Objective

CHEMISTRY

Chapterwise & Subtopicwise

MCQ's

50,000

VOLUME-I

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Periodic Table of the Elements

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 ←	9 VIIIB	10 →	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 **H** 1.0079																1 **H** 1.0079	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.179
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.06	17 **Cl** 35.453	18 **Ar** 39.948
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01.
Some Basic Concepts of Chemistry

1. Significant figures, Units for Measurement

1. Using the rules for significant figures, the correct answer for the expression $\frac{0.02858 \times 0.112}{0.5702}$ will be

(a) 0.005613 (b) 0.00561
(c) 0.0056 (d) 0.006

JEE Main-29.06.2022, Shift-II

Ans. (b) : $\frac{0.00285 \times 0.112}{0.5702} = \frac{0.003200}{0.5702}$
$= 0.00561$

2. Manganese (VI) has ability to disproportionate in acidic solution. The difference in oxidation states of two ions it forms in acidic solution is_____.

JEE Main-27.06.2022, Shift-I

Ans. (3) : Disproportionation reaction of manganese in acidic solution –

$$3MnO_4^{2-}(aq) + 4H^+(aq) \longrightarrow 2\overset{+7}{Mn}O_4^- + \overset{+4}{Mn}O_2 + 2H_2O$$

So, difference in oxidation state of product ions of-
Mn = (+7) – (+4) = 3

3. The units of surface tension and viscosity of a liquid respectively are

(a) $kg\ m^{-1}\ s^{-1}$, $N\ m^{-1}$ (b) $N\ m^{-1}$, $kg\ m^{-1}\ s^{-1}$
(c) $kg\ m^2\ s^{-1}$, $N\ m^{-2}$ (d) $N\ m^{-1}$, $kg\ m^2\ s^{-1}$

TS-EAMCET 09.08.2021, Shift-I
WB-JEE-2015

Ans. (b)

Surface tension $(\gamma) = \frac{F}{L}$ or $\frac{W}{A}$
$= Nm^{-1}$

Coefficient of viscosity$(\eta) = \frac{F}{A\frac{dV}{dx}} = \frac{N}{m^2 \frac{ms^{-1}}{m}}$

$\eta = N m^{-2} s$
$\eta = kg\, ms^{-2}\, m^{-2} s$
$\eta = kg\, m^{-1}\, s^{-1}$

4. Given the numbers : 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers are

(a) 3, 4 and 5 respectively
(b) 3, 3 and 4 respectively
(c) 3, 3 and 3 respectively
(d) 3, 4 and 4 respectively

BITSAT 2009
NEET 1998

Ans. (c) : Each has three significant figures. All non-zero number are significant 161 has 3 significant and leading zero are not significant they are nothing more then place holder, the number 0.161 and 0.0161 has 3 significant figure.

5. The prefix 10^{18} is

(a) giga (b) kilo
(c) Exa (d) nano

BITSAT 2015, 2006

Ans. (c) : Exa is a decimal unit prefix in the matric system.
Exa = 10^{18}, Giga = 10^9
Kilo = 10^3, Nano = 10^{-9}

6. Match List-I with List-II

List-I (Parameter)		List-II (Unit)	
A.	Cell constant	1.	$S\ cm^2\ mol^{-1}$
B.	Molar conductivity	2.	Dimension less
C.	Conductivity	3.	m^{-1}
D.	Degree of dissociation of electrolyte	4	Sm^{-1}

Choose the most appropriate answer from the options given below

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

[JEE Main 2021, 31 Aug Shift-II]

Ans. (a) : Cell Constant = $\frac{Length}{Area} = \frac{m}{m^2} = m^{-1}$

Conductivity (K)= $\frac{1}{\rho} = Sm^{-1}$ or ohm^{-1}

Molar conductivity (Λm) =

$\frac{K}{C} = \frac{Sm^{-1}}{Mol.\ liter^{-1}} = \frac{Sm^{-1}}{Mol\ m^{-3}}$

$= Sm^2 mol^{-1}$
Or
$= Scm^2\ mol^{-1}$

Degree of dissociation
$= \frac{\text{amount of dissociated substance}}{\text{Total amount of Substance}}$

So, dimensionless quantity.

7. **The number of significant figures in 0.00340 is….. .**

[JEE Main 2021, 25 July Shift-II]

Ans. (3) : Significant figure is the digits of a number that are used to express it to the required degree of accuracy, starting from the first non – zero digit.
So, counting these numbers, we find that the number of significant figures in 0.00340 is 3. The significant figures of 0.00340 are '340'

8. **For a A + B products the rate of the reaction is given by Rate = K [A] $[B]^2$. The units of rate constant (K) will be______**

(a) mol $L^{-1}S^{-1}$ (b) L $mol^{-1}S^{-1}$
(c) mol^2 $L^{-2}S^{-1}$ (d) mol^{-2} L^2S^{-1}

AP EAPCET 20.08.2021 Shift-II

Ans. (d): The rate constant is expressed as relationship between the rate of a chemical reaction and the concentrations of the reacting substance.

$\therefore$ Unit of rate constant for n^{th} order = $(mol)^{1-n}(lit)^{n-1}s^{-1}$

Given rate = K [A] $[B]^2$

$\therefore n = 1 + 2 = 3(\text{third order reaction})$

Unit are $(mol)^{1-3}(lit)^{3-1}s^{-1} = mol^{-2}lit^2s^{-1}$

for zero order rate constant = mol $lit^{-1}.s^{-1}$

First order rate constant = s^{-1}

Second order rate constant = mol^{-1} lit s^{-1}.

9. **The number of significant figures in 50000.020×10^{-3} _______.**

JEE Main 26.02.2021, Shift-I

Ans. (7) :
No. of significant figure in 50000.020×10^{-3} is 7.

10. **The value of which of the following unit of concentration will not change with the change in temperature?**

(a) Molarity (b) Molality
(c) Normality (d) Formality

GUJCET-2019

Ans. (b) : Molality = $\dfrac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$

Molality of concentration will not change with the change in temperature because in molality both moles of solute and mass of solvent are independent of temperature.
Thus, molality is independent of temperature.
Molarity (M) is the amount of a substance in a certain volume of solution. Molarity is defined as the moles of a solute per litres of a solution.
Normality is a measure of concentration equal to the gram equivalent weight per litre of solution.
Formality is a substance's total concentration in solution without regard to its specific chemical form.

11. **Which of the following is the correct unit of angular momentum of an electron in an orbital of an atom?**

(a) J-s (b) J / s
(c) W / s^2 (d) W s
(e) J s^2

Kerala-CEE-2019

Ans. (a) : Angular momentum of an electron in an orbital of an atom (L) = mvr

Now, L = mv × r = kg.ms^{-1} × m
= kg m^2s^{-1} .....(i)

We know that,
1 Joule = kgm^2s^{-2}

So, multiplying and dividing equation (i) by $\dfrac{s^{-1}}{s^{-1}}$ -we get

$L = kgm^2s^{-1}\times\dfrac{s^{-1}}{s^{-1}}$

$= kgm^2\dfrac{s^{-2}}{s^{-1}}$

L = J-s

Hence, the unit of angular momentum of an electron in an orbital in J-sec.

12. **The SI unit of electrochemical equivalent is**

(a) J s^{-1} (b) kg C^{-1}
(c) kg m s^{-2} (d) kg $m^{-1}s^{-2}$

MHT CET-03.05.2019, SHIFT-I

Ans. (b) : Electrochemical equivalent is the mass of the substance deposited to one of the electrodes when a current of 1 ampere is passed for 1 second.
The SI unit of electrochemical equivalent weight is kg C^{-1}

13. **The absolute zero temperature is 0 Kelvin. In ºC unit which one of the following is the absolute zero temperature?**

(a) 0ºC (b) –100ºC
(c) –273.15ºC (d) –173.15ºC

NDA (II)-2018

Ans. (c) : Zero Kelvin (–273.15ºC) is defined as absolute zero.

14. **What is the SI unit of density?**

(a) g cm^{-3} (b) g m^{-3}
(c) kg m^{-3} (d) kg cm^{-3}

MHT CET-2018

Ans. (c) : Mass per unit volume is called density. The SI unit of density is kg m^{-3}.

15. **Which symbol replaces the unit of atomic mass, amu?**

(a) u (b) A
(c) M (d) n

MHT CET-2018

Ans. (a) : u symbol represent the unit of atomic mass, amu.
Where, a = Atomic mass number
m = Molecular mass of the molecule.
n = Number of atoms

16. **Which one of the following statements is not correct?**

(a) The hydration enthalpies of alkali metal ions decrease down the group
(b) Lithium halides are some what covalent in nature
(c) Alkali metals react with water liberating oxygen gas
(d) KO_2 is paramagnetic

AP EAMCET-2017

Ans. (c): Alkali metal reacts with water to give metal hydroxide and hydrogen.

$$\underset{\text{alkali metal}}{2M} + 2H_2O \longrightarrow 2MOH + H_2(g).$$

17. Which of the following has the dimension if $[ML^0T^{-2}]$?
(a) Coefficient of viscosity (b) Surface tension
(c) Vapour pressure (d) Kinetic energy
WB-JEE-2017

Ans. (b) : Surface tension is the tendency of liquid surface at rest to shrink into the minimum surface area possible. The surface tension is given as:

$$\text{Surface tension} = \frac{\text{Force}}{\text{Length}} = \frac{MLT^{-2}}{L} = [ML^0T^{-2}]$$

18. Which one of the following is not a unit of energy?
(a) lit-atm (b) kg m^2s^{-2}
(c) Nm (d) kg.ms^{-2}
UPTU/UPSEE-2016

Ans. (d): Kg. ms^{-2} is a unit of force and other three options are the units of energy.

19. Consider following unit values of energy
I. 1 L atm II. 1 erg
III. 1 J IV. 1 kcal
Increasing order of these values is–
(a) I = II = III = IV (b) I < II < III < IV
(c) II < III < I < IV (d) IV < I < III < II
BCECE-2013

Ans. (c):
• Energy is the capacity to do work.
R = 0.0821 L atm mol^{-1} k^{-1}
R = 8.314 × 10^7 ergs mol^{-1} k^{-1}
R = 8.314 mol^{-1} k^{-1}
R = 0.002 Kcal mol^{-1} k^{-1}

$\because$ 1 L atm = $\frac{R}{0.0821}$ mol K

• 1 erg = $\frac{R}{8.314 \times 10^7}$ mol K

• 1 J = $\frac{R}{8.314}$ mol K

• 1 kcal = $\frac{R}{0.002}$ mol K

Hence, option (c) is correct answer.

20. Dimension of universal gas constant (R) is
(a) $[VPT^{-1}n^{-1}]$ (b) $[VP^{-1}Tn^{-1}]$
(c) $[VPTn^{-1}]$ (d) $[VPT^{-1}n]$
J & K CET-(2012)

Ans. (a) : From the gas equation,

$$PV = nRT$$
$$R = \frac{P \times V}{n \times T}$$
$$R = [VPT^{-1}n^{-1}]$$

21. Which of the following represents the smallest quantity?
(a) 1230 ng (b) 1.230×10^{-4}g
(c) 1.230×10^{-6}kg (d) 1.230×10^{4}μg
UPTU/UPSEE-2011

Ans. (a) : (a) 1230 ng = 1230 × 10^{-9}g = 1.230 × 10^{-6}g
(b) 1.230 × 10^{-4}g = 1.230 × 10^{-4}g.
(c) 1.230 × 10^{-6}kg = 1.230 × 10^{-6} × 10^3g
= 1.230 × 10^{-3}g
(d) 1.230 × 10^4μg = 1.230 × 10^4 × 10^{-6}g
= 1.230 × 10^{-2}g
Thus, 1230 ng is the smallest quantity.

22. How is 0.0120 written as a scientific notation?
(a) 120×10^{-4} (b) 1.2×10^{-2}
(c) 12×10^{-3} (d) 12.0×10^{-3}
UPTU/UPSEE-2011

Ans. (b) : 0.0120 is written as 1.2 × 10^{-2}, ie. decimal is moved two places towards the right so that there is only one non-zero digit before the decimal point and the exponent of 10 is –2 in the scientific notation.
Scientific notation is a form of representing in simpler form.

23. For a reaction of type A + B → products, it is observed that doubling concentration of A causes the reaction rate to be four times as great, but doubling amount of B does not affect the rate. The unit of rate constant is
(a) s^{-1} (b) s^{-1} mol L^{-1}
(c) s^{-1} mol^{-1} L (d) s s^{-1} mol^{-2} L^2
VITEEE- 2010

Ans. (c) : For a reaction -

$$A + B \rightarrow \text{product}$$

Let the initial rate be R
And order with respect to A be x and B be y. Thus, rate law can be written as,
Rate, R = $[A]^x$ $[B]^y$ ….(i)
After doubling the concentration of A, rate becomes 4R,
4R = $[2A]^x$ $[B]^y$ ….(ii)
After doubling the concentration of B, rate remains R,
R = $[A]^x$ $[2B]^y$ ....(iii)
From equation (i) and (ii), we get

$$\frac{R}{4R} = \left(\frac{1}{2}\right)^x \Rightarrow \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x$$

So, x = 2
From equation (i) and (iii), we get

$$\frac{R}{R} = \left[\frac{1}{2}\right]^y \Rightarrow \left(\frac{1}{1}\right)^0 = \left(\frac{1}{2}\right)^y$$

So, Y = 0
Hence, the rate law is, rate R = $[A]^2[B]^0$
This clearly shows that the order of this reaction is 2 and for second order reaction units of rate constant are mol^{-1} Ls^{-1}.

24. The charge on an electron in Coulombs is–
(a) 1.602×10^{-19} (b) 1.062×10^{-19}
(c) 1.620×10^{-19} (d) 1.006×10^{-19}
BCECE-2009

Ans. (a) : Coulomb is the SI unit of electric charge which is define as the amount of charge delivered by an electric current of one ampere in one second.
The charge on an electron is
$= -1.60217663 \times 10^{-19}$ coulomb.

25. In colloid particles, range of diameter is
(a) 1 to 1000 nm (b) 1 to 1000 cm
(c) 1 to 1000 mm (d) 1 to 100 km

BCECE-2008
UPTU/UPSEE-2006

Ans. (a) : Colloid is a mixture, in which insoluble particles of one substance suspended in another substance, range of diameter in colloid particles is 1 to 1000 nm.
Colloidal particle range in diameter from 1 to 1000 nanometers and can be solid, liquid, or gases.

26. In which of the following number all zeros are significant?
(a) 0.0005 (b) 0.0500
(c) 50.000 (d) 0.0050

BITSAT-2008

Ans. (c) : If zero is used to locate the decimal point it is considered as a significant figure. In 50.000, all zero are significant.

27. Which one of the following set of units represents the smallest and largest amount of energy respectively?
(a) J and erg (b) erg and cal
(c) cal and eV (d) lit-atom and J
(e) eV and lit-atom

Kerala-CEE-2007

Ans. (e) : SI unit of energy is Joule.
Converting other units of energy into joule, we find-
$1 \text{ eV} = 1.6 \times 10^{-19}$ J
1 cal = 4.186 J
$1 \text{ erg} = 10^{-7}$ J
1 lit - atom = 101.3 J
Smallest and largest amount of energy are eV and lit-atom respectively.

28. Which of the following, is not a unit of pressure?
(a) Atmosphere (b) Torr
(c) Pascal (d) Newton

JIPMER-2004

Ans. (d) : • The force per unit area is called pressure it is denoted by P. Here, Atmosphere, Torr and Pascal, these three are unit of pressure.
• Newton is not the unit of pressure. It is the unit of force.
So, the correct option is Newton.

29. The value of amu is which of the following?
(a) 1.57×10^{-24} kg (b) 1.66×10^{-24} kg
(c) 1.99×10^{-23} kg (d) 1.66×10^{-27} kg

UP CPMT-2003

Ans. (d) : 1 amu is defined as $\left(\frac{1}{12}\right)^{th}$ of the mass one carbon-12 isotope atom. As per the definition of atomic mass unit,

$$1 \text{ amu} = \frac{1}{12}\frac{12}{N_A}\text{g}$$
$$1 \text{ amu} = \frac{1}{6.023\times10^{23}}\text{g}$$
$$1 \text{ amu} = 1.6 \times 10^{-27} \text{ kg}$$

30. The radius of an atomic nucleus is generally expressed in units of:
(a) Debye (b) Coulomb
(c) Fermi (d) Tesla

AP-EAMCET (Medical), 2001

Ans. (c) : The radius of atomic nucleus is expressed in fermi.
$1 \text{ Fermi} = 10^{-13}$ cm

31. A colloidal system has particles of which of the following size?
(a) 10^{-9}m to 10^{-12}m (b) 10^{-6}m to 10^{-9}m
(c) 10^{-4}m to 10^{-10}m (d) 10^{-5}m to 10^{-7}m

(NEET-1996)

Ans. (b) : A colloidal system has particles of 10^{-6} m to 10^{-9} m size. Colloidal system consist of dispersed of dispersed phase and dispersion medium.
So, option B is correct.

32. The dimensions of pressure are the same as that of
(a) force per unit volume
(b) energy per unit volume
(c) force
(d) energy

NEET-1995

Ans. (b): Pressure $= \frac{\text{Force}}{\text{Area}} = \frac{\text{Mass}\times\text{acceleration}}{\text{Area}}$
Dimensional formula,
$$= \frac{M\times LT^{-2}}{L^2} = ML^{-1}T^{-2}$$
Energy = work = force × displacement
$$\text{Energy per unit volume} = \frac{ML^2T^{-2}}{L^3} = ML^{-1}T^{-2}$$
Dimension of pressure is $ML^{-1}T^{-2}$ which is same as the dimension of energy per unit volume.

2. Atomic, Molecular and Equivalent Masses

33. Arrange the following in the order increasing mass (atomic mass O = 16, Cu = 63, N = 14)
I. One molecule of oxygen
II. One atom of nitrogen
III. 1×10^{-10} gram molecule of oxygen
IV. 1×10^{-10} g of copper
(a) II < I < IV < III (b) I < II < III < IV
(c) III < II < IV < I (d) IV < II < III < I
(e) II < IV < I < III

AIIMS-2016
Kerala-CEE-2011

Ans. (a) : Comparing the masses, we get correct order of increasing mass is (II) < (I) < (IV) < (III)

(I) 1 molecule of oxygen = O_2

$\therefore$ Mass of O_2

$$= \frac{16\times2}{N_A} = \frac{32g}{N_A} = \frac{32}{6.22\times10^{23}} = 5.3\times10^{-23}\,g$$

(II) Mass of 1 atom of Nitrogen = $1.66\times10^{-24}\times14$

$= 23.2\times10^{-24}\,g$

(III) 1×10^{-24} gm molecule of oxygen = 1×10^{-10} moles of O_2

Mass of 1×10^{-10} gm molecule of oxygen $1\times10^{-10}\times32$

$= 3.2\times10^{-9}\,g$

(IV) Mass of copper = $1\times10^{-10}\,g$

Comparing the masses in (I), (II), (III) and (IV)

We get, (II), < (I), < (IV), < (III)

Therefore, answer is (II) < (I) < (IV) < (III)

34. 1.520 g of hydroxide of a metal on ignition gave 0.995 g of oxide. The equivalent weight of metal is :

(a) 1.52 (b) 0.995

(c) 19.00 (d) 9.00

BITSAT-2011

BCECE-2008

Ans. (d) : Let E be the equivalent weight of the metal

So, $\frac{E+17}{E+8} = \frac{1.52}{0.995}$

[17 is equivalent weight of OH and 8 is equivalent weight of oxygen]

$\Rightarrow 0.995E + 17\times0.995 = E\times1.52 + 8\times1.52$

$\Rightarrow 0.525E = 16.915 - 12.16 = 4.755$

$\therefore E = \frac{4.755}{0.525} = 9$

35. In acidic medium, the equivalent weight of $K_2Cr_2O_7$ (Mol. wt. = M) is

(a) M (b) $\frac{M}{2}$

(c) $\frac{M}{3}$ (d) $\frac{M}{6}$

WBJEE-2012

UPTU/UPSEE-2009

Ans. (d) : An equivalent weight of a solution is defined as the molecular weight of the solute divided by the valence of the solute. Equivalent weight is used for predicting the mass of substance that react with one atom of hydrogen is acid –base analysis.

Balanced chemical reaction of $K_2Cr_2O_7$ in acidic medium will be-

$$K_2Cr_2O_7 + 14H^+ + 6e^- \rightarrow 2K^+ + 2Cr^{3+} + 7H_2O$$

In the above reaction, oxidation state of chromate ion is changing from +6 to +3, i.e. the transfer of 6 electrons is taking place.

$\therefore$ Equivalent weight = $\frac{M}{6}$

36. Assertion : The normality of 0.3 M aqueous solution of H_3PO_3 is equal to 0.6N.

Reason: Equivalent weight of H_3PO_3

$$= \frac{\textbf{Molecular weight of } H_3PO_3}{3}$$

(a) If both Assertion and Reason are correct and the Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

AIIMS-2018, 2013, 2011

Ans. (c): H_3PO_3 is a divalent. This is because it has two ionizable hydrogen atoms bonded to two oxygen atom and one non-ionizable hydrogen atom bonded directly to phosphorus.

$\therefore$ Equivalent weight = $\frac{\text{Molecular weight}}{\text{Valency factor}}$

(Where, valency factor = no. of replaceable H^+ ions)

equivalent weight = $\frac{M}{q}$, since, no. of replaceable H^+ ions in H_3PO_3 = 2

37. 0.79 gm of a metal oxide is obtained from 0.5 gm of the same metal upon oxidation. Equivalent weight of the metal will be which of the following?

(a) 10 (b) 13.8

(c) 20 (d) 40

Tripura JEE-2022

Ans. (b) : Mass of metal + mass of oxygen = mass of metal oxide

Mass of oxygen = 0.79 – 0.5

= 0.29

$$\frac{\text{Mass of metal}}{\text{Mass of oxygen}} = \frac{\text{Eq. wt. of metal}}{\text{Eq. wt. of oxygen}}$$

$\text{Eq. wt. of metal} = \frac{0.5}{0.29}\times8$

$\text{Eq. wt. of metal} = 13.79 \simeq 13.8$

38. What amount of conc. H_2SO_4 solution should be used to prepare 500 m*l* of 0.5 M H_2SO_4? (The concentration of H_2SO_4 solution being used is 90% and molecular mass of H_2SO_4 = 98.079 g. mol^{-1})

(a) 22.06 g (b) 24.52 g

(c) 11.03 g (d) 27.24 g

AP-EAPCET-23.08.2021, Shift-I

Ans. (a) : Given that-

V = 500 ml

C = 0.5 M

Concentration of H_2SO_4 solution being used is 90%

So, $C = \frac{0.5\times90}{100} = 0.45\,M$

Molecular weight of H_2SO_4 = 98.079 g/mol

$$\therefore C = \frac{n(\text{moles})}{V(\text{volume})}$$

$$\text{or } C = \frac{\text{weight}}{\text{m.weight}} \times \frac{1}{V(\text{Volume})}$$

Putting the value we get-

$$0.45 = \frac{\text{weight/amount}}{98.079 \times 0.5}$$

Amount of $H_2SO_4 = 0.45 \times 0.5 \times 98.079 = 22.06$ gm.

39. When 1 : 2 equivalence ratio of the gases X and Y are heated to 573 K – 673 K at 200 – 300 atm in the presence of ZnO – Cr_2O_3 catalyst, methanol is formed. Here, the gases X and Y are ____ and ____ respectively.

(a) CO_2 & H_2 (b) CO & H_2
(c) CH_4 & O_2 (d) CH_4 & $H_2O_{(g)}$

AP EAPCET 24.08.2021, Shift-I

Ans. (b) : $CO + 2H_2 \xrightarrow[573K-673K]{ZnO+Cr_2O_3} CH_3OH$

CO and H_2 are heated to 573 K – 673 K at 200 - 300 atm in the presence of $ZnO - Cr_2O_3$ catalyst, methanol is formed. This process is used to prepare methanol on an industrial scale.

40. 3.7 gm of a gas at 25°C occupies some volume. At 17°C, 0.184 gm hydrogen gas occupies same volume when pressures of both gases are same. What will be the molecular weight of the gas?

(a) 41.98 (b) 20.67
(c) 20.94 (d) 41.34

Tripura JEE-2021

Ans. (d) : Given, Amount of gas = 3.7g
Here, volume and pressure of both gases are same.
As we know, PV = nRT
P and V are same for both gases.
So, $n_1T_1 = n_2T_2$

$$\frac{w_1}{M_1}T_1 = \frac{w_2}{M_2}T_2$$

$$\frac{3.7}{M_1} \times 298 = \frac{0.184}{2} \times 290$$

$M_1 = 41.33$ g

41. 12.3 g of 1-bromopropane is treated with alcoholic KOH. What mass of propene is obtained if yield is 50%?

(a) 6.05 g (b) 12.3 g
(c) 4.2 g (d) 2.1 g

Assam CEE-2021

Ans. (d) :

$$CH_3 - CH_2 - CH_2 - Br \xrightarrow[KOH]{alc} CH_3 - CH = CH_2$$

12.3g 50% x g?

$121 \text{ g} \rightarrow 41 \text{ g}(100\%)$

$$1 \text{ g} \rightarrow \frac{41}{121} \times \frac{50}{100}(50\%)$$

$$12.3\text{g} \rightarrow \frac{41}{121} \times \frac{50}{100} \times 12.3$$

$= 2.06 = 2.1$g

42. Vapour density of a metal chloride is 83. If equivalent weight of the metal is 6, its atomic weight will be 1

(a) 12 (b) 24
(c) 18 (d) 60

AP EAMCET (Engg.) 21.09.2020, Shift-I

Ans. (b) : Valency of metal,

$$(n) = \frac{2 \times \text{vapour density}}{\text{Equivalent weight of metal} + 35.5}$$

$$= \frac{2 \times 83}{6 + 35.5} = 4$$

The atomic weight of metal is equal to the product of the equivalent weight of metal and valency.
Atomic weight of metal = n × equivalent weight of metal
$\Rightarrow$ 4 × 6 = 24
Hence, the correct option (b).

43. A 40% by mass sucrose solution is heated till, it becomes 50% by mass. Calculate the mass of water lost from 100 g of the solution is

(a) 10 g (b) 15 g
(c) 20 g (d) 25 g

AP EAMCET (Engg.) 21.09.2020, Shift-II

Ans. (c) : 40% sucrose solution means it contains 60% water. After heating, till 50% by mass sucrose remains.

$$\text{Thus, \% water lost } = \frac{0.4}{0.5} \times 100 = 80$$

Water lost = 100 – 80 = 20 g
Hence, option (c) is correct.

