JEE MAIN 2023
Paper with Solution

CHEMISTRY | 31th Jan 2023 _ Shift-2

Umeed **Rank** Ki Ho Ya **Selection** Ki, JEET NISCHIT HAI!

Most Promising **RANKS**
Produced by MOTION Faculties

NEET / AIIMS

- AIR-1 to 10
  25 Times
- AIR-11 to 50
  83 Times
- AIR-51 to 100
  81 Times

JEE MAIN+ADVANCED

- AIR-1 to 10
  8 Times
- AIR-11 to 50
  32 Times
- AIR-51 to 100
  36 Times

Nation's Best **SELECTION**
Percentage (%) Ratio

Student Qualified in NEET

(2022)
4837/5356 = **90.31%**
(2021)
3276/3411 = **93.12%**

Student Qualified in JEE ADVANCED

(2022)
1756/4818 = **36.45%**
(2021)
1256/2994 = **41.95%**

**Student Qualified in JEE MAIN**

(2022)
4818/6653 = **72.41%**
(2021)
2994/4087 = **73.25%**

NITIN VIIJAY (NV Sir)
Founder & CEO

SECTION - A

31. Which one of the following statements is incorrect ?

(1) van Arkel method is used to purify tungsten.

(2) The malleable iron is prepared from cast iron by oxidising impurities in a reverberatory furnace.

(3) Cast iron is obtained by melting pig iron with scrap iron and coke using hot air blast.

(4) Boron and Indium can be purified by zone refining method.

Sol. **1**

Van Arkel method is used for refining of Ti, Zr, Hf, Bi, B

32. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The first ionization enthalpy of 3 d series elements is more than that of group 2 metals

Reason (R) : In 3d series of elements successive filling of d-orbitals takes place.

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

(1) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(2) Both (A) and (R) are true and (R) is the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

Sol. **2**

d-block elements have more first I.E. than group 2 elements due to poor shielding of d-orbitals

33. Given below are two statements :

Statement I : H_2O_2 is used in the synthesis of Cephalosporin

Statement II : H_2O_2 is used for the restoration of aerobic conditions to sewage wastes.

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 incorrect

(2) Statement I is incorrect but Statement II is correct

(3) Statement I is correct but Statement II is incorrect

(4) Both Statement I and Statement II are correct

Sol. **4**

Fact (NCERT based)

34. A hydrocarbon 'X' with formula C_6H_8 uses two moles H_2 on catalytic hydrogenation of its one mole. On ozonolysis, 'X' yields two moles of methane dicarbaldehyde. The hydrocarbon 'X' is :

(1) cyclohexa-1, 4-diene 　　　　(2) cyclohexa - 1, 3 – diene

(3) 1-methylcyclopenta-1, 4-diene 　　(4) hexa-1, 3, 5-triene

Sol. **1**

Methane dicarbaldehyde
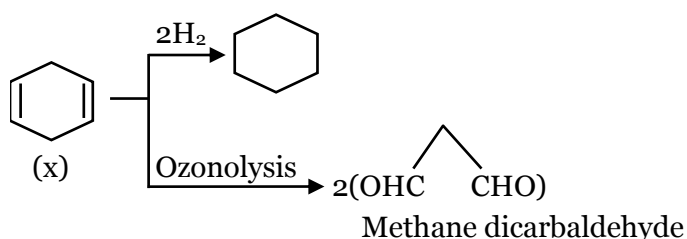
35. Evaluate the following statements for their correctness.

A. The elevation in boiling point temperature of water will be same for 0.1MNaCl and 0.1M urea.

B. Azeotropic mixtures boil without change in their composition.

C. Osmosis always takes place from hypertonic to hypotonic solution.

D. The density of $32\%H_2SO_4$ solution having molarity $4.09M$ is approximately 1.26 g mL^{-1}.

E. A negatively charged sol is obtained when KI solution is added to silver nitrate solution.

Choose the correct answer from the options given below :

(1) A, B and D only   (2) B and D only

(3) B, D and E only   (4) A and C only

Sol. **2**

(A) Value of i is different for both the solutions.

(B) True

(C) Osmosic takes place from hypotonic to hypertonic solution.

(D) $d = \dfrac{100}{\dfrac{1000}{4.09} \times \dfrac{32}{98}} \cong 1.26$ gm/ml

(E) Positively charged sol will be form.

