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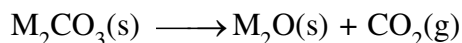


## 1. MOLE CONCEPT

1. A quantity of hydrogen gas occupies a volume of 30.0 mL at a certain temperature and pressure. What volume would half this mass of hydrogen occupy at triple the absolute temperature if the pressure were one-ninth that of the original gas?

(1) 270 mL (2) 90 mL (3) 405 mL (4) 135 mL

2. A metal carbonate decomposes according to following reaction



Percentage loss in mass on complete decomposition of  $M_2CO_3(s)$

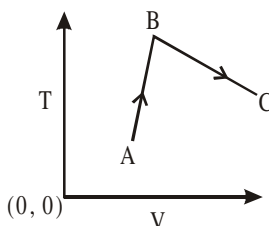
(Atomic mass of M = 102)

(1)  $\frac{100}{3}\%$  (2)  $\frac{50}{3}\%$  (3)  $\frac{25}{3}\%$  (4) 15%

3. How many litres of oxygen at 1atm & 273K will be required to burn completely 2.2 g of propane ( $C_3H_8$ )

(1) 11.2 L (2) 22.4 L (3) 5.6 L (4) 44.8 L

4. In the given isobaric process shown by graph between T & V.



- (1) Moles decreases throughout  
(2) Moles first increases then decreases  
(3) Moles first decreases then increases  
(4) Moles cannot be predicted from given data

5. 0.8 M  $FeSO_4$  solution requires 160ml, 0.2M  $Al_2(Cr_2O_7)_3$  in acidic medium, Calculate volume of  $FeSO_4$  consumed -

(1) 480 ml (2) 240 ml (3) 720 ml (4) 40 ml

6. If a pure compound is composed of  $X_2Y_3$  molecules and consists of 60 % X by weight what is the atomic weight of Y in term of atomic weight of X (Atomic mass of X =  $M_x$ ) ?

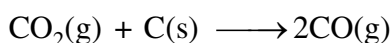
(1)  $\frac{9}{4} M_x$  (2)  $\frac{4}{9} M_x$  (3)  $\frac{2}{3} M_x$  (4)  $\frac{3}{2} M_x$

7. 10 mole of  $A_2B_3$  contains 100gm of A atom & 60 gm of B atoms. Choose the correct statements -

- (A) Molecular weight of  $A_2B_3$  is equal to 16  
(B) Atomic weight of A is equal to 5  
(C) Weight of one atom of B is equal to 2  
(D) Atomic weight of B is equal to 6

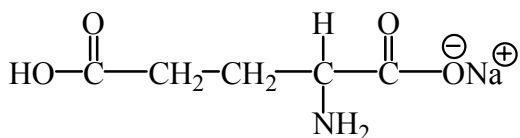
(1) A, B, C (2) A, B (3) C, D (4) A, B, D

8. Select the incorrect statement(s)
- (A) During a reaction, moles and mass of atoms remain constant
- (B) For reaction  $2A + 3B \longrightarrow C + 3D$ , for maximum product formation per gram of reactant mixture, mass ratio of A & B must be 2 : 3
- (C) Both molarity and mole fraction are temperature dependent
- (D) 22.7 litre of water at S.T.P. conditions contains  $6 \times 10^{24}$  protons.
- (1) A, B, C                      (2) B, C, D                      (3) A, C, D                      (4) A, B
9. A 150 ml mixture of CO and CO<sub>2</sub> is passed through a tube containing excess of red hot charcoal. The volume becomes 200 ml due to reaction.



Select the correct statement(s).

- (A) mole percent of CO<sub>2</sub> in the original mixture is 50
- (B) mole fraction of CO in the original mixture is 0.66
- (C) the original mixture contains 50 ml of CO<sub>2</sub>
- (D) the original mixture contains 50 ml of CO.
- (1) A, B                      (2) B, D                      (3) A, C                      (4) B, C
10. Monosodium glutamate (MSG) is salt of one of the most abundant naturally occurring non-essential amino acid which is commonly used in food products like in "MAGGI" having structural formula as



Mass % of Na in MSG is-

- (1) 14.8                      (2) 15.1                      (3) 13.6                      (4) 16.5
11. One gram of the silver salt of an organic dibasic acid yields, on strong heating, 0.6 g of silver approximately. Determine the molecular formula of the acid. [Atomic weight of Ag = 108]
- (1) C<sub>4</sub>H<sub>6</sub>O<sub>4</sub>                      (2) C<sub>4</sub>H<sub>6</sub>O<sub>6</sub>                      (3) C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>                      (4) C<sub>5</sub>H<sub>6</sub>O<sub>5</sub>
12. A sample of pure Cu (4.00g) heated in a stream of oxygen for some time, gains in weight with the formation of black oxide of copper (CuO). The final mass is 4.90 g. What percent of copper remains unoxidized (Cu = 64)
- (1) 90 %                      (2) 10 %                      (3) 20 %                      (4) 80 %
13. 40 gm of a carbonate of an **alkali metal** or **alkaline earth metal** containing some inert impurities was made to react with excess HCl solution. The liberated CO<sub>2</sub> occupied 12.315 lit. at 1 atm & 300 K. The correct option is
- (1) Mass of impurity is 1 gm and metal is Be      (2) Mass of impurity is 3 gm and metal is Li
- (3) Mass of impurity is 5 gm and metal is Be      (4) Mass of impurity is 2 gm and metal is Mg

14. 1 mole of  $\text{H}_2\text{SO}_4$  will exactly neutralise :  
 (A) 2 mole of ammonia (B) 1 mole of  $\text{Ba}(\text{OH})_2$   
 (C) 0.5 mole of  $\text{Ca}(\text{OH})_2$  (D) 2 mole of  $\text{KOH}$   
 (1) A, B, D (2) A, B, C (3) B, C, D (4) A, C, D
15. 12 g of  $\text{Mg}$  was burnt in a closed vessel containing 32 g oxygen. Which of the following is /are correct.  
 (A) 2 gm of  $\text{Mg}$  will be left unburnt.  
 (B) 0.75 gm-molecule of  $\text{O}_2$  will be left unreacted.  
 (C) 20 gm of  $\text{MgO}$  will be formed.  
 (D) The mixture at the end will weight 44 g.  
 (1) B, C, D (2) A, B, C (3) B, C (4) C, D
16. 50 gm of  $\text{CaCO}_3$  is allowed to react with 68.6 gm of  $\text{H}_3\text{PO}_4$  then select the correct option(s)-  

$$3\text{CaCO}_3 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$$
  
 (A) 51.67 gm salt is formed  
 (B) Amount of unreacted reagent = 35.93 gm  
 (C)  $n_{\text{CO}_2} = 0.5$  moles evolved  
 (D) 0.7 mole  $\text{CO}_2$  is evolved  
 (1) B, C, D (2) A, C, D (3) A, B, C (4) A, B, D
17. 'A' reacts by following two parallel reactions to give B & C. If half of 'A' goes into reaction I and other half goes to reaction-II. Then, select the correct statement(s)  

$$\text{A} + \text{N} \xrightarrow{\text{I}} \text{B} + \text{L}$$
  

$$\text{A} + \text{N} \xrightarrow{\text{II}} \frac{1}{2} \text{B} + \frac{1}{2} (\text{C}) + \text{L}$$
  
 (A) B will be always greater than C  
 (B) If 2 mole of C are formed then total 2 mole of B are also formed  
 (C) If 2 mole of C are formed then total 4 mole of B are also formed  
 (D) If 2 mole of C are formed then total 6 mole of B are also formed  
 (1) A, D (2) B, C (3) A, C (4) B, D
18. Select the correct statement(s) for  $(\text{NH}_4)_3\text{PO}_4$ .  
 (A) Ratio of number of oxygen atoms to number of hydrogen atoms is 1 : 3  
 (B) Ratio of number of cations to number of anions is 3 : 1  
 (C) Ratio of number of gm-atoms of nitrogen to gm-atoms of oxygen is 3 : 2  
 (D) Total number of atoms in one mole of  $(\text{NH}_4)_3\text{PO}_4$  is 20.  
 (1) C, D (2) B, C (3) A, B (4) A, D
19. The ratio of mass percent of C and H of an organic compound ( $\text{C}_x\text{H}_y\text{O}_z$ ) is 6 : 1. If one molecule of the above compound ( $\text{C}_x\text{H}_y\text{O}_z$ ) contains half as much oxygen as required to burn one molecule of compound  $\text{C}_x\text{H}_y$  completely to  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . The empirical formula of compound  $\text{C}_x\text{H}_y\text{O}_z$  is  
 (1)  $\text{C}_2\text{H}_4\text{O}$  (2)  $\text{C}_3\text{H}_4\text{O}_2$  (3)  $\text{C}_2\text{H}_4\text{O}_3$  (4)  $\text{C}_3\text{H}_6\text{O}_3$

20. For per gram of reactant, the maximum quantity of  $N_2$  gas is produced in which of the following thermal decomposition reactions ?  
(Given : Atomic wt. – Cr = 52u, Ba = 137u)  
(1)  $2NH_4NO_3(s) \rightarrow 2N_2(g) + 4H_2O(g) + O_2(g)$  (2)  $Ba(N_3)_2(s) \rightarrow Ba(s) + 3N_2(g)$   
(3)  $(NH_4)_2Cr_2O_7(s) \rightarrow N_2(g) + 4H_2O(g)$  (4)  $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$
21. An unknown chlorohydrocarbon has 3.55% of chlorine. If each molecule of the hydrocarbon has one chlorine atom only; chlorine atoms present in 1 g of chlorohydrocarbon are :  
(Atomic wt. of Cl = 35.5 u;  
Avogadro constant =  $6.023 \times 10^{23} \text{ mol}^{-1}$ )  
(1)  $6.023 \times 10^{21}$  (2)  $6.023 \times 10^{23}$  (3)  $6.023 \times 10^{20}$  (4)  $6.023 \times 10^9$
22. An ideal gaseous mixture of ethane ( $C_2H_6$ ) and ethene ( $C_2H_4$ ) occupies 28 litre at 1 atm,  $0^\circ\text{C}$ . The mixture reacts completely with 128 gm  $O_2$  to produce  $CO_2$  and  $H_2O$ . Mole fraction of  $C_2H_6$  in the mixture is—  
(1) 0.6 (2) 0.4 (3) 0.5 (4) 0.8
23. For a chemical reaction occurring at constant pressure and temperature.  
 $2A(g) + 5B(g) \longrightarrow C(g) + 2D(g)$   
(1) contraction in volume is double the volume of A taken if B is taken in excess.  
(2) contraction in volume is more than the volume of B taken if A is in excess.  
(3) volume contracts by 20 mL if 10 mL A is reacted with 20 mL B.  
(4) no change in volume due to reaction
24. Each volume of a gaseous organic compound containing C, H and S only produce 1 volume  $CO_2$ , 2 volume  $H_2O$  vapours and 1 volume  $SO_2$  gases on complete combustion. The molecular formula of compound is -  
(1)  $CH_2S$  (2)  $CH_4S$  (3)  $C_2H_4S$  (4)  $C_2H_6S$
25. A 2 L sample of a gaseous hydrocarbon is burnt in excess oxygen. The only products of the reaction are 8L of  $CO_2(g)$  and 10L of  $H_2O(g)$ , all at  $100^\circ\text{C}$  and 1 atm pressure. The formula of the hydrocarbon is -  
(1)  $C_5H_{12}$  (2)  $C_4H_5$  (3)  $C_4H_{10}$  (4)  $C_8H_{10}$
26. 1120 ml of ozonised oxygen ( $O_2 + O_3$ ) at 1 atm & 273K weighs 1.76 gm. The reduction in volume on passing this through alkaline pyrogallol solution is -  
(1) 896 ml (2) 224 ml (3) 448 ml (4) 672 ml
27. Two gases A and B which react according to the equation  
 $aA_{(g)} + bB_{(g)} \longrightarrow cC_{(g)} + dD_{(g)}$   
to give two gases C and D are taken (amount not known) in an Eudiometer tube (operating at a constant Pressure and temperature) to cause the above.  
If on causing the reaction there is no volume change observed then which of the following statement is/are correct.  
(A)  $(a + b) = (c + d)$   
(B) average molecular mass may increase or decrease if either of A or B is present in limited amount.  
(C) Vapour Density of the mixture will remain same throughout the course of reaction.  
(D) Total moles of all the component of mixture will change.  
(1) A, C (2) B, C (3) A, D (4) B, D

28. 20 ml mixture of  $C_3H_8$  and CO gas when burnt in excess of oxygen produce 40 ml  $CO_2$  gas. Choose the correct statement(s). (Volume of gases measured under same T & P) (Considering  $H_2O$  liquid)
- (A) Volume of  $C_3H_8$  in the mixture is 15 ml  
 (B) Volume of CO in the mixture is 10 ml  
 (C) Total volume contraction due to combustion is 35 ml.  
 (D) The volume of oxygen used for combustion is 75 ml
- (1) A, D                      (2) A, B                      (3) B, C                      (4) C, D
29. 10 ml of a gaseous mixture containing  $C_2H_x$  and  $C_3H_8$  exactly requires 40 ml  $O_2$  for complete combustion and produces 25 ml  $CO_2$  and 30 ml  $H_2O$  vapour. The correct information (s) is/are
- (A) Total volume contraction = 5 ml  
 (B) Volume contraction due to combustion of  $C_2H_x = 0$   
 (C)  $x = 4$   
 (D) Volume of  $C_2H_x$  in the initial mixture = 5 ml
- (1) A, B, C                      (2) B, C, D                      (3) C, D, A                      (4) A, B, D
30. 100 ml mixture of CO and  $CO_2$  mixed with 30 mL of  $O_2$  and sparked in eudiometer tube. The residual gas after treatment with aq. KOH has a volume of 10 mL which remains unchanged when treated with alkaline pyrogallol. If all the volumes are under the same conditions, point out **correct** options(s):
- (A) The volume of CO that reacts, is 60 mL  
 (B) The volume of CO that remains unreacted, is 10 mL  
 (C) The volume of  $O_2$  that remains unreacted, is 10 mL  
 (D) The volume of  $CO_2$  that gets absorbed by aq.KOH, is 90 mL.
- (1) A, B, C                      (2) A, B, D                      (3) B, C, D                      (4) A, C, D

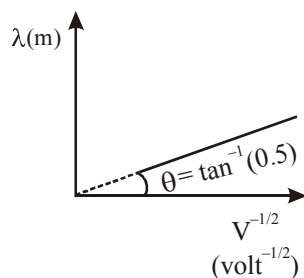
### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	3	3	3	2	2	2	4	3	4	2	2	1	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	1	3	3	4	3	2	1	2	3	1	1	3	2	2

## 2. ATOMIC STRUCTURE

1. A hydrogen atom in an excited state emits a photon which has the longest wavelength of the Paschen series. Further emissions from the atom cannot include the
- (1) longest wavelength of the Lyman series  
 (2) second longest wavelength of the Lyman series  
 (3) longest wavelength of the Balmer series  
 (4) second longest wavelength of the Balmer series

2. Whenever a hydrogen atom emits a photon in the Balmer series  
 (A) it may emit another photon in the Balmer series  
 (B) it may emit another photon in the Lyman series  
 (C) the second photon, if emitted will have a wavelength of about 122 nm  
 (D) it may emit a second photon, but the wavelength of this photon cannot be predicted  
 (1) A, D (2) A, B, C (3) B, C (4) B, D
3. If the radius of first Bohr's orbit of H-atom is  $x$ , which of the following is the correct conclusion -  
 (A) The de-Broglie wavelength in the third Bohr orbit of H-atom =  $6\pi x$   
 (B) The fourth Bohr's radius of  $\text{He}^+$  ion =  $8x$   
 (C) The de-Broglie wavelength in third Bohr's orbit of  $\text{Li}^{2+}$  =  $2x$   
 (D) The second Bohr's radius of  $\text{Be}^{2+}$  =  $x$   
 (1) B, C, D (2) A, B, C (3) A, B, D (4) C, D
4. The ratio of the wavelength of a proton &  $\alpha$ -particle will be 1 : 2 if their  
 (A) Velocity of proton to velocity of  $\alpha$  particle is in the ratio 1 : 8  
 (B) Velocity of proton to velocity of  $\alpha$  particle is in the ratio 8 : 1  
 (C) Kinetic energy of proton to Kinetic energy of  $\alpha$  particle is in the ratio 64 : 1  
 (D) Kinetic energy of proton to Kinetic energy of  $\alpha$  particle is in the ratio 16 : 1  
 (1) A, C (2) B, C (3) B, D (4) A, B
5. According to Bohr's atomic model, choose the correct statement among -  
 (1) The shortest wavelength in brackett series of  $\text{He}^+$  ion is  $R_H/4$   
 (2) The radius of 3<sup>rd</sup> orbit of  $\text{Li}^{2+}$  is equal to radius of 1<sup>st</sup> orbit of H-atom  
 (3) The velocity of electron in 3<sup>rd</sup> orbit of  $\text{Li}^{2+}$  is equal to velocity of electron in 1<sup>st</sup> orbit of H-atom  
 (4) The frequency of revolution of an electron in  $n^{\text{th}}$  orbit of H-like species is directly proportional to  $n^3$
6. In a sample of a hydrogen atoms, all the atoms are in 5th excited state. If they de-excite to the ground state, the ratio of longest and shortest wavelengths of emitted photons is  
 (1) 6 : 1 (2) 875 : 11 (3) 384 : 9 (4) 35 : 1
7. Observe the following graph for the de-Broglie wavelength of a hypothetical charged particle ( $q = 1.6 \times 10^{-19}\text{C}$ ). Find the mass of the particle

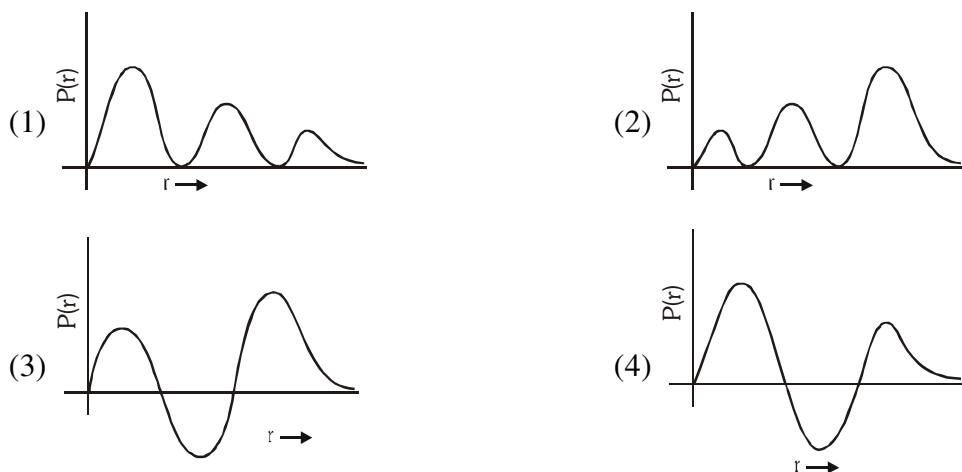
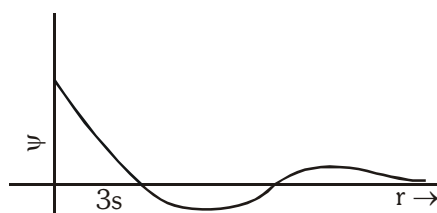


$$(h = 6.0 \times 10^{-34} \text{ J-s})$$

- (1)  $45 \times 10^{-49} \text{ kg}$  (2)  $45 \times 10^{-45} \text{ kg}$  (3)  $4.5 \times 10^{-45} \text{ kg}$  (4)  $4.5 \times 10^{-49} \text{ gm}$



8. A green bulb and a red bulb are emitting the radiations with equal power. The correct relation between numbers of photons emitted by the bulbs per second is  
 (1)  $n_g = n_r$  (2)  $n_g < n_r$  (3)  $n_g > n_r$  (4) unpredictable
9. In an excited state, a calcium atom has the electronic configuration  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^1$ . What is the orbital angular momentum for d electron :-  $\left( \hbar = \frac{h}{2\pi} \right)$   
 (1)  $\sqrt{4}\hbar$  (2)  $\sqrt{16}\hbar$  (3)  $\sqrt{6}\hbar$  (4)  $\sqrt{10}\hbar$
10. The wave function ( $\psi$ ) versus radial distance ( $r$ ) curve for certain orbital is given. Predict the shape of  $\psi^2 \cdot 4\pi r^2$  (radial probability distribution function) versus  $r$  graph.



11. In a hydrogen like sample electron is in  $2^{nd}$  excited state, the energy of  $4^{th}$  state of this sample is  $-13.6$  eV, then incorrect statement is :  
 (1) Atomic number of element is 4.  
 (2) 3 different types of spectral line will be observed if electrons make transition upto ground state from the  $2^{nd}$  excited state.  
 (3) A 25 eV photon can set free the electron from the  $2^{nd}$  excited state of this sample  
 (4)  $2^{nd}$  line of Balmer series of this sample has same energy value as  $1^{st}$  excitation energy of H-atoms.
12. An electron in a hydrogen atom in its ground state absorbs energy equal to the ionisation energy of  $Li^{+2}$ . The wavelength of the emitted electron is:  
 (1)  $3.32 \times 10^{-10}$  m (2)  $1.17 \text{ \AA}$  (3)  $2.32 \times 10^{-9}$  nm (4)  $3.33$  pm
13. Given  $\Delta H$  for the process  $Li(g) \longrightarrow Li^{+3}(g) + 3e^{-}$  is 19800 kJ/mole &  $IE_1$  for Li is 520 then  $IE_2$  &  $IE_3$  of Li are respectively (approx, value)  
 (1) 7505, 11775 (2) 520, 19280 (3) 11775, 19280 (4) Data insufficient

14. Which of the following could be derived from Rutherford's  $\alpha$ -particle scattering experiment-

- (A) Most of the space in the atom is empty  
 (B) The radius of the atom is about  $10^{-10}$  m while that of nucleus is  $10^{-15}$  m  
 (C) Electrons move in a circular path of fixed energy called orbits  
 (D) Electrons and the nucleus are held together by electrostatic forces of attraction.
- (1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) All of these

15. In a H-like sample electrons make transition from 5<sup>th</sup> excited state to 2<sup>nd</sup> excited state

- (A) 10 different spectral lines will be emitted  
 (B) 6 different spectral lines will be emitted  
 (C) Number of lines belonging to Balmer series will be 4  
 (D) Number of lines belonging to paschen series will be 3
- (1) A, C                      (2) B, C                      (3) A, D                      (4) B, D

16. Select the correct statement(s):

- (A) All electromagnetic radiation travel with speed of light in vacuum.  
 (B) Energy of photon of UV light is lower than that of yellow light.  
 (C)  $\text{He}^+$  and H have similar spectrum.  
 (D) The total energy of an electron in unielectronic species is greater than zero
- (1) A, B, C, D                      (2) B, C, D                      (3) A, C                      (4) C only

17. Choose the incorrect statement(s):

(A) Increasing order of wavelength is

Micro waves > Radio waves > IR waves > visible waves > UV waves

- (B) The order of Bohr radius is ( $r_n$  : where n is orbit number for a given atom)  $r_1 < r_2 < r_3 < r_4$   
 (C) The order of total energy is ( $E_n$  : where n is orbit number for a given atom)  $E_1 > E_2 > E_3 > E_4$   
 (D) The order of velocity of electron in H,  $\text{He}^+$ ,  $\text{Li}^+$ ,  $\text{Be}^{3+}$  species in second Bohr orbit is  
 $\text{Be}^{3+} > \text{Li}^{+2} > \text{He}^+ > \text{H}$

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

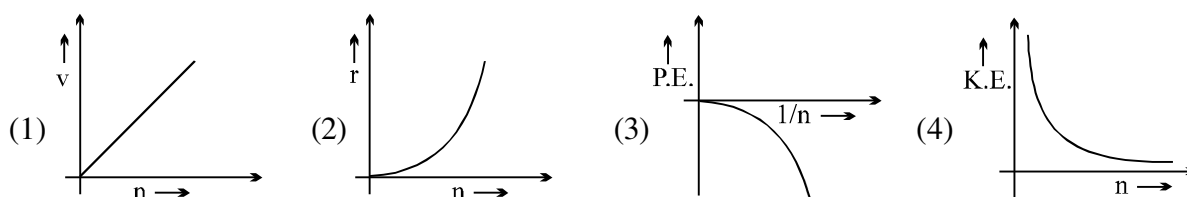
18. Select the incorrect curve(s):

If v = velocity of electron in Bohr's orbit

r = Radius of electron in Bohr's orbit

P.E. = Potential energy of electron in Bohr's orbit

K.E. = Kinetic energy of electron in Bohr's orbit.



19. Which is / are correct statement.

(A) The difference in angular momentum associated with the electron present in consecutive orbits of

$$\text{H-atom is } (n-1) \frac{h}{2\pi}$$

(B) Energy difference between energy levels will be changed if, P.E. at infinity assigned value other than zero.

(C) Frequency of spectral line in a H-atom is in the order of  $(2 \rightarrow 1) < (3 \rightarrow 1) < (4 \rightarrow 1)$

(D) On moving away from the nucleus, kinetic energy of electron decreases.

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

20. If the shortest wavelength in Lyman series of hydrogen atom is A, then the longest wavelength in Paschen series of  $\text{He}^+$  is :

(1)  $\frac{36A}{5}$  (2)  $\frac{9A}{5}$  (3)  $\frac{36A}{7}$  (4)  $\frac{5A}{9}$

21. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with :-

(1) Brackett series (2) Balmer series (3) Lyman series (4) Paschen series

22. The de-Broglie's wavelength of electron present in first Bohr orbit of 'H' atom is :-

(1)  $\frac{0.529}{2\pi} \text{Å}$  (2)  $2\pi \times 0.529 \text{Å}$  (3)  $0.529 \text{Å}$  (4)  $4 \times 0.529 \text{Å}$

### ANSWER KEY

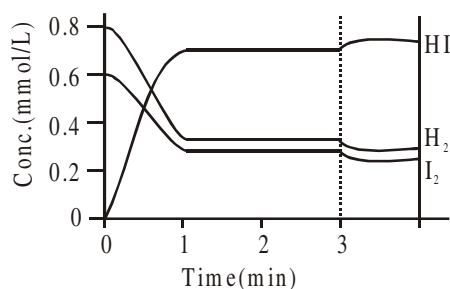
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	3	3	3	3	2	1	2	3	2	4	2	1	1	4
Que.	16	17	18	19	20	21	22								
Ans.	3	1	1	3	3	2	2								

## 3. CHEMICAL EQUILIBRIUM

1. The equation for the reaction in the figure below is :

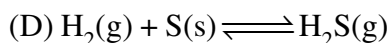
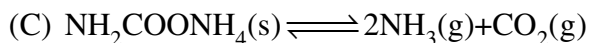
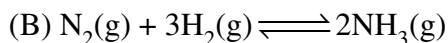
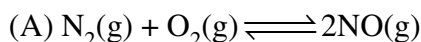


At the instant 3 min, what change was imposed into the equilibrium?



(1) Pressure was increased (2) Temperature was increased  
(3) Iodine was added to the system (4) Hydrogen was added to the system

2. At equilibrium 5 moles of Ne is added in a 10L rigid container at 300K. In which of given reaction equilibrium is not disturbed -



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

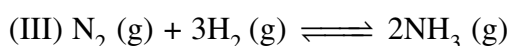
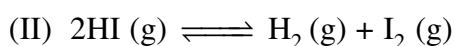
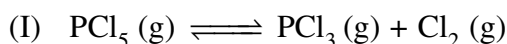
3. If  $K_p$  for a reaction is  $1/9 \times 10^{-2} \text{ atm}^{-2}$  at 500 K. Magnitude of  $K_c$  will be [Take  $R = 0.08$ ]

- (1)  $3 \times 10^{-1}$                       (2)  $1/9 \times 10^{-2}$                       (3) 16/9                      (4) Data insufficient

4. One mole of X and one mole of Y are allowed to react in a 2L container. When equilibrium is reached, the following reaction occurs:  $2\text{X} + \text{Y} \rightleftharpoons \text{Z}$ . If the concentration of Z is 0.2 M, calculate the equilibrium constant for this closed system.

- (1) 0.015                      (2) 2.22                      (3) 6.70                      (4) 66.7

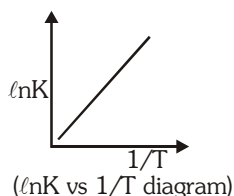
5. Consider following reaction in equilibrium with equilibrium concentration 0.01 M of every species



Extent of the reactions taking place is :

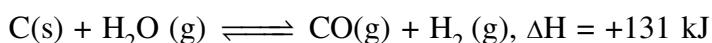
- (1)  $\text{I} > \text{II} > \text{III}$                       (2)  $\text{I} < \text{II} < \text{III}$                       (3)  $\text{II} < \text{III} < \text{I}$                       (4)  $\text{III} < \text{I} < \text{II}$

6. Variation of equilibrium constant K for the reaction ;  $2\text{A}(\text{s}) + \text{B}(\text{g}) \rightleftharpoons \text{C}(\text{g}) + 2\text{D}(\text{g})$  is plotted against absolute temperature T in figure as -  $\ln K$  Vs  $(1/T)$  :



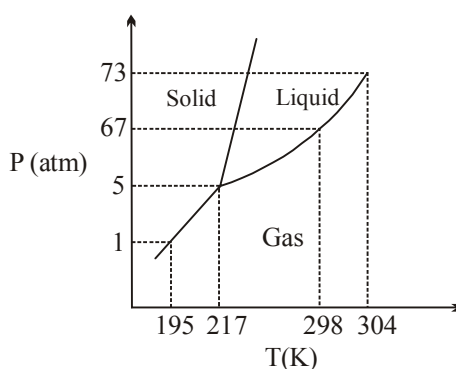
- (A) the forward reaction is exothermic                      (B) the forward reaction is endothermic  
(C) the slope of line is proportional to  $\Delta H$                       (D) removing C favours forward reaction  
(1) A, B                      (2) A, C, D                      (3) B, C, D                      (4) B, D

7. An industrial fuel, 'water gas', which consists of a mixture of  $\text{H}_2$  and CO can be made by passing steam over red-hot carbon. The reaction is :



The yield of CO and  $\text{H}_2$  at equilibrium would be shifted to the product side by

- (A) raising the relative pressure of the steam  
 (B) adding hot carbon  
 (C) raising the temperature  
 (D) reducing the volume of the system
- (1) A, B                      (2) A, C                      (3) B, C, D                      (4) A, B, C
8. Following two equilibrium is simultaneously established in a container  
 $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$   
 $\text{CO}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{COCl}_2(\text{g})$   
 If some Ni(s) is introduced in the container forming  $\text{Ni}(\text{CO})_4(\text{g})$  then at new equilibrium  
 (1)  $\text{PCl}_3$  concentration will increase  
 (2)  $\text{PCl}_3$  concentration will decrease  
 (3)  $\text{Cl}_2$  concentration will remain same  
 (4) CO concentration will remain same
9. For the reaction  $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ , the forward reaction at constant temperature is favoured by  
 (A) introducing an inert gas at constant volume  
 (B) introducing chlorine gas at constant volume  
 (C) introducing an inert gas at constant pressure  
 (D) introducing  $\text{PCl}_5$  at constant volume.  
 (1) Only C                      (2) A, C, D                      (3) A, D                      (4) C, D
10. For the gas phase reaction,  $\text{C}_2\text{H}_4 + \text{H}_2 \rightleftharpoons \text{C}_2\text{H}_6$  ( $\Delta H = -32.7 \text{ kcal}$ ), carried out in a closed vessel, the equilibrium moles of  $\text{C}_2\text{H}_4$  can be increased by  
 (A) increasing the temperature                      (B) decreasing the pressure  
 (C) removing some  $\text{H}_2$                       (D) adding some  $\text{C}_2\text{H}_6$   
 (1) A, B                      (2) A, B, C                      (3) A, C, D                      (4) A, B, C, D
11. Phase diagram of  $\text{CO}_2$  is shown as following



Based on above find the correct statement(s)

- (A) 298K is the normal boiling point of liquid  $\text{CO}_2$   
 (B) At 1 atm & 190 K  $\text{CO}_2$  will exist as gas.  
 (C)  $\text{CO}_2(\text{s})$  will sublime above 195K under normal atmospheric pressure  
 (D) Melting point & boiling point of  $\text{CO}_2$  will increase on increasing pressure  
 (1) C, D                      (2) A, C                      (3) A, C, D                      (4) B, C, D

12. The equilibrium between, gaseous isomers A, B and C can be represented as

Reaction	Equilibrium constant
$A(g) \rightleftharpoons B(g)$	: $K_1 = ?$
$B(g) \rightleftharpoons C(g)$	: $K_2 = 0.4$
$C(g) \rightleftharpoons A(g)$	: $K_3 = 0.6$

If one mole of A is taken in a closed vessel of volume 1 litre, then

- (A)  $[A] + [B] + [C] = 1 \text{ M}$  at any time of the reactions  
 (B) Concentration of C is 4.1 M at the attainment equilibrium in all the reactions  
 (C) The value of  $K_1$  is  $\frac{1}{0.24}$   
 (D) Isomer [A] is least stable as per thermodynamics.
- (1) C, D (2) A, C, D  
 (3) A, B, C (4) A, C
13. Consider the equilibrium  $\text{HgO}(s) + 4\text{I}^-(\text{aq}) + \text{H}_2\text{O}(l) \rightleftharpoons \text{HgI}_4^{2-}(\text{aq}) + 2\text{OH}^-(\text{aq})$ , which changes will decrease the equilibrium concentration of  $\text{HgI}_4^{2-}$   
 (A) Addition of 0.1 M HI (aq) (B) Addition of HgO (s)  
 (C) Addition of  $\text{H}_2\text{O}(l)$  (D) Addition of KOH (aq)  
 (1) A, C, D (2) C, D (3) A, B, D (4) Only D
14. Decrease in the pressure for the following equilibria :  $\text{H}_2\text{O}(s) \rightleftharpoons \text{H}_2\text{O}(l)$  result in the :  
 (A) formation of more  $\text{H}_2\text{O}(s)$  (B) formation of more  $\text{H}_2\text{O}(l)$   
 (C) increase in melting point of  $\text{H}_2\text{O}(s)$  (D) decrease in melting point of  $\text{H}_2\text{O}(s)$   
 (1) Only A (2) A, D (3) B, D (4) A, C
15. The following reaction occurs in the Blast Furnace where iron ore is reduced to iron metal:  
 $\text{Fe}_2\text{O}_3(s) + 3\text{CO}(g) \rightleftharpoons 2\text{Fe}(l) + 3\text{CO}_2(g)$   
 Using the Le Chatelier's principle, predict which one of the following will **not** disturb the equilibrium?  
 (1) Removal of  $\text{CO}_2$  (2) Addition of  $\text{Fe}_2\text{O}_3$   
 (3) Addition of  $\text{CO}_2$  (4) Removal of CO
16. **Statement -1** : Total number of moles in a closed system at new equilibrium is less than the old equilibrium if some amount of a substance is removed from a system (consider a reaction  $A(g) \rightleftharpoons B(g)$ ) at equilibrium.  
**Statement -2** : The number of moles of the substance which is removed, is partially compensated as the system reached to new equilibrium.  
 (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (3) Statement-1 is false, statement-2 is true.  
 (4) Statement-1 is true, statement-2 is false.

17. **Statement-1** : Ammonia at a pressure of 10 atm and  $\text{CO}_2$  at a pressure of 20 atm are introduced into an evacuated chamber. If  $K_p$  for the reaction  $\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$  is  $2020 \text{ atm}^3$ , the total pressure after a long time is less than 30 atm.

**Statement-2** : Equilibrium can be attained from both directions.

- (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (3) Statement-1 is true, statement-2 is false.  
 (4) Statement-1 is false, statement-2 is true.

### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	3	4	2	2	2	2	4	4	1	2	2	4	2
Que.	16	17													
Ans.	2	4													

## 4. IONIC EQUILIBRIUM

- The volume (in ml) of 0.5 M NaOH required for the complete reaction with 150 ml of 1.5M  $\text{H}_3\text{PO}_3$  solutions is -  
 (1) 1350 (2) 900 (3) 1250 (4) 1150
- The position of equilibrium lies to right in each of following cases :  
 $\text{AH}^+ + \text{B} \rightleftharpoons \text{A} + \text{BH}^+ (K_{\text{eq}} = 10^4)$   
 $\text{B} + \text{C-H} \rightleftharpoons \text{C}^- + \text{BH}^+ (K_{\text{eq}} = 10^6)$   
 $\text{A} + \text{C-H} \rightleftharpoons \text{C}^- + \text{AH}^+ (K_{\text{eq}} = 10^3)$   
 Based on this information, what is the order of acid strength.  
 (1)  $\text{C-H} > \text{BH}^+ > \text{AH}^+ > \text{B}$  (2)  $\text{C-H} > \text{BH}^+ > \text{AH}^+ < \text{B}$   
 (3)  $\text{C-H} > \text{AH}^+ > \text{BH}^+ > \text{B}$  (4)  $\text{AH}^+ > \text{C-H} > \text{B} > \text{BH}^+$
- A solution of  $\text{Pb}(\text{NO}_3)_2$  is added drop wise to a second solution in which  $[\text{Cl}^-] = [\text{F}^-] = [\text{I}^-] = [\text{SO}_4^{2-}] = 0.001 \text{ M}$ . What is the first precipitate that forms ?  
 (1)  $\text{PbCl}_2 (K_{\text{sp}} = 1.5 \times 10^{-5})$  (2)  $\text{PbF}_2 (K_{\text{sp}} = 3.7 \times 10^{-8})$   
 (3)  $\text{PbI}_2 (K_{\text{sp}} = 8.5 \times 10^{-9})$  (4)  $\text{PbSO}_4 (K_{\text{sp}} = 1.8 \times 10^{-8})$
- 100 mL of 0.5 M hydrazoic acid ( $\text{N}_3\text{H}$   $K_a = 3.6 \times 10^{-4}$ ) and 400 mL of 0.1 M cyanic acid ( $\text{HOCN}$ ,  $K_a = 8 \times 10^{-4}$ ) are mixed. Which of the following is true for final solution ?  
 (1)  $[\text{H}^+] = 2 \times 10^{-2} \text{ M}$  (2)  $[\text{N}_3^-] = 3.6 \times 10^{-2} \text{ M}$   
 (3)  $[\text{OCN}^-] = 4.571 \times 10^{-3} \text{ M}$  (4)  $[\text{OCN}^-] = 6.4 \times 10^{-3} \text{ M}$
- Out of the following, amphiprotic species in aqueous medium are  
 I  $\text{HPO}_3^{2-}$  II  $\text{OH}^-$  III  $\text{H}_2\text{PO}_4^-$  IV  $\text{HCO}_3^-$   
 (1) I, III, IV (2) I and III (3) III and IV (4) All

6. Liquid  $\text{NH}_3$  ionises to a slight extent. At a certain temperature its self ionization constant  $K_{\text{SIC}(\text{NH}_3)} = 10^{-30}$ . The number of  $\text{NH}_4^+$  ions present per  $100 \text{ cm}^3$  of pure liquid are  
 (1)  $10^{-15}$  (2)  $6.022 \times 10^8$  (3)  $6.022 \times 10^7$  (4) None
7. The moles of  $\text{H}^+$  from  $\text{H}_2\text{O}$  in a 1 L,  $\sqrt{5} \times 10^{-7} \text{ M}$   $\text{HCl}$  solution at  $25^\circ\text{C}$ , is ( $\sqrt{5} = 2.23$ )  
 (1)  $10^{-7}$  (2)  $6.85 \times 10^{-8}$  (3)  $3.85 \times 10^{-8}$  (4)  $10^{-8}$
8. In the volumetric estimation of  $\text{HCl}$ , if we make use of phenolphthalein as an indicator, which base is unsuitable for the titration :-  
 (1)  $\text{NaOH}$  (2)  $\text{RbOH}$  (3)  $\text{KOH}$  (4)  $\text{NH}_4\text{OH}$
9.  $\text{Na}_3\text{PO}_4$  which should be added in 10 L of  $1.0 \times 10^{-5} \text{ M}$  -  $\text{BaCl}_2$  solution without any precipitation of  $\text{Ba}_3(\text{PO}_4)_2$  is [ $K_{\text{sp}}$  of  $\text{Ba}_3(\text{PO}_4)_2$ ] =  $4 \times 10^{-23}$   
 (1)  $2 \times 10^{-4} \text{ gm}$  (2)  $0.328 \text{ gm}$  (3)  $0.164 \text{ gm}$  (4)  $0.82 \text{ gm}$
10. pH of solution at first  $1/4^{\text{th}}$  equivalence point of  $\text{Na}_2\text{CO}_3$  when titrated with  $\text{HCl}$  will be (for  $\text{H}_2\text{CO}_3$   $K_{a1} = 10^{-7}$  ;  $K_{a2} = 10^{-11}$  )  
 (1)  $7 + 10\log 3$  (2)  $7 - \log 3$  (3)  $11 + \log 3$  (4)  $11 - \log 3$
11. An acid-base indicator has a  $K_a = 1.0 \times 10^{-5}$ . The acid form of the indicator is red and the basic form is blue. Calculate the pH change required to change the colour of the indicator from 80% red to 80% blue.  
 (1) 1.20 (2) 0.80 (3) 0.20 (4) 1.40
12. Which of the following is correct for 0.1 M  $\text{BOH}$  solution ( $K_b = 10^{-5}$ )  
 (A) pH of solution is 11  
 (B)  $\text{OH}^-$  concentration is  $10^{-3} \text{ mol/L}$   
 (C) it's salt with  $\text{HCl}$  (i.e.  $\text{BCl}$ ) form the acidic solution in water  
 (D) Phenolphthalein indicator can be used during the titration of  $\text{BOH}$  with  $\text{HCl}$   
 (1) A, B (2) A, B, D (3) A, B, C (4) Only A
13. For weak monobasic acid,  $\text{HA}$ , the dissociation constant is  $2 \times 10^{-6}$ , at  $25^\circ\text{C}$ . Which of the following is/are correct regarding this acid? [ $\log 2 = 0.3$ ]  
 (A)  $\text{A}^- + \text{H}_2\text{O} \rightleftharpoons \text{HA} + \text{OH}^-$ ;  $K_{\text{eq}} = 5 \times 10^{-9}$   
 (B) The equilibrium constant for the reaction of  $\text{HA}$  with aq.  $\text{NaOH}$  is  $2 \times 10^8$   
 (C) The pH of 0.1 M,  $\text{HA}$  solution is 3.35  
 (D) solution of  $\text{A}^-$  is basic  
 (1) A, C, D (2) A, B, C (3) A, B, D (4) A, B, C, D
14. Select correct statement for 50ml 0.1M  $\text{H}_2\text{A}$ (aq.) solution ;  $K_{a1} = 10^{-5}$  ;  $K_{a2} = 10^{-8}$   
 (A)  $[\text{H}^+] = 2[\text{A}^{2-}]$   
 (B) pH of 0.1M  $\text{H}_2\text{A}$  solution is 3  
 (C) In above  $\text{H}_2\text{A}$  solution when 5 milimoles of  $\text{NaHA}$  are added then pH increases by 2 units  
 (D) 50 ml of 0.1M  $\text{NaOH}$  required to neutralised completely 50 ml of 0.1M  $\text{H}_2\text{A}$  solution  
 (1) Only A (2) A, B (3) B, C (4) A, B, C



15. A solution containing 0.01M each of  $\text{Pb}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Zn}^{2+}$  &  $\text{Cr}^{3+}$  ion. If solid  $\text{Na}_2\text{S}$  is added slowly to the solution then correct statement is based on given data -

Precipitate	$\text{PbS}$	$\text{Ag}_2\text{S}$	$\text{ZnS}$	$\text{Cr}_2\text{S}_3$
$K_{sp}$	$10^{-11}$	$10^{-12}$	$10^{-8}$	$10^{-10}$

- (A)  $\text{Pb}^{2+}$  will start precipitating first  
 (B)  $\text{Cr}^{3+}$  will start precipitating last  
 (C)  $\text{Zn}^{2+}$  will start precipitating before  $\text{Ag}^+$   
 (D) When  $\text{Zn}^{2+}$  just starts precipitating then  $\text{Pb}^{2+}$  ion gets 99.9% precipitated  
 (1) A, B (2) A, B, C (3) A, B, D (4) B, C, D
16. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 500 mL?  
 ( $K_a = 1.75 \times 10^{-5}$ ,  $pK_a = 4.76$ )  
 (1)  $4.76 < \text{pH} < 5.0$  (2)  $\text{pH} < 4.70$   
 (3) pH of solution will be equal to pH of acetic acid (4)  $\text{pH} = 4.70$
17. Zirconium phosphate  $[\text{Zr}_3(\text{PO}_4)_4]$  dissociates into three zirconium cations of charge +4 and four phosphate anions of charge -3. If molar solubility of zirconium phosphate is denoted by S and its solubility product by  $K_{sp}$  then which of the following relationship between S and  $K_{sp}$  is correct ?  
 (1)  $S = (K_{sp}/144)^{1/7}$  (2)  $S = [K_{sp}/(6912)^{1/7}]$   
 (3)  $S = (K_{sp}/6912)^{1/7}$  (4)  $S = (K_{sp}/6912)^7$
18. An alkali is titrated against an acid with methyl orange as indicator, which of the following is a correct combination ?

	Base	Acid	End point
(1)	Strong	Strong	Pinkish red to yellow
(2)	Weak	Strong	Yellow to pinkish red
(3)	Strong	Strong	Pink to colourless
(4)	Weak	Strong	Colourless to pink

19. An aqueous solution contains 0.10 M  $\text{H}_2\text{S}$  and 0.20 M  $\text{HCl}$ . If the equilibrium constants for the formation of  $\text{HS}^-$  from  $\text{H}_2\text{S}$  is  $1.0 \times 10^{-7}$  and that of  $\text{S}^{2-}$  from  $\text{HS}^-$  ions is  $1.2 \times 10^{-13}$  then the concentration of  $\text{S}^{2-}$  ions in aqueous solution is :  
 (1)  $3 \times 10^{-20}$  (2)  $6 \times 10^{-21}$  (3)  $5 \times 10^{-19}$  (4)  $5 \times 10^{-8}$
20. A aqueous solution contains an unknown concentration of  $\text{Ba}^{2+}$ . When 50 mL of a 1 M solution of  $\text{Na}_2\text{SO}_4$  is added,  $\text{BaSO}_4$  just begins to precipitate. The final volume is 500 mL. The solubility product of  $\text{BaSO}_4$  is  $1 \times 10^{-10}$ . What is the original concentration of  $\text{Ba}^{2+}$  ?  
 (1)  $2 \times 10^{-9}$  M (2)  $1.1 \times 10^{-9}$  M (3)  $1.0 \times 10^{-10}$  M (4)  $5 \times 10^{-9}$  M
21. Following four solutions are prepared by mixing different volumes of  $\text{NaOH}$  and  $\text{HCl}$  of different concentrations, pH of which one of them will be equal to 1 ?

- (1)  $75\text{mL } \frac{\text{M}}{5} \text{HCl} + 25\text{mL } \frac{\text{M}}{5} \text{NaOH}$  (2)  $100\text{mL } \frac{\text{M}}{10} \text{HCl} + 100\text{mL } \frac{\text{M}}{10} \text{NaOH}$   
 (3)  $55\text{mL } \frac{\text{M}}{10} \text{HCl} + 45\text{mL } \frac{\text{M}}{10} \text{NaOH}$  (4)  $60\text{mL } \frac{\text{M}}{10} \text{HCl} + 40\text{mL } \frac{\text{M}}{10} \text{NaOH}$

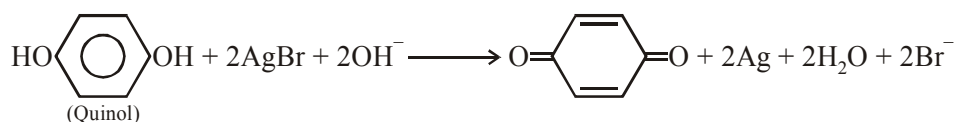
22. The minimum volume of water required to dissolve 0.1 g lead (II) chloride to get a saturated solution ( $K_{sp}$  of  $PbCl_2 = 3.2 \times 10^{-8}$ ; atomic mass of Pb = 207 u) is :  
 (1) 0.36 L (2) 0.18 L (3) 17.98 L (4) 1.798 L
23. If  $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+$ ;  $K_1 = 1.6 \times 10^3$  and  
 $[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$ ;  $K_2 = 6.8 \times 10^3$   
 The formation constant of  $[Ag(NH_3)_2]^+$  is :  
 (1)  $6.08 \times 10^{-6}$  (2)  $6.8 \times 10^{-6}$  (3)  $1.6 \times 10^3$  (4)  $1.088 \times 10^7$
24. Aqueous solutions of  $HNO_3$ ,  $KOH$ ,  $CH_3COOH$  and  $CH_3COONa$  of identical concentrations are provided. The pair(s) of solutions which form a buffer upon mixing is(are) –  
 (1)  $HNO_3$  and  $CH_3COOH$  (2)  $KOH$  and  $CH_3COONa$   
 (3)  $NaNO_3$  and  $CH_3COONa$  (4)  $CH_3COOH$  and  $CH_3COONa$
25. **Statement-1** pH of  $10^{-7}$  M  $NaOH$  solution is exist between 7 to 7.3 at  $25^\circ C$ .  
**Statement-2** Due to common ion effect ionization of water is reduced.  
 (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (3) Statement-1 is true, statement-2 is false.  
 (4) Statement-1 is false, statement-2 is true.
26. **Statement-1** In general phenolphthalein is used as an indicator for the titration of weak acid (HA) against strong base (NaOH)  
**Statement-2** At equivalent point solution is acidic.  
 (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (3) Statement-1 is true, statement-2 is false.  
 (4) Statement-1 is false, statement-2 is true.
27. **Statement-1** : Moles of  $Sr^{2+}$  furnished by sparingly soluble substance  $Sr(OH)_2$  decreases due to dilution.  
**Statement-2** : Solubility product constant of  $Sr(OH)_2$  is not affected by dilution.  
 (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
 (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
 (3) Statement-1 is true, statement-2 is false.  
 (4) Statement-1 is false, statement-2 is true.

