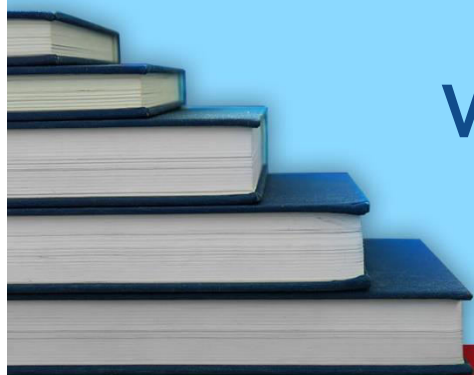


CHEMISTRY



WORKSHEET-11



STP

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Worksheet-11**(A. Physical Chemistry)****Fundamental Concepts**

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SCRATCH WORK

- Q.1** Avogadro's number represents the number of:
- A) Atoms in 1g of helium gas
 - B) Atoms in 24g of Mg
 - C) Molecules in 35.5g of chlorine gas
 - D) Electrons needed to deposit 24g Mg
- Q.2** Which one of the following terms is not used for ionic compounds?
- A) Formula unit
 - B) Empirical formula
 - C) Molecular formula
 - D) Formula mass
- Q.3** 98g H₂SO₄ contains number of moles of ions:
- A) 4.0 moles of ions
 - B) 1 mole of ions
 - C) 2 moles of ions
 - D) 3.0 moles of ions
- Q.4** Cationic molecular ions are produced by:
- A) Radio waves
 - B) α -rays
 - C) Beam of electrons
 - D) Both B and C
- Q.5** Isotopes differ in:
- A) Properties which depend upon mass
 - B) Arrangement of electrons in orbitals
 - C) Chemical properties
 - D) The extent to which they may be affected by electromagnetic field
- Q.6** Which one of the following mathematical relationships is correct for (m/e) in connection with Dempster's mass spectrometer?
- A) $\frac{m}{e} = \frac{H^2 r^2}{2E}$
 - B) $\frac{H^2 r^2}{E^2}$
 - C) $\frac{m}{e} = \frac{H^2 r}{E}$
 - D) $\frac{H^2 r}{2E}$
- Q.7** Symbol indicates not only the name of elements but also represents all of the following EXCEPT:
- A) One atom of an element
 - B) Number of parts by mass of an element
 - C) 1 gram atom of an element
 - D) 1 amu

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- Q.8 Which of the following is not mono-isotopic element?**
A) F C) Au
B) Cl D) As
- Q.9 Which of the following statements is incorrect?**
A) Formation of uni-negative ion is exothermic
B) Number of positive ions having group of atoms is less than number of negative ions having group of atoms
C) X – rays and beam of electrons are used to produce positive ions of Ne
D) Number of cationic molecular ions is less than number of anionic molecular ions
- Q.10 What volume of oxygen gas is required for the complete combustion of 5cm³ of ethyne (C₂H₂)?**
A) 12.5cm³ C) 13.5cm³
B) 13.0cm³ D) 14.0cm³
- Q.11 The relative atomic mass of boron, which consists of isotopes ¹⁰₅B and ¹¹₅B is 10.8amu. What is the percentage of ¹⁰₅B atoms in the isotopic mixture?**
A) 0.8% C) 8.0%
B) 20% D) 80%
- Q.12 How many carbon atoms are present in 34.2g of sucrose (C₁₂H₂₂O₁₁) M_r = 342)?**
A) 6.0 × 10²² C) 7.2 × 10²³
B) 3.6 × 10²⁵ D) 3.6 × 10²⁴
- Q.13 What is the number of molecules in 1000cm³ of nitrogen gas under room conditions?**
A) 2.5 × 10²² C) 4.0 × 10²³
B) 3.5 × 10²² D) 4.5 × 10²⁶
- Q.14 Which is the correct sequence of stages in mass spectrometer?**
A) Ionization, amplification, recording, detection, separation
B) Ionization, amplification, detection, separation, recording
C) Recording, detection, amplification, separation, ionization
D) Ionization, separation, detection, amplification, recording
- Q.15 How many total number of atoms are present in 49.0g of sulphuric acid (H₂SO₄)?**
A) 7 × 3 × 10²³ C) 5 × 6 × 10²³
B) 7 × 8 × 10²³ D) 6 × 6 × 10²³

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Q.16 An organic compound has empirical formula CH_2O . If molar mass of the compound is 90 grams, then molecular formula of this organic compound would be

(Ar of C = 12, H = 1.008 and O = 16):

- A) $\text{C}_6\text{H}_6\text{O}_2$ C) $\text{C}_9\text{H}_9\text{O}_3$
B) $\text{C}_3\text{H}_3\text{O}$ D) $\text{C}_3\text{H}_6\text{O}_3$

Q.17 How many bromine (Br) atoms are in 3 moles of bromine (Br) element?