36. The Lewis acid character of boron tri halides follows the order :

(1) $BI_3 > BBr_3 > BCl_3 > BF_3$ (2) $BBr_3 > BI_3 > BCl_3 > BF_3$

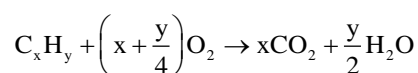(3) $BCl_3 > BF_3 > BBr_3 > BI_3$ (4) $BF_3 > BCl_3 > BBr_3 > BI_3$

Sol. **1**

Due to back bonding Lewis acidic strength of Boron halides is $BI_3 > BBr_3 > BCl_3 > BF_3$

37. When a hydrocarbon A undergoes complete combustion it requires 11 equivalents of oxygen and produces 4 equivalents of water. What is the molecular formula of A ?

(1) C_5H_8 (2) $C_{11}H_4$ (3) C_9H_8 (4) $C_{11}H_8$

Sol. **3**

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

$x + \dfrac{y}{4} = 11$ $\dfrac{y}{2} = 4$

$x = 9$ $y = 8$ (C_9H_8)

38. Arrange the following orbitals in decreasing order of energy.

A. $n = 3, l = 0, m = 0$ B. $n = 4, l = 0, m = 0$

C. $n = 3, l = 1, m = 0$ D. $n = 3, l = 2, m = 1$

The correct option for the order is :

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

Sol. **1**

According to (n+l) rule Orbital has more value of (n+l) has more energy. If value of some then orbital has more value of n has more energy

39. The element playing significant role in neuromuscular function and interneuronal transmission is :

(1) Li   (2) Mg   (3) Be   (4) Ca

Sol. **4**

Fact (NCERT based)

40. Given below are two statements :

Statement I : Upon heating a borax bead dipped in cupric sulphate in a luminous flame, the colour of the bead becomes green

Statement II : The green colour observerd is due to the formation of copper(I) metaborate

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

Sol. **4**

Due to formation of Cu (II) met borate it gives blue colour

41. Which of the following compounds are not used as disinfectants ?

A. Chloroxylenol   B. Bithional   C. Veronal   D. Prontosil

E. Terpineol

Choose the correct answer from the options given below :

(1) C, D   (2) B, D, E   (3) A, B   (4) A, B, E

Sol. **1**

* Vernonal is a tranquilizer

* Prontosil is a antibiotic drug.

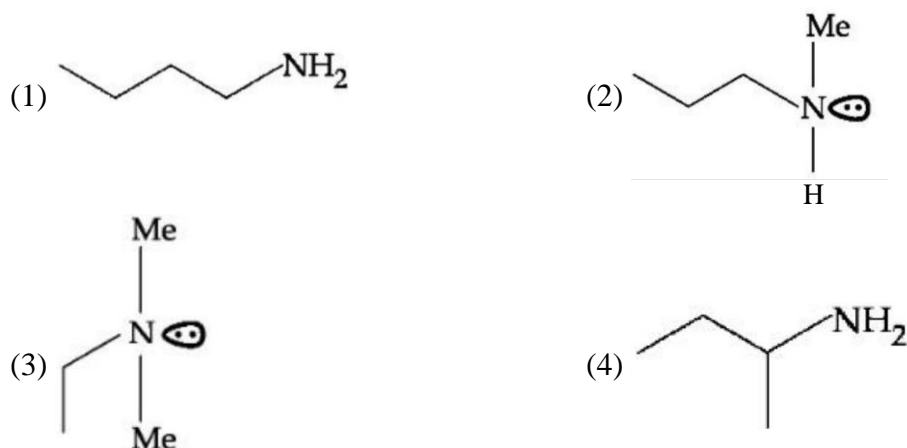**42.** Incorrect statement for the use of indicators in acid-base titration is :

(1) Methyl orange may be used for a weak acid vs weak base titration.

(2) Phenolphthalein is a suitable indicator for a weak acid vs strong base titration.

(3) Methyl orange is a suitable indicator for a strong acid vs weak base titration.

