11th Chemistry Book Back Questions - New Book

1.Basic Concepts of Chemistry and Chemical Calculations

I. Choose the Correct Answer

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 CO_2 gas** (b) 40 ml CO_2 gas and 80 ml H_2O gas
   (c) 60 ml CO_2 gas and 60 ml H_2O gas (d) 120 ml CO_2 gas
2. An element X has the following isotopic composition ^{200}X = 90 %, ^{199}X = 8 % and ^{202}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 x 10^{23} molecules of glucose
   Reason : Total number of entities present in one mole of any substance is equal to 6.02 x 10^{22}
   (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^{-1} 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 x10^{26} (b) 6.022 x 10^{23}
   (c) **6.022 x 10^{20}** (d) 9.9 x 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 H2 (g) is mixed with 11.2 litres of Cl2 (g), each at 273 K at 1 atm the moles of HCl (g), formed is equal to
   (a) 2 moles of HCl (g) (b) 0.5 moles of HCl (g)
   (c) 1.5 moles of HCl (g) (d) **1 moles of HCl (g)**
10. Hot concentrated sulphuric acid is a moderately strong oxidising agent. Which of the following reactions does not show oxidising behaviour?
    (a) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$
    (b) $C + 2H_2SO_4 \rightarrow CO2 + 2SO_2 + 2H_2O$
    (c) **$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$**

(d) none of the above

11. Choose the disproportionation reaction among the following redox reactions.
    (a) $3Mg\ (s) + N_2\ (g) \rightarrow Mg_3N_2\ (s)$
    (b) **$P_4\ (s) + 3NaOH + 3H_2O \rightarrow PH_3(g) + 3NaH_2PO_2\ (aq)$**
    (c) $Cl_2\ (g) + 2KI(aq) \rightarrow 2KCl(aq) + I_2$
    (d) $Cr_2O_3\ (s) + 2Al\ (s) \rightarrow Al_2O_3(s) + 2Cr(s)$
12. The equivalent mass of potassium permanganate in alkaline medium is
    $MnO4^- + 2H_2O + 3e^- \rightarrow MnO_2 + 4OH^-$
    (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) 6.02×10^{23} / 180 molecules of water (d) **6.022×10^{24} molecules of water**
14. 7.5 g of a gas occupies a volume of 5.6 litres at 0^0 C and 1 atm pressure. The gas is
    (a) **NO** (b) N_2O (c) CO (d) CO_2
15. Total number of electrons present in 1.7 g of ammonia is
    (a) **6.022×10^{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
    $SO_4^{2-}, SO_3^{2-}, S_2O_4^{2-}, S_2O_6^{2-}$
    (a) $SO_3^{2-} < SO_4^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$ (b) $SO_4^{2-} < S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$
    (c) **$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-} < SO_4^{2-}$** (d) $S_2O_6^{2-} < S_2O_4^{2-} < SO_4^{2-} < SO_3^{2-}$
17. The equivalent mass of ferrous oxalate is
    (a) molar mass of ferrous oxalate / 1 (b) molar mass of ferrous oxalate / 2
    (c) **molar mass of ferrous oxalate / 3** (d) none of these
18. If Avogadro number were changed from 6.02×10^{23} to 6.022×10^{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_2 and 8 g of SO_2 respectively at 273 K 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 $AgNO_3$ is mixed with 100 ml of 1.865 % potassium chloride solution?
    (a) **3.59 g** (b) 7 g (c) 14 g (d) 28 g
21. The mass of a gas that occupies a volume of 612.5 ml at room temperature and pressure (25^0 c and 1 atm pressure) is 1.1g. The molar mass of the gas is
    (a) 66.25 g mol^{-1} (b) **44 g mol^{-1}**
    (c) 24.5 g mol^{-1} (d) 662.5 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 (C_2H_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 x 10^{22} carbon atoms.
(d) all of these

25. Which one of the following is used as a standard for atomic mass.
(a) $_6\mathbf{C^{12}}$ (b) $_7C^{12}$ (c) $_6C^{13}$ (d) $_6C^{14}$

2.Quantum Mechanical Model of Atom

I. Choose the correct answer

1. Electronic configuration of species 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) 6.67×10^{15}J b) 6.67×10^{11}J
c) $\mathbf{4.42 \times 10^{-18}J}$ d) 4.42×10^{-15}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 λ_1 and λ_2 will be
a) $\lambda_1 / \lambda_2 = 1$ b) $\boldsymbol{\lambda_1 = 2\ \lambda_2}$
c) $\lambda_1 = \sqrt{25} \times \sqrt{50}\ \lambda_2$ 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 $E = -2.178 \times 10^{-18}$ 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 He^+ is expected to be similar to that of hydrogen
Reason : 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 ? **ANSWER: C**

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) [Xe] $4f^6\ 5d^1\ 6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [Xe] $4f^8\ 5d^1\ 6s^2$
b) **[Xe] $4f^7$, $6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [Xe] $4f^9\ 6s^2$**
c) [Xe] $4f^7$, $6s^2$, [Xe] $4f^8\ 6s^2$ and [Xe] $4f^8\ 5d^1\ 6s^2$
d) [Xe] $4f^6\ 5d^1\ 6s^2$, [Xe] $4f^7\ 5d^1\ 6s^2$ and [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 **ANSWER: D**

a) $\frac{\sqrt{2}h}{2\pi}$ b) $\frac{\sqrt{2h}}{2\pi}$ c) $\frac{\sqrt{2\times4}\ h}{2\pi}$ d) $\frac{\sqrt{6}\ h}{2\pi}$

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 → (n − 2) f → (n − 1)d → np** b) ns → (n − 1) d → (n − 2) f → np
c) ns → (n − 2) f → np → (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 $3d_{x^2-y^2}$ 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 **ANSWER: C**

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

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

a) 6.6×10^{-29} cm b) 6.6×10^{-30} cm
c) 6.6×10^{-31} cm d) 6.6×10^{-32} cm

22. The ratio of de Broglie wavelengths of a deuterium atom to that of an α - 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 Schnodinger wave equation is **ANSWER: A**

a) $\hat{H}\psi = E\psi$ b) $\nabla^2\psi + \frac{8\pi^2 m}{h^2}(E+V)\psi = 0$

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 ? **ANSWER: D**

a) $\Delta x . \Delta p \geq h/4\pi$ b) $\Delta x . \Delta v \geq h/4\pi m$

c) $\Delta E . \Delta t \geq h/4\pi$ d) $\Delta E . \Delta x \geq h/4\pi$

3.PERIODIC CLASSIFICATION OF ELEMENTS

I. Choose the correct answer:

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

a) bibibiium b) bididium c) didibium 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) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$ (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 kJ mol-1) of an element are given below.

