CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

31. Given below are two statements:

    Statement I: Chlorine can easily combine with oxygen to form oxides; and the product has a tendency to explode.

    Statement II: Chemical reactivity of an element can be determined by its reaction with oxygen and halogens.

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

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

    (2) Both the Statements I and II are true

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

    (4) Both the Statements I and II are false

Answer (2)

Sol. • Chlorine can easily combine with oxygen to form oxides, which can explode

  • Chemical reactivity of an element can be determined by its reaction with oxygen and Halogens

32. Which of the following represents the lattice structure of $A_{0.95}O$ containing A^{2+}, A^{3+} and O^{2-} ions?

B.

C.
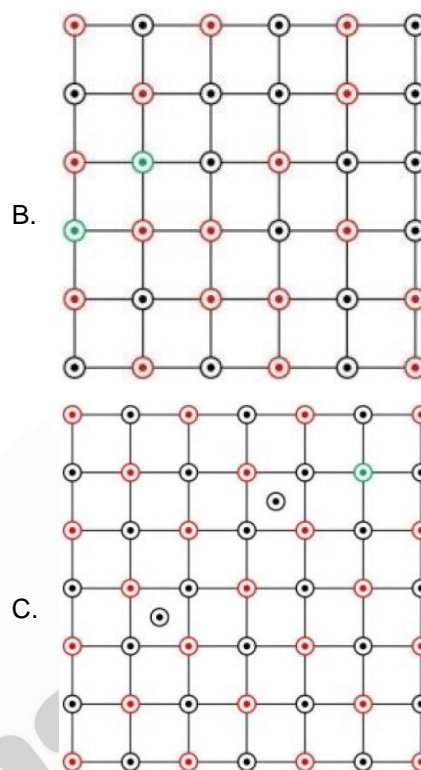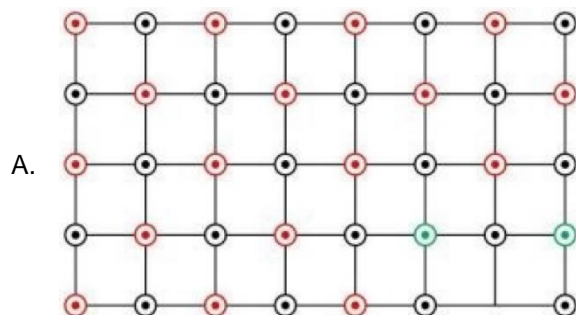
(1) A only (2) A and B only

(3) B only (4) B and C only

Answer (1)

Sol. $A_{0.95}O$

$$\% \text{ of } A^{2+} = \frac{85}{95} \times 100 \approx 90\%$$

$$\% \text{ of } A^{3+} = \frac{10}{95} \times 100 \approx 10\%$$

Option (A) satisfies this condition

33. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

    Assertion A: Hydrogen is an environment friendly fuel.

    Reason R: Atomic number of hydrogen is 1 and it is very light element.

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

    (1) Both **A** and **R** are true and **R** is the correct explanation of **A**
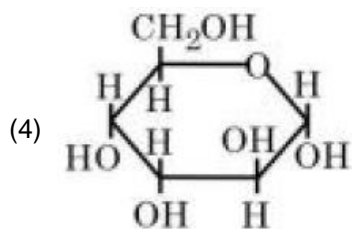
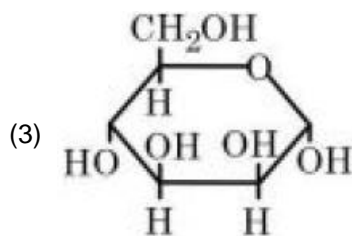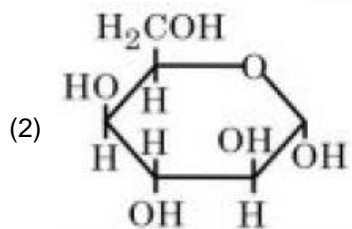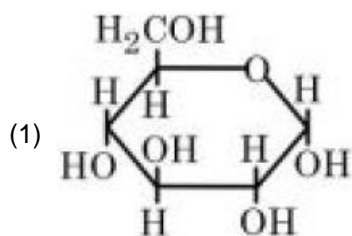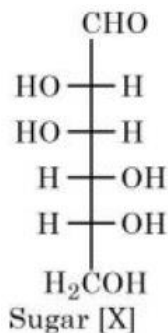   (2) **A** is true but **R** is false

(3) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
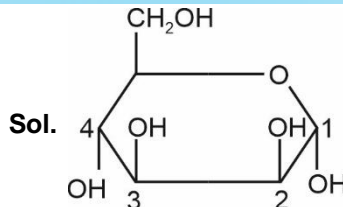
(4) **A** is false but **R** is true

Answer (3)

Sol. Hydrogen is an environment friendly fuel as its combustion produces only water vapours.

