1. At $300\ K$ and 1 atmospheric pressure, $10\ mL$ of a hydrocarbon required $55\ mL$ of O_2 for complete combustion and $40\ mL$ of CO_2 is formed. The formula of the hydrocarbon is:

   A. C_4H_8

   B. C_4H_7Cl

   C. C_4H_{10}

   D. C_4H_6

2. What would be the molality of 20% (mass/mass) aqueous solution of KI ? Molar mass of KI is $166\ g\ mol^{-1}$

   A. 1.51

   B. 1.35

   C. 1.08

   D. 1.48

3. Complete combustion of $1.80\ g$ of an oxygen containing compound $(C_xH_yO_z)$ gave $2.64\ g$ of CO_2 and $1.08\ g$ of H_2O. The percentage of oxygen in the organic compound is :

   A. 50.33

   B. 53.33

   C. 51.63

   D. 63.53

4. At 300K and 1 atm, 15 mL of a gaseous hydrocarbon requires 375 mL air containing 20% O_2 by volume for complete combustion. After combustion, the gases occupy $330\ mL$. Assuming that the water formed is in liquid form and the volumes were measured at the same temperature and pressure. The formula of the hydrocarbon is :

A. C_3H_8

B. C_4H_8

C. C_4H_{10}

D. C_3H_6

5. An unknown chlorohydrocarbon has 3.55% of chlorine. If each molecule of hydrocarbon has one chlorine atom only, then chlorine atoms present in $1\ g$ of chlorohydrocarbon are:
Atomic weight of $Cl = 35.5\ u$
Avogadro constant, $N_A = 6.023 \times 10^{23}$

A. 6.023×10^{9}

B. 6.023×10^{23}

C. 6.023×10^{21}

D. 6.023×10^{20}

6. On heating, a sample of $NaClO_3$, it gets converted to $NaCl$ with a loss of 0.16 g of oxygen. The residue is dissolved in water and precipitated as $AgCl$. The mass of $AgCl$ (in g) obtained will be :
(Given molar mass of $AgCl = 143.5\ g\ mol^{-1}$)

A. 0.35

B. 0.54

C. 0.41

D. 0.48

7. 5 moles of AB_2 weigh $125 \times 10^{-3} kg$ and 10 moles of A_2B_2 weigh $300 \times 10^{-3} kg$.The molar mass of $A(M_A)$ and molar mass of $B(M_B)$ in kg/mol are :

   A. $M_A = 10 \times 10^{-3} and M_B = 5 \times 10^{-3}$

   B. $M_A = 25 \times 10^{-3} and M_B = 50 \times 10^{-3}$

   C. $M_A = 5 \times 10^{-3} and M_B = 10 \times 10^{-3}$

   D. $M_A = 50 \times 10^{-3} and M_B = 25 \times 10^{-3}$

8. 100 mL of a water sample contains 0.81g of calcium bicarbonate and 0.73g of magnesium bicarbonate. The hardness of this water sample expressed in terms of ppm of $CaCO_3$ is: (molar mass of calcium bicarbonate is 162 g/mol and magnesium bicarbonate is 146 g/mol.

   A. $1000\ ppm$

   B. $10000\ ppm$

   C. $100\ ppm$

   D. $5000\ ppm$

9. 1 gram of a metal carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2. The molar mass of (M_2CO_3) in $gmol^{-1}$ is

   A. 1186

   B. 84.3

   C. 118.6

   D. 11.86

10. Find the mole fraction of methanol in its 5.2 molal aqueous solution.

A. 0.190

B. 0.086

C. 0.050

D. 0.100

11. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 g/mol) in 1000 g of water is 1.15 g/mL. The molarity of this solution is

A. 1.78 M

B. 1.02 M

C. 2.05 M

D. 0.50M

12. The molarity of a solution obtained by mixing 750 mL of 0.5M HCl with 250 mL of 2M HCl will be

A. 0.875 M

B. 1.00 M

C. 1.75 M

D. 0.975 M

13. The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na$ $(Mol.Wt.\ 206\ g\ mol^{-1})$ .What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin?

