iii) Norethindrone
(d) Artificial Sweetener	(iv) Salvarsan

Options :

(1) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i) (2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)

(3) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii) (4) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

Ans. **(4)**

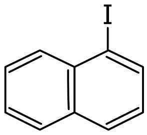
Sol. (a) Antifertility drug $\longrightarrow$ Norethindrone

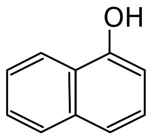
(b) Antibiotic $\longrightarrow$ Salvarsan

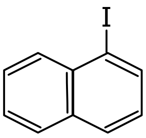
(c) Tranquilizer $\longrightarrow$ Meprobamate

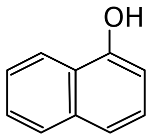
(d) Artificial sweetener $\longrightarrow$ Alitame

7. Main Products formed during a reaction of 1-methoxy naphthalene with hydroiodic acid are :

(1)  and CH_3I

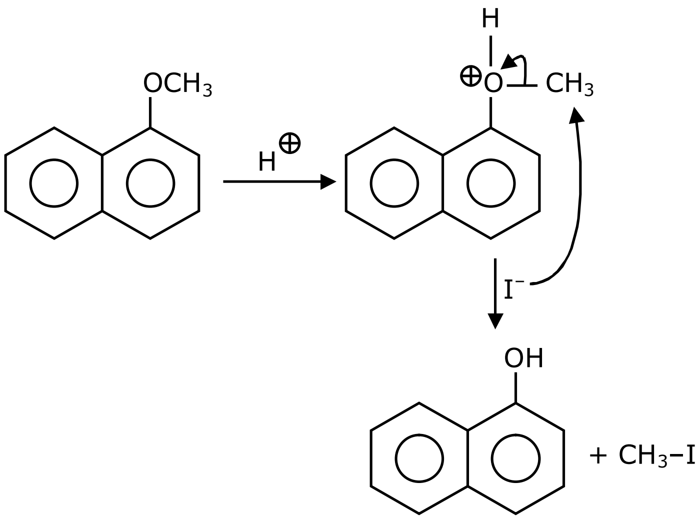
(2)  and CH_3OH

(3)  and CH_3OH

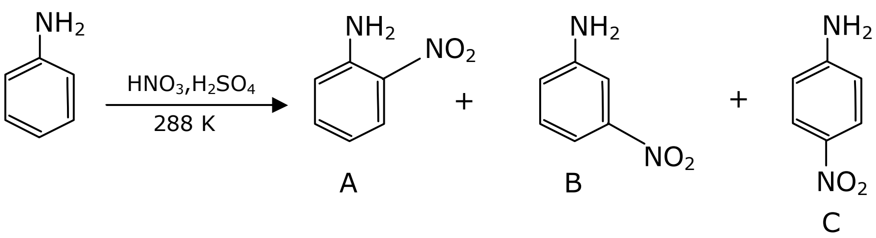
(4)  and CH_3I

Ans. (4)

Sol.



8.

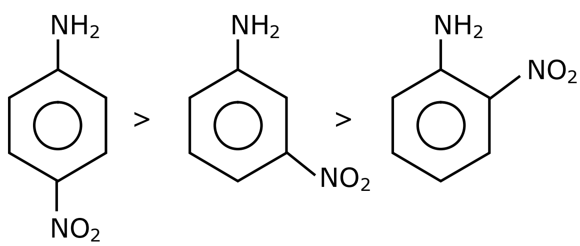


Consider the given reaction, percentage yield of :

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

Ans. (3)

Sol.

Order of % yield ⇒ 

9. An organic compound "A" on treatment with benzene sulphonyl chloride gives compound B. B is soluble in dil. NaOH solution. Compound A is :

(1) $C_6H_5-N-(CH_3)_2$

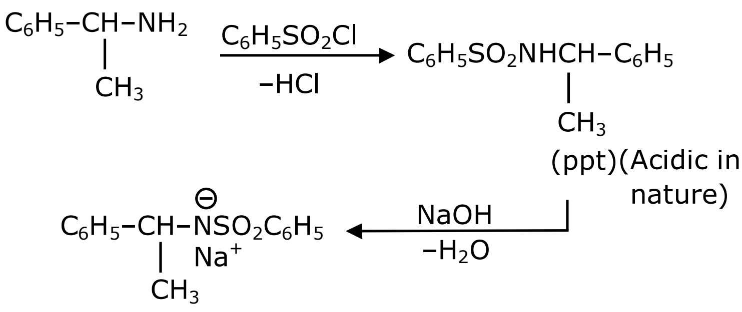
(2) $C_6H_5-NHCH_2CH_3$

(3) $C_6H_5-CH(CH_3)-NH_2$

(4) $C_6H_5-CH_2\,NH\,CH_3$

Ans. (3)

Sol.