IE_1	IE_2	IE_3	IE_4	IE_5
577.5	1810	2750	11580	14820

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) Na > Al > Mg > Si > P b) **Na < Al < Mg < Si < P**

c) Mg > Na > Si > P > Al d) Na< Al < Mg < Si < P

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) Al < O < C < Ca < F b) Al < Ca < O < C < F

c) C < F < O < Al < Ca d) **Ca < Al < C < O < 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) I > Br > Cl > F b) F > Cl > Br > I

c) **Cl > F > Br > I** d) Br > I > Cl > F

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

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) **Y > Z > X > A** b) Z > A > Y > X

c) X > Y > Z > A d) X > Y > A > 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) $1s^2, 2s^2, 2p^6, 3s^2, 3s^2, 3p^6, 4s^1$ 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 kcal mol^{-1} respectively. The energy required for the reaction

$Mg \rightarrow Mg^{2+} + 2\ e^-$ is

a) +169 kcal mol^{-1} b) - 169 kcal mol^{-1}

c) **+ 527 kcal mol^{-1}** d) - 527 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) $H^- > H^+ > H$ b) $Na^+ > F^- > O^{2-}$

c) $F > O^{2-} > Na^+$ d) **None of these**

20. The First ionisation potential of Na, Mg and Si are 496, 737 and 786 kJ mol^{-1} respectively. The ionisation potential of Al will be closer to

a) 760 kJ mol^{-1} b) **575 kJ mol^{-1}**

c) 801 kJ mol^{-1} d) 419 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 Mg c) Be and B d) **Be and Al**

4.HYDROGEN

I. Choose the correct answer

1. Which of the following statements about hydrogen is incorrect ?
   a) Hydrogen ion, H_3O^+ 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) H_2O (g) b) CO + H_2O c) **CO + H_2** d) CO + N_2
3. Which one of the following statements is incorrect with regard to ortho and para dihydrogen ?
   a) They are nuclear spin isomers
   b) **Ortho isomer has zero nuclear spin whereas the para isomer has one nuclear spin**
   c) The para isomer is favoured at low temperatures
   d) The thermal conductivity of the para isomer is 50% greater than that of the orthoisomer.
4. Ionic hydrides are formed by
   a) halogens b) chalogens c) inert gases d) **group one elements**
5. Tritium nucleus contains
   a) 1p + 0 n b) 2 p + 1n c) **1p + 2n** d) none of these
6. Non-stoichiometric hydrides are formed by
   a) **palladium, vanadium** b) carbon, nickel
   c) manganese, lithium d) 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
   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
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
   a) **1.2 g** b) 2.4 g c) 3.6 g d) √4.8 g
9. The hardness of water can be determined by volumetrically using the reagent
   a) sodium thio sulphate b) potassium permanganate
   c) hydrogen peroxide d) **EDTA**
10. The cause of permanent hardness of water is due to
    a) $Ca(HCO_3)_2$ b) $Mg(HCO_3)_2$ c) **$CaCl_2$** d) $MgCO_3$
11. Zeolite used to soften hardness of water is, hydrated

a) **Sodium aluminium silicate** b) Calcium aluminium silicate
c) Zinc aluminium borate d) Lithium aluminium hydride

12. A commercial sample of hydrogen peroxide marked as 100 volume H_2O_2, it means that
a) **1 ml of H_2O_2 will give 100 ml O_2 at STP**
b) 1 L of H_2O_2 will give 100 ml O_2 at STP
c) 1 L of H_2O_2 will give 22.4 L O_2
d) 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
a) Cr_2O_3 b) CrO_4^{2-} c) **$CrO(O_2)_2$** d) none of these

14. For decolourisation of 1 mole of acidified KMnO4, the moles of H_2O_2 required is
a) ½ b) 3/2 c) **5/2** d) 7/2

15. Volume strength of 1.5 N H_2O_2 is
a) 1.5 b) 4.5 c) 16.8 d) **8.4**

16. The hybridisation of oxygen atom is H_2O and H_2O_2 are, respectively
a) sp and sp^3 b) sp and sp c) sp and sp^2 d) **sp^3 and sp^3**

17. The reaction $H_3PO_2 + D_2O \rightarrow H_2DPO_2 + HDO$ indicates that hypo-phosphorus acid is
a) tribasic acid b) dibasic acid
c) **mono basic acid** d) none of these

18. In solid ice, oxygen atom is surrounded
a) **tetrahedrally by 4 hydrogen atoms**
b) octahedrally by 2 oxygen and 4 hydrogen atoms
c) tetrahedrally by 2 hydrogen and 2 oxygen atoms
d) octahedrally by 6 hydrogen atoms

19. The type of H-bonding present in ortho nitro phenol and p-nitro phenol are respectively
a) inter molecular H-bonding and intra molecular H-bonding
b) **intra molecular H-bonding and inter molecular H-bonding**
c) intra molecular H - bonding and no H - bonding
d) intra molecular H - bonding and intra molecular H – bonding

20. Heavy water is used as
a) modulator in nuclear reactions b) coolant in nuclear reactions
c) **both (a) and (b)** d) none of these

21. Water is a
a) basic oxide b) acidic oxide
c) **amphoteric oxide** d) none of these

5. Alkali and Alkaline Earth Metals

I. Choose the correct answer:

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) **Li^+ has minimum degree of hydration among alkali metal cations.**
   b) The oxidation state of K in KO_2 is +1
   c) Sodium is used to make Na / Pb alloy
   d) $MgSO_4$ is readily soluble in water
3. Which of the following compounds will not evolve 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

$$M^+(g) \xrightarrow[\text{Medium}]{\text{Aqueous}} M^+(aq)$$

   a) Na b) **Li** c) Rb d) K
5. Sodium is stored in
   a) alcohol b) water c) **kerosene** d) none of these
6. 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. Incase of alkali metal halides, the ionic character increases in the order
   a) MF < MCl < MBr < MI b) **MI < MBr < MCl < MF**
   c) MI < MBr < MF < 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 CaC_2 is
   a) $Ca(CN)_3$ b) CaN_2 c) **$Ca(CN)_2$** d) Ca_3N_2
12. Which of the following has highest hydration energy
   a) **$MgCl_2$** b) $CaCl_2$ c) $BaCl_2$ d) $SrCl_2$
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) 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
c) assertion is true but reason is false
d) **both assertion and reason are false**

15. Assertion : $BeSO_4$ is soluble in water while $BaSO_4$ is not
Reason : Hydration energy decreases down the group from Be to Ba and lattice energy remains almost constant.
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

16. Which is the correct sequence of solubility of carbonates of alkaline earth metals ?
a) $BaCO_3 > SrCO_3 > CaCO_3 > MgCO_3$
b) **$MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$**
c) $CaCO_3 > BaCO_3 > SrCO_3 > MgCO_3$
d) $BaCO_3 > CaCO_3 > SrCO_3 > MgCO_3$

17. In context with beryllium, which one of the following statements is incorrect ?
a) It is rendered passive by nitric acid
b) It forms Be_2C
c) **Its salts are rarely hydrolysed**
d) Its hydride is electron deficient and polymeric