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	4	4	3	3	3	4	2	3	1	3	4	3	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27			
Ans.	1	3	2	1	2	1	2	4	4	2	3	4			

## 5. REDOX

- Which of the following sample of reducing agents is/are chemically equivalent to 25ml of 0.2 N  $\text{KMnO}_4$  in acidic medium -  
 (A) 50 mL of 0.1M  $\text{FeSO}_4$  to be oxidized to  $\text{Fe}^{3+}$   
 (B) 50 mL of 0.05 M  $\text{SnCl}_2$  to be oxidized to  $\text{Sn}^{4+}$   
 (C) 25 mL of 0.1M  $\text{H}_3\text{AsO}_3$  to be oxidized to  $\text{H}_3\text{AsO}_4$   
 (D) 25 mL of 0.1M  $\text{H}_2\text{O}_2$  to be oxidized to  $\text{H}^+$  and  $\text{O}_2$   
 (1) A, B (2) B, C, D  
 (3) A, B, C, D (4) A, C
- One mole of  $\text{KMnO}_4$  is used for complete oxidation of  $\text{FeSO}_4$ ,  $\text{FeC}_2\text{O}_4$  and  $\text{H}_2\text{C}_2\text{O}_4$  respectively and separately. Pick up the correct statement :  
 (A) 5 mole of  $\text{FeSO}_4$  can be oxidised  
 (B)  $3/5$  mole of  $\text{FeC}_2\text{O}_4$  can be oxidised  
 (C)  $\frac{5}{3}$  mole of  $\text{FeC}_2\text{O}_4$  can be oxidised  
 (D) 2.5 mole of  $\text{H}_2\text{C}_2\text{O}_4$  can be oxidised  
 (1) A, B, C, D (2) B, C  
 (3) A, C, D (4) A, B, C
- The concentration of an oxalic acid solution is 'x' mol litre<sup>-1</sup>. 40 mL of this solution reacts with 16 mL of 0.05 M acidified  $\text{KMnO}_4$ . What is the pH of 'x' M oxalic acid solution ? (Assume that oxalic acid dissociates completely.) :-  
 (1) 1.3 (2) 1.699 (3) 1 (4) 2
- During developing of an exposed camera film, one step involves in the following reaction :-



Which of the following best described the role of quinol ?

- It acts as an acid (2) It acts as reducing agent  
 (3) It acts as oxidant (4) It acts as a base
- 1 mole of equimolar mixture of ferric oxalate and ferrous oxalate requires x mole of  $\text{KMnO}_4$  in acidic medium for complete oxidation. x is :-  
 (1) 0.5 mole (2) 0.9 mole (3) 1.2 mole (4) 4.5 mole

6. A solution containing  $2.7 \times 10^{-3}$  mole of  $A^{2+}$  ions required  $1.6 \times 10^{-3}$  mole of  $MnO_4^-$  for the oxidation of  $A^{2+}$  to  $AO_3^-$  the medium used is :-
- (1) neutral (2) acidic  
(3) strong basic (4) none of these
7. Which of the following is a redox-reaction ?
- (1)  $2Na[Ag(CN)_2] + Zn \longrightarrow Na_2[Zn(CN)_4] + 2Ag$   
(2)  $BaO_2 + H_2SO_4 \longrightarrow BaSO_4 + H_2O_2$   
(3)  $N_2O_5 + H_2O \longrightarrow 2HNO_3$   
(4)  $AgNO_3 + KI \longrightarrow AgI + KNO_3$
8. Following reaction describes the rusting of iron
- $$4Fe + 3O_2 \longrightarrow 4Fe^{3+} + 6O^{2-}$$
- Which one of the following statement is incorrect ?
- (1) This is an example of a redox reaction (2) Metallic iron is reduced to  $Fe^{3+}$   
(3)  $Fe^{3+}$  is an oxidising agent (4) Metallic iron is a reducing agent

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	
Ans.	3	3	3	2	2	2	1	2	

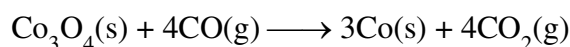
## 6. THERMODYNAMICS &amp; CHEMISTRY

1. Which of the following statements is correct ?
- (1) The presence of reacting species in a covered beaker is an example of open system.  
(2) There is an exchange of energy as well as matter between the system and the surroundings in a closed system.  
(3) The presence of reactants in a closed vessel made up of copper is an example of a closed system.  
(4) The presence of reactants in a thermos flask or any other closed insulated vessel is an example of a closed system.
2. A state function is that :
- (1) Which is used in thermochemistry  
(2) Quantity whose value depends on path of process.  
(3) Quantity whose value depends only upon the state of the system  
(4) Quantity which is used in measuring thermal change

3. Which of the following statements are always correct
- (1) The entropy change of a system participating in adiabatic process is always positive
  - (2) The entropy change of a system participating in adiabatic irreversible process is always positive
  - (3) The entropy change of surrounding is always zero in adiabatic process
  - (4) The entropy change of a system participating in adiabatic process is always zero.
4. Two mole of an ideal gas is expanded irreversibly and isothermally at  $37^{\circ}\text{C}$  until its volume is doubled and 3.41 kJ heat is absorbed from surrounding.  $\Delta S_{\text{total}}$  (system + surroundings) is :-

- (1)  $-0.52 \text{ J/K}$                       (2)  $0.52 \text{ J/K}$                       (3)  $22.52 \text{ J/K}$                       (4) 0

5. Using listed informations, calculate  $\Delta_r G^{\circ}$  (in kJ/mol) at  $27^{\circ}\text{C}$



Given : At 300 K                       $\Delta H_f^{\circ} (\text{kJ/mol})$  - 891, - 110.5,                      0.0,                      -393.5

$S^{\circ} (\text{J/K-mol})$  102.5, 197.7,                      30.0,                      213.7

- (1)  $-214.8$                       (2)  $-195.0$                       (3)  $-200.3$                       (4)  $-256.45$

6. The enthalpy of neutralization of a weak monoprotic acid (HA) in 1M solution with a strong base is  $-55.95 \text{ kJ/mol}$ . If the unionized acid required  $1.4 \text{ kJ/mol}$  heat for its complete ionization and enthalpy of neutralization of the strong monobasic acid with a strong monoacidic base is  $-57.3 \text{ kJ/mol}$ , what is the % ionization of the weak acid in molar solution ?

- (1) 1%                      (2) 3.57%                      (3) 35.7%                      (4) 10%

7. Calculate the heat produced (in kJ) when 224 g of CaO is completely converted to  $\text{CaCO}_3$  by reaction with  $\text{CO}_2$  at  $27^{\circ}\text{C}$  in a container of fixed volume.


Given :  $\Delta H_f^{\circ} (\text{CaCO}_3, \text{s}) = -1207 \text{ kJ/mol}$ ;                       $\Delta H_f^{\circ} (\text{CaO}, \text{s}) = -635 \text{ kJ/mol}$

$\Delta H_f^{\circ} (\text{CO}_2, \text{g}) = -394 \text{ kJ/mol}$ ; [Use  $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$ ]

- (1) 702.04 kJ                      (2) 721.96 kJ

- (3) 712 kJ                      (4) 721 kJ

8. If enthalpy of hydrogenation of  $\text{C}_6\text{H}_6(l)$  into  $\text{C}_6\text{H}_{12}(l)$  is  $-205 \text{ kJ/mol}$  and resonance energy of  $\text{C}_6\text{H}_6(l)$

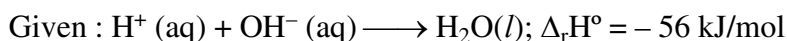
is  $-152 \text{ kJ/mol}$  then enthalpy of hydrogenation of  is

Assume  $\Delta H_{\text{vap}}$  of  $\text{C}_6\text{H}_6(l)$ ,  $\text{C}_6\text{H}_8(l)$ ,  $\text{C}_6\text{H}_{12}(l)$  all are equal :

- (1)  $-535.5 \text{ kJ/mol}$                       (2)  $-238 \text{ kJ/mol}$

- (3)  $-357 \text{ kJ/mol}$                       (4)  $-119 \text{ kJ/mol}$

9. What is the enthalpy of neutralization of HF against a strong base ?



$\Delta_f H^\circ(\text{HF}, \text{aq}) = -329 \text{ kJ/mol}$  ;  $\Delta_f H^\circ(\text{H}_2\text{O}, l) = -285 \text{ kJ/mol}$

$\Delta_f H^\circ(\text{F}^-, \text{aq}) = -320 \text{ kJ/mol}$

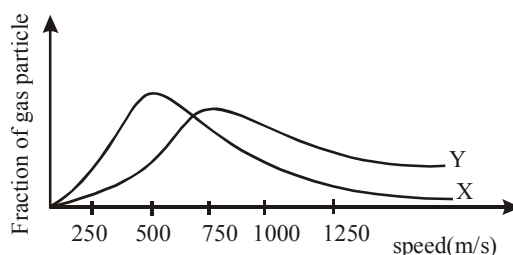
- (1)  $-17 \text{ kJ/mol}$  (2)  $-38 \text{ kJ/mol}$   
 (3)  $-47 \text{ kJ/mol}$  (4)  $-43 \text{ kJ/mol}$

### ANSWER KEY

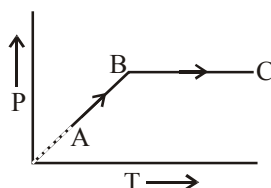
Que.	1	2	3	4	5	6	7	8	9
Ans.	3	3	3	2	4	2	1	4	3

## 7. REAL GAS & IDEAL GAS

1. The graph below shows the distribution of molecular speed of two ideal gases X and Y at 200K. on the basis of the below graph identify the correct statements -

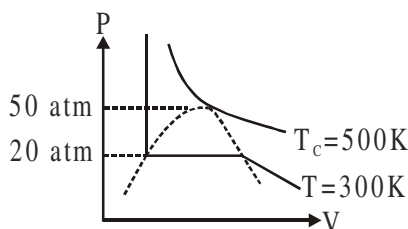


- (A) If gas X is methane, then gas Y can be  $\text{CO}_2$   
 (B) Fraction of molecules of X must be greater than Y in a particular range of speed at 200K  
 (C) Under identical conditions, rate of effusion of Y is greater than that of X  
 (D) The molar kinetic energy of gas X at 200K is equal to the molar kinetic energy of Y at 200K  
 (1) A, B, C (2) A, C (3) B, D (4) C, D
2. A gas is taken isochorically from state A to state C as shown in the graph. Choose the correct statement-



- (1) Moles of gas first remains constant and then increases  
 (2) Moles of gas first increases and then remains constant.  
 (3) Moles of gas first remains constant and then decreases  
 (4) Moles of gas first decreases and then remains constant.
3. The density of a gaseous substance at 1 atm pressure and 750 K is 0.30 g/lit. If the molecular weight of the substance is 27, the dominant forces existing among gas molecules is -  
 (1) Attractive (2) Repulsive (3) Both (1) and (2) (4) None of these

4. For real gas the P–V curve was experimentally plotted and it had the following appearance. With respect to liquification, choose the incorrect statement :



- (A) At  $T = 500\text{ K}$ ,  $P = 40\text{ atm}$ , the state will be liquid  
 (B) At  $T = 300\text{ K}$ ,  $P = 50\text{ atm}$ , the state will be gas  
 (C) At  $T < 300\text{ K}$ ,  $P = 20\text{ atm}$ , the state will be gas  
 (D) At  $300\text{ K} < T < 500\text{ K}$ ,  $P > 50\text{ atm}$ , the state will be liquid  
 (1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) A, C, D
5. Select the incorrect statement (s)
- (A) The critical constant for a Vander Waal's gas is  $V_C = 3b$ ,  $P_C = \frac{a}{27b^2}$  and  $T_C = \frac{a}{27Rb}$   
 (B) At  $56\text{ K}$  a gas may be liquified if its critical temperature is  $-156^\circ\text{C}$ .  
 (C)  $U_{\text{avg}}$  of gas in a rigid container can be doubled when the pressure is quadrupled by pumping in more gas at constant temperature  
 (D) At extremely low pressure, all real gases behave ideally.  
 (1) A, C                      (2) B, C                      (3) B, D                      (4) C, D
6. A 1 litre vessel contains 2 moles of a vanderwaal's gas.  
**Given data :**  
 $a = 2.5\text{ atm-L}^2\text{ mole}^{-2}$      $T = 240\text{ K}$   
 $b = 0.4\text{ L-mole}^{-1}$      $RT = 20\text{ L-atm mole}^{-1}$   
 Identify the correct options about the gas sample :
- (A) Pressure of gas =  $190\text{ atm}$   
 (B) Compressibility factor =  $4.75$   
 (C) Attraction forces are dominant in the gaseous sample  
 (D)  $T_B$  (Boyle temperature) =  $75\text{ K}$   
 (1) A, B, C                      (2) B, C, D                      (3) A, B, D                      (4) A, C, D
7. Choose the correct statement(s) among the following -
- (A) A gas having higher value  $T_C$  is easy to liquify  
 (B) The radius of molecules of gas having same value of  $T_C/P_C$  is same  
 (C) Hydrogen gas can be liquified at its boyle temperature by application of pressure.  
 (D) Real gas show negative deviation from ideal behaviour at low pressure condition.  
 (1) A, B, C                      (2) B, C, D                      (3) A, C, D                      (4) A, B, D

8. Select the INCORRECT statement(s):

- (A) At Boyle's temperature a real gas behaves like an ideal gas irrespective of pressure.  
 (B) At critical condition, a real gas behaves like an ideal gas.  
 (C) On increasing the temperature four times, collision frequency ( $Z_1$ ) becomes double at constant volume.  
 (D) At high pressure Van der Waals constant 'b' dominates over 'a'.

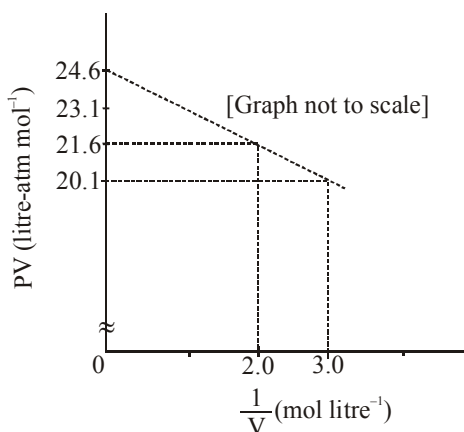
- (1) A, B                      (2) B, C                      (3) A, C                      (4) C, D

9. A gas described by Van der Waals equation

- (A) behaves similar to an ideal gas in the limit of large molar volumes  
 (B) behaves similar to an ideal gas in the limit of large pressures  
 (C) is characterised by Van der Waals coefficients that are dependent on the identity of the gas but are independent of the temperature  
 (D) has the pressure that is lower than the pressure exerted by the same gas behaving ideally

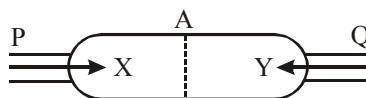
- (1) A, C, D                      (2) B, C, D                      (3) A, B, C                      (4) A, B, D

10. For one mole of a Van der Waals gas when  $b = 0$  and  $T = 300$  K, the PV vs.  $1/V$  plot is shown below. The value of the Van der Waals constant  $a$  (atm. litre<sup>2</sup> mol<sup>-2</sup>) is



- (1) 1.0                      (2) 4.5                      (3) 1.5                      (4) 3.0

11. 3 mole of gas "X" and 2 moles of gas "Y" enters from end "P" and "Q" of the cylinder respectively. The cylinder has the area of cross-section A, shown as under -



The length of the cylinder is 150 cm. The gas "X" intermixes with gas "Y" at the point A. If the molecular weight of the gases X and Y is 20 and 80 respectively, then what will be the distance of point A from Q?

- (1) 75cm                      (2) 50cm                      (3) 37.5 cm                      (4) 90 cm

12. Under identical experiment conditions which of the following pairs of gases will be most easy to separate by using effusion process -

- (1) H<sub>2</sub> and T<sub>2</sub>                      (2) SO<sub>2</sub> and SO<sub>3</sub>                      (3) NH<sub>3</sub> and CH<sub>4</sub>                      (4) U<sup>235</sup>O<sub>2</sub> and U<sup>238</sup>O<sub>2</sub>



13. Consider the following pairs of gases A and B.

	A	B
(a)	CO	N <sub>2</sub>
(b)	O <sub>2</sub>	O <sub>3</sub>
(c)	<sup>235</sup> UF <sub>6</sub>	<sup>238</sup> UF <sub>6</sub>

Relative rates of effusion of gases A to B under similar condition is in the order:

- (1)  $a < b < c$                       (2)  $a < c < b$                       (3)  $a > b > c$                       (4)  $a > c > b$
14. Four particles have speed 2, 3, 4 and 5 cm/s respectively. Their rms speed is :
- (1) 3.5 cm/s                      (2)  $\left(\frac{27}{2}\right)$  cm/s                      (3)  $\sqrt{54}$  cm/s                      (4)  $\left(\frac{\sqrt{54}}{2}\right)$  cm/s
15. When an equimolar mixture of two gases A and B [ $M_A > M_B$ ] is allowed to effuse through a Pin hole  
select incorrect statement -
- (1) B comes out at a faster rate  
(2) Relative rate of effusion of A increases with time  
(3) Rate of effusion of B will always be greater  
(4) Initially, with equal molar ratio rate of effusion of B is greater than rate of effusion of A.
16. Select the correct option(s) for an ideal gas
- (A) Most probable speed increases with increase in temperature  
(B) Fraction of particles moving with most probable speed increases with increase in temperature  
(C) Fraction of particles moving with most probable speed are more for Cl<sub>2</sub> than H<sub>2</sub> under similar condition of T, P & V.  
(D) Most probable speed is more for Cl<sub>2</sub> than H<sub>2</sub> at same temperature
- (1) A, C                      (2) B, C                      (3) C, D                      (4) A, D
17. A closed vessel at temperature T contain a mixture of two diatomic gases A and B. Molar mass of A is 16 times that of B and mass of gas A contained in the vessel is 2 times that of B. Which of the following statements are correct-
- (A) Average kinetic energy per molecule of A is equal to that of B.  
(B) Root mean square velocity of B is four times that of A  
(C) Pressure exerted by B is eight time of that exerted by A  
(D) Number of molecules of B, in the cylinder, is eight time that of A
- (1) A, B, C, D                      (2) B, C                      (3) A, C, D                      (4) B, C, D
18. Which of the following quantities is the same for all ideal gases at the same temperature :
- (A) The kinetic energy of 1 mol                      (B) The kinetic energy of 1 g  
(C) The number of molecules in 1 mol                      (D) The number of molecules in 1 g
- (1) A, C                      (2) B, C                      (3) A, D                      (4) B, D

19. Which statement is/are correct for postulates of kinetics theory of gases -  
 (A) Gases are composed of molecules whose size is negligible compared with the average distance between them  
 (B) Molecules moves randomly in straight lines in all directions and at various speeds.  
 (C) When molecules collide with one another the collisions are elastic. In an elastic collision the loss of kinetic energy takes place  
 (D) The average kinetic energy of a molecule is proportional to the absolute temperature.  
 (1) A, B, D (2) A, B, C (3) B, C, D (4) A, C
20. Which of the following statements is (are) true -  
 (A) The ratio of the average speed to the rms speed is independent of the temperature  
 (B) The square of the mean squared speed of the molecule is equal to the mean square speed at a certain temperature  
 (C) Mean kinetic energy of the gas molecules at any given temperature is independent of the mean speed  
 (D) The difference between rms speed and average speed at any temperature for different gases diminished as larger molar masses are considered  
 (1) A, B, C (2) B, C, D (3) A, B, D (4) A, C, D
21. At 300 K, the density of a certain gaseous molecule at 2 bar is double to that of dinitrogen ( $N_2$ ) at 4 bar. The molar mass of gaseous molecule is :-  
 (1)  $28 \text{ g mol}^{-1}$  (2)  $56 \text{ g mol}^{-1}$  (3)  $224 \text{ g mol}^{-1}$  (4)  $112 \text{ g mol}^{-1}$
22. Assuming ideal gas behaviour, the ratio of density of ammonia to that of hydrogen chloride at same temperature and pressure is :  
 (Atomic wt. of Cl = 35.5 u)  
 (1) 0.64 (2) 1.64 (3) 1.46 (4) 0.46
23. Let the most probable velocity of hydrogen molecules at a temperature  $t^\circ\text{C}$  is  $V_0$ . Suppose all the molecules dissociate into atoms when temperature is raised to  $(2t + 273)^\circ\text{C}$  then the new r.m.s velocity is  
 (1)  $\sqrt{2/3} V_0$  (2)  $\sqrt{3(2 + 273/t)} V_0$  (3)  $2\sqrt{3} V_0$  (4)  $\sqrt{6} V_0$

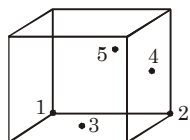
## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	3	2	3	1	3	4	1	1	3	3	1	2	4	3
Que.	16	17	18	19	20	21	22	23							
Ans.	1	1	1	1	4	4	4	4							

## 8. SOLID STATE

1. Which of the following is not a crystalline solid ?  
 (1) Common salt (2) Sugar (3) Iron (4) Rubber
2. Which of the following is not a characteristic of crystalline solids ?  
 (1) They have a regular geometry (2) They have sharp melting points  
 (3) They are isotropic (4) They undergo a clean cleavage

3. A metallic crystal crystallizes into a lattice containing a sequence of layers AB AB AB....Any packing of spheres leaves out voids in the lattice. What percentage of volume of this lattice is empty space,  
 (1) 74% (2) 26% (3) 32% (4) 48 %
4. Which of the following atoms touch each other in a fcc unit cell (diagram given) -



Atom 4 is at the centre of side face  
 Atom 5 is at the centre of back face  
 Atom 3 is at the centre of bottom face

- (A) 1 & 2 (B) 1 & 3 (C) 3 & 5 (D) 3 & 4  
 (1) Only B (2) B, D (3) B, C, D (4) C, D
5. Find type of crystallization of Ag (At. wt. = 108 amu) atom with cubical side length  $5\text{\AA}$ , if density of crystall lattice is  $2.88\text{ gram/cm}^3$ . ( $N_A = 6 \times 10^{23}$ )  
 (1) SC (2) FCC (3) BCC (4) HCP
6. If  $r_+ = 200\text{ pm}$  &  $r_- = 500\text{ pm}$  in ionic crystal then cation will be present in -  
 (1) triangular void (2) tetrahedral void (3) octahedral void (4) cubical void
7. The density of a pure substance 'A' whose atoms pack in cubic close pack arrangement is  $1\text{ gm/cc}$ . If B atoms can occupy tetrahedral void and if all the tetrahedral voids are occupied by 'B' atom. What is the density of resulting solid in gm/cc. [Atomic mass (A) =  $30\text{ gm/mol}$  & Atomic mass (B) =  $50\text{ gm/mol}$ ]  
 (1) 3.33 (2) 4.33 (3) 2.33 (4) 5.33
8. Select the correct statement about FCC (ABCAB...) structure.

(A) Distance between nearest octahedral void and tetrahedral void is  $\frac{\sqrt{3}a}{4}$

(B) Distance between two nearest octahedral void is  $\frac{a}{\sqrt{2}}$

(C) Distance between two nearest tetrahedral void is  $\frac{\sqrt{3}a}{2}$

(D) Distance between layer A and B is  $2r\sqrt{\frac{2}{3}}$

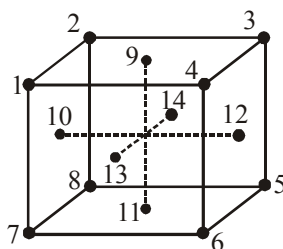
- (1) Only A (2) B, C (3) A, B, D (4) A, B, C, D
9. In a solid AB having NaCl type structure A atoms occupy the corner of the cubic unit cell and the face centered positions. If all the face-centered atom along one of the axis are removed, choose the correct options :


(Atomic weight of A = 40),

Atomic weight of B = 60,  $r_A = 1.4\text{\AA}$ ,  $r_B = 2.8\text{\AA}$

- (A) the packing fraction is 0.579 (B) The density of the resultant solid is  $1.008\text{ g/cc}$   
 (C) The packing fraction is 0.679 (D) The density of the resultant solid is  $2.008\text{ g/cc}$   
 (1) Only B (2) B, C (3) A, B (4) C, D

10. Select the correct statements considering given fcc unit cell



- (A) sphere 11 & 14 touch each other  
 (B) sphere 10 & 14 touch each other  
 (C) sphere 10 & 12 are at a distance of  $2\sqrt{2}r$   
 (D) There are six planes in the fcc unit cell having such  arrangement of atoms
- (1) A, B, C                      (2) A, B                      (3) A, B, D                      (4) A, B, C, D

11. The radius ratio of  $P^{2+}$  and  $Q^{-}$  ions  $\left(\frac{r_{P^{2+}}}{r_{Q^{-}}}\right)$  is 0.8. The unit cell of this ionic solid is

- (A) Simple cubic for  $Q^{-}$  ions and  $P^{2+}$  ions are in cubic voids  
 (B) Face centered cubic for  $Q^{-}$  ions and  $P^{2+}$  ions occupy all the tetrahedral voids.  
 (C) Face centered cubic for  $P^{2+}$  ions and  $Q^{-}$  ions occupy all the tetrahedral voids.  
 (D) Face centered cubic for  $Q^{-}$  ions and  $P^{2+}$  ions occupy 50% of octahedral voids.
- (1) Only A                      (2) A, B                      (3) A, D                      (4) A, C

12. Which of the following statement is **CORRECT** ?

- (1) A metal can show only non- stoichiometric defects  
 (2) Schottky defect reduces the density of a solid due to significant increase in volume.  
 (3) Impurity defect always change the density.  
 (4) Solids having F-centres may have metal excess defect due to missing anions.

13. The only incorrect statement for the packing of identical spheres in two dimension is :

- (1) For square close packing , coordination number is 4.  
 (2) For hexagonal close packing, coordination number is 6.  
 (3) There is only one void per atom in both, square and hexagonal close packing.  
 (4) Hexagonal close packing is more efficiently packed than square close packing.

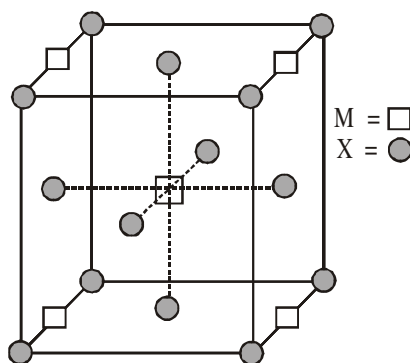
14. Which of the following statements is/are correct :

- (A) In an anti-fluorite structure, anions form FCC lattice and cations occupy all tetrahedral voids.  
 (B) If the radius of cations and anions are  $0.2 \text{ \AA}$  and  $0.95 \text{ \AA}$  , then coordination number of cation in the crystal is 4.  
 (C) Each sphere is surrounded by six voids in two dimensional hexagonal close packed layer.  
 (D) 8  $\text{Cs}^{+}$  ions occupy the second nearest neighbour locations of a  $\text{Cs}^{+}$  ion in  $\text{CsCl}$  crystals.

- (1) Only A                      (2) A, B, D                      (3) A, B, C                      (4) A, C

15. Select correct statement(s)
- (A) Density of crystal always increases due to substitutinal impurity defect.  
 (B) An ion is transferred from a lattice site to an interstitial position in Frenkel defect.  
 (C) In AgCl, the silver ion is displaced from its lattice position to an interstitial position. Such a defect is called a frenkel defect  
 (D) None
- (1) B, C                      (2) A, B, C                      (3) A, B                      (4) Only B
16. Lead metal has a density of  $11.34 \text{ g/cm}^3$  and crystallizes in a face-centred lattice. Choose the correct alternatives ( $\text{Pb} = 208$ ,  $N_A = 6 \times 10^{23}$ )
- (A) the volume of one unit cell is  $1.22 \times 10^{-22} \text{ cm}^3$ .  
 (B) the volume of one unit cell is  $1.22 \times 10^{-19} \text{ cm}^3$ .  
 (C) the atomic radius of lead is 175 pm.  
 (D) the atomic radius of lead is 155.1 pm.
- (1) Only A                      (2) B, C                      (3) B, D                      (4) A, C
17. Which of the following statement(s) is/are correct ?
- (A) NaCl is a 'AB' crystal lattice that can be interpreted to be made up of two individual fcc unit cells of  $\text{A}^+$  and  $\text{B}^-$  fused together in such a manner that the corner of one unit cell becomes the edge centre of the other.  
 (B) In a face centred cubic unit cell, the body centre is an octahedral void.  
 (C) In fcc unit cell, octahedral and tetrahedral voids are equal in number.  
 (D) Tetrahedral voids =  $2 \times$  octahedral voids, is valid for ccp and hcp.
- (1) B, D                      (2) A, B, D                      (3) B, C, D                      (4) A, C, D
18. Select the correct statement (s) :
- (A) CsCl mainly shows Schottky defect                      (B) ZnS mainly shows Frenkel defect  
 (C) NaCl unit cell contain  $4\text{Na}^+$  and  $4\text{Cl}^-$                       (D) Truncated octahedron have 24 corners.
- (1) A, C                      (2) A, B, D                      (3) B, C, D                      (4) A, B, C, D
19. Select the correct statement(s) –
- (A) The ionic crystal of AgBr has Schottky defect.  
 (B) The unit cell having crystal parameters,  $a = b \neq c$ ,  $\alpha = \beta = 90^\circ$ ,  $\gamma = 120^\circ$  is hexagonal  
 (C) Ionic compounds having Frenkel defect has high  $r^+/r^-$  ratio.  
 (D) The co-ordination number of  $\text{Na}^+$  ion in NaCl is 6
- (1) A, B                      (2) A, B, C                      (3) A, B, D                      (4) A, B, C, D
20. Which of the following is/are true ?
- (A) Ratio of nearest neighbours in simple cubic cell to next nearest neighbours in face centred cubic cell is 1.  
 (B) Packing efficiency of a unit cell in which atoms are present at each corner and each edge centre is about 26 % in metallic crystal.  
 (C) Distance between two planes in FCC or HCP arrangement is same for a metal existing in both forms, with same atomic radius.  
 (D) If number of unit cell along one edge are 'x', then total number of unit cell in cube =  $x^3$
- (1) A, B, C                      (2) A, B, C, D                      (3) B, C only                      (4) A, D only

21. A compound  $M_pX_q$  has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is :



- (1) MX                      (2)  $MX_2$                       (3)  $M_2X$                       (4)  $M_5X_{14}$
22. The incorrect statement for cubic close packed (ccp) three dimensional structure is
- (1) The number of the nearest neighbours of an atom present in the topmost layer is 12
- (2) The efficiency of atom packing is 74%
- (3) The number of octahedral and tetrahedral voids per atom are 1 and 2, respectively
- (4) The unit cell edge length is  $2\sqrt{2}$  times the radius of the atom
23. **Statement-1** : In Antifluorite structure ( $Li_2O$ ), the oxide ions occupy c.c.p. (cubic close packing) and  $Li^+$  ions, 100% tetrahedral voids.

**Statement-2** : The distance of the nearest neighbours in antifluorite structure is  $\frac{\sqrt{3}a}{4}$ , where 'a' is the edge length of the cube

- (1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
- (2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
- (3) Statement-1 is true, statement-2 is false.
- (4) Statement-1 is false, statement-2 is true.
24. In the spinel structure, oxides ions are cubical-closest packed whereas  $1/8$ th of tetrahedral voids are occupied by  $A^{2+}$  cation and  $1/2$  of octahedral voids are occupied by  $B^{3+}$  cations. The general formula of the compound having spinel structure is :-
- (1)  $A_2B_2O_4$                       (2)  $AB_2O_4$                       (3)  $A_2B_4O_2$                       (4)  $A_4B_2O_2$
25. If an element (at. mass = 50) crystallises in fcc lattice, with  $a = 0.50$  nm. What is the density of unit cell if it contains 0.25% Schottky defects (use  $N_A = 6 \times 10^{23}$ ) ?
- (1) 2.0 g/cc                      (2) 2.66 g/cc                      (3) 3.06 g/cc                      (4) none of these

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	3	2	3	3	2	2	3	2	4	4	4	3	4	1
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	4	2	4	3	2	2	1	2	2	2					

## 9. LIQUID SOLUTION & CONCENTRATION TERM

- The solubility of common salt is 36.0 gm in 100 gm of water at 20°C. If systems I, II and III contain 20.0, 18.0 and 15.0 g of the salt added to 50.0 gm of water in each case, the vapour pressures would be in the order.  
 (1)  $I < II < III$                       (2)  $I > II > III$                       (3)  $I = II > III$                       (4)  $I = II < III$
- For a liquid normal boiling points is -173°C then at 2 atm pressure it's boiling point should be nearly  
 $(\Delta H_{\text{vap}} = 200 \text{ cal/mole}, R=2 \text{ cal/mol-KI}, \ln 2 = 0.7)$   
 (1) -73°C                      (2) 333°C                      (3) 60°C                      (4) 103°C
- On the basis of information given below mark the correct option.  
**Information :** On adding acetone to methanol some of the hydrogen bonds between methanol molecules break.
  - At specific composition methanol-acetone mixture will form minimum boiling azeotrope and will show positive deviation from Raoult's law.
  - At specific composition methanol-acetone mixture forms maximum boiling azeotrope and will show positive deviation from Raoult's law.
  - At specific composition methanol-acetone mixture will form minimum boiling azeotrope and will show negative deviation from Raoult's law.
  - At specific composition methanol-acetone mixture will form maximum boiling azeotrope and will show negative deviation from Raoult's law.
- The molar concentration of HCl (aq.) is  $10^{-5} \text{ M}$ . Which of the following statements are correct.  
 $(d_{\text{solution}} = 1 \text{ gm/cc})$ 
  - The mole fraction of HCl  $\cong 1.8 \times 10^{-7}$
  - The concentration of HCl in ppm is 3.65 ppm
  - The molality of HCl solution is approximately  $10^{-5} \text{ m}$
  - The (w/v)% of solution is  $3.65 \times 10^{-5} \%$
 (1) A, B, D                      (2) A, B, C                      (3) B, D                      (4) A, D
- Solution(s) containing 40 gm NaOH is/are
  - 50 gm of 80% (w/w) NaOH
  - 50 gm of 80% (w/v) NaOH [ $d_{\text{soln.}} = 1.2 \text{ gm/ml}$ ]
  - 50 gm of 20 M NaOH [ $d_{\text{soln.}} = 1 \text{ gm/ml}$ ]
  - 50 gm of 5m NaOH
 (1) A, B, C                      (2) A, C                      (3) B, C                      (4) C, D
- The **incorrect** statement(s) regarding 2M  $\text{MgCl}_2$  aqueous solution is/are ( $d_{\text{solution}} = 1.09 \text{ gm/ml}$ )
  - Molality of  $\text{Cl}^-$  is **4.44 m**
  - Mole fraction of  $\text{MgCl}_2$  is exactly **0.035**
  - The conc. of  $\text{MgCl}_2$  is **19% w/v**
  - The conc. of  $\text{MgCl}_2$  is  **$19 \times 10^4 \text{ ppm}$**
 (1) B, C                      (2) B, C, D                      (3) B, D                      (4) A, D

7. A sample of  $\text{H}_2\text{O}_2$  solution labelled as 56.75 volume has density of 530 gm/L. Mark the correct option(s) representing concentration of same solution in other units. (Solution contains only  $\text{H}_2\text{O}$  and  $\text{H}_2\text{O}_2$ )
- (A)  $M_{\text{H}_2\text{O}_2} = 6$  (B)  $\% \frac{w}{v} = 17$
- (C) Mole fraction of  $\text{H}_2\text{O}_2 = 0.25$  (D)  $m_{\text{H}_2\text{O}_2} = \frac{1000}{72}$
- (1) B, D (2) A, C, D (3) C, D (4) A, B, C
8. 100 mL of 0.06 M  $\text{Ca}(\text{NO}_3)_2$  is added to 50 mL of 0.06 M  $\text{Na}_2\text{C}_2\text{O}_4$ . After the reaction is complete ( $\text{CaC}_2\text{O}_4$  is precipitated)
- (A) 0.003 moles of calcium oxalate will get precipitated
- (B) 0.003 M  $\text{Ca}^{2+}$  will remain in excess
- (C)  $\text{Na}_2\text{C}_2\text{O}_4$  is the limiting reagent
- (D) Oxalate ion ( $\text{C}_2\text{O}_4^{2-}$ ) concentration in final solution is 0.003 M
- (1) A, B (2) A, C (3) A, B, C (4) A, D
9. A compound has the empirical formula  $\text{C}_{10}\text{H}_8\text{Fe}$ . A solution of 0.26 g of the compound in 11.2 g of benzene ( $\text{C}_6\text{H}_6$ ) boils at  $80.26^\circ\text{C}$ . The boiling point of benzene is  $80.10^\circ\text{C}$ ; the  $K_b$  is  $2.53^\circ\text{C/molal}$ . What is the molecular formula of the compound ?
- (1)  $\text{C}_{30}\text{H}_{24}\text{Fe}_3$  (2)  $\text{C}_{10}\text{H}_8\text{Fe}$  (3)  $\text{C}_5\text{H}_4\text{Fe}$  (4)  $\text{C}_{20}\text{H}_{16}\text{Fe}_2$
10. An industrial waste water is found to contain 8.2%  $\text{Na}_3\text{PO}_4$  and 12%  $\text{MgSO}_4$  by mass in solution. If % ionisation of  $\text{Na}_3\text{PO}_4$  and  $\text{MgSO}_4$  are 50 and 60 respectively then its normal boiling point is [ $K_b(\text{H}_2\text{O}) = 0.50 \text{ K kg mol}^{-1}$ ] :-
- (1)  $102.3^\circ\text{C}$  (2)  $103.35^\circ\text{C}$  (3)  $101.785^\circ\text{C}$  (4) None of these

## ANSWER KEY

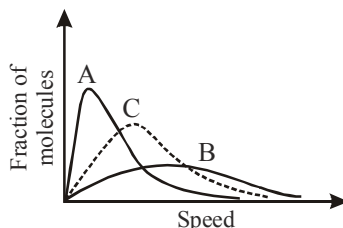
Que.	1	2	3	4	5	6	7	8	9	10	
Ans.	4	3	1	1	2	3	1	2	4	3	

## 10. CHEMICAL KINETICS

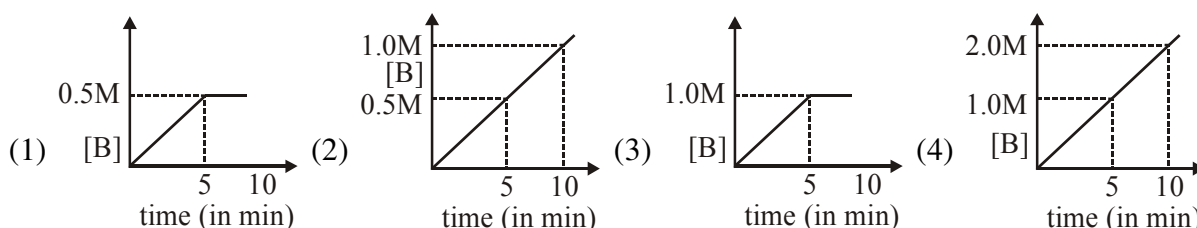
1. The order of reaction  $\text{A} \longrightarrow \text{product}$  can be given by the expression (s)
- [where  $r$  = rate of reaction ;  $[\text{A}]_1$  = concentration at time  $t_1$  ;  $[\text{A}]_2$  = concentration at time  $t_2$ ]
- (A)  $\frac{\ln r_2 - \ln r_1}{\ln [\text{A}]_2 - \ln [\text{A}]_1}$  (B)  $\frac{\ln [\text{A}_0]_2 - \ln [\text{A}_0]_1}{\ln [t_{1/2}]_2 - \ln [t_{1/2}]_1}$
- (C)  $\ln \left( \frac{-d(\text{A})}{k \cdot dt} \right) / \ln [\text{A}]$  (D)  $\frac{\ln (r/k)}{\ln [\text{A}]}$
- (1) A, B, C (2) B, C, D (3) A, C, D (4) A, B, D



2. The curve C is for the gas X at 273 K. Choose the **CORRECT** statement(s) :



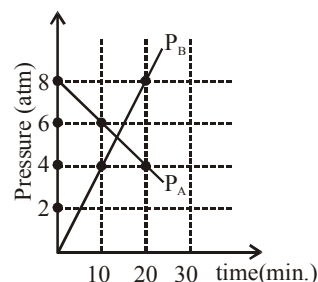
- (A) Curve A may be of a heavier gas but at same temperature  
 (B) Curve B may be of the same gas but at 373K  
 (C) Curve A may be of the same gas but at 373K  
 (D) Curve B may be of the lighter gas but at same temperature  
 (1) A, B, D                      (2) A, B, C                      (3) B, C, D                      (4) B, D
3. For a reaction of order  $n$ , what is the relationship between  $t_{3/4}$  and  $t_{1/2}$ , where  $t_{3/4}$  is the time required for concentration (C) to become  $1/4$ .  $C_0$  and  $C$  are the values of the reactant concentration at the start and after time  $t$ , respectively.  
 (1)  $t_{3/4} = t_{1/2} [2^{n-1} + 1]$                       (2)  $t_{3/4} = t_{1/2} [2^{n-1} - 1]$   
 (3)  $t_{3/4} = t_{1/2} [2^{n+1} - 1]$                       (4)  $t_{3/4} = t_{1/2} [2^{n+1} + 1]$
4. For a complex reaction \_\_\_\_\_.  
 (A) order of overall reaction is same as molecularity of the slowest step (provided slowest step having no reaction intermediate)  
 (B) order of overall reaction is less than the molecularity of the slowest step.  
 (C) order of overall reaction is greater than molecularity of the slowest step.  
 (D) molecularity of the slowest step is never zero or non interger.  
 (1) A, D                      (2) B, D                      (3) A, C                      (4) A, B
5. For a gas reaction  $A \rightarrow P$  at  $T$  (K) the rate is given by  
 $\text{rate} = k_1 p_A^2 \text{ atm/hr}$   
 $\text{rate} = k_2 C_A^2 \text{ mol/litre/hr}$   
 the relation between  $k_1$  and  $k_2$  is  
 (1)  $k_2 = k_1$                       (2)  $k_2 = k_1 RT$                       (3)  $k_2 = k_1/RT$                       (4)  $k_2 = k_1(RT)^2$
6. Consider the Arrhenius equation given below and mark the correct option.  $k = A e^{-E_a/RT}$   
 (A) Rate constant increases exponentially with increasing activation energy and decreasing temperature.  
 (B) Rate constant decreases exponentially with increasing activation energy and decreasing temperature.  
 (C) Rate constant increases exponentially with decreasing activation energy and decreasing temperature.  
 (D) Rate constant increases exponentially with decreasing activation energy and increasing temperature.  
 (1) A, B, D                      (2) B, C                      (3) B, D                      (4) A, B
7. Consider a reaction  $A(g) \xrightarrow{k=0.1 \text{ M min}^{-1}} 2B(g)$ . If initial concentration of A is 0.5 M then select correct graph.



8. In a chemical reaction A(g) is converted to B(g), following observation is made. Identify the correct statement(s)

- (A) Chemical reaction should be  $\frac{1}{2}A(g) \rightarrow B(g)$   
 (B)  $t_{1/2}$  of the reaction is independent of initial partial pressure of A.  
 (C) Reaction must be complex reaction.  
 (D) Time of completion for the reaction is 40 minutes.

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



9. For acid catalysed hydrolysis of ester rate law obtained is  $\text{rate} = k [\text{ester}] [H^+]$ , where  $k = 0.01 \text{ M}^{-1} \text{ hr}^{-1}$ . What is the half-life if the initial concentrations are 0.02 M for the ester and 0.05 M for the catalyzing acid.

- (1) 1429 hours (2) 5000 hours (3) 1386 hours (4) 2 hours

10. For the mechanism



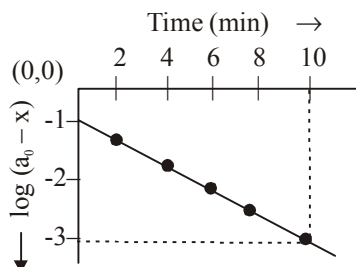
step 2 is rate-determining. Given the activation energies  $E_{a,1} = 120 \text{ kJ/mol}$ ,  $E_{a,-1} = 96 \text{ kJ/mol}$ , and  $E_{a,2} = 196 \text{ kJ/mol}$ . find  $E_a$  for the overall reaction.  $[2A + 2B \longrightarrow 2D + G + H]$

- (1) 154 (2) 244 (3) 354 (4) None of these

11. For the first order decomposition of  $\text{SO}_2\text{Cl}_2(g)$ ,

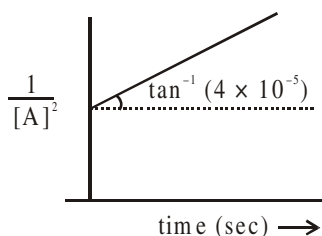


a graph of  $\log(a_0 - x)$  vs  $t$  is shown in figure. What is the rate constant ( $\text{sec}^{-1}$ )?



- (1) 0.2 (2)  $4.6 \times 10^{-1}$  (3)  $7.7 \times 10^{-3}$  (4)  $1.15 \times 10^{-2}$

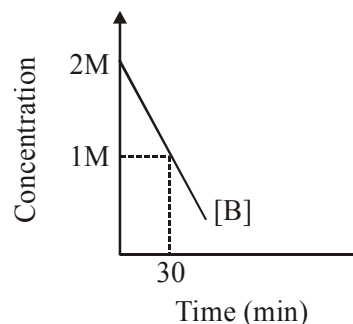
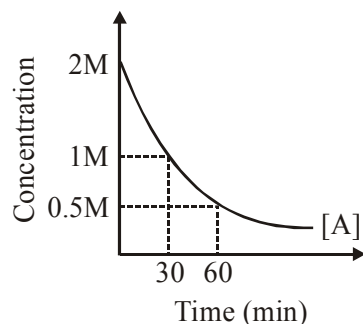
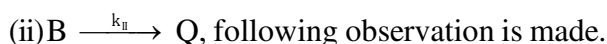
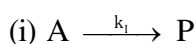
12. For a reaction  $A \longrightarrow \text{Product}$



What is the value of  $k$  for the given reaction-

- (1)  $4 \times 10^{-5} \text{ M}^{-1} \text{ s}^{-1}$  (2)  $\frac{4}{3} \times 10^{-5} \text{ M}^{-2} \text{ s}^{-1}$   
 (3)  $2 \times 10^{-5} \text{ M}^{-1} \text{ s}^{-1}$  (4)  $\frac{2}{3} \times 10^{-5} \text{ M}^{-2} \text{ s}^{-1}$

13. For the reactions

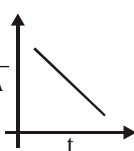


Calculate  $\frac{k_I}{k_{II}}$ , where  $k_I$  and  $k_{II}$  are rate constant for the respective reaction.

- (1) 2.303                      (2) 1                      (3) 0.36                      (4) 0.693

14. For the reaction  $A \rightarrow B$ , the rate law expression is  $-\frac{d[A]}{dt} = k[A]^{1/2}$ . If initial concentration of  $[A]$  is  $[A]_0$ , then

(A) The integrated rate expression is  $k = \frac{2}{t}(A_0^{1/2} - A^{1/2})$

(B) The graph of  $\sqrt{A}$  vs  $t$  will be 

(C) The half life period,  $t_{1/2} = \frac{K}{2[A]_0^{1/2}}$

(D) The time taken for 75% completion of reaction  $t_{3/4} = \frac{\sqrt{[A]_0}}{k}$

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

15. Select **incorrect** statement(s):

(A) Unit of pre-exponential factor (A) for second order reaction is  $\text{mol L}^{-1} \text{s}^{-1}$ .

(B) A zero order reaction must be a complex reaction.

(C) Molecularity is defined only for RDS in a complex reaction.

(D) Rate constant (k) remain unaffected on changing temperature.

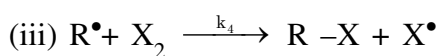
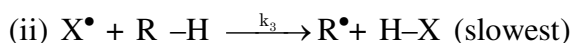
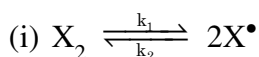
- (1) A, C, D                      (2) A, B, C                      (3) B, C, D                      (4) A, B, D

16. Which of the following is/are **correct** statement?

- (A) Stoichiometry of a reaction tells about the order of the elementary reactions.  
 (B) For a zero order reaction, rate and the rate constant are identical.  
 (C) A zero order reaction is controlled by factors other than concentration of reactants.  
 (D) A zero order reaction is always elementary reaction.

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

17. For the gas phase reaction :  $R-H + X_2 \rightarrow R-X + HX$ , following mechanism has been proposed



Based on this select the correct option (s)

(A) Effective rate constant for the formation of RX is  $k_3 k_4 \sqrt{\frac{k_1}{k_2}}$

(B)  $\frac{d[RX]}{dt} \propto [X_2]$

(C) Overall order of the reaction is 3/2

(D)  $\frac{d[RX]}{dt} \propto [RH]^1$

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

18. For a first order reaction :  $A(g) \rightarrow 2B(g)$

Time(in second)	0	20	40	$\infty$
Total pressure of system (in mm.of Hg)	64	112	124	128

- (1) Half life of reaction is 10 sec  
 (2) Value of rate constant for reaction is  $6.93 \times 10^{-3} \text{sec}^{-1}$   
 (3) Total pressure at  $t = 50$  sec will be 252 mm of Hg  
 (4) Reaction must be a complex reaction

19. Which of the following is **INCORRECT** for first order reaction ?

- (1) On introducing catalyst, both rate constant and rate of reaction increases.  
 (2) On increasing temperature both rate constant & rate of reaction increases.  
 (3) On decreasing volume both rate constant & rate of gaseous reaction increases.  
 (4) On increasing concentration of gaseous reactant at constant volume & constant temperature both total pressure and rate of the reaction increases.

20.  $2X(g) + Y(g) + 3Z(g) \rightarrow \text{Products}$ . The rate equation of above reaction is given by :

$$\text{Rate} = K [X]^1 [Y]^0 [Z]^2.$$

Choose the correct statements

- (A) If  $[Z] \gg [X]$  and 75% of X undergoes reaction in 20 sec, then 50% of X will react in 10 sec.  
 (B) Rate of reaction decreases by reducing the concentration of Y to half of the original value  
 (C) The half life of Z increases by increasing its concentration if  $[X] \gg [Z]$   
 (D) On increasing the concentration of X, Y & Z double, rate of reaction becomes 8 times

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

21. For the reaction  $A + 3B \rightarrow C$ , select the correct statement(s) :-

(A)  $\frac{d[C]}{dt} = -\frac{d[A]}{dt}$

(B)  $\frac{3d[C]}{dt} = -\frac{d[B]}{dt}$

(C) Rate law must be  $r = k [A][B]^3$

(D) Units for rate of reaction are independent of order of reaction

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

22. Choose the incorrect statement -

- (1) Activation energy of reaction always decreases on decreasing temperature  
 (2) Order of reaction may change with change in temperature  
 (3) When slowest step is the first step in a mechanism, then the rate law of overall reaction is the same as the rate law for this step  
 (4) Rate of photochemical reaction is directly proportional to intensity of absorbed photons.

23. Which statement(s) is/are false ?

- (A) Every reaction has an order if mechanism is not provided.  
 (B) All rate constant have same dimension.  
 (C) Every chemical species that appears in the rate law of reaction must be reactant or product in that reaction.  
 (D) Rate constant is never negative.

