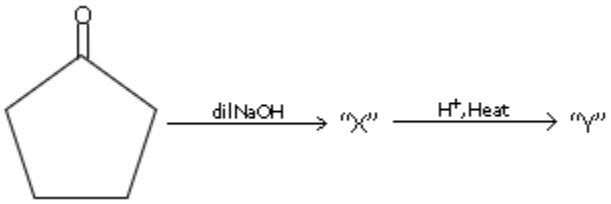
JEE MAIN 18th March Shift-2 2021 (Chemistry)

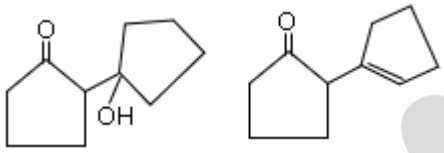
SECTION - A

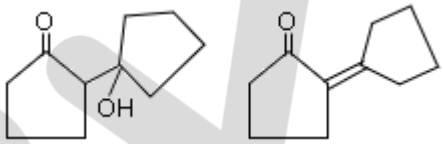
1.

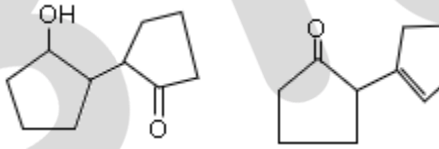


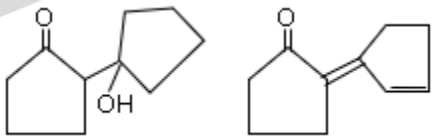
Consider the above reaction, the product 'X' and 'Y' respectively are:

a.

b. 

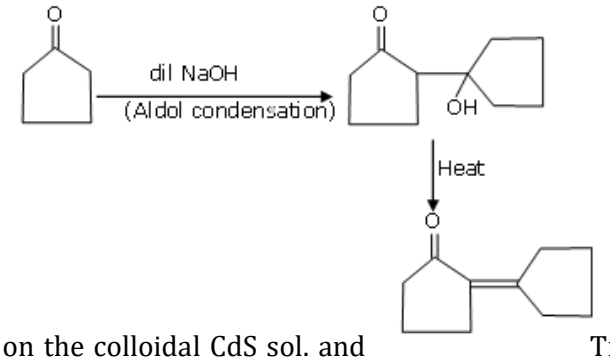
c. 

d. 



Ans: (b)

Solution:



2. The charges on the colloidal CdS sol. and TiO_2 sol. are, respectively:
   a. positive and negative
   b. negative and negative
   c. negative and positive
   d. positive and positive

Ans: (c)

Solution

CdS ® Sulphide sol. ® Negative sol.

TiO_2 ® Oxide sol. ® Positive sol.

3. The oxide that shows magnetic property is:
   a. SiO_2
   b. Na_2O
   c. Mn_3O_4
   d. MgO

Ans: (c)

Solution:

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:

   a. Both statement I and statement II are true.
   b. Statement I is true but statement II is false.
   c. Statement I is false but statement II is true.
   d. Both statement I and statement II are false.

Ans: (c)

Solution:
S-1 → false
S-2 → True
Hence option c is correct.

5. Match List-I with List-II:

List-I	List-II
a. Mercury	(i) Vapour phase refining
b. Copper	(ii) Distillation Refining
c. Silicon	(iii) Electrolytic Refining
d. Nickel	(iv) Zone Refining

Choose the most appropriate answer from the option given below:

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

Ans: (d)
Solution:

a. The pyrometallurgical extraction of mercury from its ore is essentially a distillation process.
b. The purification of metals by electrolysis. It is commonly applied to copper. A large piece of impure copper is used as the anode with a thin strip of pure copper as the cathode
c. Zone Refining. Zone refining is a very useful method to get metals with very high purity such as silicon and germanium. It is also referred to as zone melting, ..
d. Mond's process for extraction of nickel and Van-Arkel Method for preparing ultra pure titanium are based on the principle of vapour phase refining.

