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**DATE:** 10-12-2020

**TIME:** 60mins

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**1 In which of the following crystals alternate tetrahedral voids are occupied ?**

**Correct Options:**

**(B)** ZnS

**Solution:**

In ZnS structure, sulphide ions, occupy all fcc lattice points while  $Zn^{+2}$  ions are present in alternate tetrahedral voids.

**2 The radius of  $Ag^+$  ion is 126 pm while that of  $I^-$  ion is 216 pm. The co-ordination number of Ag in AgI is -**

**Correct Options:**

**(C)** 6

**Solution:**

$$\frac{r_{Ag^+}}{r_{I^-}} = \frac{126}{216} = 0.58$$

This ratio lies between 0.414 - 0.732.

So coordination number 6.

**3 CsBr has bcc structure with edge length 4.3. The shortest interionic distance in between  $Cs^+$  and  $Br^-$  is -**

**Correct Options:**

**(A)** 3.72

**Solution:**

For bcc structure,

$$\text{Atomic radius, } r = \frac{\sqrt{3}}{4} a = \frac{\sqrt{3}}{4} \times 4.3 = 1.86$$

we know that,  $r$  = half the distance between two nearest neighbouring atoms.

$$\therefore \text{shortest interionic distance} = 2 \times 1.86 = 3.72$$

**4 Frenkel defect appears in -**

**Correct Options:**

**(D)** All

**Solution:**

Frenkel defects are common in ionic compound which have low co-ordination number and in which there is large difference in size between positive and negative ions.

i.e. ZnS, AgCl, AgBr and AgI.

**5 First three nearest neighbour distances for body centered cubic lattice are respectively.**

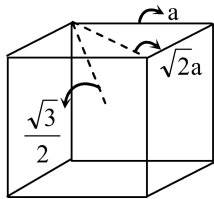
**Correct Options:**

(C)

$$\frac{\sqrt{3}a}{2}, a, \sqrt{2}a$$

Solution:

$$\frac{\sqrt{3}a}{2}, a, \sqrt{2}a$$



6 **MgAl<sub>2</sub>O<sub>4</sub>**, is found in the Spinel structure in which O<sup>2-</sup> ions constitute CCP lattice, Mg<sup>2+</sup> ions occupy 1/8th of the Tetrahedral voids and Al<sup>3+</sup> ions occupy 1/2 of the Octahedral voids. Find the total +ve charge contained in one unit cell.

Correct Options:

(D) +8 electronic charge

Solution:

$$\begin{aligned} \text{Total positive charge} &= \text{Charge on Mg}^{2+} + \text{Charge on Al}^{3+} \\ &= 1/8 \times 8 \times 2 + 1/2 \times 4 \times 3 = 8 \text{ electronic charge.} \end{aligned}$$

7 Which of the following is/are pseudo solids ? I. KClIII. Barium chloride dihydrate III. Rubber IV. Solid cake left after distillation of coal tar

Correct Options:

(C) III, IV

Solution:

Rubber & solid cake has high randomness.

8 NiO adopts a rock-salt structure. The coordination number of the Ni<sup>2+</sup> ion is -

Correct Options:

(D) Six

Solution:

NiO has cubic structure, so Ni<sup>+2</sup> has 6 coordination number.

9 The spinel structure (AB<sub>2</sub>O<sub>4</sub>) consists of an fcc array of O<sup>2-</sup> ions in which the -

Correct Options:

(A)

A cation occupies one-eighth of the tetrahedral holes and B cation occupies one-half of octahedral holes

Solution:

$$\text{O}^{2-} \text{ per unit cell} = 4$$

$$\therefore A = 1 = 8 \times \frac{1}{8}$$

$$B = 2 = 4 \times \frac{1}{2}$$

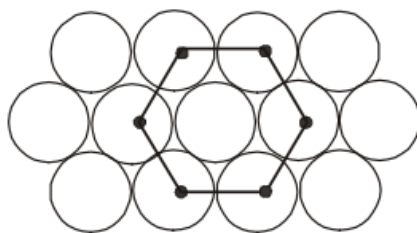
10 The number of nearest neighbours to each sphere in hexagonal close packing pattern in its own layer will be:

Correct Options:

(B) 6

Solution:

Number of nearest neighbours in hcp pattern in its own layer = 6.