A. $\frac{1}{206}$

B. $\frac{2}{309}$

C. $\frac{1}{412}$

D. $\frac{1}{103}$

14. The most abundant elements by mass in the body of a healthy human adult are : Oxygen (61.4%); Carbon (22.9%), Hydrogen (10.0%); and Nitrogen (2.6%). The weight which a 75 kg person would gain if all H^1 atoms are replaced by H^2 is :

A. 7.5 kg

B. 10 kg

C. 15 kg

D. 37.5 kg

15. The ratio of mass percent of C and H of an organic compound $(C_XH_YO_Z)$ is 6 : 1. If one molecule of the above compound $(C_XH_YO_Z)$ contains half as much oxygen as required to burn one molecule of compound C_XH_Y completely to CO_2 and H_2O. The empirical formula of compound $C_XH_YO_Z$ is

A. $C_3H_6O_3$

B. C_2H_4O

C. $C_3H_4O_2$

D. $C_2H_4O_3$

16. The ratio of the mass percentages of 'C and H' and C &O of a saturated acyclic organic compound 'X' are 4:1 and 3:4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is

17. Ferrous sulphate heptahydrate is used to fortify foods with iron.The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat (Rounded-off to the nearest integer) is
[Atomic weight : Fe=55.85 S=32.00 O=16.00]

18. The number of atoms of Na in 8 g of its sample is $x \times 10^{23}$.The value of x(rounded off to the nearest integer) is

[Given : $N_A = 6.02 \times 10^{23} mol^{-1}$
and Atomic mass of Na=23.0u]

19. 100 g of propane is completely reacted with 1000g of oxygen.The mole fraction of carbon dioxide in the resulting mixture is $x \times 10^{-2}$.The value of 'x' is (Rounded off to the nearest integer) is
[Atomic weight :H=1.008;C=12.00;O=16.00]

20. 4 g equimolar mixture of $NaOH$ and Na_2CO_3 contains x g of $NaOH$ and y g of Na_2CO_3.The value of x to the nearest integer (in g) is

21. 250 mL of 0.5 M $NaOH$ was added to 500 mL of 1M HCl.The number of unreacted HCl molecules in the solution after compelete reaction is $x \times 10^{21}$. The value of x to the nearest integer is
Take
($N_A = 6.022 \times 10^{23}$)

22. Complete combustion of 3 g ethane gives $x \times 10^{22}$ molecules of water. The value of x is
(Round off to the nearest integer)
[Use : $N_A = 6 \times 10^{23}$

23. The number of chlorine atoms in 20 mL of chlorine gas at STP is $x \times 10^{21}$. The value of x (Rounded off to the Nearest integer) is
.
[Assume chlorine is an ideal gas at STP,
$N_A = 6.023 \times 10^{23}$]

24. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, $x \times 10^{-5}$ moles of lead sulphate are precipitated out.The value of x Rounded off to the nearest integer is

25. $NaClO_3$ is used even in spacecrafts to produce O_2. The daily consumption of pure O_2 by a person is 492 L at $1\ atm$ and $300\ K$. How much amount of $NaClO_3$ in
grams, is required to produce O_2 for the daily consumption of a person at STP?
$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaC1(s) + FeO(s)$

1. The ground state energy of hydrogen atom is -13.6 eV. The energy of second excited state of He^+ ion in eV is

   A. -6.04

   B. -27.2

   C. -54.4

   D. -3.4

2. The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (v) of the incident radiation as, $[v_0$ is threshold frequency]:

   A. $\lambda \propto \frac{1}{(v-v_0)^{\frac{3}{2}}}$

   B. $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{2}}}$

   C. $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{4}}}$

   D. $\lambda \propto \frac{1}{(v-v_0)}$

3. What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity $6 \times 10^5\ ms^{-1}$ form it?
   (Mass of electron $= 9 \times 10^{-31} kg$
   Velocity of light $= 3 \times 10^8 ms^{-1}$
   Planck's constant $= 6.626 \times 10^{-34} Js$
   Charge of electron $= 1.6 \times 10^{-19} JeV^{-1}$)