18. The suspension of slaked lime in water is known as
a) lime water b) quick lime
c) **milk of lime** d) aqueous solution of slaked lime

19. A colourless solid substance (A) on heating evolved CO_2 and also gave a white residue, soluble in water. Residue also gave CO_2 when treated with dilute HCl.
a) Na_2CO_2 b) **$NaHCO_3$** c) $CaCO_3$ d) $Ca(HCO_3)_2$

20. The compound (X) on heating gives a colourless gas and a residue that is dissolved in water to obtain (B). Excess of CO_2 is bubbled through aqueous solution of B, C is formed. Solid (C) on heating gives back X. (B) is
a) $CaCO_3$ b) **$Ca(OH)_2$** c) Na_2CO_3 d) $NaHCO_3$

21. Which of the following statement is false ?
a) **Ca^{2+} ions are not important in maintaining the regular beating of the heart**
b) Mg^{2+} ions are important in the green parts of the plants
c) Mg^{2+} ions form a complex with ATP
d) Ca^{2+} ions are important in blood clotting

22. The name 'Blue John' is given to which of the following compounds ?
a) CaH_2 b) **CaF_2** c) $Ca_3(PO_4)_2$ d) CaO

23. Formula of Gypsum is
a) **$CaSO_4 . 2H_2O$** b) $CaSO_4 . ½ H_2O$
c) $3 CaSO_4 . H_2O$ d) $2CaSO_4 . 2H_2O$

24. When CaC_2 is heated in atmospheric nitrogen in an electric furnace the compound formed is
a) $Ca(CN)_2$ b) **CaNCN**
c) CaC_2N_2 d) $CaNC_2$

25. Among the following the least thermally stable is
(a) K_2CO_3 b) Na_2CO_3
(c) $BaCO_3$ d) **Li_2CO_3**

6.Gaseous State

I. Choose the correct answer:

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) $\left(P+\frac{a}{n^2V^2}\right)(V-nb)=nRT$ (b) $\left(P+\frac{na}{n^2V^2}\right)(V-nb)=nRT$
(c) $\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$ (d) $\left(P+\frac{n^2a^2}{V^2}\right)(V-nb)=nRT$

ANSWER: C

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 × 273 × 298

6. The temperatures 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

7. In a closed room of 1000 m^3 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

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 $dm^3 atm.$ b) 0.987 cal mol^{-1} K^-

c) **8.3 J $mol^{-1}K^{-1}$** d) 8 erg $mol^{-1}K^{-1}$

11. Use of hot air balloon in sports at 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 $(dm^3)^2 atm.$ mol^{-2}

Gas	O_2	N_2	NH_3	CH_4
a	1.360	1.390	4.170	2.253

The gas which can be most easily liquefied is

a) O_2 b) N_2 c) **NH_3** d) CH_4

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_2 at 400 K and 71.0 bar is 0.8697. The molar volume of CO_2 under these conditions is

a) 22.04 dm^3 b) 2.24 dm^3 c) **0.41 dm^3** d) 19.5 dm^3

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_nH_{2n-2}. 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 α 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) CH_4 (g) b) **NH_3 (g)** c) H_2 (g) d) N_2 (g)

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

a) mol L^{-1} and L atm^2 mol^{-1} b) mol L and L atm mol^2

c) **$mol^{-1}L$ and L^2 atm mol^{-2}** d) none of these

22. Assertion : Critical temperature of CO_2 is 304K, it can be liquefied above 304K.

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

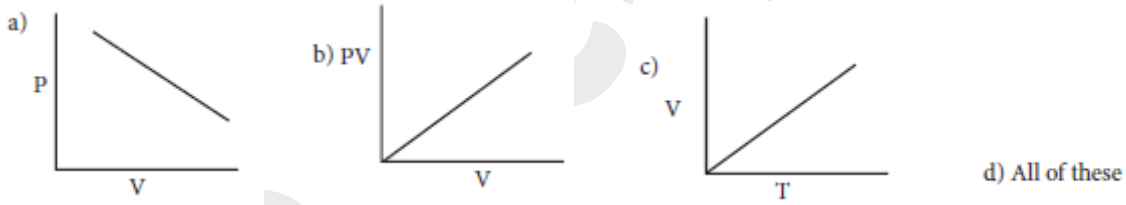
c) assertion is true but reason is false

d) **both assertion and reason are false**

23. What is the density of N_2 gas at 227^0C and 5.00 atm pressure? (R = 0.082 L atm K^{-1} 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) **ANSWER: C**



d) All of these

25. 25g of each of the following gases are taken at 27oC and 600 mm Hg pressure. Which of these will have the least volume ?

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

7.THERMODYNAMICS

I. Choose the correct answer

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

a) ΔE b) **ΔH** c) ΔS d) ΔG

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 Δ V= 0

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

a) > 0 b) > 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) **mass/volume**

7. An ideal gas expands from the volume of 1×10^{-3} m^3 to 1×10^{-2} m^3 at 300 K against a constant pressure at 1×10^5 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 CO2 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) → C(graphite), ΔH = −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 Al_2O_3 and Cr_2O_3 are − 1596 kJ and − 1134 kJ, respectively. ΔH for the reaction $2Al + Cr_2O_3 \rightarrow 2Cr + Al_2O_3$ 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 mol^{-1}) reacts with hydrochloric acid in an open beaker at 25^0 C

a) **− 2.48 kJ** b) − 2.22 kJ c) + 2.22 kJ d) + 2.48 kJ

16. The value of ΔH for cooling 2 moles of an ideal monatomic gas from 125^0 C to 25^0 C at constant pressure will be [given $C_p = 5/2R$]

a) − 250 R b) **− 500 R** c) 500 R d) + 250 R

17. Given that $C(g) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^0 = -a$ kJ; $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ $\Delta H^0 = -b$ kJ; Calculate the ΔH^0 for the reaction $C(g) + 1/2\ O_2(g) \rightarrow CO(g)$ **ANSWER: D**