11 Copper crystallises in fcc lattice with a unit cell edge of 361 pm. The radius of copper atom is:

Correct Options:

(B) 128 pm

Solution:

FCC lattice

$$a = 361 \text{ pm}$$

$$a\sqrt{2} = 4r$$

$$r = \frac{361 \times \sqrt{2}}{4} = 127.6 \approx 128 \text{ pm.}$$

12 If the anions (A) form hexagonal closest packing and cations (C) occupy only 2/3 octahedral voids in it, then the general formula of the compound is

Correct Options:

(C)  $C_2A_3$

Solution:

No. of A atoms = 6.

$$\text{No. of C atoms} = 6 \times \frac{2}{3} = 4.$$

$$\therefore \text{Formula} = C_4A_6 \text{ or } C_2A_3.$$

13 Statement-1 : In HCP structure the contribution of hexagonal face corner per atom is 1/12.  
Statement-2 : It is shared by 6 different unit cell.

Correct Options:

(D)

Statement-1 is False, Statement-2 is True.

Solution:

In HCP structure corner atom contribution is  $\left(\frac{1}{6}\right)$ .

14 Diethyl amine and methyl propyl amine express which type of Isomers

Correct Options:

(C) Metamers

Solution:

Metamers

15 What characteristic is the best common to both cis-2-butene and trans-2-butene?

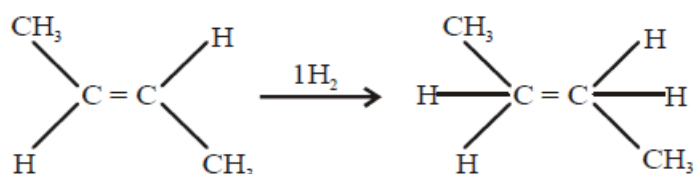
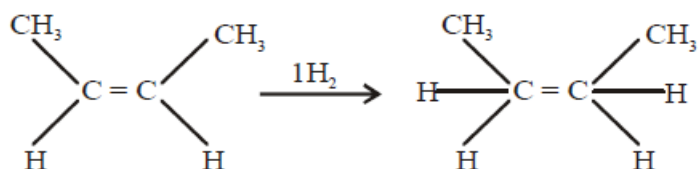
Correct Options:

(D) Product of hydrogenation

Solution:

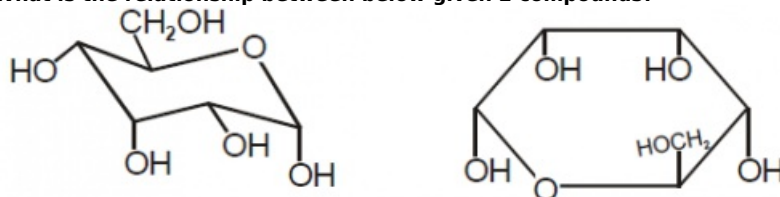
Both will give n-Butane as a product.  
Boiling point cis-2-butene > Trans 2-butene  
Dipole moment cis-2-butene > Trans 2-butene  
Heat of Hydrogenation cis-2-butene > Trans 2-butene

Product same.



Same compounds

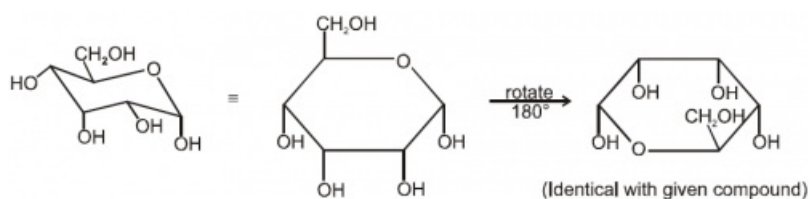
16 What is the relationship between below given 2 compounds?