   A. 0.9 eV

   B. 4.0 eV

   C. 2.1 eV

   D. 3.1 eV

4. The number of subshells associated with n = 4 and m = -2 quantum numbers is:

   A. 4

   B. 8

   C. 2

   D. 16

5. The region in the electromagnetic spectrum where the Balmer series lines appear is:

   A. Microwave

   B. Infrared

   C. Visible

   D. None of the above

6. The shortest wavelength of H atom in the Lyman series is λ_1. The longest wavelength in the Balmer series of He^+ is

   A. $\frac{5\lambda_1}{9}$

   B. $\frac{36\lambda_1}{5}$

   C. $\frac{27\lambda_1}{5}$

   D. $\frac{9\lambda_1}{5}$

7. The correct statement about probability density (except at infinite distance from nucleus) is

A. It can never be zero for 2s orbital

B. It can be zero for 3p orbital

C. It can be zero for 1s orbital

D. It can be negative for 2p orbital

8. The difference between radii of 3rd and 4th orbits of Li^{2+} is ΔR_1. The difference between the radii of 3rd and 4th orbits of He^{+} is ΔR_2. Ratio $\Delta R_1 : \Delta R_2$ is

A. 3 : 2

B. 8 : 3

C. 2 : 3

D. 3 : 8

9. The number of electron associated with quantum numbers $n = 5,\ m_s = +\frac{1}{2}$ is

A. 15

B. 50

C. 25

D. 11

10. The radius of the second Bohr orbit, in terms of the Bohr radius, a_0, in Li^{2+} is:

A. $\frac{2a_0}{3}$

B. $\frac{2a_0}{9}$

C. $\frac{4a_0}{9}$

D. $\frac{4a_0}{3}$

11. The de Broglie wavelength of an electron in the 4th Bohr orbit is:

A. $6\pi a_0$

B. $4\pi a_0$

C. $2\pi a_0$

D. $8\pi a_0$

12. Amongst the following statements, that which was not proposed by Dalton was

A. All the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass

B. Matter consists of indivisible atoms.

C. Chemical reactions involve reorganization of atoms. These are neither created nor destroyed in a chemical reaction.

D. When gases combine or reproduced in a chemical reaction, they do so in a simple ratio by volume provided all gases are at the same T & P

13. Given below are two statements:
Statement I: Rutherford's gold foil experiment cannot explain the line spectrum of hydrogen atom.
Statement II: Bohr's model of hydrogen atom contradicts Heisenberg's uncertainty principle.
In the light of the above statement, choose the most appropriate answer from the options given below:

A. Both the statement I and statement II are false

B. Statement I is true but statement II is false.

C. Statement I is false but statement II is true

D. Both statement I and statement II are true

14. A certain orbital has no angular nodes and two radial nodes. The orbital is

A. $2p$

B. $3p$

C. $3s$

D. $2s$

15. Given below are two statements :

Statement I : Bohr's theory accounts for the stability and the line spectrum of Li^+ ion.

Statement II : Bohr's theory was unable to explain the splitting of spectral lines in the presence of a magnetic field.
In the light of the above statements. choose the most appropriate answer from the options given below.

A. Both statement I and statement II are true

B. Statement I is false but statement II is true

C. Both statement I and statement II are false

D. Statement I is true but statement II is false

16. A metal surface is exposed to 500 nm radiation. The threshold frequency of the metal for photoelectric current is $4.3 \times 10^{14} Hz$. The velocity of ejected electron is $\times 10^5\ ms^{-1}$. (Nearest integer)
[Use : $h = 6.63 \times 10^{-34} Js,\ m_e = 9.0 \times 10^{-31}\ kg$]

17. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is equal to $\frac{h^2}{xma_0^2}$. The value of 10x is .
(a_0 is radius of Bohr's orbit) (Nearest integer)
[Given: $\pi = 3.14$]