44. What will be the mass of one atom of ^{12}C?

(a) 1 amu (b) 1.9923×10^{-23}g
(c) 1.6603×10^{-22}g (d) 6 amu

WB-JEE-2020

Ans. (b) : Mass of ^{12}C = 12 gm
6.022×10^{23} atoms are present in 12 g of carbon -12 element.
Mass of 6.022×10^{23} atom = 12 gm.

$$\text{Mass of 1 Atom} = \frac{12}{6.023 \times 10^{23}}$$

$= 1.993 \times 10^{-23}$ gm

45. In a flask, the weight ratio of CH_4(g) and SO_2(g) at 298 K and 1 bar is 1:2. The ratio of the number of molecules of SO_2(g) and CH_4(g) is

(a) 1:4 (b) 4:1
(c) 1:2 (d) 2:1

COMEDK-2020

Ans. (c) : Let mass of CH_4(g) =1g

Number of moles of CH_4 (n_{CH_4})= $\frac{1}{16}$

Number of molecules of CH_4(g)= $\frac{1}{16} \times N_A$

Let the mass of SO_2(g)=2g

Number of moles of SO_2(g)(n_{SO_2})= $\frac{2}{64}$

Number of molecules of SO_2(g)= $\frac{2}{64}\times N_A$

Ratio of number of molecules of SO_2(g) and number of molecules of CH_4(g) =

$$\frac{2}{64}\times N_A : \frac{1}{16}\times N_A \Rightarrow \frac{1}{32}:\frac{1}{16} \Rightarrow 1:2$$

46. Equivalent mass of $K_2Cr_2O_7$ in acidic solution is equal to

(a) molecular mass/2 (b) molecular mass/4
(c) molecular mass (d) molecular mass/ 6.

COMEDK-2019

Ans. (d) : The given reaction occurred in acidic medium is :

$$K_2Cr_2O_7 + 14H^+ + 6e^- \longrightarrow 2K^+ + 2Cr^{3+} + 7H_2O$$

In the above reaction, you can see that 1 molecule of $K_2Cr_2O_7$ is releasing 6 electrons and molecular weight of $K_2Cr_2O_7$=294 g/mol

$\therefore$Calculation of equivalent weight

$$= \frac{\text{Molecular wt. of } K_2Cr_2O_7}{\text{Acidity}}$$

Equivalent weight = $\frac{\text{Molecular wt. of } K_2Cr_2O_7}{6}$

47. Equivalent weight of $KMnO_4$ is equal to

(a) one-sixth its molecular weight
(b) its molecular weight
(c) one-fifth its molecular weight
(d) half is molecular weight.

COMEDK-2019

Ans. (c) : $2KMnO_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$

Since, mass of oxygen are available from $\frac{2\times 8}{5\times 16} = \frac{1}{5}$ mol. wt. of $KMnO_4$

Therefore, equivalent weight of $KMnO_4$

= $\frac{1}{5}\times$ molecular weight.

Thus equivalent weight of $KMnO_4$ is one fifth its molecular weight.

48. Assertion: Molecular weight of a compound is 180, if its vapour density is 90.

Reason: Molecular Weight = $\frac{\textbf{Vapour density}}{\textbf{2}}$

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

AIIMS 25 May 2019 (Morning)

Ans. (c): Relation between molecular weight and vapour density is,

Molecular weight of compound = 2 × vapour density

= 2 × 90
= 180

Hence, assertion is correct but reason is incorrect.

49. In acid medium MnO_4^- is reduced to Mn^{2+}, by a reducing agent. Then the equivalent mass of $KMnO_4$ is given by :
(M = molecular mass)

(a) M/2 (b) M
(c) M/5 (d) M/3

Manipal-2019

Ans. (c) :

$$\underset{\text{O.N.=+7}}{MnO_4^-} + 8H^+ + 5e^- \rightarrow \underset{\text{O.N=+2}}{Mn^{2+}} + 4H_2O$$

In acidic medium, Mn^{+7} goes to Mn^{+2} state and hence there is a net gain of 5 electrons.

Now, equivalent weight

$$= \frac{\text{molar mass}}{\text{number of electrons gained or lost}}$$

So, equivalent weight = $\frac{M}{5}$

50. The equivalent weight of oxalic acid in $C_2H_2O_4.2H_2O$ is

(a) 45 (b) 63
(c) 90 (d) 126

NDA (I)-2019

Ans : (b) Given, Oxalic Acid ($C_2H_2O_4.2H_2O$)

We know that,

$$\text{Equivalent weight} = \frac{\text{Molecular weight}}{\text{n - factor}}$$

$$= \frac{126}{2} = 63$$

Hence, equivalent weight of oxalic acid ($C_2H_2O_4.2H_2O$) is 63.

51. 1 mol of $FeSO_4$ (atomic weight of Fe is 55.84g mol^{-1}) is oxidised to $Fe_2(SO_4)_3$.
Calculate the equivalent weight of ferrous ion

(a) 55.84 (b) 27. 92
(c) 18.61 (d) 111.68
(e) 83.76

Kerala-CEE-2018

Ans. (a) : 1 mol of $FeSO_4$ is oxidised to $Fe_2(SO_4)_3$.

Change in oxidation number = 1(+2 → +3)

The atomic mass of Fe = 55.84

Equivalent mass = $\frac{\text{Atomic mass}}{\text{Change in oxidation state}}$

For the charge, $Fe^{2+} \rightarrow Fe^{3+}$ i.e. (3 – 2 = 1)

The equivalent mass = $\frac{55.84}{1}$ = 55.84

52. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by iodometry, the equivalent weight of $K_2Cr_2O_7$ is :

(a) Molecular weight/2
(b) Molecular weight/6
(c) Molecular weight/3
(d) Same as molecular weight

Manipal-2018

Ans. (b) : The reaction between $Na_2S_2O_3$ and $K_2Cr_2O_7$ is as shown below.

$$26H^+ + 3S_2O_3^{2-} + 4Cr_2O_7^{2-} \rightarrow 6SO_4^{2-} + 8Cr^{3+} + 13H_2O$$

The oxidation state of chromium in $K_2Cr_2O_7$ change from +6 to +3.
The net change in oxidation number per formula unit is 6.
Hence,
The equivalent weight of $K_2Cr_2O_7 = \frac{\text{Molecular weight}}{6}$

53. A certain amount of a metal whose equivalent mass is 28 displaces 0.7 L of H_2 at STP from an acid. Hence, mass of the element is :

(a) 1.75 g (b) 0875 g
(c) 3.50 g (d) 7.00 g

Manipal-2018

Ans. (a) : Moles of $H_2 = \frac{\text{given volume}}{\text{volume at STP}}$ … (i)

Equivalent weight = $\frac{\text{molar mass of metal}}{\text{valency}}$ … (ii)

Gram equivalent metal = gram equivalent of H_2
From (i) & (ii) –

$$\frac{\text{Weight of metal}}{\text{Equivalent wt. of metal}} = \text{Moles of } H_2 \times \text{Valency factor}$$

$$\Rightarrow \frac{\text{Weight of metal}}{28} = \frac{\text{given volume}}{22.4} \times 2$$

$$\Rightarrow \frac{\text{Weight of metal}}{28} = \frac{0.7}{22.4} \times 2$$

Weight = 1.75 gm

54. The masses of oxygen which combine with a fixed mass of hydrogen to form H_2O and H_2O_2, respectively, bear the simple ratio 1:2.
The above statement illustrates which of the following laws?

(a) Law of definite composition
(b) Law of multiple proportions
(c) Gay Lussac's law of gaseous volumes
(d) Avogadro's law

COMEDK-2018

Ans. (b) : The masses of oxygen which combine with a fixed mass of hydrogen to form H_2O and H_2O_2, respectively bear the simple ratio 1: 2. It illustrates the law of multiple proportions.
The law of multiple proportions can be defined as if two elements form more than one compound between them, the mass ratios of the second elements that combine with a fixed mass of the first element will always be the ratios of small whole numbers.

55. The number of times the comparative mass of a neutron is heavier than an electron is

(a) ~1842 (b) ~182
(c) ~102 (d) ~4050

J & K CET-(2018)

Ans. (a): Mass of neutron = 1.008665 amu
Mass of electron = 0.00055 amu
Hence, Neutron is 1842 times heavier than an electron.

56. What is the formula mass of anhydrous sodium carbonate? [Given that the atomic masses of sodium, carbon and oxygen are 23u, 12u and 16u respectively]

(a) 286 u (b) 106 u
(c) 83 u (d) 53 u

NDA (II)-2018

Ans. (b) : Chemical formula of anhydrous sodium carbonate- (Na_2CO_3)
= 2 × [Atomic Mass of Na + Atomic mass of C + 3 × Atomic mass of oxygen]
$=2\times23+12+3\times16=106\ \mu$

57. A sample of oxygen contains two isotopes of oxygen with masses 16 u and 18 u respectively. The proportion of these isotopes in the sample is 3 : 1. What will be the average atomic mass of oxygen in this sample?

(a) 17.5 u (b) 17 u
(c) 16 u (d) 16.5 u

NDA (II)-2018

Ans. (d) : Given,
Two isotopes of oxygen with 16u and 18u. The proportion is given, 3:1
∴ Percentage composition of isotopes of oxygen is 75% and 25%.
Now, we know that
Average atomic mass of element=

$$\frac{(\text{Atomic mass of I}^{\text{st}} \text{ isotope} \times \text{Percentage Isotop})}{100} +$$

$$\frac{(\text{Atomic mass 2}^{\text{nd}} \text{ isotope} \times \text{Percentage of 2}^{\text{nd}})}{100}$$

$$= 16 \times \frac{75}{100} + 18 \times \frac{25}{100}$$

= 16.5u
Hence, the average atomic mass of oxygen is 16.5u .

58. Assertion : Equal moles of different substances contain same number of constituent particles.
Reason: Equal weights of different substance contain the same number of constituent particles.

(a) If both Assertion and Reason are correct and the Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

AIIMS-2017

Ans. (c): Equal moles of different substances contain same number of constituent particles. But equal weights of different substances do not contain the same number of constituent particles. Hence, Assertion is correct but reason is incorrect.

$$\text{Number of moles} = \frac{\text{Weight}}{\text{Molecular weight}}$$

$$\text{Number of moles} = \frac{\text{Number of particle}}{N_A}$$

Where, N_A = Avogadro's number

59. 4 g of copper was dissolved in conc. HNO_3. The copper nitrate thus obtained gave 5 g of its oxide on strong heating the equivalent weight of copper is

(a) 23 (b) 32
(c) 12 (d) 20

BITSAT-2017

Ans. (b) : Given that, 4 g of copper gave 5 g of its oxides means one g of oxygen combines with 4 g of copper.

∵ Eq. wt of oxygen = 8,
Therefore, 8 g of oxygen combine with
= 4 × 8 g of copper = 32 g
Hence, equivalent weight of copper = 32

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

(a) 15 kg (b) 37.5 kg
(c) 7.5 kg (d) 10 kg

[JEE Main-2017]

Ans. (c) : Given that –
Percentage of mass of oxygen (W_O) = 61.4 %
Percentage of mass of carbon (W_C) = 22.9 %
Percentage of mass of hydrogen (W_H) = 10 %
Percentage of mass of nitrogen (W_N) = 2.6 %
Weight of the person (W) = 75kg.
Mass of H^1, W_H = 10% of 75kg
= 7.5 kg
Since
$_1H^2$ is double mass of $_1H^1$
Mass of H^2, W_{H^2} = 15kg
Increase in mass $\Delta w = W_{H^2} - W_{H^1}$
= 15 kg – 7.5 kg
= 7.5 kg

61. The compound $Na_2CO_3 \cdot xH_2O$ has 50% H_2O by mass. The value of "x" is

(a) 4 (b) 5
(c) 6 (d) 7
(e) 8

Kerala-CEE-2017

Ans. (c) : Molar mass of Na_2CO_3 = 106 unit
(23 × 2) + 12 + (3 × 16)
Number of moles (per unit charge) = 50% of 106 is 106/2 = 53 gm

$\frac{53}{18} = 2.94$ mol

Total moles of H_2O = 2 × 2.94 = 5.89 ≅ 6.00

62. What mass of calcium chloride in grams would be enough to produce 14.35 g of AgCl? (Atomic mass Ca = 40, Ag = 108)

(a) 5.55 g (b) 8.295 g
(c) 11.19 g (d) 16.59 g

Manipal-2017

Ans. (a) : Given, weight of AgCl = 14.35 g
Molecular weight of AgCl = 143.32 g mol^{-1}

$$\underset{111g}{CaCl_2} + 2AgNO_3 \rightarrow Ca(NO_3)_2 + \underset{2\times143.5g}{2AgCl}$$

$CaCl_2$ required to produced 2×143.5g of AgCl = 111g
$CaCl_2$ required to produced 14.35g of AgCl

$= \frac{111\times14.35}{2\times143.5} = 5.55$ g

63. The mass of oxygen that would be required to produce enough CO which completely reduces 1.6 kg Fe_2O_3 (at. mass Fe = 56), is :

(a) 240 g (b) 480 g
(c) 720 g (d) 960 g

Manipal-2017

Ans. (b) : $3C + \frac{3}{2}O_2 \rightarrow 3CO$

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

1 mol of $Fe_2O_3 \equiv 3$ mol of CO $\equiv \frac{3}{2}$ mole of O_2

160 g of Fe_2O_3 require $O_2 = \frac{3}{2}\times32 = 48$ g

1.6 kg of Fe_2O_3 require O_2 = 480 g

64. What is the actual volume occupied by water molecules present in 20 cm^3 of water?

(a) 20 cm^3 (b) 10 cm^3
(c) 40 cm^3 (d) 24.89 dm^3

MHT CET-2017

Ans. (d) : Given,
Density of water = 1 g/cc and volume = 20 cm^3 = 20cc.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass = 1× 20 = 20 g

So, no. of moles of water $= \frac{20}{18}$ = 1.11 moles

1 moles occupies 22.4L
∴ 1.11 moles occupies 24.89L, i.e.
24.89 dm^3 (1 lt = 1dm^3)

65. 0.126 g of an acid is needed to completely neutralize 20 mL 0.1 (N) NaOH solution. The equivalent weight of the acid is

(a) 53 (b) 40
(c) 45 (d) 63

WB-JEE-2017

Ans. (d) : Gram equivalents weight of Acid = Gram equivalents of weight Base

$$\frac{0.126}{E_{Acid}} = \frac{20}{1000}\times0.1$$

$$\frac{0.126\times1000}{20\times0.1} = E_{Acid}$$

E_{Acid} = 63 g/equivalent

66. **When 2.46 g of a hydrated salt (MSO_4xH_2O) is completely dehydrated 1.20 g of anhydrous salt is obtained. If the molecular weight of anhydrous salt is 120 g mol^{-1}, what is the value of x?**
(a) 2 (b) 4
(c) 5 (d) 6
(e) 7

Kerala-CEE-2016

Ans. (e) : $\underset{2.46g}{MSO_4.xH_2O} \xrightarrow{\Delta} \underset{1.20g}{MSO_4} + \underset{xg}{H_2O}$

Molecular weight of $MSO_4 \cdot xH_2O$ = 120g + x × 18g

(120g + x.18g) of $MSO_4 \cdot xH_2O$ on complete dehydration gives 120g of MSO_4

1g gives = $\frac{120}{120+18x}$

Then, 2.46g of $MSO_4 \cdot xH_2O$ gives $\frac{120 \times 2.4g}{120+18xg}$

$\frac{120 \times 2.46}{120+18x} = 1.20$

$\frac{295.2}{120+18x} = 1.20$

295.2 = 1.20 × 120 + 1.20 × 18x
295.2 = 144 + 21.6x
295.2 – 144 = 21.6 x

$x = \frac{151.2}{21.6} = 7$

67. **The following reaction occurs in acidic medium**
$KMnO_4 + 8H^+ + 5e^- \rightarrow K^+ + Mn^{2+} + 4H_2O$
What is the equivalent weight of $KMnO_4$?
(Molecular weight of $KMnO_4$ = 158)
(a) 79.0 (b) 31.6
(c) 158.0 (d) 39.5

TS-EAMCET-2016

Ans. (b) : Given that,
$KMnO_4 + 8H^+ + 5e^- \rightarrow K^+ + Mn^{2+} + 4H_2O$
$KMnO_4$ acts as oxidising agent in acidic medium.

$\therefore$ Equivalent weight of $KMnO_4 = \frac{158}{5}$

= 31.6 g/equivalent.

68. **A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is**
(a) 124 (b) 156
(c) 64 (d) 188

COMEDK-2016

Ans. (d) : Atomic mass of metal = Eq. mass × valency
=32×2 = 64
As metal M is bivalent, formula of its nitrate will be $M(NO_3)_2$.
Molecular mass of $M(NO_3)_2$= 64 +2(14+48)
= 64+124=188

69. **8.50g of NH_3 is present in 250 mL volume. Its active mass is**
(a) 1.5 ML^{-1} (b) 2.0 ML^{-1}
(c) 1.0 ML^{-1} (d) 0.5 ML^{-1}

UPTU/UPSEE-2016

Ans. (b):

$$\text{Acive mass} = \frac{\text{Given mass of compound}}{\text{molecular mass of compound} \times \text{volume of solution}}$$

Active mass is defined as number of g mol per litre. It is also known as molar concentration molarity.

$$[NH_3] = \frac{8.50\,g}{17\,g/mol \times 250mL} \times 1000mL$$

$$[NH_3] = 2.0\,mol/L$$

70. **Sulphur forms the chlorides S_2Cl_2 and SCl_2. The equivalent mass of sulphur in SCl_2 is**
(a) 8 g/ mol (b) 16 g/mol
(c) 64.8 g/mol (d) 32 g/mol

AIIMS-2015

Ans. (b): Equivalent mass of sulphur

$\Rightarrow \frac{\text{atomic mass of sulphur}}{\text{valency}}$

$\overset{x(-1)}{SCl_2} = x + 2(-1) = 0$

x = 2

$\Rightarrow \frac{32}{2} = 16$

71. **3.011×10^{22} atoms of an element weighs 1.15 g. The atomic mass of the element is :**
(a) 23 (b) 10
(c) 16 (d) 35.5

AP-EAMCET (Engg.)-2015

Ans. (a) : From Avogadro's law :
$\because$ 3.011×10^{22} atoms contain an element weight 1.15 gm.
Atomic mass → 1 mole of atoms → 6.022×10^{23} atoms

$$1\,atom = \frac{1.15}{3.011 \times 10^{22}}$$

$$6.022 \times 10^{23}\,atoms = \frac{1.15 \times 6.022 \times 10^{23}}{3.011 \times 10^{22}} = 23$$

Thus, the atomic mass of the element is = 23.

72. **$KMnO_4$ reacts with ferrous sulphate according to the following equation.**

$MnO_4^- + 5Fe^{2+} + 8H^- \rightarrow Mn^{2+} + 2Fe^{3+} + 4H_2O$

Here, 10 mL of 0.1 M $KMnO_4$ is equivalent to
(a) 50 mL of 0.1 M $FeSO_4$
(b) 20 mL of 0.1 M $FeSO_4$
(c) 40 mL of 0.1 M $FeSO_4$
(d) 30 mL of 0.1 M $FeSO_4$

JIPMER-2015

Ans. (a) : $KMnO_4$ reacts with ferrous sulphate according to the following equation,

$2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$

2 moles of $KMnO_4$ reacts with 10 moles of $FeSO_4$

The number of moles of $KMnO_4$ in 10 ml of 0.1

M = 0.1 × 0.01 = 10^{-3} moles
No. of moles $FeSO_4$ = 5×10^{-3}
Volume having 5×10^{-3} mol in 0.1 $MFeSO_4$

$$0.1 = \frac{5\times10^{-3}\times1000}{V_{m\ell}}$$

$$V_{m\ell} = \frac{5\times10^{-3}\times1000}{0.1}$$

$$V_{m\ell} = 50\,ml$$

73. In acidic medium, dichromatic ion oxidizes ferrous ion to 'ferric ion'. If the gram molecular weight of potassium dichromate is 294g, its gram equivalent weight (in grams) is

(a) 24.5 (b) 49
(c) 125 (d) 250

JIPMER-2015

Ans. (b) : In acidic medium $K_2Cr_2O_7$ acts as a strong oxidising agent and itself gets reduced to Cr^{3+}.

$$Cr_2O_7^{-2} + 6e^- \rightarrow 2Cr^{3+}$$

The oxidation state of $K_2Cr_2O_7$

$$2(+1) + 2x + 2(-7) = 0$$
$$2x = +12$$
$$x = +6$$

Equivalent weight of

$$K_2Cr_2O_7 = \frac{\text{Molecular weight}}{\text{Valency}} = \frac{294}{6} = 49$$

74. Which of the following is correctly arranged in order of increasing weight?

(a) 0.0105 equivalent of $H_2C_2O_4$. $2H_2O$ < 0.625 g of Fe < 0.006 g atom of Ag < 6.0×10^{21}atoms of Zn
(b) 0.625 g of Fe < 0.0105 equivalent of $H_2C_2O_4$. $2H_2O$ < 6.0×10^{21} atoms of Zn < 0.006 g atom of Ag
(c) 0.625 g of Fe < 6.0×10^{21} atoms of Zn < 0.006 g atom of Ag < 0.0105 equivalent of $H_2C_2O_4$. .$2H_2O$
(d) 0.0105 equivalent of $H_2C_2O_4$. $2H_2O$ < 0.006 g atom of Ag < 6.0×10^{21} atoms of Zn < 0.625 g of Fe

JIPMER-2015

Ans. (c) : Here, the correct order of increasing weight, - 0.625 g of Fe < 6.0 × 10^{21} atoms of Zn < 0.006 g atom of Ag < 0.0105 equivalent of $H_2C_2O_4$. $2H_2O$.

6.0 × 10^{21} atoms of Zn (atomic weight 65.4 g/mol)

Corresponds to $\frac{6.0\times10^{21}}{6.0\times10^{23}}\times65.4 = 0.654$ g

0.006 g atom of Ag (atomic mass 108 g/mol)

Corresponds to 0.006 × 108 = 0.648 g

0.0105 equivalent of $H_2C_2O_4.2H_2O$ (equivalent mass 63 g/eq)

Corresponds to 0.0105 × 63 = 0.662 g

75. What is the mass of the precipitate formed when 50 mL of 16.9% solution of $AgNO_3$ is mixed with 50mL of 5.8% NaCl Solution?
(Ag = 107.8, N = 14, O = 16 Na = 23, Cl = 35.5)

(a) 3.5 g (b) 7 g
(c) 14 g (d) 28 g

NEET-2015

Ans. (b) : 16.9 g $AgNO_3$ is present in 100 mL solution.
∴ 8.45 g $AgNO_3$ is present in 50 mL solution.
5.8 g NaCl is present in 100 mL solution.
2.9 g NaCl is present in 50 mL solution.
Initial mole

	$AgNO_3$ +	NaCl →	AgCl +	$NaNO_3$
	$\frac{8.45}{169.5}$ = 0.049	$\frac{2.9}{58.5}$ = 0.049	0	0
After reaction	0	0	0.049	0.049

Therefore, mass of AgCl precipitated
= 0.049 × 143.5 = 7 g

76. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weight 10 g and 0.05 mole of X_3Y_2 weights 9 g, the atomic weights of X and Y are

(a) 40, 30 (b) 60, 40
(c) 20, 30 (d) 30, 20

NEET-2015

Ans. (a) : $M_1 \rightarrow$ Molecular mass of xy_2
$M_2 \rightarrow$ Molecular mass of x_3y_2
$a_1 \rightarrow$ Atomic weight of x
$a_2 \rightarrow$ Atomic weight of y

$$\frac{10}{M_1} = 0.1$$

m_1 = 100

$a_1 + 2a_2 = 100$ … (i)

Similarly

$$\frac{9}{m_2} = 0.05$$

$$n_2 = \frac{900}{5}$$

$$3a_1 + 2a_2 = \frac{900}{5} = 180 \quad \dots (ii)$$

Solving (i) & (ii) simultaneously

$$3a_1 + 2a_2 = 180$$
$$\underline{-a_1 \pm 2a_2 = -100}$$
$$2a_1 = 80$$
$$a_1 = 40$$
$$a_2 = 30$$

Atomic weight of x & y are
40 & 30 respectivily

77. The equivalent weight of $Na_2S_2O_3$ in the following reaction is
$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

(a) M (b) M/8
(c) M/0.5 (d) M/2

JCECE - 2014

Ans. (a) : $2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2e^-$

$$E_{Na_2S_2O_3} = \frac{2M}{2} = M$$

78. The oxide of a metal contains 40% of oxygen. The valency of metal is 2. What is the atomic weight of metal?

(a) 24 (b) 13
(c) 40 (d) 36

AP-EAMCET (Engg.) - 2014

Ans. (a) : 100 gm of metal oxide contain 40 gm oxygen and 60 gm of metal.

$\therefore$ 8 gm of oxygen will be combined with =

$\frac{60\times8}{40}$ = 12 gm of metal

$\therefore$ Equivalent weight of metal = 12

Thus, atomic weight = Eq. weight × valency
= 12×2
= 24

79. Which has the maximum number of molecules among the following?

(a) 44g CO_2 (b) 48 g O_3
(c) 8 g H_2 (d) 64 g SO_2

AIIMS-2014

Ans. (c): 8g H_2 has the maximum number of molecules.

No. of moles = $\frac{\text{weight of the substance}}{\text{Molecular weight of the substance}}$

Moles of CO_2 = $\frac{44}{44} = 1\,\text{mol.}$

Moles of O_3 = $\frac{48}{48} = 1\,\text{mol.}$

Moles of H_2 = $\frac{8}{2} = 4\,\text{mol}$

Moles of SO_2 = $\frac{64}{64} = 1\,\text{mol.}$

Maximum no. of moles will corresponds to maximum number of molecules.

4 moles of H_2 i.e. $4 \times 6.023 \times 10^{23}$ molecules.

80. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4 The ratio of number of their molecule is

(a) 1:4 (b) 7:32
(c) 1:8 (d) 3:16

[JEE Main-2014]

Ans. (b) : Given ratio of masses of oxygen and Nitrogen = 1 : 4

Let mass of O_2 = x

Mass of N_2 = 4x

Molecular mass of oxygen = 32

Molecular mass of Nitrogen = 28

Molecules of O_2 = $\frac{x}{32}N_A$

Molecules of N_2 = $\frac{4x}{28}N_A$

Ratio of number of molecules = 7:32

81. What is the mass of one molecule of yellow phosphorus? (Atomic mass, P = 30)

(a) 1.993×10^{-22} kg (b) 1.993×10^{-19} mg
(c) 4.983×10^{-20} mg (d) 4.983×10^{-23} g

MHT CET-2014

Ans. (b) : Molecular mass of yellow phosphorus (P_4) = $4 \times 30 = 120$

According to Avogadro's hypothesis,

Mass of 6.022×10^{23} molecules = 120 g

Mass of 1 Molecule = $\frac{120\times1}{6.022\times10^{23}}$
$= 19.926\times10^{-23}$ g
$= 1.993\times10^{-22}$ g
$= 1.993\times10^{-19}$ mg

82. A certain metal sulphide, MS_2, is used extensively as a high temperature lubricant, If MS_2 has 40.96% sulphur by weight, atomic mass of M will be–

(a) 100 amu (b) 96 amu
(c) 60 amu (d) 30 amu

BCECE-2013

Ans. (b) :

Weight percentage of sulphur

$= \frac{\text{Mass of sulphur}}{\text{Mass of Compound}}\times100$

$\Rightarrow 40.96 = \frac{64}{M+64}\times100$

40.96 (M + 64) = 64 × 100

40. 96 M + 64 × 40.96 = 64 × 100

M = 96 amu

Where, M = Atomic mass of metal

83. Equivalent weight of $(NH_4)_2Cr_2O_7$ in the change is
$(NH_4)_2Cr_2O_7 \to N_2 + Cr_2O_3 + 4H_2O$

(a) Mol. wt./6 (b) Mol. wt./3
(c) Mol. wt./4 (d) Mol. wt./2

UP CPMT-2013

Ans. (a) : 1 mole $(NH_4)_2Cr_2O_7 \equiv$ 1 mole of Cr_2O_3
$\equiv 1 \times 6$ eq. of Cr_2O_3

$\therefore$ Reduction of $Cr_2O_7^{2-}$ to Cr^{3+} is a $6e^-$ change.