34. The correct representation in six membered pyranose form for the following sugar [X] is

Sugar [X]

(1)

(2)

(3)

(4)

Answer (3)

Sol.

C_2 and C_3OH are cis

C_3 and C_4 are anti to each other.

35. Match **List I** with **List II**

	List I		List II
(A)	Tranquilizers	(I)	Anti blood clotting
(B)	Aspirin	(II)	Salvarsan
(C)	Antibiotic	(III)	Antidepressant drugs
(D)	Antiseptic	(IV)	Soframicine

Choose the correct answer from the options given below:

(1) (A) – II, (B) – IV, (C) – I, (D) – III

(2) (A) – II, (B) – I, (C) – III, (D) – IV

(3) (A) – IV, (B) – II, (C) – I, (D) – III

(4) (A) – III, (B) – I, (C) – II, (D) – IV

Answer (4)

Sol. (A) Tranquilizers are antidepressant drugs

(B) Aspirin prevents blood clotting and hence Anti blood clotting

(C) Salvarsan is an antibiotic

(D) Soframicine is antiseptic

36. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A: In an Ellingham diagram, the oxidation of carbon to carbon monoxide shows a negative slope with respect to temperature.

Reason R: CO tends to get decomposed at higher temperature.

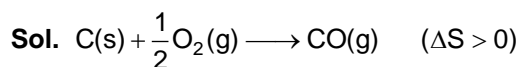In the light of the above statements, choose the **correct** answer from the options given below.

(1) **A** is not correct but **R** is correct

(2) **A** is correct but **R** is not correct

(3) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of A

(4) Both **A** and **R** are correct and **R** is the correct explanation of **A**

Answer (2)

Sol. $C(s) + \dfrac{1}{2}O_2(g) \longrightarrow CO(g)$ $(\Delta S > 0)$

Slope = (–ve)

CO doesn't get decompose at high temperature.

37. Match List I with List II

	List I		List II
	Test		**Functional group/Class of compound**
(A)	Molisch's Test	(I)	Peptide
(B)	Biuret Test	(II)	Carbohydrate
(C)	Carbylamine Test	(III)	Primary amine
(D)	Schiff's Test	(IV)	Aldehyde

Choose the correct answer from the options given below:

(1) A(III), B(IV), C(II), D(I)

(2) A(I), B(II), C(III), D(IV)

(3) A(II), B(I), C(III), D(IV)
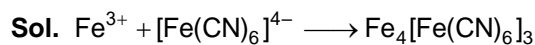
(4) A(III), B(IV), C(I), D(II)

Answer (3)

Sol. (A) Molisch test is for carbohydrates

(B) Biuret test is for proteins/peptide

(C) Carbylamine test is for primary amine

(D) Schiff's test is for aldehyde

38. A solution of $FeCl_3$ when treated with $K_4[Fe(CN)_6]$ gives a prussiun blue precipitate due to the formation of

(1) $Fe_3[Fe(CN)_6]_2$ (2) $Fe_4[Fe(CN)_6]_3$

(3) $Fe[Fe(CN)_6]$ (4) $K[Fe_2(CN)_6]$

Answer (2)

Sol. $Fe^{3+} + [Fe(CN)_6]^{4-} \longrightarrow Fe_4[Fe(CN)_6]_3$

prussian blue

39. Given below are two statements: One is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A: Amongst He, Ne, Ar and Kr; 1g of activated charcoal adsorbs more of Kr.

Reason R: The critical volume V_c (cm^3 mol^{-1}) and critical pressure P_c (atm) is highest for Krypton but the compressibility factor at critical point Z_c is lowest for Krypton.

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) **A** is true but **R** is false

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

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

Answer (2)

Sol. MW order, Kr > Ar > Ne > He

Z (at critical point)

$= \dfrac{3}{8}$

40. Which of the following complex will show largest splitting of d-orbitals?

(1) $[Fe(C_2O_4)_3]^{3-}$ (2) $[FeF_6]^{3-}$

(3) $[Fe(CN)_6]^{3-}$ (4) $[Fe(NH_3)_6]^{3+}$

Answer (3)

Sol. CN^- is strongest field ligand among given ligands.

