

**+1 CHEMISTRY BOOK BACK ONE MARK QUESTIONS**

## 1. Basic Concepts of Chemistry and Chemical Calculations

1. 40 ml of methane is completely burnt using 80 ml of oxygen at room temperature. The volume of gas left after cooling to room temperature is  
a) 40 ml  $\text{CO}_2$  gas      b) 40 ml  $\text{CO}_2$  gas and 80 ml  $\text{H}_2\text{O}$  gas  
c) 60 ml  $\text{CO}_2$  gas and 60 ml  $\text{H}_2\text{O}$  gas      d) 120 ml  $\text{CO}_2$  gas

2. An element X has the following isotopic composition  $^{200}\text{X}=90\%$ ,  $^{199}\text{X}=8\%$  and  $^{202}\text{X}=2\%$ . The weighted average atomic mass of the element X is closest to  
a) 201 u      b) 202 u      c) 199 u      d) 200 u

3. **Assertion :** Two mole of glucose contains  $12.044 \times 10^{23}$  molecules of glucose  
**Reason :** Total number of entities present in one mole of any substance is equal to  $6.02 \times 10^{23}$   
a) both assertion and reason are true and the reason is the correct explanation of assertion  
b) both assertion and reason are true but reason is not the correct explanation of assertion  
c) assertion is true but reason is false      d) both assertion and reason are false

4. Carbon forms two oxides, namely carbon monoxide and carbon dioxide. The equivalent mass of which element remains constant?  
a) Carbon      b) oxygen  
c) both carbon and oxygen      d) neither carbon nor oxygen

5. The equivalent mass of a trivalent metal element is 9 g eq<sup>-1</sup> the molar mass of its anhydrous oxide is  
a) 102 g      b) 27 g      c) 270 g      d) 78 g

6. The number of water molecules in a drop of water weighing 0.018 g is.  
a)  $6.022 \times 10^{26}$       b)  $6.022 \times 10^{23}$       c)  $6.022 \times 10^{20}$       d)  $9.9 \times 10^{22}$

7. 1 g of an impure sample of magnesium carbonate (containing no thermally decomposable impurities) on complete thermal decomposition gave 0.44 g of carbon dioxide gas. The percentage of impurity in the sample is  
a) 0%      b) 4.4%      c) 16%      d) 8.4%

8. When 6.3 g of sodium bicarbonate is added to 30 g of acetic acid solution, the residual solution is found to weigh 33 g. The number of moles of carbon dioxide released in the reaction is  
a) 3      b) 0.75      c) 0.075      d) 0.3

9. When 22.4 litres of  $\text{H}_2\text{(g)}$  is mixed with 11.2 litres of  $\text{Cl}_2\text{(g)}$ , each at 273 K at 1 atm the moles of  $\text{HCl}\text{(g)}$  formed is equal to  
a) 2 moles of  $\text{HCl}\text{(g)}$       b) 0.5 moles of  $\text{HCl}\text{(g)}$       c) 1.5 moles of  $\text{HCl}\text{(g)}$       d) 1 moles of  $\text{HCl}\text{(g)}$

10. Hot concentrated sulphuric acid is a moderately strong oxidising agent. Which of the following reactions does not show oxidising behaviour?  
a)  $\text{Cu} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$       b)  $\text{C} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + 2\text{SO}_2 + 2\text{H}_2\text{O}$

c)  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$       d) none of the above

11. Choose the disproportionation reaction among the following redox reactions.

a)  $3\text{Mg(s)} + \text{N}_2\text{(g)} \rightarrow \text{Mg}_3\text{N}_2\text{(s)}$       b)  $\text{P}_4\text{(s)} + 3\text{NaOH} + 3\text{H}_2\text{O} \rightarrow \text{PH}_3\text{(g)} + 3\text{NaH}_2\text{PO}_2\text{(aq)}$

c)  $\text{Cl}_2\text{(g)} + 2\text{KI(aq)} \rightarrow 2\text{KCl(aq)} + \text{I}_2$       d)  $\text{Cr}_2\text{O}_3\text{(s)} + 2\text{Al(s)} \rightarrow \text{Al}_2\text{O}_3\text{(s)} + 2\text{Cr(s)}$

12. The equivalent mass of potassium permanganate in alkaline medium is  
 $(\text{MnO}_4^- + 2\text{H}_2\text{O} + 3\text{e}^- \rightarrow \text{MnO}_2 + 4\text{OH}^-)$

a) 31.6      b) 52.7      c) 79      d) None of these

13. Which one of the following represents 180g of water?

a) 5 Moles of water      b) 90 Moles of water

c)  $6.022 \times 10^{23} / 180$  molecules of water      d)  $6.022 \times 10^{24}$  molecules of water

14. 7.5 g of a gas occupies a volume of 5.6 litres at 0° C and 1 atm pressure. The gas is 0° C

a) NO      b) N<sub>2</sub>O      c) CO      d) CO<sub>2</sub>

15. Total number of electrons present in 1.7 g of ammonia is

a)  $6.022 \times 10^{23}$       b)  $6.022 \times 10^{22} / 1.7$       c)  $6.022 \times 10^{24} / 1.7$       d)  $6.022 \times 10^{23} / 1.7$

16. The correct increasing order of the oxidation state of sulphur in the anions SO<sub>4</sub><sup>2-</sup>, SO<sub>3</sub><sup>2-</sup>, S<sub>2</sub>O<sub>4</sub><sup>2-</sup>, S<sub>2</sub>O<sub>6</sub><sup>2-</sup>

a) SO<sub>3</sub><sup>2-</sup> < SO<sub>4</sub><sup>2-</sup> < S<sub>2</sub>O<sub>4</sub><sup>2-</sup> < S<sub>2</sub>O<sub>6</sub><sup>2-</sup>      b) SO<sub>4</sub><sup>2-</sup> < S<sub>2</sub>O<sub>4</sub><sup>2-</sup> < S<sub>2</sub>O<sub>6</sub><sup>2-</sup> < SO<sub>3</sub><sup>2-</sup>

c) S<sub>2</sub>O<sub>4</sub><sup>2-</sup> < SO<sub>3</sub><sup>2-</sup> < S<sub>2</sub>O<sub>6</sub><sup>2-</sup> < SO<sub>4</sub><sup>2-</sup>      d) S<sub>2</sub>O<sub>6</sub><sup>2-</sup> < S<sub>2</sub>O<sub>4</sub><sup>2-</sup> < SO<sub>4</sub><sup>2-</sup> < SO<sub>3</sub><sup>2-</sup>

17. The equivalent mass of ferrous oxalate is

a) molar mass of ferrous oxlate  
1  
c) molar mass of ferrous oxlate  
3  
b) molar mass of ferrous oxlate  
2  
d) none of these

18. If Avogadro number were changed from  $6.022 \times 10^{23}$  to  $6.022 \times 10^{20}$ , this would change

a) the ratio of chemical species to each other in a balanced equation  
b) the ratio of elements to each other in a compound  
c) the definition of mass in units of grams      d) the mass of one mole of carbon

19. Two 22.4 litre containers A and B contains 8 g of O<sub>2</sub> and 8 g of SO<sub>2</sub> respectively at 273K and 1 atm pressure, then

a) Number of molecules in A and B are same      b) Number of molecules in B is more than that in A.  
c) The ratio between the number of molecules in A to number of molecules in B is 2:1  
d) Number of molecules in B is three times greater than the number of molecules in A.

20. What is the mass of precipitate formed when 50 ml of 8.5 % solution of AgNO<sub>3</sub> is mixed with 100 ml of 1.865 % potassium chloride solution?

a) 3.59 g      b) 7g      c) 14g      d) 28g

21. The mass of a gas that occupies a volume of 612.5 ml at room temperature and pressure (25° C and 1 atm pressure) is 1.1g. The molar mass of the gas is

a)  $66.25 \text{ g mol}^{-1}$       b)  $44 \text{ g mol}^{-1}$       c)  $24.5 \text{ g mol}^{-1}$       d)  $662.5 \text{ g mol}^{-1}$

22. Which of the following contain same number of carbon atoms as in 6 g of carbon-12.  
 a) 7.5 g ethane      b) 8 g methane      c) both (a) and (b)      d) none of these

23. Which of the following compound(s) has /have percentage of carbon same as that in ethylene ( $\text{C}_2\text{H}_4$ )  
 a) propene      b) ethyne      c) benzene      d) ethane

24. Which of the following is/are true with respect to carbon -12.  
 a) relative atomic mass is 12 u      b) oxidation number of carbon is +4 in all its compounds.  
 c) 1 mole of carbon-12 contain  $6.022 \times 10^{22}$  carbon atoms.      d) all of these

25. Which one of the following is used as a standard for atomic mass.  
 a)  ${}^6\text{C}^{12}$       b)  ${}^7\text{C}^{12}$       c)  ${}^6\text{C}^{13}$       d)  ${}^6\text{C}^{14}$

## **2. Quantum Mechanical Model of Atom**

1. Electronic configuration of species  $\text{M}^{2+}$  is  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$  and its atomic weight is 56. The number of neutrons in the nucleus of species M is  
 a) 26      b) 22      c) 30      d) 24

2. The energy of light of wavelength 45 nm is  
 a)  $6.67 \times 10^{15} \text{ J}$       b)  $6.67 \times 10^{11} \text{ J}$       c)  $4.42 \times 10^{-18} \text{ J}$       d)  $4.42 \times 10^{-15} \text{ J}$

3. The energies  $E_1$  and  $E_2$  of two radiations are 25 eV and 50 eV respectively. The relation between their wavelengths ie  $\lambda_1$  and  $\lambda_2$  will be  
 a)  $\frac{\lambda_1}{\lambda_2} = 1$       b)  $\lambda_1 = 2\lambda_2$       c)  $\lambda_1 = \sqrt{25 \times 50} \lambda_2$       d)  $2\lambda_1 = \lambda_2$

4. Splitting of spectral lines in an electric field is called  
 a) Zeeman effect      b) Shielding effect      c) Compton effect      d) Stark effect

5. Based on equation  $E = -2.178 \times 10^{-18} \text{ J} [Z^2/n^2]$ , certain conclusions are written. Which of them is not correct ?  
 a) Equation can be used to calculate the change in energy when the electron changes orbit  
 b) For  $n=1$ , the electron has a more negative energy than it does for  $n=6$  which means that the electron is more loosely bound in the smallest allowed orbit  
 c) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.  
 d) Larger the value of  $n$ , the larger is the orbit radius.

6. According to the Bohr Theory, which of the following transitions in the hydrogen atom will give rise to the least energetic photon ?  
 a)  $n=6$  to  $n=1$       b)  $n=5$  to  $n=4$       c)  $n=5$  to  $n=3$       d)  $n=6$  to  $n=5$

7. **Assertion :** The spectrum of  $\text{He}^+$  is expected to be similar to that of hydrogen

**Reason :**  $\text{He}^+$  is also one electron system.

a) If both assertion and reason are true and reason is the correct explanation of assertion.  
 b) If both assertion and reason are true but reason is not the correct explanation of assertion.  
 c) If assertion is true but reason is false      d) If both assertion and reason are false

8. Which of the following pairs of d-orbitals will have electron density along the axes ?  
 a)  $d_z^2$ ,  $d_{xz}$       b)  $d_{xz}$ ,  $d_{yz}$       c)  $d_z^2$ ,  $d_{x^2-y^2}$       d)  $d_{xy}$ ,  $d_{x^2-y^2}$

9. Two electrons occupying the same orbital are distinguished by  
 a) azimuthal quantum number      b) spin quantum number  
 c) magnetic quantum number      d) orbital quantum number

10. The electronic configuration of Eu (Atomic no. 63) Gd (Atomic no. 64) and Tb (Atomic no. 65) are  
 a)  $[\text{Xe}]4f^6 5d^1 6s^2$ ,  $[\text{Xe}] 4f^7 5d^1 6s^2$  and  $[\text{Xe}] 4f^8 5d^1 6s^2$   
 b)  $[\text{Xe}]4f^7 6s^2$ ,  $[\text{Xe}] 4f^7 5d^1 6s^2$  and  $[\text{Xe}] 4f^9 6s^2$   
 c)  $[\text{Xe}]4f^7 6s^2$ ,  $[\text{Xe}] 4f^8 6s^2$  and  $[\text{Xe}] 4f^8 5d^1 6s^2$   
 d)  $[\text{Xe}]4f^6 5d^1 6s^2$ ,  $[\text{Xe}] 4f^7 5d^1 6s^2$  and  $[\text{Xe}] 4f^9 6s^2$

11. The maximum number of electrons in a sub shell is given by the expression  
 a)  $2n^2$       b)  $2l + 1$       c)  $4l + 2$       d) none of these

12. For d-electron, the orbital angular momentum is  
 a)  $\frac{\sqrt{2h}}{2\pi}$       b)  $\frac{\sqrt{2h}}{2\pi}$       c)  $\frac{\sqrt{2 \times 4h}}{2\pi}$       d)  $\frac{\sqrt{6}}{2\pi}h$

13. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers ?  $n = 3$ ,  $l = 1$  and  $m = -1$   
 a) 4      b) 6      c) 2      d) 10

14. **Assertion :** Number of radial and angular nodes for 3p orbital are 1, 1 respectively.  
**Reason :** Number of radial and angular nodes depends only on principal quantum number.  
 a) both assertion and reason are true and reason is the correct explanation of assertion.  
 b) both assertion and reason are true but reason is not the correct explanation of assertion.  
 c) assertion is true but reason is false  
 d) both assertion and reason are false

15. The total number of orbitals associated with the principal quantum number  $n = 3$  is  
 a) 9      b) 8      c) 5      d) 7

16. If  $n = 6$ , the correct sequence for filling of electrons will be  
 a)  $ns \rightarrow (n-2)f \rightarrow (n-1)d \rightarrow np$       b)  $ns \rightarrow (n-1)d \rightarrow (n-2)f \rightarrow np$   
 c)  $ns \rightarrow (n-2)f \rightarrow np \rightarrow (n-1)d$       d) none of these are correct

17. Consider the following sets of quantum numbers :

	N	L	M	S
i)	3	0	0	$+1/2$
ii)	2	2	1	$-1/2$
iii)	4	3	-2	$+1/2$
iv)	1	0	-1	$+1/2$
v)	3	4	3	$-1/2$

Which of the following sets of quantum number is not possible ?