$\left[(Cr^{6+})_2 + 6e^- \to (Cr^{3+})_2\right]$

Therefore, equivalent weight of $(NH_4)_2Cr_2O_7 = M/6$

84. The equivalent mass of a certain bivalent metal is 20. The molecular mass of its anhydrous chloride is

(a) 111 (b) 55.5
(c) 75.5 (d) 91

Karnataka-CET-2012

Ans. (a) : The equivalent mass of bivalent metal

$= \frac{\text{molecular mass}}{2}$

Molecular mass = equivalent mass × 2
= 20 × 2 = 40

The metal is bivalent. So, 1 mole of metal atoms will combine with 2 moles of chlorine atoms.

$M + Cl_2 \to MCl_2$

The atomic mass of chlorine is 35.5 g

The molecular mass of its anhydrous chloride will be 40 + 2(35.5) = 111 g/mol.

85. A 100% pure sample of a divalent metal carbonate weighing 2g on complete thermal decomposition releases 448 cc of carbon dioxide at STP. The equivalent mass of the metal is

(a) 40 (b) 20
(c) 28 (d) 12
(e) 56

Kerala-CEE-2012

Ans. (b) : Formula of Metal carbonate is MCO_3
Molar mass of $MCO_3 = x + 12 + 3 \times 16$
$= (x + 60)$ g /mol
(Let atomic mass of M is x)
448 cc (448mL) CO_2 is produced from
Carbonate = 2 g
22400 cc CO_2 will be obtained from carbonate

$$= \frac{2\times 22400}{448} = 100\,g$$

$\therefore$ $100 = x + 60$
$x = 100 - 60 = 40$ g/mol

$$\text{Equivalent mass of metal} = \frac{\text{Atomic mass}}{\text{Valency}}$$

$$= \frac{40}{2} = 20\,g\,\text{equiv}^{-1}$$

86. 50 mL of each gas A and of gas B takes 150 and 200 seconds respectively for effusing through a pin hole under the similar conditions. If molecular mass of gas B is 36, the molecular mass of gas A will be

(a) 96 (b) 128
(c) 32 (d) 20.2

NEET-2012

Ans. (d) : Graham's law of effusion states that the rate of effusion of a gas is inversely proportional to the square root the molar mass of its particles.

$V_A = V_B = 50mL$
$T_A = 150s$
$T_B = 200s$
$M_B = 36$
$M_A = ?$

From Graham's law of effusion.

$$\frac{r_B}{r_A} = \sqrt{\frac{M_A}{M_B}} = \frac{V_B T_A}{T_B.V_A}$$

$$\sqrt{\frac{M_A}{36}} = \frac{V_A \times 150}{200\times V_A}$$

$$\text{or } \sqrt{\frac{M_A}{36}} = \frac{15}{20} = 3/4$$

$$\frac{M_A}{36} = \frac{9}{16}$$

$$M_A = \frac{9\times 36}{16} = \frac{81}{4} = 20.25 \approx 20.2$$

87. A certain gas takes three times as long to effuse out as helium. Its molecular mass will be

(a) 27 u (b) 36 u
(c) 64 u (d) 9 u

NEET-2012

Ans. (b) : The rate of effusion is inversely proportional to the molecular mass

$$\frac{r_1}{r_2} = \sqrt{\frac{Mw_2}{Mw_1}}$$

The rate of effusion is the ratio of the volume effused to the time taken

$$\frac{v_1}{t_1}\times\frac{t_2}{v_2} = \sqrt{\frac{Mw_2}{Mw_1}}$$

Here, volume is same.

$$\text{So, } \frac{3}{1} = \sqrt{\frac{Mw_2}{4}}$$

$$9 = \frac{Mw_2}{4}$$

$$Mw_2 = 36$$

88. Two gases A and B having the same volume diffuse through a porous partition in 20 and 10 seconds respectively. The molecular mass of A is 49 u. Molecular mass of B will be

(a) 50.00 u (b) 12.25 u
(c) 6.50 u (d) 25.00 u

UP CPMAT-2012
NEET-2011

Ans. (b) : Graham's law of diffusion states that the rate of diffusion of a gas is inversely proportional to the square root of its molecular weight.

According to the Graham's law

$$\text{Rate of diffusion (r)} \propto \frac{1}{\sqrt{M}}$$

$$\text{Rate of diffusion} = \frac{v}{t}$$

Where v is volume and t is time

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

$$\frac{\frac{v_1}{t_1}}{\frac{v_2}{t_2}} = \sqrt{\frac{M_2}{M_1}} = \frac{t_2}{t_1} = \sqrt{\frac{M_2}{49}}$$

$$\frac{1}{2} = \sqrt{\frac{M_2}{49}}$$

$$M_2 = \frac{49}{4}$$

$M_2 = 12.254$

89. Excess of silver nitrate solution is added to 100 mL of 0.01 M pentaaqua chloro chromium (III) chloride solution. The mass of silver chloride obtained in grams is [Atomic mass of silver is 108].

(a) 287×10^{-3} (b) 143.5×10^{-3}
(c) 143.5×10^{-2} (d) 287×10^{-2}

Karnataka-CET-2011

Ans. (a) : The reagent is [Cr $(H_2O)_5Cl$] Cl_2

$[Cr(H_2O_5)_5Cl]Cl_2 \xrightarrow[AgNO_3]{Excess} [Cr(H_2O_5)_5Cl]^+ NO_3^- + 2AgCl\downarrow$

No. of moles of Cl^- ion present $= \frac{2\times100\times0.01}{1000}$

= 0.002

∴ Mass of AgCl = 0.002 × 143.5

= 0.287

= 287×10^{-3} g

90. Equivalent and molecular masses are same in

(a) Mohr's salt
(b) potassium permanganate
(c) potassium dichromate
(d) oxalic acid.

COMEDK-2011

Ans. (a) : Mohr's salt is $FeSO_4.\ (NH_4)_2SO_4.\ 6H_2O$.

$Fe^{2+} \rightarrow Fe^{3+} + e^-$

The oxidation state of Fe change from +2 to +3.

$\therefore$ Equivalent wt. of Mohr's salt $= \frac{\text{Mol.wt.}}{1} = \frac{392}{1} = 392$

91. Two different electrolytic cells filled with molten $Al(NO_3)_3$ respectively are connected in series. When electricity is passed 2.7 gram Al is deposited on electrode. Calculate the weight of Cu deposited on cathode. [Cu = 63.5 ; Al = 27.0 gram. mol^{-1}]

(a) 190.5 gram (b) 9.525 gram
(c) 63.5 gram (d) 31.75 gram

GUJCET-2011

Ans. (b): $Cu^{2+} + 2e^- \rightarrow Cu(s)$

$Al^{3+} + 3e^- \rightarrow Al(s)$

When same current is passed through two electrolytic solution containing copper nitrate $[Cu(NO_2)_2]$ and aluminium nitrate $[Al(NO_3)_3]$ are connected in series.

$\therefore \frac{\text{Weight of Cu deposited}}{\text{Weight of Al deposited}} = \frac{\text{Equivalent weight of Cu}}{\text{Equivalent weight of Al}}$

$\frac{\text{Wt. of Cu}}{2.7} = \frac{31.7}{9}$

$\text{Wt. of Cu} = \frac{31.7\times2.7}{9} = 9.5\,\text{gram}$

So, weight of Cu deposited = 9.525 gm

92. Equivalent weight of crystalline oxalic acid is

(a) 90 (b) 63
(c) 53 (d) 45

BCECE-2011

Ans. (b) : Formula of crystalline oxalic acid $C_2H_2O_4$

$\text{Equivalent weight} = \frac{\text{Molecular weight}}{\text{valency}}$

$\Rightarrow \frac{126}{2} = 63$

93. The equivalent weight of $MnSO_4$ is half of its molecular weight when it is converted to

(a) Mn_2O_3 (b) MnO_2
(c) MnO_4^- (d) MnO_4^{2-}

CG PET- 2011

Ans. (b) :

Equivalent weight in redox system= $\frac{\text{Molar mass}}{\text{n} - \text{factor}}$

(where, n-factor is net change in oxidation number per formula unit of oxidising or reducing agent.)

In $MnSO_4$. n – Factor is 2 because equivalent weight is equal to its molecular weight.

Here, n-factor –

$MnSO_4 \rightarrow Mn_2O_3$ 1(+2 → +3)

$MnSO_4 \rightarrow MnO_2$ 2(+2 → +4)

$MnSO_4 \rightarrow MnO_4^-$ 5(+2 → +7)

$MnSO_4 \rightarrow MnO_4^{2-}$ 4(+2 → +6)

Therefore, $MnSO_4$ convert to MnO_2. Then the n-factor is to and the equivalent weight of $MnSO_4$ will be half of its molecular weight.

94. If the equivalent weight of a trivalent metal is 32.7, the molecular weight of its chloride is

(a) 68.2 (b) 103.2
(c) 204.6 (d) 32.7

JCECE - 2011

Ans. (c) : Atomic wt. of metal = valency × equivalent weight

= 3 × 32.7

Molecular wt. of metal chloride

(MCl_3) = (3 × 32.7) + (3 × 35.5)

= 204.6

95. In the disproportionation reaction

$3HClO_3 \longrightarrow HClO_4 + Cl_2 + 2O_2 + H_2O$, the equivalent mass of the oxidizing agent is (molar mass of $HClO_3$ = 84.45)

(a) 16.89 (b) 32.22
(c) 84.45 (d) 28.15
(e) 29.7

Kerala-CEE-2011

Ans. (a): $2H\overset{+5}{Cl}O_3 \longrightarrow H\overset{+7}{Cl}O + \overset{0}{Cl_2} + 2O_2 + H_2O$

Since oxidation number of Cl decreases from +5 in $HClO_3$ to zero in Cl_2. Therefore, $HClO_3$ acts as an oxidising agent.

Eq. mass of $HClO_3$

$= \frac{\text{Mol. mass of } HClO_3}{\text{oxidation number change}} = \frac{84.45}{5} = 16.89$

96. One atomic mass is equal to

(a) 1.66×10^{-27} g (b) 1.66×10^{-24} g
(c) 1.66×10^{-23} g (d) 1.66×10^{-25} kg

MHT CET-2011

Ans. (b) : An atomic unit of mass is defined as accurately $1/12^{th}$ mass of a C-12 atom.

One, AMU is the average of the proton rest mass and the neutron rest mass. This is approximately 1.67377×10^{-27} kilogram (kg) or 1.67377×10^{-24} gram (g). The mass of an atom in AMU is roughly equal to the sum of the number of protons and neutrons in the nucleus.

97. If The molecular wt. of $Na_2S_2O_3$ and I_2 are M_1 and M_2 respectively, then what will be the equivalent wt. of $Na_2S_2O_3$ and I_2 in the following reaction?

$$\mathbf{2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-}$$

(a) M_1, M_2 (b) $M_1, M_2/2$
(c) $2M_1, M_2$ (d) $M_1, 2M_2$

WB-JEE-2011

Ans. (b) :

Change in O.N. per mole = 0.5×2 = 1

$\underset{(+2)}{2S_2O_3^{2-}}$ $\underset{(0)}{+I_2}$ $\underset{(+2.5)}{S_4O_6^{2-}}$ $\underset{(-1)}{+2I^-}$

Change in O.N. per mole = 1 × 2 = 2

Equivalent mass of $S_2O_3^{2-} = \frac{M_1}{1} = M_1$

And equivalent mass of $I_2 = \frac{M_2}{2}$

98. 2g of metal carbonate is neutralized completely by 100 mL of 0.1 N HCl. The equivalent weight of metal carbonate is

(a) 50 (b) 100
(c) 150 (d) 200

WB-JEE-2011

Ans. (d) : As 2 g of metal carbonate is neutralized by 100 mL of 0.1 N HCl

$$\text{Normality} = \frac{\text{Number of gram equivalents of HCl}}{\text{Volume of solution (L)}}$$

$$0.1 = \text{Number of gram equivalents of HCl} \times \frac{100}{1000}$$

$\therefore$ Number of gram – equivalents of HCl

$$\frac{100 \times 0.1}{1000} = 0.01$$

Mass of 0.01 gram equivalent metal carbonate
= 2g

Mass of 1 gram equivalents metal carbonate

$$= \frac{2}{0.01} = 200\,g$$

$\therefore$ Equivalent mass of metal carbonate = 200

99. In the reaction of sodium thiosulphate with I_2 in aqueous medium the equivalent weight of sodium thiosulphate is equal to

(a) molar mass of sodium thiosulphate
(b) The average of molar masses of $Na_2S_2O_3$ and I_2
(c) half the molar mass of sodium thiosulphate
(d) molar mass of sodium thiosulphate×2

WB-JEE-2010

Ans. (a) : For two molecules of sodium thiosulphate, 2 electrons are lost by sodium thiosulphate. So, one molecule of sodium thiosulphate will lose one electron eventually.

Therefore, the number of electrons lost is 1.

$$\text{Equivalent weight} = \frac{\text{Molecular weight}}{1}$$

$$I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$$

Half reaction occur as :

$$I_2 + 2e^- \rightarrow 2I^-$$

$$2S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2e^-$$

for 2 electron lost by 2 molecules of $S_2O_3^{2-}$ (Sodium thiosulphate).

So one molecule will lost 1 electron so equivalent weight is equal to molecular weight divided by 1.

Equivalent weight = Molecular weight

100. The number of water molecules differing in molecular mass formed by hydrogen isotopes and oxygen isotopes

(a) 6 (b) 9
(c) 12 (d) 18

SCRA-2010

Ans. (a) : Water molecule mass formed by O^{16} and $_1H^1$, $_1H^2$, $_1H^3$ isotope is–

18, 20, 22, 19, 20, 19, 21, 20, 21

Water molecule mass formed by O^{17} and $_1H^1$, $_1H^2$, $_1H^3$ isotope is–

19, 21, 23, 20, 21, 20, 22, 21, 22

Water molecule mass formed by O^{18} and $_1H^1$, $_1H^2$, $_1H^3$ isotope is–

20, 22, 24, 21, 22, 21, 23, 22, 23

So, total 6 different water molecules can be formed which have mass–

18, 19, 20, 21, 22, 23

101. 0.32 g of metal gave on treatment with an acid 112 mL of hydrogen at NTP. Calculate the equivalent weight of the metal.

(a) 58 (b) 32
(c) 11.2 (d) 24

AMU-2010

Ans. (b) : Given, mass of metal = 0.32 g
volume of hydrogen = 112 ml
Equivalent weight

$$= \frac{\text{Mass of metal} \times 11200}{\text{Volume in mL of hydrogen}}$$

Given, Mass of metal = 0.32 g
Volume of hydrogen at NTP = 112 mL

$$\text{Equivalent weight} = \frac{0.32 \times 11200}{112} = 32g$$

102. The vapour density of ozone is

(a) 16 (b) 32
(c) 24 (d) 48

BITSAT-2010

Ans. (c) : We know that,

$$\text{Vapour density} = \frac{\text{molecular weight}}{2}$$

Molecular weight of O_3 = 16 × 3 = 48

$$\text{Then, Vapour density of ozone} = \frac{48}{2} = 24$$

103. The density of a gas is found to be 1.56g/L at 745 mm pressure and 65ºC. What is the molecular mass of the gas?

(a) 44.2 u (b) 4.42 u
(c) 2.24 u (d) 22.4 u

JIPMER-2010

Ans. (a): Pressure is P = 745 mm = 0.98 atm (1 atm = 760 mm Hg)
Temperature is T = 65°C = 65 + 273 = 338K
Density is d = 1.56 g/L
From ideal gas equation,

$$PV = nRT$$

$$P = \frac{m}{M \times V} \times R \times T \quad \left\{\begin{matrix}\text{Where, m = given mass.} \\ \text{M = molecular mass}\end{matrix}\right\}$$

$$M = \frac{d \times R \times T}{P} \quad (d = \text{density} = \frac{m}{v})$$

$$M = \frac{1.56 \times 338 \times 0.0821}{0.98} = 44.2u$$

Hence, the molecular mass of the gas is 44.2u

104. A 0.5 g/L solution of glucose is found to be isotonic with a 2.5 g/L solution of an organic compound. What will be the molecular weight of that organic compound?
(a) 300 (b) 600
(c) 900 (d) 200

JIPMER-2009

Ans. (c) : We know, two solutions are said to be isotonic when pressure are equal.
Osmotic pressure is given by (For glucose)

$$\frac{nRT}{V} = \frac{mRT}{MV} = \frac{0.5RT}{M} = \frac{RT}{360}$$

For other organic compound.

$$\frac{nRT}{V} = \frac{mRT}{MV} = \frac{2.5RT}{M_1}$$

n = Moles of solute.
m = mass of solute.
M = Molecular weight of solute.
V = volume of solution.
T = Temperature
When both the pressures are equal.

$$\frac{RT}{360} = \frac{2.5RT}{M_1}$$

$$M_1 = 900$$

105. The equivalent weight of Potassium permanganate ($KMnO_4$) in neutral medium will be
(a) Atomic weight (b) $\frac{\text{Atomic weight}}{2}$
(c) $\frac{\text{Atomic weight}}{3}$ (d) $\frac{\text{Atomic weight}}{5}$

MPPET- 2009

Ans. (c) : In neutral medium–

$$MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$$

Here, n = 3
∵ Molecular weight = 158.04

$$\because \text{Equivalent weight} = \frac{\text{Atomic Weight}}{\text{n - factor}}$$

$$\therefore \text{Equivalent weight} = \frac{\text{Atomic Weight}}{3}$$

106. 1.5 g of $CdCl_2$ was found to contain 0.9 g of Cd. Calculate the atomic weight of Cd.
(a) 118 (b) 112
(c) 106.5 (d) 53.25

AP EAMCET (Engg.)-2009

Ans. (c): Given that,
$CdCl_2 \rightarrow 1.5g$
$Cd \rightarrow 0.9g$
$Cl_2 \rightarrow$ 0.6 g(1.5–0.9)
∵ 0.6 g chlorine combine with 0.9 g Cd
∴ 71 g chlorine will combine with $\frac{0.9}{0.6} \times 71$ g Cd = 106.5 g Cd
∴ Atomic weight of Cd = 106.5

107. The standard for atomic mass is
(a) ${}_1^1H$ (b) ${}_6C^{12}$
(c) ${}_6C^{14}$ (d) ${}_8O^{16}$

BCECE-2009

Ans. (b) : Carbon-12 is the standard while measuring the atomic mass. because no other nuclides other than carbon – 12 have exactly whole number masses.
An atomic mass unit is defined as precisely $1/12^{th}$ mass of an atom of carbon-12 The Carbon -12 (C – 12) atom has six protons and six neutrons in its nucleus.
The C – 12 isotope of the carbon is the stable isotope which is not much affected as compared to others elements. Thus it is chosen as the standard for expressing the atomic mass and the molecular mass of the substance.

108. The equivalent mass of potassium permanganate in alkaline medium is its
(a) $\frac{\text{Molar Mass}}{5}$ (b) $\frac{\text{Molar Mass}}{3}$
(c) $\frac{\text{Molar Mass}}{2}$ (d) Molar mass itself

J & K CET-(2009)

Ans. (d) : The reaction in alkaline medium is:

$$K\overset{+7}{Mn}O_4 + 1e^- \rightarrow K_2\overset{+6}{Mn}O_4$$

Thus, n factor = change in oxidation state = 1
The equivalent mass of potassium permanganate in alkaline medium is its molar mass itself

$$\text{Equivalent weight} = \frac{\text{molar mass}}{\text{n} - \text{factor}} \Rightarrow \frac{\text{molar mass}}{1}$$

109. The formula mass of Mohr's salt is 392. The iron present in it is oxidised by $KMnO_4$ in acid medium. The equivalent mass of Mohr's salt is
(a) 392 (b) 31.6
(c) 278 (d) 156

JCECE - 2009

Ans. (a) : We know, Formula of Mohr's salt :
$(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$
oxidation of Fe^{2+} ions take place as:

$$5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$$

Total change in oxidation number of iron (Fe)
= +3 – (+2) = +1

Equivalent mass of Mohr's salt

$= \frac{\text{Molecular mass}}{\text{Change in oxidation number}}$

$= \frac{392}{1} = 392$

110. A bivalent metal has an equivalent mass of 32. The molecular mass of the metal nitrate is

(a) 182 (b) 168
(c) 192 (d) 188

Karnataka-CET, 2009

Ans. (d) : Equivalent mass $= \frac{\text{Atomic mass}}{2}$

$32 = \frac{\text{Atomic mass}}{2}$

Atomic mass of the metal = 32 × 2 = 64

Formula of metal nitrate = M $(NO_3)_2$

∴ Molecular mass = 64 + 28 + 96 = 188

111. Copper is a divalent metal. The value of its electrochemical equivalent is 3.29×10^{-4} g. Its atomic mass is

(a) 31.74 g (b) 63.5 g
(c) 126.9 g (d) 15.87 g

MHT CET-2009

Ans. (b) : Electrochemical equivalent is the weight of a substance deposited or evolved during electrolysis by the passage of a specified quantity of electricity and usually expressed in grams per coulomb.

Electrochemical equivalent, $Z = \frac{E}{96500}$

Or, $3.29\times10^{-4} = \frac{E}{96500} = 31.74$

Atomic mass = 2 ×E [∴Cu is divalent]

= 2 × 31.74 = 63.49 gm

112. 0.126 g of an acid is titrated with 0.1 N 20 mL of an base. The equivalent weight of the acid is

(a) 63 (b) 50
(c) 53 (d) 23

UP CPMT-2009

Ans. (a): We know that,

$w = \frac{E\times NV}{1000}$

$\therefore \text{Eq. wt. of acid} = \frac{w\times1000}{NV}$

$= \frac{0.126\times1000}{0.1\times20}$

$= 63$

113. Mass of 0.1 mole of methane is

(a) 1g (b) 16g
(c) 1.6 g (d) 0.1 g

Karnataka-CET, 2008

Ans. (c) : Mass of one mole of methane (CH_4) = 16g

Mass of 0.1 mole of methane = 16 × 0.1g = 1.6 g

114. In acidic medium dichromate ion oxidises ferrous ion to ferric ion. If gram molecular weight of potassium dichromate is 294 g, its gram equivalent weight is

(a) 294 g (b) 127 g
(c) 49 g (d) 24.5 g

JCECE - 2008

Ans. (c) : In acidic medium $K_2Cr_2O_7$ acts as a strong oxidizing agent and itself gets reduced to Cr^{3+}

$\overset{+6}{Cr_2}O_7^{2-} + 6e^- \rightarrow 2Cr^{3+}$

During the reaction, the oxidation number of Cr decreases from +6 to +3.

Net decrease in the oxidation number of one Cr atom is 6 – 3 = 3 for 2 Cr atoms (in dichromate ion), the total decrease in the oxidation number is 2 × 3 = 6

Equivalent weight of $K_2Cr_2O_7 = \frac{\text{molecular weight}}{6}$

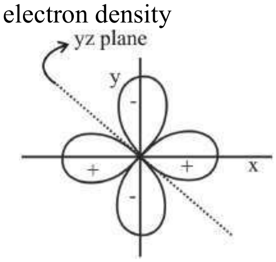
$= \frac{294}{6} = 49$

115. 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

J & K CET-(2008)

Ans. (a) : No electron density



Electron density in the yz plane of $3d_{x^2-y^2}$ orbital is zero.

116. Assertion : Equivalent weight of a base $= \frac{\text{Molecular weight}}{\text{Acidity}}$

Reason : Acidity is the number of replaceable hydrogen atoms in one molecule of the base.

(a) If both Assertion and Reason are correct and the Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

AIIMS-2008

Ans. (c):

Equivalent weight of base $= \frac{\text{Molecular weight}}{\text{Acidity}}$

Acidity of base is defined as the number of ionizable hydroxyl group present in base.

So, reason is incorrect.

117. The number of formula units calcium flouride CaF_2 present in 146.4 g of CaF_2 are (molar mass of CaF_2 is 78.08 g/mol)

(a) 1.129×10^{24} CaF_2 (b) 1.146×10^{24} CaF_2
(c) 7.808×10^{24} CaF_2 (d) 1.877×10^{24} CaF_2

VITEEE- 2008

Ans. (a) : CaF_2 = 146.4g
Molecular weight CaF_2 = 78.08 g/mol
Formula unit = no. of molecules of CaF_2.

$$\text{Moles} = \frac{\text{mass in gm}}{\text{molar mass}} = \frac{146.4\,\text{gm}}{78.08\,\text{gm}} = 1.875$$

$$\text{Molecules} = \text{Mole} \times 6.022 \times 10^{23}$$
$$= 1.875 \times 6.022 \times 10^{23}$$
$$= 1.129 \times 10^{24} \text{ units of } CaF_2$$

118. The mass of $KClO_3$ required to produce 2.4 mol of oxygen by catalytic decomposition will be

(a) 19.6 g (b) 196.0 g
(c) 122.5 g (d) 245.0 g

[Given that : $2KClO_{3(g)} \to 2KCl_{(g)} + 3O_{2(g)}$; molar mass of $KClO_3$=122.5 g]

AMU – 2007

Ans. (b) : $2KClO_{3(g)} \to 2KCl_{(g)} + 3O_{2(g)}$
Molar mass of $KClO_3$= 122.5
Now, 3 mol of O_2 is produced by 2 mol of $KClO_3$.
1 mole of O_2 is producd by $\frac{2}{3}$ mole of $KClO_3$
24 mole of O_2 is produced by $\frac{2}{3} \times 2.4$ mole of $KClO_3$
= 1.6 mol of $KClO_3$
Therefore, the mass of $KClO_3$ required to produce 2.4 mol of oxygen is given as
=1.6×122.5 g =196 g

119. The milliequivalent in 60 ml 4M H_2SO_4 is:

(a) 240 (b) 480
(c) 24 (d) 48

[BITSAT – 2007]

Ans. (b) : Relation between normality and molarity is given by the equation
Normality = n × Molarity
Where,
n = number of replaceable hydrogen = 2 (for sulfuric acid)
Given
Molarity of the solution = 4.0M
Then
$N_{H_2SO_4} = 2 \times 4 = 8\,N$
Milliequivalents = Normality × volume (in mL)
= 8 × 60
= 480 m. eq.

120. An oxide of the element contains 20% O_2 by weight. Calculate the equivalent weight of the element.

(a) 8 (b) 16
(c) 32 (d) 12

Karnataka-CET-2007

Ans. (c) : Gram equivalent of element
= Gram equivalent of O_2

$$\frac{80}{E} = \frac{20}{8}$$
E = 32

121. What is the equivalent weight of $SnCl_2$ in the following reaction

$SnCl_2 + Cl_2 \longrightarrow SnCl_4$?