Soluble

10. The first ionization energy of magnesium is smaller as compound to that of elements X and Y, but higher than that of Z. The elements X, Y and Z, respectively are :

(1) argon, lithium and sodium

(2) chlorine, lithium and sodium

(3) neon, sodium and chlorine

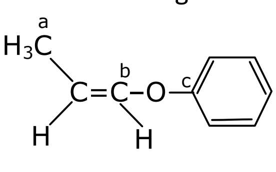
(4) argon, chlorine and sodium

Ans. (4)

Sol. Order of I.E.

3rd period $\rightarrow$ Na < Al < Mg < Si < S < P < Cl < Ar

11. In the following molecule,



Hybridisation of Carbon a, b and c respectively are :

(1) sp^3, sp^2, sp^2 (2) sp^3, sp^2, sp (3) sp^3, sp, sp (4) sp^3, sp, sp^2

Ans. (1)

Sol. $a \longrightarrow sp^3$

$b \longrightarrow sp^2$

$c \longrightarrow sp^2$

12. In the reaction of hypobromite with amide, the carbonyl carbon is lost as :

(1) HCO_3^- (2) CO_3^{2-} (3) CO_2 (4) CO

Ans. **(2)**

Sol. CO_3^{2-}

13. The oxidation states of nitrogen in NO, NO_2, N_2O and NO_3^- are in the order of :

(1) $NO_2 > NO_3^- > NO > N_2O$ (2) $N_2O > NO_2 > NO > NO_3^-$

(3) $NO_3^- > NO_2 > NO > N_2O$ (4) $NO > NO_2 > N_2O > NO_3^-$

Ans. **(3)**

Sol. O.S. of 'N'

$NO \rightarrow +2$

$NO_2 \rightarrow +4$

$N_2O \rightarrow +1$

$NO_3^- \rightarrow +5$

Decreasing order of ox. state of 'N' is as follows

$NO_3^- > NO_2 > NO > N_2O$

14. Match List-I and List-II :

List-I	**List-II**
(a) Be	(i) treatment of cancer
(b) Mg	(ii) extraction of metals
(c) Ca	(iii) incendiary bombs and signals
(d) Ra	(iv) windows of X-ray tubes
	(v) bearings for motor engines

Choose the most appropriate answer from the option given below :

Options :

(1) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(v)

(2) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

(3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(4) (a)-(iii), (b)-(iv), (c)-(v), (d)-(ii)

Ans. **(3)**

Sol. Fact (NCERT)

Due to radioactive nature Ra - is used in treatment of cancer.

15. Deficiency of vitamin K causes:

(1) Cheilosis

(2) Increase in blood clotting time

(3) Increase in fragility of RBC's

(4) Decrease in blood clotting time

Ans. **(2)**

Sol. Deficiency of vitamin "K" causes $\uparrow$ in blood clotting time.

16. Given below are two statements :

Statement I : C_2H_5OH and AgCN both can general nucleophile.

Statement II : KCN and AgCN both will generate nitrile nucleophile with all reaction condition.

Choose the most appropriate option:

(1) Statement I is false but statement II is true.

(2) Statement I is true but statement II is false.

(3) Both statement I and statement II are false.

(4) Both statement I and statement II are true.

Ans. (2)

Sol. $\Rightarrow$ C_2H_5OH & AgCN both can generate nucleophile

$\Rightarrow$ AgCN & KCN both not generate nitrite nucleophile in all reaction condition.

17. Given below are two statements :

Statement I : Non-biodegradable wastes are generated by the thermal power plants.

Statement II : Bio-degradable detergents leads to eutrophication.

In the light of the above statements, choose the most appropriate answer from the options given below.

Options :

(1) Statement I is false but statement II is true.

(2) Both statement I and statement II are true.

(3) Both statement I and statement II are false

(4) Statement I is true but statement II is false.

Ans. (2)

Sol. Fact (NCERT-Based)

18. A hard substance melts at high temperature and is an insulator in both solid and in molten state. This solid is most likely to be a/an :

(1) Metallic solid (2) Covalent solid

(3) Ionic solid (4) Molecular solid

Ans. (2)

Sol. If substance is insulator in solid & molten both phase, then it can't be ionic or metallic solid.

If melting pt. is higher, then it can't be molecular solid.