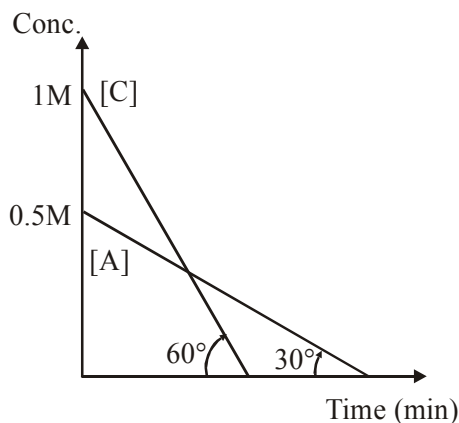
- (1) A, B, C                      (2) B, C, D                      (3) A, C, D                      (4) A, B, D

24. Two reactions  $R_1$  and  $R_2$  have identical pre-exponential factors. Activation energy of  $R_1$  exceeds that of  $R_2$  by  $10 \text{ kJ mol}^{-1}$ . If  $k_1$  and  $k_2$  are rate constants for reactions  $R_1$  and  $R_2$  respectively at 300 K, then  $\ln(k_2/k_1)$  is equal to :

( $R = 8.314 \text{ J mol}^{-1}\text{K}^{-1}$ )

- (1) 8                      (2) 12                      (3) 6                      (4) 4

25. The rate of a reaction quadruples when the temperature changes from 300 to 310 K. The activation energy of this reaction is (Assume activation energy and pre-exponential factor are independent of temperature ;  $\ln 2 = 0.693$ ,  $R = 8.314 \text{ J mol}^{-1}\text{K}^{-1}$ ) :
- (1)  $107.2 \text{ kJ mol}^{-1}\text{K}^{-1}$  (2)  $53.6 \text{ kJ mol}^{-1}\text{K}^{-1}$   
 (3)  $214.4 \text{ kJ mol}^{-1}\text{K}^{-1}$  (4)  $26.8 \text{ kJ mol}^{-1}\text{K}^{-1}$
26. The rate of a reaction A doubles on increasing the temperature from 300 to 310 K. By how much, the temperature of reaction B should be increased from 300 K so that rate doubles if activation energy of the reaction B is twice to that of reaction A :
- (1) 2.45 K (2) 4.92 K (3) 9.84 K (4) 19.67 K
27. At  $518^\circ \text{C}$ , the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was  $1.00 \text{ Torr s}^{-1}$  when 5% had reacted and  $0.5 \text{ Torr s}^{-1}$  when 33% had reacted. The order of the reaction is :
- (1) 3 (2) 1 (3) 0 (4) 2
28. Which of the following statement(s) is (are) correct
- (A) A plot of  $\log K_p$  versus  $1/T$  is linear  
 (B) A plot of  $\log [X]$  versus time is linear for a first order reaction,  $X \longrightarrow P$   
 (C) A plot of  $\log P$  versus  $1/T$  is linear at constant volume.  
 (D) A plot of  $P$  versus  $1/V$  is linear at constant temperature.
- (1) A, B, C, D (2) B, C, D (3) A, C, D (4) A, B, D
29. For the two reaction I :  $A \rightarrow B$ ; II :  $C \rightarrow D$  following graph is obtained.



Which of the following is true :

- (1) If  $[B] = [A]$  then at that time  $[D] = 0.75 \text{ M}$   
 (2) If  $[C] = [A]$  then at that time  $[B] > [D]$   
 (3)  $(t_{100\%})_{\text{reaction I}} = (t_{100\%})_{\text{reaction II}}$   
 (4)  $[A] = [C]$  at  $t = \frac{\sqrt{3}}{2} \text{ min.}$

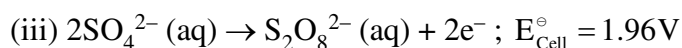
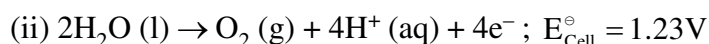
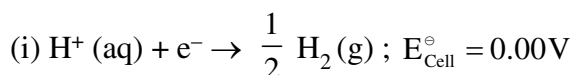
30. In a bimolecular reaction, the steric factor P was experimentally determined to be 4.5. The correct option(s) among the following is(are):
- (A) The value of frequency factor predicted by Arrhenius equation is higher than that determined experimentally
- (B) The activation energy of the reaction is unaffected by the value of the steric factor
- (C) Since  $P = 4.5$ , the reaction will not proceed unless an effective catalyst is used.
- (D) Experimentally determined value of frequency factor is higher than that predicted by Arrhenius equation.
- (1) A, B                      (2) B, D                      (3) A, C, D                      (4) B, C

### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	1	1	1	2	3	3	4	3	2	3	3	4	1	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	3	1	3	3	1	1	1	4	1	2	4	4	1	2

## 11. ELECTROCHEMISTRY

1. Potential for some half cell reactions are given below. On the basis of these mark the correct answer.



- (A) In dilute sulphuric acid solution, hydrogen will be reduced at cathode.
- (B) In concentrated sulphuric acid solution, water will be oxidised at anode.
- (C) In dilute sulphuric acid solution, water will be oxidised at anode.
- (D) In dilute sulphuric acid solution,  $\text{SO}_4^{2-}$  ion will be oxidised to tetrathionate ion at anode.
- (1) A, D                      (2) B, C                      (3) A, C                      (4) A, B, C

2. The cell potential for the unbalanced chemical reaction



is measured under standard state conditions in the electrochemical cell.  $\left( \frac{2.303 RT}{F} = 0.06 \right)$

Then which is the correct statement :-

- (A) Solution in cathodic compartment is acidic
- (B) Solution in Anodic compartment is acidic
- (C) Cell potential will be zero at  $\text{pH} = \frac{2}{9}$ , if activity of other components are equal to one.
- (D) 0.6 moles of electron pass through the circuit when 0.6 moles of  $\text{Hg}_2^{2+}$  are produced in the cell
- (1) A, B, C                      (2) A, C, D                      (3) A, D                      (4) B, C, D

3. The standard electrode potentials for the reactions

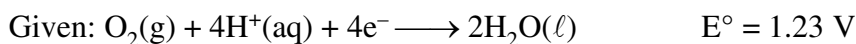


at 25 °C are 0.80 volt and -0.14 volt, respectively. The standard emf of the cell.

$\text{Sn}_{(\text{s})} | \text{Sn}_{(\text{aq})}^{2+} (1\text{M}) || \text{Ag}_{(\text{aq})}^+ (1\text{M}) | \text{Ag}_{(\text{s})}$  is :

- (1) 0.66 volt                      (2) 0.80 volt                      (3) 1.08 volt                      (4) 0.94 volt
4. The reduction potential values are given below:  
 $\text{Al}^{3+} | \text{Al} = -1.67$  volt,  $\text{Mg}^{2+} | \text{Mg} = -2.34$  volt  
 $\text{Cu}^{2+} | \text{Cu} = +0.34$  volt,  $\text{I}_2 | 2\text{I}^- = +0.53$  volt  
 Which one is the best reducing agent ?  
 (1) Al                      (2) Mg                      (3) Cu                      (4)  $\text{I}_2$
5. When an electric current is passed through a cell containing an electrolyte, positive ions move towards the cathode and negative ions towards the anode. What will happen if the cathode is pulled out of the solution?  
 (1) The positive ions will start moving towards the anode and negative ions will stop moving.  
 (2) The negative ions will continue to move towards the anode and the positive ions will stop moving  
 (3) Both positive and negative ions will move towards the anode.  
 (4) None of these movements will take place.
6. During electro refining of Cu by electrolysis of an aqueous solution of  $\text{CuSO}_4$  using copper electrodes, if 2.5 g of Cu is deposited at cathode, then at anode  
 (1) decrease of more than 2.5 g of mass takes place  
 (2) 445 ml of  $\text{O}_2$  at STP is liberated  
 (3) 2.5 g of copper is deposited  
 (4) a decrease of 2.5 g of mass takes place
7. For the fuel cell reaction  
 $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\ell)$   
 $;\Delta_f H_{298}^\circ(\text{H}_2\text{O}, \ell) = -285.5 \text{ kJ/mol}$

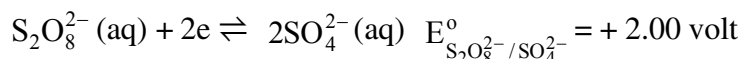
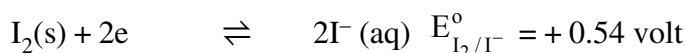
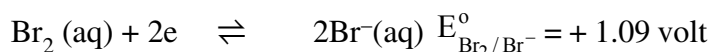
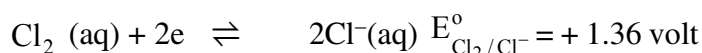
What is  $\Delta S_{298}^\circ$  for the given fuel cell reaction?



- (1) -0.322 J/K                      (2) -0.635 kJ/K                      (3) 3.51 kJ/K                      (4) -0.322 kJ/K
8. The resistance of 0.5 M solution of an electrolyte in a cell was found to be 50  $\Omega$ . If the electrodes in the cell are 2.2 cm apart and have an area of 4.4  $\text{cm}^2$  then the molar conductivity (in  $\text{S m}^2 \text{mol}^{-1}$ ) of the solution is :-  
 (1) 0.2                      (2) 0.02                      (3) 0.002                      (4) None of these
9. During discharging of lead storage battery, which of the following is/are true ?  
 (A)  $\text{H}_2\text{SO}_4$  is produced  
 (B)  $\text{H}_2\text{O}$  is consumed  
 (C)  $\text{PbSO}_4$  is formed at both electrodes  
 (D) Density of electrolytic solution decreases  
 (1) A, B                      (2) C, D                      (3) B, C                      (4) A, B, C

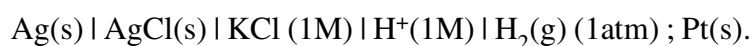


10. Which of the following arrangement will produce oxygen at anode during electrolysis ?  
 (A) Dilute  $\text{H}_2\text{SO}_4$  solution with Cu electrodes.  
 (B) Dilute  $\text{H}_2\text{SO}_4$  solution with inert electrodes.  
 (C) Fused NaOH with inert electrodes.  
 (D) Dilute NaCl solution with inert electrodes.  
 (1) A, B, C (2) B, D (3) B, C, D (4) C, D
11. If 270.0 g of water is electrolysed during an experiment performed by miss Abhilasha with 75% current efficiency then  
 (A) 168 L of  $\text{O}_2$  (g) will be evolved at anode at 1 atm & 273 K  
 (B) Total 504 L gases will be produced at 1 atm & 273 K.  
 (C) 336 L of  $\text{H}_2$  (g) will be evolved at anode at 1 atm & 273 K  
 (D) 45 F electricity will be consumed  
 (1) A, B (2) B, C (3) C, D (4) A, D
12. Pick out the correct statements among the following from inspection of standard reduction potentials (Assume standard state conditions).



- (A)  $\text{Cl}_2$  can oxidise  $\text{SO}_4^{2-}$  from solution  
 (B)  $\text{Cl}_2$  can oxidise  $\text{Br}^-$  and  $\text{I}^-$  from aqueous solution  
 (C)  $\text{S}_2\text{O}_8^{2-}$  can oxidise  $\text{Cl}^-$ ,  $\text{Br}^-$  and  $\text{I}^-$  from aqueous solution  
 (D)  $\text{S}_2\text{O}_8^{2-}$  is added slowly,  $\text{Br}^-$  can be reduce in presence of  $\text{Cl}^-$   
 (1) B, C (2) A, B, C (3) B, D (4) C, D

13. The EMF of the following cell is 0.22 volt.



Which of the following will decrease the EMF of cell.

- (A) increasing pressure of  $\text{H}_2(\text{g})$  from 1 atm to 2 atm  
 (B) increasing  $\text{Cl}^-$  concentration in Anodic compartment  
 (C) increasing  $\text{H}^+$  concentration in cathodic compartment  
 (D) decreasing KCl concentration in Anodic compartment.  
 (1) A, B, C (2) A, D (3) B, C (4) C, D

14. To find the standard potential of  $M^{3+}|M$  electrode, the following cell is constituted:  
 $Pt|M|M^{3+}(0.001 \text{ mol L}^{-1})|Ag^{+}(0.01 \text{ mol L}^{-1})|Ag$   
 The emf of the cell is found to be 0.421 volt at 298 K. The standard potential of half reaction  
 $M^{3+} + 3e^{-} \rightarrow M$  at 298 K will be:  
 (Given  $E_{Ag^{+}/Ag}^{\ominus}$  at 298 K = 0.80 Volt)  
 (1) +0.30 V (2) +0.057 V (3) -0.057 V (4) None of these
15. How long (approximate) should water be electrolysed by passing through 100 amperes current so that the oxygen released can completely burn 27.66 g of diborane ?  
 (Atomic weight of B = 10.8 u)  
 (1) 0.8 hours (2) 3.2 hours (3) 1.6 hours (4) 6.4 hours
16. When 9.65 ampere current was passed for 1.0 hour into nitrobenzene in acidic medium, the amount of p-aminophenol produced is :-  
 (1) 10.9 g (2) 98.1 g (3) 109.0 g (4) 9.81 g
17. The half cell reactions for rusting of iron are:  
 $2H^{+} + \frac{1}{2}O_2 + 2e^{-} \longrightarrow H_2O$ ;  $E^{\circ} = +1.23 \text{ V}$ ,  $Fe^{2+} + 2e^{-} \longrightarrow Fe$ ;  $E^{\circ} = -0.44 \text{ V}$   
 $\Delta G^{\circ}$  (in kJ) for the reaction is:  
 (1) -76 (2) -322 (3) -122 (4) -176
18. Consider the following cell reaction :  
 $2Fe_{(s)} + O_{2(g)} + 4H^{+}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + 2H_2O(l)$   $E^{\circ} = 1.67 \text{ V}$   
 At  $[Fe^{2+}] = 10^{-3} \text{ M}$ ,  $P(O_2) = 0.1 \text{ atm}$  and  $pH = 3$ , the cell potential at  $25^{\circ}\text{C}$  is -  
 (1) 1.47 V (2) 1.77 V (3) 1.87 V (4) 1.57 V
19. For the following electrochemical cell at 298K,  
 $Pt(s) | H_2(g, 1\text{bar}) | H^{+}(aq, 1M) || M^{4+}(C_1aq), M^{2+}(C_2aq) | Pt(s)$   
 $E_{\text{cell}} = 0.092 \text{ V}$  when  $\frac{[M^{2+}(aq.)]}{[M^{4+}(aq.)]} = 10^x$   
 Given :  $E^{\circ}_{M^{4+}/M^{2+}} = 0.151 \text{ V}$ ;  $2.303 \frac{RT}{F} = 0.059 \text{ V}$   
 The value of x is -  
 (1) -2 (2) -1 (3) 1 (4) 2
20. For the following cell :  
 $Zn(s) | ZnSO_4(aq.) || CuSO_4(aq.) | Cu(s)$   
 when the concentration of  $Zn^{2+}$  is 10 times the concentration of  $Cu^{2+}$ , the expression for  $\Delta G$  (in  $\text{J mol}^{-1}$ ) is  
 [F is Faraday constant, R is gas constant, T is temperature,  $E^{\circ}(\text{cell}) = 1.1 \text{ V}$ ]  
 (1)  $2.303 RT + 1.1F$  (2)  $2.303 RT - 2.2F$   
 (3)  $1.1 F$  (4)  $-2.2 F$

21. Statement -1 : The voltage of mercury cell remains constant for long period of time.  
Statement -2 : It is because net cell reaction does not involve active species.  
(1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
(2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
(3) Statement-1 is true, statement-2 is false.  
(4) Statement-1 is false, statement-2 is true.
22. Statement -1 : We can add the electrode potential in order to get electrode potential of net reaction.  
Statement -2 : Electrode potential is an intensive property.  
(1) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.  
(2) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.  
(3) Statement-1 is true, statement-2 is false.  
(4) Statement-1 is false, statement-2 is true.

**ANSWER KEY**

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	2	4	2	4	1	4	3	2	3	1	1	2	4	2
Que.	16	17	18	19	20	21	22								
Ans.	4	2	4	4	2	1	4								

**12. SURFACE CHEMISTRY**

1. Promoters and Poison are the substance use in chemical reaction which  
(1) Enhance and decrease the activity of catalyst respectively  
(2) Decrease and enhance the activity of catalyst respectively  
(3) Do not have any effect on catalyst  
(4) Can be used in place of catalyst whenever required
2. Peptization process may be defined as  
(1) Formation of precipitate by adding two ionic solution  
(2) Conversion of colloidal sol into precipitate  
(3) Conversion of precipitate into colloidal sol  
(4) Enrichment precipitate from solution
3. Which of the following is/are correct statements  
(A) Hardy Schulz rule is related to coagulation  
(B) Brownian movement and Tyndall effect are shown by colloids  
(C) When liquid is dispersed in liquid, it is called gel.  
(D) Gold number is a measure of protective power of lyophillic colloid.  
(1) A, B, D                      (2) B, C, D                      (3) A, C, D                      (4) A, B, C

4. Which statements is/are correct?  
(A) Physical adsorption is multilayer non-directional and non specific  
(B) Chemical adsorption is generally monolayer and specific in nature  
(C) Physical adsorption is due to free valence of atoms  
(D) Chemical adsorption is stronger than physical adsorption  
(1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) B, C
5. Which statement/s is/are correct  
(A) A solution is prepared by addition of excess of  $\text{AgNO}_3$  solution in KI solution. The charge likely to develop on colloidal particle is positive.  
(B) The effects of pressure on physical adsorption is high if temperature is low.  
(C) Gold number is the index for extent of gold plating done.  
(D) None  
(1) A, B                      (2) B, C                      (3) C, D                      (4) A, D
6. Colloidal solution can be purified by  
(A) Dialysis                      (B) Electrodialysis                      (C) Electrophoresis                      (D) Ultrafiltration  
(1) A, B, D                      (2) B, C, D                      (3) A, C, D                      (4) A, B, C
7. Which of the following is not lyophilic  
(A) Gelatin sol                      (B) Silver sol                      (C) Sulphur sol                      (D)  $\text{As}_2\text{S}_3$  sol  
(1) A, B, C                      (2) B, C, D                      (3) A, C, D                      (4) A, B, D
8. Colloidal Gold can be prepared by  
(A) Bredig's arc method                      (B) Reduction of  $\text{AuCl}_3$   
(C) Hydrolysis                      (D) Peptization  
(1) A, B                      (2) A, C, D                      (3) A, B, D                      (4) C, B
9. On adding  $\text{AgNO}_3$  solution into KI solution, colloidal sol can be obtained from.  
(A) 100 mL of 0.1 M  $\text{AgNO}_3$  + 100 of 0.1 M KI  
(B) 100 mL of 0.1 M  $\text{AgNO}_3$  + 100 of 0.2 M KI  
(C) 100 mL of 0.2 M  $\text{AgNO}_3$  + 100 of 0.1 M KI  
(D) 100 mL of 0.15 M  $\text{AgNO}_3$  + 100 of 0.25 M KI  
(1) A, B, C                      (2) B, C, D                      (3) A, B, D                      (4) A, C, D
10. The Tyndall effect is observed only when following conditions are satisfied  
(a) The diameter of the dispersed particles is much smaller than the wavelength of the light used.  
(b) The diameter of the dispersed particle is not much smaller than the wavelength of the light used.  
(c) The refractive indices of the dispersed phase and dispersion medium are almost similar in magnitude.  
(d) The refractive index of the dispersed phase and dispersion medium differ greatly in magnitude.  
(1) (a) and (d)                      (2) (b) and (d)                      (3) (a) and (c)                      (4) (b) and (c)

11. Adsorption of a gas on a surface follows Freundlich adsorption isotherm. Plot of  $\log \frac{x}{m}$  versus  $\log p$  gives a straight line with slope equal to 0.5, then :
- ( $\frac{x}{m}$  is the mass of the gas adsorbed per gram of adsorbent)
- (1) Adsorption is proportional to the square of pressure.
  - (2) Adsorption is independent of pressure.
  - (3) Adsorption is proportional to the pressure.
  - (4) Adsorption is proportional to the square root of pressure.
12. Which one of the following is not a property of physical adsorption
- (1) Unilayer adsorption occurs
  - (2) Greater the surface area, more the adsorption
  - (3) Lower the temperature, more the adsorption
  - (4) Higher the pressure, more the adsorption
13. The correct statement(s) pertaining to the adsorption of a gas on a solid surface is (are)-
- (A) Adsorption is always exothermic
  - (B) Physisorption may transform into chemisorption at high temperature
  - (C) Physisorption increases with increasing temperature but chemisorption decreases with increasing temperature
  - (D) Chemisorption is more exothermic than physisorption, however it is very slow due to higher energy of activation
- (1) A, B, C                      (2) B, C, D                      (3) A, C, D                      (4) A, B, D
14. Choose the correct reason(s) for the stability of the **lyophobic** colloidal particle.
- (A) Preferential adsorption of ions on their surface from the solution
  - (B) Preferential adsorption of solvent on their surface from the solution
  - (C) Attraction between different particles having opposite charges on their surface
  - (D) Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles
- (1) A, B                      (2) B, C                      (3) C, D                      (4) A, D
15. Methylene blue, from its aqueous solution, is adsorbed on activated charcoal at 25°C. For this process, the correct statement is -
- (1) The adsorption requires activation at 25°C
  - (2) The adsorption is accompanied by a decrease in enthalpy
  - (3) The adsorption increases with increase of temperature
  - (4) The adsorption is irreversible

16. The correct statement(s) about surface properties is (are)
- (A) Cloud is an emulsion type of colloid in which liquid is dispersed phase and gas is dispersion medium
- (B) Adsorption is accompanied by decrease in enthalpy and decrease in entropy of the system.
- (C) Brownian motion of colloidal particles does not depend on the size of the particles but depends on viscosity of the solution.
- (D) The critical temperatures of ethane and nitrogen are 563 K and 126 K, respectively. The adsorption of ethane will be more than that of nitrogen on same amount of activated charcoal at a given temperature.
- (1) A, B                      (2) C, D                      (3) B, D                      (4) A, C

**ANSWER KEY**

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	3	1	1	1	1	2	1	2	2	4	1	4	4	2
Que.	16														
Ans.	3														

## 1. PERIODIC TABLE & PERIODIC PROPERTIES

- Highest electron affinity is shown by  
 (1)  $F^-$  (2)  $Cl^-$  (3)  $Li^+$  (4)  $Na^+$
- False statement for periodic classification of elements is  
 (1) The properties of the elements are periodic function of their atomic numbers.  
 (2) No. of non-metallic elements is less than the no. of metallic elements.  
 (3) First ionization energy of elements does not increase regularly with the increase in atomic number in a period.  
 (4) d-subshell is filled by last electron with increasing atomic number of inner transition elements.
- Which of the following element has highest metallic character .

	Element	IP
(1)	P	17 eV
(2)	Q	2 eV
(3)	R	10 eV
(4)	S	13 eV

- Which of the following formula has involved all the energy terms used to calculate  $\Delta H_f^\circ$  of  $Na_2O_{(s)}$ .  
 ( $\Delta H_{sb}$  : Sublimation energy ;  $I.E_1$  : First ionisation energy ;  $I.E_2$  : Second ionisation energy ; B.D.E. : Bond dissociation energy ; E.G.E<sub>1</sub> : First electron gain enthalpy ; E.G.E<sub>2</sub> : Second electron gain enthalpy ; U : Lattice energy)

$$(1) + 2\Delta H_{sb} + I.E_1 + I.E_2 + \frac{B.D.E.}{2} + E.G.E_1 + E.G.E_2 + U$$

$$(2) + 2\Delta H_{sb} + 2I.E_1 + \frac{B.D.E.}{2} + E.G.E_1 + E.G.E_2 + U$$

$$(3) + 2\Delta H_{sb} + 2I.E_1 + \frac{B.D.E.}{2} + 2E.G.E_1 + U$$

$$(4) + 2\Delta H_{sb} + I.E_1 + \frac{B.D.E.}{2} + E.G.E_1 + E.G.E_2 + U$$

- An element 'E' have  $IE = x$  eV/atom and  $EA = y$  eV / atom and EN on Pauling scale is 1.2. Find EN of 'E' on Mullikan scale :

$$(A) \frac{x+y}{2}$$

$$(B) 1.2 \times 2.8$$

$$(C) \frac{x+y}{2.8} - 1.2$$

$$(D) 1.2 - \frac{x+y}{2}$$

$$(1) C, D$$

$$(2) A, B$$

$$(3) A, C$$

$$(4) B, D$$

- Find the correct ionic mobility order in aqueous solution from the following options-

$$(A) Li^+ < Na^+$$

$$(B) Mg^{2+} < Sr^{2+}$$

$$(C) Na^+ < K^+$$

$$(D) F^- < Cl^-$$

$$(1) \text{ Only A \& B}$$

$$(2) \text{ Only B \& C}$$

$$(3) \text{ Only A, B, C}$$

$$(4) A, B, C, D$$

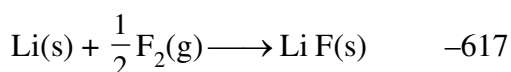
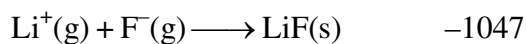
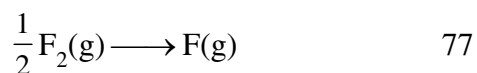
7. Which of the following is/are correct?

- (A) For  $A(g) + e^- \longrightarrow A^-(g)$   $\Delta H$  may be negative  
 (B) For  $A^-(g) + e^- \longrightarrow A^{2-}(g)$   $\Delta H$  may be negative  
 (C) For  $A^-(g) + e^- \longrightarrow A^{2-}(g)$   $\Delta H$  must be positive  
 (D) For  $Ne(g) + e^- \longrightarrow Ne^-(g)$   $\Delta H$  may be zero

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

8. Given

Reaction                                      Energy Change (in kJ)



Based on data provided, the value of electron gain enthalpy of fluorine would be :

- (1)  $-300 \text{ kJ mol}^{-1}$       (2)  $-328 \text{ kJ mol}^{-1}$       (3)  $-350 \text{ kJ mol}^{-1}$       (4)  $-228 \text{ kJ mol}^{-1}$

9. Consider the following ionization enthalpies of two elements 'A' and 'B' :

Element	Ionization enthalpy (kJ/mol)		
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
A	899	1757	14847
B	737	1450	7731

Which of the following statements is correct ?

- (1) Both A and B belong to group-2 where A comes below B  
 (2) Both A and B belong to group-1 where A comes below B  
 (3) Both A and B belong to group-1 where B comes below A  
 (4) Both A and B belong to group-2 where B comes below A

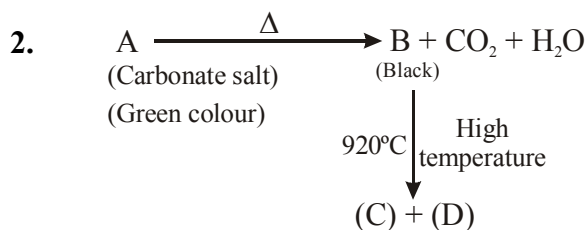
## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	
Ans.	3	4	2	2	2	4	1	2	4	



## 2. CHEMICAL BONDING

1. Which of the following ammonium salt will not give acid on heating :
- (1)  $(\text{NH}_4)_2\text{HPO}_4$       (2)  $(\text{NH}_4)_2\text{MoO}_4$       (3)  $(\text{NH}_4)_2\text{SO}_4$       (4)  $\text{NH}_4\text{Cl}$



Select the correct statements -

- (A) Compound (A) is basic copper carbonate  
 (B) Compound (B)  $\text{CuO}$   
 (C) Compound (C) is  $\text{Cu}_2\text{O}$   
 (D) Compound (D) is paramagnetic in nature

Correct options are :-

- (1) A, B, C      (2) B, C, D      (3) A, C, D      (4) A, B, C, D
3. When  $\text{O}_2$  is adsorbed on a metallic surface, electron transfer occurs from the metal to  $\text{O}_2$ . The **TRUE**, statement (s) regarding this adsorption is (are)
- (1)  $\text{O}_2$  is physisorbed      (2) heat is released  
 (3) occupancy of  $e^\ominus$  in  $\pi_{2p}^*$  of  $\text{O}_2$  is increased      (4) bond length of  $\text{O}_2$  is increased
4. Which is the incorrect match for the energy distance function for following interaction -
- (1) Debye force :  $r^{-6}$       (2) Ion-induced dipole interaction :  $r^{-2}$   
 (3) London force :  $r^{-6}$       (4) Keesom force :  $r^{-3}$
5. Identify the incorrect order of boiling point in the following pair.
- (1)  $\text{B(OH)}_3 < \text{B(OCH}_3)_3$       (2)  $\text{NF}_3 < \text{N(CH}_3)_3$   
 (3)  $\text{BF}_3 < \text{B(CH}_3)_3$       (4)  $\text{C}_2\text{H}_6 < \text{C}_2\text{F}_6$
6. Which is correct statement ?

As the s-character of a hybrid orbital decreases

- (I) The bond angle decreases      (II) The bond strength increases  
 (III) The bond length increases      (IV) Size of orbital increases  
 (1) (I), (III) and (IV)      (2) (II), (III) and (IV)  
 (3) (I) and (II)      (4) All are correct

7. Find out the % p-character in the orbital occupied by lone pairs in  $\text{H}_2\text{O}$ .

$$[\widehat{\text{HOH}} = 104.5^\circ \text{ and } \cos(104.5) = -0.25]$$

- (1) 80 %      (2) 20 %      (3) 70 %      (4) 75 %

8. Which of the following set of characteristics lead to the increase in solubility of ionic substances?
- High dipole moment, strong attraction by an ion towards solvent and large solvation energy
  - Low dipole moment, weak attraction by an ion towards solvent and high solvation energy
  - High dipole moment, strong attraction by an ion towards solvent and low solvation energy
  - High dipole moment, weak attraction by an ion towards solvent and large solvation energy
9. During the formation of a molecular orbital from atomic orbitals, probability of electron density is
- minimum in the nodal plane
  - maximum in the nodal plane
  - zero in the nodal plane
  - zero on the surface of the lobe
10. Select the correct statement for following molecules :
- (I)  $\text{PF}_2(\text{CH}_3)_3$  ; (II)  $\text{PF}_2(\text{CF}_3)_3$
- Both have trigonal bipyramidal structure with respect to P.
  - P-F bond length is longer in  $\text{PF}_2(\text{CH}_3)_3$  than in  $\text{PF}_2(\text{CF}_3)_3$
  - F-atoms occupy axial position in both
  - P-F bond length is lower in  $\text{PF}_2(\text{CH}_3)_3$  than in  $\text{PF}_2(\text{CF}_3)_3$
- A and C
  - A, C, D
  - A, B, C
  - B and C
11. The number of specie(s) which are not perfectly planar.
- $\dot{\text{C}}\text{H}_3$
  - $\dot{\text{C}}\text{F}_3$
  - $\dot{\text{C}}\text{HF}_2$
  - $\dot{\text{C}}\text{H}_2\text{F}$
- A and B
  - A, C and D
  - B, C and D
  - A, B, C and D
12. Which of the following statement is **CORRECT** :-
- The free electron of  $\text{ClO}_3$  molecule is present in d-orbital of Cl-atom
  - The free electron of  $\dot{\text{C}}\text{F}_3$  is present in  $\text{sp}^3$  hybrid orbital
  - NO is polar
  - The free electron of  $\text{ClO}_2$  molecule is not present in hybrid orbital of Cl-atom
- A and B
  - A, B and C
  - B and C
  - B, C and D
13. Which of the following statement(s) is / are **INCORRECT** for
- $\dot{\text{C}}\text{H}_3 = \text{X}$  and  $\dot{\text{C}}\text{F}_3 = \text{Y}$
- When X dimerises bond angle decreases
  - When X dimerises bond angle increases
  - In X-Y molecule C-C bond length is less than that in Y-Y molecule
  - Bond angle in Y is less than X
- B, C
  - A, B
  - A, C
  - B, C, D
14. Among the following mixtures, dipole-dipole as the major interaction, is present in
- KCl and water
  - benzene and carbon tetrachloride
  - benzene and ethanol
  - acetonitrile and acetone

15. Which one of the following properties is **not** shown by NO ?
- It combines with oxygen to form nitrogen dioxide
  - Its bond order is 2.5
  - It is diamagnetic in gaseous state
  - It is a neutral oxide
16. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy ?
- BaSO<sub>4</sub>
  - SrSO<sub>4</sub>
  - CaSO<sub>4</sub>
  - BeSO<sub>4</sub>
17. Assuming that Hund's rule is violated, the bond order and magnetic nature of the diatomic molecule B<sub>2</sub> is
- 1 and diamagnetic
  - 0 and diamagnetic
  - 1 and paramagnetic
  - 0 and paramagnetic
18. If ethylene molecule lies in X-Y plane then nodal planes of the  $\pi$ -bond will lie in
- XZ plane
  - YZ plane
  - In a plane that bisects C-C axis
  - XY plane
19. Which of the following 'd' orbital(s) participate in the hybridisation for Xe in the cationic part of XeF<sub>6</sub>(s)
- (A) d<sub>xy</sub>
  - (B) d<sub>x<sup>2</sup>-y<sup>2</sup></sub>
  - (C) d<sub>z<sup>2</sup></sub>
  - (D) d<sub>y<sup>2</sup></sub>
- (1) A, B
  - (2) B, C
  - (3) C, D
  - (4) A, D
20. Which of the following statements are correct?
- (A) The crystal lattice of ice is formed by covalent as well as hydrogen bonds
  - (B) The density of water increases when heated from 0° C to 4° C
  - (C) Above 4° C the thermal agitation of water molecules increases. Therefore, intermolecular distance increases and water starts expanding
  - (D) The density of water decreases from 0° C to a maximum at 4° C
- (1) A, B, C
  - (2) A, C, D
  - (3) B, C, D
  - (4) A, B, D
21. In which of the following chemical species hydrogen bonding takes places -
- (A) Na<sub>2</sub>HPO<sub>3</sub>(s)
  - (B) K<sub>2</sub>HPO<sub>4</sub>(s)
  - (C) KHCO<sub>3</sub>(s)
  - (D) NaHCO<sub>3</sub>(s)
- (1) A, B, C
  - (2) A, C, D
  - (3) B, C, D
  - (4) A, B, D
22. The **CORRECT** order of d<sub>C-H</sub> in the following option is -
- (1) CHF<sub>3</sub> = CH<sub>2</sub>F<sub>2</sub> = CH<sub>3</sub>F
  - (2) CHF<sub>3</sub> > CH<sub>2</sub>F<sub>2</sub> > CH<sub>3</sub>F
  - (3) CH<sub>2</sub>F<sub>2</sub> > CH<sub>3</sub>F > CHF<sub>3</sub>
  - (4) CH<sub>3</sub>F > CH<sub>2</sub>F<sub>2</sub> > CHF<sub>3</sub>

23. Which of the following statement is **CORRECT** for



- (1) All C–F bond lengths are identical  
 (2) Two C–F bonds attached to middle C-atom are longer compared to other C–F bonds at the terminal C-atoms  
 (3) Two C–F bonds attached to middle C-atom are shorter compared to other C–F bonds at the terminal C-atoms  
 (4) None is correct
24. Which of the following property is / are changed when OF (odd electron species) undergoes dimerisation?  
 (A) Magnetic nature (B) Geometry (C) Polarity (D) O–F bond length  
 (1) A, B, C (2) B, C, D (3) A, B, D (4) A, C, D
25. Which of the following molecule have only  $\sigma$  type covalent bond :  
 (1)  $\text{CaC}_2$  (2)  $\text{CsO}_2$  (3)  $\text{Na}_2\text{O}_2$  (4)  $\text{F}_2$

### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	2,3,4	2	1	1	3	1	3	3	3	4	1	4	3
Que.	16	17	18	19	20	21	22	23	24	25					
Ans.	4	1	4	2	1	3	4	2	3	4					

### 3. s-BLOCK ELEMENT

1.  $\text{Cs}^+$  ions impart violet colour to Bunsen flame. This is due to the fact that the emitted radiations are of -  
 (1) high energy (2) lower frequencies  
 (3) longer wave-lengths (4) zero wave number
2. The reaction of an element A with water produces combustible gas B and an aqueous solution of C. When another substance D reacts with this solution C also produces the same gas B. D also produces the same gas even on reaction with dilute  $\text{H}_2\text{SO}_4$  at room temperature. Element A imparts golden yellow colour to Bunsen flame. Then, A, B, C and D may be identified as  
 (1) Na,  $\text{H}_2$ , NaOH and Zn (2) K,  $\text{H}_2$ , KOH and Zn  
 (3) K,  $\text{H}_2$ , NaOH and Zn (4) Ca,  $\text{H}_2$ ,  $\text{Ca}(\text{OH})_2$  and Zn
3. The salt which finds uses in qualitative inorganic analysis is  
 (1)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  or  $\text{ZnSO}_4 \cdot 5\text{H}_2\text{O}$  (2)  $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
 (3)  $\text{Na}(\text{NH}_4)\text{HPO}_4 \cdot 4\text{H}_2\text{O}$  (4)  $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$
4. Fire extinguishers contain  
 (1) conc.  $\text{H}_2\text{SO}_4$  solution (2)  $\text{H}_2\text{SO}_4$  and  $\text{NaHCO}_3$  solutions  
 (3)  $\text{NaHCO}_3$  solution (4)  $\text{CaCO}_3$  solution

5. The commercial method of preparation of potassium by reduction of molten KCl with metallic sodium at 850°C is based on the fact that
- potassium is solid and sodium distils off at 850 °C
  - potassium being more volatile and distils off thus shifting the reaction forward
  - sodium is less reactive than potassium at 850 °C with respect to Cl<sub>2</sub>
  - sodium has less affinity to chloride ions in the presence of potassium ion
6. An alkaline earth metal (M) gives a salt with chlorine, which is soluble in water at room temperature. It also forms an insoluble sulphate whose mixture with a sulphide of a transition metal is called 'lithopone' -a white pigment. Metal M is
- Ca
  - Mg
  - Ba
  - Sr
7. (Yellow ppt) T  $\xleftarrow{K_2CrO_4/H^+}$  X  $\xrightarrow{dil.HCl}$  Y (Yellow ppt) + Z ↑ (pungent smelling gas)
- If X gives green flame test. Then, X is
- MgSO<sub>4</sub>
  - BaSO<sub>4</sub>
  - CuSO<sub>4</sub>
  - PbSO<sub>4</sub>
8. The correct order of second ionisation potentials (IP) of Ca, Ba and K is
- K > Ca > Ba
  - Ba > Ca > K
  - K > Ba > Ca
  - K = Ba = Ca
9. The correct order of solubility is
- CaCO<sub>3</sub> < KHCO<sub>3</sub> < NaHCO<sub>3</sub>
  - KHCO<sub>3</sub> < CaCO<sub>3</sub> < NaHCO<sub>3</sub>
  - NaHCO<sub>3</sub> < CaCO<sub>3</sub> < KHCO<sub>3</sub>
  - CaCO<sub>3</sub> < NaHCO<sub>3</sub> < KHCO<sub>3</sub>
10. (White ppt) D  $\xleftarrow{Na_2CO_3}$  A  $\xrightarrow{K_2CrO_4}$  B (Yellow ppt)
- (in acetic acid)
- dil. H<sub>2</sub>SO<sub>4</sub> ↓
- C (White ppt)
- If A is the metallic salt, then the white ppt. of D must be of
- strontium carbonate
  - red lead
  - barium carbonate
  - calcium carbonate
11.  $X + C + Cl_2 \xrightarrow[\text{of about } 1000\text{K}]{\text{High temperature}} Y + CO$  ;  $Y + 2H_2O \rightarrow Z + 2HCl$
- Compound Y is found in polymeric chain structure and is an electron deficient molecule. Y must be
- BeO
  - BeCl<sub>2</sub>
  - BeH<sub>2</sub>
  - AlCl<sub>3</sub>
12. A pair of substances which gives all the same products on reaction with water is
- Mg and MgO
  - Sr and SrO
  - Ca and CaH<sub>2</sub>
  - Be and BeO



19. The compound(s) formed upon combustion of sodium metal in excess air is (are)  
 (1)  $\text{Na}_2\text{O}_2$  (2)  $\text{Na}_2\text{O}$  (3)  $\text{NaO}_2$  (4)  $\text{NaOH}$
20. The gun powder is consisting of '\_\_\_\_\_' + sulphur + Charcoal what is the missing substance for gun powder  
 (1)  $\text{LiNO}_3$  (2)  $\text{NH}_4\text{NO}_2$  (3)  $\text{KNO}_3$  (4) (1) and (2) mixture

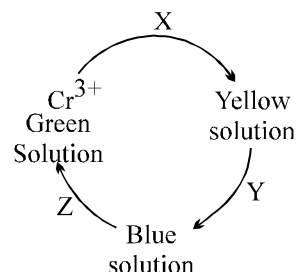
### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	3	2	2	3	2	1	4	3	2	3	3	3	3
Que.	16	17	18	19	20										
Ans.	4	1	1	1	3										

## 4. HYDROGEN & IT'S COMPOUNDS

- Ordinary hydrogen at high temperature is a mixture of :-  
 (1) 75% o-Hydrogen + 25% p-Hydrogen (2) 25% o-Hydrogen + 75% p-Hydrogen  
 (3) 50% o-Hydrogen + 50% p-Hydrogen (4) 1% o-Hydrogen + 99% p-Hydrogen
- At absolute zero :-  
 (1) Only para hydrogen exists (2) Only ortho hydrogen exists  
 (3) Both para and ortho hydrogen exist (4) None
- Pure de-mineralised water can be obtained by -  
 (1)  $\text{Na}^+$  cation exchanger and  $\text{Cl}^-$  anion exchanger  
 (2)  $\text{H}^+$  cation exchanger only  
 (3)  $\text{H}^+$  cation exchanger and  $\text{OH}^-$  anion exchanger  
 (4)  $\text{Na}^+$  cation exchanger only
- Hydrogen peroxide is now generally prepared on industrial scale by the :-  
 (1) Action of  $\text{H}_2\text{SO}_4$  on barium peroxide (2) Action of  $\text{H}_2\text{SO}_4$  on sodium peroxide  
 (3) auto-oxidation of 2-alkylanthraquinols (4) Burning hydrogen in excess of oxygen
- Which of the following is / are same for Ortho and Para hydrogen :-  
 (A) In the number of protons (B) In the molecular mass  
 (C) In the nature of spins of nucleus (D) In the nature of spins of electrons  
 (1) A, B, C (2) A, B, D (3) A, C, D (4) A, B, C, D
- Which of the following statements is/are correct :  
 (A) Atomic hydrogen is obtained by passing hydrogen gas through an electric arc  
 (B) 30% (w/v) or 100V  $\text{H}_2\text{O}_2$  solution is not called perhydrol.  
 (C) Finely divided palladium absorbs large volume of hydrogen gas.  
 (D) Ortho and para hydrogen have same physical properties.  
 (1) Only A (2) A and B (3) A, B and C (4) A and C

7. Hydrogen peroxide in its reaction with  $\text{KIO}_4$  and  $\text{NH}_2\text{OH}$  respectively, is acting as a  
 (1) reducing agent, oxidising agent (2) reducing agent, reducing agent  
 (3) oxidising agent, oxidising agent (4) oxidising agent, reducing agent
8. In this sequence X, Y, Z are respectively  
 (1) Acidified  $\text{H}_2\text{O}_2$  ; Alkaline  $\text{H}_2\text{O}_2$  ; Acidified  $\text{H}_2\text{O}_2$   
 (2) Alkaline  $\text{H}_2\text{O}_2$  ; Acidified  $\text{H}_2\text{O}_2$  ;  $\text{Zn}^{+2} / \text{HCl}$   
 (3) Acidified  $\text{H}_2\text{O}_2$  ; Heat ; Alkaline  $\text{H}_2\text{O}_2$   
 (4) Alkaline  $\text{H}_2\text{O}_2$  ; Acidified  $\text{H}_2\text{O}_2$  ; On standing



## ANSWER KEY

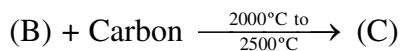
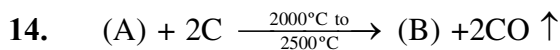
Que.	1	2	3	4	5	6	7	8	
Ans.	1	1	3	3	2	4	1	4	

## 5. p-BLOCK ELEMENT

1. Which of the following hydrated salts will not become anhydrous on heating :  
 (A)  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  (B)  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$  (C)  $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$  (D)  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$   
 Correct options are :-  
 (1) A, C (2) B, D (3) A, B, C (4) A, B, C, D
2.  $\text{X} \xrightarrow{\text{CoCl}_2} \text{CaCl}_2 + \text{Y} \uparrow$  ; the effective ingredient of X is  
 (1)  $\text{OCl}^-$  (2)  $\text{Cl}^-$  (3)  $\text{OCl}^+$  (4)  $\text{OCl}_2^-$
3. Mixed oxide(s) of Mn is/are  
 (1)  $\text{MnO}_2$  (2)  $\text{Mn}_3\text{O}_4$  (3)  $\text{Mn}_2\text{O}_7$  (4)  $\text{MnO}$
4. Potassium dichromate when heated with concentrated sulphuric acid and a soluble chloride, gives brown - red vapours of :  
 (1)  $\text{CrO}_3$  (2)  $\text{Cr}_2\text{O}_3$  (3)  $\text{CrCl}_3$  (4)  $\text{CrO}_2\text{Cl}_2$
5. An orange solid (X) on heating, gives a colourless gas (Y) and a only green residue (Z). Gas (Y) on treatment with Mg, produces a white solid substance .....  
 (1)  $\text{Mg}_3\text{N}_2$  (2)  $\text{MgO}$  (3)  $\text{Mg}_2\text{O}_3$  (4)  $\text{MgCl}_2$
6. When chlorine gas is passed through an aqueous solution of a potassium halide in the presence of chloroform, a violet colouration is obtained. On passing more of chlorine water, the violet colour is disappeared and solution becomes colourless. This test confirms the presence of ..... in aqueous solution.  
 (1) chlorine (2) fluorine (3) bromine (4) iodine
7. An explosive compound (A) reacts with water to produce  $\text{NH}_4\text{OH}$  and  $\text{HOCl}$ . Then, the compound (A), is  
 (1) TNG (2)  $\text{NCl}_3$  (3)  $\text{PCl}_3$  (4)  $\text{HNO}_3$



8. A sulphate of a metal (A) on heating evolves two gases (B) and (C) and an oxide (D). Gas (B) turns  $K_2Cr_2O_7$  paper green while gas (C) forms a trimer in which there is no S-S bond. Compound (D) with HCl, forms a Lewis acid (E) which exists as a dimer. Compounds (A), (B), (C), (D) and (E) are respectively
- (1)  $FeSO_4$ ,  $SO_2$ ,  $SO_3$ ,  $Fe_2O_3$ ,  $FeCl_3$       (2)  $Al_2(SO_4)_3$ ,  $SO_2$ ,  $SO_3$ ,  $Al_2O_3$ ,  $FeCl_3$   
 (3)  $FeS$ ,  $SO_2$ ,  $SO_3$ ,  $FeSO_4$ ,  $FeCl_3$       (4)  $FeS$ ,  $SO_2$ ,  $SO_3$ ,  $Fe_2(PO_4)_3$ ,  $FeCl_2$
9. An inorganic white crystalline compound (A) has a rock salt structure. (A) on reaction with conc.  $H_2SO_4$  and  $MnO_2$ , evolves a pungent smelling, greenish-yellow gas (B). Compound (A) gives white ppt. of (C) with  $AgNO_3$  solution. Compounds (A), (B) and (C) will be respectively
- (1)  $NaCl$ ,  $Cl_2$ ,  $AgCl$       (2)  $NaBr$ ,  $Br_2$ ,  $NaBr$   
 (3)  $NaCl$ ,  $Cl_2$ ,  $Ag_2SO_4$       (4)  $Na_2CO_3$ ,  $CO_2$ ,  $Ag_2CO_3$
10. A gas which exists in three allotropic forms  $\alpha$ ,  $\beta$  and  $\gamma$  is
- (1)  $SO_2$       (2)  $SO_3$       (3)  $CO_2$       (4)  $NH_3$
11. A red coloured mixed oxide (X) on treatment with conc.  $HNO_3$  gives a compound (Y). (Y) with HCl, produces a chloride compound (Z) which can also be produced by treating (X) with conc. HCl. Compounds (X), (Y), and (Z) will be
- (1)  $Mn_3O_4$ ,  $MnO_2$ ,  $MnCl_2$       (2)  $Pb_3O_4$ ,  $PbO_2$ ,  $PbCl_2$   
 (3)  $Fe_3O_4$ ,  $Fe_2O_3$ ,  $FeCl_2$       (4)  $Fe_3O_4$ ,  $Fe_2O_3$ ,  $FeCl_3$
12. Which of the following can't be used for oxidation of conc. HCl to  $Cl_2$  gas ?
- (1)  $Pb_3O_4$       (2)  $PbO_2$       (3)  $PbO$       (4)  $MnO_2$
13.  $Ca_2B_6O_{11} + Na_2CO_3 \xrightarrow{\Delta} [X] + CaCO_3 + NaBO_2$  (Unbalanced equation)
- Correct statement for [X]
- (A) Structure of anion of crystalline (X) has one boron atom  $sp^3$  hybridised and other three boron atoms  $sp^2$  hybridised  
 (B) (X) with  $NaOH(aq.)$  gives a compound which on reaction with  $H_2O_2$  in alkaline medium yields a compound used as brightner in soaps  
 (C) Hydrolysis of (X) with HCl or  $H_2SO_4$  yields a compound which on reaction with HF gives fluoroboric acid  
 (D) [X] on heating with cobalt salt in oxidising flame gives blue coloured bead
- Correct options are :-
- (1) A, B, C      (2) A, C, D      (3) B, C, D      (4) A, B, C, D



If A is an example of 3-d silicate then select the correct statements about (C)

- (A) Central atom of C is  $\text{sp}^3$  hybridised  
 (B) (C) is non planar and all atoms are  $\text{sp}^3$  hybridised  
 (C) (C) has diamond like structure, and it is coloured when impurity is present but pale yellow to colourless solid at room temperature  
 (D) (C) is silicon carbide (SiC) and it is not being affected by any acid except  $\text{H}_3\text{PO}_4$

Correct options are :-

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

15. **Column-I**  
**Compound**

- (P)  $\text{SnCl}_2$   
 (Q) Butter of tin  
 (R) Mosaic gold  
 (S) Pink's salt

**Code :**

- |     | P | Q | R | S |
|-----|---|---|---|---|
| (1) | 4 | 3 | 2 | 1 |
| (3) | 2 | 1 | 3 | 4 |

**Column-II**

**Correct statement for compounds given**

- (1) Used in printing technology  
 (2) Used for gilding purpose (in joining gold pieces)  
 (3) Reducing agent  
 (4) Mordant

- |     | P | Q | R | S |
|-----|---|---|---|---|
| (2) | 3 | 4 | 2 | 1 |
| (4) | 1 | 3 | 4 | 2 |

16. Aluminium chloride exists as dimer,  $\text{Al}_2\text{Cl}_6$  in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives-

- (1)  $\text{Al}^{3+} + 3\text{Cl}^-$                       (2)  $[\text{Al}(\text{H}_2\text{O})_6]^{3+} + 3\text{Cl}^-$   
 (3)  $[\text{Al}(\text{OH})_6]^{3-} + 3\text{HCl}$                       (4)  $\text{Al}_2\text{O}_3 + 6\text{HCl}$