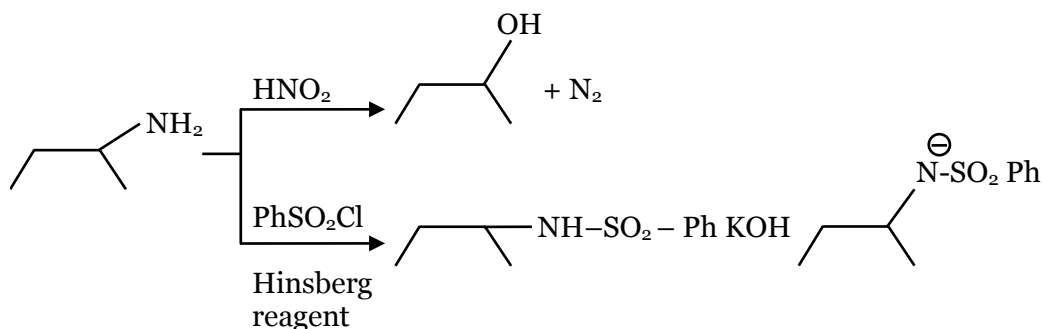(4) Phenolphthalein may be used for a strong acid vs strong base titration.

Sol. **1**

Weak acid – weak base :-

Neither phenolphthalein nor methyl orange is suitable.

43. An organic compound [A]($C_4H_{11}N$), shows optical activity and gives N_2 gas on treatment with HNO_2. The compound [A] reacts with $PhSO_2Cl$ producing a compound which is soluble in KOH.

(1)   [structure: $CH_3CH_2CH_2CH_2-NH_2$]

(2)   [structure: propyl chain with N bearing Me and H, positively charged]

(3)   [structure: N with two Me groups and ethyl, positively charged]

(4)   [structure: branched chain with NH_2]

Sol. **4**

44. The normal rain water is slightly acidic and its pH value is 5.6 because of which one of the following?
(1) $CO_2 + H_2O \rightarrow H_2CO_3$ (2) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$
(3) $4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$ (4) $N_2O_5 + H_2O \rightarrow 2HNO_3$

Sol. **1**

Due to presence of CO_2 in air normal rain water is slightly acidic

45. Match List I with List II

	LIST I		LIST II
A.	Physisorption	I.	Single Layer Adsorption
B.	Chemisorption	II.	$20 - 40 \text{ kJ mol}^{-1}$
C.	$N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2NH_3(g)$	III.	Chromatography
D.	Analytical Application or Adsorption	IV.	Heterogeneous catalysis

Choose the correct answer from the options given below:
(1) A - II, B - I, C - IV, D – III (2) A - IV, B - II, C - III, D – I
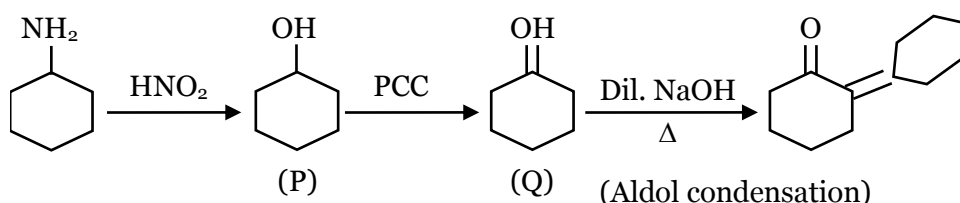(3) A - II, B - III, C - I, D – IV (4) A - III, B - IV, C - I, D – II

Sol. **1**

Theory based

46. Cyclohexylamine when treated with nitrous acid yields (P). On treating (P) with PCC results in (Q). When (Q) is heated with dil. NaOH we get (R) The final product (R) is :
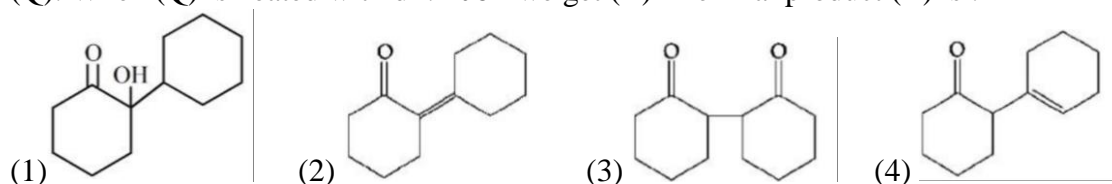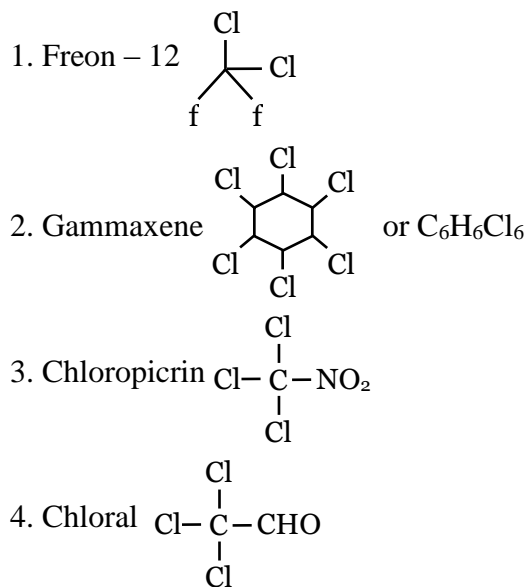