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

18. How many electrons in an atom with atomic number 105 can have  $(n+l) = 8$  ?

a) 30      b) 17      c) 15      d) unpredictable

19. Electron density in the  $yz$  plane of  $3d_{xy}$  orbital is

a) Zero      b) 0.50      c) 0.75      d) 0.90

20. If uncertainty in position and momentum are equal, then minimum uncertainty in velocity is

a)  $\frac{1}{m}\sqrt{h/\pi}$       b)  $\sqrt{h/\pi}$       c)  $\frac{1}{2m}\sqrt{h/\pi}$       d)  $\frac{h}{4\pi}$

21. A macroscopic particle of mass 100 g and moving at a velocity of  $100 \text{ cm s}^{-1}$  will have a de Broglie wavelength of

a)  $6.6 \times 10^{-29} \text{ cm}$       b)  $6.6 \times 10^{-30} \text{ cm}$       c)  $6.6 \times 10^{-31} \text{ cm}$       d)  $6.6 \times 10^{-32} \text{ cm}$

22. The ratio of de Broglie wavelengths of a deuterium atom to that of an  $\alpha$  - particle, when the velocity of the former is five times greater than that of later, is

a) 4      b) 0.2      c) 2.5      d) 0.4

23. The energy of an electron in the 3rd orbit of hydrogen atom is  $-E$ . The energy of an electron in the first orbit will be

a)  $-3E$       b)  $-E/3$       c)  $-E/9$       d)  $-9E$

24. Time independent Schrödinger wave equation is

a)  $\hat{H}\Psi = E\Psi$       b)  $\nabla^2\Psi + \frac{8\pi^2m}{h^2}(E + V)\Psi = 0$   
 c)  $\frac{\partial^2\Psi}{\partial x^2} + \frac{\partial^2\Psi}{\partial y^2} + \frac{\partial^2\Psi}{\partial z^2} + \frac{2m}{h^2}(E - V)\Psi = 0$       d) all of these

25. Which of the following does not represent the mathematical expression for the Heisenberg uncertainty principle ?

a)  $\Delta x \cdot \Delta p \geq h/4\pi$       b)  $\Delta x \cdot \Delta v \geq h/4\pi m$       c)  $\Delta E \cdot \Delta t \geq h/4\pi$       d)  $\Delta E \cdot \Delta x \geq h/4\pi$

### 3. Periodic Classification Of Elements

1. What would be the IUPAC name for an element with atomic number 222?

a) bibibium      b) bididium      c) dididium      d) bibibium

2. The electronic configuration of the elements A and B are  $1s^2, 2s^2, 2p^6, 3s^2$  and  $1s^2, 2s^2, 2p^5$  respectively. The formula of the ionic compound that can be formed between these elements is

a) AB      b)  $AB_2$       c)  $A_2B$       d) none of the above.

3. The group of elements in which the differentiating electron enters the anti penultimate shell of atoms are called

a) p-block elements      b) d-block elements      c) s-block elements      d) f-block elements

4. In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

a) I < Br < Cl < F (increasing electron gain enthalpy)

b) Li < Na < K < Rb (increasing metallic radius)

c)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$  (increasing ionic size)

d) B < C < O < N (increasing first ionisation enthalpy)

5. Which of the following elements will have the highest electronegativity?

a) Chlorine      b) Nitrogen      c) Cesium      d) Fluorine

6. Various successive ionisation enthalpies in ( $\text{kJmol}^{-1}$ ) of an element are given below.

IE <sub>1</sub>	IE <sub>2</sub>	IE <sub>3</sub>	IE <sub>4</sub>	IE <sub>5</sub>
577.5	1,810	2,750	11,580	14,820

The element is

a) phosphorus      b) Sodium      c) Aluminium      d) Silicon

7. In the third period the first ionization potential is of the order.,

a)  $\text{Na} > \text{Al} > \text{Mg} > \text{Si} > \text{P}$       b)  $\text{Na} < \text{Al} < \text{Mg} < \text{Si} < \text{P}$   
 c)  $\text{Mg} > \text{Na} > \text{Si} > \text{P} > \text{Al}$       d)  $\text{Na} < \text{Al} < \text{Mg} < \text{P} < \text{Si}$

8. Identify the wrong statement.

a) Amongst the isoelectronic species, smaller the positive charge on cation, smaller is the ionic radius  
 b) Amongst isoelectric species greater the negative charge on the anion, larger is the ionic radius  
 c) Atomic radius of the elements increases as one moves down the first group of the periodic table  
 d) Atomic radius of the elements decreases as one moves across from left to right in the 2nd period of the periodic table

9. Which one of the following arrangements represent the correct order of least negative to most negative electron gain enthalpy

a)  $\text{Al} < \text{O} < \text{C} < \text{Ca} < \text{F}$       b)  $\text{Al} < \text{Ca} < \text{O} < \text{C} < \text{F}$   
 c)  $\text{C} < \text{F} < \text{O} < \text{Al} < \text{Ca}$       d)  $\text{Ca} < \text{Al} < \text{C} < \text{O} < \text{F}$

10. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I having atomic number 9, 17, 35 and 53 respectively is

a)  $\text{I} > \text{Br} > \text{Cl} > \text{F}$       b)  $\text{F} > \text{Cl} > \text{Br} > \text{I}$       c)  $\text{Cl} > \text{F} > \text{Br} > \text{I}$       d)  $\text{Br} > \text{I} > \text{Cl} > \text{F}$

11. Which one of the following is the least electronegative element?

a) a) Bromine      b) Chlorine      c) Iodine      d) Hydrogen

12. The element with positive electron gain enthalpy is

a) Hydrogen      b) Sodium      c) Argon      d) Fluorine

13. The correct order of decreasing electronegativity values among the elements X, Y, Z and A with atomic numbers 4, 8, 7 and 12 respectively

a)  $\text{Y} > \text{Z} > \text{X} > \text{A}$       b)  $\text{Z} > \text{A} > \text{Y} > \text{X}$       c)  $\text{X} > \text{Y} > \text{Z} > \text{A}$       d)  $\text{X} > \text{Y} > \text{A} > \text{Z}$

14. Assertion : Helium has the highest value of ionisation energy among all the elements known  
 Reason : Helium has the highest value of electron affinity among all the elements known  
 a) Both assertion and reason are true and reason is correct explanation for the assertion

b) Both assertion and reason are true but the reason is not the correct explanation for the assertion  
 c) Assertion is true and the reason is false  
 d) Both assertion and the reason are false

15. The electronic configuration of the atom having maximum difference in first and second ionisation energies is  
 a)  $1s^2, 2s^2, 2p^6, 3s^1$     b)  $1s^2, 2s^2, 2p^6, 3s^2$     c)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^1$     d)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$

16. Which of the following is second most electronegative element?  
 a) Chlorine    b) Fluorine    c) Oxygen    d) Sulphur

17.  $IE_1$  and  $IE_2$  of Mg are 179 and 348  $\text{kcal mol}^{-1}$  respectively. The energy required for the reaction  $\text{Mg} \rightarrow \text{Mg}^{2+} + 2e^-$  is  
 a)  $+169 \text{ kcal mol}^{-1}$     b)  $-169 \text{ kcal mol}^{-1}$     c)  $+527 \text{ kcal mol}^{-1}$     d)  $-527 \text{ kcal mol}^{-1}$

18. In a given shell the order of screening effect is  
 a)  $s > p > d > f$     b)  $s > p > f > d$     c)  $f > d > p > s$     d)  $f > p > s > d$

19. Which of the following orders of ionic radii is correct?  
 a)  $\text{H}^- > \text{H}^+ > \text{H}$     b)  $\text{Na}^+ > \text{F}^- > \text{O}^{2-}$     c)  $\text{F} > \text{O}^{2-} > \text{Na}^+$     d) None of these

20. The First ionisation potential of Na, Mg and Si are 496, 737 and 786  $\text{kJ mol}^{-1}$  respectively. The ionisation potential of Al will be closer to  
 a)  $760 \text{ kJ mol}^{-1}$     b)  $575 \text{ kJ mol}^{-1}$     c)  $801 \text{ kJ mol}^{-1}$     d)  $419 \text{ kJ mol}^{-1}$

21. Which one of the following is true about metallic character when we move from left to right in a period and top to bottom in a group?  
 a) Decreases in a period and increases along the group  
 b) Increases in a period and decreases in a group  
 c) Increases both in the period and the group  
 d) Decreases both in the period and in the group

22. How does electron affinity change when we move from left to right in a period in the periodic table?  
 a) Generally increases    b) Generally decreases  
 c) Remains unchanged    d) First increases and then decreases

23. Which of the following pairs of elements exhibit diagonal relationship?  
 a) Be and Mg    b) Li and Be    c) Be and B    d) Be and Al

#### 4 Hydrogen

1. Which of the following statements about hydrogen is incorrect ?  
 a) Hydrogen ion,  $\text{H}_3\text{O}$  exists freely in solution.  
 b) Dihydrogen acts as a reducing agent.  
 c) Hydrogen has three isotopes of which tritium is the most common.  
 d) Hydrogen never acts as cation in ionic salts.

2. Water gas is  
 a)  $\text{H}_2\text{O}_{(\text{g})}$     b)  $\text{CO} + \text{H}_2\text{O}$     c)  $\text{CO} + \text{H}_2$     d)  $\text{CO} + \text{N}_2$

3. Which one of the following statements is incorrect with regard to ortho and para dihydrogen ?

- They are nuclear spin isomers
- Ortho isomer has zero nuclear spin whereas the para isomer has one nuclear spin
- The para isomer is favoured at low temperatures
- The thermal conductivity of the para isomer is 50% greater than that of the ortho isomer.

4. Ionic hydrides are formed by

- halogens
- chalcogens
- inert gases
- group one elements

5. Tritium nucleus contains \_\_\_\_\_

- $1p + 0n$
- $2p + 1n$
- $1p + 2n$
- none of these

6. Non-stoichiometric hydrides are formed by

- palladium, vanadium
- carbon, nickel
- manganese, lithium
- nitrogen, chlorine

7. **Assertion :** Permanent hardness of water is removed by treatment with washing soda.  
**Reason :** Washing soda reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates.

- Both assertion and reason are true and reason is the correct explanation of assertion.
- Both assertion and reason are true but reason is not the correct explanation of assertion.
- Assertion is true but reason is false
- Both assertion and reason are false.