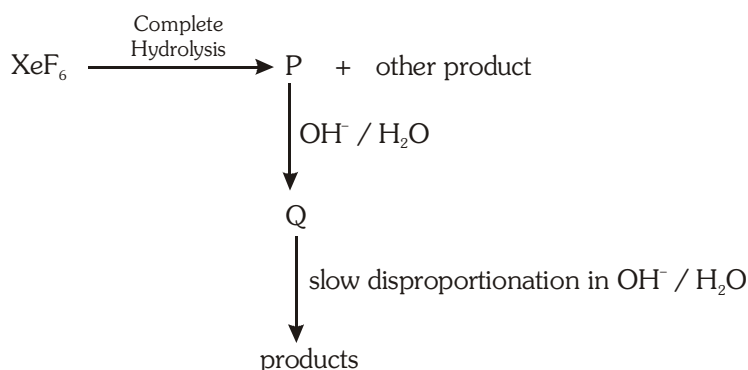
17. The soldiers of Napoleon army while at Alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White Metallic tin buttons get converted to grey powder. This transformation is related to :-

- (1) An interaction with water vapour contained in humid air  
 (2) A change in crystalline structure of tin  
 (3) A change in the partial pressure of  $\text{O}_2$  in air  
 (4) An interaction with  $\text{N}_2$  of air at low temperature

18. Regular use of which of the following fertilizer increases the acidity of soil :

- (1) Potassium nitrate                      (2) Urea  
 (3) Superphosphate of lime                      (4) Ammonium sulphate

19. Which of the following statements about the depletion of ozone layer is correct?
- The problem of ozone depletion is more serious at poles because ice crystals in the clouds over poles act as catalyst for photochemical reactions involving the decomposition of ozone by  $\text{Cl}^\bullet$  and  $\text{ClO}^\bullet$  radicals
  - The problem of ozone depletion is less serious at poles because  $\text{NO}_2$  solidifies and is not available for consuming  $\text{ClO}^\bullet$  radicals
  - Oxides of nitrogen also do not react with ozone in stratosphere
  - Freons, chlorofluorocarbons, are inert chemically, they do not react with ozone in stratosphere
20. In the following sets of reactants which two sets best exhibit the amphoteric character of  $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$  ?
- Set-1 :  $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s})$  and  $\text{OH}^- (\text{aq})$   
 Set-2 :  $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s})$  and  $\text{H}_2\text{O} (\ell)$   
 Set-3 :  $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s})$  and  $\text{H}^+ (\text{aq})$   
 Set-4 :  $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s})$  and  $\text{NH}_3 (\text{aq})$
- 1 and 2
  - 2 and 4
  - 1 and 3
  - 3 and 4
21. For per gram of reactant, the maximum quantity of  $\text{N}_2$  gas is produced in which of the following thermal decomposition reactions ?
- (Given : Atomic wt. – Cr = 52u, Ba = 137u)
- $2\text{NH}_4\text{NO}_3(\text{s}) \rightarrow 2\text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + \text{O}_2(\text{g})$
  - $\text{Ba}(\text{N}_3)_2(\text{s}) \rightarrow \text{Ba}(\text{s}) + 3\text{N}_2(\text{g})$
  - $(\text{NH}_4)_2\text{Cr}_2\text{O}_7(\text{s}) \rightarrow \text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$
  - $2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$
22. The reaction of  $\text{P}_4$  with X leads selectively to  $\text{P}_4\text{O}_6$ . The X is :-
- Dry  $\text{O}_2$
  - A mixture of  $\text{O}_2$  and  $\text{N}_2$
  - Moist  $\text{O}_2$
  - $\text{O}_2$  in the presence of aqueous NaOH
23. Under ambient conditions, the total number of gases released as products in the final step of the reaction scheme shown below is :-



- 0
  - 1
  - 2
  - 3
24. Which of the following combination will produce  $\text{H}_2$  gas ?
- Zn metal and  $\text{NaOH}(\text{aq.})$
  - Au metal and  $\text{NaCN}(\text{aq.})$  in the presence of air
  - Cu metal and conc.  $\text{HNO}_3$
  - Fe metal and conc.  $\text{HNO}_3$

25. The type of overlap in the bridge bond existing in  $\text{Al}_2(\text{CH}_3)_6$  is :-  
 (1)  $\text{sp}^3\text{-sp}^3\text{d-sp}^3$  (2)  $\text{sp}^3\text{-sp}^2\text{-sp}^3$  (3)  $\text{sp}^3\text{-s-sp}^3$  (4)  $\text{sp}^3\text{-sp}^3\text{-sp}^3$
26. The silicate anion in the mineral kinoite is a chain of three  $\text{SiO}_4$  tetrahedral those share corners with adjacent tetrahedral. The mineral also contains  $\text{Ca}^{2+}$  ions,  $\text{Cu}^{2+}$  ions, and water molecules in a 1:1:1 ratio mineral is represented as :  
 (1)  $\text{CaCuSi}_3\text{O}_{10}\cdot\text{H}_2\text{O}$  (2)  $\text{CaCuSi}_3\text{O}_{10}\cdot 2\text{H}_2\text{O}$   
 (3)  $\text{Ca}_2\text{Cu}_2\text{Si}_3\text{O}_{10}\cdot 2\text{H}_2\text{O}$  (4) none of these
27. The solubility of anhydrous  $\text{AlCl}_3$  and hydrated  $\text{AlCl}_3$  in diethyl ether are  $S_1$  and  $S_2$  respectively. Then  
 (1)  $S_1 = S_2$  (2)  $S_1 > S_2$   
 (3)  $S_1 < S_2$  (4)  $S_1 < S_2$  but not  $S_1 = S_2$
28. Which of the following statement is/are **INCORRECT** ?  
 (A)  $\text{P}_4\text{S}_{10}$  gives rise to  $\text{H}_2\text{S}$  gas on hydrolysis  
 (B)  $\text{PCl}_5$  produces  $\text{POCl}_3$  on partial hydrolysis  
 (C)  $\text{H}_2\text{SO}_5$  gives rise to  $\text{H}_2\text{SO}_3$  on hydrolysis  
 (D) d-orbital participates in the hydrolysis of  $\text{SF}_6$  at room temperature  
 (1) A, C (2) C, D (3) B, C, D (4) A, B, C, D
29. The bond dissociation energy of B-F in  $\text{BF}_3$  is  $646 \text{ kJ mol}^{-1}$  whereas that of C-F in  $\text{CF}_4$  is  $515 \text{ kJ mol}^{-1}$ . The correct reason for higher B-F bond dissociation energy as compared to that of C-F is :-  
 (1) Significant  $\text{p}\pi\text{-p}\pi$  interaction between B and F in  $\text{BF}_3$  whereas there is no possibility of such interaction between C and F in  $\text{CF}_4$ .  
 (2) Lower degree of  $\text{p}\pi\text{-p}\pi$  interaction between B and F in  $\text{BF}_3$  than that between C and F in  $\text{CF}_4$   
 (3) Smaller size of B-atom as compared to that of C-atom  
 (4) Stronger  $\sigma$  bond between B and F in  $\text{BF}_3$  as compared to that between C and F in  $\text{CF}_4$
30. The correct sequence of decreasing number of  $\pi$ -bonds in the structures of  $\text{H}_2\text{SO}_3$ ,  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{S}_2\text{O}_7$  is :-  
 (1)  $\text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_4 > \text{H}_2\text{SO}_3$  (2)  $\text{H}_2\text{SO}_3 > \text{H}_2\text{SO}_4 > \text{H}_2\text{S}_2\text{O}_7$   
 (3)  $\text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_3 > \text{H}_2\text{SO}_4$  (4)  $\text{H}_2\text{SO}_4 > \text{H}_2\text{S}_2\text{O}_7 > \text{H}_2\text{SO}_3$
31. In the reaction  

$$2\text{X} + \text{B}_2\text{H}_6 \longrightarrow [\text{BH}_2(\text{X})_2]^+ [\text{BH}_4]^-$$
 the amine(s) X is (are)  
 (A)  $\text{NH}_3$  (B)  $\text{CH}_3\text{NH}_2$  (C)  $(\text{CH}_3)_2\text{NH}$  (D)  $(\text{CH}_3)_3\text{N}$   
 (1) Only A (2) A and B (3) A, B, C (4) D

32. The solid laboratory reagent 'A' gives the following reactions -
- it imparts green colour to the flame
  - its solution does not give a precipitate on passing  $\text{H}_2\text{S}$
  - when it is heated with solid  $\text{K}_2\text{Cr}_2\text{O}_7$  and concentration  $\text{H}_2\text{SO}_4$ , a red gas is evolved. When this gas passed into aqueous solution of  $\text{NaOH}$ , turns it yellow -

Identify 'A'

- (1)  $\text{PbCl}_2$  (2)  $\text{BaCl}_2$  (3)  $\text{NaCl}$  (4) None of these
33.  $\text{Mg}_3\text{N}_2 \xrightarrow{\text{H}_2\text{O}} \text{A(gas)} \xrightarrow[\Delta]{\text{CuO}} \text{B} + \text{C(g)} + \text{H}_2\text{O}$
- C(g) can be obtained by heating
- (1)  $(\text{NH}_4)_2\text{SO}_4$  (2)  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  (3)  $\text{NH}_4\text{NO}_3$  (4)  $\text{NH}_4\text{Cl}$
34. Calcium imide on hydrolysis will give gas (B) which on oxidation by bleaching powder gives gas (C), gas (C) on reaction with magnesium give compound (D). (D) on hydrolysis gives again gas (B). (B), (C) and (D) are respectively
- (1)  $\text{NH}_3$ ,  $\text{N}_2$ ,  $\text{Mg}_3\text{N}_2$  (2)  $\text{N}_2$ ,  $\text{NH}_3$ ,  $\text{MgNH}$
- (3)  $\text{N}_2$ ,  $\text{N}_2\text{O}_5$ ,  $\text{Mg}(\text{NO}_3)_2$  (4)  $\text{NH}_3$ ,  $\text{NO}_2$ ,  $\text{Mg}(\text{NO}_2)_2$
35. In which of the molecule on hydrolysis proton donor oxyacid is not formed from their central atom-
- (1)  $\text{NCl}_3$  (2)  $\text{PCl}_3$  (3)  $\text{SF}_4$  (4)  $\text{P}_4\text{O}_{10}$

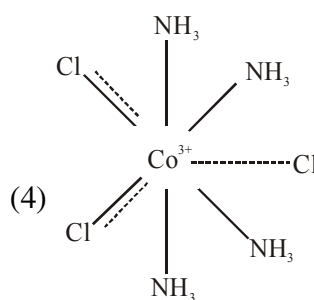
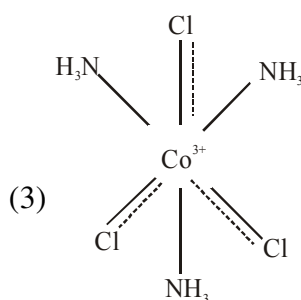
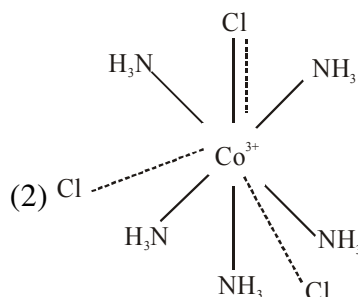
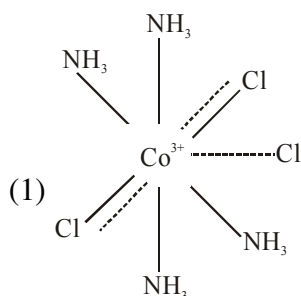
## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	1	2	4	1	4	2	1	1	2	2	3	3	4	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	2	2	4	1	3	4	2	3	1	4	3	2	2	1	1
Que.	31	32	33	34	35										
Ans.	3	2	2	1	1										

## 6. COORDINATION COMPOUNDS

1.  $\text{Y} \xleftarrow{\text{KI}} \text{CuSO}_4 \xrightarrow{\text{dil H}_2\text{SO}_4} \text{X (Blue colour)}$ , X and Y are  
(diatomic covalent molecule)
- (1)  $\text{X} = \text{I}_2$ ,  $\text{Y} = [\text{Cu}(\text{H}_2\text{O})_4]^{2+}$  (2)  $\text{X} = [\text{Cu}(\text{H}_2\text{O})_4]^{2+}$ ,  $\text{Y} = \text{I}_2$
- (3)  $\text{X} = [\text{Cu}(\text{H}_2\text{O})_4]^+$ ,  $\text{Y} = \text{I}_2$  (4)  $\text{X} = [\text{Cu}(\text{H}_2\text{O})_5]^{2+}$ ,  $\text{Y} = \text{I}_2$
2. The aqueous solution of  $\text{CuCrO}_4$  is green because it contains
- (1) green  $\text{Cu}^{2+}$  ions (2) green  $\text{CrO}_4^{2-}$  ions
- (3) blue  $\text{Cu}^{2+}$  ions and green  $\text{CrO}_4^{2-}$  ions (4) blue  $\text{Cu}^{2+}$  ions and yellow  $\text{CrO}_4^{2-}$  ions
3. In nitroprusside ion, the iron exists as  $\text{Fe}^{2+}$  and  $\text{NO}$  as  $\text{NO}^+$  rather than  $\text{Fe}^{3+}$  and  $\text{NO}$  respectively. These forms of ions are established with the help of
- (1) magnetic moment in solid state (2) thermal decomposition method
- (3) by reaction with  $\text{KCN}$  (4) by action with  $\text{K}_2\text{SO}_4$

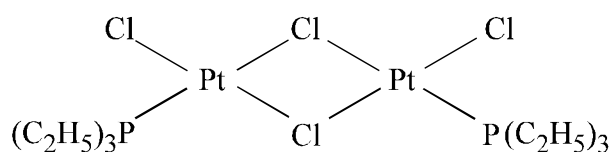
4. Excess of KI reacts with  $\text{CuSO}_4$  solution and then  $\text{Na}_2\text{S}_2\text{O}_3$  solution is added to it. Which of the statements is incorrect for this reaction :
- (1) Evolved  $\text{I}_2$  is reduced (2)  $\text{CuI}_2$  is formed  
 (3)  $\text{Na}_2\text{S}_2\text{O}_3$  is oxidised (4)  $\text{Cu}_2\text{I}_2$  is formed
5. When conc.  $\text{H}_2\text{SO}_4$  was treated with  $\text{K}_4[\text{Fe}(\text{CN})_6]$ , CO gas was evolved. By mistake, somebody used dilute  $\text{H}_2\text{SO}_4$  instead of conc.  $\text{H}_2\text{SO}_4$  then the gas evolved was
- (1) CO (2) HCN (3)  $\text{N}_2$  (4)  $\text{CO}_2$
6. Hydrogen peroxide oxidises  $[\text{Fe}(\text{CN})_6]^{4-}$  to  $[\text{Fe}(\text{CN})_6]^{3-}$  in acidic medium but reduces  $[\text{Fe}(\text{CN})_6]^{3-}$  to  $[\text{Fe}(\text{CN})_6]^{4-}$  in alkaline medium. The other products formed are, respectively :
- (1)  $(\text{H}_2\text{O} + \text{O}_2)$  and  $(\text{H}_2\text{O} + \text{OH}^-)$  (2)  $\text{H}_2\text{O}$  and  $(\text{H}_2\text{O} + \text{O}_2)$   
 (3)  $\text{H}_2\text{O}$  and  $(\text{H}_2\text{O} + \text{OH}^-)$  (4)  $(\text{H}_2\text{O} + \text{O}_2)$  and  $\text{H}_2\text{O}$
7. Aqueous solution of  $\text{FeSO}_4$  gives tests for both  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$  but after addition of excess of KCN, solution ceases to give test for  $\text{Fe}^{2+}$ . This is due to the formation of
- (1) the double salt  $\text{FeSO}_4 \cdot 2\text{KCN} \cdot 6\text{H}_2\text{O}$  (2)  $\text{Fe}(\text{CN})_3$   
 (3) the complex ion  $[\text{Fe}(\text{CN})_6]^{4-}$  (4) the complex ion  $[\text{Fe}(\text{CN})_6]^{3-}$
8. Which of the following Werner's complex has least electrical conductivity ?



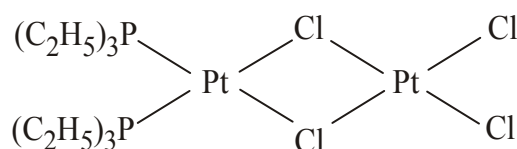
9. Which of the following order is correct for the IR vibrational frequency of CO.
- (1)  $[\text{Fe}(\text{CO})_4]^{2-} < [\text{Co}(\text{CO})_4]^- < [\text{Ni}(\text{CO})_4]$  (2)  $[\text{Fe}(\text{CO})_4]^{2-} > [\text{Co}(\text{CO})_4]^- > [\text{Ni}(\text{CO})_4]$   
 (3)  $[\text{Fe}(\text{CO})_4]^{2-} > [\text{Co}(\text{CO})_4]^- < [\text{Ni}(\text{CO})_4]$  (4)  $[\text{Fe}(\text{CO})_4]^{2-} < [\text{Co}(\text{CO})_4]^- > [\text{Ni}(\text{CO})_4]$
10. Which of the following has higher stretching frequency for C–O bond -
- (1)  $[\text{Ni}(\text{CO})_3\text{PF}_3]$  (2)  $[\text{Ni}(\text{CO})_3(\text{PMe}_3)]$   
 (3) both have equal stretching frequency (4) None of these

11. Which of the following has higher multiple bond character in M–C bond -
- (1)  $[\text{Ni}(\text{CO})_4]$
  - (2)  $[\text{Co}(\text{CO})_4]^-$
  - (3)  $[\text{Fe}(\text{CO})_4]^{2-}$
  - (4) (2) and (3) both have equal multiple bond character in M–C bond
12. Which of the following statement is correct regarding the compound " $[(\text{CO})_3\text{Fe}(\text{CO})_3\text{Fe}(\text{CO})_3]$ ".
- (1) The  $d_{\text{C-O}}$  (bridging) is greater than  $d_{\text{C-O}}$  (terminal)
  - (2) The bond order of bridging C – O bond is greater than that of terminal C – O bond
  - (3) The E.A.N. value of each Fe-atom is 35
  - (4) The oxidation state of Fe in this complex is (–I)
13. Which of the following statement is **INCORRECT** regarding the following compound
- $$[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$$
- (1) It is the polymerisation isomer of  $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]$
  - (2) E.A.N. of cationic part is equal to that of anionic part
  - (3) It is the co-ordination isomer of  $[\text{Pt}(\text{NH}_3)_3\text{Cl}][\text{Pt}(\text{NH}_3)\text{Cl}_3]$
  - (4) Synergic bonding is not involved in the complex

14. The complexes given below show:

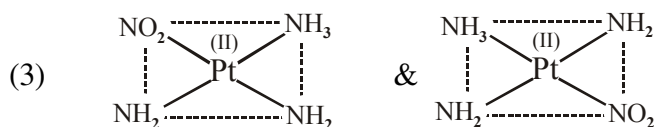
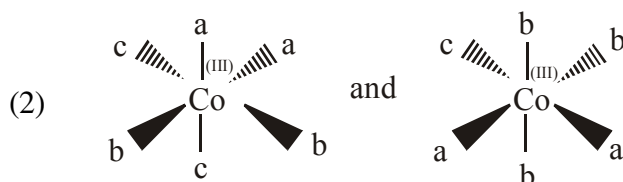
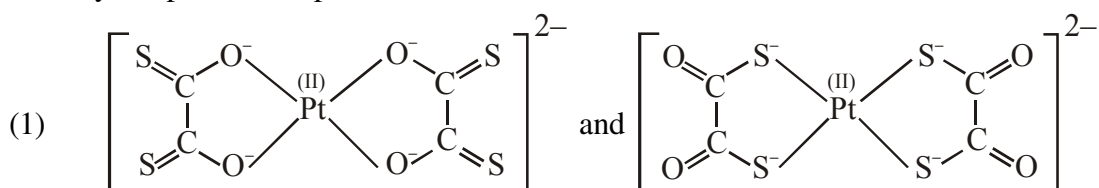


and



- (1) Optical isomerism
  - (2) Co-ordination isomerism
  - (3) Geometrical isomerism
  - (4) Co-ordination position isomerism
15. How many coordination isomers of  $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$  show geometrical isomerism.
- (1) All
  - (2) One
  - (3) Two
  - (4) None

16. Identify the pair of complex which are stereoisomer of each other -

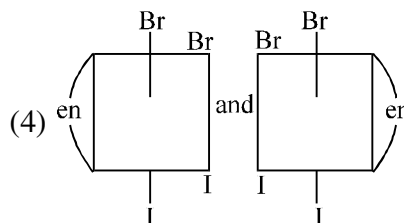
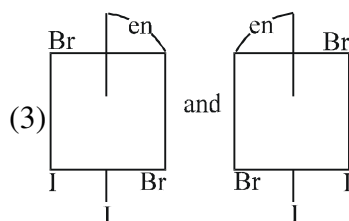
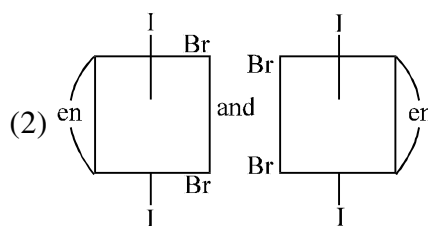
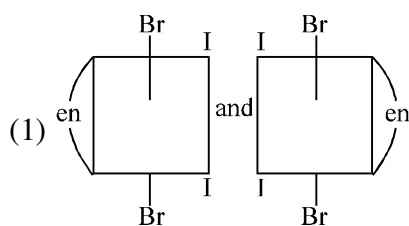


(4) All of the above

17. Find complex which have maximum number of stereoisomers -



18. The complex ion has two optical isomers. Their **CORRECT** configurations are:



19. One unknown complex has the spin only magnetic moment is of 1.73 BM. As per the C. F. T., complex is.

- (1)  $d^7$ , octahedral, with strong field ligand (2)  $d^9$ , sq. planar, with strong field ligand  
(3)  $d^9$ , tetrahedral with weak field ligand (4) All of these

20.  $[\text{Fe}(\text{H}_2\text{O})_6]^{+2}$  has Crystal Field Splitting Energy value  $10,400 \text{ cm}^{-1}$  and pairing energy value  $17,600 \text{ cm}^{-1}$  then it is :

- (1) Low spin complex (2) Paramagnetic in nature  
(3) Diamagnetic in nature (4) None of these

21. A complex of certain metal has the magnetic moment of 4.91 BM whereas another complex of the same metal with same oxidation state has zero magnetic moment. The metal ion could be

- (1)  $\text{Co}^{2+}$  (2)  $\text{Mn}^{2+}$  (3)  $\text{Fe}^{2+}$  (4)  $\text{Fe}^{3+}$



22. On treatment of  $[\text{Ni}(\text{NH}_3)_4]^{2+}$  with concentrated HCl, two compounds I and II having the same formula,  $[\text{NiCl}_2(\text{NH}_3)_2]$  are obtained, I can be converted into II by boiling with dilute HCl. A solution of I reacts with oxalic acid to form  $[\text{Ni}(\text{C}_2\text{O}_4)(\text{NH}_3)_2]$  whereas II does not react. Point out the correct statement of the following
- (1) I cis, II trans; both tetrahedral (2) I cis, II trans; both square planar  
(3) I trans, II cis; both tetrahedral (4) I trans, II cis; both square planar
23. Select appropriate ligand for given complex  
 $[\text{Co}(\text{.....})_6]^{\pm x}$  ;  $\mu = 0 \text{ BM}$
- (1)  $\text{C}_2\text{O}_4^{2-}$  (2) en (3)  $\text{H}_2\text{O}$  (4)  $\text{F}^-$
24. Which of the following is correct electronic configuration of 3d orbital in excited state of central metal ion, when  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  absorbed yellow-green light.
- (1) 3d 

			1	
--	--	--	---	--

 (2)  $t_{2g}^1, e_g^0$   
(3)  $t_{2g}^1, e_g^1$  (4)  $t_{2g}^0, e_g^1$
25. Select **INCORRECT** statement(s) for  $[\text{Cu}(\text{CN})_4]^{3-}$ ,  $[\text{Cd}(\text{CN})_4]^{2-}$  and  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  complex ion.
- (A) Both  $[\text{Cd}(\text{CN})_4]^{2-}$  and  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  have square planar geometry  
(B)  $[\text{Cu}(\text{CN})_4]^{3-}$  and  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  have equal no. of unpaired electron  
(C)  $[\text{Cu}(\text{CN})_4]^{3-}$  and  $[\text{Cd}(\text{CN})_4]^{2-}$  can be separated from the mixture on passing  $\text{H}_2\text{S}$  gas.  
(D) All the three complexes have magnetic moment equal to zero.
- (1) A, B (2) A, B, C (3) A, B, D (4) B, C, D
26. Which of the following statement(s) is/are **INCORRECT**
- (A) In  $[\text{CoBrCl}(\text{en})_2]^+$  geometrical isomerism exists, while optical isomerism does not exist  
(B) Potassium aquadicyanidosuperoxidoperoxidochromate(III) is IUPAC name for  $\text{K}_2[\text{Cr}(\text{CN})_2\text{O}_2(\text{O}_2)(\text{H}_2\text{O})]$   
(C) There are 3 geometrical isomers and 15 stereoisomers possible for  $[\text{Pt}(\text{NO}_2)(\text{NH}_3)(\text{NH}_2\text{OH})(\text{py})]^+$  and  $[\text{PtBr Cl I}(\text{NO}_2)(\text{NH}_3)(\text{py})]$  respectively  
(D) cis and trans forms are not diastereomers of each other
- (1) A, B (2) B, C, D (3) A, C, D (4) A, B, C, D
27. Which of the following is **CORRECT** about Tetraamminedithiocyanato-Scobalt(III) tris(oxalato)cobaltate(III)
- (A) formula of the complex is  $[\text{Co}(\text{SCN})_2(\text{NH}_3)_4][\text{Co}(\text{ox})_3]$   
(B) It is a chelating complex and show linkage isomerism.  
(C) It shows optical isomerism.  
(D) It shows geometrical isomerism.
- (1) A, C (2) B, C, D (3) A, D (4) C, D

28. Which of the following compound(s) can show optical isomerism ?  
 (A)  $[\text{PtCl}_4]^{2-}$  (B)  $[\text{PtCl}_2(\text{NH}_3)_2]$  (C)  $[\text{Fe}(\text{EDTA})]^-$  (D)  $[\text{Fe}(\text{en})_3]^{3+}$   
 (1) Only C (2) Only D (3) A, C, D (4) C, D
29. One mole of the complex compound  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ , gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of  $\text{AgNO}_3$  solution to yield two moles of  $\text{AgCl}(\text{s})$ . The structure of the complex is -  
 (1)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3] \cdot 2\text{NH}_3$  (2)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl} \cdot \text{NH}_3$   
 (3)  $[\text{Co}(\text{NH}_3)_4\text{Cl}]\text{Cl}_2 \cdot \text{NH}_3$  (4)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
30. Ammonia forms the complex ion  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  with copper ions in alkaline solutions but not in acidic solution. What is the reason for it :-  
 (1) In acidic solutions hydration protects copper ions  
 (2) In acidic solutions protons coordinate with ammonia molecules forming  $\text{NH}_4^+$  ions and  $\text{NH}_3$  molecules are not available  
 (3) In alkaline solutions insoluble  $\text{Cu}(\text{OH})_2$  is precipitated which is soluble in excess of any alkali  
 (4) Copper hydroxide is an amphoteric substance
31. Among the properties (a) reducing (b) oxidising (c) complexing, the set of properties shown by  $\text{CN}^-$  ion towards metal species is :-  
 (1) c, a (2) b, c (3) a, b (4) a, b, c
32. The coordination number of a central metal atom in a complex is determined by :-  
 (1) The number of ligands around a metal ion bonded by sigma and pi-bonds both  
 (2) The number of ligands around a metal ion bonded by pi-bonds  
 (3) The number of ligands around a metal ion bonded by sigma bonds  
 (4) The number of only anionic ligands bonded to the metal ion
33. A solution containing 2.675 g of  $\text{CoCl}_3 \cdot 6\text{NH}_3$  (molar mass =  $267.5 \text{ g mol}^{-1}$ ) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of  $\text{AgNO}_3$  to give 4.30 g of  $\text{AgCl}$  (molar mass =  $143.5 \text{ g mol}^{-1}$ ). The formula of the complex is :-  
 (At. mass of Ag = 108 u)  
 (1)  $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$  (2)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  (3)  $[\text{CoCl}_2(\text{NH}_3)_4]\text{Cl}$  (4)  $[\text{CoCl}_3(\text{NH}_3)_3]$
34. Which one of the following complexes will consume more equivalents of aqueous solution of  $\text{Ag}(\text{NO}_3)$  ?  
 (1)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (2)  $\text{Na}_2[\text{CrCl}_5(\text{H}_2\text{O})]$  (3)  $\text{Na}_3[\text{CrCl}_6]$  (4)  $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2$
35.  $[\text{Co}_2(\text{CO})_8]$  displays :-  
 (1) no Co-Co bond, four terminal CO and four bridging CO  
 (2) one Co-Co bond, six terminal CO and two bridging CO  
 (3) no Co-Co bond, six terminal CO and two bridging CO  
 (4) one Co-Co bond, four terminal CO and four bridging CO

36. On treatment of 100 mL of 0.1 M solution of  $\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$  with excess  $\text{AgNO}_3$ ;  $1.2 \times 10^{22}$  ions are precipitated. The complex is :-

- (1)  $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$  (2)  $[\text{Co}(\text{H}_2\text{O})_3\text{Cl}_3] \cdot 3\text{H}_2\text{O}$   
 (3)  $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$  (4)  $[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$

37. Spin only magnetic moment of the compound  $\text{Hg}(\text{II}) [\text{Co}(\text{SCN})_4]$  is :-

- (1)  $\sqrt{3}$  (2)  $\sqrt{15}$  (3)  $\sqrt{24}$  (4)  $\sqrt{8}$

38. Among the following complexes (K–P)

$\text{K}_3[\text{Fe}(\text{CN})_6]$  (K),  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  (L),  $\text{Na}_3[\text{Co}(\text{oxalate})_3]$  (M),  $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$  (N),  
 $\text{K}_2[\text{Pt}(\text{CN})_4]$  (O) and  $[\text{Zn}(\text{H}_2\text{O})_6](\text{NO}_3)_2$  (P)

The diamagnetic complex are -

- (1) K, L, M, N (2) K, M, O, P (3) L, M, O, P (4) L, M, N, O

39.  $\text{NiCl}_2\{\text{P}(\text{C}_2\text{H}_5)_2(\text{C}_6\text{H}_5)\}_2$  exhibits temperature dependent magnetic behavior (paramagnetic/diamagnetic).

The coordination geometries of  $\text{Ni}^{2+}$  in the paramagnetic and diamagnetic states are respectively :

- (1) tetrahedral and tetrahedral (2) square planar and square planar  
 (3) tetrahedral and square planar (4) square planar and tetrahedral

40. Match each coordination compound in List-I with an appropriate pair of characteristics from List-II and select the correct answer using the code given below the lists.

{en =  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$  ' atomic numbers ; Ti = 22 ; Cr = 24 ; Co = 27 ; Pt = 78 }

**List-I**

- (P)  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$   
 (Q)  $[\text{Ti}(\text{H}_2\text{O})_5\text{Cl}](\text{NO}_3)_2$   
 (R)  $[\text{Pt}(\text{en})(\text{NH}_3)\text{Cl}]\text{NO}_3$   
 (S)  $[\text{Co}(\text{NH}_3)_4(\text{NO}_3)_2]\text{NO}_3$

**List-II**

- (1) Paramagnetic and exhibits ionisation isomerism  
 (2) Diamagnetic and exhibits *cis-trans* isomerism  
 (3) Paramagnetic and exhibits *cis-trans* isomerism  
 (4) Diamagnetic and exhibits ionisation isomerism

**Code :**

- |     | P | Q | R | S |
|-----|---|---|---|---|
| (1) | 4 | 2 | 3 | 1 |
| (3) | 2 | 1 | 3 | 4 |

- |     | P | Q | R | S |
|-----|---|---|---|---|
| (2) | 3 | 1 | 4 | 2 |
| (4) | 1 | 3 | 4 | 2 |

41.  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  can be distinguished by

- (1)  $\text{K}_3[\text{Fe}(\text{CN})_6]$  (2)  $\text{K}_4[\text{Fe}(\text{CN})_6]$  (3) KSCN (4) All

42. Which of the following ligand is unsymmetrical bidentate ligand as well as having chiral centre which can not be symmetrical in any complex.

- (1) pn (2) bn (3)  $\text{gly}^-$  (4)  $\text{dmg}^-$

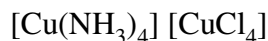
43. Which of the following ligand is of ambidentate type -

- (1)  $\text{NO}_3^-$  (2)  $\text{C}_2\text{O}_4^{2-}$  (3)  $\text{S}_2\text{O}_3^{2-}$  (4) None of these

44. Arrange the following compound according to  $d_{C-C}$  order.

- (I)  $\text{C}_2\text{F}_4$  (II)  $\text{C}_2\text{H}_4$  (III)  $[\text{PtCl}_3(\text{C}_2\text{H}_4)]^-$   
 (1) I > II > III (2) III > II > I (3) II > I > III (4) II > III > I

45. The total possible co-ordination isomers for the following compounds respectively are



(1) 4, 4, 4

(2) 2, 2, 2

(3) 2, 2, 4

(4) 4, 2, 4

46. Consider the following isomerism :-

(i) Ionization

(ii) Hydrate

(iii) Coordination

(iv) Geometrical

(v) Optical

Which of the above isomerism(s) is/are exhibited by  $[\text{Cr}(\text{NH}_3)_2(\text{OH})_2\text{Cl}_2]^-$

(1) (i) and (v)

(2) (ii) and (iii)

(3) (iii), (ii) and (i)

(4) (iv) and (v)

47. Which of the following statements is/are **false**

(A) In  $[\text{PtCl}_2(\text{NH}_3)_4]^{2+}$  complex ion, the cis-form is optically active, while trans-form is optically inactive

(B) In  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ , geometrical isomerism does not exist, while optical isomerism exists

(C)  $[\text{Mabcd}]^{n\pm}$  square planar complexes exhibit both optical as well as geometrical isomerism

(D) In  $[\text{Mabcd}]^{n\pm}$  tetrahedral complexes, optical isomerism cannot be observed

(1) A, C, D

(2) B, C, D

(3) A, B, C

(4) A, B, D

48. Select **incorrect** match for the following complexes.

(1)  $[\text{IrF}_6]^{3-}$  ( $\Delta > P$ )

(2)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  ( $\Delta < P$ )

(3)  $\text{Fe}(\text{CO})_5$  ( $\Delta > P$ )

(4)  $[\text{PdCl}_2(\text{SCN})_2]^{2-}$  ( $\Delta > P$ )

49. **Column-I**

**Column II**

(A)  $[\text{Ma}_2\text{bcde}]^{n\pm}$

(P) 3 optically inactive isomers

(B)  $[\text{Ma}_2\text{b}_2\text{c}_2]^{n\pm}$

(Q) 4 geometrical isomers

(C)  $[\text{Ma}_3\text{bcd}]^{n\pm}$

(R) 6 stereo(space)isomers

(D)  $[\text{M}(\text{AB})\text{c}_2\text{d}_2]^{n\pm}$

(S) 2 optically active isomers

(where  $\text{AB} \rightarrow$  Unsym. bidentate ligand, a,b,c,d & e  $\rightarrow$  monodentate ligands)

(1) (A)–P; (B)–R, S; (C)–P, Q, S; (D)–Q, R

(2) (A)–Q; (B)–R, S; (C)–R, S; (D)–Q, R

(3) (A)–R; (B)–P, Q; (C)–P, Q; (D)–P, Q

(4) (A)–P; (B)–P, Q; (C)–R, S; (D)–P, Q

50. Which of the following statements is/are true
- (A) In Ferrocyanide ion, the effective atomic number is 36  
 (B) Chelating ligands are atleast bidentate ligands  
 (C)  $[\text{CrCl}_2(\text{CN})_2(\text{NH}_3)_2]^-$  and  $[\text{CrCl}_3(\text{NH}_3)_3]$  both have  $d^2sp^3$  hybridisation  
 (D) As the number of rings in complex increases, stability of complex (chelate) also increases
- (1) A, B only      (2) B, C only      (3) A, D only      (4) A, B, C, D

### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	1	2	2	2	3	3	1	1	3	1	1	4	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	3	4	4	2	3	2	3	4	3	4	2	4	4	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	1	3	2	1	2	1	2	3	3	2	4	1	3	2	4
Que.	46	47	48	49	50										
Ans.	4	1	2	1	4										

## 7. d & f-BLOCK

- An ornamental of gold having 75% of gold, it is of ..... carat.  
 (1) 18      (2) 16      (3) 24      (4) 20
- A compound of mercury used in cosmetics, in Ayurvedic and Yunani medicines and known as Vermilion is -  
 (1)  $\text{HgCl}_2$       (2)  $\text{HgS}$       (3)  $\text{Hg}_2\text{Cl}_2$       (4)  $\text{HgI}$
- The d-block element which is a liquid at room temperature, having high specific heat, less reactivity than hydrogen and its chloride ( $\text{MX}_2$ ) is volatile on heating is  
 (1) Cu      (2) Hg      (3) Ce      (4) Pm
- A metal M which is not affected by strong acids like conc.  $\text{HNO}_3$ , conc.  $\text{H}_2\text{SO}_4$  and conc. solution of alkalis like NaOH, KOH forms  $\text{MCl}_3$  which finds use for toning in photography. The metal M is  
 (1) Al      (2) Hg      (3) Au      (4) Cu
- Manganese steel is used for making railway tracks because  
 (1) it is hard with high percentage of Mn  
 (2) it is soft with high percentage of Mn  
 (3) it is hard with small concentration of manganese with impurities  
 (4) it is soft with small concentration of manganese with impurities
- Transition elements in lower oxidation states act as Lewis acid because  
 (1) they form complexes      (2) they are oxidising agents  
 (3) they donate electrons      (4) they do not show catalytic properties

7. An element of 3d-transition series shows two oxidation states  $x$  and  $y$ , differ by two units then  
(A) compounds in oxidation state  $x$  are ionic if  $x > y$   
(B) compounds in oxidation state  $x$  are ionic if  $x < y$   
(C) compounds in oxidation state  $y$  are covalent if  $x < y$   
(D) compounds in oxidation state  $y$  are covalent if  $y < x$   
(1) A, B                      (2) B, C                      (3) A, B, C                      (4) A, C, D
8. Which of the following statement is false ?  
(1)  $\text{Na}_2\text{Cr}_2\text{O}_7$  is a primary standard solution in volumetry  
(2)  $\text{Cr}_2\text{O}_7^{2-}$  has a Cr–O–Cr bond  
(3)  $\text{CrO}_4^{2-}$  is tetrahedral in shape  
(4)  $\text{Na}_2\text{Cr}_2\text{O}_7$  is more soluble than  $\text{K}_2\text{Cr}_2\text{O}_7$
9. Pick out the incorrect statement:  
(1)  $\text{MnO}_4^{2-}$  is quite strongly oxidizing and stable only in very strong alkalies. In dilute alkali, neutral solutions, it disproportionates.  
(2) In acidic solutions,  $\text{MnO}_4^-$  is reduced to  $\text{Mn}^{2+}$  and thus,  $\text{KMnO}_4$  is widely used as oxidising agent  
(3)  $\text{KMnO}_4$  does not acts as oxidising agent in alkaline medium  
(4)  $\text{KMnO}_4$  is manufactured by the fusion of pyrolusite ore with  $\text{KOH}$  in presence of air or  $\text{KNO}_3$ , followed by electrolytic oxidation in strongly alkaline solution.
10. Colourless solutions of the following four salts are placed separately in four different test tubes and a strip of copper is dipped in each one of these. Which solution will turn blue?  
(1)  $\text{KNO}_3$                       (2)  $\text{AgNO}_3$                       (3)  $\text{Zn}(\text{NO}_3)_2$                       (4)  $\text{ZnSO}_4$
11. Metre scales are made-up of alloy  
(1) invar                      (2) stainless steel                      (3) elektron                      (4) magnalium
12. 'Bordeaux mixture' is used as a fungicide. It is a mixture of  
(1)  $\text{CaSO}_4 + \text{Cu}(\text{OH})_2$                       (2)  $\text{CuSO}_4 + \text{Ca}(\text{OH})_2$   
(3)  $\text{CuSO}_4 + \text{CaO}$                       (4)  $\text{CuO} + \text{CaO}$
13. Mercury is a liquid at  $0^\circ\text{C}$  because of  
(A) very high ionisation energy                      (B) weak metallic bonds  
(C) high heat of hydration                      (D) high heat of sublimation  
(1) A, B                      (2) B, D                      (3) C, D                      (4) A, C
14. Calomel on reaction with  $\text{NH}_4\text{OH}$  gives  
(1)  $\text{HgNH}_2\text{Cl}$                       (2)  $\text{NH}_2\text{--Hg--Hg--Cl}$                       (3)  $\text{Hg}_2\text{O}$                       (4)  $\text{HgO}$

15. In context with the transition elements, which of the following statements is incorrect ?
- (1) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.
  - (2) Once the  $d^5$  configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases.
  - (3) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.
  - (4) In the highest oxidation states, the transition metal show basic character and form cationic complexes.
16. The correct stability order is ?
- (1)  $\text{CrO}_4^{2-} > \text{FeO}_4^{2-} > \text{MnO}_4^{2-}$
  - (2)  $\text{MnO}_4^{2-} > \text{CrO}_4^{2-} > \text{MnO}_4^{2-}$
  - (3)  $\text{CrO}_4^{2-} > \text{MnO}_4^{2-} > \text{FeO}_4^{2-}$
  - (4)  $\text{FeO}_4^{2-} > \text{CrO}_4^{2-} > \text{MnO}_4^{2-}$
17. Which of the following compounds is metallic and ferromagnetic ?
- (1)  $\text{MnO}_2$
  - (2)  $\text{TiO}_2$
  - (3)  $\text{CrO}_2$
  - (4)  $\text{VO}_2$
18. Anhydrous ferric chloride is prepared by :
- (1) heating hydrated ferric chloride at a high temperature in a stream of air
  - (2) heating metallic iron in a stream of dry chlorine gas
  - (3) reaction of ferric oxide with HCl
  - (4) reaction of metallic iron with HCl
19. Addition of high proportions of manganese makes steel useful in making rails of railroads, because manganese.
- (1) gives hardness to steel
  - (2) helps the formation of oxides of iron
  - (3) can remove oxygen and sulphur
  - (4) can show highest oxidation state of +7.
20. Metal(s) which does/do not form amalgam is/are
- (A) Fe
  - (B) Pt
  - (C) Zn
  - (D) Au
  - (1) Only A
  - (2) Only B
  - (3) A, B
  - (4) A, C
21. The colour of  $\text{KMnO}_4/\text{H}^+$  will be decolourised by
- (1)  $\text{S}^{2-}$  solution
  - (2)  $\text{SO}_3^{2-}$  solution
  - (3) both (1) and (2)
  - (4) None

22. In the  $K_2Cr_2O_7$  solution **when** alkali solution of  $BaCl_2$  is added, the yellow ppt. obtained is of  
 (1)  $BaCr_2O_7$  (2)  $BaCrO_4$  (3)  $BaCrO_4 \cdot 2H_2O$  (4) none
23. Which of the following exhibits only +3 oxidation state ?  
 (1) Ac (2) Pa (3) U (4) Th
24. Identify the **INCORRECT** statement among the following -  
 (1) d-block elements show irregular and erratic chemical properties among themselves  
 (2) La and Lu have partially filled d-orbitals and no other partially filled orbitals  
 (3) The chemistry of various lanthanoids is very similar  
 (4) 4f and 5f-orbitals are equally shielded

## ANSWER KEY

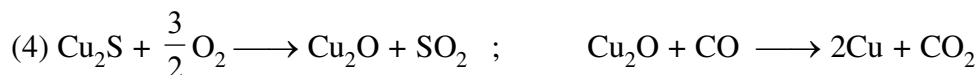
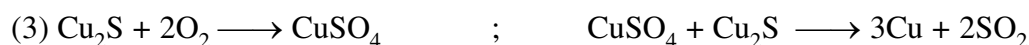
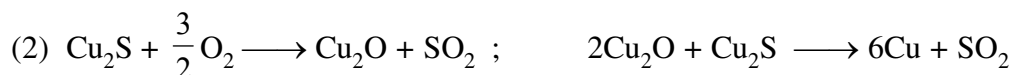
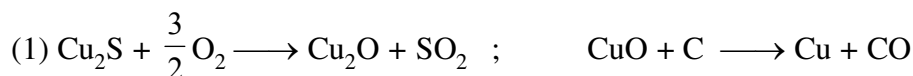
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Que.	16	17	18	19	20	21	22	23	24						
Ans.	3	3	2	1	3	3	2	1	4						

## 8. METALLURGY

1. Among the following statements, the incorrect one is  
 (1) calamine and siderite are carbonate ores  
 (2) argentite and cuprite are oxide ores  
 (3) zinc blende and pyrites are sulphide ores  
 (4) malachite and azurite are ores of copper
2. The benefaction of the sulphide ores is usually done by  
 (1) Electrolysis (2) Smelting process  
 (3) Metal displacement method (4) Froth flotation method
3. Froth floatation process for concentration of ores is an illustration of the practical application of:  
 (1) Adsorption (2) Absorption  
 (3) Coagulation (4) Sedimentation
4. When roasting is carried out :  
 (i) Sulphide ore is converted into oxide and sulphate  
 (ii) remove water of hydration  
 (iii) the ore melts  
 (iv) arsenic and sulphur impurities are removed
- Of these statements:  
 (1) (i), (ii) and (iii) are correct (2) (i) and (iv) are correct  
 (3) (i), (ii) and (iv) are correct (4) (ii), (iii) and (iv) are correct



5. Formation of metallic copper from the sulphide ore in the commercial thermo-metallurgical process essentially involves which one of the following reaction:



6. A metal has a high concentration into the earth crust and whose oxides cannot be reduced by carbon. The most suitable method for the extraction of such metal is

- (1) Alumino thermite process (2) Electrolysis process  
(3) Van-Arkel's process (4) Cupellation

7. Bessemerisation is carried out for

- I : Fe, II : Cu, III : Al, IV : silver  
(1) I, II (2) II, III (3) III, IV (4) I, III

8. Zone refining is based on the principle of

- (1) fractional distillation (2) fractional crystallisation  
(3) partition coefficient (4) chromatographic separation

9. When an impurity in a metal has greater affinity for oxygen and is more easily oxidised than the metal itself. Then, the metal is refined by

- (1) cupellation (2) zone-refining (3) distillation (4) electrolytic process

10. Which of the following process is not associated with recovery of the silver -

- (1) As a side product in electrolytic refining of copper  
(2) Parke's process in which Zn is used to extract silver by solvent extraction from molten lead  
(3) By reaction of silver sulphide with KCN and then reaction of soluble complex with Zn  
(4) By boiling  $\text{Na}[\text{Ag}(\text{CN})_2]$  aq.

11. Addition of high proportions of manganese makes steel useful in making rails of railroads, because manganese

- (1) gives hardness to steel (2) helps the formation of oxides of iron  
(3) can remove oxygen and sulphur (4) can show highest oxidation state of +7

12. Blister copper is refined by stirring molten impure metal with green logs of wood because such a wood liberates hydrocarbon gases (like  $\text{CH}_4$ ). This process X is called \_\_\_\_\_ and the metal contains impurities of Y is \_\_\_\_\_.