18. The number of photons emitted by a monochromatic (single frequency) infrared range finder of power 1 mW and wavelength of 1000 nm, in 0.1 second is $x \times 10^{13}$. The value of x is . (Nearest integer)
($h = 6.63 \times 10^{-34}\ Js,\ c = 3.00 \times 10^8\ ms^{-1}$)

19. The value of magnetic quantum number of the outermost electron of Zn^+ ion is . (Integer answer)

20. A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is $x \times 10^{20}$. The value of x is . (Nearest integer)
[Given: $h = 6.63 \times 10^{-34}\ Js$ and $c = 3.0 \times 10^{8}\ ms^{-1}$]

21. The Azimuthal quantum number for the valence electrons of Ga^{+} ion is . (Atomic number of Ga = 31)

22. The wavelength of electrons accelerated from rest through a potential difference of 40 kV is $x \times 10^{-12} m$. The value of x is . (Nearest integer)
Given: Mass of electron $= 9.1 \times 10^{-31}\ kg$
Charge on an electron $= 1.6 \times 10^{-19}\ C$
Planck's constant $= 6.63 \times 10^{-34}\ Js$

23. A source of monochromatic radiation of wavelength 400 nm provides 1000 J of energy in 10 seconds. When this radiation falls on the surface of sodium, $x \times 10^{20}$ electrons are ejected per second. Assume that wavelength 400 nm is sufficient for ejection of electron from the surface of sodium metal. The value of x is . (Nearest integer)
$(h = 6.626 \times 10^{-34}\ Js)$

24. An accelerated electron has a speed of $5 \times 10^{6}\ ms^{-1}$ with an uncertainty of 0.02%. The uncertainty in finding its location while in motion is $x \times 10^{-9}\ m$. The value of x is .
[Use mass of electron $= 9.1 \times 10^{-31}\ kg,\ h = 6.63 \times 10^{-34}\ Js,\ \pi 3.14$]

25. The number of orbital with $n = 5, m, = +2$ is/are: (Round off to the Nearest Integer)

1. Which of the following are isostructural pairs?

A. SO_4^{2-} and CrO_4^{2-}

B. $SiCl_4$ and $TiCl_4$

C. NH_3 and NO_3^-

D. BCl_3 and $BrCl_3$

A. A and C only

B. B and C only

C. A and B only

D. C and D only

2. The correct shape and $[I—I—I]^-$ bond angles respectively in I_3^- ion are:

A. Distorted trigonal planar; 135° and 90°

B. Trigonal planar; 120°

C. T-shaped; 180° and 90°

D. Linear; 180°

3. According to molecular orbital theory, the species among the following that does not exist is:

A. He_2^-

B. Be_2

C. He_2^+

D. O_2^{2-}

4. Which among the following species has unequal bond lengths?

A. XeF_4

B. BF_4^-

C. SF_4

D. SiF_4

5. Given below are two statements:
Statement I: *o*-Nitrophenol is steam volatile due to intramolecular hydrogen bonding.
Statement II: *o*-Nitrophenol has high melting point due to hydrogen bonding.
In the light of the above statements, choose
the most appropriate answer from the
options given below:

A. Both statement I and statement II are true

B. Statement I is false but statement II is true

C. Statement I is true but statement II is false

D. Both statement I and statement II are false

6. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R
Assertion A: Dipole-dipole interactions are only non-covalent interactions, resulting in hydrogen bond formation.
Reason R: Fluorine is the most electronegative element and hydrogen bonds in HF are symmetrical.
In the light of the above statements, choose the most appropriate answer from the options given below:

A. A is false but R is true

B. Both A and R are true and R is the correct explanation of A

C. A is true but R is false

D. Both A and R are true but R is NOT the correct explanation of A

7. Match list-I with list-II:

List-I (Molecule)	List-II (Bond order)
(a)Ne_2	(i) 1
(b)N_2	(ii) 2
(c)F_2	(iii) 0
(d)O_2	(iv) 3

Choose the correct answer from the options given below

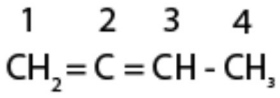
A. $(a)-(iv);(b)-(iii);(c)-(ii);(d)-(i)$