Sol. **2**

47. In the following halogenated organic compounds the one with maximum number of chlorine atoms in its structure is :

(1) Freon-12   (2) Gammaxene   (3) Chloropicrin   (4) Chloral

Sol. **2**

1. Freon – 12

Cl
|
C—Cl
/ \
f   f

2. Gammaxene

Cl, Cl, Cl, Cl, Cl, Cl (hexachlorocyclohexane)   or $C_6H_6Cl_6$

3. Chloropicrin

Cl
|
$Cl—C—NO_2$
|
Cl

4. Chloral

Cl
|
$Cl—C—CHO$
|
Cl

48. In Dumas method for the estimation of N_2, the sample is heated with copper oxide and the gas evolved is passed over :

(1) Copper oxide   (2) Ni   (3) Pd   (4) Copper gauze

Sol. **2**

Duma's method. The nitrogen containing organic compound, when heated with CuO in a atmosphere of CO_2, yields free N_2 in addition to CO_2 and H_2O.

$$C_xH_yN_z + (2x + \frac{y}{2})CuO \rightarrow$$

$$xCO_2 + \frac{y}{2}H_2O + \frac{z}{2}N_2 + (2x + \frac{y}{2})Cu$$
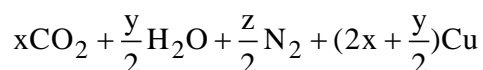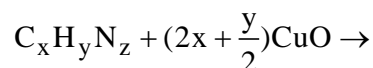
Traces of nitrogen oxides formed, if any, are reduced to nitrogen by passing the gaseous mixture over heated copper gauze.

49. Which of the following elements have half-filled f-orbitals in their ground state ?

(Given : atomic number $Sm = 62; Eu = 63; Tb = 65; Gd = 64, Pm = 61$)

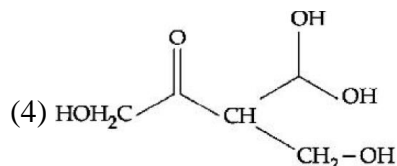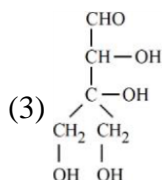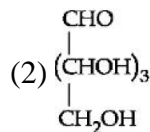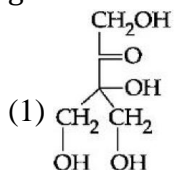A. Sm   B. B. Eu C. Tb   D. Gd   E. Pm

Choose the correct answer from the options given below :