(a) 95 (b) 45
(c) 60 (d) 30

Karnataka-CET-2007

Ans. (a) : $\underset{190}{SnCl_2} + \underset{71}{Cl_2} \longrightarrow SnCl_4$

$$\frac{190}{E_1} = \frac{71}{35.5}$$
$\Rightarrow$ E_1 = 95

122. An element, X has the following isotopic composition :

$^{200}X : 90\%$ $^{199}X : 8.0\%$ $^{202}X : 2.0\%$

The weighted average atomic mass of the naturally occurring element X is closed to

(a) 201 amu (b) 202 amu
(c) 199 amu (d) 200 amu

NEET-2007

Ans. (d) : weight of ^{200}X = 0.90 × 200 = 180.00 u
Weight of ^{199}X = 0.08 × 199 = 15.92 u
Weight of ^{202}X = 0.02 × 202 = 4.04 u
Total weight = 199.96 ≈ 200 amu.

123. A 0.5 g/L solution of glucose is found to be isotonic with a 2.5 g/L solution of an organic compound. What will be the molecular weight of that organic compound?

(a) 300 (b) 600
(c) 900 (d) 200

AP-EAMCET (Medical), 2006

Ans. (c) : 0.5 g/L (Glucose) 2.5 g/L (Organic compound)
Isotone,
$\pi_1 = \pi_2$
$C_1RT = C_2RT$ $\{C_1, C_2$ = Molarity$\}$
$C_1 = C_2$

$$\frac{0.5/180}{1} = \frac{2.5/M}{1}$$
$$\frac{0.5}{180} = \frac{2.5}{M}$$
$$\boxed{M = 900\,g/mole}$$

124. The equivalent weight of potassium permanganate when it acts as oxidizing agent in ferrous ion estimation is

(a) 158 (b) 31.6
(c) 79 (d) 39.5

VITEEE- 2006

Ans. (b) : The oxidation of ferrous ion by $KMnO_4$ takes place in acidic medium as per following reaction

$$2KMnO_4 + 8H_2SO_4 + 10FeSO_4$$
$$\rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5Fe_2(SO_4)_3$$
$\therefore$ Eq. mass of $KMnO_4$
$$\frac{\text{Molecular mass}}{\text{change in oxidation number}}$$
$$= \frac{158}{5} = 31.6$$

125. $KMnO_4$ (mol. wt. = 158) oxidizes oxalic acid in acidic medium to CO_2 and water as follows.
$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$
What is the equivalent weight of $KMnO_4$?
(a) 158 (b) 31.6
(c) 39.5 (d) 79

J & K CET-(2006)

Ans. (b) : Given that,
Molecular wt. of $KMnO_4$ = 158
$$MnO^{-4} \longrightarrow Mn^{2}_{+}$$
(Oxidation number of M_n = +7) (Oxidation number of M_n = +2)
Equivalent mass of $KMnO_4$ =
$$\frac{\text{molecular mass}}{\text{change in oxidation number}}$$
$$= \frac{158}{5} = 31.6$$

126. 1.520 g of hydroxide a metal on ignition gave 0.995 g of oxide. The equivalent weight of metal is
(a) 1.52 (b) 0.995
(c) 190 (d) 9

UP CPMT-2006

Ans. (d) : Since hydroxide and oxide both are involving in same reaction, the ratio of their molecular weight is equal to the ratio of their equivalent weight.
$$\frac{E_{Hydroxide}}{E_{metal} + E_{OH^-}} = \frac{E_{oxide}}{E_{metal} + E_O}$$
$$\frac{1.520}{E+17} = \frac{0.995}{E+8}$$
$$E = 9$$

127. The mass of a photon with wave length 3.6 Å is
(a) 6.135×10^{-29} kg (b) 3.60×10^{-29} kg
(c) 6.135×10^{-33} kg (d) 3.60×10^{-27} kg

AMU-2005

Ans. (a) : $\lambda = 3.6 \times 10^{-10}$m
We know, de-Broglie wavelength
$$\lambda = \frac{h}{p} \Rightarrow \lambda = \frac{h}{mv} \Rightarrow m = \frac{h}{\lambda v}$$
$\lambda = 3.6$ A° $= 3.6 \times 10^{-10}$m
Velocity of Photon = velocity of light
$$m = \frac{h}{\lambda v} = \frac{6.626\times10^{-34}\,Js^{-1}}{(3.6\times10^{-10}\,m)(3\times10^{8}\,ms^{-1})}$$
$$= 6.135 \times 10^{-29}\text{kg.}$$

128. The standard adopted for the determination of atomic weight of elements is based on:
(a) H^1 (b) C^{12}
(c) O^{16} (d) S^{32}

JCECE - 2005

Ans. (b) : The standard adopted for the determination of atomic weight of elements is based on C^{12}.
Mass of one atom of an element = atomic mass × $\left(\frac{1}{12}\right)^{th}$ of the mass of one atom of carbon.

129. The mass of carbon anode consumed (giving only carbon dioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is
(a) 270 kg (b) 540 kg
(c) 90 kg (d) 180 kg

NEET-2005

Ans. (c): $\underset{3\times12=36}{2Al_2O_3 + 3C} \longrightarrow \underset{4\times27=108}{4Al + 3CO_2}$
$\therefore$ For 108 g of Al, 36 g of C is required in above reaction
$\therefore$ For 270 kg of Al require amount of C
$$= \frac{36}{108}\times 270 = 90 \text{ kg}$$

130. What is the ratio of mass of an electron to the mass of a proton?
(a) 1 : 2 (b) 1 : 1
(c) 1 : 1837 (d) 1 : 3

UPTU/UPSEE-2004

Ans. (c) : It is clear that an electron is 1/1837 times lighter than a proton,
So, ratio between them will be = 1 : 1837
Or
$$\frac{\text{Mass of proton}}{\text{Mass of electron}} = \frac{1.6\times10^{-27}}{9.1\times10^{-31}} = 1.8\times10^{3}$$

131. Equivalent weight of an acid:
(a) Depends on the reaction involved
(b) Depends upon the number of oxygen atoms present
(c) Is always constant
(d) None of the above

UPTU/UPSEE-2004

Ans. (a) : Equivalent Weight – The equivalent of a compound can be calculated by dividing the molecular weight by the number of positive or negative electrical charge that result from the dissolution of the compound (i.e. acidity or basicity).
Example- NaOH
$$\frac{23+16+2}{1} = \frac{\text{Molecular weight}}{\text{Basicity}} = 41$$
Equivalent weight of an acid depends on the reaction involved with the base.
The equivalent weight of an acid does not depend on the number of oxygen atoms presents.

132. In acidic medium, dichromate ion oxidizes ferrous ion to ferric ion. If the gram molecular weight of potassium dichromate is 294 g, its gram equivalent weight is…. g.

(a) 294 (b) 147
(c) 49 (d) 24.5

AP-EAMCET (Medical), 2003

Ans. (c) : From reaction-

$$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$$

Potassium dichromate ($K_2Cr_2O_7$) acts as a strong oxidizing agent and itself gets reduced to Cr^{3+}.

$$Cr_2O_7^{2-} + 6e^- \longrightarrow 2Cr^{3+}$$

change in oxidation number = 6

Equivalent weight of

$$K_2Cr_2O_7 = \frac{\text{Molecular Weight}}{\text{Total change in oxidation number}}$$

$$= \frac{294}{6} = 49g$$

133. The number of gram equivalent of H_2SO_4 in 1000 mL 3M solution is:

(a) 3 (b) 6
(c) 4 (d) 1.5

JCECE - 2003

$$H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$$

Ans. (b):

$\therefore$ 1 mole H_2SO_4 = 2 g - equivalent of H_2SO_4

$\therefore$ 3 mole H_2SO_4 = 2 × 3 g - equivalent of H_2SO_4
= 6 g equivalent of H_2SO_4

134. Assertion: Atoms can neither be created nor destroyed.
Reason: Under similar condition of temperature and pressure, equal volume of gases does not contain equal number of atoms.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

AIIMS-2002

Ans. (c): Dalton hypothesized the law of conservation of mass. According to this law atoms can neither be created nor destroyed.

Avogadro's law states that under similar condition of temperature and pressure, equal volume of gases contain equal number of atoms.

Therefore Assertion is correct but Reason is incorrect.

135. The equivalent weight of $KMnO_4$ in acidic medium is

(a) 158 (b) 52.67
(c) 31.6 (d) 49

UP CPMT-2002

Ans. (c) : Equivalent weight of $KMnO_4$ = 158

$KMnO_4$ as an oxidizer in acidic media

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$$

In Acidic medium

$$= \frac{\text{Molecular weight}}{\text{No. of electron lost or gained}} = \frac{158}{5} = 31.6$$

In Basic Medium = $\frac{\text{Molecular weight}}{3} = \frac{158}{3} = 52.67$

In Neutral Medium = $\frac{\text{Molecular weight}}{1} = 158$

136. The oxygen obtained from 72 kg water is

(a) 72 kg (b) 46 kg
(c) 50 kg (d) 64 kg

UP CPMT-2002

Ans. (d) : Molecular weight of H_2O = 18

Atomic weight of oxygen = 16

$\because$ 18 gm H_2O contain = 16 gm Oxygen

$\therefore$ 72 kg H_2O contain = $\frac{72 \times 16}{18}$

= 64000 gm or 64 kg.

137. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/g whose radius and length are 7 Å and 10 Å respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus.

(a) 15.4 kg/mol (b) 1.54×10^4 kg/mol
(c) 3.08×10^4 kg/mol (d) 3.08×10^4 kg/mol

NEET-2001

Ans. (a) : Given,

Radius (r) = 7Å = 7×10^{-8}

Length (L) = 10Å = 10×10^{-8}cm

Specific volume (volume of 1g of cylindrical virus)= 6.02×10^{-2} cc/gm

Volume of virus $\pi r^2 L = \frac{22}{7} \times (7 \times 10^{-8})^2 \times 10 \times 10^{-8}$

= 154×10^{-23} cc

Wt. of one virus particle $= \frac{\text{Volume}}{\text{Specific volume}}$

$\therefore$ Molecular wt. of virus = wt. of N_A particle

$$= \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \times 6.02 \times 10^{23}$$

= 15400g/mol = 15.4 kg/mol

138. The oxide of an element contains 67.67% oxygen and the vapour density of its volatile chloride is 79. Equivalent weight of the element is

(a) 2.46 (b) 3.82
(c) 4.36 (d) 4.96

AIIMS-1998

Ans. (b): Equivalent weight of an element is its weight which reacts with 8 gm of oxygen to form oxide.

67.67 g of oxygen combines with 32.33 g of the element to form oxide.

1 g of oxygen will combine with $\frac{32.33}{67.67}$ g of element to form oxide.

8 g of oxygen will combine with $8\times\frac{32.33}{67.67}$ = 3.82 g of element to form oxide.
Hence, the equivalent weight of the element is 3.82 g.

139. The weight of a single atom of oxygen is:

(a) 1.057×10^{23} g (b) 3.556×10^{23} g
(c) 2.656×10^{-23} g (d) 4.538×10^{-23} g

AIIMS-1998

Ans. (c): Molar mass of oxygen atoms = 16 g mol^{-1}
Number of atom in 1 mole = 6.022×10^{23}

Therefore, 1 atom of oxygen weight $=\frac{16}{6.022\times10^{23}}$
$=2.657\times10^{-23}$ g

140. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecules of haemoglobin is

(a) 4 (b) 6
(c) 3 (d) 2

NEET-1998

Ans. (a) : Given that,
Molecular weight of haemoglobin = 67200
It contains 0.334% of iron by weight.

Weight of iron = $\frac{0.334}{100}\times67200 = 224.448$

No. of atoms = $\frac{\text{weight of iron in haemoglobin}}{\text{Atomic weight}}$

$=\frac{224.448}{56}$
= 4.008

141. If active mass of a 6% solution of a compound is 2, its molecular weight will be

(a) 30 (b) 15
(c) 60 (d) 22

AIIMS-1996

Ans. (a): Given, 6% of solution contains 6g of Compound in 100 ml of solution.
Then, mass of Compound present in 1 liter of Solution = 60 g

$\Rightarrow$ No. of moles = $\frac{\text{given mass}}{\text{molar mass}}=\frac{60g}{M}$

$\Rightarrow$ Active mass is defined as number of moles per litre.

So, Active mass = $\frac{60g}{M}$/ litre

$2=\frac{60}{M}\times\frac{1}{1L}$

Then, M (molar mass) = 30

142. A bivalent metal has the equivalent weight of 12. The molecular weight of its oxide will be

(a) 36 (b) 24
(c) 40 (d) 32

AIIMS-1994

Ans. (c): Molecular weight = equivalent weight × n-factor
(Where , n-factor of the metal ion = 2.)
So molecular weight = 12 × 2 = 24
Since it is bivalent ion it requires only one oxygen combine to form oxide.
Therefore, the molecular wt. of the oxide is molecular wt. = molecular wt. of metal + molecular wt. of oxygen
i.e. molecular wt. = 24 + 16 = 40

143. The weight to a metal of equivalent weight 12, which will give 0.475 g of its chloride, is

(a) 0.18 g (b) 0. 12 g
(c) 0. 24 g (d) 0. 16 g

AIIMS-1994

Ans. (b) : Equivalent weight of metal chloride = Equivalent weight of Metal + Equivalent wt. of Cl = 12 +35.5 = 47.5
47.5 g of metal chloride will give 12g of metal
Then, 0.475g of metal chloride will give -

$\equiv\frac{12\times0.475}{47.5}$
= 0.12g

144. The molecular mass of a volatile substance may be measured by

(a) Liebig's method
(b) Hofmann's method
(c) Victor Meyer's method
(d) none of these

AIIMS-1994

Ans. (c): The molecular mass of volatile substances can be determined by Victor Meyar. In this method primary, secondary and tertiary alcohols are subjected to a series of chemical analysis and the colour of resulting solution observed. A known mass of the compound is vaporized in an instrument called Victor Meyar tube.

145. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene?

(a) 2.8 kg (b) 6.4 kg
(c) 9.6 kg (d) 96 kg

NEET-1989

Ans. (c) : $C_2H_4(\text{ethylene})+3O_2\longrightarrow2CO_2+2H_2O$

To oxidise 1mol of ethylene we required 3 moles of oxygen.
Then,
For oxidising 28g of C_2H_4,
We need 3×32 = 96g of oxygen.
For 2.8kg of C_2H_4,

We need $=\frac{96}{28}\times2.8$ =9.6kg of oxygen.

146. 2.76 g of silver carbonate on being strongly heated yields a residue weighing

(a) 3.54 g (b) 3.0 g
(c) 1.36 g (d) 2.16 g

IIT JEE 1997

Ans. (d) :

$Ag_2CO_3(s)\longrightarrow2Ag(s)+CO_2(g)+\frac{1}{2}O_2(g)$

Molecular weight of $Ag_2 CO_3$ = 276 gm
and molecular weight of Ag = 2×108 = 216 gm
$\because$276 gm of Ag_2CO_3 give = 216 gm of Ag

$\therefore$ 1 gm of Ag_2CO_2 give = $\frac{216}{276}$ gm of Ag

Then, 2.76 gm Ag_2CO_2 give = $\frac{216}{276}\times 2.76$ gm of Ag

= 2.16 gm of Ag

147. The molecular weight of O_2 and SO_2 are 32 and 64 respectively At 15^0C and 150 mmHg pressure, one litre of O_2 contains 'N' molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be

(a) N/2 (b) N
(c) 2N (d) 4N

AIPMT 1990

Ans. (c) : Avogadro's law states, equal volumes of all gases contain equal number of molecules under similar, condition of temperature and pressure.

Given, T = 15°C
P = 759 mm

Volume of O_2 = v_1 = 1 lit
No. of O_2 molecules = n_1 = N
Volume of SO_2 = V_2 = 2 lit
No. of molecule of SO_2 = n_2 =?

From Avogadro's law, $\frac{v_1}{n_1} = \frac{v_2}{n_2}$ Avogadro's law

$$\frac{1}{N} = \frac{2}{n_2}$$

n_2 = 2N

3. Mole Concept and Molar Mass

148. 2.0 g of H_2 gas is adsorbed on 2.5 g of platinum powder at 300 K and 1 bar pressure. The volume of the gas adsorbed per gram of the adsorbent is ______mL.
(Given: R = 0.083 L bar K^{-1} mol^{-1})

JEE Main-26.06.2022, Shift-I

Ans. (9960) : Given,
Mass of H_2 = 2.0g
Mass of platinum (Pt) = 2.5g
Temperature = 300K
Pressure = 1 bar
R = 0.083 L bar K^{-1} mol^{-1}

$$V_{H_2(g)} = \frac{n\times R\times T}{1}$$

$$= \frac{2}{2}\times\frac{0.083\times 300}{1} = 24.9L$$

$\therefore$ 24.9L H_2(g) adsorbed on 2.5 Pt
$\therefore$ Volume of H_2(g) adsorbed on 1g Pt

$$= \frac{24.9}{2.5} = 9.96L = 9960\text{ mL}$$

149. A commercially cold conc. HCl is 35% HCl by mass. If the density of this commercial acid is 1.46 g/mL, the molarity of this solution is:
(Atomic mass:Cl=35.5 amu, H=1 amu)

(a) 10.2 M (b) 12.5 M
(c) 14.0 M (d) 18.2 M

JEE Main-26.06.2022, Shift-I

Ans. (c) : Given, Concentration of HCl = 35% by mass
Density = 1.46 g/mL
We know that–

$$\text{Molarity} = \frac{(W/W\%)\times d\times 10}{(\text{Molar mass})_{\text{solute}}}$$

$$= \frac{35\times 1.46\times 10}{36.5}$$

= 14.0M

150. Which one of the following contains the highest number of oxygen atoms?

(a) One mole of aluminum sulphate
(b) Three moles of ferrous sulphate
(c) Three moles of hydrogen peroxide
(d) Two moles of potassium permanganate
(e) One mole of potassium dichromate

Kerala CEE -03.07.2022

Ans. (a) : One mole of aluminum sulphate =$Al_2 (SO_4)_3$
It contain 12 mole of oxygen
1 mole of oxygen = N_A atoms
$\therefore$ 12 mole of oxygen = 12 N_A atoms

(b) Three moles of ferrous sulphate = 3 $FeSO_4$
It contain 12 mole of oxygen
$\therefore$ 12 mole of oxygen = 12 N_A atoms.

(c) Three moles of hydrogen peroxide = $3H_2O_2$
It contain 6 mole of oxygen
$\therefore$ 6 mole of oxygen = 6 N_A atoms

(d) Two moles of potassium permanganate =$2KMnO_4$
It contain 8 mole of oxygen
$\therefore$ 8 mole of oxygen =$8N_A$ atoms

(e) One mole of potassium dichromate = $K_2Cr_2O_7$
It contain 7 mole of oxygen
$\therefore$ 7 mole of oxygen =7 N_A atoms
Here, N_A =Avogadro number
So, option (a) one mole of aluminum sulphate contains the highest number of oxygen atoms.

151. Two elements A and B which form 0.15 moles of A_2B and AB_3 type compounds. If both A_2B and AB_3 weigh equally, then the atomic weight of a is _______ times of atomic weight of B.

JEE Main-27.06.2022, Shift-I

Ans. (2) : Given,
Moles of A_2B = 0.15 mole
Moles of AB_3 = 0.15 mole
Weight of A_2B = Weight of AB_3
Let molar mass of element A = x g
and molar mass of element B = y g
We know that –

$$\text{No. of moles} = \frac{\text{given mass}}{\text{molar mass}}$$

For compound A_2B –

Molar mass $(2x + y) = \frac{\text{given mass}}{\text{no. of moles}} = \frac{w}{0.15}$

For compound AB_3 –

Molar mass $(x + 3y) = \frac{w}{0.15}$

So,

$x + 3y = 2x + y$

$2x - x = 3y - y$

$x = 2y$

So, atomic weight of A is 2 times of atomic weight of B.

152. Choose the correct answer:
Given below are two statements: one is labelled as
Assertion (A) and the other is labelled as Reason (R).
Assertion (A): At 10^oC, the density of a 5 M solution of KCl [atomic masses of K and Cl are 39 and 35.5 g mol^{-1} respectively], is 'X' g mL^{-1}. The solution is cooled to -21^oC. The molality of the solution will remain unchanged.
Reason (R): The molality of a solution does not change with temperature as mass remains unaffected with temperature.
In the light of the above statement choose the correct answer from the options given below.

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

JEE Main-27.06.2022, Shift-I

Ans. (a) : We know that molality and mass both are temperature independent so, on changing temperature. Molality and mass remain unchanged.

153. If a rocket runs on a fuel ($C_{15}H_{30}$) and liquid oxygen, the weight of oxygen required and CO_2 released for every litre of fuel respectively are:
(Given: density of the fuel is 0.756 g/mL)

(a) 1188 g and 1296 g (b) 2376 g and 2592 g
(c) 2592 g and 2376 g (d) 3429 g and 3142 g

JEE Main-24.06.2022, Shift-I

Ans. (c) : Given,
Density of fuel = 0.756 g/mL
Molecular formula of fuel = $C_{15}H_{30}$
Then, molar mass of fuel = $15 \times 12 + 30 \times 1$
= 210 g

Density = $\frac{\text{mass}}{\text{volume}}$

Mass = density × volume
= 0.756 × 1000 = 756 gm.

The reaction is —

$C_{15}H_{30}(l) + \frac{45}{2}O_2(g) \longrightarrow 15CO_2(g) + 15H_2O$

Weight of oxygen = $\frac{45}{2}\left[\frac{756}{210}\right] \times 32 = 2592$ g

Weight of $CO_2 = 15\left[\frac{756}{210}\right] \times 44 = 2376$ g.

154. Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is 0.46 gL^{-1} at 257^oC and 100 mm Hg. The molar mass of geraniol is —— g mol^{-1} (Nearest Integer)
[Given: R = 0.082 L atm K^{-1} mol^{-1}]

JEE Main-29.06.2022, Shift-I

Ans. (152) : $P = \frac{dRT}{M}$

$P = \frac{100}{760}$ atm

T = 256 + 273 = 530K

$d = 0.46\frac{g}{L}$

$M = \frac{0.46 \times 0.082 \times 530}{100} \times 760$

= 151.92 = 152

155. Production of iron in blast furnace follows the following equation:

$$Fe_3O_4(s) + 4CO(g) \rightarrow 3Fe(l) + 4CO_2(g)$$

When 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is:
[Given: Molar Atomic mass (g mol^{-1}): Fe = 56
Molar Atomic mass (g mol^{-1}): O = 16
Molar Atomic mass (g mol^{-1}): C =12]

(a) 1400 (b) 2200
(c) 3360 (d) 4200

JEE Main-29.06.2022, Shift-I

Ans. (c) : Given,
The reaction is ———

$Fe_3O_4(s) + 4CO(g) \longrightarrow 3Fe(l) + 4CO_2(g)$

Fe_3O_4 = 4.640 kg.
CO = 2.520 kg.

Molar mass of $Fe_3O_4 = 3 \times 56 + 4 \times 16$
= 232 g

1 mole of Fe_3O_4 is produced 3 mole of Fe
= 3 × 56 = 168g Fe

∵ 232 g FeO_4 produce 168 g Fe.

∵ 4.640 kg Fe_3O_4 will produce = $\frac{168}{232} \times 4.640$ kg
= 3.36 kg
= 3360 g

So, the correct option is (c)

156. Number of grams of bromine that will completely react with 5.0 g of pent-1-ene is_____$\times 10^{-2}$ g.
(Atomic mass of Br= 80 g/mol) [Nearest Integer]

JEE Main-25.06.2022, Shift-I

Ans. (1142) :

$$C-C-C-C-C=C+Br^{+} \longrightarrow C-C-C-C(Br)-C(Br)$$

1 mole   1 mole

Molecular mass of pent -1-ene = 70

Mole of pent -1-ene = $\frac{5}{70}\times\frac{1}{14}$ mole

Required mole of bromine = $\frac{1}{14}\times160$

= 11.42 or 1142 $\times10^{-2}$

157. The number of N atoms in 681 g of $C_7H_5N_3O_6$ is X × 10^{21}. The value of X is____. (N_A= 6.02 × 10^{23} mol^{-1}) (Nearest Integer)

JEE Main-25.06.2022, Shift-I

Ans. (5418) : Molar mass of $C_7H_5N_3O_6$ is 84 + 5 + 42 + 96 = 227

$^{n}C_6H_5N_3O_6 = \frac{681}{227}$ = 3 moles

$^{n}N = \frac{681}{227}$ × 3 = 9 moles of N

No. of N atoms = 9 × 6.02 × 10^{23}

= 5418 × 10^{21}

158. CNG is an important transportation fuel. When 100 g CNG is mixed with 208 g oxygen in vehicles, it leads to the formation of CO_2 and H_2O and produced large quantity of heat during this combustion, then the amount of carbon dioxide, produced in grams is———. [nearest integer]

JEE Main-26.06.2022, Shift-II

Ans. (143) : $CH_4 + 2O_2(g) \longrightarrow CO_2(g) + H_2O$

Mass	100	208	moles = 3.25
Moles	$\frac{100}{16}$	$\frac{208}{32}$	mass = 143 gram
⇒	6.25		$\frac{6.5}{2}$ 3.25 (L.R.)

$$\frac{^{n}O_2}{2} = \frac{^{n}CO_2}{1}$$

$$\frac{6.5}{2} = {}^{n}CO_2$$

Mass of CO_2 = $\frac{6.5}{2}\times44$ = 143 gm.

159. The maximum number of molecules is present in

(a) 15 L of H_2 gas at STP
(b) 5 L of N_2 gas at STP
(c) 0.5 g of H_2 gas
(d) 10 g of H_2 gas

JCECE - 2008
UPTU/UPSEE-2007
NEET-2004

Ans. (a)
1 mole of gas at STP occupies a volume of 22.4 L

Option (a)- 15 L of gas corresponds to

$$\frac{15L}{22.4L} = 0.67\text{ moles}$$

Option (b)- 5L of N_2 gas at STP:

5L of gas corresponds to $\frac{5L}{22.4L} = 0.22$ moles

Option (c)- 0.5g of H_2 gas (molecular weight 2g/mole) corresponds to $\frac{0.5g}{2g/mol} = 0.25$ moles

Option (d)- 10g of O_2 gas (molecular weight 3g/ mol) corresponds to $\frac{10g}{32g/mol} = 0.3125$ moles

Higher is the number of moles of a gas, higher will be its number of molecules.

160. 10 gm of hydrogen and 64 g of oxygen were kept in a steel vessel and exploded. Amount of water produced in this reaction will be

(a) 2 mol
(b) 4 mol
(c) 8 mol
(d) 10 mol

UP CPMT-2012
NEET-2009

Ans. (b) : $2H_2 + O_2 \rightarrow 2H_2O$

10g of hydrogen (molar mass 2g /mol) = $\frac{10g}{2g/mol}$

= 5 mol

64g of oxygen (molar mass 32g/mol) = $\frac{64}{32g/mol}$

= 2 mol

2 moles of oxygen will react with 2 × 2 = 4 moles of hydrogen to form 4 moles of water.