Correct Options:

(D) Identical

Solution:

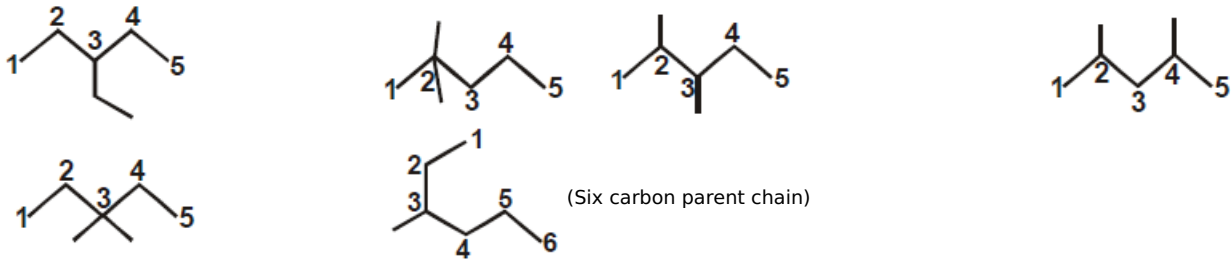


17 How many different structural isomers of molecular formula  $C_7H_{16}$  are possible, which contains five membered Parent Chain ?

Correct Options:

(B) 5

Solution:



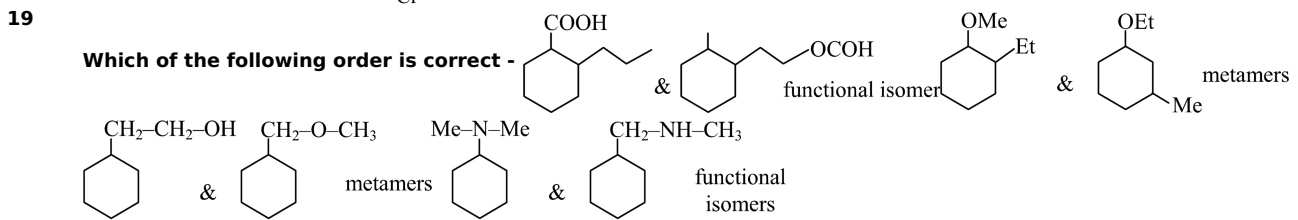
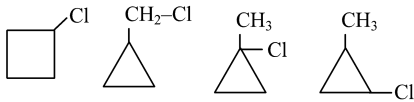
Thus, 5 structures are possible.

**18 How many cyclic structural isomers of  $C_4H_7Cl$  is possible -**

**Correct Options:**

**(A) 4**

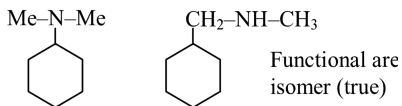
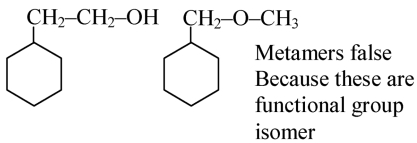
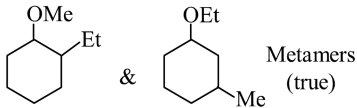
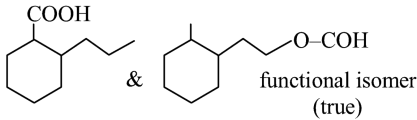
**Solution:**