8. If a body of a fish contains 1.2 g hydrogen in its total body mass, if all the hydrogen is replaced with deuterium then the increase in body weight of the fish will be

- 1.2g
- 2.4g
- 3.6g
- $\sqrt{4.8}$  g

9. The hardness of water can be determined by volumetrically using the reagent

- sodium thio sulphate
- potassium permanganate
- hydrogen peroxide
- EDTA

10. The cause of permanent hardness of water is due to

- $Ca(HCO_3)_2$
- $Mg(HCO_3)_2$
- $CaCl_2$
- $MgCO_3$

11. Zeolite used to soften hardness of water is, hydrated

- Sodium aluminium silicate
- Calcium aluminium silicate
- Zinc aluminium borate
- Lithium aluminium hydride

12. A commercial sample of hydrogen peroxide marked as 100 volume  $H_2O_2$ , it means that

- 1 ml of  $H_2O_2$  will give 100 ml  $O_2$  at STP
- 1 L of  $H_2O_2$  will give 100 ml  $O_2$  at STP
- 1 L of  $H_2O_2$  will give 22.4 L  $O_2$
- 1 ml of  $H_2O_2$  will give 1 mole of  $O_2$  at STP

13. When hydrogen peroxide is shaken with an acidified solution of potassium dichromate in presence of ether, the ethereal layer turns blue due to the formation of

- $Cr_2O_3$
- $CrO_4^{2-}$
- $CrO(O_2)_2$
- none of these

## 5. Alkali and Alkaline Earth Metals

1. For alkali metals, which one of the following trends is incorrect ?
  - a) Hydration energy: Li > Na > K > Rb
  - b) Ionisation energy: Li > Na > K > Rb
  - c) Density: Li < Na < K < Rb
  - d) Atomic size: Li < Na < K < Rb
2. Which of the following statements is incorrect ?
  - a)  $\text{Li}^+$  has minimum degree of hydration among alkali metal cations.
  - b) The oxidation state of K in  $\text{KO}_2$  is +1
  - c) Sodium is used to make Na / Pb alloy
  - d)  $\text{MgSO}_4$  is readily soluble in water
3. Which of the following compounds will not evolve  $\text{H}_2$  gas on reaction with alkali metals ?
  - a) ethanoic acid
  - b) ethanol
  - c) phenol
  - d) none of these
4. Which of the following has the highest tendency to give the reaction  $\text{M}^+(\text{g}) \xrightarrow{\text{Aqueous medium}} \text{M}^+(\text{aq})$ 
  - a) Na
  - b) Li
  - c) Rb
  - d) K

5. sodium is stored in  
 a) alcohol                    b) water                    c) kerosene                    d) none of these

6.  $\text{RbO}_2$  is  
 a) superoxide and paramagnetic                    b) peroxide and diamagnetic  
 c) superoxide and diamagnetic                    d) peroxide and paramagnetic

7. Find the wrong statement  
 a) sodium metal is used in organic qualitative analysis  
 b) sodium carbonate is soluble in water and it is used in inorganic qualitative analysis  
 c) potassium carbonate can be prepared by solvay process  
 d) potassium bicarbonate is acidic salt

8. Lithium shows diagonal relationship with  
 a) sodium                    b) magnesium                    c) calcium                    d) aluminium

9. In case of alkali metal halides, the ionic character increases in the order  
 a)  $\text{MF} < \text{MCl} < \text{MBr} < \text{MI}$                     b)  $\text{MI} < \text{MBr} < \text{MCl} < \text{MF}$   
 c)  $\text{MI} < \text{MBr} < \text{MF} < \text{MCl}$                     d) none of these

10. In which process, fused sodium hydroxide is electrolysed for extraction of sodium ?  
 a) Castner's process                    b) Cyanide process  
 c) Down process                            d) All of these

11. The product obtained as a result of a reaction of nitrogen with  $\text{CaC}_2$  is  
 a)  $\text{Ca}(\text{CN})_3$                     b)  $\text{CaN}_2$                     c)  $\text{Ca}(\text{CN})_2$                     d)  $\text{Ca}_3\text{N}_2$

12. Which of the following has highest hydration energy  
 a)  $\text{MgCl}_2$                     b)  $\text{CaCl}_2$                     c)  $\text{BaCl}_2$                     d)  $\text{SrCl}_2$

13. Match the flame colours of the alkali and alkaline earth metal salts in the bunsen burner  
 (p) Sodium                    (1) Brick red  
 (q) Calcium                    (2) Yellow  
 (r) Barium                    (3) Lilac (violet)  
 (s) Strontium                    (4) Apple green  
 (t) Cesium                    (5) Crimson red  
 (u) Potassium                    (6) Blue  
 a) p - 2, q - 1, r - 4, s - 5, t - 6, u - 3                    b) p - 1, q - 2, r - 4, s - 5, t - 6, u - 3  
 c) p - 4, q - 1, r - 2, s - 3, t - 5, u - 6                    d) p - 6, q - 5, r - 4, s - 3, t - 1, u - 2

14. **Assertion :** Generally alkali and alkaline earth metals form superoxides  
**Reason :** There is a single bond between O and O in superoxides.  
 a) both assertion and reason are true and reason is the correct explanation of assertion  
 b) both assertion and reason are true but reason is not the correct explanation of assertion



## **6. Gaseous State**

1. Gases deviate from ideal behavior at high pressure. Which of the following statement(s) is correct for non-ideality?
  - a) at high pressure the collision between the gas molecule become enormous
  - b) at high pressure the gas molecules move only in one direction
  - c) at high pressure, the volume of gas become insignificant
  - d) at high pressure the intermolecular interactions become significant.
2. Rate of diffusion of a gas is
  - a) directly proportional to its density
  - b) directly proportional to its molecular weight
  - c) directly proportional to its square root of its molecular weight
  - d) inversely proportional to the square root of its molecular weight.
3. Which of the following is the correct expression for the equation of state of van der Waals gas?
 

a) $(P + \frac{a}{n^2V^2})(V - nb) = nRT$	b) $(P + \frac{na}{n^2V^2})(V - nb) = nRT$
c) $(P + \frac{an^2}{V^2})(V - nb) = nRT$	d) $(P + \frac{n^2a^2}{V^2})(V - nb) = nRT$
4. When an ideal gas undergoes unrestrained expansion, no cooling occurs because the molecules
 

a) are above inversion temperature	b) exert no attractive forces on each other
c) do work equal to the loss in kinetic energy	d) collide without loss of energy
5. Equal weights of methane and oxygen are mixed in an empty container at 298 K. The fraction of total pressure exerted by oxygen is
 

a) 1/3	b) 1/2	c) 2/3	d) 1/3 x 273 x 298
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6. The temperature at which real gases obey the ideal gas laws over a wide range of pressure is called
 

a) Critical temperature	b) Boyle temperature	c) Inversion temperature	d) Reduced temperature
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7. In a closed room of 1000 m<sup>3</sup> a perfume bottle is opened up. The room develops a smell. This is due to which property of gases?
 

a) Viscosity	b) Density	c) Diffusion	d) None
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8. A bottle of ammonia and a bottle of HCl connected through a long tube are opened simultaneously at both ends. The white ammonium chloride ring first formed will be
 

a) At the center of the tube	b) Near the hydrogen chloride bottle
c) Near the ammonia bottle	d) Throughout the length of the tube
9. The value of universal gas constant depends upon
 

a) Temperature of the gas	b) Volume of the gas
c) Number of moles of the gas	d) units of Pressure and volume.

10. The value of the gas constant R is  
 a)  $0.082 \text{ dm}^3 \text{ atm.}$       b)  $0.987 \text{ cal mol}^{-1} \text{ K}^{-1}$       c)  $8.3 \text{ J mol}^{-1} \text{ K}^{-1}$       d)  $8 \text{ erg mol}^{-1} \text{ K}^{-1}$

11. Use of hot air balloon in sports and meteorological observation is an application of  
 a) Boyle's law      b) Newton's law      c) Kelvin's law      d) Brown's law

12. The table indicates the value of van der Waals constant 'a' in  $(\text{dm}^3)^2 \text{ atm. mol}^{-2}$

Gas	O <sub>2</sub>	N <sub>2</sub>	NH <sub>3</sub>	CH <sub>4</sub>
a	1.360	1.390	4.170	2.253

The gas which can be most easily liquefied is

a) O<sub>2</sub>      b) N<sub>2</sub>      c) NH<sub>3</sub>      d) CH<sub>4</sub>

13. Consider the following statements

i) Atmospheric pressure is less at the top of a mountain than at sea level  
 ii) Gases are much more compressible than solids or liquids  
 iii) When the atmospheric pressure increases the height of the mercury column rises Select the correct statement  
 a) I and II      b) II and III      c) I and III      d) I, II and III

14. Compressibility factor for CO<sub>2</sub> at 400 K and 71.0 bar is 0.8697. The molar volume of CO<sub>2</sub> under these conditions is  
 a) 22.04 dm<sup>3</sup>      b) 2.24 dm<sup>3</sup>      c) 0.41 dm<sup>3</sup>      d) 19.5 dm<sup>3</sup>

15. If temperature and volume of an ideal gas is increased to twice its values, the initial pressure P becomes  
 a) 4P      b) 2P      c) P      d) 3P

16. At identical temperature and pressure, the rate of diffusion of hydrogen gas is  $3\sqrt{3}$  times that of a hydrocarbon having molecular formula C<sub>n</sub>H<sub>2n-2</sub>. What is the value of n ?  
 a) 8      b) 4      c) 3      d) 1

17. Equal moles of hydrogen and oxygen gases are placed in a container, with a pin-hole through which both can escape what fraction of oxygen escapes in the time required for one-half of the hydrogen to escape.  
 a) 3/8      b) 1/2      c) 1/8      d) 1/4

18. The variation of volume V, with temperature T, keeping pressure constant is called the coefficient of thermal expansion ie  $\alpha = \frac{1}{V} \left( \frac{\partial V}{\partial T} \right)_P$ . For an ideal gas  $\alpha$  is equal to  
 a) T      b) 1/T      c) P      d) none of these

19. Four gases P, Q, R and S have almost same values of 'b' but their 'a' values (a, b are Vander Waals Constants) are in the order Q < R < S < P. At a particular temperature, among the four gases the most easily liquefiable one is  
 a) P      b) Q      c) R      d) S

20. Maximum deviation from ideal gas is expected from .

a)  $\text{CH}_{4(g)}$       b)  $\text{NH}_{3(g)}$       c)  $\text{H}_{2(g)}$       d)  $\text{N}_{2(g)}$

21. The units of Vander Waals constants 'b' and 'a' respectively

a)  $\text{mol L}^{-1}$  and  $\text{L atm}^2 \text{ mol}^{-1}$       b)  $\text{mol L}$  and  $\text{L atm mol}^2$   
 c)  $\text{mol}^{-1}\text{L}$  and  $\text{L}^2\text{atm mol}^{-2}$       d) none of these

22. **Assertion :** Critical temperature of  $\text{CO}_2$  is 304 K, it can be liquefied above 304 K.

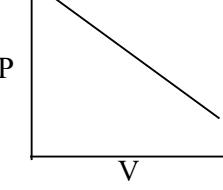
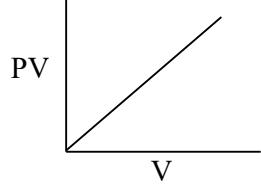
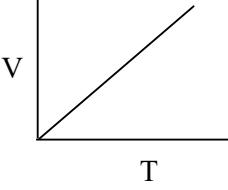
**Reason :** For a given mass of gas, volume is to directly proportional to pressure at constant temperature

a) both assertion and reason are true and reason is the correct explanation of assertion  
 b) both assertion and reason are true but reason is not the correct explanation of assertion  
 c) assertion is true but reason is false      d) both assertion and reason are false.