161. The mass of one mole of electron is

(a) 9.1 × 10^{-28}g
(b) 0.55 mg
(c) 9.1 × 10^{-24}g
(d) 6 10^{-12}g

UP CPMT-2010
UPTU/UPSEE-2006

Ans. (b): As we know that,
Mass of one electron = 9.1× 10^{-31} kg
= 9.1× 10^{-28} g
1 mole = 6.023×10^{23} electron
So, 1 mole of electron has mass of
= 9.1 × 10^{-28} × 6.023 × 10^{23}
= 5.48×10^{-4}
= 0.55mg

162. The number of moles of oxygen obtained by the electrolytic decomposition of 108 g water is

(a) 2.5
(b) 3
(c) 5
(d) 7.5

JIPMER-2008, JCECE-2007

Ans. (b): $2H_2O \xrightarrow{\text{Electrolysis}} 2H_2 + O_2$

2 mole   1 mole

2×18

= 36

$\because$ 36 g of H_2O produce 1 mole of oxygen

$\therefore$ 108 g of water will produce oxygen

$$= \frac{108}{36} = 3\,\text{mole}$$

163. The number of moles of $KMnO_4$ reduced by one mole of KI in alkaline medium is

(a) one fifth (b) five
(c) one (d) two

JCECE-2012
JIPMER-2007

Ans. (d) : In alkaline solution, $KMnO_4$ is reduced to MnO_2 (colourless).

$$2KMnO_4 + 2H_2O \longrightarrow MnO_2 + 2KOH + 3[O]$$
$$KI + 3[O] \longrightarrow KIO_3$$
$$2KMnO_4 + 2H_2O + KI \longrightarrow 2MnO_2 + 2KOH + KIO_3$$

Hence, two moles of $KMnO_4$ are reduced by one mole of KI.

164. In Kjeldahl's method, ammonia from 5g of food neutralizes 30 cm^3 of 0.1 N acid. The percentage of nitrogen in the food is

(a) 0.84 (b) 8.4
(c) 16.8 (d) 1.68

BCECE-2014
Karnataka-CET, 2010

Ans. (a) : Given, w = 5g, V = 30 cm^3

From Kjedahl's method,

$$\text{percentage of nitrogen} = \frac{1.4 \times N \times V}{w} = \frac{1.4 \times 0.1 \times 30}{5}$$
$$= 0.84\%$$

165. 50 cm^3 of 0.2 N HCl is titrated against 0.1 N NaOH solution. The titration is discontinued after adding 50 cm^3 of NaOH. The remaining titration is completed by adding 0.5 N KOH. The volume of KOH required for completing the titration is

(a) 12 cm^3 (b) 10 cm^3
(c) 25 cm^3 (d) 10.5 cm^3

Karnataka-CET, 2010, 2011

Ans. (b) : (i) Calculation of volume of HCl left often incomplete titration.

When 0.1 N NaOH is used,

N_1V_1 (For HCl) = N_2V_2 (For NaOH)

$0.2\text{ N} \times V_1 = 50 \times 0.1\text{N}$

$$V_1 = \frac{50 \times 0.1}{0.2} = 25\text{cm}^3$$

(ii) Calculation of volume of KOH for completing the titration.

When 0.5 N KOH is used,

N_1V_1 (For remaining HCl) = N_3V_3 (For KOH)

$0.2\text{ N} \times 25 = 0.5\text{ N} \times V_3$

$$V_3 = \frac{0.2 \times 25}{0.5}$$
$$= 10\text{ cm}^3$$

166. A gas is found to have a formula $[CO]_x$. Its vapour density is 70, the x is

(a) 3.0 (b) 3.5
(c) 5.0 (d) 6.5

BCECE-2007
BITSAT-2006

Ans. (c) : $\text{Vapour density} = \frac{(\text{molecular weight})}{2}$

Formula mass CO is = 28

Vapour density of the gas = 70

Molecular weight of gas = 2 × vapour density = 2 × 70 = 140

$$x = \frac{\text{molecular weight}}{\text{weight of CO}}$$
$$x = \frac{140}{28} = 5$$

167. Number of atoms of He is 100 amu of He (atomic wt. of He is 4) are :

(a) 25 (b) 100
(c) 50 (d) $100 \times 6 \times 10^{-23}$

BITSAT-2012
BCECE-2008

Ans. (a) : We know formula,

$$\text{No. of atoms} = \frac{\text{Mass of substance}}{\text{Atomic mass}}$$
$$100\text{ amu of He} = \frac{100}{4}\text{ atoms of He}$$
$$= 25\text{ atoms.}$$

[1 AMU = mass of one proton (approx.)]

168. Calculate the mole fraction of aqueous solution of 1 molal urea (NH_2CONH_2)

(a) 0.01878 (b) 0.01768
(c) 0.01800 (d) 0.01698

GUJCET-2022

Ans. (b) : Molarity = 1M

$$\text{Molarity} = \frac{\text{n solute}}{\text{mass of solvent in kg}}$$
$$\frac{1}{1} = \frac{\text{n solute}}{\text{mass of solvent in kg}}$$

Hence solute in urea and solvent aqueous solution is given

$$X_{urea} = \frac{n_{urea}}{n_{urea} + n_{H_2O}}$$

$n_{urea} = 1$ and mass of H_2O = 1 kg = 1000 gm

$$\therefore\ X_{urea} = \frac{1}{1 + \frac{1000}{18}}$$

$$X_{urea} = \frac{1}{1+55.55}$$

$$\begin{cases} X_{urea} = \frac{w(\text{given mass})}{\text{molecular wt.}} \\ \text{and} \\ n_{H_2O} = \frac{w}{\text{molecular wt.}} \\ = \frac{1000}{18} \end{cases}$$

$$X_{urea} = \frac{1}{56.55}$$
$\simeq 0.0177$

169. How many numbers of mole ions produced from aqueous solution of 1 mole Iron (III) hexacyano Ferrate (II) complex ?

(a) 4 (b) 7
(c) 5 (d) 6

GUJCET-2022

Ans. (b): Co-ordination compounds donot completely dissociate in water into all its cationic and anionic components.
Chemical formula of, Ferric hexacynoferrate (II)
$Fe_4[Fe(CN)_6]_3$
Its co-ordination sphere does not get dissociated in aqueous solution,
by adding Ferric hexacynoferrate (II) to water, it will produce 4 Fe^{+3} ion and $3[Fe(CN)_6]^{-4}$ ion
So, it will produce total 7 ions in aqueous solution.

170. The number of electron present in 2.3g of NO_2 is

(a) 6.92×10^{23} (b) 6.92×10^{22}
(c) 138×10^{23} (d) 6.023×10^{23}

Assam CEE-2021

Ans. (a) : Number of molecule = mole × N_A

$$= \frac{\text{mass}}{\text{molar mass}} \times N_A$$
$$= \frac{2.3g}{46} \times N_A$$
$$= 0.05 \times N_A$$

Molecular of weight of NO_2 = 7 + 16 = 23
1 molecule = 23 e^- of NO_2
Total number of e^- = 23 × 0.05 × N_A = 6.92×10^{23}

171. Number of atom in 5.586 g Fe ($M = 55.86 \text{ g mol}^{-1}$) is

(a) Twice of 60.0 g of C (b) Twice of 0.6 g of C
(c) Twice of 6.0 g of C (d) Twice of 600g of C

Assam CEE-2021

Ans. (b) : Number of atom = mole × N_A

$$= \frac{\text{Mass}}{\text{atomic mass}} \times N_A$$
$$= \frac{5.586}{55.86} \times N_A$$
$$= 0.1\ N_A$$

0.6g C Number of atom $= \frac{0.6}{12} \times N_A$
$= 0.05\ N_A$

172. A reaction of 0.1 mole of benzylamine with bromomethane gave 23 g of benzyle trimethyl ammonium bromide. The number of moles of bromomethane consumed in this reaction are $n \times 10^{-1}$, when n = ... (Round off to the nearest integer)
(Given : Atomic masses : C = 12.0 u, H = 1.0 u. N = 14.0 u, Br = 80.0 u)

[JEE Main 2021, 18 March Shift-I]

Ans. Number of moles of benzyl trimethyl
Ammonium bromide formed = $\frac{23}{230} = 0.1$
No. of moles of bromomethane consumed
= 3 × 0.1
= 3×10^{-1}

173. The number of moles of CuO, that will be utilised in Dumas method for estimation nitrogen in a sample of 57.5 g of N, N-dimethylaminopentane is…… $x10^{-2}$ (Nearest integer)

[JEE Main 2021, 27 Aug Shift-II]

Ans. Moles of N in N, N– dimethylaminopentane =
$$\left(\frac{57.5}{115}\right) = 0.5\text{mol}$$

$$\frac{n_{CuO}\text{reacted}}{\left(\frac{45}{2}\right)} = \frac{n_{C_7H_{17}N}\text{ reacted}}{1}$$

$$\Rightarrow n_{CuO}\text{reacted} = \left(\frac{45}{2}\right) \times 0.5 = 11.25$$

174. The ratio of the mass percentages of 'C' and H' and 'C and 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............

[JEE Main 2021, 2 Sep Shift-II]

Ans. Mass ratio of C : H is 4 : 1 ⇒ 12 : 3 &
C : O is 3 : 4 ⇒ 12 : 16
So,

	Mass	Mole	Mole ratio
C	12	1	1
H	3	3	3
O	16	1	1

Empirical formula ⇒ CH_3O
As compound is saturated acyclic so molecular Formula is $C_2H_6O_2$

$$C_2H_6O_2 + \frac{5}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$$

So, required moles of O_2 is 5.

175. The minimum number of moles of O_2 required for complete combustion of 1 mole of propane and 2 moles of butane is…….

[JEE Main 2021, 5 Sep Shift-I]

Ans. $C_3H_8 + SO_2 \rightarrow CO_2 + 4H_2O$

$1\text{mole} \;\; 5\text{mole}$

For 1 mole propane Combustion 5 mole O_2 required

$$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$$

$1\text{mole} \rightarrow 6.5\text{mole}$

$2\text{mole} \rightarrow 13\text{mole}$

For 2 moles of butane 13 mole of O_2 is required

total moles = 13 + 5 = 18

176. The ammonia (NH_3) released on quantitative reaction of 0.6 g urea (NH_2CONH_2) with sodium hydroxide (NaOH) can be neutralised by

[JEE Main 2021, 7 Jan Shift-II]

Ans. $NH_2CONH_2 + 2NaOH \rightarrow 2NH_3 + Na_2CO_3$

1 mole urea gives 2 moles ammonia as per the balance reaction.

$$n_{urea} = \frac{0.6}{60} = 0.01 \text{ mole}$$

$\therefore$ $n_{ammonia} = 2 \times 0.01 = 0.02$ mole

Now,

0.02 moles of NH_3 reacts with 0.02 moles of HCl.

$$\text{Mole of HCl} = \frac{100 \times 0.2}{1000} = 0.02 \text{ mole}$$

177. A chloro compound A,
(i) Forms aldehydes on ozonolysis followed by the hydrolysis,
(ii) When vaporised completely, 1.53 g of A gives 448 mL of vapour at STP.
The number of carbon atoms in a molecule of compound A is……. .

[JEE Main 2021, 26 Aug Shift-II]

Ans. 448 ml of A $\Rightarrow$ 1.53 gm A

1ml of A = 1.53/448gm of A

$$22400 \text{ ml of A} \Rightarrow \frac{1.53}{448} \times 22400 \text{ gm A} = 76.5 \text{ A gm}$$

$$\underset{\text{It has 3 Carbon atoms}}{H_3CHC-CH-Cl} \xrightarrow[Zn/H_2O]{O_3} \underset{\text{Aldehyde}}{CH_3-CH=0}$$

& mm is 36 + 5 + 35.5 = 76.5

178. 4g equimolar mixture of NaOH and Na_2CO_3 contains x g of NaOH and y g of Na_2CO_3. The value of x is…….g. (Nearest integer)

[JEE Main 2021, 20 July Shift-II]

Ans. Mass of NaOH = x

$$\text{Moles of NaOH} = \frac{x}{40}$$

Mass of Na_2CO_3 = y

$$\text{Moles of } Na_2CO_3 = \frac{y}{106}$$

$$\frac{x}{40} = \frac{y}{106} = K$$

x + y = 4

40K + 106K = 4

K = 4/146

Now, x = 40K

$$x = 40 \times \frac{4}{146} g$$

So,

x = 1.1, y = 2.9

x = 1.1 $\approx$ 1 (nearest integer)

179. The hardness of a water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3} M $CaSO_4$ is
(Molar mass of $CaSO_4$ = 136 g mol^{-1})

(a) 100 ppm (b) 10 ppm
(c) 50 ppm (d) 90 ppm

[JEE Main 2021, 12 Jan Shift-I]

Ans. (a) : The hardness of water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3}M $CaSO_4$

Mole of $CaSO_4$ = 10^{-3} moles

Mass of water = 1000g

DOH (in terms of $CaCO_3$) = $10^{-3} \times 100/1000$ g

Hardness = $(10^{-3} \times 100/1000) \times 10^6$

Hardness of water = 100 ppm

180. The $NaNO_3$ weighed out to make 50 mL of an aqueous solution containing 70.0 mg Na^+ per mL is…..g. (Rounded off to the nearest integer) [Given : Atomic weight in g mol^{-1}, Na : 23 ; N : 14 ; O : 16].

[JEE Main 2021, 26 Feb Shift-II]

Ans. Given that,

Na^+ present in 50ml

Na^+ = 70 mg/mL

W_{Na^+} in 50 mL solution

= 70 × 50 mg
= 3500 mg
= 3.5 mg

$$\text{Moles of } Na^+ \text{ in 50 mL solution} = \frac{3.5}{23}$$

Moles of $NaNO_3$ = moles of Na^+

$$= \frac{3.5}{23} \text{mol}$$

$$\text{Mass of } NaNO_3 = \frac{3.5}{23} \times 85 = 12.934 \simeq 13 \text{gm}$$

181. The number of atoms in 8 g of sodium is X $\times 10^{23}$. The value of X is…….
(nearest integer)
[Given : $N_A = 6.02 \times 10^{23}$ mol^{-1} Atomic mass of Na = 23.0 u]

[JEE Main 2021, 1 Sep Shift-II]

Ans. We know that,

$$\frac{\text{Weight of sodium atom}}{\text{Molecular mass of sodium atom}} = \frac{\text{Number of atoms}}{\text{Avogadro's number}}$$

$$\frac{8g}{23g} = \frac{\text{Number of atoms}}{6.02 \times 10^{23}}$$

$$\text{Number of atoms} = \frac{8 \times 6.02 \times 10^{23}}{23}$$

Number of atoms = 2.09×10^{23}

x $\approx$ 2

182. 10.0 mL of 0.05 M $KMnO_4$ solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is……x10^{-2} g/L.
(Round off to the nearest integer)
[JEE Main 2021, 27 July Shift-II]

Ans.(1575). n_{eq} $KMnO_4$ = $n_{eq}H_2C_2O_4.2H_2O$

then $\frac{10\times0.05}{1000}\times5=\frac{10\times m}{1000}\times2$

$\therefore$ Conc. of oxalic acid solution = 0.125 M

0.125 × 126 g/L = 15.75 g/L

1575 × 10^{-2} g/L

183. When 10 mL of an aqueous solution of Fe^{2+} ions was titrated in the presence of dil. H_2SO_4 using diphenylamine indicator, 15 mL of 0.02 M solution of $K_2Cr_2O_7$ was required to get the end point. The morality of the solution containing Fe^{2+} ions is x ×10^{-2} M. The value of x is….. .
(Nearest integer)
[JEE Main 2021, 25 July Shift-I]

Ans.(18)

$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$

$Cr_2O_7^{2-}$: 15 mL 0.02 M and 1 mole used in reaction

Fe^{2+} : 10 mL M_2 ? and 6 mole used in reaction

$(Cr_2O_7^{2-})$ (Fe^{2+})

Now, $\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}$

$\frac{0.02M\times15\,mL}{1\,mole}=\frac{M_2\times10\,mL}{6\,\,mole}$

$M_2=\frac{0.02\times15\times6}{10}=0.18\,M=18\times10^{-2}M$

184. Calculate the amount of lime, Ca $(OH)_2$ required to remove hardness of 50,000 litres of well water which contains 1.62 g of calcium bicarbonate per 10 liters. [Given, atomic masses : Ca→40, H →1, C → 12, O → 16]

(a) 1.5 kg (b) 3.7 kg
(c) 2.8 kg (d) 4.2 kg

AP- EAPCET- 07-09-2021, Shift-I

Ans. (b) : Ca (HCO_3) + $Ca(OH)_2 \rightarrow$ 2 $CaCO_3$ + $2H_2O$

well water contain 1.62 gm of calcium bicarbonate per 10 litres of water so, 50,000 litres of well water contain

$=\frac{1.62\times50,000}{10}=162\times50$ gm of calcium carbonate

$\therefore$ No. of moles of calcium bicarbonate $=\frac{162\times50}{162}$

= 50 mole

The mass of calcium hydroxide required is $\frac{74\times50}{1000}$

= 3.7 kg

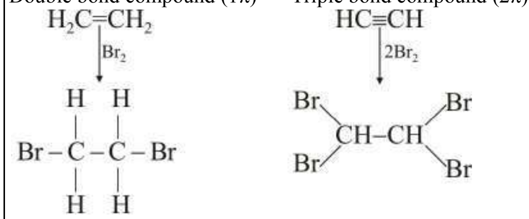
185. One mole of an organic compound with a double bond and a triple bond is reacted with Br_2/CCl_4. The amount of Br_2 required to completely brominates all π-bonds in the compounds is (Given Br mass is 80 amu)

(a) 480 g (b) 160 g
(c) 320 g (d) 240 g

TS-EAMCET 09.08.2021, Shift-I

Ans. (a) :

Double bond compound (1π) Triple bond compound (2π)



Since, weight of Br of 1mole = 80gm

Then, weight of 6 mole of Br atom is = 80 × 6

= 480 gm.

186. Number of moles of dichromate needed to oxidizes one mole of Sn^{2+} is

(a) 3 (b) 2
(c) $\frac{1}{3}$ (d) $\frac{1}{2}$

TS-EAMCET 09.08.2021, Shift-I

Ans. (c) : The overall oxidation reaction is given below–

$\overset{+6}{Cr_2}O_7^{2-} + 14H^+ + 3Sn^{+2} \rightarrow 2Cr^{3+} + 3Sn^{4+} + 7H_2O$

Thus, 3 mole of Sn^{+2} will reduce 1 mole of $K_2Cr_2O_7$.

Therefore, 1 moles of Sn^{2+} will reduce 1/3 moles of $K_2Cr_2O_7$.

187. 20 g of $CaCO_3$ on heating produces x amount of CO_2. If the final weight of $CaCO_3$ after the reaction is 5 g. the amount of CO_2 liberated in L at STP is

(a) 44 (b) 3.36
(c) 22 (d) 6.66

TS-EAMCET 09.08.2021, Shift-I

Ans. (b) : The balanced equation is–

$CaCO_3 \rightarrow CO_2 + CaO$

1mole 1mole = 22.4 litre at STP

$\because$ 100 gm of $CaCO_3$ evolve CO_2 = 22.4 litre

1gm of $CaCO_3$ evolve $CO_2 = \frac{22.4}{100}$

$\therefore$ 15 gm of $CaCO_3$ evolve CO_2 $=\frac{22.4}{100}\times15$

= 3.36 litre

188. $KMnO_4$ oxidises oxalic acid in acidic medium. The number of CO_2 molecules produced per mole of $KMnO_4$ is

(a) 5 (b) 4
(c) 3 (d) 1.5

TS EAMCET 05.08.2021, Shift-I

Ans. (a) : for 2 mole →

$2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow 2\,MnSO_4 + 10\,CO_2 + K_2SO_4 + 8\,H_2O$

For one mole 10/2 = 5 CO_2 molecule are formed.

189. Salts of A (atomic weight 8), B (atomic weight 18) and C (atomic weight 50) were electrolysed under identical conditions using the same quantity of electricity. It was found that 2.4g of A was deposited, the weight of B and C deposited are 1.8 g and 7.5 g respectively. The valences of A, B and C are, respectively,

(a) 3, 1 and 2 (b) 1, 2 and 3
(c) 1, 3 and 2 (d) 3, 2 and 1

TS EAMCET 04.08.2021, Shift-I

Ans. (c) : According to Faraday law–

$$W = Z.Q = \frac{E.Q}{96500}$$

For A,

$$2.4 = \frac{(8/x)Q}{96500}$$

$$x = \frac{8Q}{96500 \times 2.4}$$

For B,

$$1.8 = \frac{(18/y)Q}{96500}$$

$$y = \frac{18Q}{96500 \times 1.8}$$

For C,

$$7.5 = \frac{(50/z)Q}{96500}$$

$$z = \frac{50Q}{96500 \times 7.5}$$

Hence, $x : y : z = \left(\frac{8}{2.4}\right) : \left(\frac{18}{1.8}\right) : \left(\frac{50}{7.5}\right)$

$= 3.33 : 10 : 6.66$

$= 1 : 3 : 2$

By solving equation,

A = 1, B = 3 and C = 2

So, valence of A, B and C are 1, 3 and 2.

190. The number of grams of oxygen in 32.2g of Na_2SO_4. $10H_2O$ is approximately

(a) 32.2 g (b) 22.4 g
(c) 11.2 g (d) 64.4 g

TS EAMCET 04.08.2021, Shift-I

Ans. (b) : No. of oxygen atoms in one molecule of $Na_2SO_4.10\ H_2O$ = 4 + 10 = 14

Thus, moles of oxygen in n moles of compound = 14n

Molar mass of Na_2SO_4. 10 H_2O = 46 + 32 + 64 + 180 = 322 g/mol

Since, $32.2g = \frac{32.2}{322} = 0.1$ moles

Thus, moles of oxygen = 0.1 × 14 = 1.4

So, weight is 16 × 1.4 = 22.4 g

191. KBr is doped with 10^{-5} mole percent of $SrBr_2$. The number of cationic vacancies in 1 g of KBr crystal is _______ 10^{14}. (Round off to the Nearest Integer).
[Atomic Mass: K: 39.1 u, Br: 79.9u N_A=6.023 ×10^{23}]

JEE Main 17.03.2021, Shift-II

Ans. (5).

100 mole of KBr is doped with 10^{-5} mole of $SrBr_2$.

1 mole KBr contain $= \frac{10^{-5}}{100} = 10^{-7}$ mol of $SrBr_2$

Hence, 10^{-7} moles cation vacancy (as $1Sr^{2+}$ will result 1 cation vacancy)

119g KBr contains 10^{-7} mol of $SrBr_2$

1g KBr contains $\frac{10^{-7}}{119}$ mol of $SrBr_2$

∴ Required number of cation vacancy

$$= \frac{10^{-7} \times 6.023 \times 10^{23}}{119}$$

$= 5.06 \times 10^{14}$

$\approx 5 \times 10^{14}$

192. A gas X is dissolved in water at 2 bar pressure. Its mole fraction in the solution is 0.02. Find the mole fraction of water in the solution when the pressure of the gas is doubled at the same temperature.

(a) 0.04 (b) 0.98
(c) 0.96 (d) 0.02

AP EAPCET 24.08.2021, Shift-I

Ans. (c) : According to the Raoult's law –

$P_1 = X_1P_0$

Where –

P_1 = Vapour pressure of the solvent.

P_0 = Vapour pressure in pure state.

X_1 = mole fraction

Given – P_1 = 2 Bar

$X_1 = 0.02$

and

$P_2 = 2P_1 = 2 \times 2 = 4$ Bar

X_2 = ?

∴ $P_1 = X_1P_0$

$2 = 0.02 \times P_0$ ... (I)

and

$P_2 = X_1P_0$

$4 = X_2\ P_0$ ... (II)

From (I) and (II) we get

$$\frac{0.02}{X_2} = \frac{1}{2}$$

or $X_2 = 0.04$

So, Mole fraction of water = $1 - X_2 = 1 - 0.04 = 0.96$

193. How many moles of electrons weighs one kg?

(a) 3×10^4 (b) 6×10^{23}
(c) 1×10^8 (d) 1.8×10^6

TS EAMCET 10.08.2021, Shift-II

Ans.(d) :

$1 \text{mole } e^- = 6.023\times10^{23} e^-$

$\text{Mass 1 mole of electron} = 6.023\times10^{23}\times9.108\times10^{-31}\text{kg}$

$= 6.023\times9.108\times10^{-8}\text{kg}$

$$\text{No. of mole in one kg} = \frac{1}{9.108\times6.023\times10^{-8}}$$

$$= \frac{10^8}{9.108\times6.023}$$

$$= \frac{100}{9.108\times6.023}\times10^6$$

$$= 1.82\times10^6$$

194. 3.011×10^{22} atoms of an element weighs 1.5gm. The atomic mass of the element is ———

(a) 10 amu (b) 2.3 amu
(c) 35.5 amu (d) 23 amu

AP EAPCET 25.08.2021, Shift-II

Ans. (d) : Given that –

Weigh = 1.15gm

Atoms = 3.011×10^{22}

$$\text{Atomic mass} = \frac{\text{Mass}}{\text{No. of atoms}}$$

$$= \frac{1.15\text{ gm}}{3.011\times10^{22}}$$

$= 0.38 \times 10^{-22}$ gm

We know,

1amu = 1.66×10^{-24} gm

Then,

$$= \frac{0.38\times10^{-22}}{1.66\times10^{-24}}$$

= 23 amu.

195. If $Fe_{0.96}O$, Fe is present in +2 and +3 oxidation state, what is the mole-fraction of Fe^{2+} in the compound?

(a) 12/25 (b) 25/12
(c) 1/12 (d) 11/12

AP EAPCET 25.08.2021, Shift-II

Ans. (d) : Given $Fe_{0.96}O$, Fe is present +2 and +3 oxidation state

Let 'x' molecule fraction of Fe^{+2} and (0.96 – x) molecular fraction of Fe^{+3}

Now,

x (+2) + (0.96 – x) (+3) – 2 = 0

2x – 3x + 2.88 – 2 = 0

x = 0.88

Fraction of Fe^{+2} = 0.88 and fraction of Fe^{+3} = 0.12

$$\text{Mole fraction of } Fe^{+2} = \frac{0.88}{0.88+0.12}$$

$$= \frac{11}{12}$$

196. When oxalic acid is oxidised with acidified $KMnO_4$, the number of moles of CO_2 liberated is (consider balancing the reaction)

(a) 2 (b) 4
(c) 6 **(d) 10**

TS EAMCET 10.08.2021, Shift-I

Ans. (d) : Balance chemical reaction

$2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \rightarrow 2MnO_4 + K_2SO_4 + 8H_2O$ + 10 mole of CO_2 liberate.