(1) A and B only   (2) A and E only   (3) C and D only   (4) B and D only
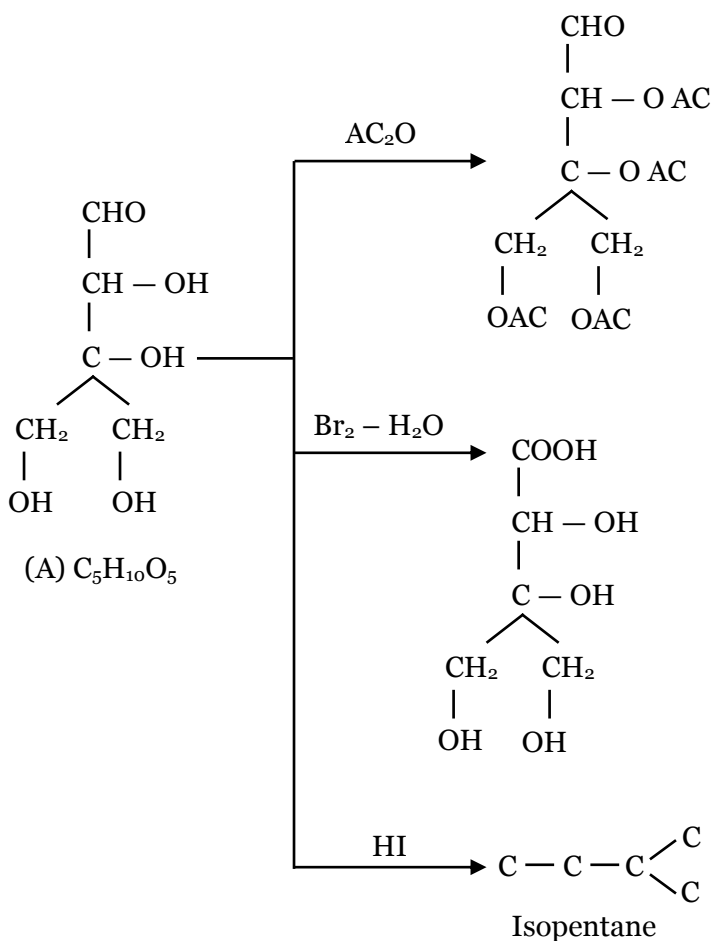
Sol. **4**

Fact (NCERT based)

50. Compound A, $C_5H_{10}O_5$, given a tetraacetate with AC_2O and oxidation of A with $Br_2 - H_2O$ gives an acid, $C_5H_{10}O_6$. Reduction of A with HI gives isopentane. The possible structure of A is :

(1)
$$\begin{array}{c} CH_2OH \\ |\!=\!O \\ -OH \\ CH_2 \quad CH_2 \\ |\qquad| \\ OH \quad OH \end{array}$$

(2)
$$\begin{array}{c} CHO \\ (CHOH)_3 \\ | \\ CH_2OH \end{array}$$

(3)
$$\begin{array}{c} CHO \\ CH-OH \\ C-OH \\ CH_2 \quad CH_2 \\ |\qquad| \\ OH \quad OH \end{array}$$

(4)
$$HOH_2C-C(=O)-CH(CH_2OH)-CH(OH)_2$$

Sol. **3**

CHO | CH—OH | C—OH ; CH₂—OH, CH₂—OH (A) $C_5H_{10}O_5$

AC_2O → tetraacetate

$Br_2 - H_2O$ → acid COOH...

HI → Isopentane

SECTION B

51. The rate constant for a first order reaction is 20 min^{-1}. The time required for the initial concentration of the reactant to reduce to its $\dfrac{1}{32}$ level is _____ 10^{-2} min. (Nearest integer)
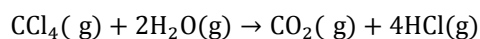
(Given : $\ln 10 = 2.303$
$\log 2 = 0.3010$)

Sol. **17**

$t = \dfrac{1}{20} \ln 32$

$= \dfrac{2.303 \times 5 \times 0.3010}{20} = 17.33 \times 10^{-2}$

$\approx 17 \times 10^{-2}$

52. Enthalpies of formation of $CCl_4(g), H_2O(g), CO_2(g)$ and $HCl(g)$ are $-105, -242, -394$ and -92 kJ mol^{-1} respectively. The magnitude of enthalpy of the reaction given below is ____ $kJmol^{-1}$. (nearest integer)

$$CCl_4(g) + 2H_2O(g) \rightarrow CO_2(g) + 4HCl(g)$$

Sol. **173**

$\Delta H_r = (\Delta H_f)CO_2 + (\Delta H_f)_{HCl} - (\Delta H_f)_{CCl_4} - 2(\Delta H_f)H_2O$

$= -173$

53. A sample of a metal oxide has formula $M_{0.83}O_{1.00}$. The metal M can exist in two oxidation states $+2$ and $+3$. In the sample of $M_{0.83}O_{1.00}$, the percentage of metal ions existing in $+2$ oxidation state is ____ %. (nearest integer)

Sol. **59**

$M^{2+} \rightarrow x \quad M^{3+} \rightarrow (0.83 - x)$

$2x + 3(0.83 - x) = 2$

$x = 2.49 - 2 = 0.49$

% of $M^{2+} = \dfrac{0.49}{0.83} \times 100 = 59\%$

54. The resistivity of a 0.8M solution of an electrolyte is $5 \times 10^{-3} \Omega \text{cm}$. Its molar conductivity is ____ $\times 10^4 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$