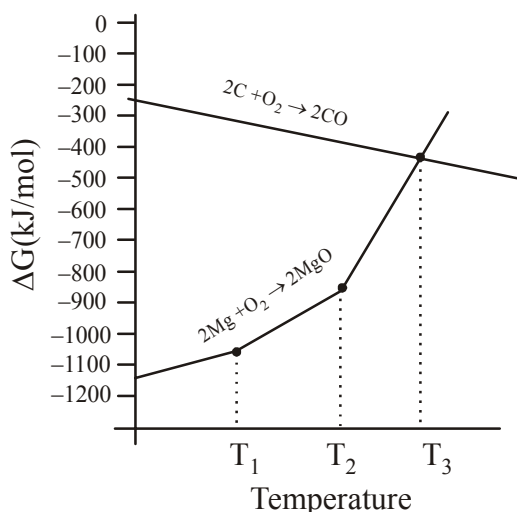
- (1) X = cupellation, Y =  $\text{CuO}_2$  (2) X = poling, Y =  $\text{Cu}_2\text{O}$   
(3) X = poling, Y =  $\text{CuO}$  (4) X = cupellation, Y =  $\text{CuO}$

13. For extraction of sodium from NaCl, the electrolytic mixture  $\text{NaCl} + \text{KCl} + \text{CaCl}_2$  is used. During extraction process, only sodium is deposited on cathode but K and Ca do not because  
(1) Na is more reactive than K and Ca  
(2) Na is less reactive than K and Ca  
(3) NaCl is less stable than  $\text{Na}_3\text{AlF}_6$  and  $\text{CaCl}_2$   
(4) the discharge potential of  $\text{Na}^+$  is less than that of  $\text{K}^+$  and  $\text{Ca}^{2+}$  ions.
14. Molten carnallite on electrolysis gives:  
(1) Ca and  $\text{Cl}_2$                       (2) Na and  $\text{CO}_2$                       (3) Al and  $\text{Cl}_2$                       (4) Mg and  $\text{Cl}_2$
15. Which of the following statement is correct regarding Cu-extraction  
(1) In the smelting step carbon reduction takes places  
(2) During partial roasting  $\text{Cu}_2\text{S}$  remains almost unaffected  
(3) In Bessemer converter, only self reduction occur, not slag formation  
(4) Blister forms in the blister Cu is due to dissolved  $\text{CO}_2$
16. Refractory materials are generally used in furnaces because  
(1) they are chemically inert                      (2) they can withstand high temperature  
(3) they do not contain impurities                      (4) they decrease melting point of ore
17. Calcination and roasting processes of ores to form their oxides are beneficial  
(A) to convert ores into porous form so that their reduction becomes easier  
(B) as impurities like S, As, Sb, are removed  
(C) as organic impurities are removed.  
(D) as the ores are converted into oxide form which makes the reduction easier  
(1) A, B                      (2) B, D                      (3) A, C, D                      (4) A, B, C, D
18. Hoop's process of purification of aluminium involves formation of layers during electrolysis. It involves  
(A) the three layers have same densities but different materials.  
(B) the three layers have different densities  
(C) the upper layer is of pure aluminium which acts as a cathode  
(D) the bottom layer is of impure aluminium which acts as an anode and middle layer consists of cryolite and  $\text{BaF}_2$ .  
(1) Only A                      (2) A, B, C                      (3) B and C                      (4) B, C and D
19. Calcium silicate slag formed in extraction of iron  
(A) prevents the reoxidation of molten iron.  
(B) catalyses the combustion of carbon.  
(C) reduces  $\text{CO}_2$  to CO at the bottom of the furnace.  
(D) is used in cement industry.  
(1) A                      (2) A, C                      (3) B, C, D                      (4) A, D
20. Amphoteric nature of aluminium is employed in which of the following process for extraction of aluminium?  
(A) Baeyer's process                      (B) Hall's process  
(C) Serpec's process                      (D) Dow's process  
(1) A, B                      (2) A, B, C                      (3) B, C, D                      (4) A, B, C, D

21. During extraction of copper, it is obtained in the form of molten *matte*. Which of the following is **not true**?
- (A) *matte* is further treated in Bessemer's converter  
 (B) molten *matte* is electrolysed  
 (C) It is treated with a blast of air and sand  
 (D) It is dissolved in  $\text{CuSiF}_6$  and crystallised.
- (1) Only A                      (2) Only B                      (3) A and C                      (4) B and D
22. The major role of fluorspar ( $\text{CaF}_2$ ) which is added in small quantities in the electrolytic reduction of alumina dissolved in fused cryolite ( $\text{Na}_3\text{AlF}_6$ ) is
- (A) as a catalyst  
 (B) to make the fused mixture very conducting  
 (C) to lower the melting temperature of the mixture  
 (D) to decrease the rate of oxidation of carbon at the anode.
- (1) Only A                      (2) A, D                      (3) B and C                      (4) Only D
23. Which of the following reaction does not occur in blast furnace during extraction of iron :
- (1)  $\text{CaO} + \text{SiO}_2 \longrightarrow \text{CaSiO}_3$                       (2)  $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$   
 (3)  $\text{FeO} + \text{SiO}_2 \longrightarrow \text{FeSiO}_3$                       (4)  $\text{FeO} \longrightarrow \text{Fe} + \frac{1}{2}\text{O}_2$
24. Which of the following employ downward movement of ore due to gravity?
- (A) Gravity separation                      (B) Froth floatation  
 (C) Blast furnace                      (D) Bessemer's converter
- (1) A and B                      (2) A and C                      (3) B and D                      (4) B, C and D
25. The **CORRECT** statements are :
- (A) generally the calcination and roasting is done in blast furnace  
 (B) the sandy and rocky materials associated with ore are called matrix  
 (C) froth floatation process is suitable for sulphide ores  
 (D) substance that reacts with gangue to form fusible mass is called slag
- (1) A and B                      (2) B and C  
 (3) A, B and C                      (4) B, C and D
26. In the context of the Hall-Heroult process for the extraction of Al, which of the following statements is false ?
- (1)  $\text{Al}^{3+}$  is reduced at the cathode to form Al  
 (2) Only  $\text{Na}_3\text{AlF}_6$  serves as the electrolyte  
 (3) CO and  $\text{CO}_2$  are produced in this process  
 (4)  $\text{Al}_2\text{O}_3$  is mixed with  $\text{CaF}_2$  which lowers the melting point of the mixture and brings conductivity

27. The methods chiefly used for the extraction of lead and tin from their ores are respectively :
- self reduction and carbon reduction
  - self reduction and electrolytic reduction
  - carbon reduction and self reduction
  - cyanide process and carbon reduction
28. Native silver metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of :-
- nitrogen
  - oxygen
  - carbon dioxide
  - argon
29. In the cyanide extraction process of silver from argentite ore, the oxidizing and reducing agents used are :
- $O_2$  and CO respectively.
  - $O_2$  and Zn dust respectively.
  - $HNO_3$  and Zn dust respectively.
  - $HNO_3$  and CO respectively.
30. Upon heating with  $Cu_2S$ , the reagent(s) that give copper metal is/are
- $CuFeS_2$
  - $CuO$
  - $Cu_2O$
  - $CuSO_4$
31. Extraction of copper from copper pyrite ( $CuFeS_2$ ) involves
- crushing followed by concentration of the ore by froth-flotation
  - removal of iron as slag
  - self-reduction step to produce 'blister copper' following evolution of  $SO_2$
  - refining of 'blister copper' by carbon reduction
- A, B, C
  - B, C, D
  - A, C, D
  - A, B, D
32. 
$$A + NaCN \xrightleftharpoons[\text{Complex}]{\text{air (leaching)}} B + Na_2S \xrightarrow{O_2} Na_2SO_4$$
 the B is -  
(sulphide ore)
- Paramagnetic
  - Diamagnetic
  - Linear complex
  - Co-ordination number of central atom is 4
33. Which of the following statement is **CORRECT**
- Roasting is unnecessarily done for Fe-extraction because there is no sulphide ore
  - In the smelting step of Cu-extraction, reduction of the ore takes place.
  - Ores may not be mineral
  - Sphalerite is the ore of the zinc

34. Carbon reduction is **NOT** used for extraction of Al from  $\text{Al}_2\text{O}_3$  because
- (A) High temperature is required  
 (B) It incurs huge cost  
 (C) Al is obtained in the solid form and its separation becomes difficult  
 (D) It forms carbide with the used coke powder at that temperature
- (1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) A, C, D
35. Select the **INCORRECT** statements about the plot is / are:



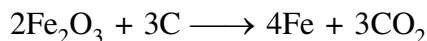
- (1)  $T_1$  and  $T_2$  are melting point & boiling point of Mg respectively.  
 (2)  $T_1$  and  $T_2$  are melting point & boiling point of MgO respectively.  
 (3) Reduction of MgO by coke is possible above  $T_3$   
 (4) Mg can be extracted from gaseous products by rapid cooling.
36. For same above question find the **CORRECT** statement regarding  $\Delta G^\circ$
- (1) After  $T_1$  point  $|\Delta G^\circ|$  decreases  
 (2) After  $T_2$  point  $|\Delta G^\circ|$  increases  
 (3) After both points  $|\Delta G^\circ|$  decreases  
 (4) Both (1) and (3) are correct
37. Give the correct order of initials **T** or **F** for following statements. Use **T** if statement is true and **F** if it is false.
- (i) Cu metal is extracted from its sulphide ore by reduction of  $\text{Cu}_2\text{O}$  with FeS.  
 (ii) An ore of Tin containing  $\text{FeWO}_4$  is concentrated by magnetic separation method.  
 (iii) Auto reduction process is used in the extraction of Cu & Hg.  
 (iv) Cassiterite and Rutile are oxide ores of the metals.
- (1) TFTT                      (2) TTFT                      (3) FTTT                      (4) FFFT

38. Select the correct option for the given processes.

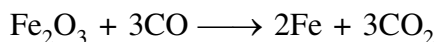
- (i) Process of heating steel to redness and then cooling it very slowly.
- (ii) Process of heating steel in presence of  $\text{NH}_3$  and producing hard coating of Iron Nitride on the surface of steel.
- (iii) Process of heating steel to redness and then cooling it suddenly by plunging it into water or oil.
- (iv) Process of heating quenched steel to a temperature well below redness and then cooling it slowly.
- (1) Tempering, Nitriding, Annealing & Quenching respectively
- (2) Quenching, Nitriding, Annealing & Case Hardening respectively
- (3) Tempering, Case harding, Quenching & Annealing respectively
- (4) Annealing, Nitriding, Quenching & Tempering respectively

39. During the production of iron and steel.

- (A) The oxide ore is primarily reduced to iron by solid coke according to the reaction.



- (B) The oxide ore is reduced by the carbon monoxide according to the reaction



- (C) Major silica impurities are removed as calcium silicate slag by addition of a fluxing agent lime stone.  
 (D) The converter slag containing phosphorus is used as a fertilizer.

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

40. Which of the following statement is/are correct regarding the extraction of lead.

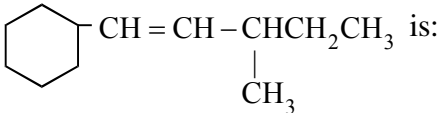
- (A) Carbon reduction can be employed to get Pb from  $\text{PbS}$  when impurity content is high  
 (B) Self-reduction can be employed to get Pb from  $\text{PbS}$  when impurity content is low.  
 (C) The obtained lead is hard due to the presence of impurity like Sn, As, Sb, Bi etc  
 (D)  $(\text{PbSiF}_6 + \text{H}_2\text{SiF}_6)$  is used as electrolyte for its electrorefining

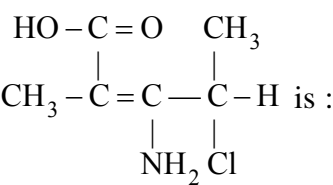
- (1) Only A                      (2) Only C                      (3) Only D                      (4) A, B, C, D

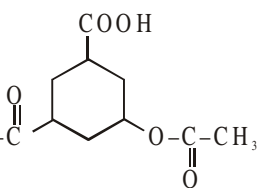
### ANSWER KEY

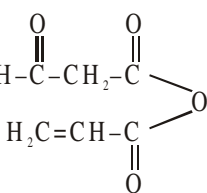
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Que.	31	32	33	34	35	36	37	38	39	40					
Ans.	1	2,3	4	1	2	4	3	4	2	4					

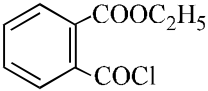
## 1. NOMENCLATURE & COMMON NAME

- The compound which has one isopropyl group is:
  - 2,2,3,3-Tetramethyl pentane
  - 2,2-Dimethyl pentane
  - 2,2,3-Trimethyl pentane
  - 2-Methyl pentane
- The IUPAC name of  is:
  - 1-Cyclohexyl-3-methyl pent-1-ene
  - 3-Methyl-5-cyclohexyl pent-1-ene
  - 1-Cyclohexyl-3-ethyl but-1-ene
  - 1-Cyclohexyl-3,4-dimethyl but-1-ene
- The IUPAC name of the following structure is  $[\text{CH}_3\text{CH}(\text{CH}_3)]_2 \text{C}(\text{CH}_2\text{CH}_3)\text{C}(\text{CH}_3) \text{C}(\text{CH}_2\text{CH}_3)_2$ 
  - 3,5-Diethyl-4,6-dimethyl-5-(1-methylethyl) hept-3-ene
  - 3,5-Diethyl-5-isopropyl-4,6-dimethylhept-2-ene
  - 3,5-Diethyl-5-propyl-4,6-dimethylhept-3-ene
  - None of these
- The IUPAC name of  $\beta$ -ethoxy- $\alpha$ -hydroxy propionic acid (trivial name) is:
  - 1,2-Dihydroxy-1-oxo-3-ethoxy propane
  - 1-Carboxy-2-ethoxy ethanol
  - 3-Ethoxy-2-hydroxy propanoic acid
  - All above

- The IUPAC name of compound  is :
  - 2-Amino-3-chloro-2-methylpent-2-enoic acid
  - 3-Amino-4-chloro-2-methylpent-2-enoic acid
  - 4-Amino-3-chloro-2-methylpent-2-enoic acid
  - All of the above

- The IUPAC name of compound 
  - 3-Carbonyl methoxy -5- Ethanoyl oxy cyclohexanoic acid
  - 3-Ethanoyl oxy -5- Methoxy carbonyl cyclohexane carboxylic acid
  - 5-Ethanoyl oxy -5- Methoxy carbonyl cyclohexanoic acid
  - 3-Methoxy carbonyl -5- Ethanoyl oxy cyclohexane carboxylic acid

- The IUPAC name of 
  - 2-Formyl ethanoic propanoic Anhydride
  - Ethanoic prop-2-enoic Anhydride
  - Prop-2-enoic-2-formyl propanoic Anhydride
  - 2-Oxopropanoic prop-2-enoic Anhydride

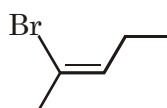
8. The IUPAC name of  is :
- (1) 2-Chlorocarbonyl ethylbenzoate (2) 2-Carboxyethyl benzoyl chloride  
 (3) Ethyl-2-(chlorocarbonyl)benzoate (4) Ethyl-1-(chlorocarbonyl)benzoate
9. Structural formula of isopropyl methanoate is :
- (1)  $\text{CH}_3 - \text{C}(=\text{O}) - \text{O} - \text{CH}(\text{CH}_3) - \text{CH}_3$  (2)  $\text{H} - \text{C}(=\text{O}) - \text{O} - \text{CH}_2 - \text{CH}(\text{CH}_3) - \text{CH}_3$   
 (3)  $\text{CH}_3 - \text{C}(=\text{O}) - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  (4)  $\text{H} - \text{C}(=\text{O}) - \text{O} - \text{CH}(\text{CH}_3) - \text{CH}_3$
10. Which of the following pairs have absence of carbocyclic ring in both compounds?
- (1) Pyridine, Benzene (2) Benzene, Cyclohexane  
 (3) Cyclohexane, Furane (4) Furane, Pyridine

## ANSWER KEY

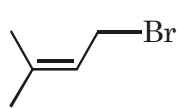
Que.	1	2	3	4	5	6	7	8	9	10	
Ans.	4	1	1	3	2	2	4	3	4	4	

## 2. ISOMERISM

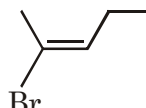
1. Which one of the following statements concerning compounds V–Z is true :



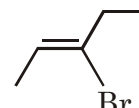
(V)



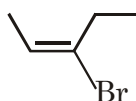
(W)



(X)

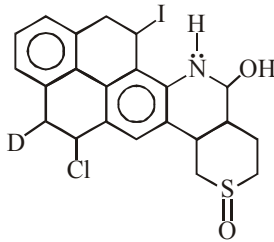


(Y)



(Z)

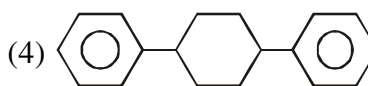
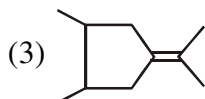
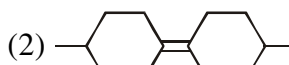
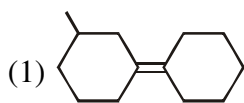
- (1) V and X are conformational isomers (2) Y and Z are constitutional isomers  
 (3) X and Y are constitutional isomers (4) V and Y are stereoisomers
2. Which of the following compound has no isomer?
- (1)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$  (2)  $\text{CH}_3\text{CHO}$   
 (3)  $\text{CH}_2=\text{CH}-\text{Cl}$  (4)  $\text{ClCH}_2\text{CH}_2\text{Cl}$

3.  has 'x' chiral centre then find the value of x :

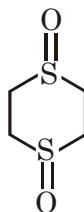
- (1) 7 (2) 8 (3) 6 (4) 5



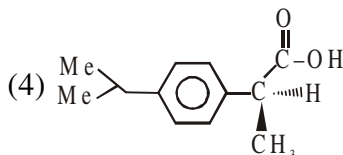
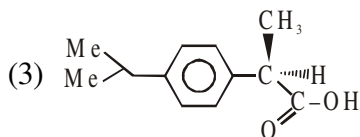
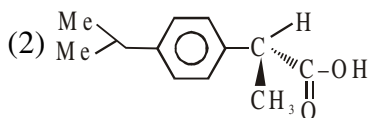
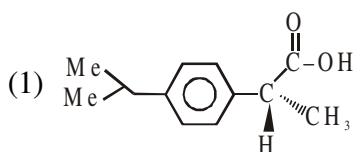
4. The number of optically active compounds in the isomers of  $C_4H_9Br$  is :  
 (1) 1 (2) 2 (3) 3 (4) 4
5. Compounds which can show both optical as well as geometrical isomerism :



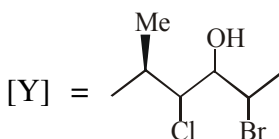
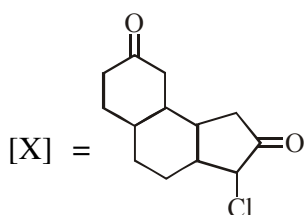
6. The correct statement for the given compound is



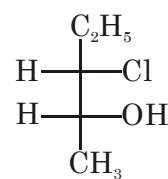
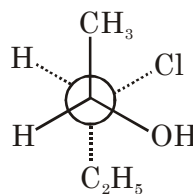
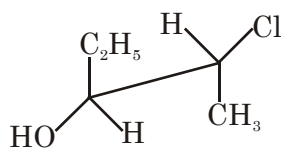
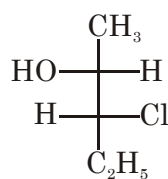
- (1) It can show geometrical isomerism (2) It can show optical isomerism  
 (3) It contains chiral centre (4) None of these
7. The S-ibuprofen is responsible for its pain relieving property. Which one of the structures shown is S-ibuprofen :



8. Number of chiral centres in [X] & [Y] is a & b respectively. The value of (a-b) is :



- (1) 1 (2) 2 (3) 3 (4) 4
9. The two projection formulae that represent a pair of enantiomers are :-



- (1) I and II

- (2) III and IV

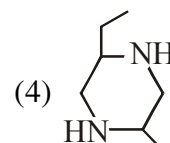
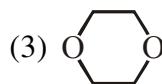
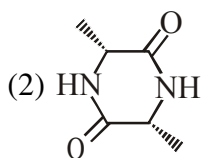
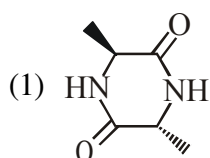
- (3) I and III

- (4) II and IV

10. When an optically active compound is placed in a 10 dm tube is present 20 gm in a 200 ml solution rotates the PPL by  $30^\circ$ . Calculate the angle of rotation & specific angle of rotation if above solution is diluted to 1 Litre.

(1)  $16^\circ$  &  $36^\circ$                       (2)  $6^\circ$  &  $30^\circ$                       (3)  $3^\circ$  &  $30^\circ$                       (4)  $6^\circ$  &  $36^\circ$

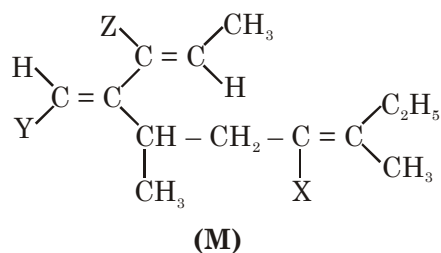
11. Which of the following is example of meso compound?



12. Molecular formula  $C_5H_{10}O$  can have :

(1) 6-Aldehyde, 4-Ketone                      (2) 5-Aldehyde, 3-Ketone  
(3) 4-Aldehyde, 3-Ketone                      (4) 5-Aldehyde, 2-Ketone

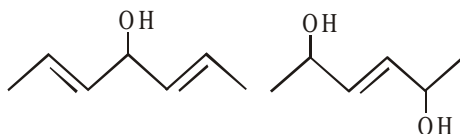
13. In the given halogenoalkene M, atoms X, Y and Z represents hydrogen or bromine or chlorine. To show geometrical isomerism in all pi bonds, what could be the identities of atoms X, Y and Z?



	X	Y	Z
1	Cl	H	Cl
2	H	Br	Cl
3	H	Br	H

(1) 1, 2 and 3                      (2) 1 and 2 only                      (3) 2 and 3 only                      (4) 1 and 3 only

14. Total number of stereoisomer of following compounds are respectively :-

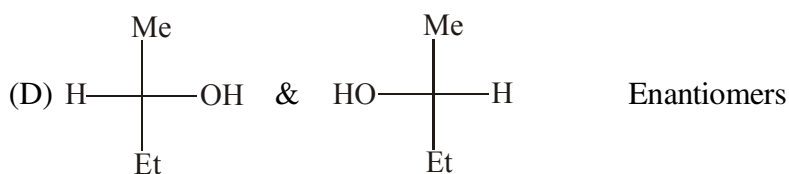
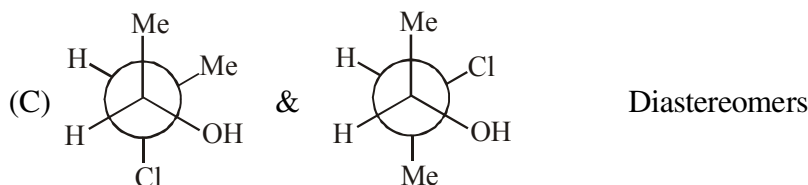
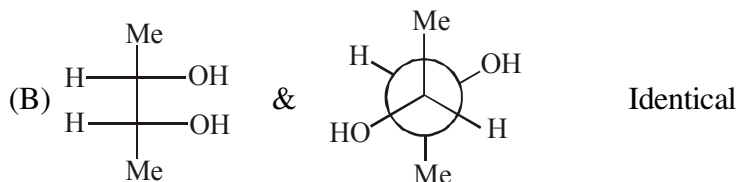
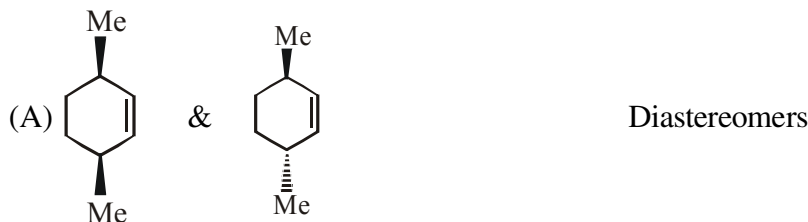


(1) 4, 6                      (2) 8                      (3) 6, 6                      (4) 8, 8

15. Compound is ?

(1) (2R, 3S)                      (2) (2R, 3R)                      (3) (2S, 3S)                      (4) (2S, 3R)

16. Identify correct relation between pair of compounds ?



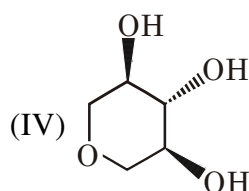
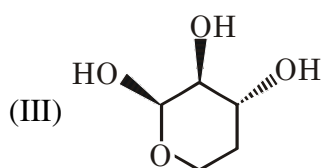
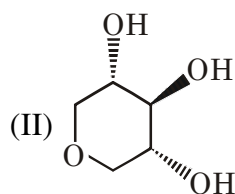
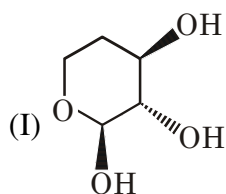
(1) A, B, C

(2) A, B

(3) B, C, D

(4) A, B, C, D

17. Which two of the following compounds are diastereomers?



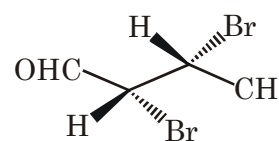
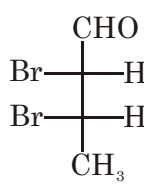
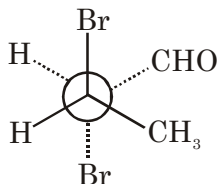
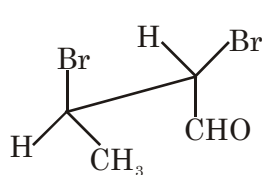
(1) I & II

(2) II & IV

(3) III & IV

(4) I & III

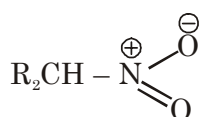
18. Identify the correct statement regarding following molecules?



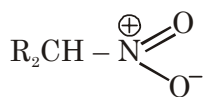
(1) **M** and **O** are diastereomers  
(3) **M** and **N** are identical

(2) **N** and **P** are enantiomers  
(4) **O** and **P** are diastereomers

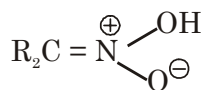
19. The correct statements describing the relationship between :



(X)

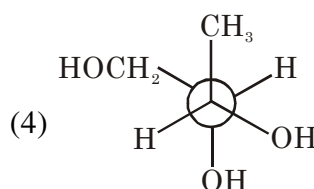
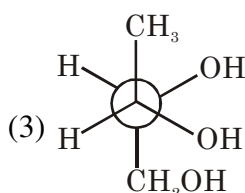
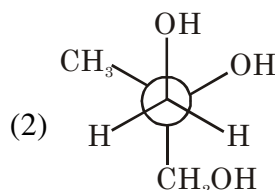
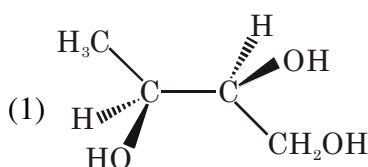


(Y)



(Z)

- (1) X and Y are resonance structures and Z is a tautomer  
 (2) X and Y are tautomers and Z is resonance structure  
 (3) X, Y and Z are all resonance structures  
 (4) X, Y and Z all are tautomers
20. Which of the following statements is/are not correct for D-(+) glyceraldehyde :
- (A) The symbol D indicates the dextrorotatory nature of the compound  
 (B) The sign(+) indicates the dextrorotatory nature of the compound  
 (C) The symbol D indicates that (–OH) group lies left to the chiral centre in the conventionally correct Fischer projection diagram  
 (D) The symbol D indicates that (–OH) group lies right to the chiral centre in the conventionally correct Fischer projection diagram
- (1) A, B, C                      (2) A, C                      (3) A, B, C, D                      (4) A, D
21. Which compound is different from the others?

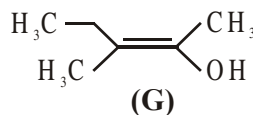
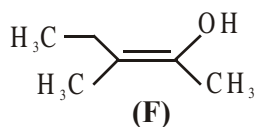
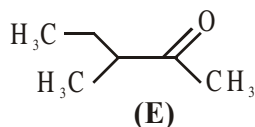


22. Which of the following will have a meso-isomer also-
- (1) 2-chlorobutane                      (2) 2,3-dichlorobutane  
 (3) 2,3-dichloropentene                      (4) 2-hydroxy propanoic acid
23. Amongst the following compounds, the optically active alkane having lowest molecular mass is
- (1)  $\text{CH}_3 - \text{CH}_2 - \text{C} \equiv \text{CH}$                       (2)  $\text{CH}_3 - \text{CH}_2 - \text{CH}(\text{CH}_3) - \text{CH}_3$   
 (3)                      (4)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
24. Of the five isomeric hexanes, the isomer which can give two monochlorinated compounds is :
- (1) 2-methyl pentane                      (2) 2,2-dimethyl butane  
 (3) 2,3-dimethyl butane                      (4) n-hexane

25. The number of possible enantiomeric pairs that can be produced during monochlorination of 2-methyl butane is :

- (1) 2 (2) 3 (3) 4 (4) 1

26. The correct statement(s) concerning the structures E, F and G is (are)

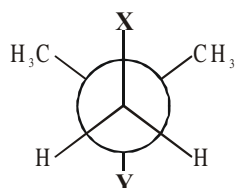


- (A) E, F and G are resonance structures (B) E, F and E, G are tautomers  
(C) F and G are geometrical isomers (D) F and G are diastereomers  
(1) A, B, C (2) B, C, D (3) A, B, C, D (4) A, B

27. The correct statement(s) about the compound  $\text{H}_3\text{C}(\text{HO})\text{HC} - \text{CH} = \text{CH} - \text{CH}(\text{OH})\text{CH}_3$  (X) is (are) :

- (1) The total number of stereoisomers possible for X is 6  
(2) The total number of diastereomers possible for X is 3  
(3) If the stereochemistry about the double bond in X is trans, the number of enantiomers possible for X is 4  
(4) If the stereochemistry about the double bond in X is cis, the number of enantiomers possible for X is 4

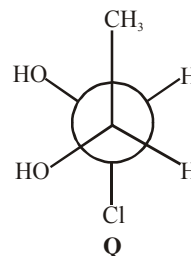
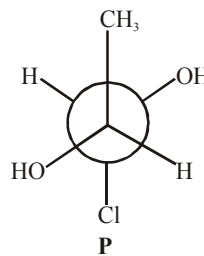
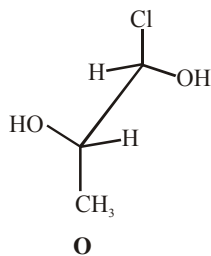
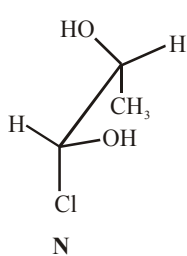
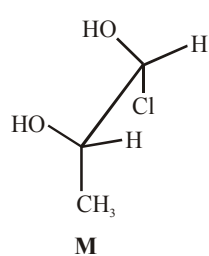
28. In the Newman projection for 2,2-dimethylbutane



X and Y can respectively be –

- (1) H and H (2)  $\text{CH}_3$  and  $\text{C}_2\text{H}_5$  (3)  $\text{C}_2\text{H}_5$  and H (4)  $\text{CH}_3$  and  $\text{CH}_3$

29. Which of the given statement(s) about N, O, P and Q with respect to M is (are) correct ?



(A) M and N are non-mirror image stereoisomers (B) M and O are identical

(C) M and P are enantiomers

(D) M and Q are identical

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

## ANSWER KEY

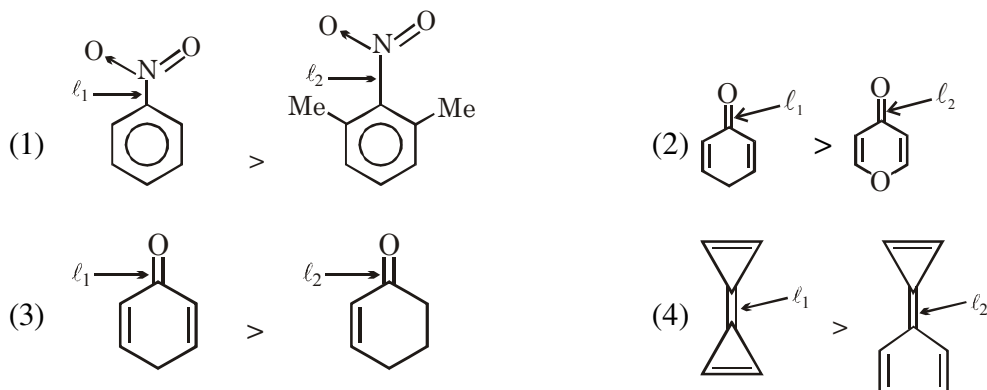
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	3	1	2	3	1	4	2	3	2	1	2	3	1	1
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Ans.	4	4	4	1	2	2	2	3	3	1	2	1	4	3	

## 3. GOC

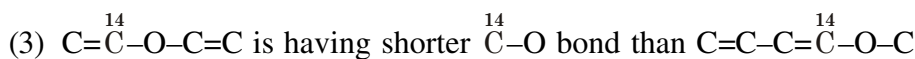
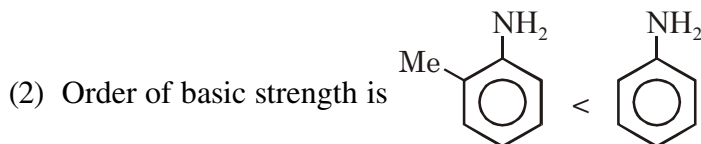
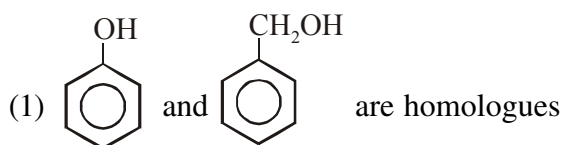
1. When benzene sulphonic acid and p-nitrophenol are treated with  $\text{NaHCO}_3$ , the gases released respectively are

(1)  $\text{SO}_2, \text{NO}_2$       (2)  $\text{SO}_2, \text{NO}$       (3)  $\text{SO}_2, \text{CO}_2$       (4)  $\text{CO}_2, \text{CO}_2$

2. Identify correct bond length order ? ( $\ell_1$  &  $\ell_2$ )



3. Select correct statement :

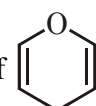
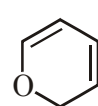


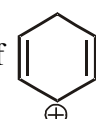
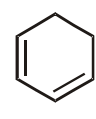
(4) Cyclooctatetraene is antiaromatic compound

4. Select correct statement(s) :

(A) Heat of hydrogenation per mole of  $\text{H}_2$  is greater in 1-butene than 1,3-butadiene

(B)  $\text{CCl}_3^\ominus$  is more stable than  $\text{CF}_3^\ominus$

(C) Resonance energy of  is less than 

(D) Resonance energy of  &  is equal.

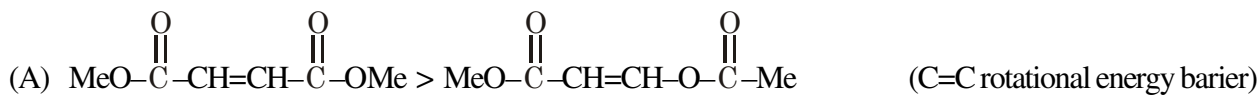
(1) A, B, C

(2) A, B, C, D

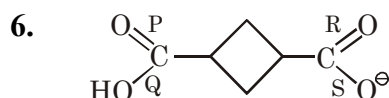
(3) A, C, D

(4) C, D

5. Select correct order among following :



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

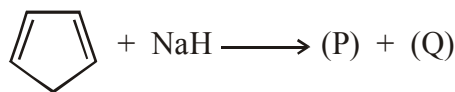


Select correct order of bond length of above bond P, Q, R & S :

(1)  $\text{P} > \text{R} > \text{S} > \text{Q}$  (2)  $\text{Q} > \text{R} = \text{S} > \text{P}$  (3)  $\text{S} > \text{Q} > \text{R} > \text{P}$  (4) None of these

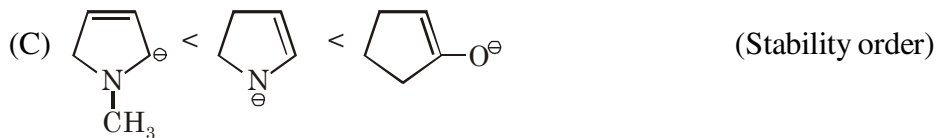
7. If X = Number of resonating structure of (P) involving monoanion &  
Y = Molecular weight of gas (Q).

Then find out the value of (X + Y) :



(1) 5 (2) 6 (3) 8 (4) 7

8. Select the order which is correct among following :



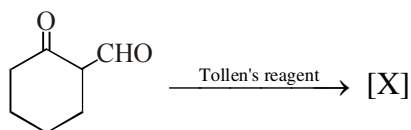
(1) A, C, D (2) A, B, C (3) A, B, C, D (4) A, B

## ANSWER KEY

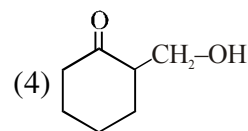
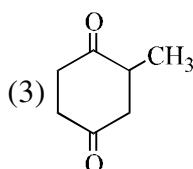
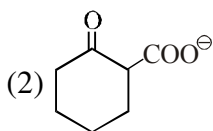
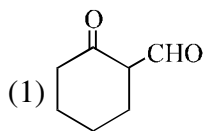
Que.	1	2	3	4	5	6	7	8	
Ans.	4	3	2	2	1	2	4	1	

## 4. OXIDATION

1. In the given reaction



[X] will be:



2. Which one of the following compounds will give dimethyl glyoxal with
- $\text{SeO}_2$
- :

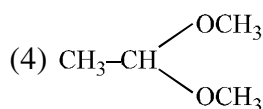
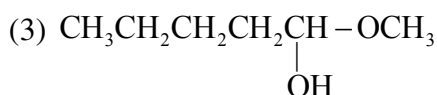
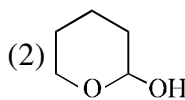
(1) Acetone

(2) Acetophenone

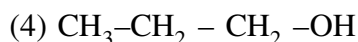
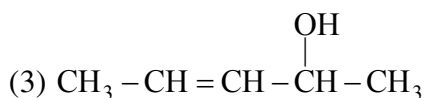
(3) Ethyl methyl ketone

(4) Propanaldehyde

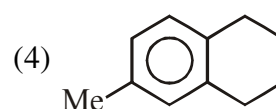
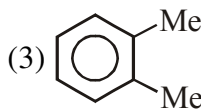
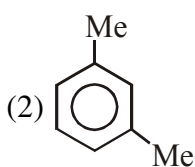
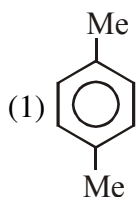
3. Which of the following compound will not give positive Tollens test

(1)  $\text{CH}_3\text{CHO}$ 

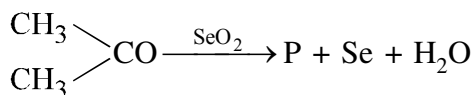
4. Which one of the following alcohols are oxidised by
- $\text{MnO}_2$
- ?

(1)  $\text{C}_6\text{H}_5 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ 

- 5.
- $\text{A} \xrightarrow{\text{H}^+ / \text{KMnO}_4} \text{B} \xrightarrow{\Delta} \text{Phthalic Anhydride}$
- ; A is :



6. In the reaction, P is

(1)  $\text{CH}_3\text{COCHO}$ (2)  $\text{CH}_3\text{COOCH}_3$ (3)  $\text{CH}_3\text{COCH}_2\text{OH}$ 

(4) None

7. The best reagent to convert pent-3-en-2-ol into pent-3-en-2-one is -

(1) Acidic dichromate

(2) Acidic permanganate

(3) Pyridinium chloro-chromate

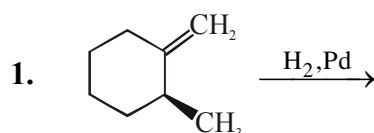
(4) Chromic anhydride in glacial acetic acid

## ANSWER KEY

Que.	1	2	3	4	5	6	7	
Ans.	1	3	4	3	3	1	4	

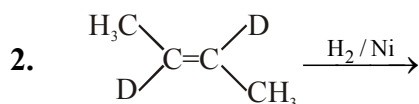


# 5. REDUCTION



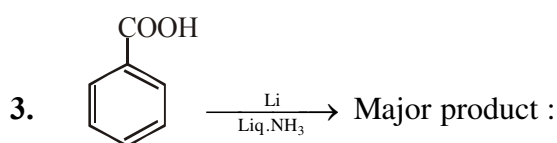
Products of the above reaction will be :

- (1) Racemic mixture      (2) Diastereomers      (3) Meso      (4) Structural isomer

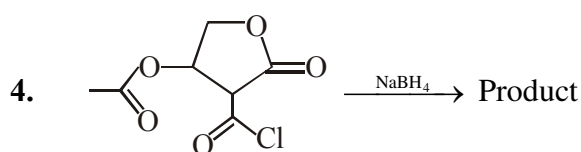


Product of above reaction will be :

- (1) Racemic mixture      (2) Diastereomers      (3) Meso      (4) Constitutional isomers



- (1)
- (2)
- (3)
- (4)



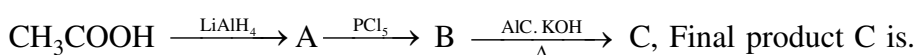
The product is :

- (1)
- (2)  $\text{CH}_3\text{--CH}_2\text{--OH}$
- (3)
- (4)

5. Under Wolff Kishner reduction conditions, the conversions which may be brought about is?

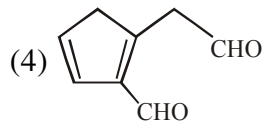
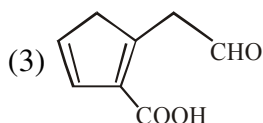
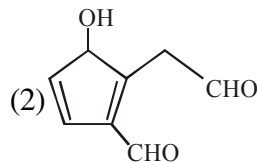
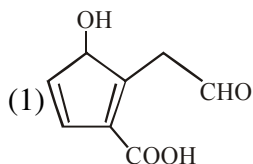
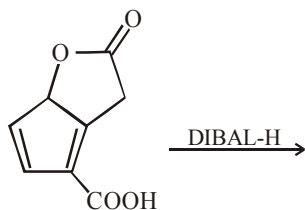
- (1) Benzaldehyde into Benzyl alcohol      (2) Cyclohexanol into Cyclohexane  
(3) Cyclohexanone into Cyclohexanol      (4) Benzophenone into Diphenylmethane

6. In the reaction,

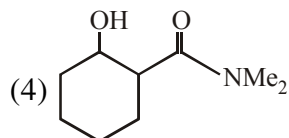
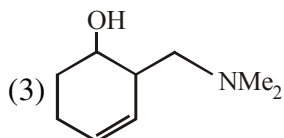
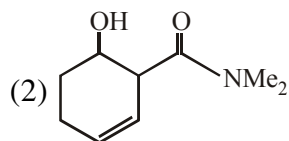
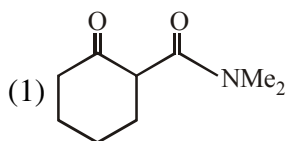
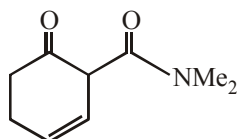


- (1) Ethylene      (2) Acetyl chloride      (3) Acetaldehyde      (4) Acetylene

7. The major product obtained in the following reaction is :



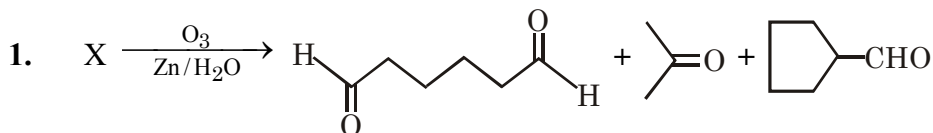
8. The main reduction product of the following compound with  $\text{NaBH}_4$  in methanol is :-



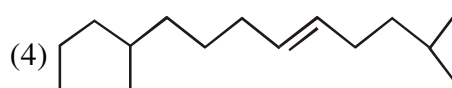
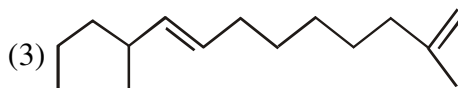
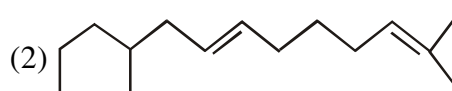
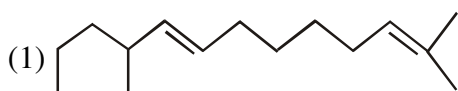
### ANSWER KEY

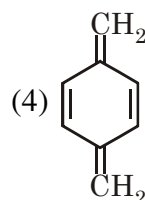
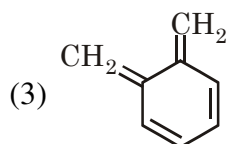
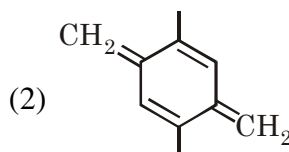
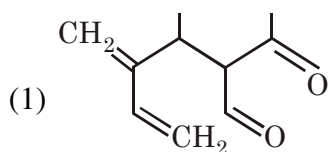
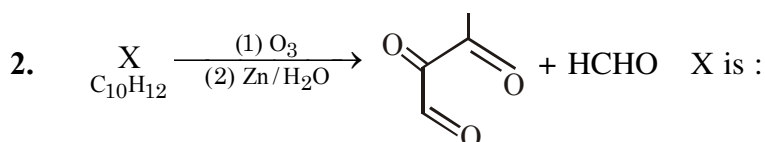
Que.	1	2	3	4	5	6	7	8	
Ans.	2	1	2	4	4	1	1	2	

### 6. HYDROCARBON

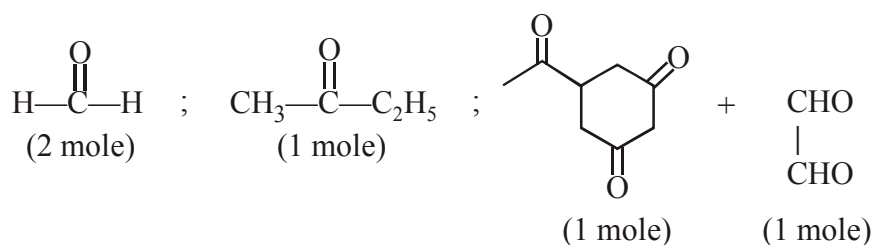


reactant 'X' is :

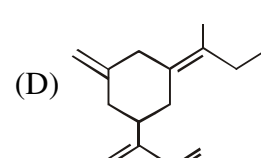
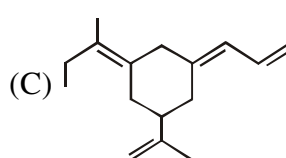
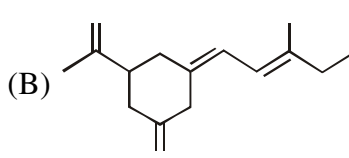
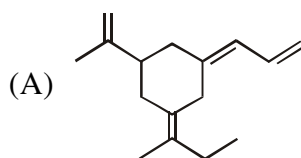




3. By which compound's reductive ozonolysis the following products are obtained



Possible compounds are :

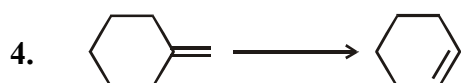


(1) A, B, D

(2) A, B, C

(3) B, C, D

(4) A, C, D



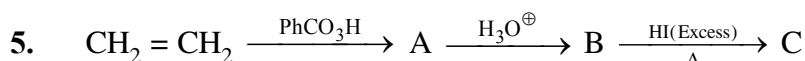
The reagents used can be

(1)  $\text{H}_3\text{O}^+$  ; conc.  $\text{H}_2\text{SO}_4/\Delta$

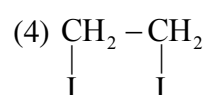
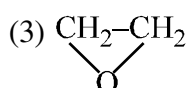
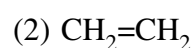
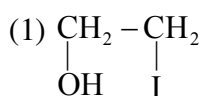
(2)  $\text{O}_3 / \text{Zn}$  ; LAH ; conc.  $\text{H}_2\text{SO}_4 / \Delta$

(3)  $\text{O}_3 / \text{Zn}$  ;  $\text{H}_2(\text{Ni})$  ;  $\text{N}_2\text{H}_4/\text{OH}^-$

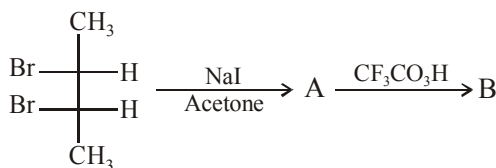
(4)  $\text{B}_2\text{H}_6 + \text{H}_2\text{O}_2 + \text{NaOH}$  ;  $\text{Al}_2\text{O}_3$



Structure of C is



6. The correct statement for the given reaction is :



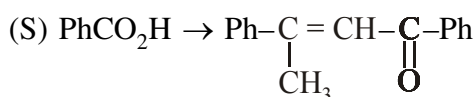
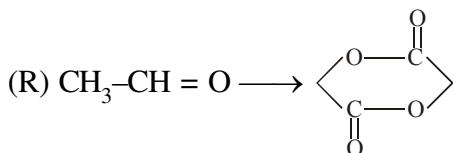
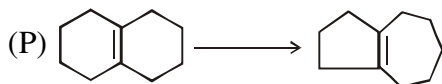
- (1) B is optically inactive due to external compensation  
 (2) B is optically inactive due to internal compensation  
 (3) A is predominantly cis-alkene  
 (4) B does not have chiral centres
7. Following conversion can not be carried out by using sequence



- (1) (i)  $\text{LiAlH}_4$ , PCC  
 (2) (i)  $\text{R}'-\text{OH}/\text{H}^+$  (ii) DIBAL-H  
 (3) (i)  $\text{Ca}(\text{OH})_2$  (ii)  $(\text{HCOO})_2\text{Ca}$ / Dry distillation  
 (4) (i)  $\text{LiAlH}_4$  (ii)  $\text{CrO}_3$  + Conc.  $\text{H}_2\text{SO}_4$

8. List - I

(Conversion)



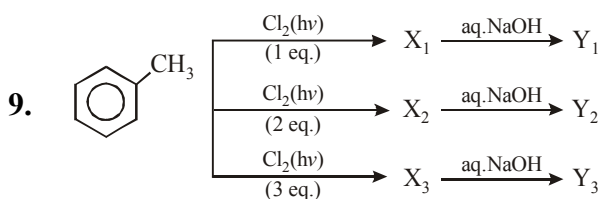
List - II

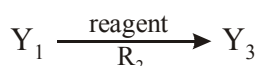
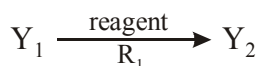
(Sequence of reagents for that conversion)

- (1) (i)  $\text{SOCl}_2$ , (ii)  $(\text{CH}_3)_2\text{Cd}$ , (iii)  $\bar{\text{O}}\text{H}/\Delta$   
 (2) (i)  $\text{SeO}_2$ , (ii)  $\bar{\text{O}}\text{H}$ , (iii)  $\text{H}^+/\Delta$   
 (3) (i)  $\text{O}_3/\text{Zn}, \text{H}_2\text{O}$ , (ii)  $\bar{\text{O}}\text{H}/\Delta$ , (iii)  $\text{N}_2\text{H}_4 + \bar{\text{O}}\text{H}/\Delta$   
 (4) (i)  $\text{O}_3/\text{Zn}, \text{H}_2\text{O}$ , (ii)  $\bar{\text{O}}\text{H}/\Delta$ , (iii)  $\text{NaOH} + \text{I}_2; \text{H}^+$

Code :

	P	Q	R	S
(1)	3	4	1	2
(2)	3	2	4	1
(3)	3	4	2	1
(4)	3	2	1	4





$R_1$  &  $R_2$  are respectively :

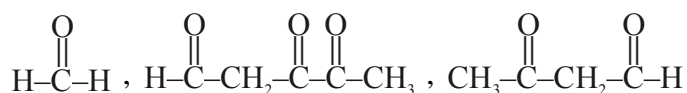
(1) PCC ; Cu + 300° C

(2) PCC ;  $\text{KMnO}_4$

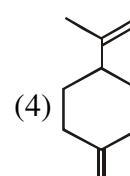
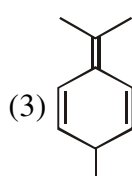
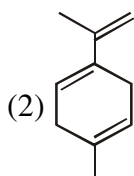
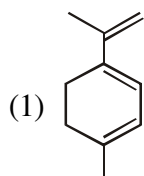
(3) PCC ; PDC

(4)  $\text{CrO}_3$  ;  $\text{HIO}_4$

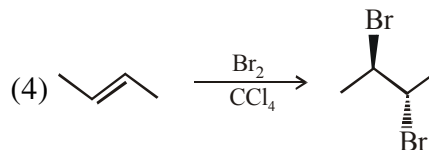
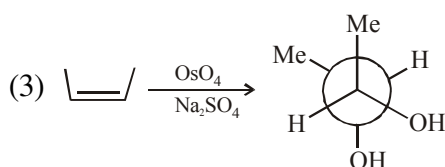
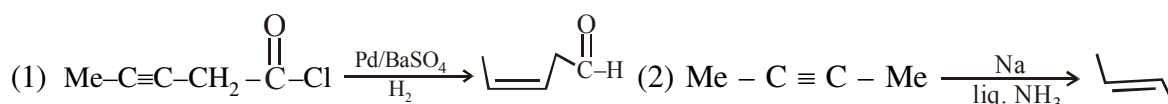
10. A polyene (1) reacts with 3 mole of  $\text{H}_2$  gas in presence of platinum catalyst to form 1-isopropyl 4-methyl cyclohexane. When (1) undergoes ozonolysis, following products are obtained



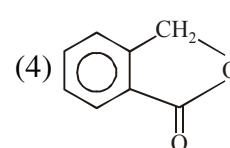
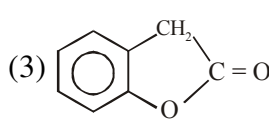
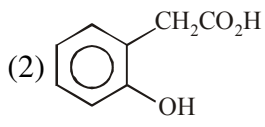
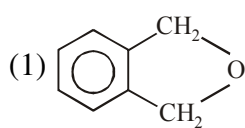
Structure of (1) is :



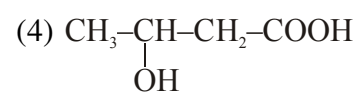
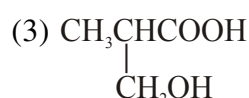
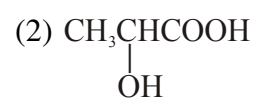
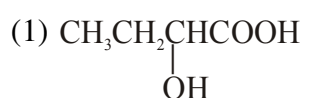
11. Identify reaction incorrectly match with its product ?