23. What is the density of  $\text{N}_2$  gas at  $227^\circ\text{C}$  and 5.00 atm pressure? ( $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$ )

a) 1.40 g/L      b) 2.81 g/L      c) 3.41 g/L      d) 0.29 g/L

24. Which of the following diagrams correctly describes the behaviour of a fixed mass of an ideal gas?  
 (T is measured in K)

a)  b)  c)  d) All of these

25. 25g of each of the following gases are taken at  $27^\circ\text{C}$  and 600 mm Hg pressure. Which of these will have the least volume ?

a) HBr      b) HCl      c) HF      d) HI

### 7.Thermodynamics

1. The amount of heat exchanged with the surrounding at constant pressure is given by the quantity

a)  $\Delta E$       b)  $\Delta H$       c)  $\Delta S$       d)  $\Delta G$

2. All the naturally occurring processes proceed spontaneously in a direction which leads to

a) decrease in entropy      b) increase in enthalpy  
 c) increase in free energy      d) decrease in free energy

3. In an adiabatic process, which of the following is true ?

a)  $q = w$       b)  $q = 0$       c)  $\Delta E = q$       d)  $P\Delta V = 0$

4. In a reversible process, the change in entropy of the universe is

a)  $> 0$       b)  $\geq 0$       c)  $< 0$       d)  $= 0$

5. In an adiabatic expansion of an ideal gas

a)  $w = -\Delta u$       b)  $w = \Delta u + \Delta H$       c)  $\Delta u = 0$       d)  $w = 0$

6. The intensive property among the quantities below is

a) mass      b) volume      c) enthalpy      d)  $\frac{\text{mass}}{\text{volume}}$

7. An ideal gas expands from the volume of  $1 \times 10^{-3} \text{ m}^3$  to  $1 \times 10^{-2} \text{ m}^3$  at 300 K against a constant pressure at  $1 \times 10^5 \text{ Nm}^{-2}$ . The work done is

a) -900 J      b) 900 kJ      c) 270 kJ      d) -900 kJ

8. Heat of combustion is always

a) positive      b) negative      c) zero      d) either positive or negative

9. The heat of formation of CO and  $\text{CO}_2$  are - 26.4 kCal and - 94 kCal, respectively. Heat of combustion of carbon monoxide will be

a) +26.4 kCal      b) -67.6 kCal      c) -120.6 kCal      d) +52.8 kCal

10. C (diamond)  $\rightarrow$  C(graphite),  $\Delta H = -\text{ve}$ , this indicates that

a) graphite is more stable than diamond      b) graphite has more energy than diamond  
c) both are equally stable      d) stability cannot be predicted

11. The enthalpies of formation of  $\text{Al}_2\text{O}_3$  and  $\text{Cr}_2\text{O}_3$  are - 1596 kJ and - 1134 kJ, respectively.  $\Delta H$  for the reaction  $2\text{Al} + \text{Cr}_2\text{O}_3 \rightarrow 2\text{Cr} + \text{Al}_2\text{O}_3$  is

a) -1365 kJ      b) 2730 kJ      c) -2730 kJ      d) -462 kJ

12. Which of the following is not a thermodynamic function ?

a) internal energy      b) enthalpy      c) entropy      d) frictional energy

13. If one mole of ammonia and one mole of hydrogen chloride are mixed in a closed container to form ammonium chloride gas, then

a)  $\Delta H > \Delta U$       b)  $\Delta H - \Delta U = 0$       c)  $\Delta H + \Delta U = 0$       d)  $\Delta H < \Delta U$

14. Change in internal energy, when 4 kJ of work is done on the system and 1 kJ of heat is given out by the system is

a) + 1 kJ      b) - 5 kJ      c) + 3 kJ      d) - 3 kJ

15. The work done by the liberated gas when 55.85 g of iron (molar mass 55.85 g  $\text{mol}^{-1}$ ) reacts with hydrochloric acid in an open beaker at  $25^\circ\text{C}$

a) -2.48 kJ      b) -2.22 kJ      c) + 2.22 kJ      d) +2.48 kJ

16. The value of  $\Delta H$  for cooling 2 moles of an ideal monatomic gas from  $125^\circ\text{C}$  to  $25^\circ\text{C}$  at constant pressure will be [given  $C_p = \frac{5}{2} R$ ]

a) -250 R      b) -500 R      c) +500 R      d) +250 R

17. Given that  $\text{C(g)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$   $\Delta H^0 = -a \text{ kJ}$ ;  $2 \text{ CO(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{CO}_2\text{(g)}$   $\Delta H^0 = -b \text{ kJ}$ ; Calculate the  $\Delta H^0$  for the reaction  $\text{C(g)} + \frac{1}{2}\text{O}_2\text{(g)} \rightarrow \text{CO(g)}$

a)  $\frac{b+2a}{2}$       b)  $2a - b$       c)  $\frac{2a-b}{2}$       d)  $\frac{b-2a}{2}$

18. When 15.68 litres of a gas mixture of methane and propane are fully combusted at  $0^\circ \text{C}$  and 1 atmosphere, 32 litres of oxygen at the same temperature and pressure are consumed. The amount of heat of released from this combustion in kJ is ( $\Delta H_c(\text{CH}_4) = -890 \text{ kJ mol}^{-1}$  and  $\Delta H_c(\text{C}_3\text{H}_8) = -2220 \text{ kJ mol}^{-1}$ )

a) -889 kJ      b) -1390 kJ      c) -3180 kJ      d) -632.68 kJ

19. The bond dissociation energy of methane and ethane are  $360 \text{ kJ mol}^{-1}$  and  $620 \text{ kJ mol}^{-1}$  respectively. Then, the bond dissociation energy of C-C bond is

a)  $170 \text{ kJ mol}^{-1}$       b)  $50 \text{ kJ mol}^{-1}$       c)  $80 \text{ kJ mol}^{-1}$       d)  $220 \text{ kJ mol}^{-1}$

20. The correct thermodynamic conditions for the spontaneous reaction at all temperature is

a)  $\Delta H < 0$  and  $\Delta S > 0$       b)  $\Delta H < 0$  and  $\Delta S < 0$       c)  $\Delta H > 0$  and  $\Delta S = 0$       d)  $\Delta H > 0$  and  $\Delta S > 0$

21. The temperature of the system, decreases in an \_\_\_\_\_

a) Isothermal expansion      b) Isothermal Compression      c) adiabatic expansion      d) adiabatic compression

22. In an isothermal reversible compression of an ideal gas the sign of  $q$ ,  $\Delta S$  and  $w$  are respectively

a) +, -, -      b) -, +, -      c) +, -, +      d) -, -, +

23. Molar heat of vapourisation of a liquid is  $4.8 \text{ kJ mol}^{-1}$ . If the entropy change is  $16 \text{ J mol}^{-1} \text{ K}^{-1}$ , the boiling point of the liquid is

a) 323 K      b)  $27^\circ \text{C}$       c) 164 K      d) 0.3 K

24.  $\Delta S$  is expected to be maximum for the reaction

a)  $\text{Ca}_{(s)} + \frac{1}{2}\text{O}_{2(g)} \rightarrow \text{CaO}_{(s)}$       b)  $\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$   
 c)  $\text{N}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{NO}_{(g)}$       d)  $\text{CaCO}_{3(s)} \rightarrow \text{CaO}_{(s)} + \text{CO}_{2(g)}$

25. The values of  $\Delta H$  and  $\Delta S$  for a reaction are respectively  $30 \text{ kJ mol}^{-1}$  and  $100 \text{ JK}^{-1} \text{ mol}^{-1}$ . Then the temperature above which the reaction will become spontaneous is

a) 300 K      b) 30 K      c) 100 K      d)  $20^\circ \text{C}$

## 8. Physical and Chemical Equilibrium

2. At a given temperature and pressure, the equilibrium constant values for the equilibria



The relation between  $K_1$  and  $K_2$  is

a)  $K_1 = \frac{1}{\sqrt{K_2}}$       b)  $K_2 = K_1^{-1/2}$       c)  $K_1^2 = 2K_2$       d)  $\frac{K_1}{2} = K_2$

3. The equilibrium constant for a reaction at room temperature is  $K_1$  and that at 700 K is  $K_2$ . If  $K_1 > K_2$ , then

a) The forward reaction is exothermic      b) The forward reaction is endothermic  
 c) The reaction does not attain equilibrium      d) The reverse reaction is exothermic

4. The formation of ammonia from  $N_2(g)$  and  $H_2(g)$  is a reversible reaction

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{Heat}$ . What is the effect of increase of temperature on this equilibrium reaction

a) equilibrium is unaltered      b) formation of ammonia is favoured  
 c) equilibrium is shifted to the left      d) reaction rate does not change

5. Solubility of carbon dioxide gas in cold water can be increased by

a) increase in pressure      b) decrease in pressure      c) increase in volume      d) none of these

6. Which one of the following is incorrect statement ?

a) for a system at equilibrium,  $Q$  is always less than the equilibrium constant  
 b) equilibrium can be attained from either side of the reaction  
 c) presence of catalyst affects both the forward reaction and reverse reaction to the same extent  
 d) Equilibrium constant varied with temperature.

7.  $K_1$  and  $K_2$  are the equilibrium constants for the reactions respectively.



What is the equilibrium constant for the reaction  $NO_2(g) \rightleftharpoons \frac{1}{2}N_2(g) + O_2(g)$

a)  $\frac{1}{\sqrt{K_1K_2}}$       b)  $(K_1=K_2)^{1/2}$       c)  $\frac{1}{2K_1K_2}$       d)  $\left[\frac{1}{K_1K_2}\right]^{3/2}$

8. In the equilibrium,  $2A(g) \rightleftharpoons 2B(g) + C_2(g)$  the equilibrium concentrations of A, B and  $C_2$  at 400 K are  $1 \times 10^{-4} M$ ,  $2.0 \times 10^{-3} M$ ,  $1.5 \times 10^{-4} M$ . respectively. The value of  $K_C$  for the equilibrium at 400 K is

a) 0.06      b) 0.09      c) 0.62      d)  $3 \times 10^{-2}$

9. An equilibrium constant of  $3.2 \times 10^{-6}$  for a reaction means, the equilibrium is

a) largely towards forward direction      b) largely towards reverse direction  
 c) never established      d) none of these

10.  $\frac{K_C}{K_P}$  for the reaction,  $\text{N}_2 \text{ (g)} + 3 \text{ H}_2 \text{ (g)} \rightleftharpoons 2 \text{ NH}_3 \text{ (g)}$  is

a)  $\frac{1}{RT}$       b)  $\sqrt{RT}$       c)  $RT$       d)  $(RT)^2$

11. For the reaction  $\text{AB (g)} \rightleftharpoons \text{A(g)} + \text{B(g)}$ , at equilibrium, AB is 20% dissociated at a total pressure of P, The equilibrium constant  $K_P$  is related to the total pressure by the expression

a)  $P = 24 K_P$       b)  $P = 8 K_P$       c)  $24P = K_P$       d) none of these

12. In which of the following equilibrium,  $K_P$  and  $K_C$  are not equal?

a)  $2\text{NO(g)} \rightleftharpoons \text{N}_2 \text{ (g)} + \text{O}_2 \text{ (g)}$       b)  $\text{SO}_2 \text{ (g)} + \text{NO}_2 \rightleftharpoons \text{SO}_3 \text{ (g)} + \text{NO(g)}$   
 c)  $\text{H}_2 \text{ (g)} + \text{I}_2 \text{ (g)} \rightleftharpoons 2\text{HI(g)}$       d)  $\text{PCl}_5 \text{ (g)} \rightleftharpoons \text{PCl}_3 \text{ (g)} + \text{Cl}_2 \text{ (g)}$

13. If x is the fraction of  $\text{PCl}_5$  dissociated at equilibrium in the reaction  $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$  then starting with 0.5 mole of  $\text{PCl}_5$ , the total number of moles of reactants and products at equilibrium is

a)  $0.5 - x$       b)  $x + 0.5$       c)  $2x + 0.5$       d)  $x + 1$

14. The values of  $K_{P1}$  and  $K_{P2}$  for the reactions  $\text{X} \rightleftharpoons \text{Y} + \text{Z}$  and  $\text{A} \rightleftharpoons 2\text{B}$  are in the ratio 9 : 1 if degree of dissociation and initial concentration of X and A be equal then total pressure at equilibrium  $P_1$  and  $P_2$  are in the ratio

a) 36:1      b) 1:1      c) 3:1      d) 1:9

15. In the reaction,  $\text{Fe(OH)}_3 \text{ (s)} \rightleftharpoons \text{Fe}^{3+} \text{ (aq)} + 3\text{OH}^- \text{ (aq)}$  if the concentration of  $\text{OH}^-$  ions is decreased by  $\frac{1}{4}$  times, then the equilibrium concentration of  $\text{Fe}^{3+}$  will

a) not changed      b) also decreased by  $\frac{1}{4}$  times  
 c) increase by 4 times      d) increase by 64 times

16. Consider the reaction where  $K_P = 0.5$  at a particular temperature

$\text{PCl}_5 \text{ (g)} \rightleftharpoons \text{PCl}_3 \text{ (g)} + \text{Cl}_2 \text{ (g)}$  if the three gases are mixed in a container so that the partial pressure of each gas is initially 1 atm, then which one of the following is true

a) more  $\text{PCl}_3$  will be produced      b) more  $\text{Cl}_2$  will be produced  
 c) more  $\text{PCl}_5$  will be produced      d) none of these

17. Equimolar concentrations of  $\text{H}_2$  and  $\text{I}_2$  are heated to equilibrium in a 1 litre flask. What percentage of initial concentration of  $\text{H}_2$  has reacted at equilibrium if rate constant for both forward and reverse reactions are equal

a) 33%      b) 66%      c)  $(33)^2 \%$       d) 16.5%

18. In a chemical equilibrium, the rate constant for the forward reaction is  $2.5 \times 10^2$  and the equilibrium constant is 50. The rate constant for the reverse reaction is,

a) 11.5      b) 5      c)  $2 \times 10^2$       d)  $2 \times 10^{-3}$

19. Which of the following is not a general characteristic of equilibrium involving physical process

a) Equilibrium is possible only in a closed system at a given temperature

b) The opposing processes occur at the same rate and there is a dynamic but stable condition c) All the physical processes stop at equilibrium

d) All measurable properties of the system remains constant.