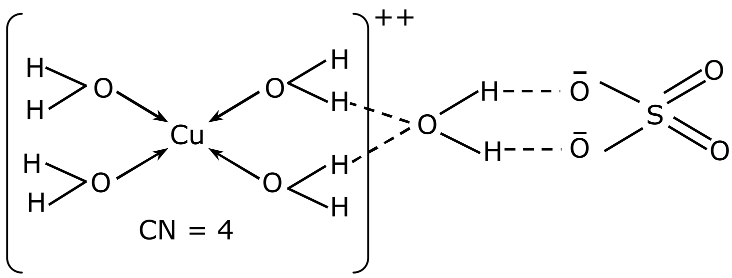
$\therefore$ It should be covalent network solid.

19. The secondary valency and the number of hydrogen bounded water molecule(s) in $CuSO_4.5H_2O$, respectively, are :

(1) 6 and 4 (2) 4 and 1 (3) 5 and 1 (4) 6 and 5

Ans. (2)

Sol.



20. In basic medium, H_2O_2 exhibits which of the following reactions ?

(A) $Mn^{2+} \rightarrow Mn^{4+}$

(B) $I_2 \rightarrow I^-$

(C) $PbS \rightarrow PbSO_4$

Choose the most appropriate answer from the options given below :

(1) (A), (C) only (2) (A) only (3) (B) only (4) (A), (B) only

Ans. (4)

Sol. (1) Oxidising action in basic medium

$2Fe^{2+} + H_2O_2 \longrightarrow 2Fe^{3+} + 2OH^-$

$Mn^{2+} + H_2O_2 \longrightarrow Mn^{4+} + 2OH^-$

(2) Reducing action in basic medium

$I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$

$2MnO_4^- + 3H_2O_2 \longrightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$

SECTION - B

1. The solubility of $CdSO_4$ in water is 8.0×10^{-4} mol L^{-1}. Its solubility in 0.01 M H_2SO_4 solution is ______ $\times 10^{-6}$ mol L^{-1}. (Round off to the Nearest Integer).

Assume that solubility is much less than 0.01 M)

Ans. 64

Sol. $CdSO_4(s) \rightleftharpoons Cd^{+2}(aq) + SO_4^{2-}(aq)$

$\quad S \quad\quad S$

$S = 8 \times 10^{-4} \quad K_{sp} = S^2 = 64 \times 10^{-8}$

$CdSO_4(s) \rightleftharpoons Cd^{+2} + SO_4^{2-}$

$\quad S \quad\quad S + 10^{-2}$

$K_{sp}(CdSO_4) = 64 \times 10^{-8} = s(s + 10^{-2})$

$64 \times 10^{-8} \simeq s \times 10^{-2} = 64 \times 10^{-6}$

2. The molar conductivities at infinite dilution of barium chloride, sulphuric acid and hydrochloric acid are 280, 860 and 426 S cm^2 mol^{-1} respectively. The molar conductivity at infinite dilution of barium sulphate is _____ S cm^2 mol^{-1}. (Round off to the Nearest Integer).

Ans. 288

Sol. $\lambda_M^{\infty}(BaCl_2) = 280$

$\lambda_M^{\infty}(H_2SO_4) = 860$

$\lambda_M^{\infty}(HCl) = 426$

$\lambda_M^{\infty}(BaSO_4) = ??$

$= \lambda_M^{\infty}(H_2SO_4) + \lambda_M^{\infty}(BaCl_2) - 2 \times \lambda_M^{\infty}(HCl)$

$= 860 + 280 - 2 \times 426$

$= 288$

3. A reaction has a half life of 1 min. The time required for 99.9% completion of the reaction is _____ min. (Round off to the nearest integer)
[Use : ln 2 = 0.69; ln 10 = 23]

Ans. **10**

Sol. $t_{99.9\%} = ??$

$\simeq 10 \times t_{1/2}$

$\simeq 10\,\text{min}$

Derivation

$$t_{99.9\%} = \frac{1}{K}\ell n\left\{\frac{100}{0.1}\right\} = \frac{1}{K}\ell n(1000)$$

$$= \frac{3}{K}\ell n(10) = 3\frac{(t_{1/2})}{\ell n(2)} \times \ell n(10)$$

$$= 3 \times (1\text{ min}) \times \frac{\ell n(10)}{\ell n(2)}$$

$$= \frac{3}{\log(2)} = \frac{3}{0.3} \simeq 10\,\text{min}$$

4. The gas phase reaction

$2A\,(g) \rightleftharpoons A_2(g)$

at 400 K has $\Delta G^{o} = +\,25.2$ kJ mol^{-1}

The equilibrium K_C for this reaction is _______ $\times 10^{-2}$. (Round off to the Nearest Integer).