41. Which of the following are the example of double salt?

(A) $FeSO_4.(NH_4)_2SO_4.6H_2O$

(B) $CuSO_4.4NH_3.H_2O$

(C) $K_2SO_4.Al_2(SO_4)_3.24H_2O$

(D) $Fe(CN)_2.4KCN$

Choose the correct answer

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

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

Answer (2)

Sol. A = $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ –double salt

B. $CuSO_4 \cdot 4NH_3 \cdot H_2O$

$= [Cu(NH_3)_4]SO_4 \cdot H_2O$ –complex salt

C. $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ –double salt

D. $Fe(CN)_2 \cdot 4KCN$

$K_4[Fe(CN)_6]$ –complex salt

42. How can photochemical smog be controlled?

(1) By complete combustion of fuel.

(2) By using catalyst.

(3) By using catalytic convertors in the automobiles/industry.

(4) By using tell chimneys.

Answer (3)

Sol. Photochemical smog is caused by

Nitrogen oxides which can be prevented by using catalytic convertors in the automobiles/industy

43. But-2-yne is reacted separately with one mole of Hydrogen as shown below

$$\underline{B} \xleftarrow[\text{liq NH}_3]{\text{Na}} \underset{+H_2}{CH_3-C\equiv C-CH_3} \xrightarrow[\Delta]{Pd/C} \underline{A}$$
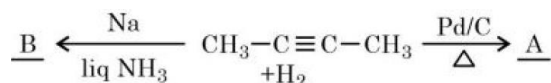
(A) A is more than soluble than B.

(B) The boiling point & melting point of A are higher and lower than B respectively.

(C) A is more polar than B because dipole moment of A is zero.

(D) Br_2 adds easily to B than A.

Identify the incorrect statements from the option given below

(1) A, C & D only

(2) B, C & D only

(3) B and C only

(4) A and B only

Answer (2)

Sol. A: Cis – But-2-ene

B: Trans-But-2-ene

BP: A > B

mp: B > A

μ-order = B > A (μ of A = 0)

Addition of Br_2 is easy in A.

44. Choose the correct statement(s)

(A) Beryllium oxide is purely acidic in nature.

(B) Beryllium carbonate is kept in the atmosphere of CO_2.

(C) Beryllium sulphate is readily soluble in water.

(D) Beryllium shows anomalous behaviour.

Choose the correct answer from the options given below:

(1) A, B & C only

(2) A only

(3) A and B only

(4) B, C and D only

Answer (4)

Sol. • BeO is amphoteric

• $BeCO_3 \rightleftharpoons BeO + CO_2$
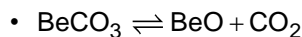
To shift equilibrium in backward direction,

It is kept in atmosphere of CO_2

• $BeSO_4$ is readily soluble in water

• Be shows anomalous behaviour

45. Highest oxidation state of Mn is exhibited in Mn_2O_7. The correct statements about Mn_2O_7 are

(A) Mn is tetrahedrally surrounded by oxygen atoms.

(B) Mn is octahedrally surrounded by oxygen atoms.

(C) Contains Mn-O-Mn bridge.

(D) Contains Mn-Mn bond.

Choose the correct answer from the options below:

(1) A and C only
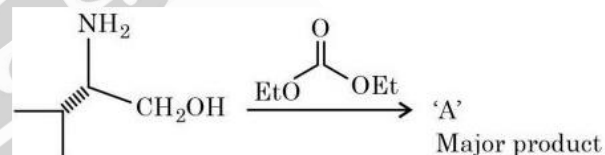
(2) B and C only

(3) A and D only

(4) B and D only

Answer (1)

Sol.
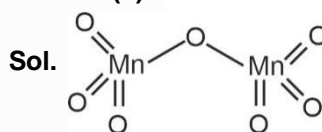
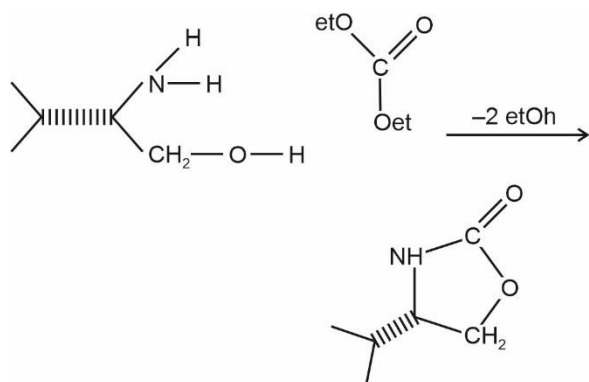Mn is surrounded tetrahedrally by O-atoms. Mn_2O_7, contains Mn-O-Mn Bridge.