**Correct Options:**

**(C) TTFT**

**Solution:**

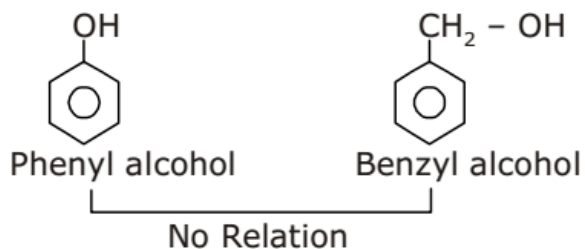


**20 Phenol and benzyl alcohol are**

**Correct Options:**

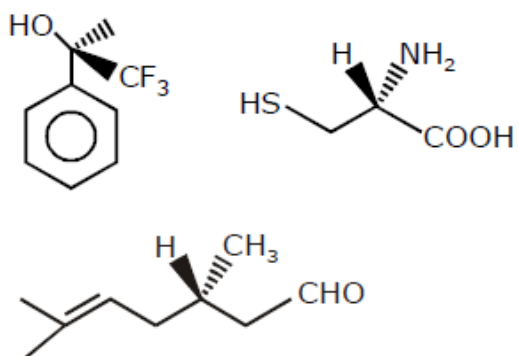
**(D) none of these**

**Solution:**



21

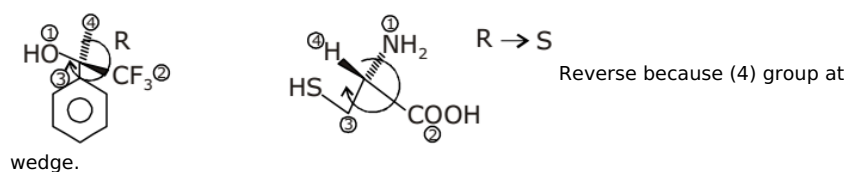
The R/S configuration of these compounds are respectively.



Correct Options:

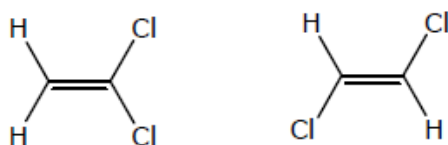
(C) R, S, S

Solution:



22

The above compounds differ in

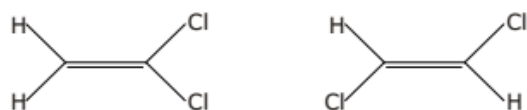
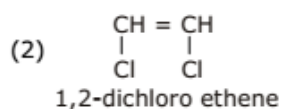
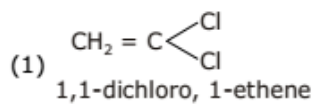


Correct Options:

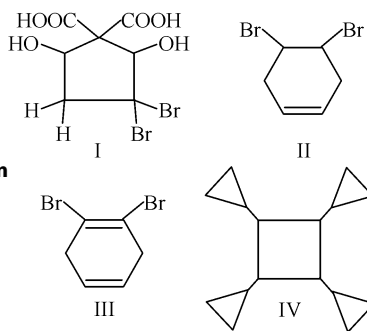
(C) structure

Solution:

The above compounds are different in structure.



23



Which will show geometrical isomerism

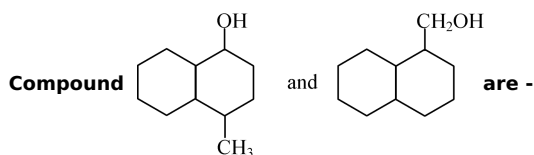
Correct Options:

(D) I, II, IV

Solution:

I, II, IV fulfill condition of geometric isomerism

24



Correct Options:

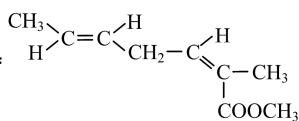
(A) Functional isomers

Solution:

Phenol & Alcohol are functional group isomer

25

The correct stereochemical name of

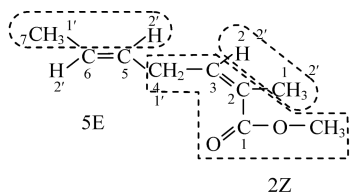


Correct Options:

(D) Methyl 2-methylhepta (2Z, 5E) dienoate

Solution:

Methyl-2-methyl-hepta (2Z-5E) dienoate

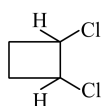
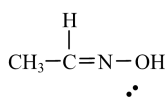


26 Which will form geometrical isomers -

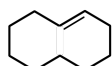
Correct Options:

(D) All

Solution:

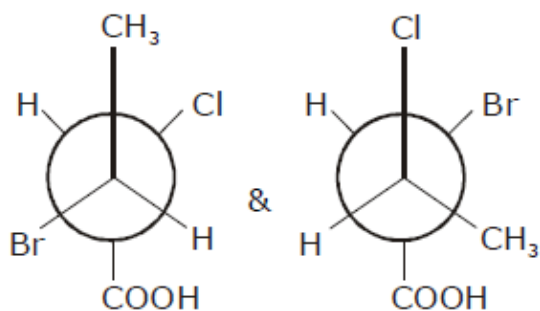


Cyclo alkane  
So, restricted rotation



Only more than eight carbon cycloalkene show, geometrical isomerism. All of these show, geometrical isomerism.