197. The strength of 50 volume of H_2O_2 solution is approximately.

(a) 50% (b) 25%
(c) 10% (d) 15%

TS EAMCET 10.08.2021, Shift-I

Ans. (d) : $2H_2O_2 \rightarrow 2H_2O + O_2$

$2(34) = 68g \qquad 22.4\,L\,at\,NTP$

50 volume H_2O_2 means 1L of 50 volume of H_2O_2 give 50L O_2 at STP

$\therefore$ 22.4 liter of O_2 produced from = 68 gm H_2O_2

$\therefore$ 50 liter of

$$O_2 \text{ produced from} = \frac{68}{22.4}\times50 = 151.7g\ of\ H_2O_2$$

$$\text{Percentage strength of } H_2O_2 \text{ Solution} = \frac{151.7}{1000}\times100$$

$$= 15.17\%\ or \approx 15\%$$

198. 100 ml of 0.2 M acetic acid is completely neutralized using a standard solution of NaOH. The volume of ethane obtained at STP after complete electrolysis of the resulting solution is ———

(a) 11.2 L (b) 2.24 L
(c) 0.224 L (d) 22.4 L

AP EAPCET 23-08-2021 Shift-I

Ans. (c) : $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

Number of moles of sodium acetate

$$= \frac{100\text{ ml}}{1000\text{ ml/lit}}\times0.2\text{mol/lit} = 0.02 \text{ moles}$$

$$2CH_3COONa \xrightarrow[\text{electrolysis}]{\text{hydrolysis}} CH_3-H_3+2CO_2+2NaOH+H_2\uparrow$$

Number of moles of ethane are one half the number of moles of sodium acetate(CH_3COONa).

$$\text{No. of moles of ethane} = \frac{0.02}{2} = 0.01 \text{ moles.}$$

At STP, 1 mole of ethane occupies = 22.4 liter.

0.01 mole of ethane =?

0.01×22.4= 0.224 liter.

199. The number of sodium ions present in 0.5 mole of sodium ferrocyanide is

(a) 2×10^{23} (b) 0.5×10^{23}
(c) 12×10^{23} (d) 4×10^{23}

TS-EAMCET (Engg.), 05.08.2021 Shift-II

Ans. (c) : Formula of sodium ferrocyanide $Na_4[Fe(CN)_6]$ contains 4 Na atoms.

Number of Na atoms = Number of moles × Number of atom per molecule × Avogadro number

$= 0.5 \times 4 \times 6.023 \times 10^{23}$

$= 12.046 \times 10^{23}$

$\approx 12 \times 10^{23}$

200. **56 g of CaO has been mixed with 63 g of HNO_3, the amount of $Ca(NO_3)_2$ formed is**
$Ca(NO_3)_2$ 63gHNO₃56gCaO
(a) 4g (b) 8.28g
(c) 164 g (d) 82 g
TS-EAMCET (Engg.), 07.08.2021 Shift-II

Ans. (d) : $\underset{\text{Calcium oxide}}{CaO} + \underset{\text{Nitric acid}}{2HNO_3} \rightarrow \underset{\text{Calcium nitrate}}{Ca(NO_3)_2} + H_2O$
Molar mass of CaO = 56 gm/mol
Molar mass of HNO_3 = 63 gm/mol
Molar mass of $Ca(NO_3)_2$ = 164 gm/mol
Molar mass of H_2O = 18 gm/mol
∵ 126 gm Nitric acid forms = 164 gm $Ca(NO_3)_2$
$\therefore$ 1 gm Nitric acid forms = $\frac{164}{126}$ gm $Ca(NO_3)_2$
$\therefore$ 63gm Nitric acid forms $= 63\times\frac{164}{126}$ gm $Ca(NO_3)_2$
= 82 gm $Ca(NO_3)_2$

201. **When 35 mL of 0.15 M lead nitrate solution is mised with 20 mL of 0.12 M chromic sulphate solution,-------$\times10^{-5}$ moles of lead sulphate precipitate out. (Round off to the Nearest Integer).**
JEE Main 16.03.2021, Shift-II

Ans. The following reaction take place -
$3Pb(NO_3)_2 + Cr_2(SO_4)_3 \longrightarrow 3PbSO_4 + 2Cr(NO_3)_3$
lead nitrate chromic sulphate lead sulphate chromic nitrate.
Volume of lead nitrate solution = 35mL
concentration of lead nitrate = 0.15M
$\therefore$ Number of moles of $Pb(NO_3)_2 = 0.15\times35\times10^{-3}$mol
$= 5.25\times10^{-3}$mol
Similarly, number of moles of $Cr_2(SO_4)_3$
$= 0.12\times20\times10^{-3}$mol
$= 2.4\times10^{-3}$mol
therefore moles of $PbSO_4$ formed = 5.25×10^{-3}
$= 525\times10^{-5}$

202. **The volume strength (in L) of 3N H_2O_2 is approximately ____**
(a) 3 (b) 8
(c) 17 (d) 9
AP EAPCET 24.08.2021 Shift-II

Ans. (c): Given, normality = 3N
Volume strength = ?
$\therefore$ We known,
Volume strength = 5.6 × Normality
= 5.6 × 3
= 16.8
Volume strength ≈ 17

203. **A cylinder contains a mixture of 5 g of N_2 and 6 g of Ar gases. If the total pressure of the mixture of the gases in the cylinder is 30 bar, then the partial pressure of N_2 gas is ___ (Molecular mass of N_2 = 28 g mol^{-1}. Atomic mass of Ar = 40u)**
(a) 16.36 bar (b) 0.545 bar
(c) 30 bar (d) 0.180 bar
AP EAPCET 24.08.2021 Shift-II

Ans. (a) : Given that,
$W_{N_2} = 5$ gm
$W_{A_r} = 6$ gm
$n_{N_2} = \frac{\text{weight}}{\text{m. weight}} = \frac{5}{28} = 0.18$
$n_{A_r} = \frac{\text{weight}}{\text{m. weight}} = \frac{6}{40} = 0.15$
Mole fraction of $N_2 = \frac{0.18}{0.18+0.15} = 0.5454$
$\therefore$ Partial pressure of $(P_{N_2}) = X_{N_2} \times P_{total}$
= 0.5454 × 30
= 16. 36 bar

204. **The molal elevation constant is the ratio of Elevation in boiling point to ——**
(a) Molarity
(b) Molality
(c) Mole fraction of solute
(d) Mole fraction of solvent
AP EAPCET 19-08-2021 Shift-I

Ans. (b): Due to solute presence in the solution the solution's boiling point is greater than the pure solvents boiling point. This is called as deviation in boiling point and it can be represented as-
$\Delta T_b = K_b \times$ molality
or $K_b = \frac{\Delta T_b}{\text{molality}}$

205. **When 10 g of copper and 10 g of iodine are mixed, calculate the theorctical yield of CuI according to the equation,**
$2Cu + I_2 \rightarrow 2CuI$
(a) 30 g (b) 10 g
(c) 15 g (d) 20 g
AP EAMCET (Engg.) 21.09.2020, Shift-II

Ans. (c) : I_2 is limiting reagent,
mole of I_2 = mole of Cul
Mole of CuI $= \frac{10}{127}$
Mass of CuI $= \frac{10}{127}\times190.5 = 15$g
Hence, the correct option is (c).

206. **One mole of oxygen gas at STP is equal to**
(a) 6.022×10^{23} molecules of oxygen
(b) 6.022×10^{23} atoms of oxygen
(c) 16 g of oxygen
(d) 32 g of oxygen
AP EAMCET (Engg.) 17.09.2020 Shift-I

Ans. (a) : 1 mole of $O_2(g)$ at STP contains Avogadro number (N_a = 6.022 × 10^{23} mol^{-1}) of O_2 molecules, which will occupy its molar volume, i.e, 22.4 L.

207. **Which of the following units is useful in relating concentration of solution with its vapour pressure ?**
(a) Mole fraction (b) Parts per million
(c) Mass percentage (d) Molality
AP EAMCET (Engg.) 21.09.2020, Shift-I

Ans. (a) : According to Raoult's law, relative lowering of vapour pressure is directly proportional to mole fraction of solute. So, mole fraction is used in relating concentration of solution with its vapour pressure.
Raoult's law Can be expressed as;

$$\frac{P^0 - P_s}{P^0} = \frac{n_2}{n_1 + n_2} = x_2$$

Where, x_2= Mole fraction of solute
n_1= Moles of solvent
n_2= Moles of solute
p_s= Vapour pressure of the solution
p^0= Vapour pressure of pure solvent

208. Calculate the energy required to convert all atoms 4.8 g of Mg to Mg^{2+} in the vapour state. IE, and IE_2 of Mg are 740 kJ/mol and 1450 kJ/mol respectively.

(a) + 740 kJ/mol (b) –740 kJ/mol
(c) –1450 kJ/mol (d) +438 kJ/mol

AP EAMCET (Engg.) 21.09.2020, Shift-I

Ans. (d) : For 1 mole of $(Mg \rightarrow Mg^{2+})$ 1E = $1E_1$ + $1E_2$ = (740 + 1450) = 2190 kJ/mol. Number of mole in 4.8g of Mg = 4.8/24 = 0.2 mol.
For 1 mole energy required = 2190 kJ/mol.
For 0.2 mole energy required = 2190 0 × 0.2 = 438 kJ.
Thus, for 4.8 g of Mg to Mg^{2+} conversion, energy required is 438 kJ. Hence, the correct option is (d).

209. An excess of $AgNO_3$ is added to 100 mL of 0.01 M solution of dichlorotetraaquachromium (III) chloride. The number of moles of AgCl precipitated would be

(a) 0.001 (b) 0.002
(c) 0.003 (d) 0.01

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Ans. (a): Molecular formula of dichlorotetraaqua chromium (III)
chloride is $[Cr(H_2O)_4 Cl_2] Cl$.
On ionisation it generate only one Cl^- ion

$$[Cr(H_2O)_4Cl_2]Cl \xrightarrow{\text{exces } AgNO_3} [Cr(H_2O)_4Cl_2]^+ + AgCl\downarrow$$

Using formula, molarity $= \frac{\text{No.of moles}}{\text{Volume}} \times 1000$

$$0.01 = \frac{\text{No.of moles}}{100} \times 1000$$

No. of moles of AgCl = 0.001 mol AgCl

210. The volume (in mL) of 0.1 NaOH required to neutralise 10mL of 0.1 N phophonic acid is …

[JEE Main 2020, 3 Sep Shift-II]

Ans. $H_3PO_2 + NaOH \rightarrow NaH_2PO_2 + H_2O$

$$\frac{\text{Moles of } H_3PO_2 \text{ reacted}}{1} = \frac{\text{Moles of NaOH reacted}}{1}$$

$$\frac{0.1 \times 10}{1} = 0.1 \times V_{NaOH}$$

V_{NaOH} = 10 ml

211. The mass of ammonia in grams produced when 2.8 kg of dinitrogen quantitatively reacts with 1 kg of dihydrogen is…..

[JEE Main 2020, 4 Sep Shift-I]

Ans. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

Number of moles of $N_2 = \frac{2.8 \times 10^3}{28} = 100$

Number of moles of $H_2 = \frac{1000}{2} = 500$

∴ Number of moles of NH_3 produced = 2 × 100
= 200
Mass of NH_3 Produced = 200 × 17 = 3400 gm

212. The volume, in mL, of 0.02 M $K_2Cr_2O_7$ solution required to react with 0.288 g of ferrous oxalate in acidic medium is…….
(Molar mass of Fe = 56 g mol^{-1})

[JEE Main 2020, 5 Sep Shift-II]

Ans. $K_2Cr_2O_7 + FeC_2O_4 \rightarrow Cr^{+3} + Fe^{+3} + CO_2$

n_{factor} of $K_2Cr_2O_7 = 3 \times 2 = 6$

n_{factor} of $FeC_2O_4 = 1 + 2 = 3$

$$\frac{0.02 \times 6 \times V(mL)}{1000} = \frac{0.288}{144} \times 3$$

V = 50 mL

213. The volume (in mL) of 0.125 M $AgNO_3$ required to quantitatively precipitate chloride ions in 0.3 g of $[Co(NH_3)_6]Cl_3$ is…….

$M_{[co(NH_3)_6]Cl_3} = 267.46 g/mol$

$M_{AgNO_3} = 169.87 g/mol$

[JEE Main 2020, 8 Jan Shift-I]

Ans. $[CO(NH_3)_6]Cl_3 + 3AgNO_3 \rightarrow 3AgCl_3$

0.3 gm v ml, 0.125m

$$\frac{\text{wt.}}{\text{mol.wt.}} \times (n - \text{factor}) = \text{Molarity} \times \text{volume}$$

$$\frac{0.3}{267.46} \times 3 = 0.125 \times v \times 10^{-3}$$

$$v = \frac{0.3 \times 3 \times 1000}{267.46 \times 0.125} = 26.92 \text{ mL}$$

214. $NaClO_3$ 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 300 K. How much amount of $NaClO_3$ in grams, is required to produce O_2 for the daily consumption of a person at 1 atm, 300 K……?
$NaClO_3$ (s)+Fe(s)→O_2(g)+NaCl(s)+FeO(s)
R = 0.082 L atm mol^{-1} K^{-1}

[JEE Main 2020, 8 Jan Shift-II]

Ans.
$NaClO_{3(S)} + Fe_{(s)} \rightarrow O_{2(g)} + NaCl_{(s)} + FeO(s)$
Moles of $NaClO_3$ = moles of O_2

Moles of $O_2 = \frac{PV}{RT} = \frac{1 \times 492}{0.082 \times 300}$
= 20 mol
Molar mass of $NaClO_3$ = 23 + 35.5 + 3 × 16
= 106.5 g
Mass of $NaClO_3$ = 20 × 106.5 = 2130 g

215. Ferrous sulfate 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 is….. .
Atomic weight : Fe = 55.85; S=32.00, O=16.00
[JEE Main 2020, 8 Jan Shift-I]

Ans. $FeSO_4.\ 7H_2O$ (m = 277.85)

$$PPM = \frac{\text{Mass of iron}}{\text{Mass of wheat}} \times 10^6$$

$$\Rightarrow 10 = \frac{\text{Mass of iron}}{100 \times 10^3} \times 10^6$$

$\Rightarrow$ Mass of iron = 1 gm

Molecular mass of $FeSO_4\ 7H_2O$ is 277.85

55.85 gm iron is present in 277.85 gm of salt

1 gm iron is present in $= \frac{277.85}{55.85} = 4.97$ gm of salt

216. Which one of the following will have the largest number of atoms?

(a) 1g Au(s) (b) 1g Na(s)
(c) 1g Li(s) (d) 1g of Cl_2(g)
(e) 1g of O_2(g)

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Ans. (c) : No. of moles $= \frac{\text{weight in gram}}{\text{molecular weight}}$

(i) 1 g Au (s) $= \frac{1}{197}$ mol atom of Au

$= \frac{1}{197} \times 6.022 \times 10^{23}$
$= 0.005076 \times 6.022 \times 10^{23}$
$= 0.005076 \times 6.0 \times 10^{23}$
$\approx 0.0305 \times 10^{23} = 3.05 \times 10^{21}$

(ii) 1 g Na (s) $= \frac{1}{23}$ mol atom of Na

$= \frac{1}{23} \times 6.022 \times 10^{23}$
$= 0.0434 \times 6.022 \times 10^{23}$
$= 0.26 \times 10^{23} = 2.6 \times 10^{22}$

(iii) 1 g Li (s) $= \frac{1}{7}$ mol atom of Li

$= \frac{1}{7} \times 6.022 \times 10^{23}$
$= 0.1428 \times 6.022 \times 10^{23}$
$= 0.860 \times 10^{23} = 8.61 \times 10^{22}$

(iv) 1 g Cl_2 (g) $= \frac{1}{71}$ mol atom of Cl_2

$= \frac{1}{71} \times 6.022 \times 10^{23} = 8.48 \times 10^{21}$

(v) 1 g O_2 (g) $= \frac{1}{32}$ mol atom of O_2

$= \frac{1}{32} \times 6.022 \times 10^{23} = 1.188 \times 10^{22}$

So, 1 g Li(s) has the largest no, of atoms.

217. Which one of the following has maximum number of atoms?

(a) 1 g of $Ag_{(s)}$ [Atomic mass of Ag = 108]
(b) 1 g of $Mg_{(s)}$ [Atomic mass of Mg = 24]
(c) 1 g of $O_{2(s)}$ [Atomic mass of O = 16]
(d) 1 g of $Li_{(s)}$ [Atomic mass of Li = 7]

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Ans. (d):

Number of atoms in 1g of Li $= \frac{1}{7} \times N_A$

$= \frac{1}{7} \times 6.023 \times 10^{23}$

$= 0.86 \times 10^{23}$

Number of atoms in 1g of Ag $= \frac{1}{108} \times N_A$
$= 0.056 \times 10^{23}$

Number of atoms in 1g of Mg $= \frac{1}{24} \times N_A$
$= 0.25 \times 10^{23}$

Number of atoms in 1g of O_2 $= \frac{1}{32} \times N_A \times 2$
$= \frac{N_A}{16} = 0.37 \times 10^{23}$

Max. number of atoms are present in 1g of Li.

218. $2KHCO_3 \rightarrow$ …+ CO_2 + H_2O find amount of gases formed (in lit).
When amount of $KHCO_3$ is 33 gm.

(a) 5.6 (b) 11.2
(c) 7.39 (d) 22.4

JIPMER-2019

Ans. (c) :

$$\underset{n=\frac{33}{100}}{2KHCO_3(s)} \longrightarrow K_2CO_3(s) + \underset{0.165}{CO_2(g)} + \underset{0.166}{H_2O}$$

Total moles of gas (0.165 + 0.165) mol

Total volume of gas = 0.33 × 22.4 L
= 7.39 L

219. The mass of AgCl precipitated when a solution containing 11.70g of NaCl is added to a solution containing 3.4 g of $AgNO_3$ is
[Atomic mass of Ag = 108, Atomic mass of Na = 23]

(a) 5.74g (b) 1.17g
(c) 2.87g (d) 6.8 g

Karnataka-CET-2019

Ans. (c):

$$NaCl + AgNO_3 \longrightarrow NaNO_3 + AgCl$$

m.wt. $\Rightarrow$ 58.5g 170g 85g 143.5g

G.wf. $\Rightarrow$ 11.72g 3.4g

170g $AgNO_3$ will give 143.5g AgCl

Then, 3.4 g $AgNO_3$ will give x g AgCl

$$x = \frac{3.4 \times 143.5}{170}$$

$x = 2.87\,g$

220. 0.1 mole of XeF_6 is treated with 1.8 g of water. The product obtained is

(a) XeO_3 (b) XeO_2F_2
(c) $XeOF_4$ (d) $Xe + XeO_3$

Karnataka-CET-2019

Ans. (c) : When 0.1 mole of XeF_6 is treated with 1.8 g of water. The product obtained is XeF_4

$\therefore$ moles of water = $\frac{\text{Given mass of water}}{\text{molecular mass}} = \frac{1.8}{18} = 0.1\text{mole}$

When 0.1 mole of XeF_6 react with 0.1 mole of H_2O then $XeOF_4$ and HF are formed

reaction involved as follows:

$$XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$$

221. The number of moles of electron required to reduce 0.2 mole of $Cr_2O_7^{-2}$ to Cr^{+3} is

(a) 1.2 (b) 6
(c) 12 (d) 0.6

Karnataka-CET-2019

Ans. (a) : From given reaction:-

$\overset{+6}{Cr_2}O_7^{2-} \rightarrow 2Cr^{+3}$

1 mole required 6 mole of electrons 0.2 mole requires

$\frac{0.2\times6}{1}$ =1.2 mole of electrons.

222. In a lead-acid battery, if 1 A current is passed to charge the battery for 1 h, what is the amount of $PbSO_4$ converted to PbO_2? (Given data: 1F = 96500 C mol^{-1})

(a) 0.0373 moles (b) 0.0186 moles
(c) 0.0093 moles (d) 0.0268 moles
(e) 0.0400 moles

Kerala-CEE-2019

Ans. (b) : Given,

i = 1A, T = 1h = 60 × 60 = 3600sec

Charge = 1 × 3600 = 3600 C

$PbSO_4 + 2e^- \times PbO_2$

Moles = $\frac{\text{Charge}}{2\times96500}$

$= \frac{3600}{193000}$

= 0.0186 moles.

223. On passing silent electric discharge through oxygen in an ozonizer, 5.5 mol% of oxygen is converted to ozone. How many moles of O_2 and O_3 result when 35 moles of O_2 is originally present?

(a) 33.0 (b) 34.4
(c) 35.0 (d) 31.8
(e) 31.0

Kerala-CEE-2019

Ans. (b) : Given, 5.5 mol% of O_2 is converted into O_3.

$\therefore 35 - \frac{35\times5.5}{100}$ moles of O_2

$= \frac{35\times5.5}{100}\times\frac{2}{3}$ mole of O_3

33.05 moles of O_2 = 1.28 moles of O_3

Thus the total no. of moles present originally was

= 33.05 of O_2 + 1.28 of O_3

= 34.4 moles.

224. In a mixture of 1 g H_2 and 8 g O_2 the mole fraction of hydrogen is :

(a) 0.667 (b) 0.5
(c) 0.33 (d) None of the above

Manipal-2019

Ans. (a) :

• No. of moles of H_2 = $\frac{1}{2} = 0.5$

• No. of moles of O_2 = $\frac{8}{32} = 0.25$

• Total moles of H_2 and O_2 = 0.5 + 0.25

= 0.75

• Mole fraction of H_2 = $\frac{\text{No. of mass of } H_2}{\text{Total moles}}$

• = $\frac{0.50}{0.75}$ =0.667

225. Two electrolytic cells are connected in series containing $CuSO_4$ solution and molten $AlCl_3$. If in electrolysis 0.4 moles of 'Cu' are deposited on cathode of first cell. The number of moles of 'Al' deposited on cathode of the second cell is

(a) 0.6 moles (b) 0.27 moles
(c) 0.18 moles (d) 0.4 moles

MHT CET-02.05.2019, Shift-III

Ans. (b) : Given,

Number of moles of Cu deposited = 0.4 moles

According to Faraday's second law.

$$\frac{\text{Weight of Cu deposited}}{\text{Weigth of Al deposited}} = \frac{E_4 \text{ wt. of Cu}}{E_4 \text{ wt. of Al}} ---(i)$$

$\because$ No. of moles = $\frac{\text{weight}}{\text{molecular weight}}$

$\therefore$ weight of Cu = 0.4 × 63.5

Now, from E_q (i), $\frac{0.4\times63.5}{\text{weight fo Al deposited}} = \frac{\frac{63.5}{2}}{\frac{27}{3}}$

$\therefore$ weight of Al deposited = $\frac{0.4\times63.5\times9}{31.75}$ =7.2g

Number of moles of Al deposited = $\frac{7.2}{27}$ = 0.27 moles

226. A cold drink bottle contains 200 mL liquid, in which CO_2 is 0.1 molar. Considering CO_2 as an ideal gas the volume of the dissolved CO_2 at S.T.P is

(a) 22.4 L (b) 0.224 L
(c) 2.24 L (d) 0.448 L

MHT CET-02.05.2019, Shift-III

Ans. (d) : Number of moles of CO_2 in 200 ml solution

= molarity × volume (in L)

$$= 0.1 \times \frac{200}{1000} = 0.02$$

volume of 0.02 mole of CO_2 at STP = 22.4×0.02

= 0.448 L

227. How many gram of sodium (atomic mass 23 u) is required to prepare one mole of ethane from methyl chloride by Wurtz reaction?

(a) 2 (b) 23

(c) 11.5 (d) 46

MHT CET-02.05.2019, Shift-II

Ans. (d): Wurtz reaction–

$$2CH_3Cl + 2Na \xrightarrow{\text{Dry ether}} CH_3-CH_3 + 2NaCl$$

Ethane

⇒2 moles of sodium metal reacts to give 1 mole of ethane.

weight of 2 moles of Na = 23 × 2 = 46 g

228. The volume of 1 mole of any pure gas at standard temperature and pressure is always equal to

(a) 0.022414 m^3 (b) 22.414 m^3

(c) 2.2414 m^3 (d) 0.22414 m^3

MHT CET-02.05.2019, Shift-II

Ans. (a) : The volume of 1 mole of any pure gas at standard temp. and pressure (STP) is equal to 22.414 L

1L = 0.001m^3

∴ 22.414 L = 0.022414 m^3

229. Which of the following gases has the density 1.8 gm/lit at 27 °C temperature and 760 Torr pressure?

(a) O_2 (b) CO_2

(c) NH_3 (d) SO_2

Tripura JEE-2019

Ans. (b) : Given,

$$P = 760 \text{ Torr} = \frac{760}{760} = 1 \text{atm}$$

T = 27°C = 27 + 273 = 300 K

d = 1.8 g/L

$$PV = \frac{m}{M}RT$$

$$M = \frac{mRT}{VP} \Rightarrow M = \frac{dRT}{P}$$

$$M = \frac{1.8 \times 0.0821 \times 300}{1}$$

$$M = 44 g/mole$$

Molar mass of gas = 44g/mole

So, gas is CO_2 molar mass 44 g/mole.

230. 20 gm of a metal produces 0.504 gm H_2(g) on reaction with dilute H_2SO_4. Calculate the receivable amount of metal oxide from 2 gm of same metal.

(a) 2.4gm (b) 2.2gm

(c) 2.8gm (d) 2.6gm

Tripura JEE-2019

Ans. (a) : Given,

0.504g of H_2 is liberated by 20g of the metal

So, 1.008g H_2 is liberated by $\frac{20 \times 1.008}{0.504}$

= 40g of the metal.

40g metal combines with 8g of oxygen

So, 2.0g of metal combines with = $\frac{8 \times 2}{40}$ g

= 0.4g of oxygen

Amount of metal oxide = Mass of metal + Mass of oxygen = (2.0 + 0.4) = 2.4 g

231. At S.T.P. the volume of 7.5 g of a gas is 5.6L. The gas is

(a) NO (b) N_2O

(c) CO (d) CO_2

WB-JEE-2019

Ans. (a) : We know,

22.4 L volume of S.T.P. contain 1 mole

Then, 5.6 L volume at S.T.P contain

$$= \frac{1}{22.4} \times 5.6 = 0.25 \text{mole}$$

And,

$$\text{No. of mole} = \frac{\text{Mass}}{\text{Molecular weight}}$$

$$\text{Molecular weight} = \frac{7.5}{0.25} = 30$$

From the given option NO has molecular weight 30. Hence, correct option is 'a'

232. 1.2 g of Mg is treated with 100mL of 1M H_2SO_4. Molar concentration of the H_2SO_4 solution after complete reaction will be

(a) 0.20 M (b) 0.005 M

(c) 0.10 M (d) 0.5 M

CG PET -2019

Ans. (d) : $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

24g (98g = 1 mol)

1.2g Mg reacts with = 0.5 mol H_2SO_4

H_2SO_4 taken = 100 mL of 1 M H_2SO_4

= 0.1 mol

H_2SO_4 left = 0.1 – 0.05

= 0.05 mol in 100 mL solution

[H_2SO_4] = 0.05 × 10 = 0.5 M

233. The volume of ' 10 vol' of H_2O_2 required to liberate 500mL O_2 at NTP is

(a) 125mL (b) 500mL

(c) 50mL (d) 100mL

CG PET -2019

Ans. (c) : 10 vol of H_2O_2 means that

10 L O_2 can be liberated from 1 L H_2O_2

1 L O_2 liberated from $\frac{1}{10}$ L H_2O_2

500 mL O_2 liberated from = $\frac{500}{10}$ mL H_2O_2

$= 50$ mL H_2O_2
10 vol. H_2O_2 means that 1 mL H_2O_2 gives 10 mL O_2.
Thus, 50 mL H_2O_2 will give 500 mL O_2.