B. $(a)-(ii);(b)-(i);(c)-(iv);(d)-(iii)$

C. $(a)-(i);(b)-(ii);(c)-(iii);(d)-(iv)$

D. $(a)-(iii);(b)-(iv);(c)-(i);(d)-(ii)$

8. In given molecule,



the hybridization of carbon 1, 2, 3 and 4 respectively, are :

A. sp^2, sp^2, sp^2, sp^3

B. sp^2, sp, sp^2, sp^3

C. sp^3, sp, sp^3, sp^3

D. sp^2, sp^3, sp^2, sp^3

9. Given below are two statements one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: The H — O — H bond angle in water molecule is 104.5°.
Reason R: The lone pair-lone pair repulsion of electrons is higher than the bond pair-bond pair repulsion.
In the light of the above statements, choose the correct answer from the options given below.

A. A is false but R is true

B. A is true but R is false

C. Both A and R are true, and R is the correct explanation of A

D. Both A and R are true, but R is not the correct explanation of A

10. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is,

A. Trigonal pyramidal

B. See-saw

C. T-shaped

D. Trigonal planar

11. Which of the following compound cannot act as a Lewis base?

A. NF_3

B. PCl_5

C. ClF_3

D. SF_4

12. Amongst the following, the linear species is

A. N_3^-

B. OCl_2

C. O_3

D. NO_2

13. The hybridizations of the atomic orbitals of nitrogen in NO_2^-, NO_2^+ and NH_4^+ respectively are,

A. sp^3, sp^2 and sp

B. sp, sp^2 and sp^3

C. sp^2, sp and sp^3

D. sp^3, sp and sp^2

14. Match List-I with List-II

List-I (Species)	List-II (Hybrid orbitals)
(a) SF_4	(i) sp^3d^2
(b) IF_5	(ii) d^2sp^3
(c) NO_2^+	(iii) sp^3d
(d) NH_4^+	(iv) sp^3
	(v) sp

Choose the correct answer from the options given below :

A. $(a)-(ii),(b)-(i),(c)-(iv),(d)-(v)$

B. $(a)-(iv),(b)-(iii),(c)-(ii),(d)-(v)$

C. $(a)-(i),(b)-(ii),(c)-(v),(d)-(iii)$

D. $(a)-(iii),(b)-(i),(c)-(v),(d)-(iv)$

15. In the following the correct bond order sequence is:

A. $O_2^+ > O_2^- > O_2^{2-} > O_2$

B. $O_2^+ > O_2 > O_2^- > O_2^{2-}$

C. $O_2^{2-} > O_2^+ > O_2^- > O_2$

D. $O_2 > O_2^- > O_2^{2-} > O_2^+$

16. AX is a covalent diatomic molecule where A and X are second row elements of periodic table. Based on molecular orbital theory, the bond order of AX is 2.5. The total number of
electrons in AX is
(Round off to the Nearest Integer).

17. $SF_4, BF_4^-, ClF_3, AsF_3, PCl_5, BrF_5, XeF_4, SF_6$
The number of species that have two lone pairs of electrons in their central atom is/are

18. The number of lone pairs of electrons on the central I-atom in I_3^- is

19. The difference between bond orders of CO and NO^+ is $\frac{x}{2}$ where x is (Round off to the Nearest Integer)

20. In gaseous triethylamine the $''-C-N-C-''$ bond angle is degree.

21. The total number of electrons in all bonding molecular orbitals of O_2^{2-} is (Round off to the Nearest Integer).

22. AB_3 is an interhalogen T- shaped molecule. The number of lone pairs of electrons on A is

23. The number of species having non-pyramidal shape among the following is _____.

$(A) SO_3$
$(B) NO_3^-$
$(C) PCl_3$
$(D) CO_3^{2-}$

24. According to molecular orbital theory, the number of unpair electrons(s) in O_2^{2-} is

25. The spin only magnetic moment value of B_2^+ species is $x \times 10^{-2}\ B.M.$.
[Given : $\sqrt{3} = 1.73$] x is : (Nearest integer)