6. Match List-I with List-II :

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

Options:

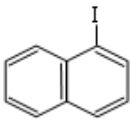
a. (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
b. (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
c. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)
d. (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

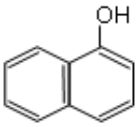
Ans: (4)

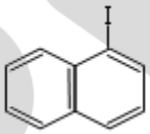
Solution:

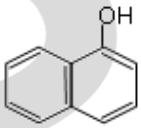
a. Antifertility drug → Norethindrone
b. Antibiotic → Salvarsan
c. Tranquilizer → Meprobamate
d. Artificial sweetener → Alitame

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

e.  and CH_3I

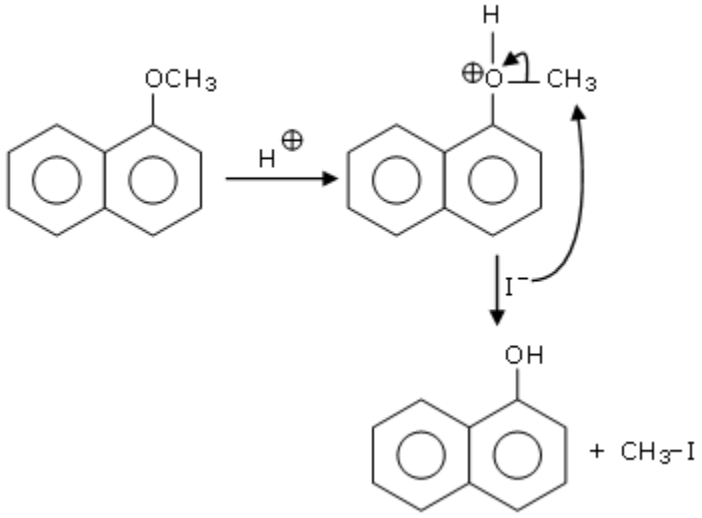
f.  and CH_3OH

g.  and CH_3OH

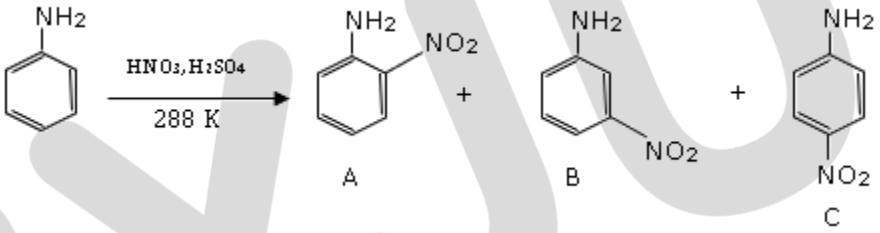
h.  and CH_3I

Ans: (d)

Solution:



8.

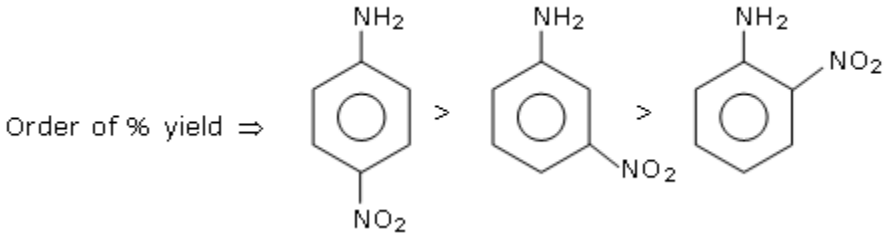


Consider the given reaction, percentage yield of:

a. A > C > B
b. B > C > A
c. C > B > A
d. C > A > B

Ans: (c)

Solution:



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

a. $C_6H_5–N–(CH_3)_2$

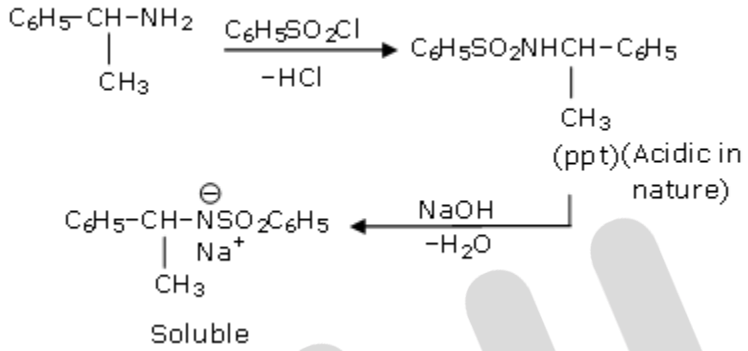
b. $C_6H_5–NHCH_2CH_3$

c. $C_6H_5–\underset{\displaystyle CH_3}{\underset{|}{CH}}–NH_2$

d. $C_6H_5–CH_2\,NH\,CH_3$

Ans: (c)

Solution:



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 :

a. argon, lithium and sodium
b. chlorine, lithium and sodium
c. neon, sodium and chlorine
d. argon, chlorine and sodium

Ans: (d)

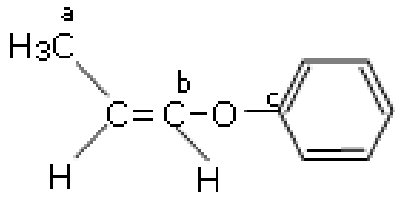
Solution:

Order of I.E.

3rd period → Na < Al < Mg < Si < S < P < Cl < Ar

,

11. In the following molecule:



Hybridisation of Carbon a, b and c respectively are:

a. sp^3, sp^2, sp^2
b. sp^3, sp^2, sp
c. sp^3, sp, sp
d. sp^3, sp, sp^2

Ans: (a)
Solution:
a. $\rightarrow sp^3$
b. $\rightarrow sp^2$
c. $\rightarrow sp^2$

12. In the reaction of hypobromite with amide, the carbonyl carbon is lost as:
    a. HCO_3^-
    b. CO_3^{2-}
    c. CO_2
    d. CO

Ans: (b)
Solution:
CO_3^{2-}

13. The oxidation states of nitrogen in NO, NO_2, N_2O and NO_3^- are in the order of
    a. $NO_2 > NO_3^- > NO > N_2O$
    b. $N_2O > NO_2 > NO > NO_3^-$
    c. $NO_3^- > NO_2 > NO > N_2O$
    d. $NO > NO_2 > NO_3^- > N_2O$

Ans: (c)
Solution:
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 :

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

Ans: (c)

Solution:

Fact (NCERT)

a. Be is used in bearings of motor engine. The higher strength copper beryllium compared to alternative bronze landing gear materials allows the bearings to be made smaller and lighter.
b. When combined with water while burning it releases gas and oxygen. Magnesium is used in either powdered or solid form as an incendiary agent for both illumination and antipersonnel purposes.
c. Pure calcium metal is used as a reducing agent in the preparation of other types of metal, such as thorium and uranium and zirconium.
d. Due to radioactive nature Ra- is used in treatment of cancer.

15. Deficiency of vitamin K causes:

a. Cheilosis
b. Increase in blood clotting time
c. Increase in fragility of RBC's
d. Decrease in blood clotting time

Ans: (b)

Solution:

Deficiency of vitamin "K" causes increase in blood clotting time.

16. Given below are two statements:

Statement I : C_2H_5OH and AgCN both can generate nucleophile.
Statement II : KCN and AgCN both will generate nitrile nucleophile with all reaction condition.
Choose the most appropriate option:

a. Statement I is false but statement II is true.
b. Statement I is true but statement II is false.
c. Both statement I and statement II are false.
d. Both statement I and statement II are true.

Ans: (b)
Solution:
Þ C_2H_5OH & AgCN both can generate nucleophile
Þ 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 :

a. Statement I is false but statement II is true.
b. Statement I is true but statement II is false.
c. Both statement I and statement II are false.
d. Both statement I and statement II are true.