20. For the formation of Two moles of  $\text{SO}_3$  (g) from  $\text{SO}_2$  and  $\text{O}_2$ , the equilibrium constant is  $K_1$ . The equilibrium constant for the dissociation of one mole of  $\text{SO}_3$  into  $\text{SO}_2$  and  $\text{O}_2$  is

a)  $\frac{1}{K_1}$       b)  $K_1^2$       c)  $\left(\frac{1}{K_1}\right)^{1/2}$       d)  $\frac{K_1}{2}$

21. Match the equilibria with the corresponding conditions,

i) Liquid  $\rightleftharpoons$  Vapour  
 ii) Solid  $\rightleftharpoons$  Liquid  
 iii) Solid  $\rightleftharpoons$  Vapour  
 iv) Solute (s)  $\rightleftharpoons$  Solute (Solution)

	(i)	(ii)	(iii)	(iv)
1) melting point	1	2	3	4
2) Saturated solution	3	1	4	2
3) Boiling point	2	1	3	4
4) Sublimation point	3	2	4	5
5) Unsaturated solution				

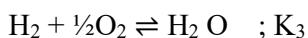
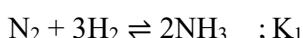
22. Consider the following reversible reaction at equilibrium,  $\text{A} + \text{B} \rightleftharpoons \text{C}$ , If the concentration of the reactants A and B are doubled, then the equilibrium constant will

a) be doubled      b) become one fourth      c) be halved      d) remain the same

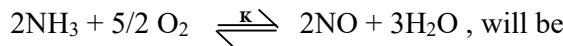
23.  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}_{(\text{aq})}$  (pink)  $4\text{Cl}^{-}_{(\text{aq})} \rightleftharpoons [\text{CoCl}_4]^{2-}_{(\text{aq})}$  (blue) +  $6\text{H}_2\text{O}_{(\text{l})}$  In the above reaction at equilibrium, the reaction mixture is blue in colour at room temperature. On cooling this mixture, it becomes pink in colour. On the basis of this information, which one of the following is true ?

a)  $\Delta H > 0$  for the forward reaction      b)  $\Delta H = 0$  for the reverse reaction  
 c)  $\Delta H < 0$  for the forward reaction      d) Sign of the  $\Delta H$  cannot be predicted based on this information.

24. The equilibrium constants of the following reactions are :



The equilibrium constants of the following reactions



a)  $\text{K}_2^3 \text{K}_3/\text{K}_1$       b)  $\text{K}_1 \text{K}_3^3/\text{K}_2$       c)  $\text{K}_2 \text{K}_3^3/\text{K}_1$       d)  $\text{K}_2 \text{K}_3/\text{K}_1$

25. A 20 litre container at 400 K contains  $\text{CO}_2$  (g) at pressure 0.4 atm and an excess of  $\text{SrO}$  (neglect the volume of solid  $\text{SrO}$ ). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of  $\text{CO}_2$  attains its maximum value will be :

Given that :  $\text{SrCO}_3 \text{ (s)} \rightleftharpoons \text{SrO (s)} + \text{CO}_2 \text{ (g)}$   $K_p = 1.6 \text{ atm}$

a) 2 litre      b) 5 litre      c) 10 litre      d) 4 litre

### 9. Solutions

- The molality of a solution containing 1.8g of glucose dissolved in 250g of water is  
 a) 0.2 M      b) 0.01 M      c) 0.02 M      d) 0.04 M
- Which of the following concentration terms is / are independent of temperature  
 a) molality      b) molarity      c) mole fraction      d) (a) and (c)
- Stomach acid, a dilute solution of  $\text{HCl}$  can be neutralised by reaction with Aluminium hydroxide  $\text{Al(OH)}_3 + 3\text{HCl} \text{ (aq)} \rightarrow \text{AlCl}_3 + 3\text{H}_2\text{O}$  How many millilitres of 0.1 M  $\text{Al(OH)}_3$  solution are needed to neutralise 21 mL of 0.1 M  $\text{HCl}$  ?  
 a) 14 mL      b) 7 mL      c) 21 mL      d) none of these
- The partial pressure of nitrogen in air is 0.76 atm and its Henry's law constant is  $7.6 \times 10^4 \text{ atm}$  at 300K. What is the molefraction of nitrogen gas in the solution obtained when air is bubbled through water at 300K  
 a)  $1 \times 10^{-4}$       b)  $1 \times 10^{-6}$       c)  $2 \times 10^{-5}$       d)  $1 \times 10^{-5}$
- The Henry's law constant for the solubility of Nitrogen gas in water at 350 K is  $8 \times 10^4 \text{ atm}$ . The mole fraction of nitrogen in air is 0.5. The number of moles of Nitrogen from air dissolved in 10 moles of water at 350K and 4 atm pressure is  
 a)  $4 \times 10^{-4}$       b)  $4 \times 10^4$       c)  $2 \times 10^{-2}$       d)  $2.5 \times 10^{-4}$
- Which one of the following is incorrect for ideal solution ?  
 a)  $\Delta H_{\text{mix}} = 0$       b)  $\Delta U_{\text{mix}} = 0$   
 c)  $\Delta P = P_{\text{observed}} - P_{\text{Calculated by Raoult's law}} = 0$       d)  $\Delta G_{\text{mix}} = 0$
- Which one of the following gases has the lowest value of Henry's law constant ?  
 a)  $\text{N}_2$       b)  $\text{He}$       c)  $\text{CO}_2$       d)  $\text{H}_2$
- $P_1$  and  $P_2$  are the vapour pressures of pure liquid components, 1 and 2 respectively of an ideal binary solution if  $X_1$  represents the mole fraction of component 1, the total pressure of the solution formed by 1 and 2 will be  
 a)  $P_1 + X_1 (P_2 - P_1)$       b)  $P_2 - X_1 (P_2 + P_1)$       c)  $P_1 - X_2 (P_1 - P_2)$       d)  $P_1 + X_2 (P_1 - P_2)$
- Osometric pressure (p) of a solution is given by the relation  
 a)  $\pi = nRT$       b)  $\pi V = nRT$       c)  $\pi RT = n$       d) none of these

10. Which one of the following binary liquid mixtures exhibits positive deviation from Raoult's law ?  
 a) Acetone + chloroform b) Water + nitric acid c) HCl + water d) ethanol + water

11. The Henry's law constants for two gases A and B are x and y respectively. The ratio of mole fractions of A to B is 0.2. The ratio of mole fraction of B and A dissolved in water will be  
 a)  $2x/y$  b)  $y/0.2x$  c)  $0.2/y$  d)  $5x/y$

12. At  $100^{\circ}\text{C}$  the vapour pressure of a solution containing 6.5g a solute in 100g water is 732mm. If  $K_b = 0.52$ , the boiling point of this solution will be  
 a)  $102^{\circ}\text{C}$  b)  $100^{\circ}\text{C}$  c)  $101^{\circ}\text{C}$  d)  $100.52^{\circ}\text{C}$

13. According to Raoult's law, the relative lowering of vapour pressure for a solution is equal to  
 a) mole fraction of solvent b) mole fraction of solute  
 c) number of moles of solute d) number of moles of solvent

14. At same temperature, which pair of the following solutions are isotonic ?  
 a) 0.2 M  $\text{BaCl}_2$  and 0.2M urea b) 0.1 M glucose and 0.2 M urea  
 c) 0.1 M  $\text{NaCl}$  and 0.1 M  $\text{K}_2\text{SO}_4$  d) 0.1 M  $\text{Ba}(\text{NO}_3)_2$  and 0.1 M  $\text{Na}_2\text{SO}_4$

15. The empirical formula of a non-electrolyte(X) is  $\text{CH}_2\text{O}$ . A solution containing six gram of X exerts the same osmotic pressure as that of 0.025M glucose solution at the same temperature. The molecular formula of X is  
 a)  $\text{C}_2\text{H}_4\text{O}_2$  b)  $\text{C}_8\text{H}_{16}\text{O}_8$  c)  $\text{C}_4\text{H}_8\text{O}_4$  d)  $\text{CH}_2\text{O}$

16. The  $K_H$  for the solution of oxygen dissolved in water is  $4 \times 10^4$  atm at a given temperature. If the partial pressure of oxygen in air is 0.4 atm, the mole fraction of oxygen in solution is  
 a)  $4.6 \times 10^3$  b)  $1.6 \times 10^4$  c)  $1 \times 10^{-5}$  d)  $1 \times 10^5$

17. Normality of 1.25M sulphuric acid is  
 a) 1.25 N b) 3.75 N c) 2.5 N d) 2.25 N

18. Two liquids X and Y on mixing gives a warm solution. The solution is  
 a) ideal  
 b) non-ideal and shows positive deviation from Raoult's law  
 c) ideal and shows negative deviation from Raoult's Law  
 d) non-ideal and shows negative deviation from Raoult's Law

19. The relative lowering of vapour pressure of a sugar solution in water is  $3.5 \times 10^{-3}$ . The mole fraction of water in that solution is  
 a) 0.0035 b) 0.35 c) 0.0035 / 18 d) 0.9965

20. The mass of a non-volatile solute (molar mass 80 g  $\text{mol}^{-1}$ ) which should be dissolved in 92g of toluene to reduce its vapour pressure to 90%  
 a) 10g b) 20g c) 9.2 g d) 8.89g

21. For a solution, the plot of osmotic pressure (p) verses the concentration (c in  $\text{mol L}^{-1}$ ) gives a straight line with slope  $310R$  where 'R' is the gas constant. The temperature at which osmotic pressure measured is  
 a)  $310 \times 0.082 \text{ K}$  b)  $310^{\circ}\text{C}$  c)  $37^{\circ}\text{C}$  d)  $310 / 0.082 \text{ K}$

22. 200ml of an aqueous solution of a protein contains 1.26g of protein. At 300K, the osmotic pressure of this solution is found to be  $2.52 \times 10^{-3}$  bar. The molar mass of protein will be ( $R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$ )  
 a) 62.22 Kg mol<sup>-1</sup>      b) 12444g mol<sup>-1</sup>      c) 300g mol<sup>-1</sup>      d) none of these

23. The Van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is (NEET)  
 a) 0      b) 1      c) 2      d) 3

24. What is the molality of a 10% W/W aqueous sodium hydroxide solution ?  
 a) 2.778      b) 2.5      c) 10      d) 0.4

25. The correct equation for the degree of an associating solute, 'n' molecules of which undergoes association in solution, is  
 a)  $\alpha = \frac{n(i-1)}{n-1}$       b)  $\alpha^2 = \frac{n(1-i)}{(n-1)}$       c)  $\alpha = \frac{n(i-1)}{1-n}$       d)  $\alpha = \frac{n(1-i)}{(1-i)}$

26. Which of the following aqueous solutions has the highest boiling point ?  
 a) 0.1 M KNO<sub>3</sub>      b) 0.1 M Na<sub>3</sub>PO<sub>4</sub>      c) 0.1 M BaCl<sub>2</sub>      d) 0.1 M K<sub>2</sub>SO<sub>4</sub>

27. The freezing point depression constant for water is 1.86 K Kgmol<sup>-1</sup>. If 5g Na<sub>2</sub>SO<sub>4</sub> is dissolved in 45g water, the depression in freezing point is 3.64°C. The Vant Hoff factor for Na<sub>2</sub>SO<sub>4</sub> is  
 a) 2.5      b) 2.63      c) 3.64      d) 5.50

28. Equimolal aqueous solutions of NaCl and KCl are prepared. If the freezing point of NaCl is -2°C, the freezing point of KCl solution is expected to be  
 a) -2°C      b) -4°C      c) -1°C      d) 0°C

29. Phenol dimerises in benzene having van't Hoff factor 0.54. What is the degree of association ?  
 a) 0.46      b) 92      c) 46      d) 0.92

30. **Assertion :** An ideal solution obeys Raoult's Law  
**Reason :** In an ideal solution, solvent-solvent as well as solute-solute interactions are similar to solute-solvent interactions.  
 a) both assertion and reason are true and reason is the correct explanation of assertion  
 b) both assertion and reason are true but reason is not the correct explanation of assertion  
 c) assertion is true but reason is false      d) both assertion and reason are false.