- A) $3 \times 6.022 \times 10^{23}$ atoms C) $81 \times 3 \times 10^{23}$ atoms
B) $79 \times 3 \times 6 \times 10^{23}$ atoms D) $3 \times 6.022 \times 10^{23}$ atoms

Q.18 Carbon dioxide (CO_2) gas produced during combustion analysis of given organic compound is absorbed in 50% of KOH solution. It is a:

- A) Chemical change only
B) Physical change only
C) May be physical or chemical change
D) Neither physical nor chemical change

Q.19 In the experimental determination of the percentage of carbon and hydrogen in an organic compound, water is absorbed by:

- A) KOH C) K_2SO_4
B) MgCl_2 D) $\text{Mg}(\text{ClO}_4)_2$

Q.20 12g of magnesium (Mg) reacts with dilute sulphuric acid (H_2SO_4) to produce hydrogen (H_2) gas. The amount of hydrogen (H_2) gas produced is:

- A) 4g C) 2g
B) 3g D) 1g

Q.21 5.6g of potassium hydroxide (KOH) has been dissolved in 100cm^3 of aqueous solution, molarity of the solution is:

- A) 1.0M C) 1.5M
B) 2.0M D) 2.5M

Q.22 Which of the following units of concentration of solution change with the increase of temperature?

- I. Molality III. Molarity
II. Mole Fraction IV. %age composition (v/v)
- A) I, II C) III, IV
B) I, II, III D) II, III

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Q.23 Mark the incorrect statement about mole fraction:

- A) It is used for three components of a solution
- B) It is independent of temperature
- C) Its value is always less than 1
- D) Sum of mole fractions is ≥ 1

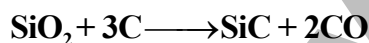
Q.24 Which of the following is unit of molarity?

- A) mol dm^{-3}
- B) gram equivalent L^{-1}
- C) mol kg^{-1}
- D) g cm^{-3}

Q.25 What is the percentage by (v/v) of ethanol, if 5.0cm^3 of ethanol is dissolved in 45.0cm^3 of water?

- A) 10%
- B) 8%
- C) 6%
- D) 4%

Q.26 Silicon carbide (SiC) is an important ceramic material. It is produced by allowing silica (SiO_2) to react with carbon at high temperature as shown in the reaction:



When 0.3kg sand is reacted with excess of carbon, 0.1kg of silicon carbide (SiC) is produced. What is the percentage yield of silicon carbide (SiC)?

- A) 35%
- B) 40%
- C) 50%
- D) 45%

Q.27 All of the following terms are correctly matched with the given data EXCEPT:

Options	Terms	For which it is used	Example
A)	Relative atomic mass (A_r)	Element	$\text{H}=1.008\text{amu}$
B)	Relative isotopic mass	Isotopes or elements	${}^{12}_6\text{C}$, ${}^{13}_6\text{C}$, ${}^{15}_6\text{C}$
C)	Relative molecular mass (M_r)	Covalent compounds	$\text{H}_2\text{O}=18.0\text{amu}$
D)	Relative formula mass	Ionic compound	$\text{KCl}=74.5\text{amu}$

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Q.33 Ascorbic acid (vitamin C) contains 48% carbon, 4% hydrogen and 48% oxygen. Which of the following is empirical formula of ascorbic acid?