234. The volume strength of 1 M H_2O_2 is (Molar mass of H_2O_2 = 34 g mol^{-1})
(a) 16.8 (b) 22.4
(c) 11.35 (d) 5.6
[JEE Main-2019, 12 Jan Shift-II]

Ans. (c) : The balanced reaction
$$2H_2O_2 \rightarrow 2H_2O + O_2$$
$$-1 \quad -2 \quad 0 \text{(Oxidation state of O)}$$
2 moles of H_2O_2 give 1 mole of O_2
1 mole of H_2O_2 will give 11.2L of O_2 gas
Volume strength of H_2O_2 = 11.2 × molarity
For 1 M H_2O_2 volume strength is 11. 2 L.

235. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using 0.1 Faraday electricity. How many moles of Ni will be deposited at the cathode?
(a) 0.20 (b) 0.10
(c) 0.15 (d) 0.05
[JEE Main 2019, 9 April Shift-II]

Ans. (d) : $Ni(NO_3)_2 \rightarrow Ni^{2+} + 2NO_3^-$
$$Ni^{2+} + 2e^- \rightarrow Ni$$
2. eq. of Ni^{2+} will be discharged from 2F
0.1 eq. of Ni^{2+} will be discharged from 0.1 F
No. of eq. = No of moles × (n – factor)
0.1 = No. of moles × 2
No. of moles of Ni = $\frac{0.1}{2} = 0.05$ mol.

236. In order to oxidise a mixture of one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is
(a) 2 (b) 1
(c) 3 (d) 1.5
[JEE Main 2019, 8 April Shift-I]

Ans. (a) :
$FeC_2O_4 + KMnO_4 \rightarrow Fe^{3+} + CO_2 + Mn^{2+}$
v.f. = 3 v.f = 5
1× 3 = mole × 5
Mole = $\frac{3}{5}$
$Fe_2(C_2O_4)_3 + KMnO_4 \rightarrow Fe^{3+} + CO_2 + Mn^{2+}$
v.f. = 6 v.f = 5
1× 6 = mole × 5
Mole = $\frac{6}{5}$
$FeSO_4 + KMnO_4 \rightarrow Fe^{3+} + SO_4^{2-} + Mn^{2+}$
v.f. = 1 v.f = 5
1× 1 = mole × 5
Mole = $\frac{1}{5}$
$Fe(SO_4)_3$ doesn't oxidize
Total moles of $KMnO_4$ = $\frac{3}{5} + \frac{6}{5} + \frac{1}{5} = 2$

237. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is
(a) 2 (b) 5
(c) 1 (d) 10
[JEE Main 2019, 10 Jan Shift-II]

Ans. (c) : As given in question, Reaction of oxalate with permanganate in acidic medium
$5C_2O_4^{2-} + 2MnO_4^- \rightarrow 10CO_2 + 2Mn^{2+} + 8H$
N factor (4 – 3) × 2 = 2 – (7–2) = 5
$5C_2O_4^{2-}$ ions transfer $10e^-$ to produce to molecules of CO_2
So, number of electron involved in producing 10 molecule of CO_2 is 10.
Thus, number of electron involed in producing 1 molecules of CO_2 is 1.

238. For the following reaction , the mass of water produced from 445 g of $C_{57}H_{110}O_6$ is :
$2C_{57}H_{110}O_6(s)+163O_2(g)\rightarrow114CO_2(g)+110H_2O(l)$
(a) 490 g (b) 495 g
(c) 445 g (d) 890 g
[JEE Main 2019, 10 Jan Shift-II]

Ans. (b) : Given equation
$2C_{57}H_{110}O_6(s)+163O_2(g)\rightarrow114CO_2(g)+110H_2O(l)$
Moles of $C_{57}H_{110}O_6(s) = \frac{445}{890} = 0.5$ moles
$$2C_{57}H_{110}O_6(s) + 163O_2 \rightarrow 114CO_2(g) + 110H_2O(I)$$
$$nH_2O = \frac{110}{4} = \frac{55}{2}$$
No. of moles of H_2O = $\frac{\text{given mass}}{\text{molar mass}}$
Given mass = No. of moles × molar mass
$= \frac{55}{2} \times 18$
= 495 g

239. 5 moles of AB_2 weight 125×10^{-3} kg and 10 moles of A_2B_2 weight 300×10^{-3} kg. The molar mass of $A(M_A)$ and molar mass of $B(M_B)$ in kg mol^{-1} are
(a) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$
(b) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$
(c) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$
(d) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$
[JEE Main 2019,12 April Shift-I]

Ans. (d) : 5 moles of AB_2 weight 125 g
$$= \frac{\text{weight in g}}{\text{number of moles}} = \frac{125}{5} = 25$$
$\therefore$ AB_2 = 25 g/mol
$$5 = \frac{125}{M_A + 2M_B}$$
$M_A + 2M_B = 25$
10 mole of A_2B_2 weight 300 g

$$= \frac{\text{weight in g}}{\text{number of moles}} = \frac{300}{10} = 30$$

$\therefore$ A_2B_2 = 30 g / mole

$$10 = \frac{300}{2M_A + 2M_B}$$

$$2M_A + 2M_B = 30$$

$\therefore$ Molar mass of A, (M_A) = 5 g or 5×10^{-3}kg

$\therefore$ Molar mass of B, (M_B) = 10 g or 10×10^{-3}kg

240. Total number of atoms in 44 g of CO_2 is

(a) 6.02×10^{23} (b) 6.02×10^{24}
(c) 1.806×10^{24} (d) 18.06×10^{22}

J & K CET-(2019)

Ans. (c) : 44 gram CO_2 mean 44/44 = 1 mole of the CO_2.
1 mole CO_2 implies total of 6.022×10^{23} molecules of CO_2. 1 molecules of CO_2 has 3 atoms.
Therefore total atoms in 44 grams of CO_2 has $(6.022\times10^{23}) \times 3 = 18.066 \times 10^{23}$ atoms $= 1.806 \times 10^{24}$ atoms

241. The amount of water (g) produced by the combustion of 32 g of methane is

(a) 18 g (b) 36 g
(c) 54 g (d) 72 g

Assam CEE-2019

Ans. (d) : $CH_4(g) + 2O_2 \rightarrow CO_2 + 2H_2O$
As per stoichiometric equation, 16 g of methane produces 36 g of H_2O

$\therefore$32 g of methane will produce $= \frac{36}{16}\times 32 = 72$ g H_2O.

242. Which one of the following is the lightest?

(a) 0.2 mole of hydrogen gas
(b) 6.023×10^{22} molecules of nitrogen
(c) 0.1 g of silver
(d) 0.1 mole of oxygen gas

AIIMS 25 May 2019 (Evening)

Ans. (c):

(a) Moles $= \frac{\text{Weight}}{\text{Molecular weight}}$

Weight of H_2 = mole × molecular wt.
$= 0.2 \times 2 = 0.4$ g

(b) 6.023×10^{23} represents 1 mole
Thus 6.023×10^{22} will represent 0.1 mole
Weight of $N_2 = 0.1 \times 28 = 2.8$ g
(c) Weight of Silver = 0.1 g
(d) Weight of oxygen = $32 \times 0.1 = 3.2$ g
Thus from the above, silver is lightest.

243. Calculate molarity of a 63% w/w HNO_3 solution if density is 1.4g/mL:

(a) 14 M (b) 12 M
(c) 10 M (d) 8 M

AIIMS 26 May 2019 (Evening)

Ans. (a):
HNO_3 solution = 63 % w/w
Density = 1.4 g / mL

$$\text{Molarity} = \frac{\%\ w/w \times d \times 10}{M_{Solute}}$$

$$M = \frac{63 \times 1.4 \times 10}{63} = 14\,M$$

244. Haemoglobin contains 0.33% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (at. Wt. of Fe= 56) present in one molecule of haemoglobin is

(a) 6 (b) 1
(c) 2 (d) 4

AIIMS-27 May, 2018 (E)

Ans. (d) : Given,
% of Iron = 0.334 %
Molecular weight of the haemoglobin = 67200 g / mol
Weight of the Iron = 56 g
The number of iron atoms =

$$\frac{\text{Molecular Weight of haemoglobin} \times \%\text{ of iron}}{100 \times \text{Atomic weight of Iron}}$$

$$= \frac{67200 \times 0.334}{100 \times 56} = 4$$

245. 100 mL brandy contains 40 mL ethanol. The mole fraction of water is

(a) 0.6 (b) 0.667
(c) 0.26 (d) 0.425

CG PET -2018

Ans. (a) : Volume of water = 100 – 40 = 60 mL and
Volume fraction $\propto$ mole fraction

$$\text{Volume fraction of water} = \frac{\text{Volume of water}}{\text{Total volume}}$$

$$= \frac{60}{100} = 0.6$$

246. If 0.05g of urea is dissolved in 5 g of water, then

(a) Its molarity will be greater than molality
(b) Its molality will be greater than molarity
(c) Molarity and molality will be same
(d) Its normality will be 50/60

CG PET -2018

Ans. (b) : $\text{Molarity} = \frac{\text{Number of moles of solute}}{\text{Volume of solution (in L)}}$

$$\text{And Molality} = \frac{\text{Number of moles of solute}}{\text{Mass of solution (in kg)}}$$

$\therefore$Mass of solute (urea) and solvent (water) remain in changed, during the calculations of molarity and molality.
Then volume of solution and contain water molecules.
($\therefore$ In case of volume of solution, it has both solute and solvent)
Thus, molality will be greater than that of molarity.

247. How many grams of Cl_2 gas will be obtained by the complete reaction of 31.6 gm of potassium permanganate with hydrochloric acid?
[Mole mass of $KMnO_4$ = 316 gm/mol]

(a) 71 (b) 17.75
(c) 35.5 (d) 142

GUJCET-2018

Ans. (b) :
$2KMnO_4 + 16HCL \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$
Moles of 31.6 gm of potassium permanganate
$= \frac{31.6\,gm}{316\,gm/mol} = 0.1$ mole
0.1 moles of potassium permanganate will give
$\frac{5}{2} \times 0.1 = 0.250$ moles of chlorine.
The molar mass of Cl_2 = 71 g/mole
The mass of Cl_2 = 71 g/mole × 0.250 mol = 17.75 g

248. Two solutions NaCl and CH_3COOH are prepared separately. The molarity of both is 0.1 m and osmotic pressure p_1 and p_2 respectively. The correct relationship between osmotic pressure is

(a) $p_1 = p_2$ (b) $p_1 > p_2$
(c) $p_2 > p_1$ (d) $p_1 \neq p_2$

JCECE - 2018

Ans. (b) : NaCl is a salt made up of strong acid and strong base that completely dissociates to give 2 ions. As we know osmotic pressure is directly proportional to i (Van't Hoff factor) i.e. $\pi \propto i$. So, $P_1 > P_2$.

249. 1.0 g of Mg is burnt with 0.28 g of O_2 in a closed vessel. Which reactant is left in excess and how much?

(a) Mg, 5.8 g (b) Mg, 0.58 g
(c) O_2, 0.24 g (d) O_2, 2.4 g

Karnataka-CET-2018

Ans. (b) : The burning of Mg occurs as follows:
$2Mg + O_2 \rightarrow 2MgO$
Moles 212
Molar mass of Mg = 48g and O_2 = 32g
32 g of oxygen, needs 48 g of Mg
0.28 g of oxygen, needs $= \frac{48 \times 0.28}{32}$
$= 0.42\,g$ of Mg
Mg left (in excess) = 1– 0.42 = 0.58g

250. Mass % of carbon in ethanol is

(a) 52 (b) 13
(c) 34 (d) 90
(e) 80

Kerala-CEE-2018

Ans. (a) : Molecular mass of C_2H_5OH = 46.00
[Atomic mass of C = 12, H = 1, O = 16]
46.00 of C_2H_5OH is contain, C = 24g
Mass % of Carbon $= \frac{\text{Molar mass of carbon}}{\text{Molar mass of ethanol}} \times 100$
$= \frac{24 \times 100}{46}$
= 52.17% ≈ 52%

251. 1.2 g of Mg (at. mass 24) will produce MgO equal to :

(a) 0.05 mol (b) 40 g
(c) 40 mg (d) 4 g

Manipal-2018

Ans. (a) : $Mg + \frac{1}{2}O_2 \rightarrow MgO$
From the above equation
1 mol of Mg reacts to give 1 mol of MgO.
Number of moles of Mg in
1.2 g $= \frac{1 \times 1.2}{24} = 0.05$ mol of Mg
The number of moles of MgO = 0.05 mol

252. The Avogadro number or a mole represents :

(a) 6.02×10^{23} ions
(b) 6.02×10^{23} atoms
(c) 6.02×10^{23} molecules
(d) 6.02×10^{23} entities

HP CET-2018

Ans. (b): Avogadro's number is the number of particles/atom in one mole of any substance.
$N_a = 6.023 \times 10^{23}$ atom.

253. To a 4 L of 0.2 M solution of NaOH 2 L of 0.5 M NaOH are added. The molarity of resulting solution is :

(a) 0.9 M (b) 0.3 M
(c) 1.8 M (d) 0.18 M

Manipal-2018

Ans. (b) : Given,
$M_1 = 0.2$ M ; $V_s = 4$ L
$M_2 = 0.5$ M ; $V_s' = 2$ L
$M_{total} = \frac{M_1V_s + M_2V_s'}{V_s + V_s'} = \frac{0.2 \times 4 + 0.5 \times 2}{4 + 2}$
$= \frac{0.8 + 1.0}{6} = \frac{1.8}{6} = 0.3M$

254. If 20 g of $CaCO_3$ is treated with 100 mL of 20% HCl solution, the amount of CO_2 produced is :

(a) 22.4 L (b) 8.80 g
(c) 4.40 g (d) 2.24 L

Manipal-2018

Ans. (b) :
$CaCO_3 + 2HCl \rightarrow CaCl + CO_2 + H_2O$
100g 73g 44g
100 mL of 20% HCl solution = 20g HCl
$CaCO_3$ is the limiting reactant 100g of $CaCO_3$ gives 44g CO_2
20g $CaCO_3$ gives $\frac{44}{100} \times 20 = 8.80\,g$ of CO_2.

255. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in) g of the remaining product at STP will be

(a) 1.4 (b) 3.0
(c) 2.8 (d) 4.4

NEET-2018

Ans. (c)

$HCOOH \xrightarrow{H_2SO_4} CO + H_2O$ ....(i)

$(COOH)_2 \xrightarrow{H_2SO_4} CO + CO_2 + H_2O$ ....(ii)

Conc. H_2SO_4 is a strong dehydrating agent

Moles of HCOOH = $\frac{2.3}{46} = 0.05$ mole

Moles of $(COOH)_2$ = $\frac{2.3}{46} = 0.05$ mole

From reaction (i),
Number of CO formed = 0.05 mole
From reaction (ii),
Number of CO formed = 0.05 mole
Number of CO_2 formed = 0.05 mole
Hence, Total CO formed = 0.05 + 0.05 = 0.1 mole
KOH pellets absorbs all CO_2, H_2O absorbed by H_2SO_4 thus CO is remaining product.
Thus the weight of the remaining product = 0.1 × 28 = 2.8g

256. In which case is number of molecules of water maximum?
(a) 18 mL of water
(b) 0.18 g of water
(c) 0.00224 L of water vapours at 1 atm and 273 K
(d) 10^{-3} mol of water

NEET-2018

Ans. (a) : 1 moles of water contain = 6.023×10^{23} atom
(i) Mass of water = 18×1 = 18g (H_2O = 18)
Molecules of water

$= \text{mole} \times N_A = \frac{18}{18} \times 6.023 \times 10^{23} = 6.023 \times 10^{23}$

(ii) Molecules of water = mole × N_A

$= \frac{18}{18} \times 6.023 \times 10^{23}$

$= 6.023 \times 10^{21}$

(iii) Molecules of water = mole × 6.023×10^{23}

$= 10^{-4} \times 6.023 \times 10^{23}$

$= 6.023 \times 10^{-19}$

(iv) Molecules of water = mole × N_A = $6.023 \times 10^{23} \times 10^{-3}$

$= 6.023 \times 10^{20}$

From above, It is clear that 18 mL of water has maximum molecules.

257. One litre of an acidified solution of $KMnO_4$ containing 15.8 g $KMnO_4$ is decolourised by passing sufficient amount of SO_2. If SO_2 is produced by roasting of iron pyrite (FeS_2). The amount of pyrite required to produce the necessary amount of SO_2 will be
(a) 15.8 g FeS_2 (b) 15.0 g FeS_2
(c) 7.5 g FeS_2 (d) 7.9 g FeS_2

UPTU/UPSEE-2018

Ans. (b) 2 $KMnO_4$ + 5SO_2 + 2H_2O → K_2SO_4 + 2$MnSO_4$+2H_2SO_4
Molar mass of $KMnO_4$ is 158.034 g/mol

Moles of $KMnO_4$ = $\frac{15.8\text{g}}{158.034\,\text{g/mol}} = 0.10$ moles

According to given equation, 2 moles of $KMnO_4$ reacts with 5 moles of SO_2

∴ 0.10 moles of $KMnO_4$ will react with $\frac{5}{2} \times 0.10$ moles of SO_2 i.e. 0.25 moles of SO_2

Given, SO_2 is produced by roasting of iron pyrite (FeS_2) as:

$4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$

So, 8 moles of SO_2 will be formed by 4 moles of FeS_2

∴ 0.25 moles of SO_2 will be formed by $\frac{4}{8} \times 0.25$ moles of FeS_2 = 0.125 moles of FeS_2

molecular mass of FeS_2 = 119.98 g mol^{-1}

∴ Amount of FeS_2 required to give necessary SO_2

= 119.98g mol^{-1} × 0.125 mol.

= 14.99g ≈ 15g of FeS_2

258. What will be the correct number of total electrons in 1.6 g methane ?
(a) 6.02×10^{24} (b) 6.02×10^{23}
(c) 6.02×10^{22} (d) 9.632×10^{23}

UPTU/UPSEE-2018

Ans. (b): Given mass of methane = 1.6g
Molecular weight of methane = 12 + 4 = 16 g mol^{-1}

Moles of methane $= \frac{\text{Given mass}}{\text{Molecular mass}}$

Moles of Methane = $\frac{1.6}{16} = 0.1$

In one mole there are 6.02×10^{23} atoms
In 0.1 mol there are $0.1 \times 6.02 \times 10^{23}$ atoms
= 6.02×10^{22} atoms
[No. of electron in CH_4 = 6+4=10]
Hence, Total number of electrons = Number of electrons present in CH_4 × atoms present in 0.1 mole
= 10× 6.02×10^{22} = 6.02×10^{23}

259. The heat of neutralisation of a strong base and a strong acid is 13.7 kcal. The heat released when 0.6 mole HCl solution is added to 0.25 mole of NaOH is
(a) 3.425 kcal (b) 8.22 kcal
(c) 11.645 kcal (d) 13.7 kcal

WB-JEE-2018

Ans. (a) :

$\underset{1\text{mol}}{HCl} + \underset{1\text{mol}}{NaOH} \longrightarrow NaCl + H_2O$

$\Delta H = -13.7$ Kcal

According to question,

$\underset{0.25\text{mol}}{HCl} + \underset{0.6\text{mol}}{NaOH} \longrightarrow NaCl + H_2O$ ....(i)

In equation (i), NaOH acts as a limiting reagent. for 1 mole of NaOH and 1 mole of HCl heat of neutralization = 13.7 kcal.
∴ For 0.25 mole of NaOH and 0.6 mole of HCl, heat of neutralization = 13.7 × 0.25 = 3.425 kcal.

260. How many moles of electrons will weigh one kilogram?

(a) 6.023×10^{23} (b) $\frac{1}{9.108}\times10^{31}$

(c) $\frac{6.023}{9.108}\times10^{54}$ (d) $\frac{1}{9.108\times6.023}\times10^{8}$

WB-JEE-2018

Ans. (d) : 1 mole of electrons = 6.023×10^{23} electrons
Mass of 1 mole of electrons

$= 6.023 \times 10^{23} \times 9.108 \times 10^{-31}$ kg

No. of moles of electron in 1 kg $= \frac{10^8}{9.108\times6.023}$ moles of electrons.

Thus, $\frac{1}{9.108\times6.023}\times10^{8}$ moles of electrons will weight one kilogram.

261. The number of molecules of 8 g of oxygen gas at NTP is

(a) 6.022×10^{23} (b) $8 \times 6.022 \times 10^{23}$

(c) $\frac{1}{4}\times6.022\times10^{23}$ (d) $\frac{1}{2}\times6.022\times10^{23}$

Assam CEE-2018

Ans. (c) : Mass of Oxygen molecule O_2 = 8g
Molar mass of O_2 = 16 + 16 = 32g

The number of Moles O_2 in 8g of O_2 = $\frac{8}{32}=\frac{1}{4}$

= 0.25 moles

1 mole contains = 6.022×10^{23} number of O_2
Then 0.25 mole will contain

$6.022 \times 10^{23} \times \frac{1}{4}$

The number of molecules of 8 g of oxygen gas at NTP is $6.022 \times 10^{23} \times \frac{1}{4}$.

262. The 25 mL of a 0.15 M solution of lead nitrate, $Pb(NO_3)_2$ reacts with all of the aluminium sulphate, $Al_2(SO_4)_3$, present in 20 mL of a solution. What is the molar concentration of the $Al_2(SO_4)_3$?

$$3Pb(NO_3)_2(aq)+Al_2(SO_4)_3(aq)\rightarrow$$
$$3PbSO_4(s)+2Al(NO_3)_3(aq)$$

(a) 6.25×10^{-2} M (b) 2.421×10^{-2} M

(c) 0.1875 M (d) None of these

BITSAT-2018

Ans. (a) : Given,
$Al_2(SO_4)_3 + Pb(NO_3)_2 \rightarrow 3PbSO_4 + 2Al(NO_3)_3$
As we know,
Molar mass of $Pb(NO_3)_2$ = Volume × Concentration

= 25 × 0.15

= 3.75 mL M

And Molar mass of $Al_2(SO_4)_3$ $=\frac{1}{3}\times3.75$

Then, $M\times20=\frac{1}{3}\times3.75$

M = 0.0625M
M = 6.25×10^{-2}M

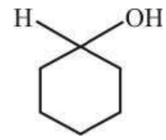
263. How many grams of cyclohexanol is required to produce 20 g cyclohexane, if % yield is 54%?

(a) 88 (b) 66

(c) 22 (d) 44

CG PET -2018

Ans. (d) : Formula of cyclohexanol is C_6H_{11} OH.



Molecular mass of C_6H_{11} OH = 100
Molecular mass of cyclohexane

$(C_6H_{12})=84$

∵ For 84 g of cyclohexane, we need = 100 g of material $C_6H_{11}(OH)$

∴ For 20 g of cyclohexane,

We need = $\frac{100\times20}{84}$

= 23.80 g of $C_6H_{11}(OH)$

∴ 54 g of $C_6H_{11}(OH)$ we get from = 100 g of $C_6H_{11}(OH)$

∴ 23.8 g of $C_6H_{11}(OH)$ get from = $\frac{100\times23.8}{54}$ = 44%

264. Excess of acidic solution of KI to mixed with 25 mL H_2O_2. Liberated I_2 requires 20 mL of 0.3 N $Na_2S_2O_3$ solution. The volume strength of H_2O_2 is

(a) 1.344 volume (b) 2.688 volume

(c) 1.5 volume (d) 2.5 volume

CG PET -2018

Ans. (a) : The reaction involved in this liberation is

$2KI+H_2O_2\rightarrow I_2+2KOH$

Normality of 25 ml H_2O_2 be x N
From above titration
N_1 = Normality of H_2O_2
V_1 = Volume of H_2O_2
N_2 = Normality of $Na_2S_2O_3$ or I_2
V_2 = Volume of $Na_2S_2O_3$ or I_2

$N_1V_1=N_2V_2$

a × 25 = 0.3 × 20

a = $\frac{0.3\times20}{25}$

a = 0.24
Normality of H_2O_2 solution = 0.24 N
Volume strength = Normality × Equivalent weight
Equivalent weight of H_2O_2 in terms of oxygen = 5.6 L
Volume strength= 0.24 × 5.6

= 1.344 g L^{-1}

265. Number of electrons present in 3.6 mg of NH_4^+ are

(a) 1.20×10^{21} (b) 1.20×10^{20}
(c) 1.20×10^{22} (d) 2×10^{-3}

AMU-2017

Ans. (b) : Given, mass of NH_4^+ = 3.6 mg = 3.6×10^{-3} g

Molar mass of $NH_4^+ = (1 \times 14) + (4 \times 1) = 18$ g [N = 14, H = 1]

$$\text{No. of moles} = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$= \frac{3.6 \times 10^{-3}}{18} = 0.2 \times 10^{-3} \text{ moles}$$

No. of electrons in 3.6 mg of NH_4^+

= Moles × Avogadro Number

= $0.2 \times 10^{-3} \times 6.023 \times 10^{23}$

= 1.2×10^{20} electron of NH_4^+

266. If 3.01×10^{20} molecules are removed from 98 mg of H_2SO_4, then number of moles of H_2SO_4 left are

(a) 0.1×10^{-3} mol (b) 9.95×10^{-2} mol
(c) 0.5×10^{-3} mol (d) 1.66×10^{-3} mol

Karnataka-CET-2017

Ans. (c) :

Molecular weight of H_2SO_4 = 98 mg = 98×10^{-3} g

$$\text{No. of moles} = \frac{\text{weight}}{\text{mole.wt.}}$$

$$= \frac{98 \times 10^{-3}}{98} = 10^{-3} \text{ moles} = 0.001 \text{mol}$$

1 mole $H_2SO_4 = 6.022 \times 10^{23}$ molecules

0.001 moles = $6.022 \times 10^{23} \times 0.001$

= 6.022×10^{20} molecules

If 3.01×10^{20} molecules are removed then,

Remaining molecules = $6.022 \times 10^{20} - 3.01 \times 10^{20}$

= 3.01×10^{20}

$$\text{No. of moles} = \frac{3.01 \times 10^{20}}{6.022 \times 10^{23}}$$

$$= \frac{1}{2} \times 10^{-3} = 0.5 \times 10^{-3} \text{ moles}$$

267. One mole of an unknown compound was treated with excess water and resulted in the evolution of two moles of a readily combustible gas. The resulting solution was treated with CO_2 and resulted in the formation of white turbidity. The unknown compound is

(a) Ca (b) CaH_2
(c) $Ca(OH)_2$ (d) $Ca(NO_3)_2$
(e) $CaSO_4$

Kerala-CEE-2017

Ans. (b) : The unknown compound is CaH_2 or calcium hydride

$CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$
(2 mole)
readily combustible H_2 gas

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
White turbidity.