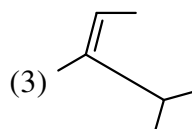
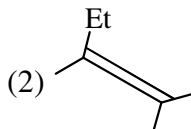
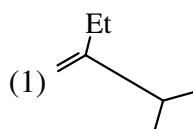
12.  $\xrightarrow[\text{(1 mole)}]{\text{O}_3/\text{Zn}} \text{X} \xrightarrow[2. \text{H}^+]{1. \text{OH}^-} \text{Y} \xrightarrow{\Delta} \text{Z}$ , Z is :



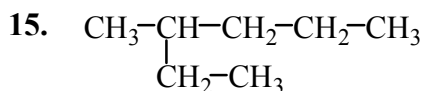
13. An optically active compound 'X' has molecular formula  $\text{C}_4\text{H}_8\text{O}_3$ . It evolves  $\text{CO}_2$  with  $\text{NaHCO}_3$ . 'X' reacts with  $\text{LiAlH}_4$  to give an achiral compound 'X' is :



14.  $\xrightarrow[\Delta]{\text{OH}^-} \text{Olefinic product.}$  Identify major product

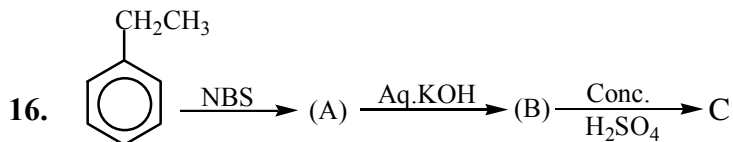


(4) None of these



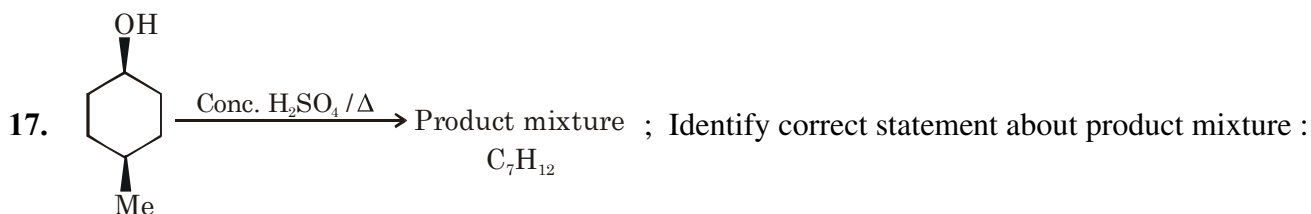
Number of monochlorinated products when above compound undergo reaction with  $\text{Cl}_2/h\nu$  is :

- (1) 10 (2) 15 (3) 18 (4) 20



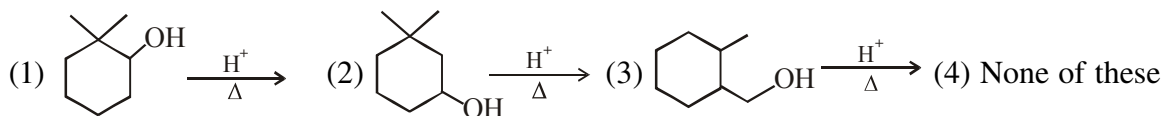
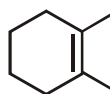
Which statement is incorrect regarding C

- (1) C decolorised  $\text{Br}_2$  water  
 (2) C on reaction with  $\text{HBr}$  &  $\text{HBr} + \text{H}_2\text{O}_2$  giving same product  
 (3) C is also formed when A undergoes reaction with alcoholic  $\text{KOH}$   
 (4) C when reacts with  $\text{H}_3\text{O}^+$ , B is formed

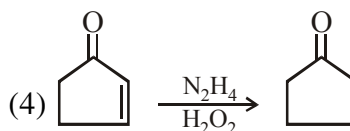
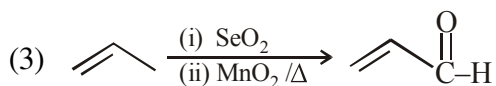
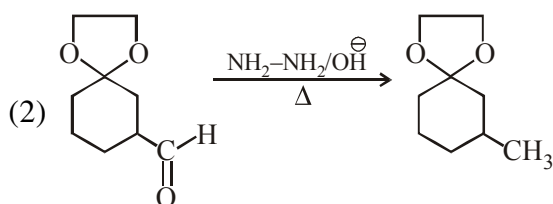
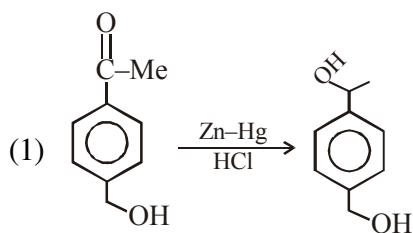


- (1) It is resolvable (2) It is non resolvable  
 (3) Meso is obtained (4) Diastereoisomeric product is obtained

18. Which of the following reaction will not produce given alkene as major product ?



19. Identify reaction incorrectly match with its product ?



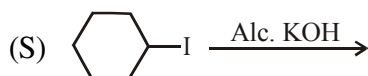
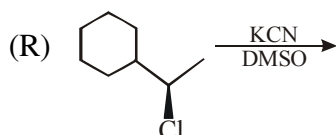
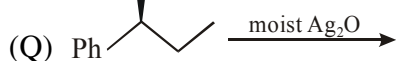
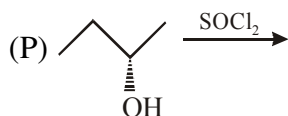
### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	2	2	2	2	1	4	3	2	2	3	4	3	1	4
Que.	16	17	18	19											
Ans.	2	1	2	1											

# 7 (A). ALKYLHALID

## 1. List-I

### Reaction



## List-II

### Mechanism for the formation of major product

(1) E2

(2) S<sub>N</sub>1

(3) S<sub>N</sub>i

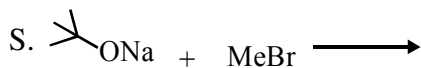
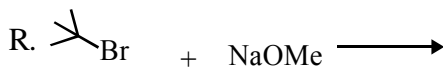
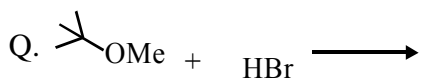
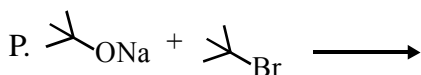
(4) S<sub>N</sub>2

### Codes :

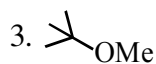
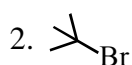
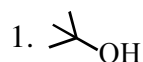
	P	Q	R	S		P	Q	R	S
(1)	3	4	2	1	(2)	3	1	2	4
(3)	3	2	4	1	(4)	3	2	1	4

## 2. LIST-I contains reactions and LIST-II contains major products.

### LIST-I

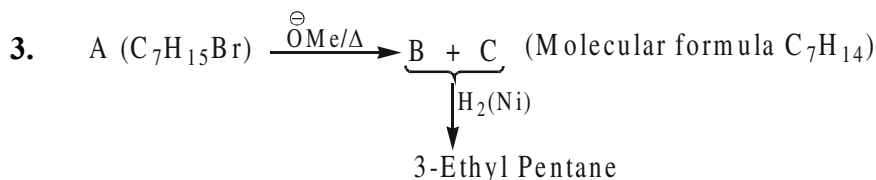


### LIST-II

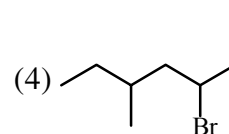
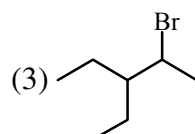
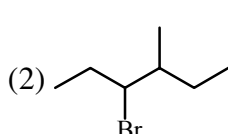
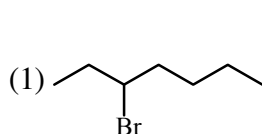


Match each reaction in LIST-I with one or more product in LIST-II and choose the correct option.

- (1) P → 1,5; Q → 2; R → 3; S → 4  
 (2) P → 1,4; Q → 2; R → 4; S → 3  
 (3) P → 1,4; Q → 1,2; R → 3,4; S → 4  
 (4) P → 4,5; Q → 4; R → 4; S → 3,4



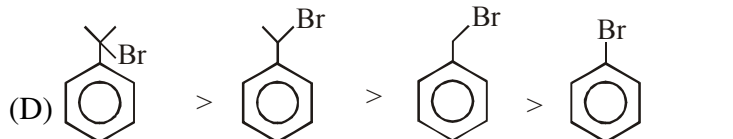
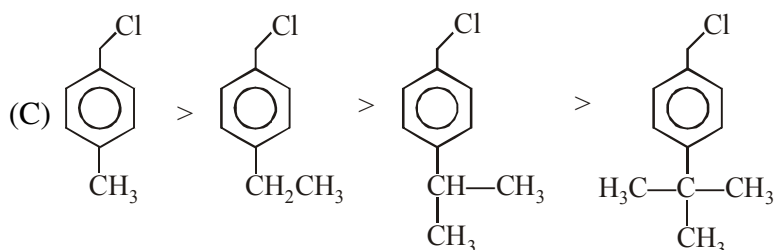
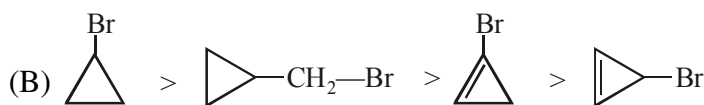
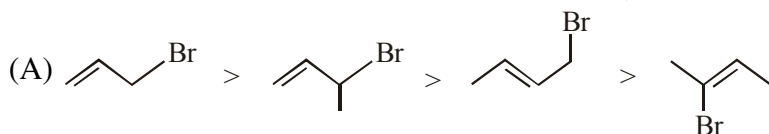
Structure of A is :-



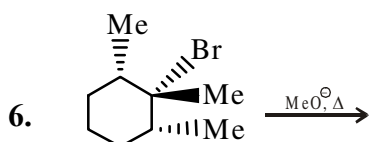
4. Which of the following option is **correct** regarding  $\text{CH}_3\text{S}^\ominus$  and  $\text{CH}_3\text{O}^\ominus$  :

- (1)  $\text{CH}_3\text{O}^\ominus$  is stronger base than  $\text{CH}_3-\text{S}^\ominus$ .
- (2)  $\text{CH}_3\text{O}^\ominus$  is stronger nucleophile than  $\text{CH}_3\text{S}^\ominus$  (in  $\text{H}_2\text{O}$ ).
- (3)  $\text{CH}_3\text{O}^\ominus$  is weaker base than  $\text{CH}_3\text{S}^\ominus$ .
- (4)  $\text{CH}_3\text{O}^\ominus$  &  $\text{CH}_3\text{S}^\ominus$  both give major elimination product when react with  $\text{CH}_3-\underset{\text{CH}_3}{\text{CH}}-\text{Cl}$

5. Consider following and find correct order of  $\text{S}_\text{N}^1$  rate :

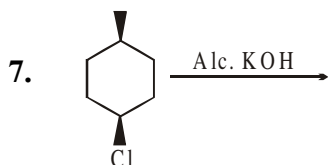


- (1) A, B                      (2) B, C, D                      (3) C, D                      (4) All



Correct statement regarding product.

- (1) Only one alkene is produced
- (2) Non resolvable major product
- (3) Major product shows geometrical isomerism
- (4) Major product can show optical isomerism



Consider statements and identify correct statements

- (A) Product can show geometrical isomerism
- (B) It is an example of  $\text{E}_2$  mechanism
- (C)  $(\pm)$  4-methyl cyclohexene is obtained as a product
- (D) Racemic mixture of alcohols are obtained as product

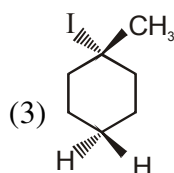
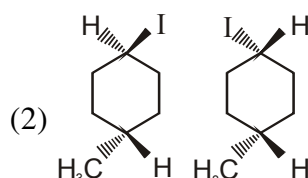
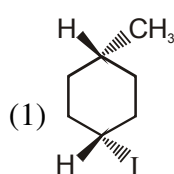
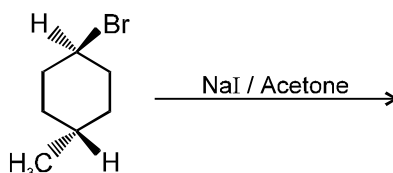
- (1) A, B, C                      (2) B, C, D                      (3) B, C                      (4) C, D



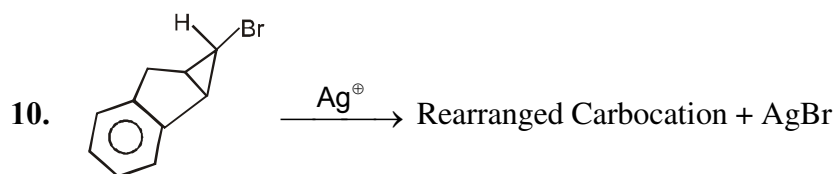
8. Which of the following options is correct ?

- (1) Pentane 1, 5 diol is less soluble in water than pentanol
- (2) Rate of substitution of methoxy methyl chloride is higher than ethyl chloride in same condition
- (3)  $\text{Ph}_2\text{CHCl}$  is less reactive than  $\text{PhCH}_2\text{Cl}$  toward  $\text{S}_\text{N}1$  reaction
- (4) Ditert-butyl ether can be prepared by williamson reaction

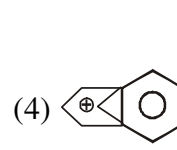
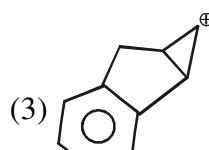
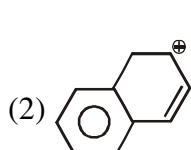
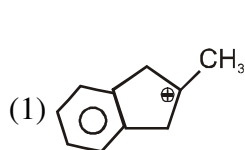
9. Select the correct informations about products in reactions I and II.



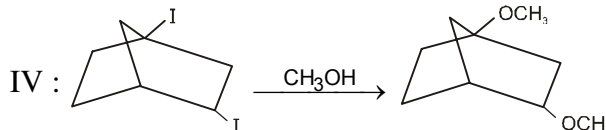
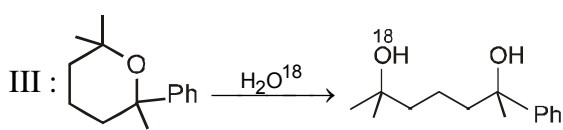
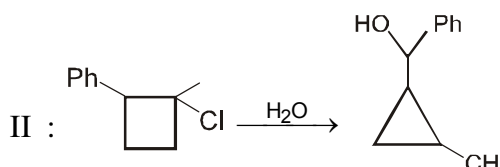
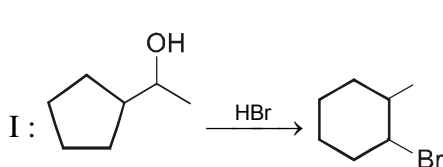
(4)  $\text{S}_\text{N}2$



Major rearranged carbocation is :



11. Which of the following reactions are not representing the correct major product :



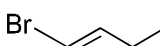
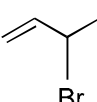
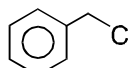
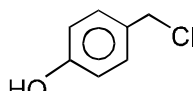

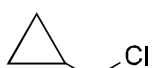
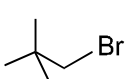

(1) I

(2) II

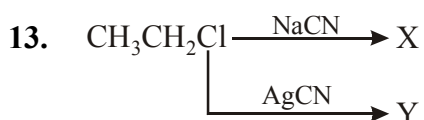
(3) III

(4) All

12. Which one will undergo hydrolysis (solvolysis) more rapidly amongst the given pairs of compounds

	(X)	(Y)
(I)		
(II)		
(III)		
(IV)		

	I	II	III	IV
(1)	$x > y$	$y > x$	$x > y$	$x > y$
(2)	$y > x$	$y > x$	$x > y$	$x > y$
(3)	$x > y$	$x > y$	$y > x$	$y > x$
(4)	$y > x$	$y > x$	$x > y$	$y > x$



X' & Y' are related as :

- (1) Chain isomers      (2) Functional isomers    (3) Positional isomers    (4) Stereoisomers

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	
Ans.	3	2	3	1	3	4	3	2	1	2	4	4	2	

## 7 (B). HALOGEN DERIVATIVE

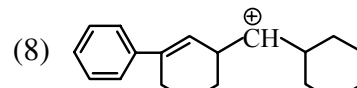
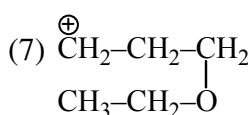
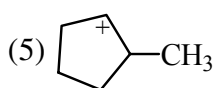
1. How many 1,2-shifts are involved during the course of following rearrangement :



- (1) 1 (2) 2 (3) 3 (4) 4

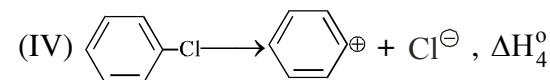
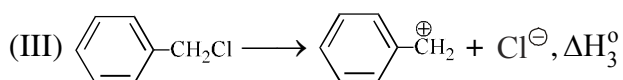
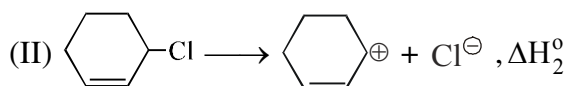
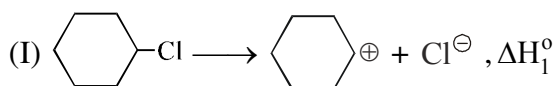
2. How many following carbocation undergo re-arrangement -

- (1)  $\text{CH}_3\text{CH}_2\text{CH}_2^+$  (2)  $(\text{CH}_3)_2\text{CH}^+\text{CHCH}_3$  (3)  $(\text{CH}_3)_3\text{C}^+\text{CHCH}_3$  (4)  $(\text{CH}_3\text{CH}_2)_3\text{CCH}_2^+$



- (1) 5 (2) 8 (3) 6 (4) 7

3. For the reactions



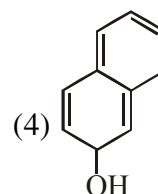
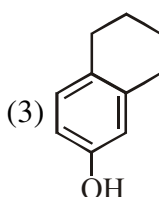
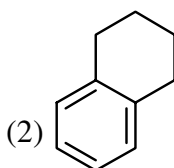
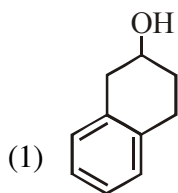
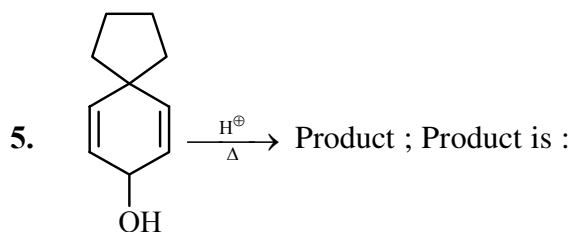
The correct decreasing order of enthalpies of reaction for producing carbocation is :

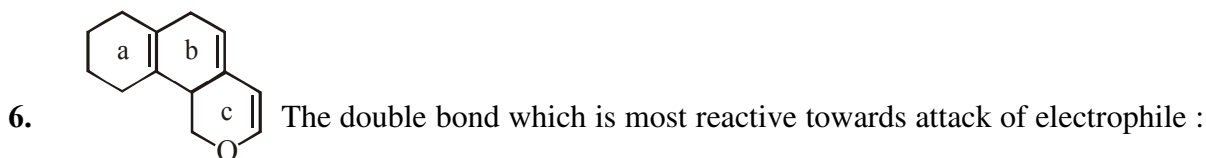
- (1)  $\Delta H_1^0 > \Delta H_2^0 > \Delta H_3^0 > \Delta H_4^0$  (2)  $\Delta H_4^0 > \Delta H_1^0 > \Delta H_2^0 > \Delta H_3^0$   
(3)  $\Delta H_3^0 > \Delta H_2^0 > \Delta H_1^0 > \Delta H_4^0$  (4)  $\Delta H_2^0 > \Delta H_1^0 > \Delta H_4^0 > \Delta H_3^0$

4. -Br, which is not the correct statement :

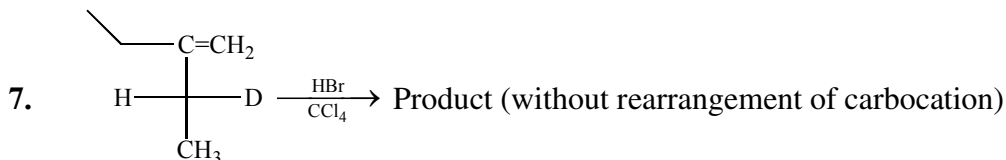
- (1) I is more soluble in water than bromocyclopropane  
(2) I gives pale yellow ppt. on addition with aq.  $\text{AgNO}_3$   
(3) I is having lower dipole moment than bromocyclopropane

- (4) I is more ionic than



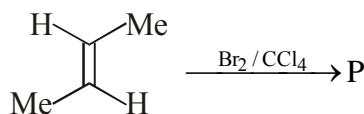


- (1) a (2) b (3) c (4) None

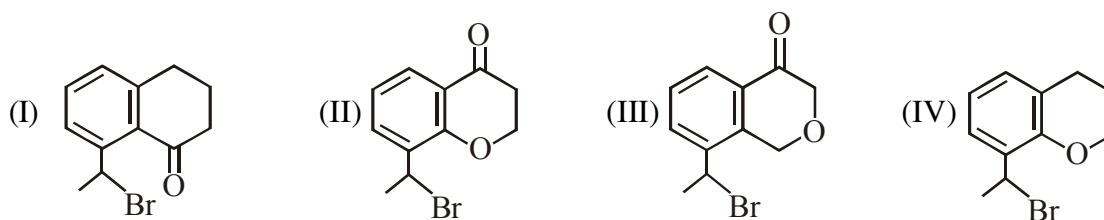


What is stereochemistry of product :

- (1) Racemic mixture (2) Optically inactive (3) Mixture of diastereomers (4) Meso product
8. Select incorrect statements about the product (P) of the reaction :

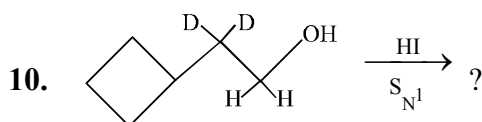


- (1) P is optically inactive due to internal compensation  
 (2) P is optically inactive due to the presence of plane of symmetry in the molecule  
 (3) The structure of P has two Br atoms at vicinal position  
 (4) P can have four possible optical isomers.
9. Consider the following molecules :

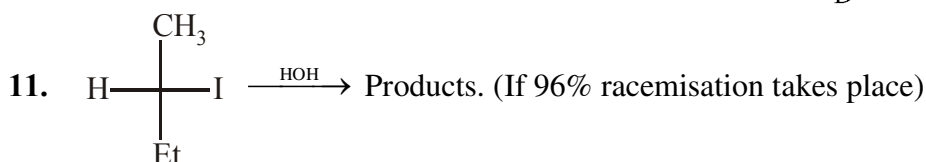
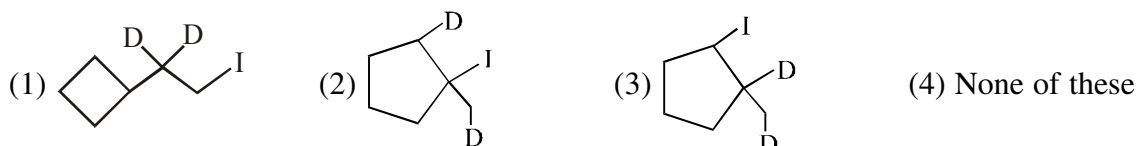


The correct decreasing ease of hydrolysis of alkyl halide is :

- (1) II > III > IV > I (2) II > IV > III > I (3) II > I > III > IV (4) IV > II > III > I



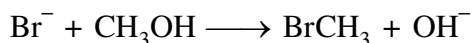
Major product is:



Find out the correct statement about the reaction.

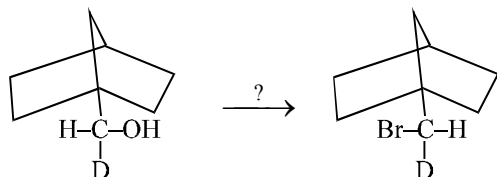
- (1) Among the products 48% S and 48% R configuration containing molecules are present  
 (2) Among the products 50% S and 50% R configuration containing molecules are present  
 (3) Among the products 48% S and 52% R configuration containing molecules are present  
 (4) Among the products 52% S and 48% R configuration containing molecules are present

12. Select suitable reason for non-occurrence of the following reaction.



- (1) Attacking nucleophile is stronger one
- (2) Leaving group is a stronger base than nucleophile
- (3) Alcohols are not good substrate for  $\text{S}_\text{N}$  reaction
- (4) Hydroxide ions are weak bases

13. Which reaction conditions (reagent) is suitable for the following reaction:



- (1)  $\text{Br}_2 / \text{CCl}_4$
- (2)  $\text{SOBr}_2$
- (3)  $\text{PBr}_3$
- (4)  $\text{HBr} / \text{conc H}_2\text{SO}_4$

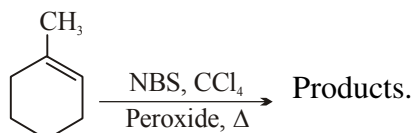
14. Consider the following reactions :



Identify value of X + Y.

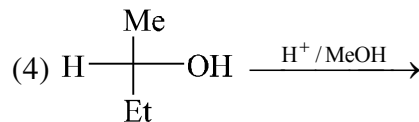
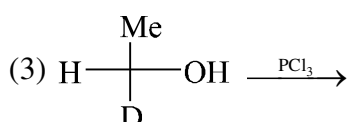
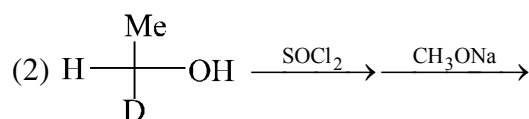
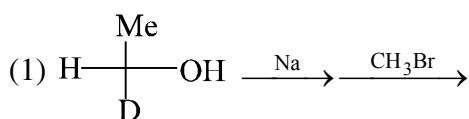
- (1) 8
- (2) 9
- (3) 11
- (4) 10

15. Find out the total no. of products (including stereo) in the given reaction :

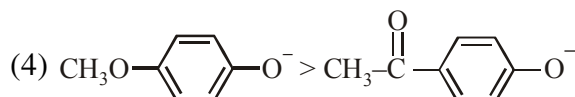
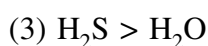
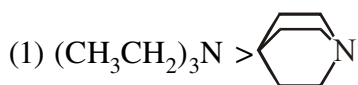


- (1) 8
- (2) 9
- (3) 10
- (4) 11

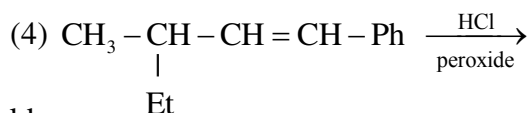
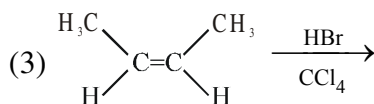
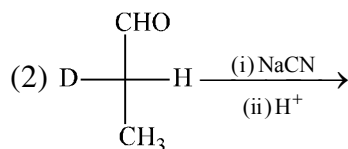
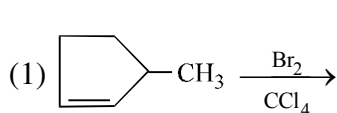
16. In which of the following reaction configuration about chiral C is completely retained in the final product



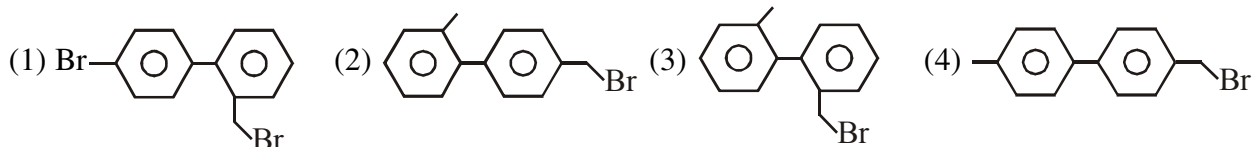
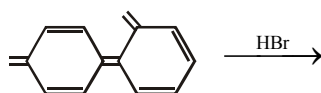
17. Which of the following is incorrect order of nucleophilicity ?



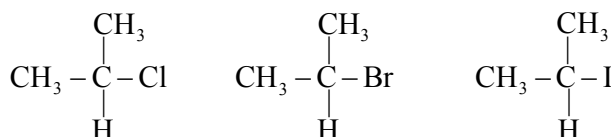
18. Which of following reaction products are not diastereomer of each other :



19. Product obtained in given reaction in good yield are :



20. From left to right, correct statements are :



(A) Rate of  $S_N1$  mechanism increases in polar protic solvent

(B) Rate of  $S_N2$  mechanism increases in DMSO

(C) Rate of  $E_2$  mechanism increases

(D) Rate of  $E_1$  mechanism increases

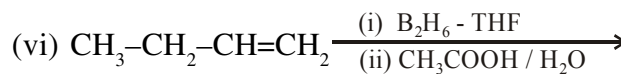
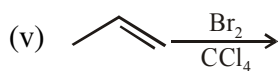
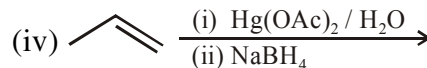
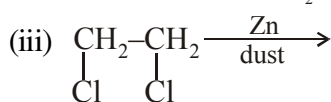
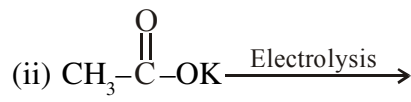
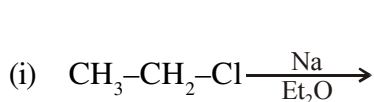
(1) A, B, C

(2) B, C, D

(3) A, C, D

(4) All

21. Number of following reactions which produces hydrocarbon as major product ?

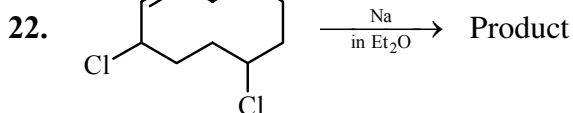


(1) 2

(2) 4

(3) 5

(4) 6



Consider following statements

(A) odd no. of double bond equivalent in product

(B) product is bicyclic compound

(C) product can show geometrical isomerism

(D) reaction involve carbocation as intermediate

(1) A, B, C

(2) B, C, D

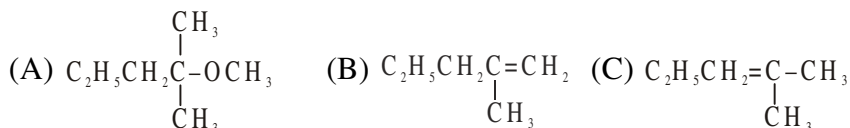
(3) A, C, D

(4) All

23. Bottles containing  $C_6H_5I$  and  $C_6H_5-CH_2I$  lost their original labels. They were labelled A and B for testing. A and B were separately taken in a test tube and boiled with NaOH solution. The end solution in each tube was made acidic with dilute  $HNO_3$  and then some  $AgNO_3$  solution was added. Substance B gave a yellow precipitate. Which one of the following statements is true for this experiment.

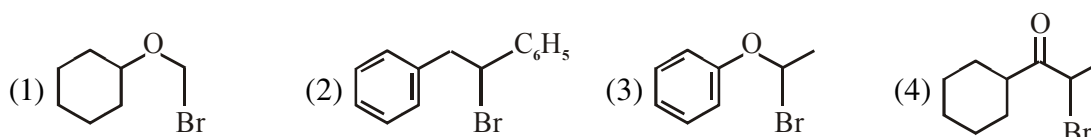
- (1) A was  $C_6H_5I$  (2) A was  $C_6H_5CH_2I$   
(3) B was  $C_6H_5I$  (4) Addition of  $HNO_3$  was unnecessary

24. 2-chloro-2-methylpentane on reaction with sodium methoxide in methanol yields :

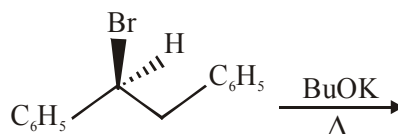


- (1) (A) and (B) (2) All of these (3) (A) and (C) (4) (C) only

25. Which of the following, upon treatment with tert-BuONa followed by addition of bromine water, fails to decolourize the colour of bromine ?

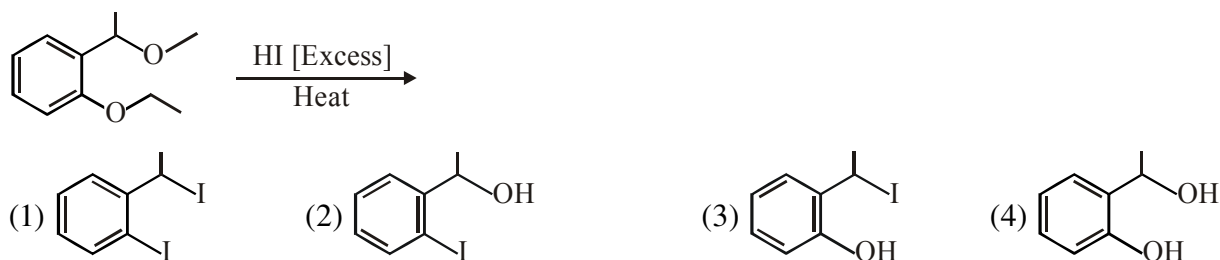


26. The major product obtained in the following reaction is :



- (1)  $(\pm)C_6H_5CH(O^tBu)CH_2CH_2C_6H_5$  (2)  $C_6H_5CH=CHC_6H_5$   
(3)  $(+)C_6H_5CH(O^tBu)CH_2CH_2C_6H_5$  (4)  $(-)C_6H_5CH(O^tBu)CH_2CH_2C_6H_5$

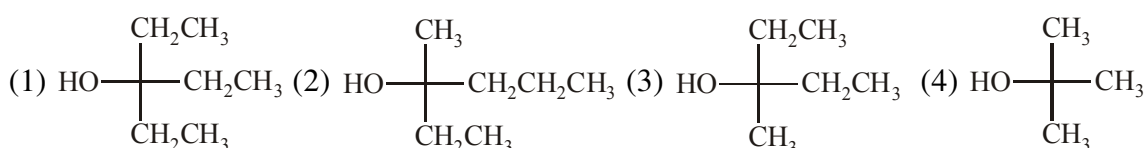
27. The major product formed in the following reaction is :



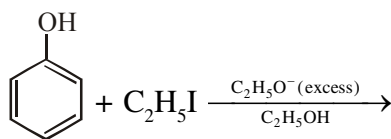
28. An  $S_N2$  reaction at an asymmetric carbon of a compound always gives.

- (1) an enantiomer of the substance (2) a product with opposite optical rotation  
(3) a mixture of diastereomers (4) a single stereoisomer

29.  $CH_3MgBr$  + Ethyl ester  $\rightarrow$  which can be formed as product. (excess)

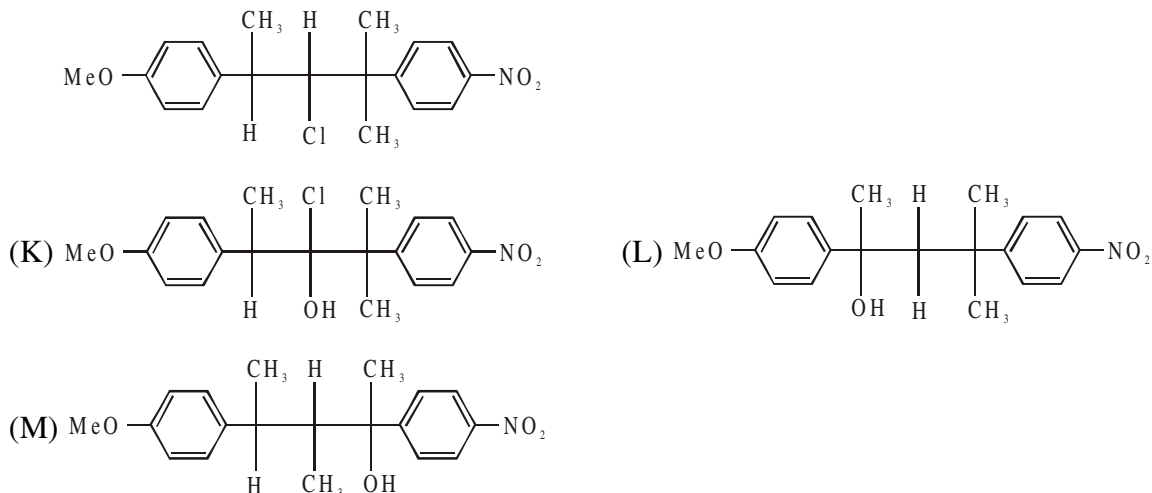


30. The product of following reaction is (Major)



- (1)  $\text{C}_6\text{H}_5\text{OC}_2\text{H}_5$       (2)  $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$       (3)  $\text{C}_6\text{H}_5\text{OC}_6\text{H}_5$       (4)  $\text{C}_6\text{H}_5\text{I}$

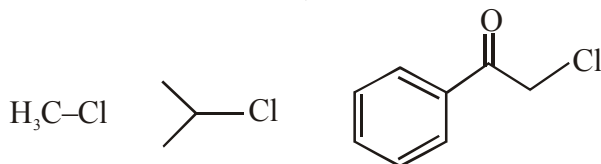
31. The following compound on hydrolysis in aqueous acetone will give :



It mainly gives

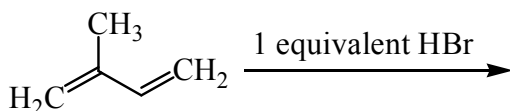
- (1) L      (2) K      (3) L and M      (4) M

32. KI in acetone, undergoes  $\text{S}_{\text{N}}2$  reaction with each of P, Q, R and S. The rates of the reaction vary as



- (1)  $\text{P} > \text{Q} > \text{R}$       (2)  $\text{P} > \text{R} > \text{Q}$       (3)  $\text{Q} > \text{R} > \text{P}$       (4)  $\text{R} > \text{P} > \text{Q}$

33. In the following reaction, the major product is -



- (1)
- (2)
- (3)
- (4)

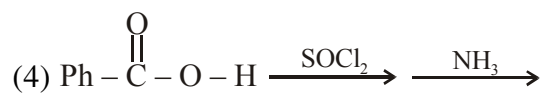
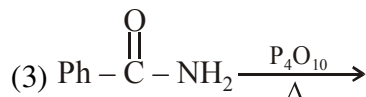
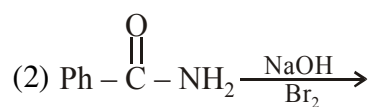
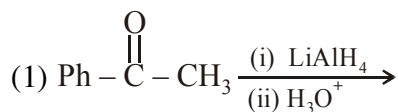
### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	2	2	3	2	2	3	4	4	2	3	2	3	1	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	1	3	2	4	2	1	1	2	1	2	3	4	4	2
Que.	31	32	33												
Ans.	1	4	4												

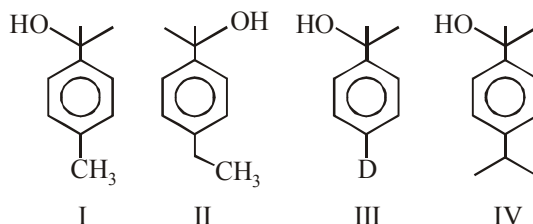


# 8. ALCOHOLS & ETHERS

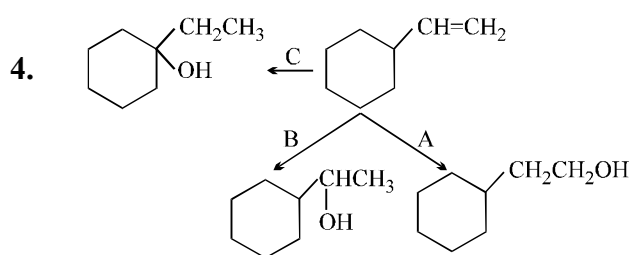
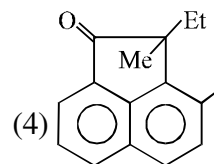
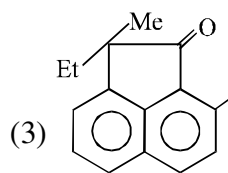
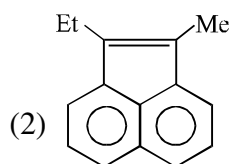
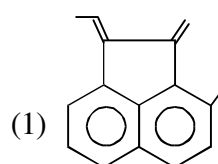
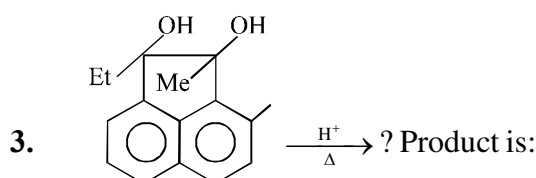
1. In which of the following reaction, cyanide will be obtained as a major product ?



2. Correct order for the rate of dehydration for the given compound with  $\text{H}_2\text{SO}_4 / \Delta$  :



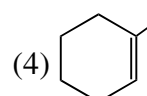
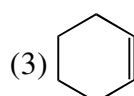
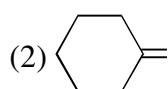
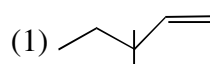
- (1) I > II > III > IV    (2) IV > II > I > III    (3) I > II > IV > III    (4) III > IV > II > I



Select schemes A, B, C out of

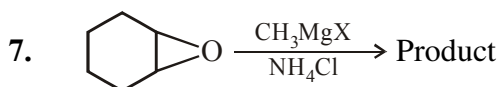
- (I) Acid catalysed hydration    (II) HBO    (III) Oxymercuration-demercuration  
 (1) I in all cases    (2) I, II, III    (3) II, III, I    (4) III, I, II

5. HBO, oxymercuration-demercuration and acid catalysed hydration will give same product in



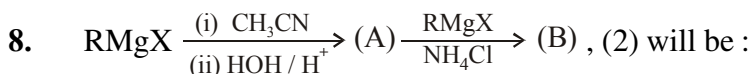
6. Which of the following ethers is least reactive to cleavage with conc. HBr ?

- (1)  $\text{Ph}-\text{CH}_2-\text{O}-\text{CH}_3$  (2)  $\text{Ph}-\text{O}-\text{Ph}$  (3)  (4) 

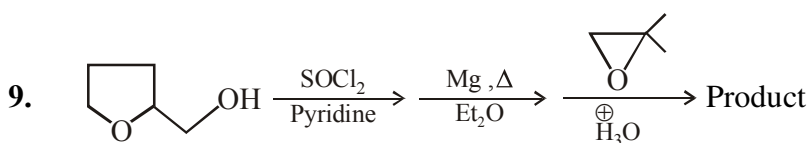


What is the product ?

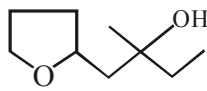
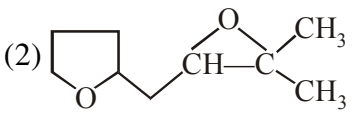
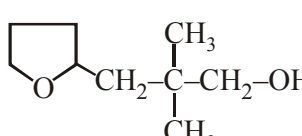
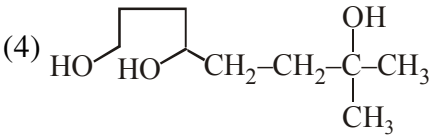
- (1) Enantiomer (2) Diastereoisomer (3) Meso (4) Achiral

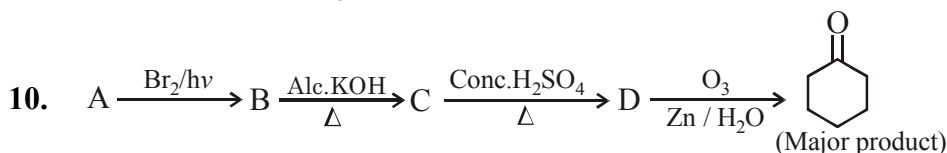


- (1)  $1^\circ \text{ROH}$  (2)  $2^\circ \text{ROH}$  (3)  $3^\circ \text{ROH}$  (4) Alkene



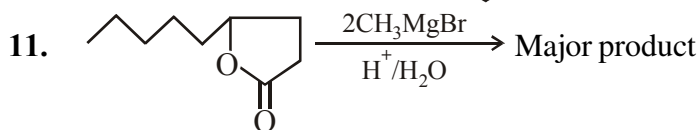
Product of reaction is :

- (1)  (2)   
 (3)  (4) 



Find out the structure of 'A' :

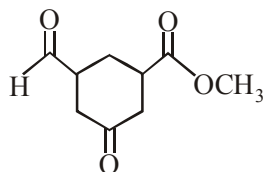
- (1)  (2)  (3)  (4) 



- (1)  (2)   
 (3)  (4) No reaction

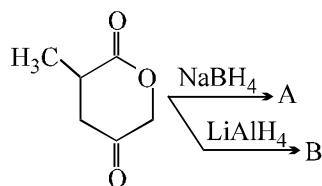
12.  $\text{Cl}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OC}_2\text{H}_5 \xrightarrow[(2) \text{NH}_4\text{Cl}]{(1) \text{'X'RMgX}} 3^\circ \text{Alcohol. Find out value of 'X'.$   
 (1) 2 (2) 3 (3) 4 (4) 1

13. Find out the product when the following compound react with  $\text{NaBH}_4$  :



- (1) (2)   
 (3) (4)

14. Predict major organic product from the following reaction :



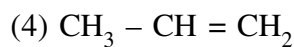
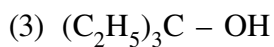
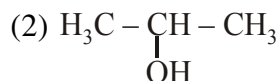
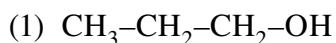
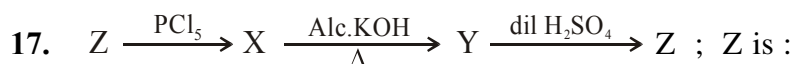
- (1)   
 (2)   
 (3)   
 (4)

15. Which of the following order is incorrect ?

- (1)  $\text{CH}_3-\text{CH}_2-\text{OH} > \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH} > \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{OH}$  (Solubility in  $\text{H}_2\text{O}$ )  
 (2)  $\text{CH}_3-\text{CH}_2-\text{OH} > \text{CH}_3-\text{O}-\text{CH}_3 > \text{CH}_3-\text{CH}_2-\text{CH}_3$  (Boiling point)  
 (3) Pentan-1-ol > Pentanal > Ethoxy ethane (Boiling point)  
 (4)  $\text{CH}_3-\text{OH} > \text{CH}_3-\text{CH}_2-\text{OH} > \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$  (Boiling point)

16.  $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2 \xrightarrow[\text{H}_2\text{O}]{\text{X}_2} \text{A} \xrightarrow[\text{limited amount}]{\text{OH}^-} \text{B}$ , Product 'B' is :

- (1) (2)   
 (3) (4) None



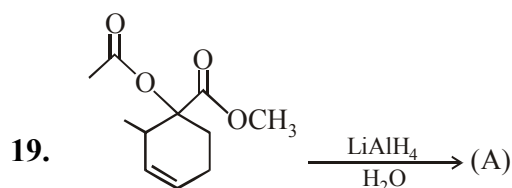
18. If phenyl magnesium bromide and acetaldehyde are the reactants, the product formed after hydrolysis would be :

(1) Benzyl alcohol

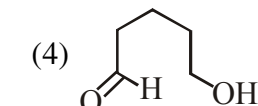
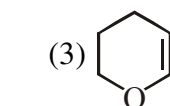
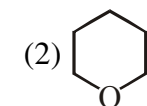
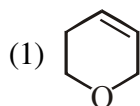
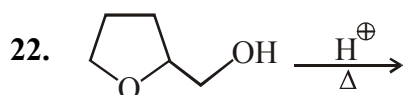
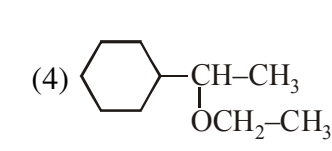
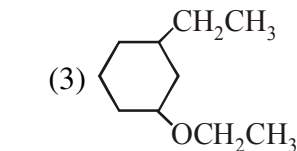
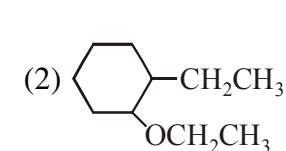
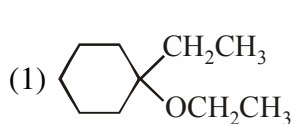
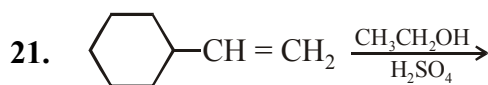
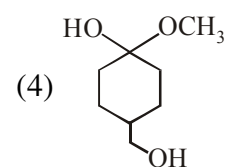
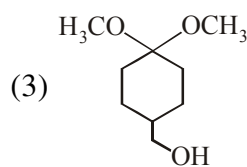
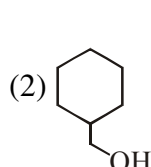
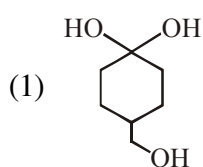
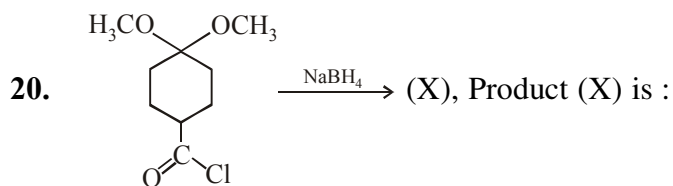
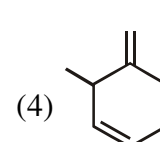
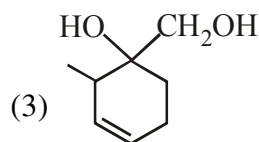
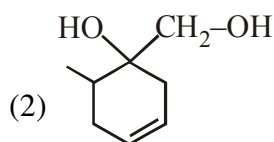
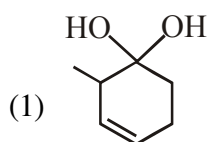
(2) 1-Phenylethanol

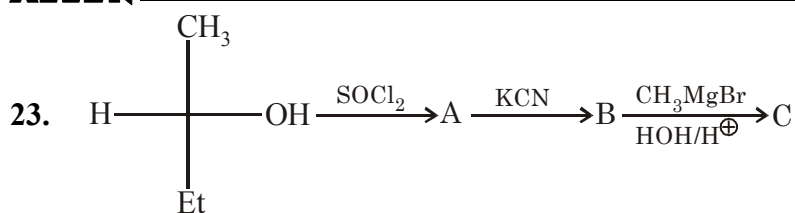
(3) 2-Phenylethanol

(4) Acetone

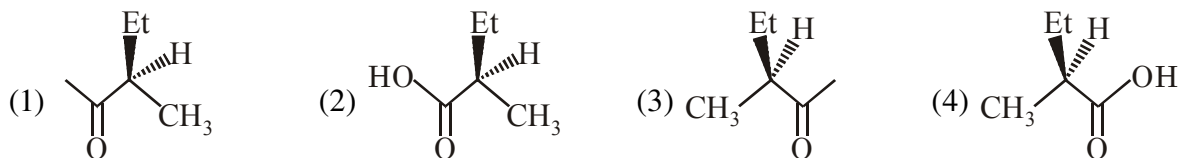


Find out 'A' of the reaction

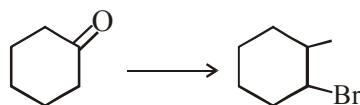




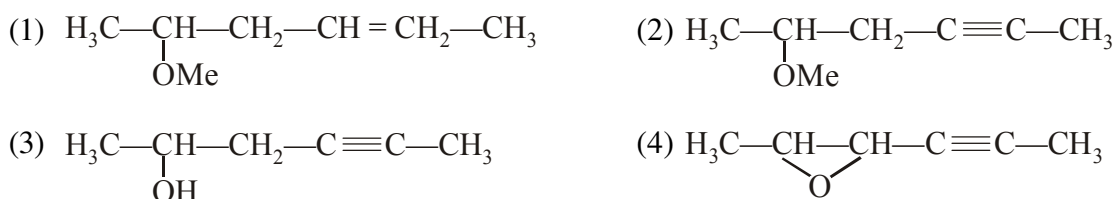
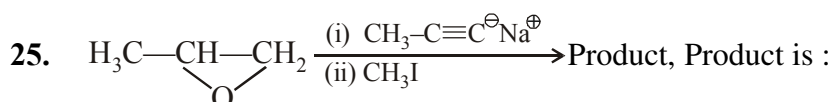
the final product C is :



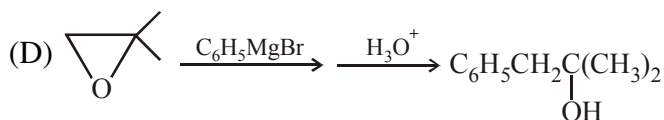
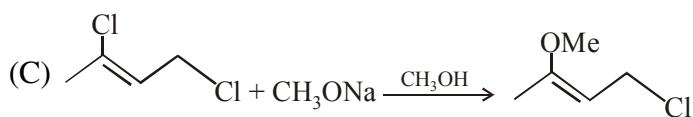
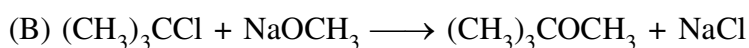
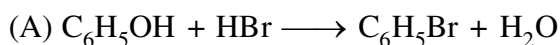
24. Which combination of reagents will bring about the following conversion ?