- A) $C_2H_4O_3$ C) $C_2H_2O_3$
B) CH_2O D) $C_4H_4O_3$

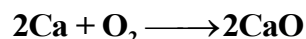
Q.34 The number of moles of sodium hydroxide present in $2.5dm^3$ of 0.5M aqueous solution is:

- A) 1.25 C) 0.5
B) 12.5 D) 5.0

Q.35 Molarity of pure water is:

- A) 5.55 C) 55.5
B) 55.0 D) 55.1

Q.36 Calcium reacts with excess oxygen to form calcium oxide (CaO) as shown in the equation:



The maximum mass of CaO formed when 4.0g of calcium is burnt in excess oxygen is (Ar values Ca = 40amu, O = 16amu):

- A) 3.6g C) 2.6g
B) 5.6g D) 4.6g

Q.37 If we know the mass of one substance, we can calculate the volume of other substance and vice versa with the help of a balanced chemical equation, which is called:

- A) Mass-mass relationship
B) Mass-volume relationship
C) Mole-volume relationship
D) Mass-mole relationship

Q.38 By using the value of Avogadro's number ($N_A = 6.0 \times 10^{23}$)mol⁻¹, calculate the total number of atoms in 7.1g of Cl-element (Ar value Cl = 35.5):

- A) 1.2×10^{23} Cl-atoms C) 1.0×10^{23} Cl-atoms
B) 1.6×10^{23} Cl-atoms D) 1.5×10^{23} Cl-atoms

Q.39 Which one of the followings has same number of molecules as present in 11g of CO₂?

- A) 4g of O₂ C) 4g of O
B) 4.5g of H₂O D) $\frac{1}{4}$ moles of NaCl

Q.40 28g of N₂ gas at STP will occupy the volume of:

- A) 22.41dm³ C) 44.82cm³
B) 44.82dm³ D) 2.241dm³

ANSWER KEY (Worksheet-11)

1	B	11	B	21	A	31	A
2	C	12	C	22	C	32	A
3	D	13	A	23	D	33	D
4	D	14	D	24	A	34	A
5	A	15	A	25	A	35	C
6	A	16	D	26	C	36	B
7	D	17	D	27	B	37	B
8	B	18	A	28	D	38	A
9	D	19	D	29	C	39	B
10	A	20	D	30	C	40	A

ANSWERS EXPLAINED

Q.1 (B) The number of particles present in one mole of a substance is called **Avogadro's number**.

($N_A = 6.022 \times 10^{23}$) Statement (B) fulfills the condition of N_A such as. 24g of Mg = 1 mole

Molar mass of Mg = 24g

= 6.022×10^{23} Mg atoms

Q.2 (C) The term **molecular formula cannot** be used for ionic compounds because molecular formula term is used for covalent compounds. In fact, molecule is an aggregation of atoms whereas **ionic compounds involve ions not atoms**.

Q.3 (D) Given amount of $H_2SO_4 = 98g$

Number of moles of $H_2SO_4 = \frac{98}{98}$

= 1mole

H_2SO_4 on dissociation splits up into ions such as



1mole 2mole 1mole

= 2 + 1 = 3moles of ions

Conclusion: From the equation it is clear that 1mole of H_2SO_4 produces 3 moles of ions.

Q.4 (D) Cationic molecular ions can be generated by passing high energy

beam of electrons, α -particles or X-rays through a gas.

Q.5 (A) All the isotopes of an element have same number of protons and electrons but they have different mass number. e.g. Cl element has two isotopes $^{35}_{17}Cl, ^{37}_{17}Cl$

Q.6 (A) Where H stands for magnetic field, r stands for radius of circular path, E stands for strength of electric field

- If E is increased by keeping H constant then r will increase

$$\therefore E \propto r \dots i$$

and positive ion of a particular m/e will fall at a different place as compared to the first place.

- If H is increased by keeping E constant, the r will decrease

$$\therefore H \propto \frac{1}{r} \dots ii$$

$$\text{Overall equation } \frac{m}{e} = \frac{H^2 r^2}{2E} \dots iii$$

Q.7 (D) Symbol does not represent amu.

$$1\text{amu} = \frac{1}{6.026 \times 10^{23}} g = 1.661 \times 10^{-24} g$$

$$\therefore 1\text{amu} = 1.661 \times 10^{-24} g$$

$$= 1.661 \times 10^{-27} kg$$

$$= 1.661 \times 10^{-21} mg$$

Q.8 (B)

Opt.	Elements	No. of isotopes
A)	F	Mono-isotopic
B)	Cl	Di-isotopic
C)	Au	Mono-isotopic
D)	As	Mono-isotopic

Q.9 (D) Because **cationic molecular** ions are comparatively **more stable** than **anionic molecular ions**.

