Some Basic Concepts of Chemistry & Structure of Atom

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

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4. 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}

5. 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

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

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7. 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. $5000\ ppm$

8. 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

9. 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

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10. 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

11. 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

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

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13. 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

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

A. 4

B. 8

C. 2

D. 16

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

A. Microwave

B. Infrared

C. Visible

D. None of the above

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

17. 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

18. 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

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

A. 15

B. 50

C. 25

D. 11

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

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

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

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

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

21. 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

22. 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]

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23. 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]

24. 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]

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?
    $NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaC1(s) + FeO(s)$

26. 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 : $h = 6.63 \times 10^{-34} Js,\ m_e = 9.0 \times 10^{-31}\ kg$]

27. 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: $\pi = 3.14$]

28. 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)
    ($h = 6.63 \times 10^{-34}\ Js,\ c = 3.00 \times 10^8\ ms^{-1}$)

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

30. 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 $c = 3.0 \times 10^{8}\ ms^{-1}$]