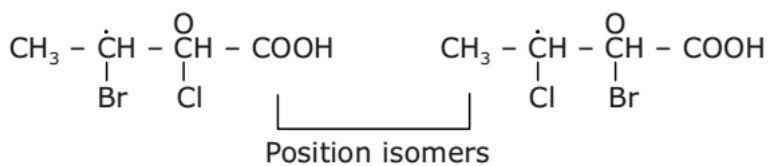
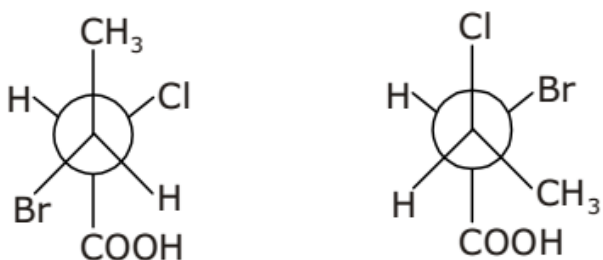
27



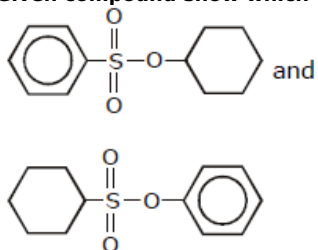
Correct Options:

(D) Position isomers

Solution:



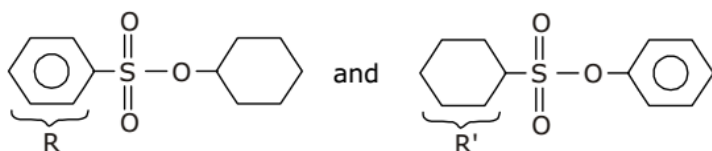
28 Given compound show which type of isomerism?



Correct Options:

(C) Metamerism

Solution:



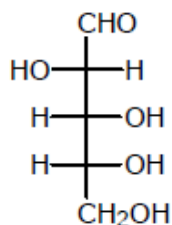
R & R' are different so show Metamerism.

29 Which of the following sugars has the configuration (2S 3R, 4R) ?

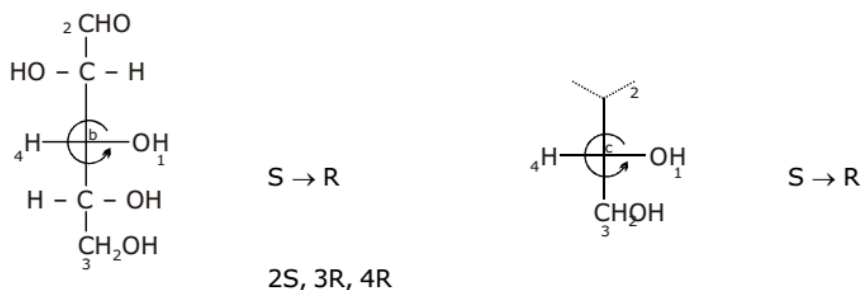
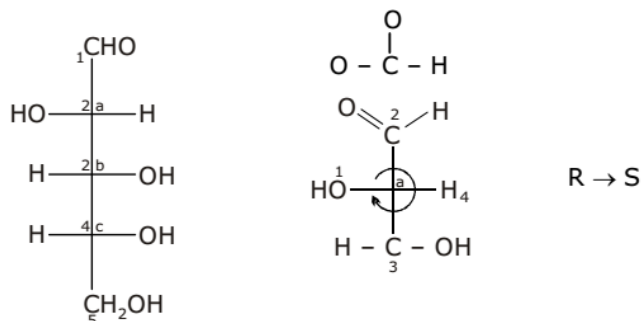
Correct Options:



(C)