Q.10 (A) $2\text{C}_2\text{H}_2 + 5\text{O}_2 \longrightarrow 4\text{CO}_2 + 2\text{H}_2\text{O} \dots$

Volume ratio b/w C_2H_2 and $\text{O}_2 = 2:5$

2cm^3 of C_2H_2 requires $\text{O}_2 = 5\text{cm}^3$

$1\text{cm}^3 \dots \dots \dots = \frac{5}{2}$

$5\text{cm}^3 \dots \dots \dots = \frac{5}{2} \times 5 = 12.5\text{cm}^3$

Total volume of oxygen gas required for complete combustion of ethyne = 12.5cm^3

Q.11 (B) $B = 10.8$ amu (relative atomic mass of boron)

$$\begin{array}{l}
 \begin{array}{cc}
 {}^{11}\text{B} & {}^{10}\text{B} \\
 x & 100 - x
 \end{array} \\
 \\
 \frac{11(x) + 10(100 - x)}{100} & = 10.8 \\
 11x + 1000 - 10x & = 10.8 \times 100 \\
 x + 1000 & = 1080 \\
 x = 1080 - 1000 & = x = 80\% \\
 \therefore \text{ \%age of } {}^{10}\text{B} & = 100 - 80 = 20\%
 \end{array}$$

Q.12 (C) Number of C-atoms in sucrose

$$= \frac{34.2}{342} \times 6 \times 10^{23} \times 12$$

$$= 7.2 \times 10^{23}$$

Q.13 (A) Given data

Volume of nitrogen gas at

$$\text{RTP} = 1000\text{cm}^3$$

Number of nitrogen molecules (N_2)

$$= \frac{1000}{24000} \times 6 \times 10^{23}$$

$$= 2.5 \times 10^{22}$$

Q.14 (D) Sequence of stages in mass spectrometer are as:

Ionization, separation, detection, amplification, recording

Q.15 (A) Total numbers of atoms in H_2SO_4

$$= \frac{49}{98} \times 6 \times 10^{23} \times 7$$

$$= 7 \times 3 \times 10^{23}$$

Q.16 (D) Given data:

Empirical formula mass of organic compound ($\text{CH}_2\text{O} = 30\text{g}$)

Molecular mass of organic compound = 90g

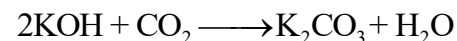
Molecular formula of organic compound = **n (Empirical formula)**

$$n = \frac{\text{molecular mass}}{\text{empirical formula mass}} = \frac{90}{30} = 3$$

Molecular formula = $3(\text{CH}_2\text{O}) = \text{C}_3\text{H}_6\text{O}_3$

Q.17 (D) Number of Br-atoms = $3 \times 6.022 \times 10^{23}$

Q.18 (A) When CO_2 is absorbed in pre-weighed **50% KOH solution**, reaction, take place as shown below:



From this reaction, it is clear that the absorption of CO_2 in KOH solution is a **chemical change**.

Q.19 (D) $\text{Mg}(\text{ClO}_4)_2$ acts as **drying agent** and absorbs water. Conc. H_2SO_4 and CaO also act as **drying agent**.

Q.20 (D) $\text{Mg} + \text{H}_2\text{SO}_4 \longrightarrow \text{MgSO}_4 + \text{H}_2$

$\text{Mg} : \text{H}_2$

1 : 1

0.5 : 0.5mole

- Number of moles of $\text{Mg} = \frac{12}{24} = 0.5$
- Amount of H_2 gas = Number of moles of H_2 x molar mass of hydrogen gas
= $0.5 \times 2 = 1.0\text{g}$
- **Amount of $\text{H}_2 = 1.0\text{g}$**

Q.21 (A) $M = \frac{W_2 \times 1000}{M_2 \times \text{Volume of Solution (cm}^3\text{)}}$

$$M = \frac{5.6 \times 1000}{56 \times 100} = 1.0\text{M}$$

Q.22 (C) In fact, both **molarity** and **percentage composition (v/v)** involve **volume of solution**. Since volume changes with the **increase of temperature** ($V \propto T$). Both **molarity** and **percentage composition (v/v)** change with the **increase in temperature**.

Q.23 (D) In fact, sum of mole fractions = 1

$$\text{i.e. } x_1 + x_2 + x_3 = 1$$

In general all the solutions which have concentration in terms of volume are temperature depended and all the solutions which have concentration in terms of mass are temperature independent.