268. The mass of $CaCO_3$ required to react with 25 mL of 0.75 M HCl is :

(a) 0.94 g (b) 9.4 g
(c) 0.094 g (d) 0.49 g

Manipal-2017

Ans. (a) :

1 moles $CaCO_3$ = 2 moles of HCl

$$\text{No. of moles of HCl} = \frac{MV}{1000} = \frac{0.75 \times 25}{1000} = 0.01875 \text{moles}$$

$$\text{NO. of moles of } CaCO_3 = \frac{1}{2} \times \text{number of moles of HCl}$$

$$= \frac{1}{2} \times 0.01875 = 9.375 \times 10^{-3}$$

Mass of $CaCO_3$ = No of moles × Molar Mass

[Molar mass of $CaCO_3$ = 40+12+16×3 = 100]

= $9.375 \times 10^{-3} \times 100 = 0.9375$g

269. What is the quantity of hydrogen gas liberated when 46 g sodium reacts with excess ethanol? (Given atomic mass of Na = 23)

(a) 2.4×10^{-3} kg (b) 2.0×10^{-3} kg
(c) 4.0×10^{-3} kg (d) 2.4×10^{-2} kg

MHT CET-2017

Ans. (b) : The reaction of ethanol with water is as follows-

$2C_2H_5OH(l) + 2Na(s) \rightarrow 2C_2H_5O^-Na^+ + H_2(g)\uparrow$

$$\text{Moles of Na (46g)} = \frac{\text{Mass}}{\text{Molecular weight}} = \frac{46}{23} = 2 \text{ mol}$$

Here, 2 moles of Na will give 1 mole of H.

The molecular weight of Hydrogen

$$= \frac{\text{Mass of hydrogen}}{\text{Moles of hydrogen}} = \frac{2}{1} = \text{g mol}^{-1}$$

Thus, quantity of hydrogen gas librated = 2 g

= 2×10^{-3} kg

270. The number of grams/weight of NH_4Cl required to be added to 3 liters of 0.01 M $NH_3$to prepare the buffer of pH=9.45 at temperature 298 K ($K_b$for NH_3 is 1.85×10^{-5})

(a) 0.354 gm (b) 4.55 gm
(c) 0.455 gm (d) 3.55 gm

UPTU/UPSEE-2017

Ans. (a) : Given pH = 9.45

K_b for NH_3 is 1.85×10^{-5}

$$pOH = pK_b + \log\frac{[NH_4Cl]}{[NH_3]}$$

$$\Rightarrow \ pOH = -\log K_b + \log\frac{[NH_4Cl]}{[NH_3]}$$

$(\because pK_b = -\log K_b)$

Also, pOH = 14 – pH = 14 – 9.45 = 4.55

$$\text{and } \log\frac{[NH_4Cl]}{[NH_3].K_b} = \log 3 \approx 0.470$$

$$\text{Thus, } \log 10^{14} - (\log 10^9 + \log 3) \approx \log\frac{[NH_4Cl]}{[NH_3].K_b}$$

$$\frac{10^{14}}{10^9\times 3}\approx\frac{[NH_4Cl]}{[NH_3].K_b}$$

Or $\frac{10^4\times[NH_3].K_b}{10^9\times 3}$

$= [NH_4Cl]\approx\frac{10^{14}}{10^9\times 3}\times 0.01\times 1.85\times 10^{-5}$

$= 0.354\,gm.$

271. The yield of acetanilide in the reaction (100% conversion) of 2 moles of aniline with 1 mole of acetic anhydride is

(a) 270 g (b) 135 g
(c) 67.5 g (d) 177 g

WB-JEE-2017

Ans. (b) :

$$\underset{\text{Aniline}}{C_6H_5NH_2} + \underset{\text{Acetic anhydride}}{(CH_3CO)_2O} \longrightarrow \underset{\text{Acetanilide}}{C_6H_5NHCOCH_3} + \underset{\text{Acetic acid}}{CH_3COOH}$$

Int.	2	1	0	0
Final	1	0	1	1

Thus acetic anhydride is the limiting reagent.
Molar mass of $C_6H_5NHCOCH_3$ or C_8H_9NO
$= 12 \times 8 + 9 \times 1 + 14 \times 1 + 16 \times 1$
$= 96 + 9 + 14 + 16 = 135\ g\ mol^{-1}$
Amount of acetanilide formed = 1 mol
$= 1\ mol \times 135\ g\ mol^{-1} = 135g$

272. 0.50 mol of $BaCl_2$ is mixed with 0.20 mol of Na_3PO_4 to get $Ba_3(PO_4)_2$. Number of moles $Ba_3(PO_4)_2$ of obtained are

(a) 0.6 mol (b) 0.2 mol
(c) 0.1 mol (d) 0.05 mol

BCECE-2017
Assam CEE-2014

Ans. (c) : Balanced equation for reaction between $BaCl_2$ and Na_3PO_4 is as follows:

$$3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6NaCl$$

3 moles of $BaCl_2$ react with 2 moles of Na_3PO_4 to give 1 mole of $Ba_3(PO_4)_2$
0.5 moles of $BaCl_2$ will react with (2/3) × 0.5 = 0.33 moles of Na_3PO_4
Available moles of Na_3PO_4 = 0.2
So, Na_3PO_4 is the limiting reagent
Now, 2 moles of Na_3PO_4 give 1 mole of $Ba_3(PO_4)_2$
So, 0.2 moles of $Na_3(PO_4)2$
Hence maximum number of moles of $Ba_3(PO_4)_2$ formed = 0.1

273. 4.9 g of H_2SO_4 is present in 100 mL solution. the molarity and normality of the solution will be

	Molarity	Normality
(a)	1M	0.5 N
(b)	1M	0.25 N
(c)	0.5M	1N
(d)	2M	3N

CG PET -2017

Ans. (c) : Given Mass of $H_2SO_4(w) = 4.9g$
Volume of solution (V)= 100mL
Molar mass (M)=98
Molarity (C) $= \frac{w\times 1000}{M\times V}, \therefore C = \frac{4.9}{98}\times\frac{1000}{100}$
Molarity = 0.5M
Normality (N)=Z× molarity (C)
where, Z= equivalent factor
For $H_2SO_4(Z=2) \Rightarrow 0.5M$
∴ Normality =2×0.5=1N

274. 1 g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2. The molar mass of M_2CO_3 in g mol^{-1} is

(a) 1186 (b) 84.3
(c) 118.6 (d) 11.86

[JEE Main-2017]

Ans. (b) : Given chemical equation.

$$M_2CO_3 + 2HCl \rightarrow 2MCl + H_2O + CO_2$$

1 gm 0.01186 mol

From the above chemical eq^n.

$$nM_2CO_3 = nCO_2$$

$$\frac{1}{\text{Molar mass of } M_2CO_3} = 0.01186$$

$$\text{Molar mass of } M_2CO_3 = \frac{1}{0.01186}$$

$$M = 84.3\ g\ mol^{-1}$$

275. At 25°C consider the density of water is 1 g/L and that of propanol to be 0.925g/L what volume of propanol will have same number of molecules as present in 210 mL of water?

(a) 757 mL (b) 825 mL
(c) 646 mL (d) 437 mL

J & K CET-(2017)

Ans. (a) : Given, density of water = 1g/L
and Density of propanol = 0.925 g/L

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

For water :

$1 = \frac{18}{V_{H_2O}}$ (molar mass of water = 18 g mol^{-1})

$V_{H_2O} = 18\ L$

For propanol :

$0.925 = \frac{60}{V_{propanol}}$

[Molar mass of $CH_3CH_2CH_2OH$ = 60g mol^{-1}]

$V_{propanol} = 64.86\ L$

Ratio : $\frac{V_{propanol}}{V_{H_2O}} = \frac{64.86}{18}$

$V_{propanol} = 3.603\times V_{H_2O}$

$V_{propanol} = 3.603\times 210$

= 756.63
= 757 mL

276. **Dissolving 120 g of urea in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is**

(a) 1.78 M (b) 2 M
(c) 2.05 M (d) 2.22 M

JCECE - 2017

Ans. (c) : Given, Mass of urea = 120g
Molar mass of urea = 120 + 1000 = 1120 g
Density of solution = 1.15 g/mL

Volume of solution = $\frac{\text{mass}}{\text{density}} = \frac{1120}{1.15} = 973.15\text{mL}$

$$\text{Molarity} = \frac{W \times 1000}{M \times \text{Volume(in mL)}}$$

$$= \frac{120 \times 1000}{60 \times 973.15} = 2.05 \text{ M}$$

The molarity of the solution is 2.05M

277. **How much CO_2 is produced on heating of 1 kg of carbon?**

(a) $\frac{11}{3}$kg (b) $\frac{3}{11}$kg
(c) $\frac{4}{3}$kg (d) $\frac{3}{4}$kg

NDA (II)-2017

Ans. (a) : We know that, $C+O_2 \rightarrow CO_2$
12 g of C produces = 44 g of CO_2

So, $\frac{12}{1000}$ kg of C produces = $\frac{44}{1000}$ kg of CO_2

$\therefore$ 1 kg of C produces = $\frac{44}{1000} \times \frac{1000}{12}$ kg of CO_2

$= \frac{11}{3}$ kg

Hence, $\frac{11}{3}$ kg of CO_2 produced on heating 1 kg of carbon.

278. **The compound $C_6H_{12}O_4$ contains**

(a) 22 atoms per mole
(b) twice the mass percent of H as compared to the mass percent of C
(c) six times the mass percent of C as compared to the mass percent of H
(d) thrice the mass percent of H as compared to the mass percent of O

NDA (II)-2017

Ans. (c) : Given, $C_6H_{12}O_4$
Molar mass of C in $C_6H_{12}O_4$= 6×12=72
Molar mass of H in $C_6H_{12}O_4$= 1×12=12
Therefore, mass percent of C is six times as compared to the mass percent of H.

279. **A 5.2 molal aqueous solution methyl alcohol, CH_3OH is supplied. What is the mole fraction of methyl alcohol in the solution?**

(a) 0.05 (b) 0.10
(c) 0.18 (d) 0.086

JCECE - 2017

Ans. (d) : Given,
n_1 (CH_3OH) = 5.2 mol

n_2 (H_2O) = $\frac{1000\text{g}}{18\text{g/mol}} = 55.56$ mol

$\therefore$ $n_1 + n_2 = 5.20 + 55.56$
= 60.76 mol

$\therefore$ X_{CH_3OH} = mole fraction of CH_3OH

$= \frac{n_1}{n_1 + n_2} = \frac{5.2}{60.76} = 0.086$

280. **The molality of 90% H_2SO_4 solution is [density = 1.8 g/mL]**

(a) 1.8 (b) 48.4
(c) 91.8 (d) 94.6

COMEDK-2017

Ans. (c) : Given,
[density = 1.8 g/mL]
Sstrength of H_2SO_4=90%
and mass of solvent =100 – 90=10 g
Now, Molality= Moles of solute dissolved in

1000 g of the solvent = $\frac{90 \times 1000}{98 \times 10} = 91.8$

281. **6g of a non-volatile, non-electrolyte X dissolved in 100 g of water freezes at –0.93ºC. The molar mass of X in g mol^{-1} is (K_f of H_2O = 1.86 K kg mol^{-1})**

(a) 60 (b) 140
(c) 180 (d) 120

AP-EAMCET – 2016

Ans. (d) : Given that–
K_f = 1.86 K kg mol^{-1}
W = 6 gm
$\Delta T_f = -0.93°C$
W' = 100 gm

$\therefore$ $\Delta T_f = \frac{K_f \times W \times 1000}{M \times W'}$

$0.93 = \frac{1.86 \times 6 \times 1000}{M \times 100}$

$M = \frac{1.86 \times 6 \times 10}{0.93}$

M = 120

282. **The number of moles of H_2O in one litre is**

(a) 50.5 (b) 55
(c) 55.05 (d) 55.55

SRMJEEE – 2015, 2010

Ans. (d) : A appropriate unit of measurement for water's density is gram per milliliter or 1 gram per cubic centimeter (1g/cm^3) i.e.
Density of water = 1 g/cc
and

Density of water = $\frac{\text{Mass of water}}{\text{Volume of water}}$

Or mass of water = 1 × 1000 = 1000 gm

$$\text{No. of moles} = \frac{\text{Mass of water}}{\text{Molecular weight}}$$

$$\text{No. of moles} = \frac{1000\text{ gm}}{18} = 55.5\text{ mol}$$

283. What weight of HCl is present in 155 mL of a 0.54 M solution?

(a) 3.06 g (b) 6.12 g
(c) 1.53 g (d) 0.30 g

AMU-2016

Ans. (a) : Given,
V_s (HCl) = 155 mL = 0.155 L
n(HCl) = V_s (HCl) × C(HCl) = 0.155L × 0.540M
= 0.0837 mol.
Molecular weight = 36.4 g/mol
m(HCl) = n(HCl) × M(HCl)
= 0.0837 mol × 36.5 g/mol
= 3.05505g ≈ 3.060 g

284. If 27 g of water is formed during complete combustion of pure propene (C_3H_6), the mass of propene burnt is

(a) 42 g (b) 21 g
(c) 14 g (d) 56 g
(e) 40 g

Kerala-CEE-2016

Ans. (b) : Given,
H_2O (formed) = 27g
Reaction,

$$\underset{\text{Propene}\,(3\times12+6=42)}{C_3H_6} + \frac{9}{2}O_2 \longrightarrow 3CO_2 + \underset{(3\times18=54)}{3H_2O}$$

The mass ratio between C_3H_6 and H_2O
= 42:54
∴ 54g of H_2O require = 42g C_3H_6
∴ 27g of H_2O require = $\frac{42\times27}{54}$
= 21g. C_3H_6

285. A silicon chip used in an integrated circuit of computer has a mass of 5.68 mg. The number of Si atoms present in this chip are :

(a) 144×10^{20} atoms (b) 18×10^{20} atoms
(c) 21×10^{20} atoms (d) None of these

Manipal-2016

Ans. (d) : Given,
Molar mass of Si = 28g = 28000 mg
So, 28000 mg of Si contain 6.022×10^{23} atoms
Then, 5.68 mg of silicon contain $\frac{6.022\times10^{23}}{28000}\times5.68$
$= 0.00122 \times 10^{23} = 1.22 \times 10^{20}$ atoms
The number of Si atoms present in this chip is
$= 1.22 \times 10^{20}$ atoms

286. Cost of sugar ($C_{12}H_{22}O_{11}$) is ₹ 50 per kg. Calculate its cost per mol.

(a) ₹ 17.1 per mol (b) ₹ 27.1 per mol
(c) ₹ 14.1 per mol (d) none of the above

Manipal-2016

Ans. (a) : Given, cost of sugar = ₹ 50 kg
Molar mass of sugar = 12 × 12 + 1 × 22 + 11 × 16
= 342g
[C = 12, H = 1, O = 16]
∵ Cost of 1000 g of sugar is Rs. 50
∴ Cost of 342g of sugar = $\frac{50}{1000}\times342$
= ₹. 17.1

287. A man writes his biodata with carbon pencil on the plane paper having mass 150 mg. After writing his biodata, he weighs the written paper and find its mass is 152 mg. What is the number of carbon atoms present in the paper?

(a) 1.0036×10^{20} (b) 5.02×10^{20}
(c) 1.0036×10^{23} (d) 0.502×10^{20}

Manipal-2016

Ans. (a) : We know,
Mass of C-atoms = 152–150 = 2mg
Molar mass of C-atoms = 12g = 12000mg
12000 mg of carbon contains = $\frac{6.022\times10^{23}}{12000}\times2$
$= 0.0010036\times10^{23}$
$= 1.0036\times10^{20}$ atoms.
Therefore, the number of carbon atoms present in 1.0036×10^{20} atoms.

288. The concentration of a solution can be expressed in molarity, normality, formality and molality. Among them, which mode of expression is the most accurate for the all conditions?

(a) Molarity (b) Formality
(c) Normality (d) Molality

Manipal-2016

Ans. (d) : Molality (m) = $\frac{\text{Moles of solute}}{\text{Mass of solvent in kg}}$
Molality is defined in terms of weight, hence independent of temperature. Remaining three concentration units are defined in terms of volume of solution, they depends on temperature.

289. When a liquid that is immiscible with water was steam distilled at. 95.2°C at a total pressure of 99.652 kPa. The distillate contained 1.27 g of the liquid per gram of water. What will be the molar mass of the liquid if the vapour pressure of water is 85.140 kPa at 95.2°C²

(a) 99.65 g mol^{-1} (b) 18 g mol^{-1}
(c) 134.1 g mol^{-1} (d) 105.74 g mol^{-1}

UPTU/UPSEE-2016

Ans. (c): Given,
$P_{total} = 99.652$ kP_a
$P_{water} = P_B = 85.140$ kP_a
$P_{liquid} = P_A = (99.652–85.140)$ kP_a
$= 14.512$ kP_a
and $\frac{m_A}{m_B} = \frac{1.27}{1} \Rightarrow \frac{m_A}{m_B} = \frac{p_A m_A}{p_B m_B}$

$$M_A = \left(\frac{m_A}{m_B}\right)\left(\frac{p_B m_B}{p_A}\right)$$

$$M_A = 1.27 \times \left(\frac{85.140\,kP_a \times 18\,g\,mol^{-1}}{14.512\,kP_a}\right)$$

$$M_A \simeq 134.1\,g\,mol^{-1}$$

290. Number of atoms of sulphur in 9.8 grams of H_2SO_4 are–

(a) 0.6023×10^{23} (b) 6.023×10^{23}
(c) 6×10^{23} (d) 6.023×10^{21}

BCECE-2016

Ans. (a) : No. of atom in 9.8 g of H_2SO_4

$H_2SO_4 = 2 + 32 + 16 \times 4$
$= 98$

No. of moles $= \frac{\text{Given mass}}{\text{Molecular mass}}$

$= \frac{9.8}{98}$

$= 0.1$ moles

So, No. of atoms = No. of moles × N_A
$= 0.1 \times 6.023 \times 10^{23}$
$= 0.6023 \times 10^{23}$

291. For 1 molar solution of NaCl in water at 25^0C and 1-atm pressure show that–

(a) molarity = mole fraction
(b) molality = mole fraction
(c) Normality = mole fraction
(d) molarity = normality

BCECE-2016

Ans. (d) : 1 Molar solution of NaCl will have molarity and Normality.

292. If 50 mL of 0.1 M HCl and 200 mL of 0.01 M HCl are mixed together. The molarity of mixture will be –

(a) 0.28 M (b) 2.8 M
(c) 0.028 M (d) 28..57 M

BCECE-2016

Ans. (c) : Given,
$M_1 = 0.1$, $M_2 = 0.001$
$V_1 = 50$, $V_2 = 200$

$$M_{(mixture)} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2}$$

$$\frac{(0.1\times50)+(0.01\times200)}{50+200}$$

$$\frac{5+2}{250} = \frac{7}{250}$$

Molarity of mixture = 0.028M.

293. Among the following gases of specified masses, which one has least number of molecules? (Atomic masses of H, C, O and S are respectively 1, 12, 16 and 32 g mol^{-1})

(a) 32 g of sulphur dioxide gas
(b) 8 g of oxygen gas
(c) 16 g of methane gas
(d) 4 g of hydrogen gas

J & K CET-(2016)

Ans. (b) : We know that,
32g of SO_2 gas:
Molar mass of SO_2 = 64 g
64 g $SO_2 \equiv 6.023 \times 10^{23}$ molecules
$\therefore$ 32 g of $SO_2 = 3.01 \times 10^{23}$ molecules
8 g of oxygen gas :
32 g of $O_2 \equiv 6.023 \times 10^{23}$ molecules

$\therefore$ 8 g of $O_2 \equiv \frac{6.023\times10^{23}}{32}\times8 = 1.5\times10^{23}$ molecules

16 g of $CH_4 \equiv 6.023 \times 10^{23}$ molecules
4g of H_2 gas:
2g $H_2 \equiv 6.023 \times 10^{23}$ molecules

4 g of $H_2 \equiv \frac{6.023\times10^{23}}{2}\times4$

$= 12.046 \times 10^{23}$ molecules

294. 20 volume of H_2O_2 means

(a) 20% H_2O_2 solution
(b) 20 mL of solution contain 1 g of H_2O_2
(c) 1 mL of solution liberate 20 mL of O_2 at STP
(d) 20 mL of solution contain 1 mol of H_2O_2

JCECE - 2016

Ans. (c) : By definition volume strength of H_2O, the amount of O_2 liberated by 1 mL of H_2O_2 at STP is the volume strength of H_2O_2.

295. If 1.4 g of $N_2(g)$ react with 1 g of $H_2(g)$ to form ammonia (NH_3), then amount of $NH_3(g)$ formed and number of atoms present in NH_3 respectively are (in moles)

(a) 0.5 and 0.1 (b) 0.1 and 0.1
(c) 0.1 and 0.5 (d) 0.5 and 0.5

JCECE - 2016

Ans. (b) : The relation used for formation of ammonia is
Given,

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

Relation by mass = 28 : 6 : 34
14 : 3 : 17

$N_2(g) = 1.4g \Rightarrow H_2(g) = 1g$

Thus, $N_2(g)$ behave as a limiting reagent and $NH_3(g)$ will formed as per amount of N_2 used.
Therefore,
14g of N_2 give NH_3 = 17 g

$\therefore$ 1.4 g of N_2 give $NH_3 = \frac{17\times1.4}{14}$

Amount of NH_3 (g) = 1.7 g

No. of moles of NH_3, $n = \frac{w}{M}$

$$n = \frac{1.7}{17} = 0.1 \text{ mol.}$$

Also
No. of moles of $NH_3 \equiv$ No. of atoms of N in NH_3
$\therefore$ If no. of moles of NH_3 = 0.1
Then, no. of moles of N-atoms in NH_3 = 0.1 mol
Hence,
No. of moles of NH_3 = 0.1 mol
No. of moles of N-atoms = 0.1 mol

296. **Solid $NaHCO_3$ will be neutralized by 40.0mL of 0.1M H_2SO_4 solution. What would be the weight of solid $NaHCO_3$ in gram?**
(a) 0.672g (b) 6.07g
(c) 17g (d) 20g
JIPMER-2016

Ans. (a) :
$$\underset{\substack{2\text{mole}\\=168g}}{2NaHCO_3} + \underset{\substack{1\text{mole}\\=98g}}{H_2SO_4} \longrightarrow Na_2SO_4 + 2H_2O + 2CO_2$$
Mole ratio
m- moles of H_2SO_4 = M × V_{mL} = 40.0×0.01
= 4 m – mole
Moles of H_2SO_4 = M × VmL = 40.0×0.1 = 4m mol
Also, it can written as m-moles of $NaHCO_3$ when neutralised = 4×2 = 8m-moles.
But m-mole $=\frac{w}{m}\times1000$
$$8=\frac{w}{84}\times1000 \Rightarrow w=\frac{84\times8}{1000} \Rightarrow w=0.672\,g.$$

297. **Which one of the following has different number of molecules? (All are kept at normal temperature and pressure)**
(a) 3 gram of Hydrogen (b) 48 gram of Oxygen
(c) 42 gram of Nitrogen (d) 2 gram of Carbon
NDA (II)-2016

Ans. (d) : We know that,
1 mole= 6.022×10^{23} atom
1g of hydrogen= 6.022×10^{23} atoms
3g of hydrogen= $3\times6.022\times10^{23}$ atoms
$\frac{3}{2}\times6.022\times10^{23}$ molecule (∴ hydrogen is diatomic)
Now , 16g of oxygen = 6.022×10^{23} atoms
48g of oxygen= $\frac{3}{2}\times6.022\times10^{23}$ atoms
(∴ Oxygen is diatomic)
Again, 12g of carbon= 6.022×10^{23} atoms
2g of carbon= $\frac{1}{6}\times6.022\times10^{23}$ molecule
(∴ carbon is monoatomic molecule)
Hence, 2g of C contain different number of molecules.

298. **The number of oxygen atoms in 4.4g of CO_2 is**
(a) 1.2×10^{23} (b) 6×10^{22}
(c) 6×10^{23} (d) 12×10^{23}
Karnataka-CET-2016

Ans. (a) : Given that,
Moles of CO_2 = $\frac{4.4}{44}$ = 0.1moles
∴ Number of molecules of CO_2 = 0.1 × 6.022 × 10^{23}
= 6.022 × 10^{22} molecules
1 molecule of CO_2 contains 2 oxygen atoms.
∴Number of oxygen atoms = 2 × 6.022 × 10^{22}
= 12.044 × 10^{22} atoms
= 1.2 × 10^{23} atoms

299. **One mole of $N_2O_{4(g)}$ at 300 K is kept in a closed vessel at 1 atm pressure. It is heated to 600 K when 20% by mass of $N_2O_{4(g)}$ decomposes to $NO_{2(g)}$. The resultant pressure is**
(a) 1.2 atm (b) 2.4 atm
(c) 2.0 atm (d) 1.0 atm
AMU-2015

Ans. (b) : $N_2O_4 \rightarrow 2NO_2$
Moles of un reacted N_2O_4 = 1(1 – 0.2) = 0.8
Moles of NO_2 = 2 × 0.2 = 0.4
Total moles (n_2) = 0.8 + 0.4 = 1.2
$P_1/(T_1n_1) = P_2/T_2 \times n_2$
$$\frac{1}{300\times1}=\frac{P_2}{600\times1.2}.$$
P_2 = 2.4 atm

300. **When 4A of current is passed through a 1.0 L, 0.10 M Fe^{3+} (aq) solution for 1 hour, it is partly reduced to Fe(s) and partly of Fe^{2+}(aq), Identify the incorrect statement.**
(a) 0.10 mole of electrons are required to convert all Fe^{3+} to Fe^{2+}
(b) 0.025 mol of Fe(s) will be deposited
(c) 0.05 mol of iron remains as Fe^{2+}
(d) 0.050 mol of iron remains as Fe^{2+}
BCECE-2015

Ans. (d) : Given,
4 a, 1 hours, 1.0L, 0.l0mF_e^{+3}
Number of $F=\frac{It}{96500}=\frac{4\times3600}{96500}=0.15F$
Initially mole Fe^{+3} =b 1 × 0.10 = 0.1 mole
$e^- + F3^{+3} \longrightarrow F^{+3}$
1F = 1 Mole $F3^{+3}$ deposited
0.15 F = 0.15 mole $F3^{+3}$ deposited > Initially mole
0.1 mole Fe^{+3} = 0.1 F electricity = 0.1 mole Fe^{+2}
Fe^{+2} 0.1 mole
0.05 F ⇒ $Fe^{+2} + 2e^- \longrightarrow Fe$
2F = 1 mole Fe^{+2}
$0.05=\frac{1}{2}\times0.05$ mole Fe^{+2} 0.025 mole Fe^{+2}
Fe mole = 0.025 mole
$Fe^{+2} \rightarrow$ 0.1 – 0.025 = 0.05 mole
Hence the in correct option (d)

301. **The number of Na atoms in 46g of Na (atomic weight of Na = 23) is**
(a) 6.023 × 10^{23} (b) 2
(c) 1 (d) 12.046 × 10^{23}
J & K CET-(2015)

Ans. (d) : Given,
Molar mass of Na = 23 g, Given mass = 46 g
No. of atoms = $\frac{\text{Given mass}\times N_A}{\text{Molar mass}}$
$=\frac{46\times6.022\times10^{23}}{23}$
$=2\times6.022\times10^{23}$
= 12.044 × 10^{23} atoms
∴ 46 g of Na contains 12.044 × 10^{23} atoms

302. **In order to prepare one liter 1N solution of $KMnO_4$, how many grams of $KMnO_4$ are required, if the solution to be used in acid medium for oxidation?**