46. In the following reaction, 'A' is

Answer (2)

Sol.

47. Match **List-I** with **List-II**

	List-I		List-II
A.	Slaked lime	I.	NaOH
B.	Dead burnt plaster	II.	$Ca(OH)_2$
C.	Caustic soda	III.	$Na_2CO_3.10H_2O$
D.	Washing soda	IV.	$CaSO_4$

Choose the **correct** answer from the options given below.

(1) A – II, B – IV, C – I, D – III

(2) A – III, B – IV, C – II, D – I

(3) A – III, B – II, C – IV, D – I

(4) A – I, B – IV, C – II, D – III

Answer (1)

Sol. A : Slaked lime : $Ca(OH)_2$

B : Dead burnt plaster : $CaSO_4$
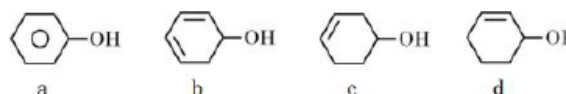
C : Caustic Soda : NaOH

D : Washing Soda : $Na_2CO_3 \cdot 10H_2O$

48. Identify the incorrect option from the following.

(1)

(2)

(3)

(4)

Answer (1)

Sol.

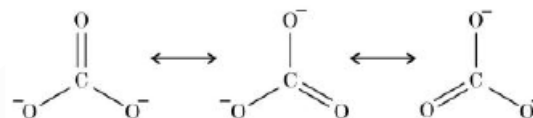49. Decreasing order of dehydration of the following alcohols is

(1) b > a > d > c

(2) a > d > b > c

(3) b > d > c > a

(4) d > b > c > a

Answer (3)

Sol. b > d > c > a

b will form Aromatic Benzene on dehydration

d will form conjugated alkene

a will not undergo dehydration easily

50. Resonance in carbonate ion (CO_3^{2-}) is

Which of the following is true?

(1) CO_3^{2-} has a single structure i.e., resonance hybrid of the above three structures.

(2) It is possible to identify each structure individually by some physical or chemical method.

(3) Each structure exists for equal amount of time.

(4) All these structures are in dynamic equilibrium with each other.

Answer (1)

Sol. Resonating structures are hypothetical and are assumed to explain properties of Real hybrid.

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse andw the on-screen virtual numeric keypad in the place designated to enter the answer.

51. Sum of oxidation states of bromine in bromic acid and perbromic acid is _____.
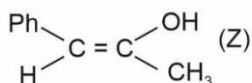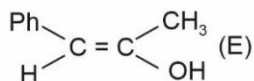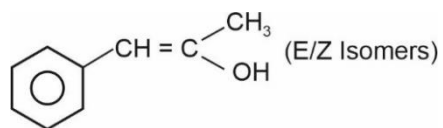
Answer (12)

Sol. Bromic Acid $\left(\underset{+5}{HBrO_3} \right)$

Perbromic Acid $\left(\underset{+7}{HBrO_4} \right)$

52. Number of isomeric compounds with molecular formula $C_9H_{10}O$ which (i) do not dissolve in NaOH (ii) do not dissolve in HCl. (iii) do not give orange precipitate with 2, 4-DNP (iv) on hydrogenation give identical compound with molecular formula $C_9H_{12}O$ is _____.

Answer (2)

Sol. 2 possibilities

53. 25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M $AgNO_3$ solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration? _____ (Nearest integer).

(Given: K_f = 2.0 K kg mol^{-1})

Assume (1) 100% ionization and

(2) Density of the aqueous solution as 1 g mL^{-1}

Answer (3)

Sol. $25 \times M = 20 \times 1$

$M = \dfrac{20}{25} = \dfrac{4}{5} = 0.8$

$\Delta T_f = (i)\,(K_f)\,(m)$

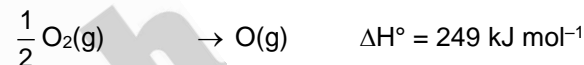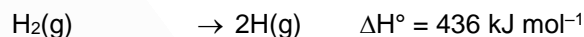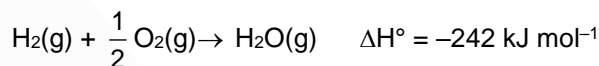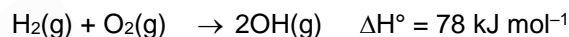$= (2)\,(2)\left(\dfrac{4}{5}\right) = \dfrac{16}{5} = 3.2$