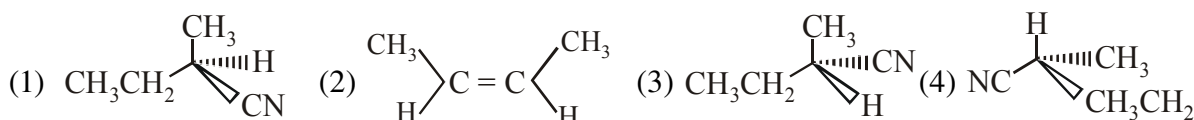
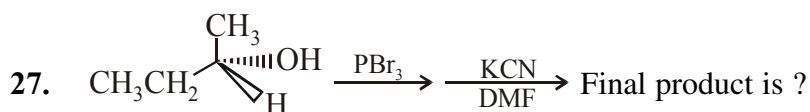
- (1)  $\text{MeMgBr/H}^+$ ,  $\text{H}_2\text{SO}_4/\Delta$ ,  $\text{HBr/H}_2\text{O}_2$ ,  $h\nu$       (2)  $\text{MeMgBr/H}^+$ ,  $\text{H}_2\text{SO}_4/\Delta$ ,  $\text{HBr}$   
 (3)  $\text{MeMgBr/H}^+$ ,  $\text{HBr/CCl}_4$       (4)  $\text{HBr/H}_2\text{O}_2$ ,  $\text{MeMgBr/H}^+$



26. Which of the following reaction is not possible ?



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



28. An organic compound  $C_3H_6O$  does not give a precipitate with 2,4-dinitrophenyl hydrazine reagent and does not react with sodium metal. It could be:

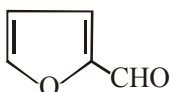
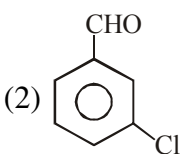
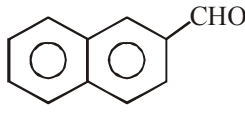
- (1)  $CH_3-CH_2-CHO$  (2)  $CH_3-CO-CH_3$   
 (3)  $CH_2=CH-CH_2OH$  (4)  $CH_2=CH-OCH_3$

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	3	4	3	3	2	1	3	4	2	1	2	2	2	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28		
Ans.	1	2	2	3	3	1	3	1	1	2	1	3	4		

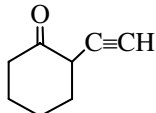
## 9. ALDOL &amp; SIMILAR NAME REACTIONS

1. Which of following does not give Cannizzaro reaction

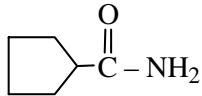
- (1)  (2)  (3)  (4)  $Cl_3C-CHO$

2.  $PhCOCHBr_2 \xrightarrow{Aq. \bar{O}H} A \xrightarrow{Conc. \bar{O}H} B \xrightarrow{H^+}$ ; the compound 'C' is :

- (1)  $PhCH(OH)CHO$  (2)  $PhCH(OH)COOH$   
 (3)  $PhCOOH$  (4) None of these

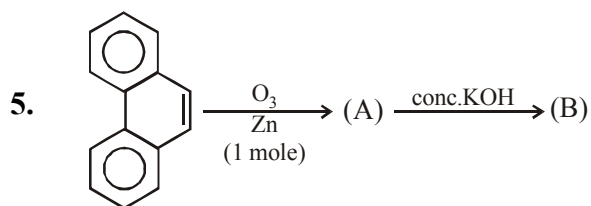
3.   $\xrightarrow{1\% HgSO_4 / Dil. H_2SO_4} \xrightarrow[I_2 / NaOH]{H^+} \xrightarrow{\Delta} X$ ; X is :

- (1)  (2)   
 (3)  (4) 

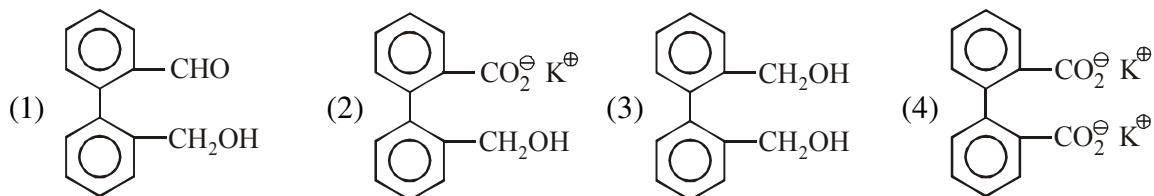
4.   $\xrightarrow[\Delta]{P_2O_5} A \xrightarrow[(ii) H_3O^+]{(i) CH_3MgBr} B \xrightarrow{(i) I_2 + Ca(OH)_2} C + D \xrightarrow{\Delta} E$   
 $\downarrow$   
 $(CHI_3)$

Product E is:

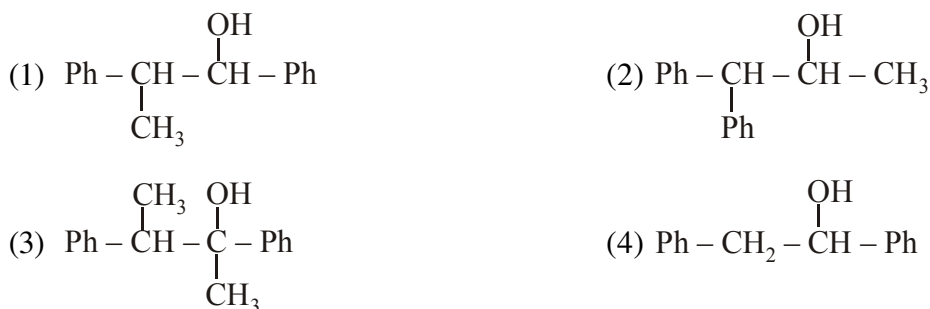
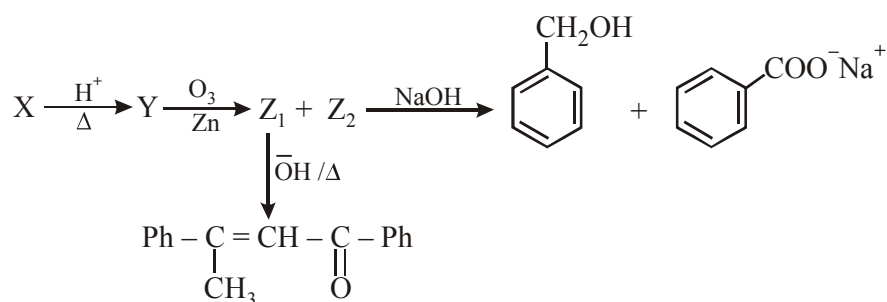
- (1)  (2)   
 (3)  (4) 



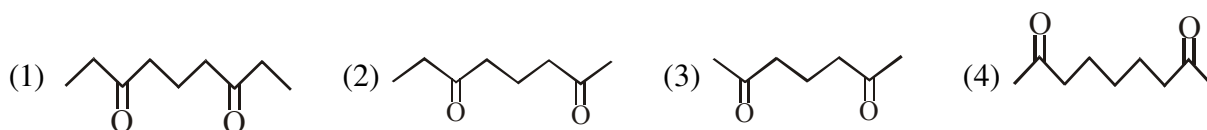
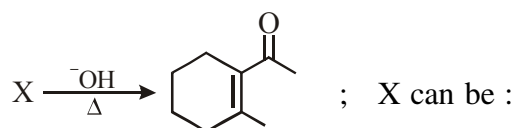
End product (B) of above reaction is :



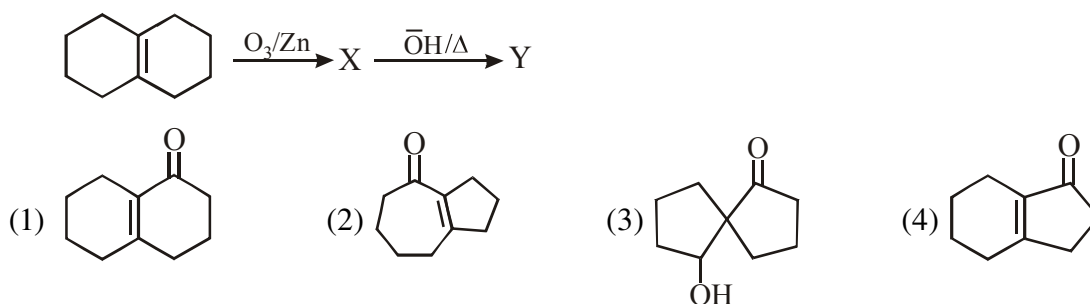
6. Reactant 'X' will be :



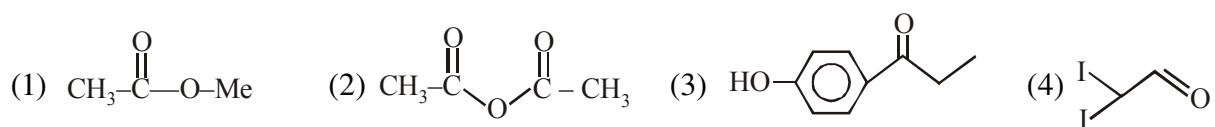
7. Consider following intramolecular aldol condensation reaction :



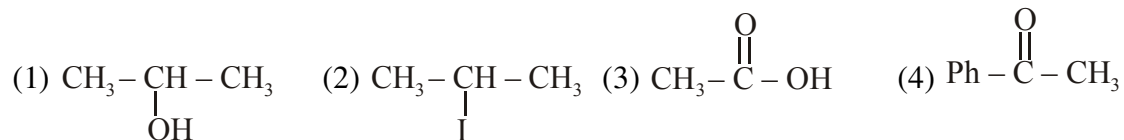
8. Product 'Y' formed in the given reaction is :



9. Select the compound which show haloform reaction is :



10. Which of the following compound not give a sweet smelling product having anesthetic use in presence of  $\text{Cl}_2$ ,  $\text{NaOH}$ ,  $\Delta$ .



## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	
Ans.	4	2	4	3	2	1	4	2	4	3	



# 10. CARBONYL COMPOUND



Compound 'A' is :-

- (1)  $\text{CH}_3\text{-CH}_2\text{-OH}$  (2)  $\begin{array}{c} \text{CH}_2\text{-OH} \\ | \\ \text{H}_2\text{C}-\text{C}-\text{CH}_2\text{-OH} \\ | \quad | \\ \text{OH} \quad \text{CH}_2\text{-OH} \end{array}$   
(3)  $\text{CH}_3\text{-OH}$  (4)  $\text{OHC-CH}_2\text{-CH}_2\text{-OH}$

2. Acetophenone can be obtained by the distillation of :

- (1)  $(\text{C}_6\text{H}_5\text{COO})_2\text{Ca}$  (2)  $(\text{CH}_3\text{COO})_2\text{Ca}$   
(3)  $(\text{C}_6\text{H}_5\text{COO})_2\text{Ca}$  and  $(\text{CH}_3\text{COO})_2\text{Ca}$  (4)  $(\text{C}_6\text{H}_5\text{COO})_2\text{Ca}$  and  $(\text{HCOO})_2\text{Ca}$

3. Acetal or ketal is:

- (1) Vic dialkoxy compound (2)  $\alpha, \omega$ -dialkoxy compound  
(3)  $\alpha$ -alkoxy alcohol (4) Gem dialkoxy compound

4. Cross cannizzaro reaction is example of :

- (1) Redox reaction (2) Disproportionation  
(3) Both (1) and (2) (4) Only oxidation

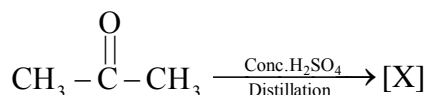
5. Which of the following can't give Iodoform test ?

- (1)  $\text{CH}_3\text{-CH}_2\text{-I}$  (2)  $\text{CH}_3\text{-CH}_2\text{-Br}$   
(3)  $\text{CH}_3\text{-CH}_2\text{-Cl}$  (4)  $\text{CH}_3\text{-C(=O)-NH}_2$

6. Which one of the combinations will give propanaldehyde on dry distillation ?

- (1)  $(\text{C}_6\text{H}_5\text{COO})_2\text{Ca}$  and  $(\text{HCOO})_2\text{Ca}$   
(2)  $(\text{CH}_3\text{COO})_2\text{Ca}$  and  $(\text{CH}_3\text{CH}_2\text{-COO})_2\text{Ca}$   
(3)  $(\text{CH}_3\text{-CH}_2\text{-COO})_2\text{Ca}$  and  $(\text{HCOO})_2\text{Ca}$   
(4)  $(\text{CH}_3\text{COO})_2\text{Ca}$  and  $(\text{CH}_3\text{COO})_2\text{Ca}$

7. In the given reaction :



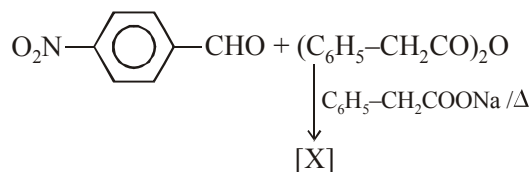
[X] will be :

- (1) Methyl oxide (2) Phorone  
(3) 1, 3, 5-Trimethylbenzene (4) 2-Butyne

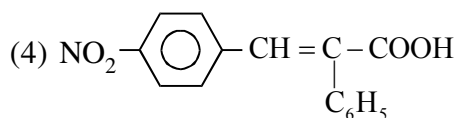
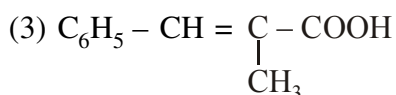
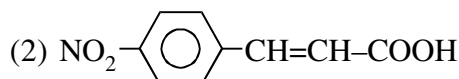
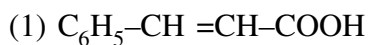
8. Grignard reagents can never give carbonyl compounds with :

- (1)  $\text{CO}_2$  (2)  $\text{RCOCl}$  (3)  $\text{RCN}$  (4)  $\text{RCOOR}$

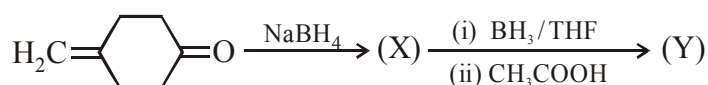
9. The product of the reaction :



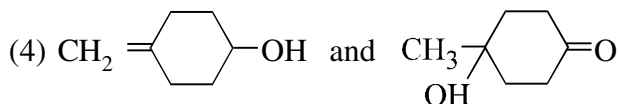
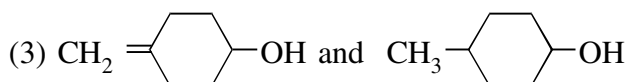
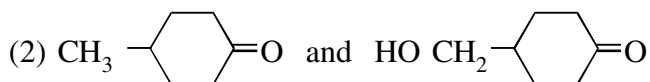
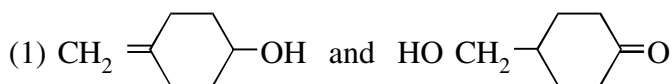
will be :



10. In the given reaction :



(X) and (Y) are :



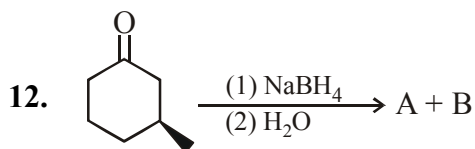
11. A compound with molecular formula  $\text{C}_8\text{H}_{18}\text{O}_4$  does not give litmus test and does not give colour with 2,4-DNP. It reacts with excess  $\text{MeCOCl}$  to give a compound whose vapour density is 152. Compound A contains how many hydroxy groups ?

(1) 1

(2) 2

(3) 3

(4) 4



Identify relationship between A & B products ?

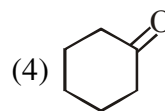
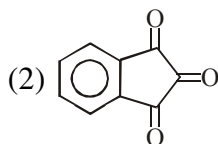
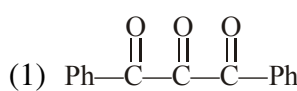
(1) Diastereoisomers

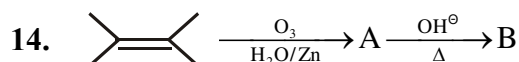
(2) Enantiomers

(3) Positional isomer

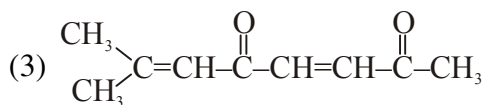
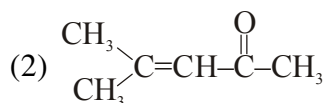
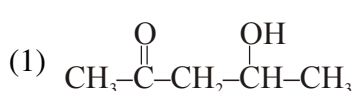
(4) Identical

13. Which of the following does not form a stable hydrate by the addition of  $\text{H}_2\text{O}$ ?

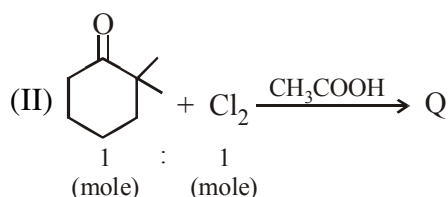
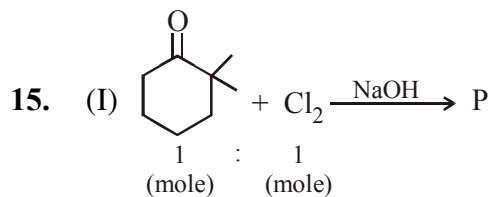




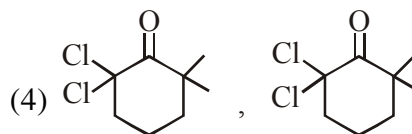
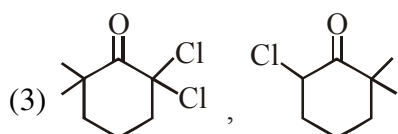
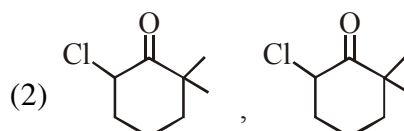
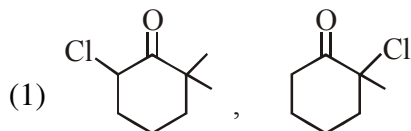
Compound 'B' is



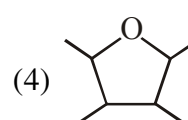
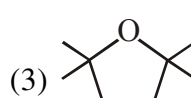
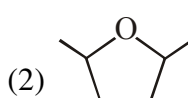
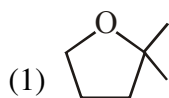
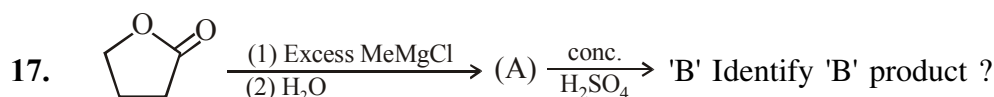
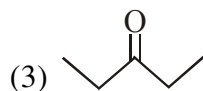
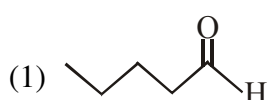
(4) None of these



Organic product P & Q are respectively -



16. An organic compound (1),  $C_5H_{10}O$ , reacts with hydrazine to form a hydrazone derivative (2). The hydrazone (2) on being heated with KOH at about  $180^\circ C$ , gives n-pentane. The compound (1) does not respond positively to Tollen's reagent and to the iodoform test. The compound (1) is



18. An optically inactive alcohol (1)  $C_6H_{12}O$  is oxidized by  $MnO_2$  to produce optically inactive carbonyl compound while reduction of (1) by  $H_2/Ni$  produces optically active compound. Possible structure(s) of alcohol is/are

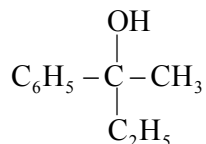
(1) Hex-2-ene-1-ol

(2) Hex-3-ene-2-ol

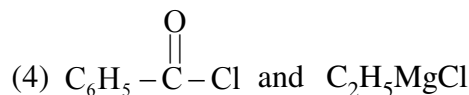
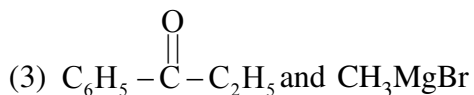
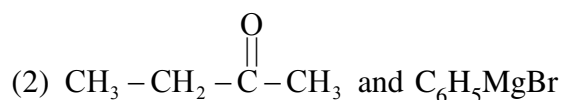
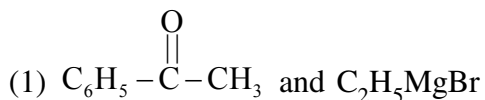
(3) 2-Methyl pent-2-ene-1-ol

(4) 4-Methyl pent-2-ene-1-ol

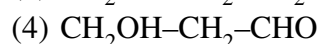
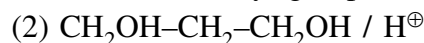
19. Consider the structure of given alcohol :



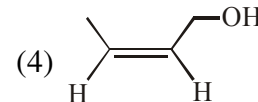
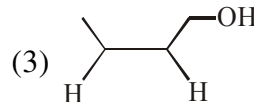
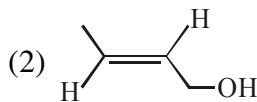
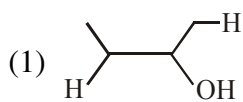
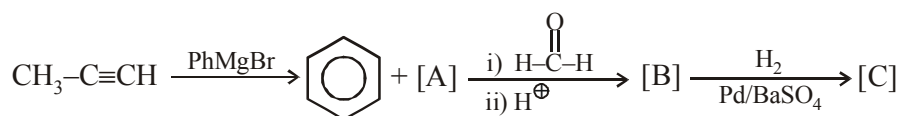
This alcohol can not be prepared from



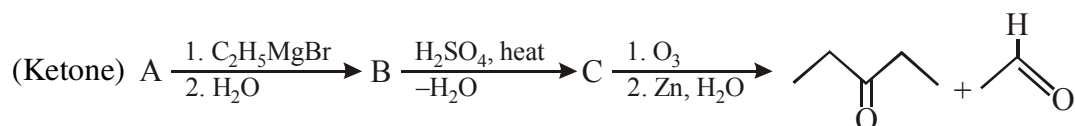
20. Which of the following can not be used for protection of carbonyl group



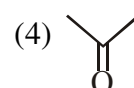
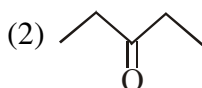
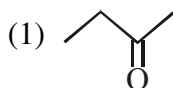
21. Final product in the given reaction sequence is :



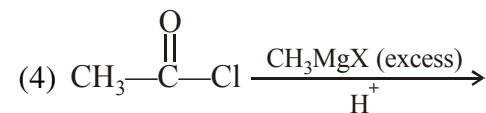
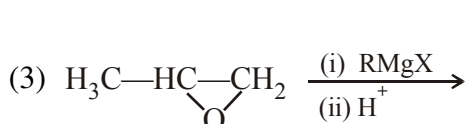
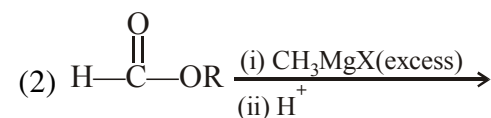
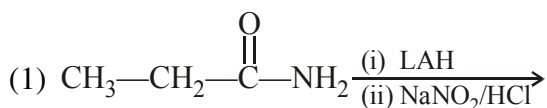
22. Consider the following sequence of reactions.



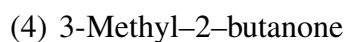
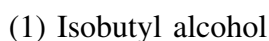
The ketone (A) is :



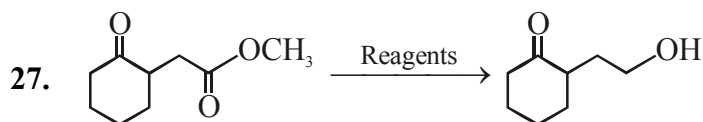
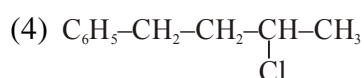
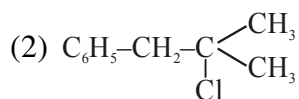
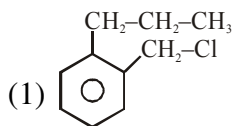
23. Which of the following reactions will not give 2° alcohol as a major product :



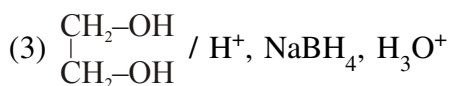
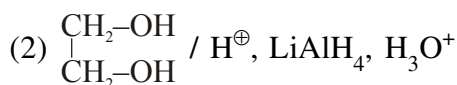
24. Iodoform can be prepared from all except :-



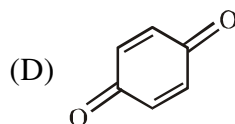
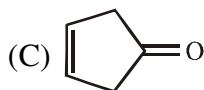
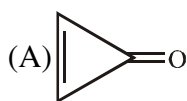
25. A compound with molecular mass 180 is acylated with  $\text{CH}_3\text{COCl}$  to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is :-  
 (1) 2 (2) 5 (3) 4 (4) 6
26. A compound A with molecular formula  $\text{C}_{10}\text{H}_{13}\text{Cl}$  gives a white precipitate on adding silver nitrate solution. A on reacting with alcoholic KOH gives compound B as the main product. B on ozonolysis gives C and D. C gives Cannizaro reaction but not aldol condensation. D gives aldol condensation but not Cannizaro reaction. A is :



Reagents is :-



28. Which of the following compounds will show highest dipole moment ?



(1) (B)

(2) (C)

(3) (A)

(4) (D)

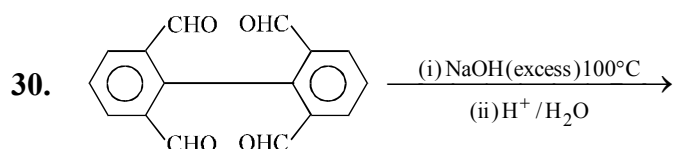
29. Which of the following compounds will most readily be dehydrated to give alkene under acidic condition?

(1) 4-Hydroxypentan-2-one

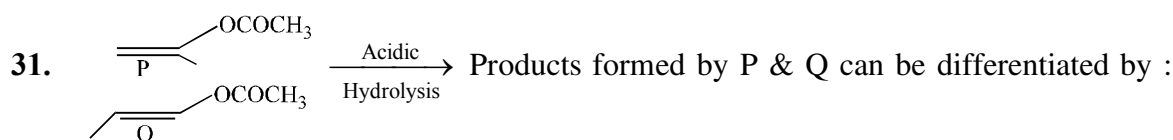
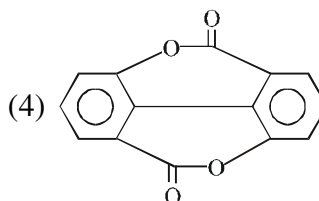
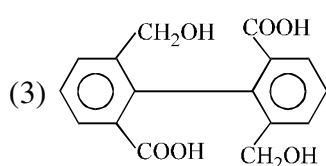
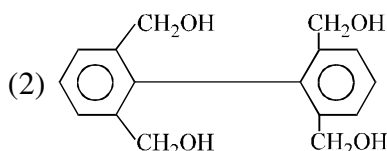
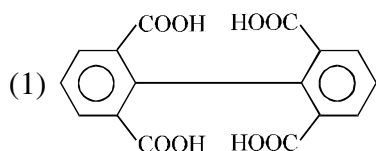
(2) 2-Hydroxycyclopentanone

(3) 3-Hydroxypentan-2-one

(4) 1-Pentanol



any one of the products formed is :



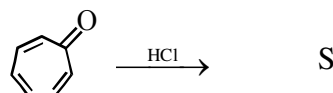
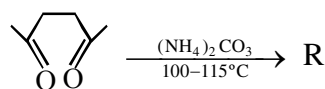
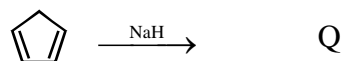
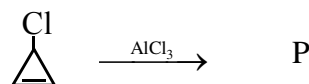
(1) 2, 4 DNP

(2) Lucas reagent ( $\text{ZnCl}_2$ ) conc. HCl

(3)  $\text{NaHSO}_3$

(4) Fehlings solution

32. Among P, Q, R and S, the aromatic compound(s) is / are :



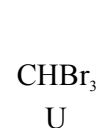
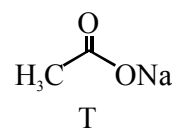
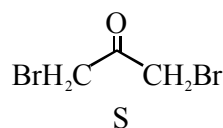
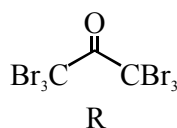
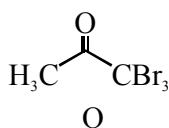
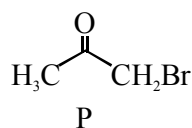
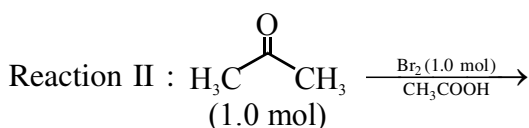
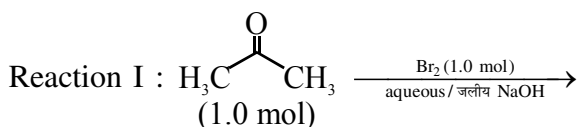
(1) R, S

(2) Q, R, S

(3) P, Q, R, S

(4) P, Q, R

33. After completion of the reactions (I and II), the organic compound(s) in the reaction mixtures is(are)



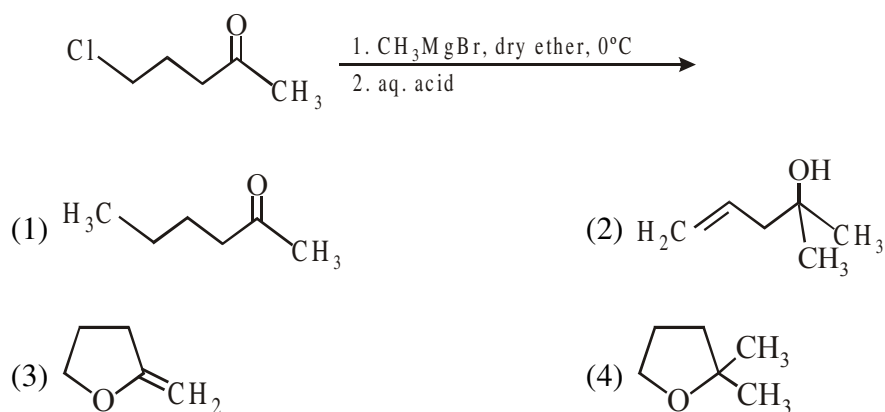
(1) Reaction I : P and Reaction II : P

(2) Reaction I : U, acetone and Reaction II : Q acetone

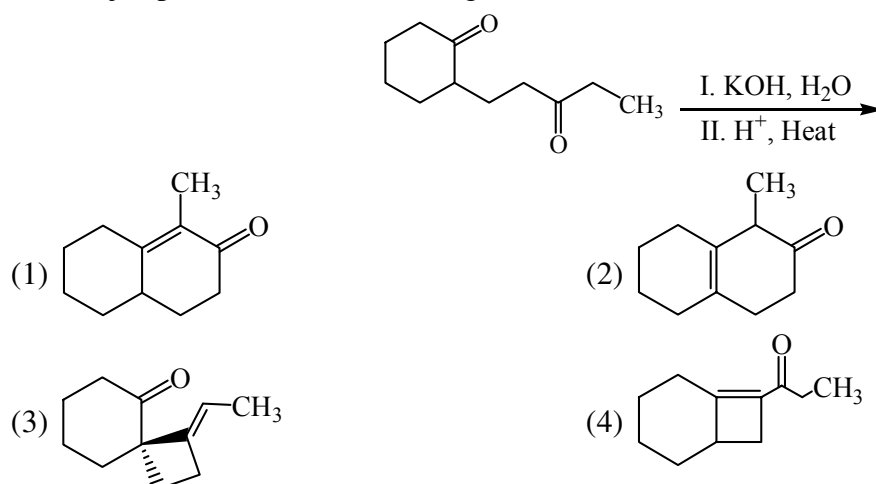
(3) Reaction I : T, U, acetone and Reaction II : P

(4) Reaction I : R, acetone and Reaction II : S acetone

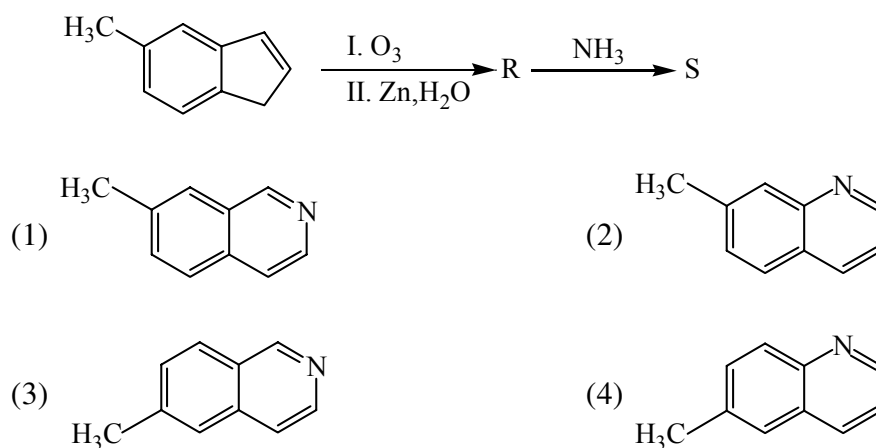
34. The major product in the following reaction is



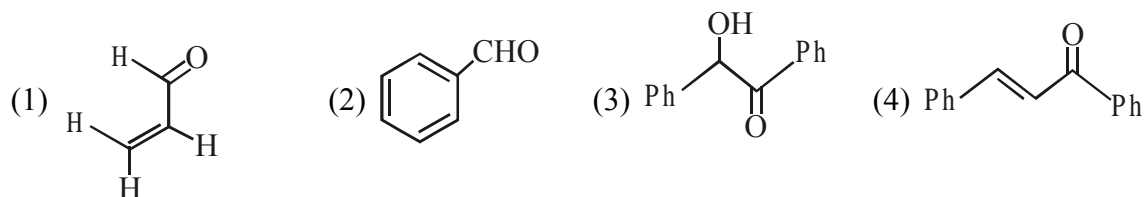
35. The major product of the following reaction is -

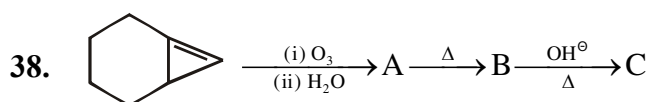


36. In the following reactions, the product S is -

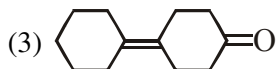
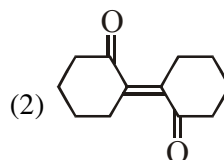
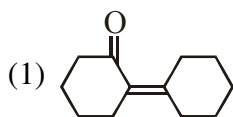


37. Positive Tollen's test is not observed by :



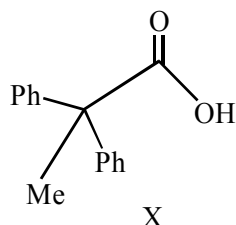


Compound 'C' is

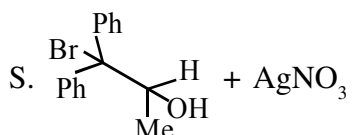
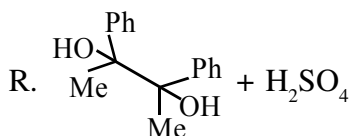
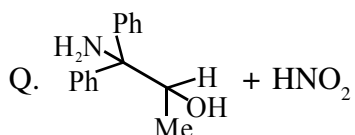
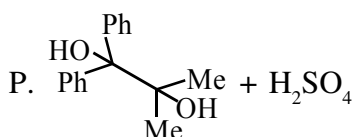


(4) None of these

39. The desired product X can be prepared by reacting the major product of the reactions in LIST-I with one or more appropriate reagents in LIST-II.  
(given, order of migratory aptitude: aryl > alkyl > hydrogen)



## LIST-I



## LIST-II

1. I<sub>2</sub>, NaOH

2. [Ag(NH<sub>3</sub>)<sub>2</sub>]OH

3. Fehling solution

4. HCHO, NaOH

5. NaOBr

The correct option is

(1) P → 1; Q → 2,3; R → 1,4; S → 2,4

(2) P → 1,5; Q → 3,4; R → 4,5; S → 3

(3) P → 1,5; Q → 3,4; R → 5; S → 2,4

(4) P → 1,5; Q → 2,3; R → 1,5; S → 2,3

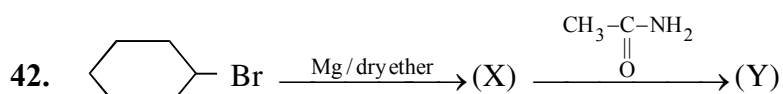


40. During the preparation of ethane by Kolbe's electrolytic method using inert electrodes the pH of the electrolyte

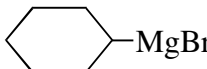
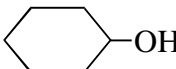
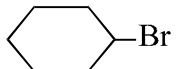
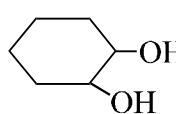
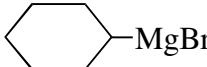
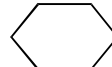
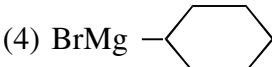
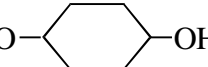
- (1) Increases progressively as the reaction proceeds
- (2) Decreases progressively as the reaction proceeds
- (3) Remains constant throughout the reaction
- (4) May decrease if the concentration of the electrolyte is not very high

41. How many products will be formed excluding stereo when cis-1,3,5-trimethyl cyclohexene reacts with NBS?

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

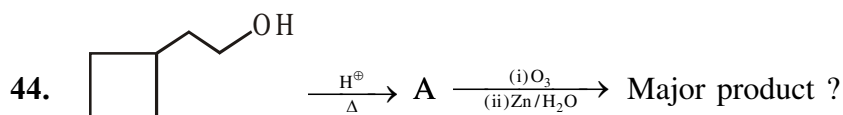


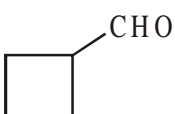
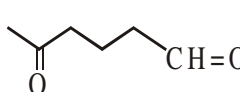
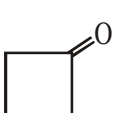
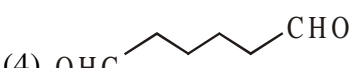
The structures of (X) and (Y) respectively are

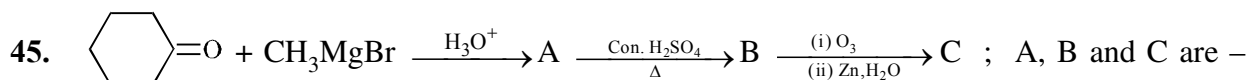
- (1)  ; 
- (2)  ; 
- (3)  ; 
- (4)  ; 

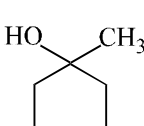
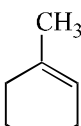
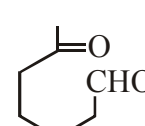
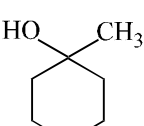
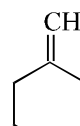
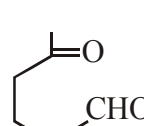
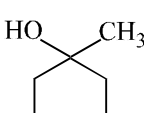
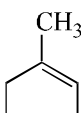
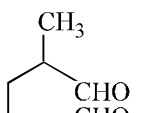
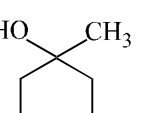
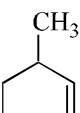
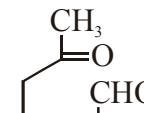
43. When n-butane is heated in the presence of  $\text{AlCl}_3/\text{HCl}$  it will be converted into –

- (1) Ethane
- (2) Propane
- (3) Butene
- (4) Isobutane

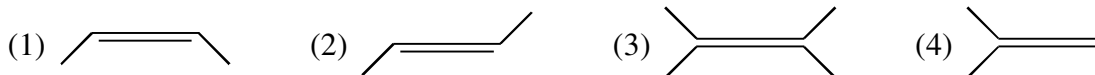


- (1)  +  $\text{HCHO}$
- (2) 
- (3)  +  $\text{CH}_3\text{CHO}$
- (4) 

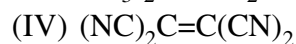
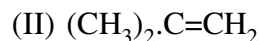


- (1)   
- (2)   
- (3)   
- (4)   

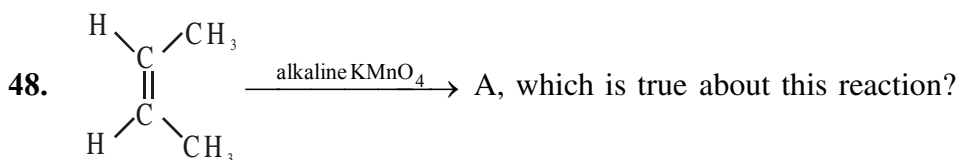
46. Which has least heat of hydrogenation –



47. For the ionic reaction of hydrochloric acid with the following alkenes, predict the correct sequence of reactivity as measured by reaction rates:



(1)  $\text{IV} > \text{I} > \text{III} > \text{II}$  (2)  $\text{I} > \text{IV} > \text{II} > \text{III}$  (3)  $\text{III} > \text{II} > \text{IV} > \text{I}$  (4)  $\text{II} > \text{I} > \text{III} > \text{IV}$



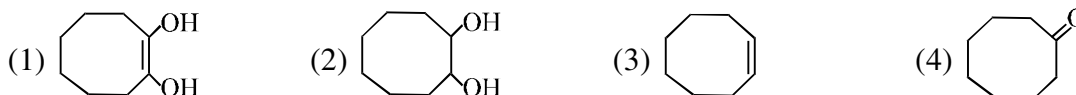
(1) A is meso 2, 3-butanediol formed by *syn* addition

(2) A is meso 2, 3-butanediol formed by *anti* addition

(3) A is a racemic mixture of *d* and *l*, 2, 3-butanediol formed by anti addition

(4) A is a racemic mixture of *d* and *l* 2,3-butanediol formed by *syn* addition

49. The reaction of cyclooctyne with  $\text{HgSO}_4$  in the presence of a  $\text{H}_2\text{SO}_4$  gives



50. Acetylene may be prepared using Kolbe's electrolytic method employing –

(1) Pot. acetate

(2) Pot. succinate

(3) Pot. fumarate

(4) None of these

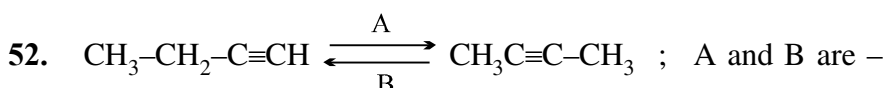
51. A mixture of  $\text{CH}_4$ ,  $\text{C}_2\text{H}_4$  and  $\text{C}_2\text{H}_2$  gaseous are passed through a Wolf bottle containing ammonical cuprous chloride. The gas coming out is

(1) Methane

(2) Acetylene

(3) Mixture of methane and ethylene

(4) original mixture

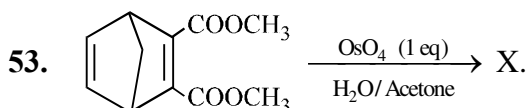


(1) alcoholic KOH and  $\text{NaNH}_2$

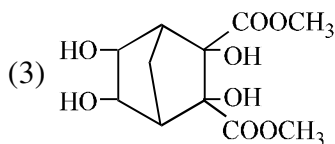
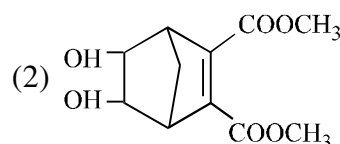
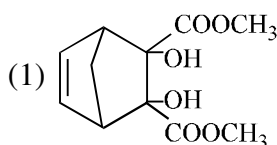
(2)  $\text{NaNH}_2$  and alcoholic KOH

(3)  $\text{NaNH}_2$  and Lindlar catalyst

(4) Lindlar and  $\text{NaNH}_2$  catalyst








Identify 'X'.



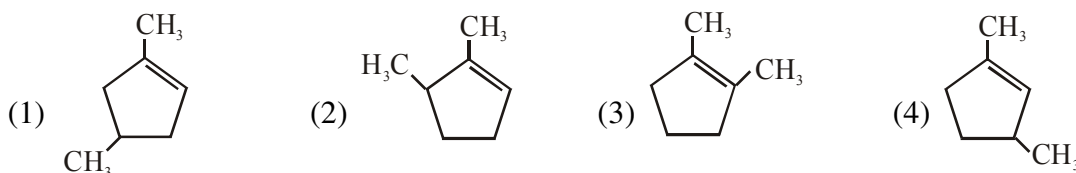
(4) Reaction will not occur

54. Aqueous solution of potassium propanoate is electrolysed. Possible organic products are:
- (A) n-Butane (B)  $C_2H_5COOC_2H_5$   
 (C)  $CH_3-CH_3$  (D)  $CH_2=CH_2$   
 (1) A, B, C (2) A, B, C, D  
 (3) A, C (4) A, C, D
55. Which of the following elimination reactions will occur to give but-1-ene as the major product?
- (1)  $CH_3-CHCl-CH_2-CH_3 + KOH \xrightarrow{EtOH}$  (2)  $C_6H_5-\underset{\substack{| \\ NMe_3}}{CH}-CH_2-CH_3 + NaOEt \xrightarrow[\Delta]{EtOH}$   
 (3)  $CH_3-CH_2-CHCl-CH_3 + Me_3COK^+ \xrightarrow{\Delta}$  (4)  $CH_3-CH_2-CH(OH)-CH_3 + \text{conc. } H_2SO_4 \xrightarrow{\Delta}$
56. Which of the following will not react with acetylene -
- (1) NaOH (2) ammonical  $AgNO_3$   
 (3) Na (4) HCl
57. The product formed when acetylene reacts with hypochlorous acid -
- (1)  $CH_3COCl$  (2)  $ClCH_2CHO$   
 (3)  $Cl_2CHCHO$  (4)  $ClCH_2COOH$
58. Reaction of one molecule of HBr with one molecule of 1,3-butadiene at  $40^\circ C$  gives predominantly
- (1) 1-bromo-2-butene under thermodynamically controlled conditions  
 (2) 3-bromobutene under kinetically controlled conditions  
 (3) 1-bromo-2-butene under kinetically controlled conditions  
 (4) 3-bromobutene under thermodynamically controlled conditions
59. Phenyl magnesium bromide reacts with methanol to give-
- (1) A mixture of anisole and  $Mg(OH)Br$  (2) A mixture of benzene and  $Mg(OMe)Br$   
 (3) A mixture of toluene and  $Mg(OH)Br$  (4) A mixture of phenol and  $Mg(Me)Br$

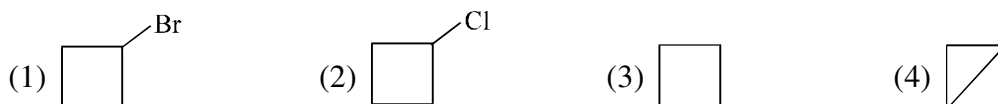
60.   $CH_2-CH=CH_2$  on mercuration- demercuration produces the major product :-

- (1)   $CH_2-\underset{\substack{| \\ OH}}{CH}-CH_3$  (2)   $CH_2-CH_2-CH_2-OH$   
 (3)   $CH_2-COOH$  (4)   $CH_2-\underset{\substack{| \\ OH}}{CH}-\underset{\substack{| \\ OH}}{CH_2}$

61. In the presence of peroxide,  $\text{HCl}$  and  $\text{HI}$  do not give anti-Markownikoff's addition to alkenes because
- (1) All the steps are exothermic in  $\text{HCl}$  and  $\text{HI}$
  - (2) One of the steps is endothermic in  $\text{HCl}$  and  $\text{HI}$
  - (3)  $\text{HCl}$  is oxidizing and the  $\text{HI}$  is reducing
  - (4) Both  $\text{HCl}$  and  $\text{HI}$  are strong acids
62. Which compound would give 5-keto-2-methyl hexanal upon ozonolysis?

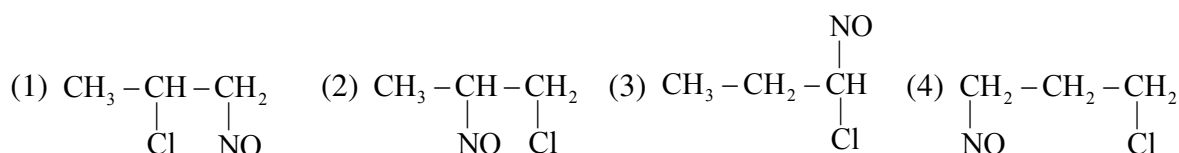


63. 1-Bromo-3-chlorocyclobutane when treated with two equivalents of  $\text{Na}$ , in the presence of ether which of the following will be formed?

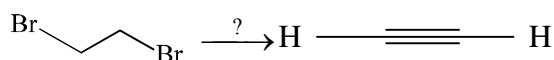


64.  $\text{CH}_3\text{--CH=CH}_2 + \text{NOCl} \rightarrow \text{P}$

Identify the adduct.