Ans: (b)
Solution:
Fact (NCERT-Based)

Statement II – Bio – degradable detergents does not contain phosphate salts as phosphate salts lead to over enrichment of phosphate causes water bodies choked with algae and other plants **(eutrophication).** So,statement II is false.

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:

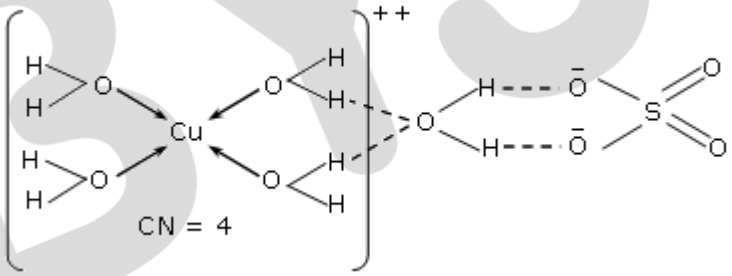
a. Metallic solid
b. Covalent solid
c. Ionic solid
d. Molecular solid

Ans: (2)
Solution:
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.
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:

a. 6 and 4
b. 4 and 1
c. 5 and 1
d. 6 and 5

Ans: (b)
Solution:



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. $PbS \rightarrow PbSO_4$

a. (A), (C) only
b. (A) only
c. (B) only
d. (A), (B) only

Ans: (d)

Solution:

(1) Oxidising action in basic medium

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

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

(2) Reducing action in basic medium

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

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

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

Solution:

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

$S \qquad S$

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

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

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

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

$64 \times 10^{-8} \gg s \times 10^{-2}$

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

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

Solution:

$\lambda_M^\infty(BaCl_2) = 280$

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

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

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

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

$= 860 + 280 - 2 \times 426 = 288$

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 ln2 = 0.69, ln10 = 2.3]

Ans: 10

Solution:

$t_{99.9\%} = ?? = 10 \times t_{(1/2)} = 10$ min

Derivation

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

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

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

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

4. The gas phase reaction

$2A(g) \rightarrow A_2(g)$

at 400 K has $DG^{\circ} = +25.2$ kJ mol^{-1}

The equilibrium contant 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

Solution:

Using formula

$DG^{\circ} = -RT\ln K_P$

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

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

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

$= 5.01 \times 10^{-5} \times 10^{-4}$ Pa^{-1}

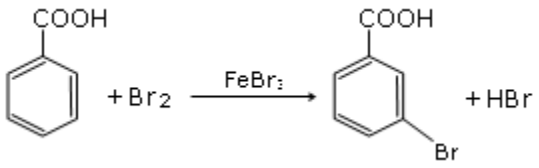
$$= \frac{K_C}{8.3 \times 400}$$

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

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

Ans. 2

5.



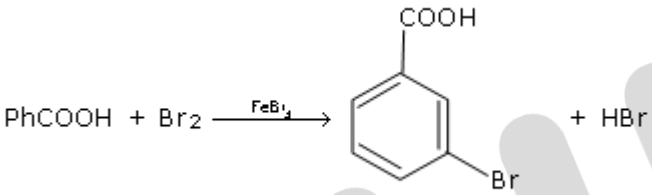
Consider the above reaction where 6.1 g of benzoic acid is used to get 7.8 g of m-bromo benzoic acid. The percentage yield of the product is ____

(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

Solution:



6.1 7.8

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

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

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

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

$$= 77.612\%$$

$$\simeq 78 \text{ Nearest Integer}$$

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

Solution:

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

m = 2; T_b soln. = 100.52

$DT_b = 0.52$

$= i \times K_b \times m$

$0.52 = i \times 0.52 \times 2$

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

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

$a = 1$

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

Solution:

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

Ans: 50

Solution:

$Na_2CO_3 + HCl$ ¾ →

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

Solution:

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

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

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

Solution:

Partial Hydrolysis

$XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

$XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

Complete hydrolysis

$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$