[Use : R = 8.3 J mol^{-1} K^{-1}, ln 10 = 2.3

$\log_{10} 2 = 0.30$, 1 atm = 1 bar]

[antilog (– 0.3) = 0.501]

Ans. **2**

Sol. Using formula

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

$25200 = -2.3 \times 8.3 \times 400 \log (K_P)$

$K_P = 10^{-3.3} = 10^{-3} \times 0.501$

$= 5.01 \times 10^{-4}$ Bar^{-1}

$= 5.01 \times 10^{-5}$ Pa^{-1}

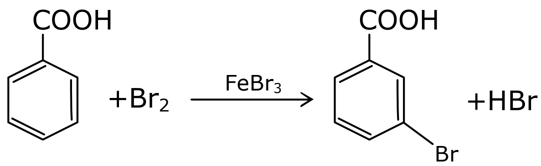
$$= \frac{K_C}{8.3 \times 400}$$

$K_C = 1.66 \times 10^{-5}$ m^3/mole

$= 1.66 \times 10^{-2}$ L/mol

Ans. 2

5.

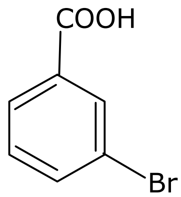


Consider the above reaction where 6.1 g of benzoic acid is used to get 7.8 g of m-bromo benzoic acid. The percentage yield of the product is _____

(Round off to the Nearest integer)

[Given : Atomic masses : C : 12.0 u, H : 1.0 u, O : 16.0 u, Br : 80.0 u]

Ans. **78**

Sol. $PhCOOH + Br_2 \xrightarrow{FeBr_3}$ 

$+ HBr$

6.1 7.8

$$\frac{\text{moles of PhCOOH}}{1} = \frac{\text{Moles of } C_6H_4COOHBr}{1}$$

Moles of $C_6H_4COOHBr = \frac{6.1}{122} = \frac{1}{20}$ mol

mass of $C_6H_4COOHBr = 201 \times \frac{1}{20}$ gm

% yield $= \frac{7.8}{201/20} \times 100$

$= 77.612\%$

$\simeq 78$ Nearest Integer

6. A solute A dimerizes in water. The boiling point of a 2 molal solution of A is 100.52ºC. The percentage association of A is _______ . (Round off to the Nearest integer.)

[Use : K_b for water = 0.52 K kg mol^{-1}

Boiling point of water = 100ºC]

Ans. **1**

Sol. $2A \longrightarrow A_2$

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

m = 2; T_b soln. = 100.52

$\Delta T_b = 0.52$

$= i \times K_b \times m$

$0.52 = i \times 0.52 \times 2$

$i = \frac{1}{2} = 1 + 1 + \left(1/2 - 1\right)\alpha$

$\alpha/2 = 1/2$

$\alpha = 1$

7. The number of species below that have two lone pairs of electrons in their central atom is ______ .
(Round off to the Nearest Integer.)
SF_4, BF_4^-, ClF_3, AsF_3, PCl_5, BrF_5, XeF_4, SF_6

Ans. **(2)**

Sol. ClF_3 and XeF_4 have two lp-in their central atom

8. 10.0 mL of Na_2CO_3 solution is titrated against 0.2 M HCl solution. The following litre values were obtained in 5 readings.
4.8 mL, 4.9 mL, 5.0 mL, 5.0 mL and 5.0 mL
Based on these readings, and convention of titrimetric estimation the concentration of Na_2CO_3 solution is _____ mM.
(Round off to the Nearest Integer)

Ans. **50**

Sol. $Na_2CO_3 + HCl \longrightarrow$
10ml 0.2M
M = ?? 5ml
$M_{eq.}$ of Na_2CO_3 = $M_{eq.}$ of HCl
$M \times 10 \times 2 = 0.2 \times 5 \times 1$
$M = 5 \times 10^{-2} M = 50 \times 10^{-3} M = 50$ mM
Ans 50

9. In Tollen's test for aldehyde, the overall number of electron(s) transferred to the Tollen's reagent formula $[Ag(NH_3)_2]^+$ per aldehyde group to form silver mirror is ________
(Round off to the Nearest Integer)

Ans. **(2)**

Sol. $R-CHO \xrightarrow{2\left[Ag(NH_3)_2\right]^+ OH^{\ominus}} RCOOH + 2Ag + 2NH_3 + H_2O$

$2Ag^+ \xrightarrow{2e^-} 2Ag$

10. A xenon compound 'A' upon partial hydrolysis gives XeO_2F_2. The number of lone pair of electrons presents in compound A is ______. (Round off to the Nearest Integer).

Ans. **(19)**

Sol. Partial Hydro $\begin{cases} XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF \\ XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF \end{cases}$

Complete hydrolysis $\{XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$