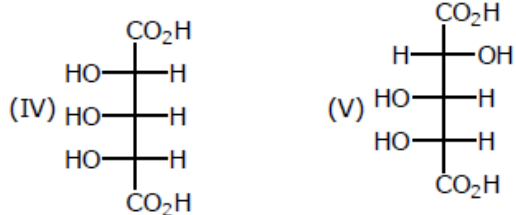
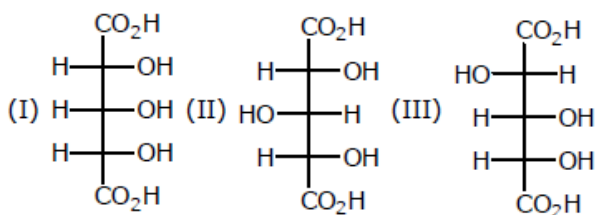


Solution:



30

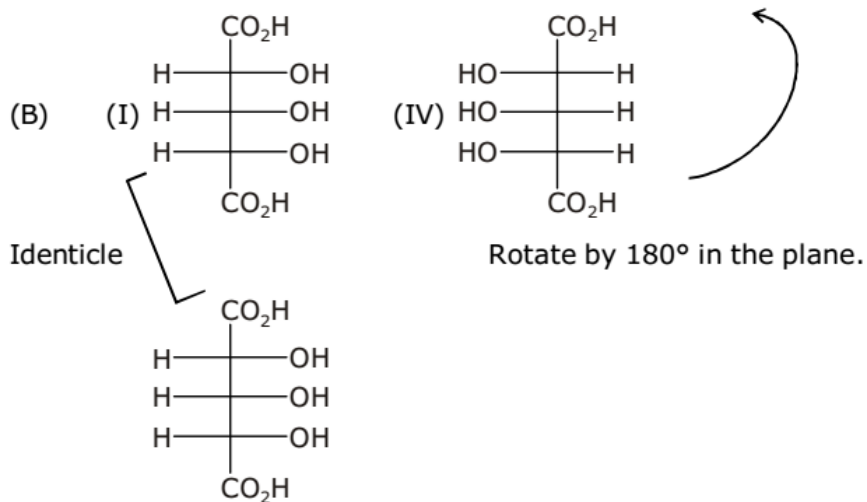
Which of the above formula represent identical compounds ?



Correct Options:

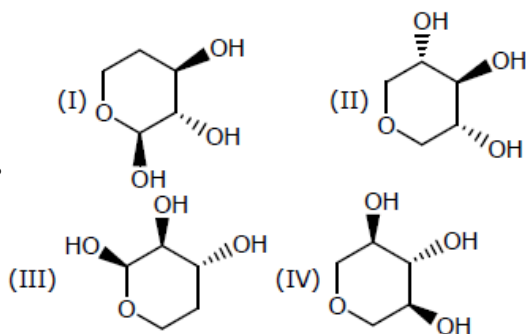
(B) I and IV

Solution:



31

Which two of the following compounds are identical ?

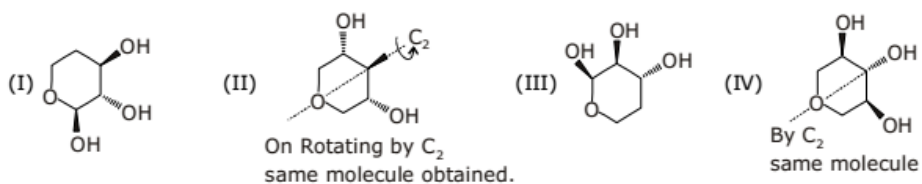


Correct Options:

(B) II & IV

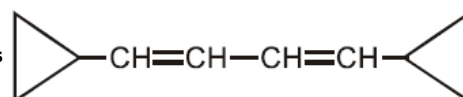
Solution:

Identical compounds are = II & IV



32

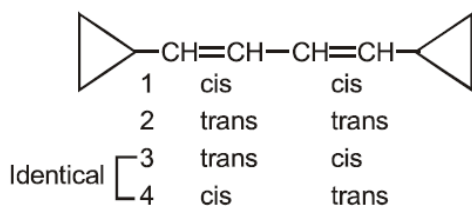
The total number of geometrical isomers possible in following compound is