Q.24 (A) Mathematically molarity of solution

$$= \frac{\text{Number of moles of solute}}{\text{Volume of solution in dm}^3}$$

$$= \text{mol dm}^{-3}$$

Q.25 (A) Volume of ethanol : 5.0cm^3

Volume of water = 45.0cm^3

Volume of solution = $5 + 45 = 50.0\text{cm}^3$

%age of ethanol by volume

$$= \frac{5}{50} \times 100 = 10\% \text{ (v/v)}$$

Q.26 (C) $\text{SiO}_2 + 3\text{C} \longrightarrow \text{SiC} + 2\text{CO}$

Mass of sand (SiO_2) is treated with

$\text{C} = 0.3\text{kg} = 300\text{g}$

Mass of Silicon carbide produced (actual yield)

$$= 0.1\text{kg} = 100\text{g} \dots \text{i}$$

Molar mass of sand (SiO_2) = $28 + 32$

$$= 60.0\text{gmol}^{-1}$$

Molar mass of silicon carbide = $28 + 12$

$$= 40\text{gmol}^{-1}$$

$$\text{Theoretical Yield} = \frac{40}{60} \times 300 = 200\text{g} \dots$$

ii

$$\text{Percentage Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

$$= \frac{100}{200} \times 100 = 50\% \dots \text{iii}$$

\therefore **Percentage Yield of silicon carbide (SiC) = 50%**

Q.27 (B)

- **Relative isotopic mass term is used only for isotopes**
- **Moreover, carbon element has three isotopes ${}^{12}_6\text{C}$, ${}^{13}_6\text{C}$, ${}^{14}_6\text{C}$ but not ${}^{15}_{16}\text{C}$**

Q.28 (D) In fact, the term mass number is used for isotopes of an element. Mass number is sum of protons and

neutrons but it is not sum of protons and electrons.

Q.29 (C) In fact, **both** experimental error and human error **affect actual yield**.

Q.30 (C) Given data A = 3 mole, B = 6 mole,
C = 1 mole

Mole fraction (x) of component A = ?

Percentage of mole fraction of component A = $\frac{3}{10} \times 100 = 30\%$

Q.31 (A) Since all the isotopes of an element **have same proton number**, therefore, they have **same electronic configuration**. So isotopes of an element have same chemical properties but have **different** physical properties because they have different **mass numbers**.

Q.32 (A) Given data

C%	:	H%	:	O%
60	:	8.0	:	32
$\frac{60}{12}$:	$\frac{8.0}{1}$:	$\frac{32}{16}$
5	:	8	:	2
2.5	:	4	:	1
2(2.5)	:	4	:	1
Empirical formula				= C ₅ H ₈ O ₂
Empirical formula mass				= 100
Molecular formula				= n(empirical formula)

$$n = \frac{200}{100} = 2$$

\therefore **Molecular formula = C₁₀H₁₆O₄**

Q.33 (D)

C%	:	H%	:	O%
48	:	4	:	48
$\frac{48}{12}$:	$\frac{4}{1}$:	$\frac{48}{16}$
$\frac{4}{3}$:	$\frac{4}{3}$:	$\frac{3}{3}$
3(1.33)	:	1.33	:	1
4	:	4	:	3

Empirical Formula of ascorbic acid



Q.34 (A) Number of moles of NaOH.

$$2.5 \times 0.5 = 1.25 \text{ moles.}$$

Q.35 (C) Molality of pure water

$$= \frac{\text{number of moles of solute}}{\text{volume of solution in dm}^3}$$

$$= \frac{1000/18}{1} = 55.5 \text{ mol dm}^{-3}.$$

$$\therefore \text{molarity of pure water} = 55.5 \text{ mol dm}^{-3}$$

Q.36 (B) From the balanced equation



Molar ratio 2 : 2

0.1 : 0.1

Molar mass of CaO = 56amu

Mass of CaO formed = 0.1 x 56 = 5.6g

Q.37 (B) If we know the mass of one substance, we can calculate the volume of other substance with the help of balanced chemical equation and this relationship is called **mass – volume relationship**.

Q.38 (A) Number of chlorine atoms

$$= \frac{7.1}{35.5} \times 6 \times 10^{23}$$

$$= 1.2 \times 10^{23}$$

Q.39 (B)

	CO ₂	:	H ₂ O
Molar mass	44g	:	18g
According to Condition	11g	:	?
Amount of water			= 4.5g

∴ 4.5g of water has same number of water molecule as present in 11g of CO₂

Q.40 (A) 1mole of N₂ gas = 28g
= 22.41dm³ at STP

STEP ENTRY TEST 2020

STOP

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