## 10. Chemical Bonding

1. In which of the following Compounds does the central atom obey the octet rule?  
 a) XeF<sub>4</sub>      b) AlCl<sub>3</sub>      c) SF<sub>6</sub>      d) SCl<sub>2</sub>
2. In the molecule O<sub>A</sub> = C = O<sub>B</sub>, the formal charge on O<sub>A</sub>, C and O<sub>B</sub> are respectively.  
 a) -1, 0, + 1      b) +1, 0, -1      c) -2, 0, +2      d) 0, 0, 0
3. Which of the following is electron deficient?  
 a) PH<sub>3</sub>      b) (CH<sub>3</sub>)<sub>2</sub>      c) BH<sub>3</sub>      d) NH<sub>3</sub>
4. Which of the following molecule contain no  $\pi$  bond?  
 a) SO<sub>2</sub>      b) NO<sub>2</sub>      c) CO<sub>2</sub>      d) H<sub>2</sub>O



c) All five  $sp^3d$  hybrid orbitals are not equivalent out of these five  $sp^3d$  hybrid orbitals, three are at an angle of  $120^\circ$ , remainir two are perpendicular to the plane containing the other three.

d) none of these.

18. The molecules having same hybridisation, shape and number of lone pairs of electons are

a)  $SeF_4$ ,  $XeO_2F_2$       b)  $SF_4$ ,  $XeF_2$       c)  $XeOF_4$ ,  $TeF_4$       d)  $SeCl_4$ ,  $XeF_4$

19. In which of the following molecules / ions  $BF_3$ ,  $NO_2^-$ ,  $H_2O$  the central atom is  $sp^2$  hybridised?

a)  $NH_2^-$  and  $H_2O$       b)  $NO_2^-$  and  $H_2O$       c)  $BF_3$  and  $NO_2^-$       d)  $BF_3$  and  $NH_2^-$

20. Some of the following properties of two species,  $NO_3^-$  and  $H_3O^+$  are described below. which one of them is correct?

a) dissimilar in hybridisation for the central atom with different structure.  
 b) isostructural with same hybridisation for the Central atom.  
 c) different hybridiration for the central atom with same structure      d) none of these.

21. The types of hybridiration on the five carbon atom from right to left in the, 2,3 pentadiene.

a)  $sp^3, sp^2, sp, sp^2, sp^3$       b)  $sp^3, sp, sp, sp, sp^3$       c)  $sp^2, sp, sp^2, sp^2, sp^3$       d)  $sp^3, sp^3, sp^2, sp^3, sp^3$

22.  $XeF_2$  is isostructural with

a)  $SbCl_2$       b)  $BaCl_2$       c)  $TeF_2$       d)  $ICl_2^-$

23. The percentage of s-character of the hybrid orbitals in methane, ethane, ethene and ethyne are respectively

a) 25,25,33.3,50      b) 50,50,33.3,25      c) 50,25,33.3,50      d) 50,25,25,50

24. Of the following molecules, which have shape similar to carbon dioxide?

a)  $SnCl_2$       b)  $NO_2$       c)  $C_2H_2$       d) All of these.

25. According to VSEPR theory, the repulsion between different parts of electrons obey the order.VSEPR

a)  $l.p-l.p > b.p-b.p > l.p-b.p$       b)  $b.p-b.p > b.p-l.p > l.p-b.p$   
 c)  $l.p-l.p > b.p-l.p > b.p-b.p$       d)  $b.p-b.p > l.p-l.p > b.p-l.p$

26. Shape of  $ClF_3$  is

a) Planar triangular      b) Pyramidal      c) 'T' Shaped      d) none of these

27. Non- Zero dipole moment is shown by

a)  $CO_2$       b) p-dichlorobenzene      c) carbontetrachloride      d) water.

28. Which of the following conditions is not correct for resonating structures?

a) the contributing structure must have the same number of unpaired electrons  
 b) the contributing structures should have similar energies  
 c) the resonance hybrid should have higher energy than any of the contributing structure.  
 d) none of these.

29. Among the following, the compound that contains, ionic, covalent and Co-ordinate linkage is

a)  $NH_4Cl$       b)  $NH_3$       c)  $NaCl$       d) none of these

30.  $CaO$  and  $NaCl$  have the same crystal structure and approximately the same radii. If  $U$  is the lattice energy of  $NaCl$ , the approximate lattice energy of  $CaO$  is

a)  $U$       b)  $2U$       c)  $U/2$       d)  $4U$

## 11. Fundamentals of Organic Chemistry

1. Select the molecule which has only one  $\pi$  bond

a)  $\text{CH}_3\text{--CH=CH--CH}_3$  b)  $\text{CH}_3\text{--CH=CH--CHO}$  c)  $\text{CH}_3\text{--CH=CH--COOH}$  d) All of these

7 6 5 4 3 2 1

2. In the hydrocarbon  $\text{CH}_3\text{--CH}_2\text{--CH=CH--CH}_2\text{--C}\equiv\text{CH}$  the state of hybridisation of carbon 1,2,3,4 and 7 are in the following sequence.

a)  $\text{sp}, \text{sp}, \text{sp}^3, \text{sp}^2, \text{sp}^3$  b)  $\text{sp}^2, \text{sp}, \text{sp}^3, \text{sp}^2, \text{sp}^3$  c)  $\text{sp}, \text{sp}, \text{sp}^2, \text{sp}, \text{sp}^3$  d) none of these

3. The general formula for alkadiene is

a)  $\text{C}_n\text{H}_{2n}$  b)  $\text{C}_n\text{H}_{2n-1}$  c)  $\text{C}_n\text{H}_{2n-2}$  d)  $\text{C}_n\text{H}_{n-2}$

4. Structure of the compound whose IUPAC name is 5,6 - dimethylhept - 2 - ene is,

a) b) c) d) None of these

5.

The IUPAC name of the Compound is

a) 2,3 - Diethylheptane b) 3- Methyl -4- ethyloctane  
c) 5-ethyl -6-methyloctane d) 4-Ethyl -3 - methylheptane

6. Which one of the following names does not fit a real name?

a) 3 - Methyl -3-hexanone b) 4-Methyl -3- hexanone  
c) 3- Methyl -3- hexanol d) 2- Methyl cyclo hexanone.

7. The IUPAC name of the compound  $\text{CH}_3\text{--CH=CH--C}\equiv\text{CH}$  is

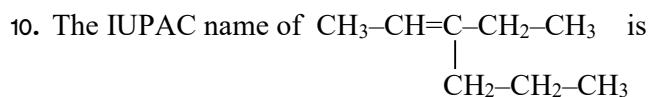
a) Pent - 4 - yn-2-ene b) Pent -3-en-1-yne  
c) pent - 2- en - 4 - yne d) Pent - 1 - yn -3 -ene

8. IUPAC name of  $\text{CH}_3\text{--C}(\text{CH}_3)\text{--CH}(\text{CH}_3)\text{--C}(\text{CH}_3)\text{--CH}_2\text{--CH}_3$  is

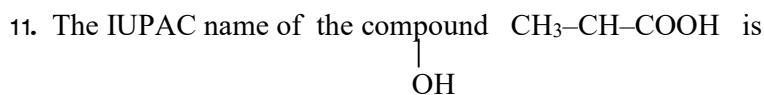
a) 3,4,4 - Trimethylheptane b) 2 - Ethyl -3, 3- dimethyl heptane  
c) 3, 4,4 - Trimethyloctane d) 2 - Butyl -2 -methyl - 3 - ethyl-butane

9. The IUPAC name of  $\text{H}_3\text{C} - \text{C}(\text{CH}_3)\text{--CH}=\text{C}(\text{CH}_3)_2$  is

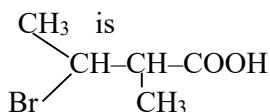
a) 2,4,4 - Trimethylpent -2-ene b) 2,4,4 - Trimethylpent -3-ene  
c) 2,2,4 - Trimethylpent -3-ene d) 2,2,4 - Trimethylpent -2-ene



a) 3 – Ethyl -2- hexene      b) 3 – Propyl -3- hexene  
 c) 4 – Ethyl – 4 – hexene      d) 3 – Propyl -2-hexene



a) 2 – Hydroxypropionic acid      b) 2 – Hydroxy Propanoic acid  
 c) Propan – 2 – ol – 1 – oic acid      d) 1 – Carboxyethanol



a) 2 – Bromo -3 – methyl butanoic acid      b) 2 - methyl - 3- bromobutanoic acid  
 c) 3 - Bromo - 2 - methylbutanoic acid      d) 3 - Bromo - 2, 3 - dimethyl propanoic acid



a)  $\text{CH}_3\text{--CH}_2\text{--CH}_2\text{--CH}_2\text{--}$       b)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{--C} \text{---} \text{CH}_3 \end{array}$   
 c)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{--CH} \text{---} \text{CH}_2\text{--} \end{array}$       d)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{--CH} \text{---} \text{CH}_2\text{--CH}_3 \end{array}$



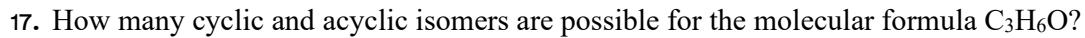
a) 1      b) 2      c) 3      d) 4



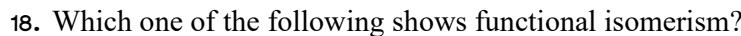
a) 3 – Chloropentane      b) 2 Chloro propane  
 c) Meso – tartaric acid      d) Glucose



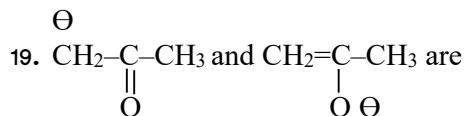
a) acetaldehyde      b) dimethylether      c) acetone      d) methyl carbinol



a) 4      b) 5      c) 9      d) 10



a) ethylene      b) Propane      c) ethanol      d)  $\text{CH}_2\text{Cl}_2$



a) resonating structure      b) tautomers  
 c) Optical isomers      d) Conformers

20. Nitrogen detection in an organic compound is carried out by Lassaigne's test. The blue colour formed is due to the formation of

a)  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$       b)  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$       c)  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_2$       d)  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_3$

21. Lassaigne's test for the detection of nitrogen fails in

a)  $\text{H}_2\text{N}-\text{CO}-\text{NH} \cdot \text{NH}_2 \cdot \text{HCl}$       b)  $\text{NH}_2-\text{NH}_2 \cdot \text{HCl}$   
 c)  $\text{C}_6\text{H}_5-\text{NH}-\text{NH}_2 \cdot \text{HCl}$       d)  $\text{C}_6\text{H}_5-\text{CONH}_2$

22. Connect pair of compounds which give blue colouration / precipitate and white precipitate respectively, when their Lassaigne's test is separately done.

a)  $\text{NH}_2-\text{NH}_2 \cdot \text{HCl}$  and  $\text{ClCH}_2-\text{CHO}$       b)  $\text{NH}_2-\text{CS}-\text{NH}_2$  and  $\text{CH}_3-\text{CH}_2\text{Cl}$   
 c)  $\text{NH}_2-\text{CH}_2-\text{COOH}$  and  $\text{NH}_2-\text{CONH}_2$       d)  $\text{C}_6\text{H}_5-\text{NH}_2$  and  $\text{ClCH}_2-\text{CHO}$ .