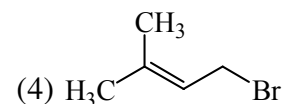
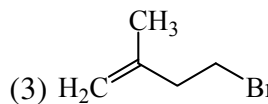
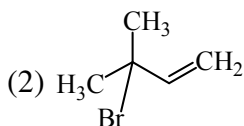
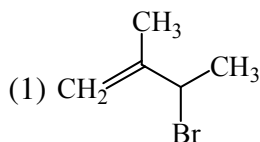
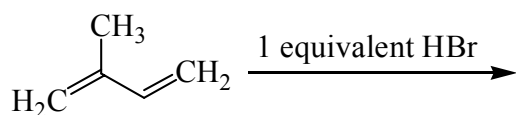
65. The reagent(s) for the following conversion,



is / are

- (1) alcoholic  $\text{KOH}$
  - (2) alcoholic  $\text{KOH}$  followed by  $\text{NaNH}_2$
  - (3) aqueous  $\text{KOH}$  followed by  $\text{NaNH}_2$
  - (4)  $\text{Zn} / \text{CH}_3\text{OH}$
66. The synthesis of 3-octyne is achieved by adding a bromoalkane into a mixture of sodium amide and an alkyne. The bromoalkane and alkyne respectively are
- (1)  $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$  and  $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$
  - (2)  $\text{BrCH}_2\text{CH}_2\text{CH}_3$  and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CH}$
  - (3)  $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$  and  $\text{CH}_3\text{C}\equiv\text{CH}$
  - (4)  $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$  and  $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$

67. In the following reaction, the major product is -

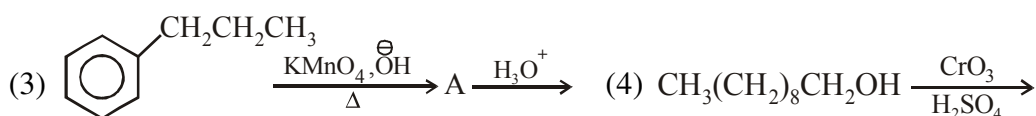
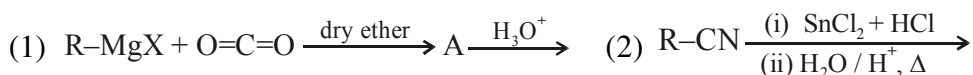


### ANSWER KEY

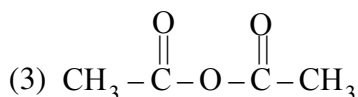
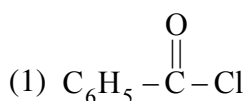
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	4	1	4	3	3	1	4	3	3	1	4	4	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	1	3	4	4	4	2	4	1	2	2	2	3	1	3
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	4	3	3	4	1	1	4	1	4	1	2	3	4	2	1
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	3	4	1	4	3	3	1	2	2	3	1	3	1	2	1
Que.	61	62	63	64	65	66	67								
Ans.	2	4	4	1	2	4	4								

## 11. CARBOXYLIC ACIDS & IT'S DERIVATIVE, ALIPHATIC AMINES

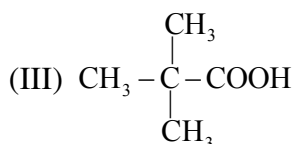
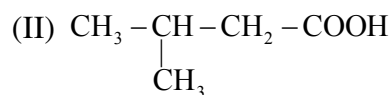
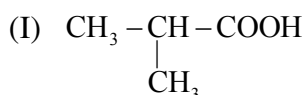
1. Which of the following set of reaction can not produce carboxylic acid as the final product :



2. Which of the following compounds gives carboxylic acid with  $\text{HNO}_2$ ?

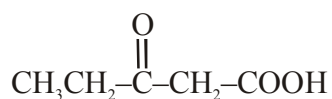


3. Arrange these esters in decreasing order of ease of esterification with  $\text{CH}_3\text{OH}/\text{H}^+$  :

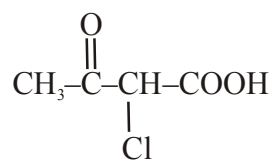


(1) II > I > III > IV (2) I > II > III > IV (3) III > IV > II > I (4) IV > III > II > I

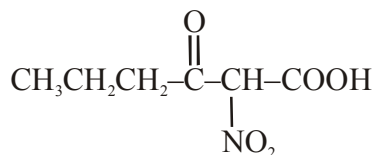
4. Correct order of decarboxylation



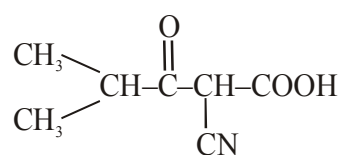
(a)



(b)



(c)



(d)

(1)  $a > b > c > d$ (2)  $c > d > b > a$ (3)  $c > d > a > b$ (4)  $d > c > a > b$ 

5. N-Ethyl phthalimide on hydrolysis gives:

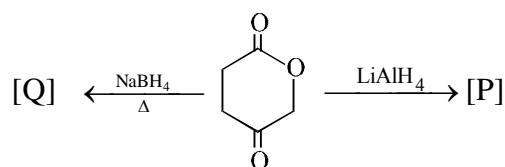
(1) Methyl alcohol

(2) Ethyl amine

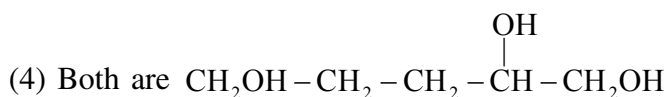
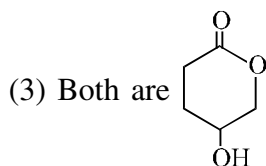
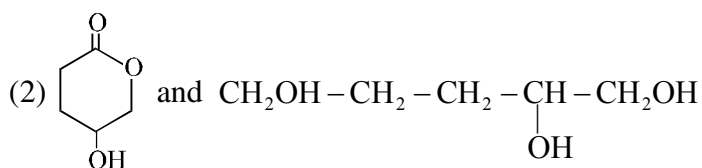
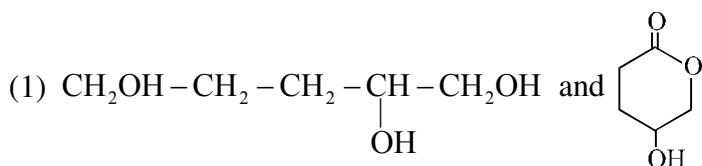
(3) Dimethyl amine

(4) Diethyl amine

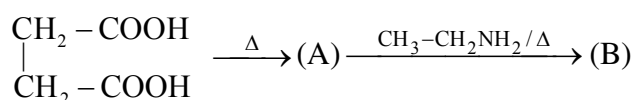
6. In the given reaction:



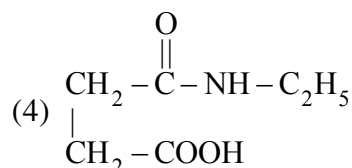
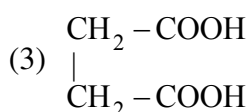
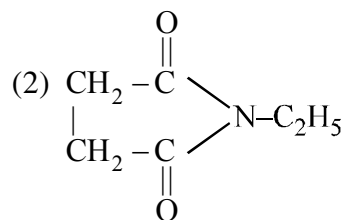
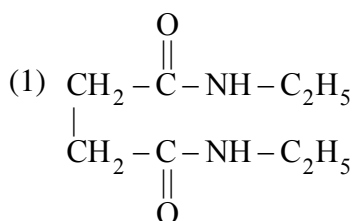
[P] and [Q] respectively be :



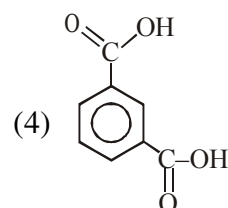
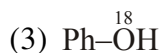
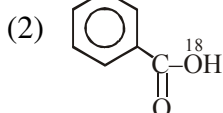
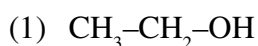
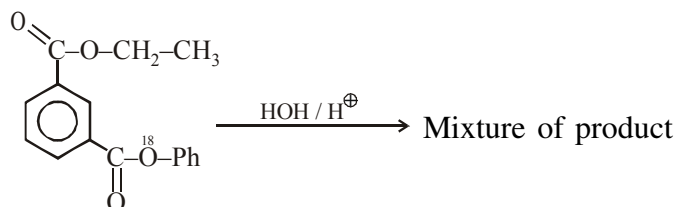
7. In the given reaction sequence:



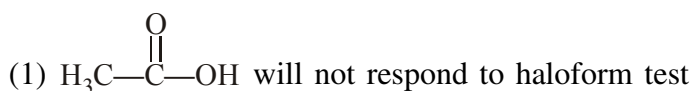
(B) will be:



8. Which of the following is not present in mixture of product :



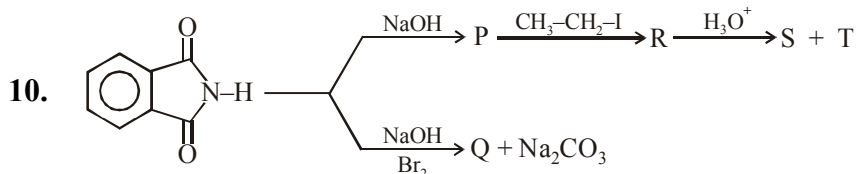
9. Among the following, which statement is not correct ?



(2) Schiff's reagent and Schiff's base are different compounds

(3) Fehling's solution is a good reagent to detect aromatic aldehydes

(4) Both aldehyde and ketone can react with 2,4-dinitrophenylhydrazine reagent



If T can evolve effervescence of  $\text{CO}_2$  with a  $\text{NaHCO}_3$ , then incorrect statement(s) is :

(1) S & Q can be distinguished by dye azo test

(2) T is most acidic among all isomeric benzenoid dicarboxylic acid

(3) Q & S can be distinguished by mustered oil test

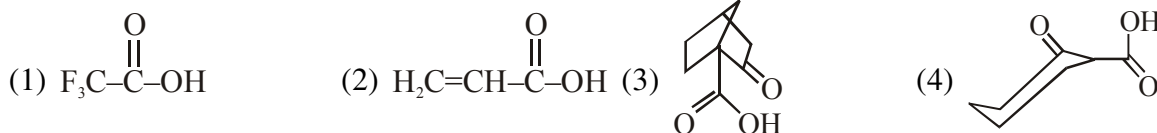
(4) P, Q & T all are soluble in a  $\text{NaHCO}_3$

11.  $\text{RCH}_2\text{CONH}_2 + \text{NaOBr} \longrightarrow ?$

Rate of reaction will be faster if 'R' is

- (1)  $\text{CH}_3 -$  (2)  $\text{C}_2\text{H}_5 -$  (3)  $\text{NO}_2 -$  (4)  $\text{CN} -$

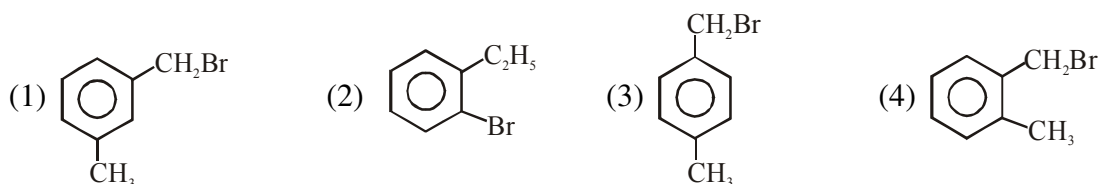
12. Which of the following carboxylic acids undergoes decarboxylation on simply heating ?



13. Which of the following compounds will not give acetic acid with  $\text{KMnO}_4/\text{H}^+/\Delta$  :

- (1)  $\text{CH}_3-\text{CHO}$  (2)  $\text{CH}_3-\text{CH}=\text{CH}-\text{CH}_3$   
(3)  $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_3$  (4)  $\text{CH}\equiv\text{CH}$

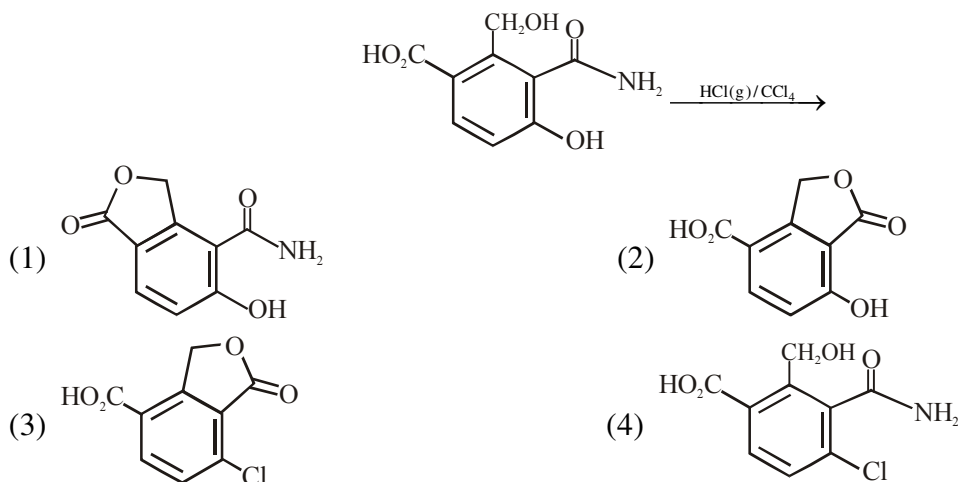
14. Compound (A),  $\text{C}_8\text{H}_9\text{Br}$ , gives a white precipitate when warmed with alcoholic  $\text{AgNO}_3$ . Oxidation of (A) gives an acid (B),  $\text{C}_8\text{H}_6\text{O}_4$ . (B) easily forms anhydride on heating. Identify the compound (A):



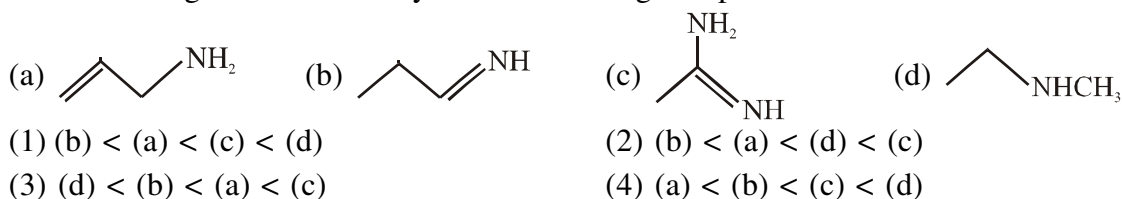
15. In the Hofmann bromamide degradation reaction, the number of moles of  $\text{NaOH}$  and  $\text{Br}_2$  used per mole of amine produced are :

- (1) Four moles of  $\text{NaOH}$  and one mole of  $\text{Br}_2$   
(2) One mole of  $\text{NaOH}$  and one mole of  $\text{Br}_2$   
(3) Four moles of  $\text{NaOH}$  and two moles of  $\text{Br}_2$   
(4) Two moles of  $\text{NaOH}$  and two moles of  $\text{Br}_2$

16. The major product expected from the following reaction is :

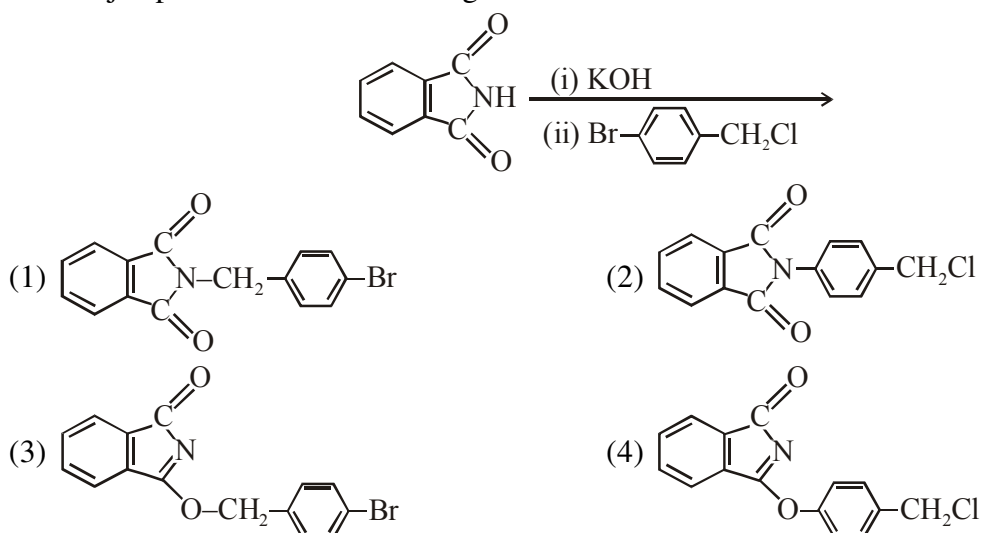


17. The increasing order of basicity of the following compounds is :

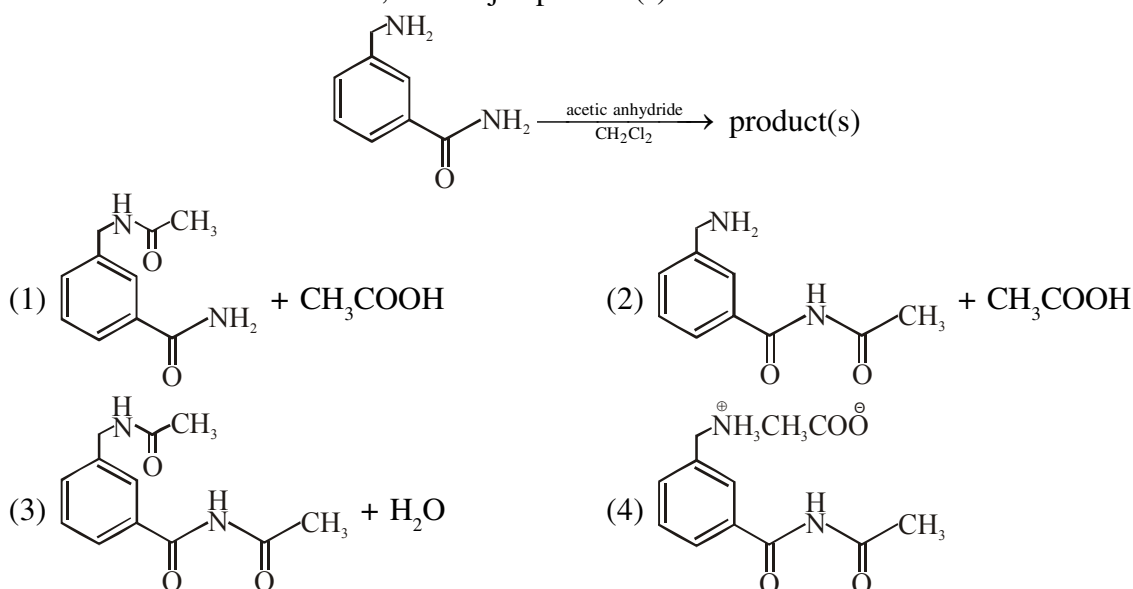




18. The major product of the following reaction is



19. In the reaction shown below, the major product(s) formed is / are :



20. Which are correct against property mentioned ?

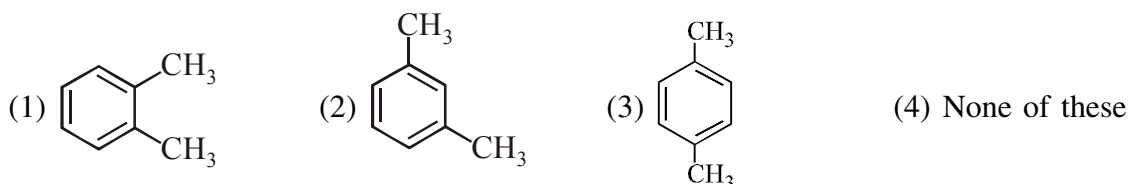
- (A)  $\text{CH}_3\text{COCl} > (\text{CH}_3\text{CO})_2\text{O} > \text{CH}_3\text{COOEt} > \text{CH}_3\text{CONH}_2$  (Rate of hydrolysis)
- (B)  $\text{CH}_3\text{--CH}_2\text{--COOH} > \text{CH}_3\text{--CH(CH}_3\text{)--COOH} > \text{CH}_3\text{--C(CH}_3\text{)}_2\text{--COOH}$  (Rate of esterification)
- (C) > > (Rate of esterification)
- (D)  $\text{CH}_3\text{--C(=O)--COOH} > \text{CH}_3\text{--C(=O)--CH}_2\text{--COOH} > \text{Ph--CH}_2\text{--COOH}$  (Rate of decarboxylation)
- (1) A, B, C, D      (2) A, B, C      (3) A, B      (4) A, C, D

### ANSWER KEY

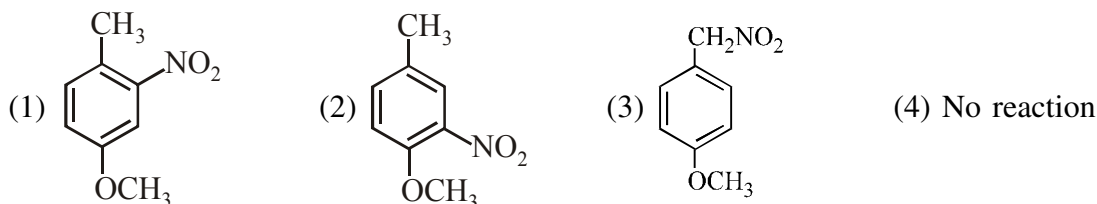
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	2	1	2	2	1	2	2	3	3	2	4	4	4	1
Que.	16	17	18	19	20										
Ans.	1	2	1	1	3										

## 12. AROMATIC COMPOUNDS AND NITROGEN COMPOUND

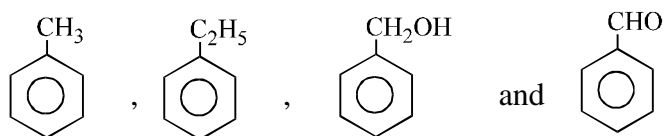
1. o/p ratio in highest for nitration of which of the following compound ?  
 (1) Ethyl benzene (2) Toluene  
 (3) Isopropyl benzene (4) Tertiarybutyl benzene
2. Ring nitration of dimethyl benzene results in the formation of only one nitro dimethyl benzene. The dimethyl benzene is:



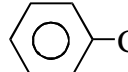
3. If p-methoxy toluene is nitrated, the major product is:



4. If the mixture of the following four aromatic compounds on oxidation by strong oxidising agent gives:

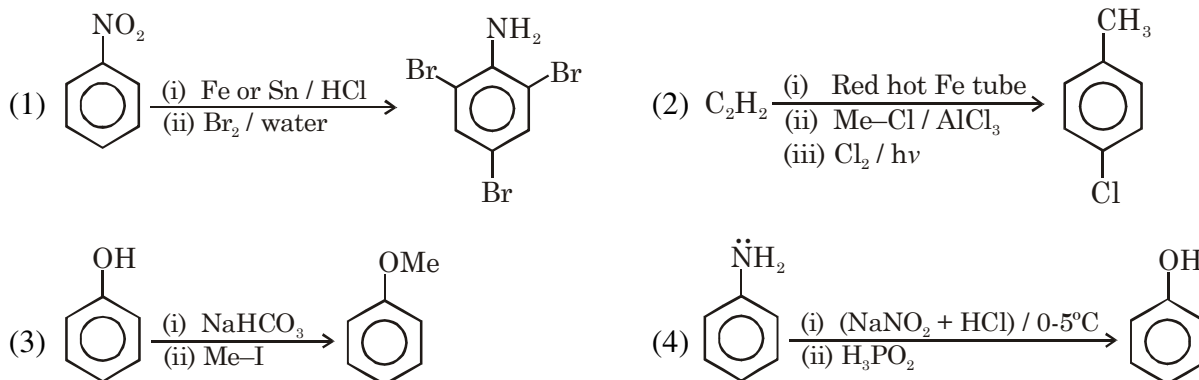


- (1) Mixture of  $C_6H_5CH_2OH + C_6H_5COOH$  (2) Mixture of  $C_6H_5CHO + C_6H_5COOH$   
 (3) Only  $C_6H_5COOH$  (4) None of the above

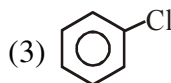
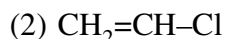
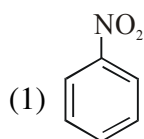
5. Chloral +   $\xrightarrow{\text{Conc. } H_2SO_4}$  product. The product is:

- (1) Lindane (2) DDT (3) Teflon (4) Ethaneperchlorate

6. Select the reaction giving correct major product :

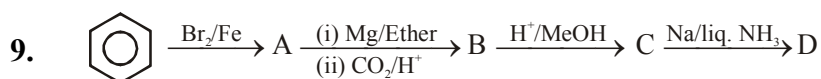


7. Which of the following can be used as reagent in Friedel Crafts reaction?

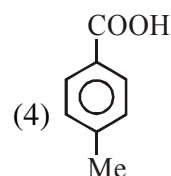
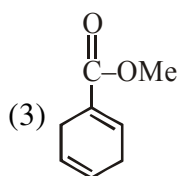
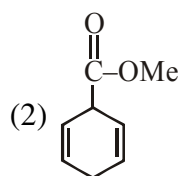
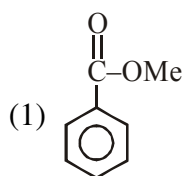


8. Find out correct statement :

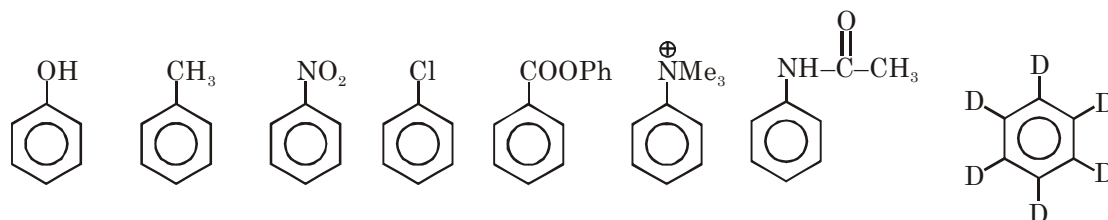
- (1) Although benzene contains three double bonds, normally it does not undergo addition reaction.
- (2) m-Chlorobromobenzene is an isomer of m-bromochlorobenzene.
- (3) In benzene, carbon uses all the three p orbitals for hybridization.
- (4) An electron donating substituent in benzene orients the incoming electrophilic group to the meta position.



Compound 'D' is



10. How many of following compounds are less reactive than benzene for sulphonation by conc.  $\text{H}_2\text{SO}_4$  :



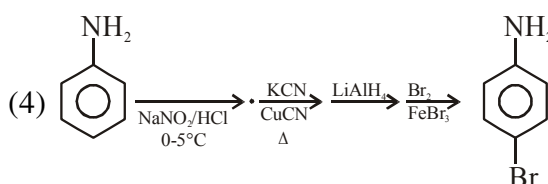
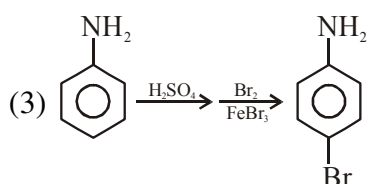
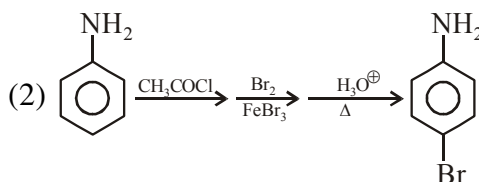
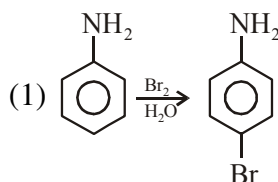
(1) 2

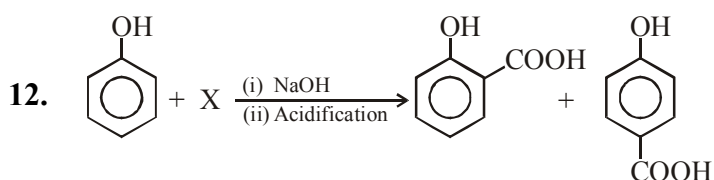
(2) 4

(3) 6

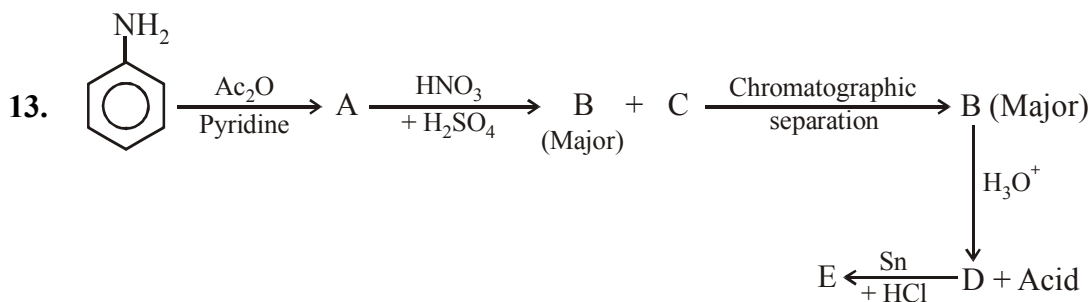
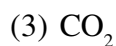
(4) 8

11. Which of the following method is used to prepare p-bromo aniline as major product :

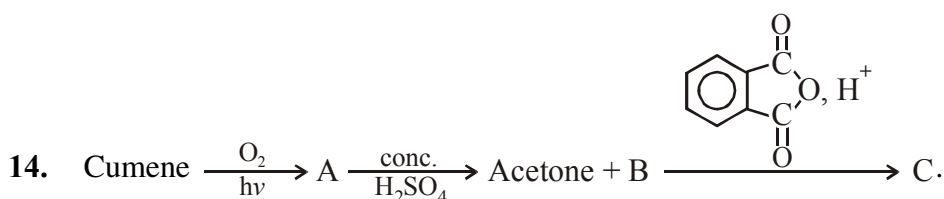
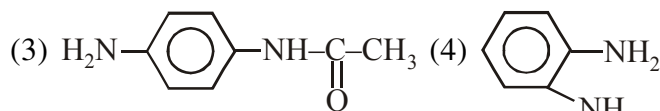
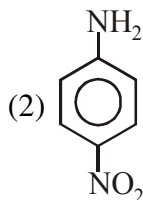
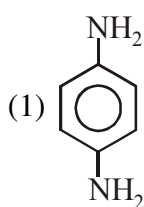




X is/are -



E is :



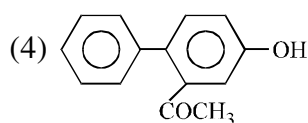
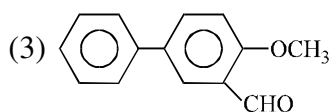
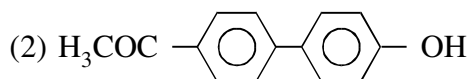
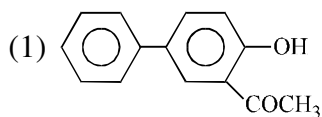
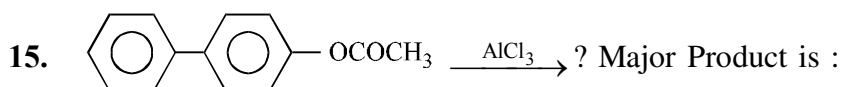
Identify correct statement :

(1) Product C is phenolphthalein which is an indicator

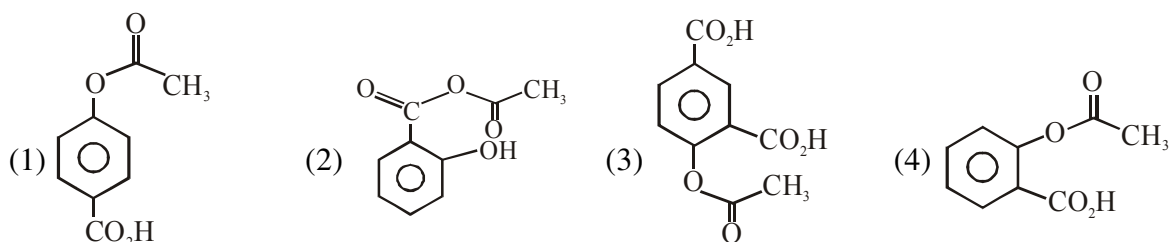
(2) Product B gives  $\text{CO}_2$  effervescence with  $\text{NaHCO}_3$

(3) Product A formation involves carbocation intermediate

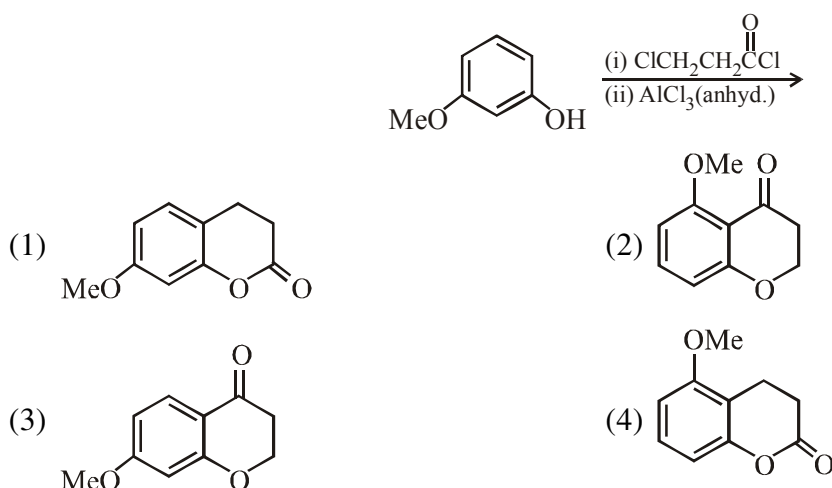
(4) Product B gives no colour with neutral  $\text{FeCl}_3$



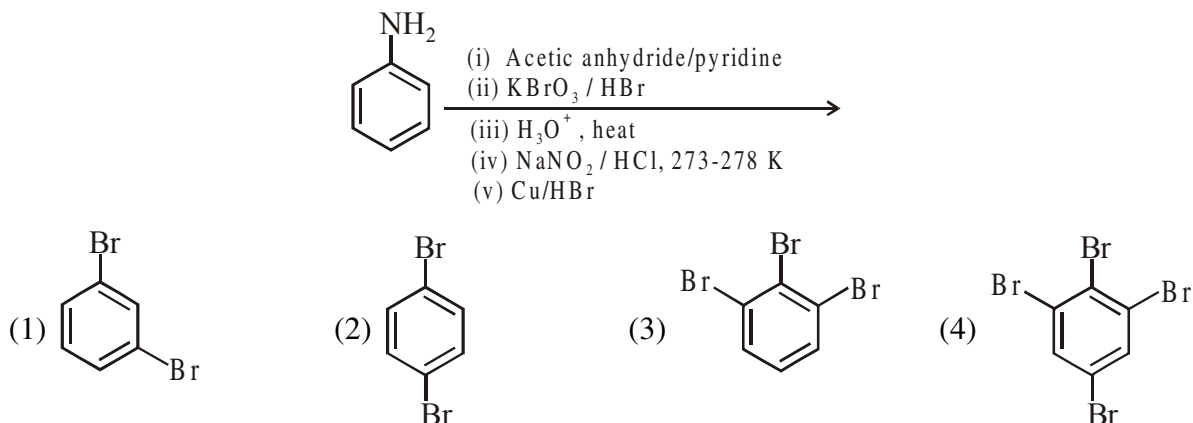
16. Phenol on treatment with  $\text{CO}_2$  in the presence of  $\text{NaOH}$  followed by acidification produces compound X as the major product. X on treatment with  $(\text{CH}_3\text{CO})_2\text{O}$  in the presence of catalytic amount of  $\text{H}_2\text{SO}_4$  produces :



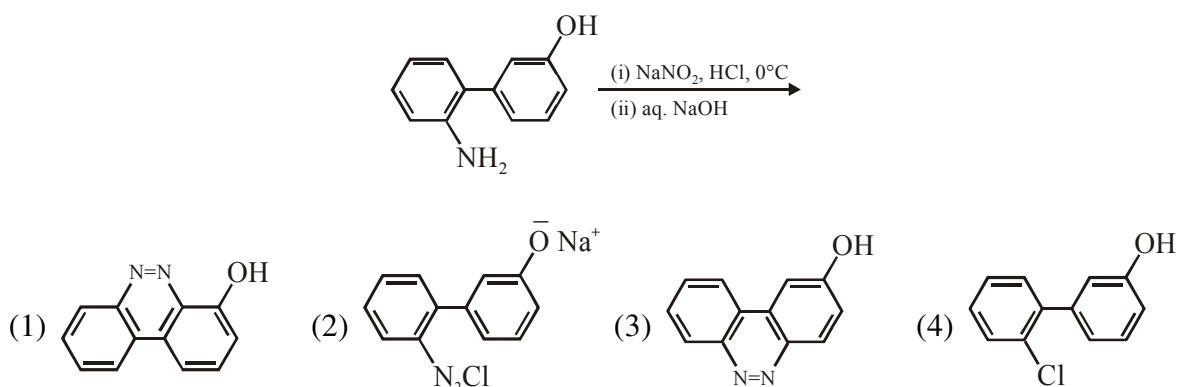
17. The major product of the following reaction is :



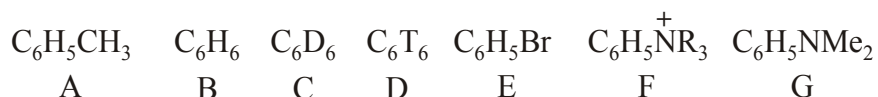
18. The product(s) of the following reaction sequence is(are)



19. The major product of the following reaction is :



20. What is correct order of rate of nitration of the following compounds ?

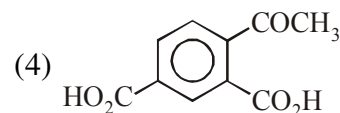
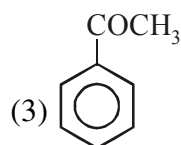
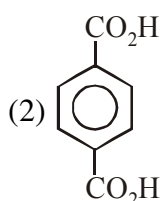
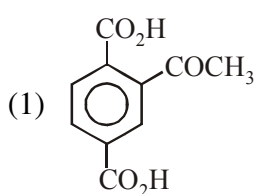
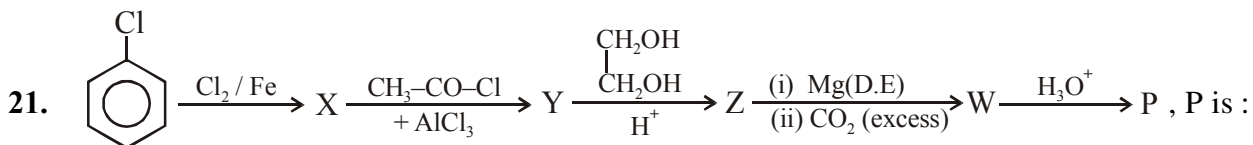


(1)  $G > A > B > C > D > E > F$

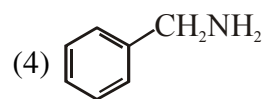
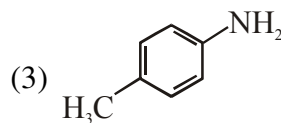
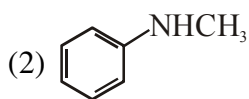
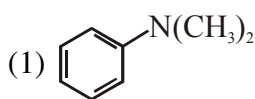
(2)  $G > B > C > D > A > F$

(3)  $G > A > B = C = D > E > F$

(4)  $G > A > B > C = D > E > F$



22. Amongst the compounds given, the one that would form a brilliant coloured dye on treatment with  $\text{NaNO}_2$  in dil.  $\text{HCl}$  followed by addition to an alkaline solution of  $\beta$ -naphthol is -



### ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	2	3	2	1	4	1	3	2	2	3	1	1	1
Que.	16	17	18	19	20	21	22								
Ans.	4	1	2	3	3	1	3								

### 13. POLYMER

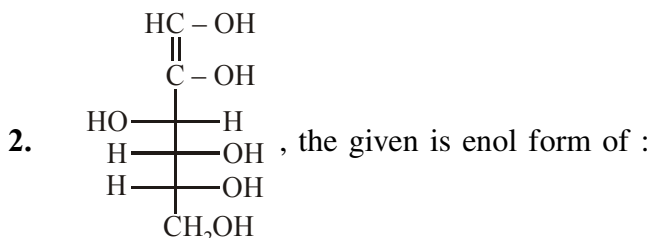
- Select the correct statement.  
 (A) Elastomers have the weakest intermolecular forces  
 (B) Buna-N is example of synthetic copolymer  
 (C) Some fibres have crystalline nature  
 (D) Thermoplastic polymers have stronger intermolecular forces than fibres  
 (1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) A, C, D
- Which of the following statements about low density polythene is FALSE ?  
 (1) It is used in the manufacture of buckets, dust-bins etc  
 (2) Its synthesis requires high pressure  
 (3) It is a poor conductor of electricity  
 (4) Its synthesis requires dioxygen or a peroxide initiator as a catalyst.
- Among cellulose, polyvinyl chloride, nylon and natural rubber, the polymer in which the intermolecular force of attraction is weakest is :-  
 (1) nylon                      (2) polyvinyl chloride                      (3) cellulose                      (4) natural rubber
- Synthetic polymer which resembles natural rubber is :-  
 (1) Chloroprene                      (2) Glyyptal                      (3) Nylon                      (4) Neoprene
- Terylene is a condensation polymer of ethylene glycol and :-  
 (1) Salicylic acid                      (2) Terephthalic acid                      (3) Benzoic acid                      (4) Phthalic acid
- Isoprene substances are used for making :-  
 (1) Natural rubber                      (2) Propane                      (3) Petrol                      (4) Liquid fuel
- Which of the following statements is wrong ?  
 (1) PVC stands for polyvinyl chloride                      (2) Buna-S stands for natural rubber  
 (3) PTFE stands for teflon                      (4) PMMA stands for polymethyl metha acrylate
- An example of natural biopolymer is :-  
 (1) Rubber                      (2) Nylon                      (3) Teflon                      (4) DNA
- Which of the following sets contains only addition polymers ?  
 (1) Bakelite, PVC, polyethylene                      (2) Polyethylene, PVC, acrilan  
 (3) Buna-S, nylon, polybutadiene                      (4) Polyethylene, polypropylene, terylene

### ANSWER KEY

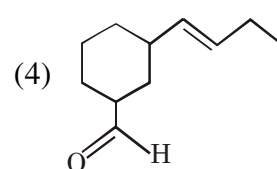
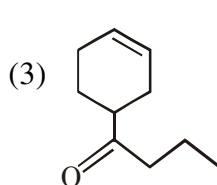
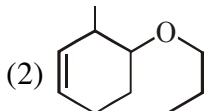
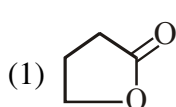
Que.	1	2	3	4	5	6	7	8	9	
Ans.	3	1	4	4	2	1	2	4	2	

## 14. BIOMOLECULES

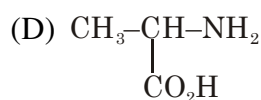
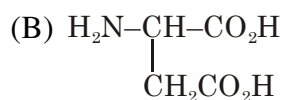
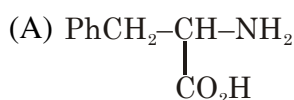
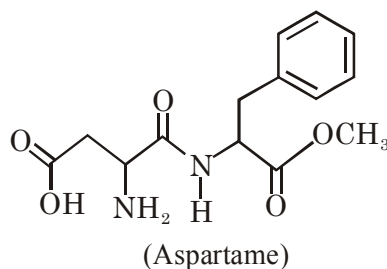
1. A D-carbohydrate is :
- (1) Always dextrorotatory
  - (2) Always laevorotatory
  - (3) Always the mirror image of the corresponding L-carbohydrate
  - (4) None of these



- (1) D-glucose
  - (2) D-mannose
  - (3) D-fructose
  - (4) All of these
3. A compound which does not react with Brady's reagent but decolourise  $\text{Br}_2 / \text{H}_2\text{O}$  solution is :



4. C-2 epimer of D-glucose is-
- (1) Mannose
  - (2) Fructose
  - (3) Galactose
  - (4) All
5. Same osazone product is obtained in case of D-glucose, D-Mannose and D-Fructose due to
- (1) The same configuration at C-5
  - (2) The same constitution.
  - (3) The same constitution at C-1 and C-2
  - (4) The same configuration at C-3, C-4, C-5.
6. "Aspartame" is roughly 100 times as sweet as cane sugar. On complete hydrolysis of aspartame, products obtained is/are :



(1) A, B, D

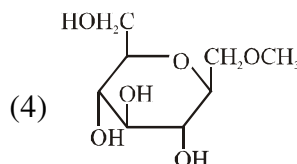
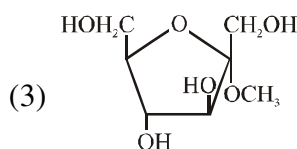
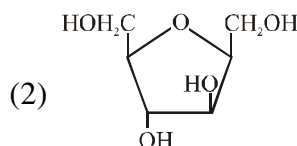
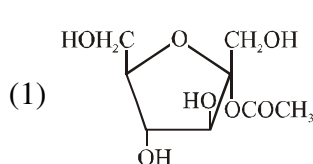
(2) B, C, D

(3) A, B, C

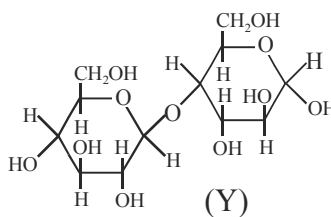
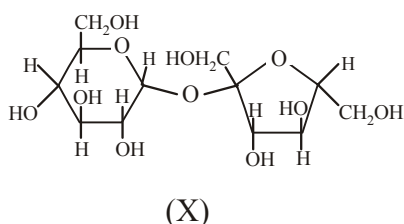
(4) A, C, D



7. Starch molecules are polymer with repeating glucose units. Select the correct statement(s).
- (A) Glucose units are joined through  $\alpha$ -glycosidic linkage  
 (B) The branches of amylopectin are linked to the chain with  $\alpha$ -1,6'-glycosidic linkages  
 (C) The linear linkages of amylopectin are formed by  $\alpha$ -1,6'-glycosidic bond  
 (D) Amylose has an unbranched skeleton of glucose molecules with  $\alpha$ -1,4'-glycosidic linkages
- (1) A, B, D                      (2) B, C, D                      (3) A, B, C                      (4) A, C, D
8. The distillation technique most suited for separating glycerol from spent-lye in the soap industry is
- (1) Distillation under reduced pressure  
 (2) Simple distillation  
 (3) Fractional distillation  
 (4) Steam distillation
9. Which of the following compounds will behave as a reducing sugar in an aqueous KOH solution

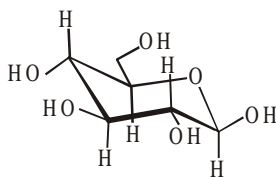


10. The correct statement(s) about the following sugars X and Y is(are)



- (A) X is a reducing sugar and Y is a non-reducing sugar  
 (B) X is a non-reducing sugar and Y is a reducing sugar  
 (C) The glucosidic linkages in X and Y are  $\alpha$  and  $\beta$ , respectively.  
 (D) The glucosidic linkages in X and Y are  $\beta$  and  $\alpha$ , respectively
- (1) A, B, C                      (2) A, D                      (3) B, C                      (4) B, D

11. The following carbohydrate is



(1) a ketohexose

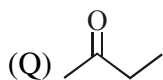
(2) an aldohexose

(3) an  $\alpha$ -furanose

(4) an  $\alpha$ -pyranose

12. List - I

(P)  $\text{CH}_3\text{-CH}_2\text{-C}\equiv\text{CH}$



List - II

(1) White turbidity with anhydrous  $\text{ZnCl}_2 + \text{HCl}$

(2) Reddish brown ppt. with Fehling solution

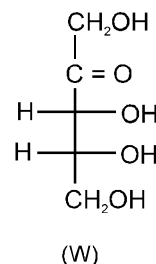
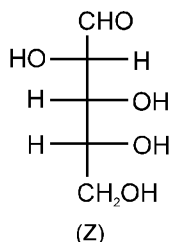
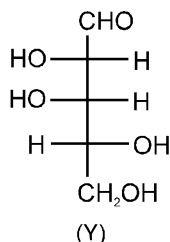
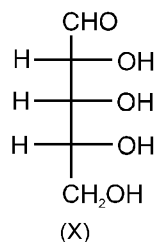
(3) Yellow ppt. with  $\text{NaOH} + \text{I}_2$

(4) White ppt with Tollen's reagent

Code :

	P	Q	R	S
(1)	4	3	1	2
(2)	4	1	3	2
(3)	3	2	4	1
(4)	3	4	2	1

13. Which of the following will form same product (osazone) on reaction with  $\text{PhNHNH}_2$  (excess).



(1) X, Y

(2) X, Z

(3) Z, W

(4) X, Z, W

## ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ans.	3	4	2	2	4	3	1	1	1	3	2	1	4

## 15. CHEMISTRY IN EVERY DAY LIFE

- Which of the following is an anionic detergent ?  
 (1) Glyceryl oleate (2) Sodium stearate  
 (3) Sodium lauryl sulphate (4) Cetyltrimethyl ammonium bromide

- The correct match between items of List-I and List-II is :-

	List-I		List-II
(A)	Phenelzine	(P)	Pyrimidine
(B)	Chloroxylenol	(Q)	Furan
(C)	Uracil	(R)	Hydrazine
(D)	Ranitidine	(S)	Phenol

- (1) (A)-(S), (B)-(R), (C)-(P), (D)-(Q)  
 (2) (A)-(R), (B)-(S), (C)-(P), (D)-(Q)  
 (3) (A)-(S), (B)-(R), (C)-(Q), (D)-(P)  
 (4) (A)-(R), (B)-(S), (C)-(Q), (D)-(P)
- Dettol consists of :-  
 (1) cresol + ethanol (2) chloroxylenol + terpineol  
 (3) xylenol + terpineol (4) none of the above
- The substances which relieve anxiety, reduce mental tension and induce sleep are called :-  
 (1) tranquillizers (2) antipyretics  
 (3) analgesics (4) anaesthetics
- Salol can be used as :-  
 (1) antiseptic (2) antipyretic  
 (3) both (1) and (2) (4) none of these
- In making lemon pickle :-  
 (1) citric acid acts as a preservative  
 (2) lemon oil acts as a preservative  
 (3) salt plays the same role as sugar in jam  
 (4) chillies are used to kill all germs and bacteria
- Valium is :-  
 (1) hormone (2) antibiotic (3) vitamin (4) tranquillizer

8. Point out the wrong statement :-

- (1) Phenacetin is a very important antibiotic
- (2) Penicillin was discovered by A. Flemming
- (3) Chloroquine is an antimalarial drug
- (4) Ether is an anaesthetic

9. Which of the following is used as an antipyretic ?

- (1) Chloroquine
- (2) Paracetamol
- (3) Chloramphenicol
- (4) LSD

**ANSWER KEY**

Que.	1	2	3	4	5	6	7	8	9	
Ans.	3	2	2	1	1	3	4	1	2	