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 0^0 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 (ΔH_c (CH_4) = − 890 kJ mol^{-1} and ΔH_c(C_3H_8) = − 2220 kJ mol^{-1})

a) − 889 kJ b) − 1390 kJ c) − 3180 kJ d) **− 653.66 kJ**

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

a) 170 kJ mol^{-1} b) 50 kJ mol^{-1} c) **80 kJ mol^{-1}** d) 220 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, ΔS and w are respectively

a) +, −, − b) −, +, − c) +, −, + d) **−, −, +**

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

a) 323 K b) **27^0 C** c) 164 K d) 0.3 K

24. ΔS is expected to be maximum for the reaction

a) $Ca(S) + 1/2\ O_2(g) \rightarrow CaO(S)$

b) $C(S) + O_2(g) \rightarrow CO_2(g)$

c) $N_2(g) + O_2(g) \rightarrow 2NO(g)$

d) **$CaCO_3(S) \rightarrow CaO(S) + CO_2(g)$**

25. The values of ΔH and ΔS for a reaction are respectively 30 kJ mol^{-1} and 100 JK^{-1} mol^1. Then the temperature above which the reaction will become spontaneous is

a) **300 K** b) 30 K c) 100 K d) 20^0C

8.Physical and Chemical Equilibrium

I. Choose the correct answer

1. If K_b and K_f for a reversible reactions are 0.8×10^{-5} and 1.6×10^{-4} respectively, the value of the equilibrium constant is,

a) **20** b) 0.2×10^{-1} c) 0.05 d) none of these

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

$$3A_2 + B_2 + 2C \xleftrightarrow{K_1} 2A_3BC \text{ and}$$

$$A_3BC \xleftrightarrow{K_2} 3/2\,[A_2] + \frac{1}{2}B_2 + C$$

The relation between K_1 and K_2 is **ANSWER: B**

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 K1 and that at 700 K is K2. If K1 > K2, 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

   $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$

   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. K1 and K2 are the equilibrium constants for the reactions respectively.

   $N_2(g) + O_2(g) \overset{K_1}{\rightleftharpoons} 2NO(g)$

   $2NO(g) + O_2(g) \overset{K_2}{\rightleftharpoons} 2NO_2(g)$

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

a) $\frac{1}{\sqrt{K_1 K_2}}$ b) $(K_1 = K_2)^{1/2}$ c) $\frac{1}{2K_1 K_2}$ d) $\left(\frac{1}{K_1 K_2}\right)^{3/2}$ **ANSWER: A**

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 1×10^{-4} M, 2.0×10^{-3} M, 1.5×10^{-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) 3×10^{-2}
9. An equilibrium constant of 3.2×10^{-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. Kc/ Kp for the reaction, $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ is
    a) 1/ RT b) √RT c) RT d) $(RT)^2$
11. For the reaction $AB(g) \rightleftharpoons A(g) + B(g)$, 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) 24 P = K_p d) none of these

12. In which of the following equilibrium, K_p and K_c are not equal?
a) $2\ NO(g) \rightleftharpoons N_2(g) + O_2(g)$
b) $SO_2\ (g) + NO_2 \rightleftharpoons SO_3(g) + NO(g)$
c) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
d) **$PCl_5\ (g) \rightleftharpoons PCl_3(g) + Cl_2(g)$**

13. If x is the fraction of PCl_5 dissociated at equilibrium in the reaction

$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$

then starting with 0.5 mole of 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 for the reactions K_{p1} and K_{p2} $X \rightleftharpoons Y + Z$
$A \rightleftharpoons 2B$ 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,

$$Fe\ (OH)_3\ (s) \rightleftharpoons Fe^{3+}(aq) + 3OH^-(aq),$$

if the concentration of OH^- ions is decreased by ¼ times, then the equilibrium concentration of Fe^{3+} will
a) not changed b) also decreased by ¼ times
c) increase by 4 times d) **increase by 64 times**

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

$$PCl_5(g) \rightleftharpoons PCl_3\ (g) + Cl_2\ (g)$$

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 PCl_3 will be produced b) more Cl_2 will be produced
c) **more PCl_5 will be produced** d) none of these

17. Equimolar concentrations of H_2 and I_2 are heated to equilibrium in a 1 litre flask. What percentage of initial concentration of 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 2.5×10^2 and the equilibrium constant is 50. The rate constant for the reverse reaction is,
a) 11. b) **5** c) 2×10^2 d) 2×10^{-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 $SO_3(g)$ from SO_2 and O_2, the equilibrium constant is K_1. The equilibrium constant for the dissociation of one mole of SO_3 into SO_2 and O_2 is
a) $1/K_1$ b) K_1^2 c) **$(1/K_1)^{1/2}$** d) $K_1/2$

21. Match the equilibria with the corresponding conditions,

i) Liquid ⇌ Vapour
ii) Solid ⇌ Liquid
iii) Solid ⇌ Vapour
iv) Solute (s) ⇌ Solute (Solution)
1) melting point
2) Saturated solution
3) Boiling point
4) Sublimation point
5) Unsaturated solution

	i.	ii.	iii.	iv.
(a)	1	2	3	4
(b)	**3**	**1**	**4**	**2**
(c)	2	1	3	4
(d)	3	2	4	5

22. Consider the following reversible reaction at equilibrium, A + B ⇌ 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. $[Co(H_2O)_6]^{2+}$ (aq) (pink) + $4Cl^-$ (aq) ⇌ $[CoCl_4]^{2-}$ (aq) (blue)+ 6 H_2O (*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) **ΔH > 0 for the forward reaction**
b) ΔH = 0 for the reverse reaction
c) ΔH < 0 for the forward reaction
d) Sign of the ΔH cannot be predicted based on this information.

24. The equilibrium constants of the following reactions are :

$N_2 + 3H_2 \rightleftharpoons 2NH3$; K_1
$N_2 + O_2 \rightleftharpoons 2NO$; K_2
$H_2 + ½O_2 \rightleftharpoons H_2O$; K_3

The equilibrium constant (K) for the reaction ;

$2NH_3 + \frac{5}{2} O_2 \xrightleftharpoons{K} 2NO + 3H_2O$, will be

a) $K_2^3 K_3 / K_1$ b) $K_1 K_3^3 / K_2$ c) **$K_2 K_3^3 / K_1$** d) $K_2 K_3 / K_1$

25. A 20 litre container at 400 K contains CO_2 (g) at pressure 0.4 atm and an excess of SrO (neglect the volume of solid 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 CO_2 attains its maximum value will be :

Given that : $SrCO_3$ (S) ⇌ SrO (S) + CO_2(g) KP = 1.6 atm

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

9. SOLUTIONS

I. Choose the correct answer

1. 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**
2. Which of the following concentration terms is / are independent of temperature
   a) molality b) molarity c) mole fraction d) **(a) and (c)**
3. Stomach acid, a dilute solution of HCl can be neutralised by reaction with Aluminium hydroxide
   $Al(OH)_3 + 3HCl\ (aq) \rightarrow AlCl_3 + 3\ H_2O$
   How many millilitres of 0.1 M $Al(OH)_3$ solution are needed to neutralise 21 mL of 0.1 M HCl ?
   a) 14 mL b) **7 mL** c) 21 mL d) none of these
4. The partial pressure of nitrogen in air is 0.76 atm and its Henry's law constant is 7.6×10^4 atm at 300K. What is the mole fraction of nitrogen gas in the solution obtained when air is bubbled through water at 300K ?
   a) 1×10^{-4} b) 1×10^{-6} c) 2×10^{-5} d) **1×10^{-5}**
5. The Henry's law constant for the solubility of Nitrogen gas in water at 350 K is 8×10^4 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) 4×10^{-4} b) 4×10^4 c) 2×10^{-2} d) **2.5×10^{-4}**
6. Which one of the following is incorrect for ideal solution ?
   a) $\Delta H_{mix} = 0$ b) $\Delta U_{mix} = 0$
   c) $\Delta P = P_{observed} - P_{calculated\ by\ raoults\ law} = 0$ d) **$\Delta G_{mix} = 0$**
7. Which one of the following gases has the lowest value of Henry's law constant ?
   a) N_2 b) He c) **CO_2** d) H_2
8. 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) $P_1 + X_2\ (P_1 - P_2)$
9. Osometic pressure (p) of a solution is given by the relation
   a) p = nRT b) **pV = nRT**
   c) pRT = n d) none of these
10. Which one of the following binary liquid mixtures exhibits positive deviation from Raoults 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 / 0.2 x c) 0.2x / y d) **5x / y**