23. Sodium nitroprusside reacts with sulphide ion to give a purple colour due to the formation of

a)  $[\text{Fe}(\text{CN})_5 \text{NO}]^{3-}$       b)  $[\text{Fe}(\text{NO})_5 \text{CN}]^+$       c)  $[\text{Fe}(\text{CN})_5 \text{NOS}]^{4-}$       d)  $[\text{Fe}(\text{CN})_5 \text{NOS}]^{3-}$

24. An organic Compound weighing 0.15g gave on carius estimation, 0.12g of silver bromide. The percentage of bromine in the Compound will be close to

a) 46%      b) 34%      c) 3.4%      d) 4.6%

25. A sample of 0.5g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50mL of 0.5M  $\text{H}_2\text{SO}_4$ . The remaining acid after neutralisation by ammonia consumed 80mL of 0.5M  $\text{NaOH}$ , The percentage of nitrogen in the organic compound is

a) 14%      b) 28%      c) 42%      d) 56%

26. In an organic compound, phosphorus is estimated as

a)  $\text{Mg}_2\text{P}_2\text{O}_7$       b)  $\text{Mg}_3(\text{PO}_4)_2$       c)  $\text{H}_3\text{PO}_4$       d)  $\text{P}_2\text{O}_5$

27. Ortho and para-nitro phenol can be separated by

a) azeotropic distillation      b) destructive distillation  
 c) steam distillation      d) cannot be separated

28. The purity of an organic compound is determined by

a) Chromatography      b) Crystallisation      c) melting or boiling point      d) both (a) and (c)

29. A liquid which decomposes at its boiling point can be purified by

a) distillation at atmospheric pressure      b) distillation under reduced pressure  
 c) fractional distillation      d) steam distillation

30. **Assertion:**  $\text{CH}_3-\underset{\text{COOC}_2\text{H}_5}{\overset{|}{\text{C}}}=\text{CH}-\text{COOH}$  is 3- carbethoxy -2- butenoicacid

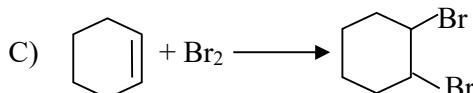
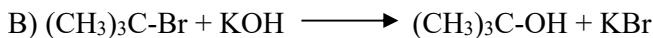


**Reason :** The principal functional group gets lowest number followed by double bond (or) triple bond.

a) both the assertion and reason are true and the reason is the correct explanation of assertion.  
 b) both assertion and reason are true and the reason is not the correct explanation of assertion.  
 c) assertion is true but reason is false      d) both the assertion and reason are false.

## 12. Basic concepts of organic reactions

1. For the following reactions



Which of the following statement is correct?

- (a) (A) is elimination, (B) and (C) are substitution
- (b) (A) is substitution, (B) and (C) are elimination
- (c) (A) and (B) are elimination and (C) is addition reaction
- (d) (A) is elimination, B is substitution and (C) is addition reaction.

2. What is the hybridisation state of benzyl carbonium ion?

a)  $\text{sp}^2$       b)  $\text{spd}^2$       c)  $\text{sp}^3$       d)  $\text{sp}^2\text{d}$

3. Decreasing order of nucleophilicity is

a)  $\text{OH}^- > \text{NH}_2^- > \text{OCH}_3^- > \text{RNH}_2^-$       b)  $\text{NH}_2^- > \text{OH}^- > \text{OCH}_3^- > \text{RNH}_2^-$   
 c)  $\text{NH}_2^- > \text{CH}_3\text{O}^- > \text{OH}^- > \text{RNH}_2^-$       d)  $\text{CH}_3\text{O}^- > \text{NH}_2^- > \text{OH}^- > \text{RNH}_2^-$

4. Which of the following species is not electrophilic in nature?

a)  $\text{Cl}^+$       b)  $\text{BH}_3$       c)  $\text{H}_3\text{O}^+$       d)  $^+\text{NO}_2$

5. Homolytic fission of covalent bond leads to the formation of

a) electrophile      b) nucleophile      c) Carbo cation      d) free radical

6. Hyper Conjugation is also known as

a) no bond resonance b) Baker - nathan effect      c) both (a)and (b)      d) none of these

7. Which of the group has highest  $+\text{I}$  effect?

a)  $\text{CH}_3^-$       b)  $\text{CH}_3\text{-CH}_2^-$       c)  $(\text{CH}_3)_2\text{-CH-}$       d)  $(\text{CH}_3)_3\text{-C-}$

8. Which of the following species does not exert a resonance effect?

a)  $\text{C}_6\text{H}_5\text{OH}$       b)  $\text{C}_6\text{H}_5\text{Cl}$       c)  $\text{C}_6\text{H}_5\text{NH}_2$       d)  $\text{C}_6\text{H}_5\text{NH}_3^+$

9.  $-\text{I}$  effect is shown by

a)  $-\text{Cl}$       b)  $-\text{Br}$       c) both (a) and (b)      d)  $-\text{CH}_3$

10. Which of the following carbocation will be most stable?

a)  $\text{Ph}_3\text{C}^+$       b)  $\text{CH}_3\text{-CH}_2^+$       c)  $(\text{CH}_3)_2\text{-CH}^+$       d)  $\text{CH}_2=\text{CH-CH}_2^+$

11. **Assertion:** Tertiary Carbocations are generally formed more easily than primary Carbocations ions.

**Reason :** Hyper conjugation as well as inductive effect due to additional alkyl group stabilize tertiary carbonium ions.

- a) both assertion and reason are true and reason is the correct explanation of assertion.
- b) both assertion and reason are true but reason is not the correct explanation of assertion.
- c) Assertion is true but reason is false      d) Both assertion and reason are false.

12. Heterolytic fission of C–C bond results in the formation of  
 a) free radical      b) Carbanion      c) Carbocation      d) Carbanion and Carbocation

13. Which of the following represent a set of nucleophiles?  
 a)  $\text{BF}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_2^-$     b)  $\text{AlCl}_3$ ,  $\text{BF}_3$ ,  $\text{NH}_3$     c)  $\text{CN}^-$ ,  $\text{RCH}_2^-$ ,  $\text{ROH}$     d)  $\text{H}^+$ ,  $\text{RNH}_3^+$ ,  $:\text{CCl}_2$

14. Which of the following species does not acts as a nucleophile?  
 a)  $\text{ROH}$       b)  $\text{ROR}$       c)  $\text{PCl}_3$       d)  $\text{BF}_3$

15. The geometrical shape of carbocation is  
 a) Linear      b) tetrahedral      c) Planar      d) Pyramidal

### 13. Hydrocarbons

1. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is (NEET)  
 a) the eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has torsional strain.  
 b) the staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.  
 c) the staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.  
 d) the staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has no torsional strain.

2.  $\text{C}_2\text{H}_5\text{Br} + 2\text{Na} \xrightarrow{\text{dry ether}} \text{C}_4\text{H}_{10} + 2\text{NaBr}$ . The above reaction is an example of which of the following.  
 a) Reimer Tiemann reaction    b) Wurtz reaction    c) Aldol condensation    d) Hoffmann reaction

3. An alkyl bromide (A) reacts with sodium in ether to form 4, 5– diethyloctane, the  
 a)  $\text{CH}_3(\text{CH}_2)_3\text{Br}$       b)  $\text{CH}_3(\text{CH}_2)_5\text{Br}$   
 c)  $\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{Br})\text{CH}_3$       d)  $\text{CH}_3-(\text{CH}_2)_2-\text{CH}(\text{Br})\text{CH}_2-\text{CH}_3$

4. The C – H bond and C – C bond in ethane are formed by which of the following types of overlap  
 a)  $\text{sp}^3 - \text{s}$  and  $\text{sp}^3 - \text{sp}^3$     b)  $\text{sp}^2 - \text{s}$  and  $\text{sp}^2 - \text{sp}^2$     c)  $\text{sp} - \text{sp}$  and  $\text{sp} - \text{sp}$     d)  $\text{p} - \text{s}$  and  $\text{p} - \text{p}$

5. In the following reaction

The major product obtained is

a)

b)

c)

d)

6. Which of the following is optically active  
 a) 2 – methyl pentane    b) citric acid    c) Glycerol    d) none of these

7. The compounds formed at anode in the electrolysis of an aqueous solution of potassium acetate are  
 a)  $\text{CH}_4$  and  $\text{H}_2$     b)  $\text{CH}_4$  and  $\text{CO}_2$     c)  $\text{C}_2\text{H}_6$  and  $\text{CO}_2$     d)  $\text{C}_2\text{H}_4$  and  $\text{Cl}_2$

8. The general formula for cyclo alkanes

a)  $C_nH_n$       b)  $C_nH_{2n}$       c)  $C_nH_{2n-2}$       d)  $C_nH_{2n+2}$

9. The compound that will react most readily with gaseous bromine has the formula (NEET)

a)  $C_3H_6$       b)  $C_2H_2$       c)  $C_4H_{10}$       d)  $C_2H_4$

10. Which of the following compounds shall not produce propene by reaction with HBr followed by elimination (or) only direct elimination reaction (NEET)

a)       b)  $CH_3-CH_2-CH_2-OH$       c)  $H_2C=C=O$       d)  $CH_3-CH_2-CH_2 Br$

11. Which among the following alkenes on reductive ozonolysis produces only propanone ?

a) 2 – Methyl propene      b) 2 – Methyl but – 2 - ene  
 c) 2, 3 – Dimethyl but – 1 – ene      d) 2, 3 – Dimethyl but – 2 – ene

12. The major product formed when 2 – bromo – 2 – methyl butane is refluxed with ethanolic KOH is

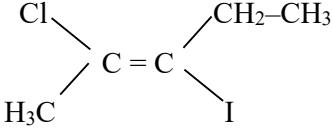
a) 2 – methylbut – 2 – ene      b) 2 – methyl butan – 1 – ol  
 c) 2 – methyl but – 1 – ene      d) 2 – methyl butan – 2 – ol

13. Major product of the below mentioned reaction is,

$(CH_3)_2C=CH_2 \xrightarrow{ICl}$

a) 2-chloro –1– iodo – 2 – methyl propane      b) 1–chloro–2–iodo–2–methylpropane  
 c) 1,2 – dichloro – 2 – methyl propane      d) 1, 2 – diiodo – 2 – methyl propane.

14. The IUPAC name of the following compound is

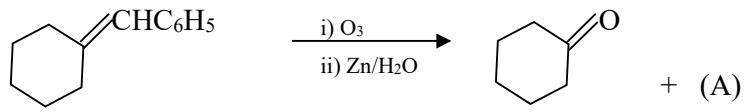


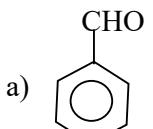
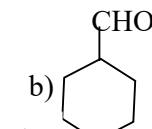
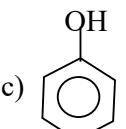
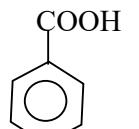
a) trans–2–chloro–3–iodo – 2 – pentene b) cis–3 – iodo – 4 – chloro – 3 – pentane  
 c) trans–3–iodo–4–chloro – 3 – pentene d) cis–2 – chloro – 3 – iodo – 2 – pentene

15. Cis – 2 – butene and trans – 2 – butene are

a) conformational isomers      b) structural isomers  
 c) configurational isomers      d) optical isomers

16. Identify the compound (A) in the following reaction



a)       b)   
 c)       d) 

17.  $CH_2-CH_2 \xrightarrow{(A)} CH \equiv CH$  where A is,

a) Zn      b) Con  $H_2SO_4$       c) alc. KOH      d) dil  $H_2SO_4$

18. Consider the nitration of benzene using mixed con H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub> if a large quantity of KHSO<sub>4</sub> is added to the mixture, the rate of nitration will be

a) unchanged      b) doubled      c) faster      d) slower

19. In which of the following molecules, all atoms are co-planar



d) both (a) and (b)

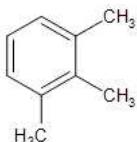
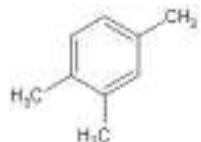
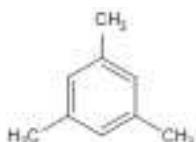
20. Propyne on passing through red hot iron tube gives

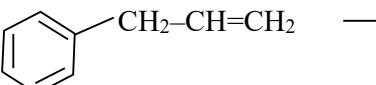
a)

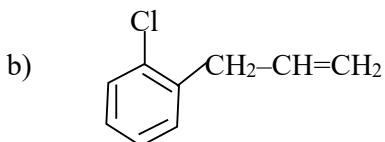
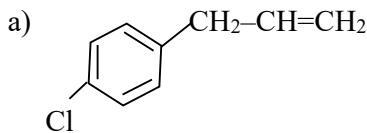
b)

c)

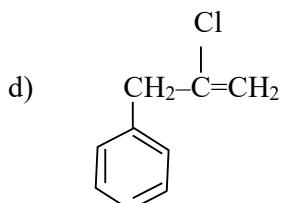
d) none of these



21.   $\xrightarrow{\text{HCl}}$  (A) is



c) a) and b)



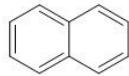
22. Which one of the following is non aromatic ?

a)

b)

c)

d)



23. Which of the following compounds will not undergo Friedal – crafts reaction easily ? (NEET)

a) Nitro benzene      b) Toluene      c) Cumene      d) Xylene

24. Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating ?

a) – COOH      b) – NO<sub>2</sub>      c) – C ≡ N      d) – SO<sub>3</sub>H

25. Which of the following can be used as the halide component for friedal - crafts reaction ?

a) Chloro benzene      b) Bromo benzene      c) chloro ethene      d) isopropyl chloride.