Nearest Integer – 3

54. A and B are two substances undergoing radioactive decay in a container. The half life of A is 15 min and that of B is 5 min. If the initial concentration of B is 4 times that of A and they both start decaying at the same time, how much time will it take for the concentration of both of them to be same? _____ min.
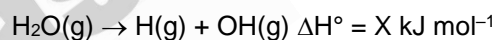
Answer (15)

Sol.

After 15 min, [A] = [B] = $\dfrac{CO}{2}$
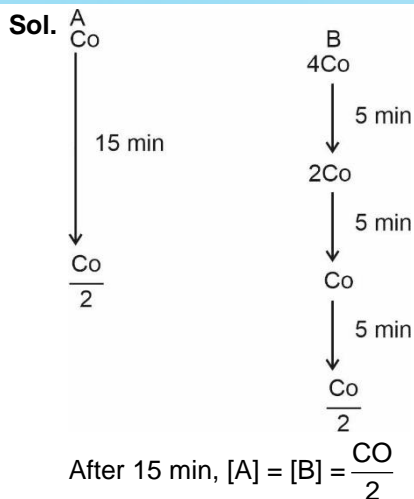
55. At 25°C, the enthalpy of the following processes are given

$H_2(g) + O_2(g) \rightarrow 2OH(g)$ $\Delta H° = 78$ kJ mol^{-1}

$H_2(g) + \dfrac{1}{2} O_2(g) \rightarrow H_2O(g)$ $\Delta H° = -242$ kJ mol^{-1}

$H_2(g) \rightarrow 2H(g)$ $\Delta H° = 436$ kJ mol^{-1}

$\dfrac{1}{2} O_2(g) \rightarrow O(g)$ $\Delta H° = 249$ kJ mol^{-1}

What would be the value of X for the following reaction? _____ (Nearest integer)

$H_2O(g) \rightarrow H(g) + OH(g)$ $\Delta H° = X$ kJ mol^{-1}

Answer (499)

Sol. $\dfrac{(i) + (iii)}{2} - (ii)$ gives desired reaction

$\Delta H_r = \dfrac{436 + 78}{2} - (-242)$

$= \dfrac{436 + 78}{2} + 242 = 499$

56. The density of 3 M solution of NaCl is 1.0 g mL^{-1}. Molality of the solution is _____ $\times\ 10^{-2}$ m. (Nearest integer).

Given : Molar mass of Na and Cl is 23 and 35.5 g mol^{-1} respectively.

Answer (364)

Sol. $m = \dfrac{1000\,M}{1000\,\rho - M.mw} = \dfrac{1000 \times 3}{1000 - 3 \times (58.5)}$

$= \dfrac{3000}{(1000 - 175.5)} = 3.638$

$= 363.8 \times 10^{-2}$

Nearest integer = 364

57. Electrons in a cathode ray tube have been emitted with a velocity of 1000 m s^{-1}. The number of following statements which is/are <u>true</u> about the emitted radiation is _____.

Given : h = 6×10^{-34} J s, m_e = 9×10^{-31} kg.

(A) The deBroglie wavelength of the electron emitted is 666.67 nm.

(B) The characteristic of electrons emitted depend upon the material of the electrodes of the cathode ray tube.

(C) The cathode rays start from cathode and move towards anode.

(D) The nature of the emitted electrons depends on the nature of the gas present in cathode ray tube.

Answer (2)

Sol. ▪ Characteristics of electrons emitted doesn't depend upon material of electrode, nature of gas present.

▪ Cathode rays start from cathode

▪ $\lambda = \dfrac{h}{mv} = \dfrac{6 \times 10^{-34}}{(9 \times 10^{-31})(10^3)} = .666 \times 10^{-6}\,m$
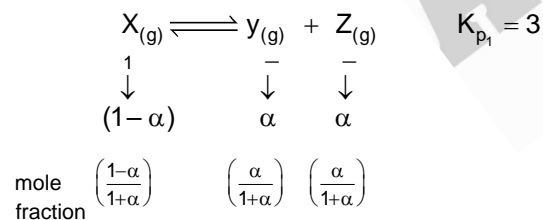
= 666.67 nm

A & C are correct.