12. At 100^0C 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) 102^0C b) 100^0C c) **101^0C** d) 100.52°C

13. According to Raoults 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 $BaCl_2$ and 0.2M urea

b) 0.1 M glucose and 0.2 M urea

c) 0.1 M NaCl and 0.1 M K_2SO_4

d) **0.1 M Ba $(NO_3)_2$ and 0.1 M Na_2 SO_4**

15. The empirical formula of a non-electrolyte(X) is CH_2O. 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) $C_2H_4O_2$ b) **$C_8H_{16}O_8$** c) $C_4H_8O_4$ d) CH_2O

16. The K_H for the solution of oxygen dissolved in water is 4×10^4 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) 4.6×10^3 b) 1.6×10^4 c) **1×10^{-5}** d) 1×10^5

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 Raoults law

c) ideal and shows negative deviation from Raoults Law

d) **non-ideal and shows negative deviation from Raoults Law**

19. The relative lowering of vapour pressure of a sugar solution in water is 3.5×10^{-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-voltaile solute (molar mass 80 g 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 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 × 0.082 K b) 310°C c) **37°C** d) 310 / 0.082 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 × 10^{-3} bar. The molar mass of protein will be (R = 0.083 L bar mol^{-1} K^{-1})

a) **62.22 Kg mol^{-1}** b) 12444g mol^{-1} c) 300g mol^{-1} d) none of these

23. The Van't Hoff factor (i) for a dilute aqueous solution of the strong elecrolyte barium hydroxide is

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 **ANSWER: C**

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) $\alpha = \frac{n(1-i)}{n(1-i)}$

26. Which of the following aqueous solutions has the highest boiling point ?

a) 0.1 M KNO_3 b) **0.1 M Na_3PO_4** c) 0.1 M $BaCl_2$ d) 0.1 M K_2SO_4

27. The freezing point depression constant for water is 1.86 K $Kgmol^{-1}$. If 5g Na_2SO_4 is dissolved in 45g water, the depression in freezing point is 3.64°C. The Vant Hoff factor for Na_2SO_4 is

a) **2.50** 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 Raoults 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

I. Choose the Correct Answer

1. In which of the following Compounds does the central atom obey the octet rule?
   a) XeF_4 b) $AlCl_3$ c) SF_6 d) **SCl_2**
2. In the molecule $O_A = C = O_B$, the formal charge on OA, C and OB 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_3 b) $(CH_3)_2$ c) **BH_3** d) NH_3
4. Which of the following molecule contain no л bond?
   a) SO_2 b) NO_2 c) CO_2 d) **H_2O**
5. The ratio of number of sigma (σ) and pi (л) bonds in 2- butynal is
   a) **8/3** b) 5/3 c) 8/2 d) 9/2
6. Which one of the following is the likely bond angles of sulphur tetrafluoride molecule?
   a) $120^o,80^o$ b) $109^o,28$ c) 90° d) **$89^o,117^o$**
7. **Assertion:** Oxygen molecule is paramagnetic.
   Reason : It has two unpaired electron in its bonding molecular orbital
   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
8. According to Valence bond theory, a bond between two atoms is formed when
   a) fully filled atomic orbitals overlap
   b) **half filled atomic orbitals overlap**
   c) non- bonding atomic orbitals overlap
   d) empty atomic orbitals overlap
9. In ClF_3 ,NF_3 and BF_3 molecules the chlorine, nitrogen and boron atoms are
   a) sp^3 hybridised
   b) sp^3 ,sp^3 and sp^2 respectively
   c) sp^2 hybridised
   d) **sp^3d, sp^3 and sp hybridised respectively**
10. When one s and three p orbitals hybridise,
    a) four equvivalent orbitals at 900 to each other will be formed

b) **four equvivalent orbitals at 109º 28' to each other will be formed.**
c) four equivalent orbitals, that are lying the same plane will be formed
d) none of these

11. Which of these represents the correct order of their increasing bond order.
a) $C_2 < C_2^{2-} < O_2^{2-} < O_2$ b) $C_2^{2-} < C_2^{+} < O_2 < O_2^{2-}$
c) $O_2^{2-} < O_2 < C_2^{2-} < C_2^{+}$ d) **$O_2^{2-} < C_2^{+} < O_2 < C_2^{2-}$**

12. Hybridisation of central atom in PCl5 involves the mixing of orbitals.
a) s, p_x, p_y, d_{x^2} , $d_{x^2-y^2}$ b) s, $p_x.p_y$, $p_{xy}.d_{x^2-y^2}$
c) **s, p_x , p_y , p_z , $d_{x^2-y^2}$** d) s, p_x , p_y , d_{xy} , $d_{x^2-y^2}$

13. The correct order of O-O bond length in hydrogen peroxide, ozone and oxygen is
a) $H_2O_2 > O_3 > O_2$ b) **$O_2 > O_3 > H_2O_2$**
c) $O_2 > H_2O_2 > O_3$ d) $O_3 > O_2 > H_2O_2$

14. Which one of the following is diamagnetic.?
a) O_2 b) **O_2^{2-}** c) O^{2+} d) None of these

15. Bond order of a species is 2.5 and the number of electons in its bonding molecular orbital is formd to be 8 The no. of electons in its antibonding molecular orbital is
a) **three** b) four
c) Zero d) can not be calculated form the given unformation.