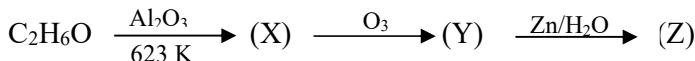
26. An alkane is obtained by decarboxylation of sodium propionate. Same alkane can be prepared by

a) Catalytic hydrogenation of propene      b) action of sodium metal on iodomethane  
c) reduction of 1 – chloro propane      d) reduction of bromomethane

27. Which of the following is aliphatic saturated hydrocarbon

a) C<sub>8</sub> H<sub>18</sub>      b) C<sub>9</sub> H<sub>18</sub>      c) C<sub>8</sub> H<sub>14</sub>      d) All of these

28. Identify the compound 'Z' in the following reaction



a) Formaldehyde      b) Acetaldehyde      c) Formic acid      d) none of these.

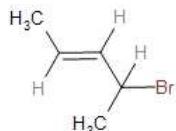
29. Peroxide effect (Kharasch effect) can be studied in case of

a) Oct - 4 - ene      b) hex - 3 - ene      c) pent - 1 - ene      d) but - 2 - ene

30. 2 - butyne on chlorination gives

a) 1 - chloro butane      b) 1, 2 - dichloro butane  
c) 1, 1, 2, 2 - tetrachlorobutane      d) 2, 2, 3, 3 - tetra chloro butane

#### 14. Haloalkanes and Haloarenes



1. The IUPAC name of is

a) 2-Bromo pent - 3 - ene      b) 4-Bromo pent - 2 - ene  
c) 2-Bromo pent - 4 - ene      d) 4-Bromo pent - 1 - ene

2. Of the following compounds, which has the highest boiling point?

a) n-Butyl chloride      b) Isobutyl chloride  
c) t-Butyl chloride      d) n-propyl chloride

3. Arrange the following compounds in increasing order of their density

A) CCl<sub>4</sub>      B) CHCl<sub>3</sub>      C) CH<sub>2</sub>Cl<sub>2</sub>      D) CH<sub>3</sub>Cl  
a) D < C < B < A      b) C > B > A > D      c) A < B < C < D      d) C > A > B > D

4. With respect to the position of - Cl in the compound CH<sub>3</sub>-CH = CH-CH<sub>2</sub>-Cl, it is classified as

a) Vinyl      b) Allyl      c) Secondary      d) Aralkyl

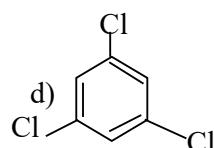
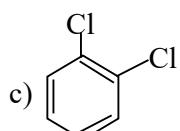
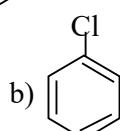
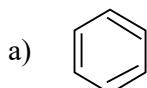
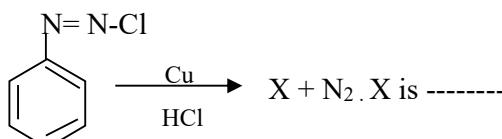
5. What should be the correct IUPAC name of diethyl chloromethane?

a) 3 - Chloro pentane      b) 1-Chloropentane  
c) 1-Chloro-1, 1, diethyl methane      d) 1 -Chloro-1-ethyl propane

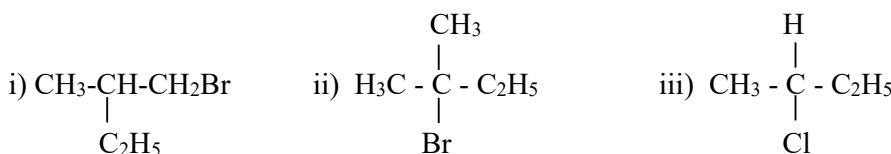
6. C -X bond is strongest in

a) Chloromethane      b) Iodomethane      c) Bromomethane      d) Fluoromethane

7. In the reaction



8. Which of the following compounds will give racemic mixture on nucleophilic substitution by OH- ion?



a) (i)      b) (ii) and (iii)      c) (iii)      d) (i) and (ii)

9. The treatment of ethyl formate with excess of RMgX gives



10. Benzene reacts with  $\text{Cl}_2$  in the presence of  $\text{FeCl}_3$  and in absence of sunlight to form

a) Chlorobenzene      b) Benzyl chloride      c) Benzal chloride      d) Benzene hexachloride

11. The name of  $\text{C}_2\text{F}_4\text{Cl}_2$  is \_\_\_\_\_

a) Freon – 112      b) Freon – 113      c) Freon – 114      d) Freon – 115

12. Which of the following reagent is helpful to differentiate ethylene dichloride and ethylidene chloride?

a)  $\text{Zn}$  / methanol      b)  $\text{KOH}$  / ethanol      c) aqueous  $\text{KOH}$       d)  $\text{ZnCl}_2$  / Con HCl

13. Match the compounds given in Column I with suitable items given in Column II

	<b>Column I (Compound)</b>		<b>Column II (Uses)</b>
A	Iodoform	1	Fire extinguisher
B	Carbon tetra chloride	2	Insecticide
C	CFC	3	Antiseptic
D	DDT	4	Refrigerants

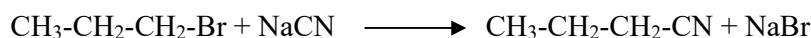
	A	B	C	D
a	2	4	1	3
b	3	2	4	1
c	1	2	3	4
d	3	1	4	2

14. **Assertion:** In mono haloarenes, electrophilic substitution occurs at ortho and para positions.

**Reason :** Halogen atom is a ring deactivator.

a) If both assertion and reason are true and reason is the correct explanation of assertion.  
 b) If both assertion and reason are true but reason is not the correct explanation of assertion.  
 c) If assertion is true but reason is false.  
 d) If both assertion and reason are false.

15. Consider the reaction,



This reaction will be the fastest in

- a) ethanol
- b) methanol
- c) DMF (N, N' – dimethyl formamide)
- d) water

16. Freon-12 is manufactured from tetrachloro methane by

- a) Wurtz reaction
- b) Swarts reaction
- c) Haloform reaction
- d) Gattermann reaction

17. The most easily hydrolysed molecule under S<sub>N</sub>1 condition is

- a) allyl chloride
- b) ethyl chloride
- c) isopropylchloride
- d) benzyl chloride

18. The carbo cation formed in S<sub>N</sub>1 reaction of alkyl halide in the slow step is

- a) sp<sup>3</sup> hybridised
- b) sp<sup>2</sup> hybridised
- c) sp hybridised
- d) none of these

19. The major products obtained when chlorobenzene is nitrated with HNO<sub>3</sub> and con H<sub>2</sub>SO<sub>4</sub>

- a) 1-chloro-4-nitrobenzene
- b) 1-chloro-2-nitrobenzene
- c) 1-chloro-3-nitrobenzene
- d) 1-chloro-1-nitrobenzene

20. Which one of the following is most reactive towards nucleophilic substitution reaction ?



21. Ethylidene chloride on treatment with aqueous KOH gives

- a) acetaldehyde
- b) ethyleneglycol
- c) formaldehyde
- d) glycoxal

22. The raw material for Rasching process

- a) chloro benzene
- b) phenol
- c) benzene
- d) anisole

23. Chloroform reacts with nitric acid to produce

- a) nitro toluene
- b) nitro glycerine
- c) chloropicrin
- d) chloropicric acid

24. acetone  $\xrightarrow{\substack{\text{i) } \text{CH}_3\text{MgI} \\ \text{ii) H}_2\text{O/H}^{\text{-}}}}$  X. X, is

- a) 2-propanol
- b) 2-methyl-2-propanol
- c) 1-propanol
- d) acetonol

25. Silverpropionate when refluxed with Bromine in carbontetrachloride gives

- a) propionic acid
- b) chloro ethane
- c) bromo ethane
- d) chloro propane

## 15. Environmental Chemistry

1. The gaseous envelope around the earth is known as atmosphere. The region lying between an altitudes of 11-50 km is \_\_\_\_\_
  - a) Troposphere
  - b) Mesosphere
  - c) Thermosphere
  - d) stratosphere
2. Which of the following is natural and human disturbance in ecology?
  - a) Forest fire
  - b) Floods
  - c) Acid rain
  - d) Green house effect
3. Bhopal Gas Tragedy is a case of \_\_\_\_\_
  - a) thermal pollution
  - b) air pollution
  - c) nuclear pollution
  - d) land pollution

4. Haemoglobin of the blood forms carboxy haemoglobin with
  - a) Carbon dioxide
  - b) Carbon tetra chloride
  - c) Carbon monoxide
  - d) Carbonic acid
5. Which sequence for green house gases is based on GWP?
  - a) CFC > N<sub>2</sub>O > CO<sub>2</sub> > CH<sub>4</sub>
  - b) CFC > CO<sub>2</sub> > N<sub>2</sub>O > CH<sub>4</sub>
  - c) CFC > N<sub>2</sub>O > CH<sub>4</sub> > CO<sub>2</sub>
  - d) CFC > CH<sub>4</sub> > N<sub>2</sub>O > CO<sub>2</sub>
6. Photo chemical smog formed in congested metropolitan cities mainly consists of
  - a) Ozone, SO<sub>2</sub> and hydrocarbons
  - b) Ozone, PAN and NO<sub>2</sub>
  - c) PAN, smoke and SO<sub>2</sub>
  - d) Hydrocarbons, SO<sub>2</sub> and CO<sub>2</sub>
7. The pH of normal rain water is
  - a) 6.5
  - b) 7.5
  - c) 5.6
  - d) 4.6
8. Ozone depletion will cause
  - a) forest fires
  - b) eutrophication
  - c) bio magnification
  - d) global warming
9. Identify the wrong statement in the following
  - a) The clean water would have a BOD value of more than 5 ppm
  - b) Greenhouse effect is also called as Global warming
  - c) Minute solid particles in air is known as particulate pollutants
  - d) Biosphere is the protective blanket of gases surrounding the earth
10. Living in the atmosphere of CO is dangerous because it
  - a) Combines with O<sub>2</sub> present inside to form CO<sub>2</sub>
  - b) Reduces organic matter of tissues
  - c) Combines with haemoglobin and makes it incapable to absorb oxygen
  - d) Diluted the blood
11. Release of oxides of nitrogen and hydrocarbons into the atmosphere by motor vehicles is prevented by using \_\_\_\_\_
  - a) grit chamber
  - b) scrubbers
  - c) trickling filters
  - d) catalytic convertors
12. Biochemical oxygen Demand value less than 5 ppm indicates a water sample to be
  - a) highly polluted
  - b) poor in dissolved oxygen
  - c) rich in dissolved oxygen
  - d) low COD
13. Match the List I with List II and select the correct answer using the code given below the lists.

List I		List II	
A	Depletion of ozone layer	1	CO <sub>2</sub>
B	Acid rain	2	NO
C	Photochemical smog	3	SO <sub>2</sub>
D	Green house effect	4	CFC

**Code:**

	A	B	C	D
A	3	4	1	2
b	2	1	4	3
C	4	3	2	1
d	2	4	1	3

14.

List I		List II	
A	Stone leprosy	1	CO
B	Biological magnification	2	Green house gases
C	Global warming	3	Acid rain
D	Combination with haemoglobin	4	DDT

**Code:**

	A	B	C	D
a	1	2	3	4
b	3	4	2	1
c	2	3	4	1
d	4	2	1	3

15. **Assertion (A):** If BOD level of water in a reservoir is more than 5 ppm it is highly polluted.**Reason(R) :** High biological oxygen demand means high activity of bacteria in water.

- a) Both (A) and R are correct and (R) is the correct explanation of (A)
- b) Both (A) and R are correct and (R) is not the correct explanation of (A)
- c) Both (A) and R are not correct
- d) (A) is correct but (R) is not correct.

16. **Assertion (A):** Excessive use of chlorinated pesticide causes soil and water pollution.**Reason (R) :** Such pesticides are non-biodegradable.

- a) Both (A) and R are correct and (R) is the correct explanation of (A)
- b) Both (A) and R are correct and (R) is not the correct explanation of (A)
- c) Both (A) and R are not correct
- d) (A) is correct but (R) is not correct.

17. **Assertion (A):** Oxygen plays a key role in the troposphere.

**Reason (R):** Troposphere is not responsible for all biological activities.

- a) Both (A) and R are correct and (R) is the correct explanation of (A)
- b) Both (A) and R are correct and (R) is not the correct explanation of (A)
- c) Both (A) and R are not correct
- d) (A) is correct but (R) is not correct.

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