58. (i) $X(g) \rightleftharpoons Y(g) + Z(g)$ $\quad K_{p1} = 3$

(ii) $A(g) \rightleftharpoons 2B(g)$ $\qquad K_{p2} = 1$

If the degree of dissociation and initial concentration of both the reactants X(g) and A(g) are equal, then the ratio of the total pressure at equilibrium $\left(\dfrac{p_1}{p_2}\right)$ is equal to x:1. The value of x is _____ (Nearest integer)
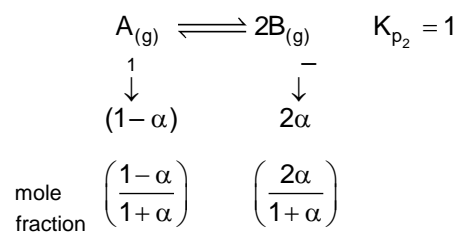
Answer (12)

Sol.

$$X_{(g)} \rightleftharpoons y_{(g)} + Z_{(g)} \qquad K_{P_1} = 3$$

$$\begin{array}{ccc} 1 & - & - \\ \downarrow & \downarrow & \downarrow \\ (1-\alpha) & \alpha & \alpha \end{array}$$

mole fraction $\left(\dfrac{1-\alpha}{1+\alpha}\right)$ $\left(\dfrac{\alpha}{1+\alpha}\right)$ $\left(\dfrac{\alpha}{1+\alpha}\right)$

$$K_{P_1} = 3 = \dfrac{\alpha}{(1+\alpha)} \dfrac{\alpha}{(1+\alpha)} \dfrac{(1+\alpha)}{(1-\alpha)}(p_1)^1$$

$$3 = \dfrac{\alpha^2}{1-\alpha^2} \cdot p_1$$

$$A_{(g)} \rightleftharpoons 2B_{(g)} \qquad K_{P_2} = 1$$

$$\begin{array}{cc} 1 & - \\ \downarrow & \downarrow \\ (1-\alpha) & 2\alpha \end{array}$$

mole fraction $\left(\dfrac{1-\alpha}{1+\alpha}\right)$ $\left(\dfrac{2\alpha}{1+\alpha}\right)$

$$1 = \dfrac{4\alpha^2}{(1+\alpha)^2} \dfrac{(1+\alpha)}{(1-\alpha)} \cdot p_2$$

$$1 = \dfrac{4\alpha^2}{1-\alpha^2} \cdot p_2$$

$$\dfrac{Kp_1}{Kp_2} = \dfrac{3}{1} = \dfrac{p_1}{4p_2}$$

$$\Rightarrow \dfrac{p_1}{p_2} = 12$$

59. At what pH, given half cell $MnO_4^- (0.1\ M)\ |\ Mn^{2+}$ (0.001 M) will have electrode potential of 1.282 V? _____ (Nearest Integer)

Given $E^\circ_{MnO_4^-|Mn^{2+}} = 1.54V$, $\dfrac{2.303RT}{F} = 0.059V$

Answer (3)

Sol. $5e^- + 8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$

$$\qquad\qquad\qquad 10^{-1} \qquad 10^{-3}$$
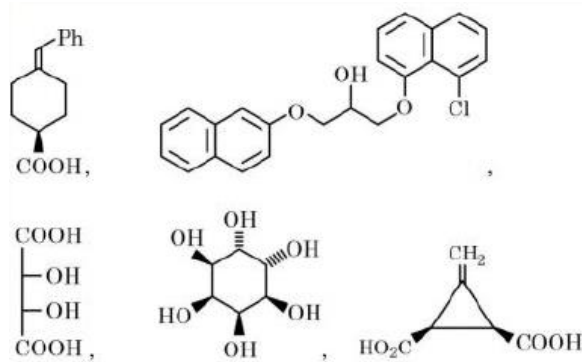
$$1.282 = 1.54 - \dfrac{.059}{5} \log \dfrac{10^{-3}}{10^{-1}(H^+)^8}$$

$$-.258 = \dfrac{-.059}{5}(-2 + 8\,pH)$$

$$21.8644 = (-2 + 8\,pH)$$

$$23.8644 = 8\,pH$$

$$pH = 2.98 \approx 3$$

60. The total number of chiral compound/s from the following is _____.

Answer (2)

Sol. Compound I – achiral

Compound II – chiral

Compound III – achiral

Compound IV – chiral

Compound V – achiral