16. Shape and hybridisation of IF_5 are
a) Trigonal bipyramidal, Sp^3d^2 b) Trigonal bipyramidal, Sp^3d
c) **Square pyramidal, Sp^3d^2** d) Octahedral, Sp^3d^2

17. Pick out the incorrect statement from the following
a) Sp^3 hybrid orbitals are equivalent and are at an angle of 109º 28' with eachother
b) dsp^2 hybrid orbitals are equivalent and bond angle between any two of them is 90º
c) **All five sp^3d hybrid orbitals are not equivalent out of these five sp^3d hybrid orbitals, three are at an angle of 120º, 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 carbondixide?
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.
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. It 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

I. Choose the correct answer

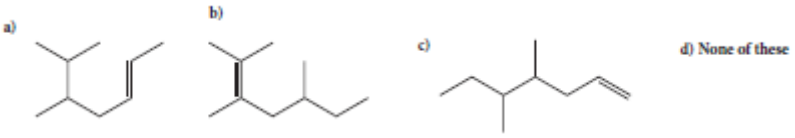
1. Select the molecule which has only one π bond.
a) **CH_3– CH = CH – CH_3** b) CH_3– CH = CH – CHO
c) CH_3– CH = CH – COOH d) All of these

2. In the hydrocarbon $\overset{7}{CH_3}-\overset{6}{CH_2}-\overset{5}{CH}=\overset{4}{CH}-\overset{3}{CH_2}-\overset{2}{C}\equiv\overset{1}{CH}$ the state of hybridisation of carbon 1,2,3,4 and 7 are in the following sequence.
a) **sp, sp, sp^3, sp^2, sp^3** b) sp^2, sp, sp^3, sp^2, sp^3
c) sp, sp, sp^2, sp, sp^3 d) none of these

3. The general formula for alkadiene is
a) C_nH_{2n} b) C_nH_{2n-1}

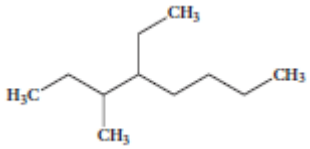
c) $\mathbf{C_nH_{2n-2}}$ d) C_nH_{n-2}

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



ANSWER: A

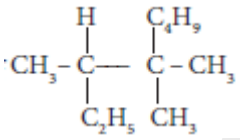
5. The IUPAC name of the Compound is



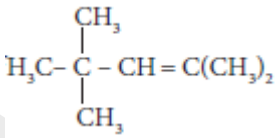
a) 2,3 - Diemethylheptane b) 3- Methyl -4- ethyloctane
c) 5-ethyl -6-methyloctane d) **4-Ethyl -3 - methyloctane.**

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.

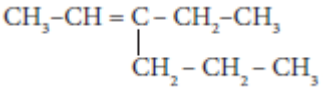
7. The IUPAC name of the compound CH_3–CH= CH – C ≡ CH is
a) Pent - 4 - yn-2-ene b) **Pent -3-en-l-yne**
c) pent – 2– en – 4 – yne d) Pent – 1 – yn –3 –ene

8. IUPAC name of  is

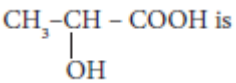
a) 3,4,4 – Trimethylheptane b) 2 – Ethyl –3, 3– dimethyl heptane
c) **3, 4,4 – Trimethyloctane** d) 2 – Butyl -2 –methyl – 3 – ethyl-butane.

9. The IUPAC name of  is

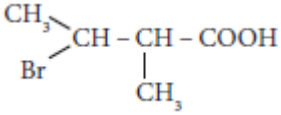
a) 2,4,4 – Trimethylpent -2-ene b) 2,4,4 – Trimethylpent -3-ene
c) **2,2,4 – Trimethylpent -3-ene** d) 2,2,4 – Trimethylpent -2-ene

10. The IUPAC name of the compound  is

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

11. The IUPAC name of the compound  is

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

12. The IUPAC name of  is

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.

13. The structure of isobutyl group in an organic compound is **ANSWER: C**

a) $CH_3-CH_2-CH_2-CH_2-$
b) $CH_3-C(CH_3)_2$
c) $CH_3-CH(CH_3)-CH_2-$
d) $CH_3-CH(-)-CH_2-CH_3$

14. The number of stereoisomers of 1, 2 – dihydroxy cyclopentane
a) 1 b)2 c) **3** d) 4

15. Which of the following is optically active?
a) 3 – Chloropentane
b) 2 Chloro propane
c) Meso – tartaric acid
d) **Glucose**

16. The isomer of ethanol is
a) acetaldehyde
b) **dimethylether**
c) acetone
d) methyl carbinol

17. How many cyclic and acyclic isomers are possible for the molecular formula C_3H_6O?
a) 4 b) 5 c) **9** d) 10

18. Which one of the following shows functional isomerism?
a) ethylene
b) Propane
c) **ethanol**
d) CH_2Cl_2

19. $\overset{\ominus}{C}H_2-\underset{\underset{O}{\|}}{C}-CH_3$ and $CH_2=\underset{\underset{O}{|}}{C}-CH_3$ are
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) $Fe_3[Fe(CN)_6]_2$
b) **$Fe_4[Fe(CN)_6]_3$**
c) $Fe_4[Fe(CN)_6]_2$
d) $Fe_3[Fe(CN)_6]_3$

21. Lassaigne's test for the detection of nitrogen fails in
a) $H_2N-CO-NH.NH_2.HCl$
b) $NH_2-NH_2.HCl$
c) **$C_6H_5-NH-NH_2.HCl$**
d) $C_6H_5CONH_2$

22. Connect pair of compounds which give blue colouration / precipitate and white precipitate respectively, when their Lassaigne's test is separately done.
a) NH_2NH_2HCl and $ClCH_2-CHO$
b) NH_2CSNH_2 and CH_3-CH_2Cl
c) NH_2CH_2COOH and NH_2CONH_2
d) **$C_6H_5NH_2$ and $ClCH_2-CHO$.**

23. Sodium nitropruside reacts with sulphide ion to give a purple colour due to the formation of
a) $[Fe(CN)_5NO]^{3-}$
b) $[Fe(NO)_5CN]^{+}$
c) **$[Fe(CN)_5NOS]^{4-}$**
d) $[Fe(CN)_5NOS]^{3-}$

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%

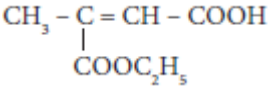
25. A sample of 0.5g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50mL of 0.5M H2SO4. The remaining acid after neutralisation by ammonia consumed 80mL of 0.5 MNaOH, The percentage of nitrogen in the organic compound is.
a) 14% b) **28%** c) 42% d) 56%

26. In an organic compound, phosphorus is estimated as
a) **$Mg_2P_2O_7$** b) $Mg_3(PO_4)_2$ c) H_3PO_4 d) P_2O_5

27. Ortho and para-nitro phenol can be separated by
a) azeotropic distillation b) destructive distillation
c) **steam distillation** d) cannot be separated

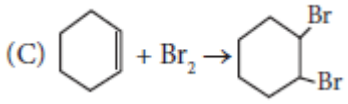
28. The purity of an organic compound is determined by
a) Chromatography b) Crystallisation
c) melting or boiling point d) **both (a) and (c)**

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:  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

I. Choose the correct answer

1. For the following reactions
(A) $CH_3CH_2CH_2Br + KOH \rightarrow CH_2 = CH_2 + KBr + H_2O$
(B) $(CH_3)_3CBr + KOH \rightarrow (CH_3)_3 COH + KBr$
(C) 
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) **sp^2** (b) spd^2 (c) sp^3 (d) sp^2d