(Nearest integer)

Sol. **25**

$K = \dfrac{1}{5 \times 10^{-3}}$

$\wedge_m = K \times \dfrac{1000}{M} = \dfrac{1}{5 \times 10^{-3}} \times \dfrac{1000}{0.8}$

$= \dfrac{1000}{40} \times 10^4 = 25 \times 10^4$

55. At 298 K, the solubility of silver chloride in water is 1.434×10^{-3} g L^{-1}. The value of $-\log K_{sp}$ for silver chloride is (Given mass of Ag is 107.9 g mol^{-1} and mass of Cl is 35.5 g mol^{-1})

Sol. 10

1.434×10^{-3} gm/L

$= \dfrac{1.434 \times 10^{-3}}{107.9 + 35.5} M = 10^{-5}$ m

$Ksp = S^2 = 10^{-10} \Rightarrow -\log Ksp = +10$

56. If the CFSE of $[Ti(H_2O)_6]^{3+}$ is -96.0 kJ/mol, this complex will absorb maximum at wavelength ___ nm. (nearest integer)

Assume Planck's constant (h) $= 6.4 \times 10^{-34}$ Js, Speed of light (c) $= 3.0 \times 10^8$ m/s and Avogadro's Constant (N_A) $= 6 \times 10^{23}$/mol

Sol. **480**

$CFSE = \left(-\dfrac{2}{5} x + \dfrac{3}{5} y \right) \Delta_0$

$-96 = \dfrac{-2}{5} \times 1 \times \Delta_0$

$\Delta_0 = 240\, kJ/mole = \dfrac{240 \times 10^3}{NA/molecule}$

$\Delta_0 = \dfrac{hc}{\lambda abs}$

$\dfrac{240 \times 10^3}{6 \times 10^{23}} = \dfrac{6.4 \times 10^{-34} \times 3 \times 10^8}{\lambda abs}$

$\lambda ab = \dfrac{6.4 \times 3 \times 6 \times 10^{-3}}{240 \times 10^3}$ m
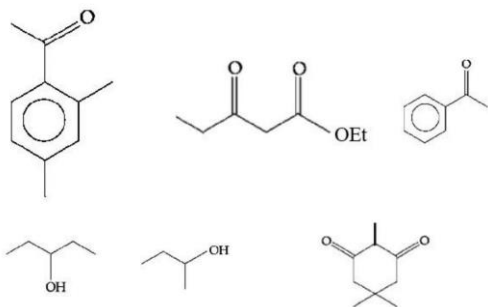
$= 4.8 \times 10^{-7}$ m

$= 4.8 \times 10^{-7} \times 10^9$ nm

$= 480$ nm

57. The number of alkali metal(s), from Li, K, Cs, Rb having ionization enthalpy greater than 400 kJ mol^{-1} and forming stable super oxide is
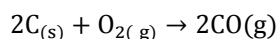
Sol. **2**

K, Rb and Cs form stable super oxides but Cs has ionisation enthalpy less than 400 kJ.

**58.** The number of molecules which gives haloform test among the following molecules is

Sol. 3

59. Assume carbon burns according to following equation :

$$2C_{(s)} + O_{2(g)} \rightarrow 2CO(g)$$

when   12 g carbon is burnt in 48 g of oxygen, the volume of carbon monoxide produced is × 10^{-1} L at STP [nearest integer]

[Given: Assume co as ideal gas, Mass of c is 12 g mol^{-1}, Mass of O is 16 g mol^{-1} and molar volume of an ideal gas STP is 22.7 L mol^{-1}]

Sol. 227

$2C \; + \; O_2 \rightarrow 2CO$
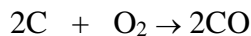
12g   48 gm

1 mole 1.5 mole

"C" is LR.

Moles of CO formed = 1

Volume of CO = 1 × 22.7

$= 227 \times 10^{-1}$ L

60. Amongst the following, the number of species having the linear shape is

$XeF_2, I_3^+, C_3O_2, I_3^-, CO_2, SO_2, BeCl_2$ and $BCl_2^{\ominus}$

Sol. 5

$XeF_2, I_3^-, C_3O_2, CO_2, BeCl_2$