Correct Options:

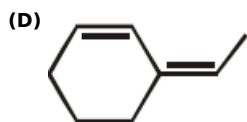
(C) 3

Solution:

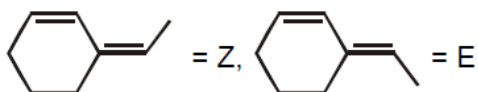


33 The compound which can show geometrical isomerism is

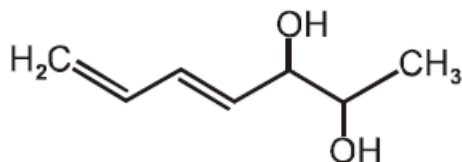
Correct Options:



Solution:



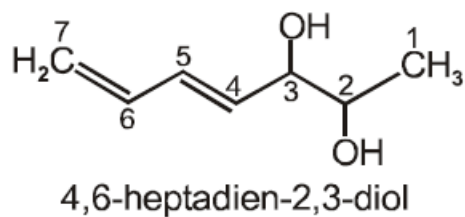
34 What is the IUPAC name of the molecule shown ?



Correct Options:

(D) 4,6-heptadien-2,3-diol

Solution:



35 For the reaction  $\text{CO} + \frac{1}{2} \text{O}_2 \longrightarrow \text{CO}_2$ , the value of  $\frac{K_P}{K_C}$  is -

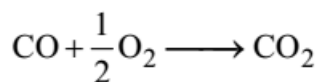
Correct Options:

(C)  $\frac{1}{\sqrt{RT}}$

Solution:

We know that,  $K_p = K_c(RT)^{\Delta n}$  [ $\because \Delta n = n_p - n_R$ ]

From the reaction,



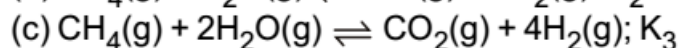
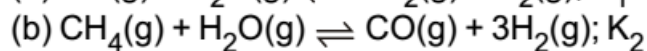
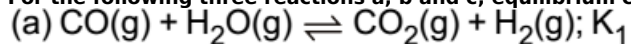
$$n_R = 1 + \frac{1}{2} = 1\frac{1}{2} \quad n_P = 1$$

$$\Delta n = 1 - 1\frac{1}{2} = -\frac{1}{2}$$

$$K_P = K_C \cdot (RT)^{-1/2} = \frac{K_C}{(RT)^{1/2}} = \frac{K_C}{\sqrt{RT}}$$

$$\frac{K_P}{K_C} = \frac{1}{\sqrt{RT}}$$

36 For the following three reactions a, b and c, equilibrium constants are given -



Which of the following relations is correct ?

Correct Options:

(B)  $K_3 = K_1 K_2$

Solution:

From the equation,

$$K_1 = \frac{[\text{CO}_2][\text{H}_2]}{[\text{CO}][\text{H}_2\text{O}]}, \quad K_2 = \frac{[\text{CO}][\text{H}_2]^3}{[\text{CH}_4][\text{H}_2\text{O}]}$$

$$K_3 = \frac{[\text{CO}_2][\text{H}_2]^4}{[\text{CH}_4][\text{H}_2\text{O}]^2}$$

On multiplying  $K_1$  and  $K_2$

$$\begin{aligned} K_1 \cdot K_2 &= \frac{[\text{CO}_2][\text{H}_2]}{[\text{CO}][\text{H}_2\text{O}]} \cdot \frac{[\text{CO}][\text{H}_2]^3}{[\text{CH}_4][\text{H}_2\text{O}]} \\ &= \frac{[\text{CO}_2][\text{H}_2]^4}{[\text{CH}_4][\text{H}_2\text{O}]^2} = K_3 \end{aligned}$$

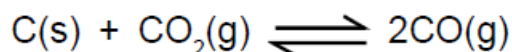
i.e.,  $K_3 = K_1 \cdot K_2$

37 In the reaction  $\text{C(s)} + \text{CO}_2\text{(g)} \rightleftharpoons 2\text{CO(g)}$ , the equilibrium pressure is 12 atm. If 50% of  $\text{CO}_2$  reacts then  $K_p$  will be