3. Decreasing order of nucleophilicity is
(a) $OH^- > NH_2^- > {}^-OCH_3 > RNH_2$ (b) **$NH_2^- > OH^- > {}^-OCH_3 > RNH_2$**
(c) $NH_2^- > CH_3O^- > OH^- > RNH_2$ (d) $CH_3O^- > NH_2^- > OH^- > RNH_2$

4. Which of the following species is not electrophilic in nature?
(a) Cl^+ (b) BH_3 (c) **H_3O^+** (d) $^+NO_2$

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 +I effect?
   (a) CH_3- (b) CH_3-CH_2- (c) $(CH_3)_2$-CH- (d) **$(CH_3)_3$-C-**
8. Which of the following species does not exert a resonance effect?
   (a) C_6H_5OH (b) C_6H_5Cl (c) $C_6H_5NH_2$ (d) **$C_6H_5NH_3$**
9. -I effect is shown by
   (a) -Cl (b) -Br (c) **both (a) and (b)** (d) $-CH_3$
10. Which of the following carbocation will be most stable? **ANSWER: D**
    (a) Ph_3C^+ (b) $CH_3-\overset{+}{C}H_2$ (c) $(CH_3)_2-\overset{+}{C}H$ (d) $CH_2=CH-\overset{+}{C}H_2$
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-Br 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 nuclephiles?
    (a) BF_3, H_2O, NH^{2-} (b) $AlCl_3$, BF_3, NH_3
    (c) **CN^-, RCH_2^-, ROH** (d) H^+, RNH_3^+, CCl_2
14. Which of the following species does not acts as a nucleophile?
    (a) ROH (b) ROR
    (c) PCl_3 (d) **BF_3**
15. The geometrical shape of carbocation is
    (a) Linear (b) tetrahedral
    (c) **Planar** (d) Pyramidal

13.HYDROCARBONS

I. Choose the correct answer

1. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is
   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. $C_2H_5Br + 2Na \xrightarrow{\text{dry ether}} C_4H_{10} + 2NaBr$

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 compound (A) is

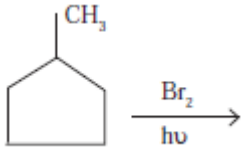
a) $CH_3(CH_2)_3Br$ b) $CH_3(CH_2)_5Br$ c) $CH_3(CH_2)_3CH(Br)CH_3$

d) $CH_3 - (CH_2)_2 - CH(Br) - CH_2 - CH_3$

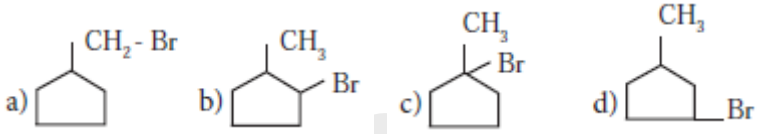
4. The C – H bond and C – C bond in ethane are formed by which of the following types of overlap

a) **$sp^3 - s$ and $sp^3 - sp^3$** b) $sp^2 - s$ and $sp^2 - sp^2$

c) sp – sp and sp – sp d) p – s and p – p

5. In the following reaction, 

The major product obtained is



ANSWER: C

6. Which of the following is optically active

a) **2 – methyl pentane** b) citric acid

c) Glycerol d) none of of these

7. The compounds formed at anode in the electrolysis of an aquous solution of potassium acetate are

a) CH_4 and H_2 b) CH_4 and CO_2

c) **C_2H_6 and CO_2** d) C_2H_4 and 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

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 elemination (or) only direct elimination reaction

a)

b) $CH_3 - CH_2 - CH_2 - OH$

c) **$H_2C = C = 0$** d) $CH_3 - CH_2 - CH_2Br$

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

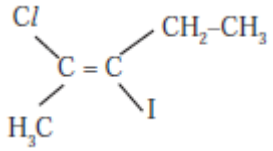
a) 2 – Methyl propene b) 2 – Methyl but – 2 - ene

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

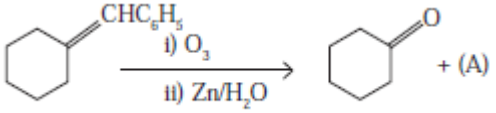
14. The IUPAC name of the following compound is

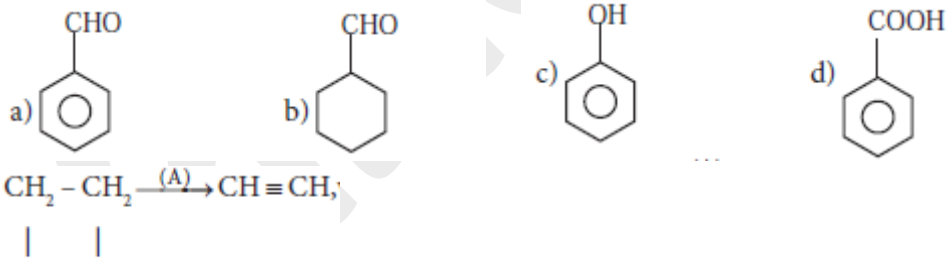


    a) **trans–2–chloro–3–iodo – 2 – pentane** b) cis–3 – iodo – 4 – chloro – 3 – pentane
    c) trans–3–iodo–4–chloro – 3 – pentene d) cis–2 – chloro – 3 – iodo – 2 – pentene

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 **ANSWER: A**

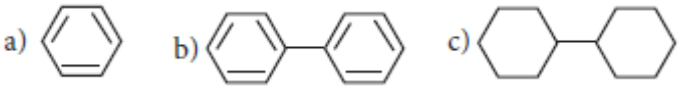




17. $CH_2-CH_2 \xrightarrow{(A)} CH\equiv CH$ where A is,
    a) Zn b) Conc H_2SO_4 c) **alc. KOH** d) dil H_2SO_4

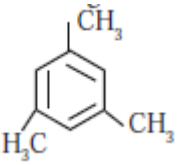
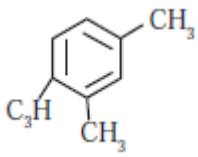
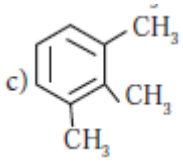
18. Consider the nitration of benzene using mixed con H_2SO_4 and HNO_3 if a large quantity of $KHSO_4$ is added to the mixture, the rate of nitration will be
    a) unchanged b) doubled c) faster d) **slower**

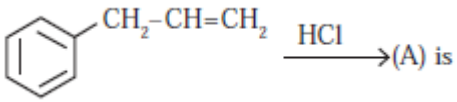
19. In which of the following molecules, all atoms are co-planar

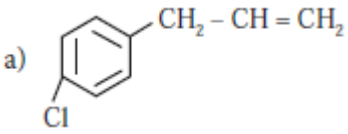


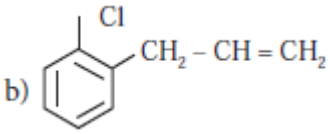
    d) **both (a) and (b)**

20. Propyne on passing through red hot iron tube gives **ANSWER; A**

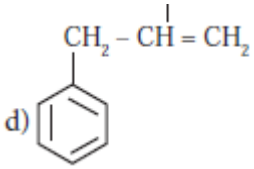
a)  b)  c)  d) none of these

21.  **ANSWER: D**

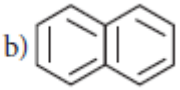
a) 

b) 

c) both (a) and (b)

d) 

22. Which one of the following is non aromatic ? **ANSWER: D**

a) b)  c) d)

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

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_2** c) – C ≡ N d) – SO_3H

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**

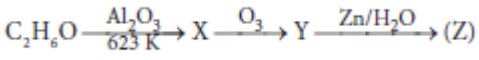
c) reduction of 1 – chloro propane

d) reduction of bromomethane

27. Which of the following is aliphatic saturated hydrocarbon

a) **$C_8 H_{18}$** b) $C_9 H_{18}$ c) $C_8 H_{14}$ 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

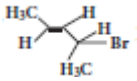
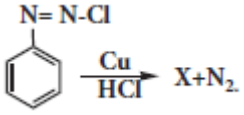
a) Oct – 4 – ene b) hex – 3 – ene

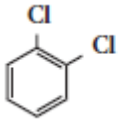
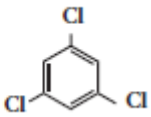
c) **pent – 1 – ene** d) but – 2 – ene

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**

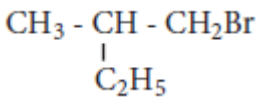
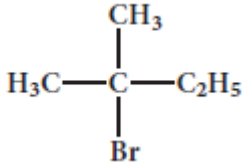
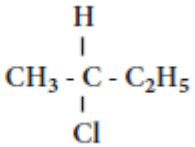
14.Haloalkanes and Haloarenes

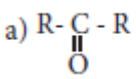
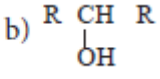
I. Choose the correct answer

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) CCl4 B) CHCl3 C) CH2Cl2 D) CH3Cl
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 CH3 – CH = CH – CH2 – 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  X is _____ **ANSWER: B**

a) b) c)  d) 

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

i)  ii)  iii) 

a) (i) b) (ii) and (iii) c) **(iii)** d) (i) and (ii)
9. The treatment of ethyl formate with excess of RMgX gives
a)  b) 

c) **R- CHO** d) R- O – R

10. Benzene reacts with Cl_2 in the presence of $FeCl_3$ and in absence of sunlight to form
    a) **Chlorobenzene** b) Benzyl chloride
    c) Benzal chloride d) Benzene hexachloride
11. The name of $C_2F_4Cl_2$ 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) Zn / methanol b) KOH / ethanol
    c) **aqueous KOH** d) ZnCl2 / Con HCl
13. Match the compounds given in Column I with suitable items given in Column II

	Column I (Compound)		**Column II (Uses)**
A	Iodoform	1	Fire extinguisher
B	Carbon tetrachloride	2	Insecticide
C	CFC	3	Antiseptic
D	DTD	4	Refrigerants

Code
    a) A → 2 B → 4 C →1 D →3 b) A → 3 B → 2 C →4 D →1
    c) A → 1 B → 2 C →3 D →4 d) **A → 3 B → 1 C →4 D →2**
14. **Assertion:** In mono haloarenes, electrophilic substitution occurs at ortho and para positions.
    Reason: Halogen atom is a ring deactivator
    (i) If both assertion and reason are true and reason is the correct explanation of assertion.
    (ii) **If both assertion and reason are true but reason is not the correct explanation of assertion.**
    (iii) If assertion is true but reason is false.
    (iv) If both assertion and reason are false.

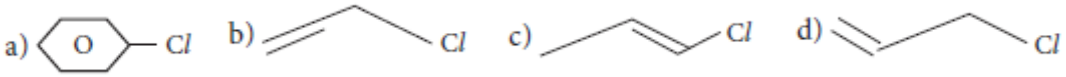
15. Consider the reaction, $CH_3CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$
    This reaction will be the fastest in
    a) ethanol b) methanol
    c) **DMF (N, N' – dimethyl formanide)** d) water
16. Freon-12 is manufactured from tetrachloro methane by
    a) Wurtz reaction b) **Swarts reaction**
    c) Haloform reaction d) Gattermann reaction
17. The most easily hydrolysed molecule under SN1 condition is
    a) **allyl chloride** b) ethyl chloride

c) ispropylchloride d) benzyl chloride

18. The carbo cation formed in SN1 reaction of al kyl halide in the slow step is
a) sp^3 hybridised b) **sp^2 hybridised**
c) sp hybridised d) none of these

19. The major products obtained when chlorobenzene is nitrated with HNO_3 and con H_2SO_4
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 ?



ANSWER: D

21. Ethylidene chloride on treatment with aqueous KOH gives
a) **acetaldehyde** b) ehtyleneglycol
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 $\xrightarrow[\text{ii) } H_2O / H^{-1}]{\text{i) } CH_3MgI} X,$ 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

I. Choose the correct answer

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_2O > CO_2> CH_4 b) CFC > CO_2> N_2O > CH_4
   c) **CFC > N_2O > CH_4> CO_2** d) CFC > CH_4> N_2O > CO_2
6. Photo chemical smog formed in congested metropolitan cities mainly consists of
   a) Ozone, SO_2 and hydrocarbons b) **Ozone, PAN and NO_2**
   c) PAN, smoke and SO_2 d) Hydrocarbons, SO_2 and CO_2
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_2 present inside to form CO_2
   b) Reduces organic matter of tissues
   c) Combines with haemoglobin and makes it incapable to absorb oxygen
   d) **Dries up 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_2
B	Acid rain	2	NO
C	Photochemical smog	3	SO_2
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) i b) ii c) iii d) iv
Choose the correct option out of the choices given below each question
i) Both (A) and R are correct and (R) is the correct explanation of (A)
ii) Both (A) and R are correct and (R) is not the correct explanation of (A)
iii) Both (A) and R are not correct
iv) **(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) i b) ii c) iii d) iv
Choose the correct option out of the choices given below each question
i) **Both (A) and R are correct and (R) is the correct explanation of (A)**
ii) Both (A) and R are correct and (R) is not the correct explanation of (A)
iii) Both (A) and R are not correct
iv) (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) i b) ii c) iii d) iv
Choose the correct option out of the choices given below each question
i) Both (A) and R are correct and (R) is the correct explanation of (A)
ii) Both (A) and R are correct and (R) is not the correct explanation of (A)
iii) Both (A) and R are not correct
iv) **(A) is correct but(R) is not correct**