Correct Options:

(B) 16 atm

Solution:



$$P - P/2 \quad P = \frac{3P}{2} = 12$$

$$\text{so } K_P = \frac{P^2}{(P/2)} = 2P = 2 \times 8 = 16 \text{ atm.}$$

- 38** If it is found that the equilibrium constant increases by factor of four when the temperature is increased from 25°C to 40°C. The value of  $\Delta H^\circ$  is

Correct Options:

(D) 71.65 kJ

Solution:

$$\ln \left( \frac{K_{P_2}}{K_{P_1}} \right) = \frac{\Delta H^\circ}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$$

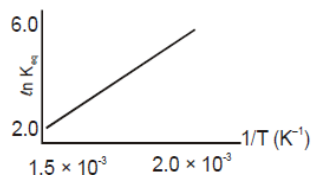
As we know

$$\ln 4 = \frac{\Delta H^\circ}{8.314} \left( \frac{1}{298} - \frac{1}{313} \right)$$

$$\Delta H^\circ = 71.6 \text{ kJ}$$

- 39** A schematic plot of  $\ln K_{eq}$  versus inverse of

temperature for a reaction is shown below

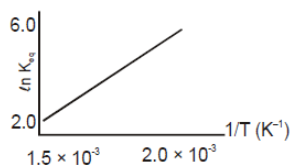


The reaction must be

Correct Options:

(B) exothermic

Solution:



$\ln K_{eq}$  Vs  $1/T$

$$\text{Now, } \ln K_{eq} = \frac{-\Delta H}{RT}$$

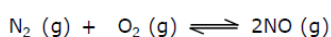
= slope > 0

$\therefore \Delta H < 0$  exothermic reaction

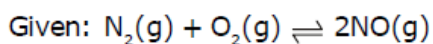
- 40** Which of the following equilibria is not affected by change in volume of the flask -

Correct Options:

(C)



Solution:



$$\Delta n_g = 2 - 2 = 0$$

So, there is no effect of change in volume

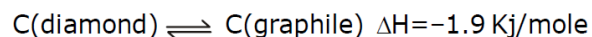
- 41 Densities of diamond and graphite are 3.5 and 2.3 gm/mL. respectively and for  $C(\text{diamond}) \rightleftharpoons C(\text{graphite}) \Delta H = -1.9 \text{ kJ/mole}$  favourable conditions for formation of diamond are**

**Correct Options:**

- (C)**  
high pressure and high temperature

**Solution:**

It is exothermic reaction  
so it favours low temperature  
density of graphite is less than diamond  
--> low pressure.  
but for formation of diamond Reverse  
condition high temperature & high pressure

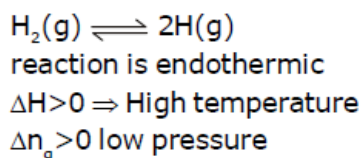


- 42 Under what conditions of temperature and pressure, the formation of atomic hydrogen from molecular hydrogen will be favoured most ?**

**Correct Options:**

- (C)**  
High temperature and low pressure

**Solution:**



- 43 If pressure is applied to the liquid vapour equilibria liquid  $\rightleftharpoons$  vapour the boiling point of the liquid**

**Correct Options:**

- (B)** will increase

**Solution:**

conceptual

- 44 A reversible chemical reaction having two reactants is in equilibrium. If the concentrations of the reactants are doubled then the equilibrium constant will:**

**Correct Options:**

- (D)** Remain the same

**Solution:**

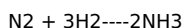
eq const depend on temp only

- 45 A one litre vessel initially contains 2.0, 0.5 and 0.0 moles of  $N_2$ ,  $H_2$  and  $NH_3$  respectively. The system after attaining equilibrium has 0.2 mole of  $NH_3$ . The number of moles of  $N_2$  in the vessel at equilibrium is**

**Correct Options:**

- (A)** 1.9

**Solution:**



2    0.5    -

2-0.1    0.5-0.3    0.2