CHEMISTRY

WORKSHEET-11

STEP

A PROJECT BY PUNJAB GROUP

Worksheet-11

(A. Physical Chemistry)

Fundamental Concepts

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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 C) Molecular formula

B) Empirical formula D) Formula mass

Q.3 98g H_2SO_4 contains number of moles of ions:

A) 4.0 moles of ions C) 2 moles of ions

B) 1 mole of ions D) 3.0 moles of ions

Q.4 Cationic molecular ions are produced by:

A) Radio waves C) Beam of electrons

B) α-rays 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) $\frac{m}{e} = \frac{H^2r^2}{2E}$ C) $\frac{m}{e} = \frac{H^2r}{E}$

B) $\frac{H^2r^2}{E^2}$ D) $\frac{H^2r}{2E}$

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 $5cm^3$ of ethyne (C_2H_2)?

A) $12.5cm^3$ C) $13.5cm^3$

B) $13.0cm^3$ D) $14.0cm^3$

Q.11 The relative atomic mass of boron, which consists of isotopes $^{10}_{5}B$ and $^{11}_{5}B$ is 10.8amu. What is the percentage of $^{10}_{5}B$ 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 ($C_{12}H_{22}O_{11}$) $M_r = 342$)?

A) 6.0×10^{22} C) 7.2×10^{23}

B) 3.6×10^{25} D) 3.6×10^{24}

Q.13 What is the number of molecules in $1000cm^3$ of nitrogen gas under room conditions?

A) 2.5×10^{22} C) 4.0×10^{23}

B) 3.5×10^{22} D) 4.5×10^{26}

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 (H_2SO_4)?

A) $7 \times 3 \times 10^{23}$ C) $5 \times 6 \times 10^{23}$

B) $7 \times 8 \times 10^{23}$ D) $6 \times 6 \times 10^{23}$

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

A) $C_6H_6O_2$ C) $C_9H_9O_3$

B) C_3H_3O D) $C_3H_6O_3$

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 x 3 x 10^{23} atoms

B) 79 x 3 x 6 x 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) $Mg(ClO_4)_2$

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) $moldm^{-3}$ C) $molkg^{-1}$

B) gram equivalent L^{-1} D) gcm^{-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% C) 6%

B) 8% 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:**

$$SiO_2 + 3C \longrightarrow SiC + 2CO$$

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% C) 50%

B) 40% 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	H=1.008amu
B)	Relative isotopic mass	Isotopes or elements	$^{12}_{6}C$, $^{13}_{6}C$, $^{15}_{6}C$
C)	Relative molecular mass (M_r)	Covalent compounds	H_2O=18.0amu
D)	Relative formula mass	Ionic compound	KCl=74.5amu

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Q.28 All of the following terms are correctly matched w.r.t their definition EXCEPT:

Options	Term	Definition
A)	Relative atomic mass	It is the mass of one atom of an element as compared to the mass of an atom of carbon taken as 12
B)	Relative formula mass	It is sum of relative atomic mass of atoms of one formula unit of an ionic compound
C)	Relative molecular mass	It is the sum of relative atomic mass of atoms of one molecule of a covalent compound
D)	Mass number	It is sum of proton and neutrino

Q.29 Identify the incorrect statement about yield:

A) Actual yield is less than theoretical yield

B) Percentage yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

C) Experimental error does not affect actual yield

D) Efficiency of a chemical reaction depends on the amount of product

Q.30 A solution contains three components A, B and C in the molar ratio 3 : 6 : 1. The percentage of mole fraction of component A is:

A) 20% C) 30%

B) 25% D) 35%

Q.31 Isotopes of an element have all of the following different properties EXCEPT

A) They have different chemical properties

B) They have difference mass number

C) They have different number of neutrons

D) They have different half life

Q.32 The combustion analysis of an organic compound shows 60% carbon, 8% hydrogen and 32% oxygen. If the molecular mass of the given organic compound is 200, then the molecular formula of the organic compound is (Ar of C = 12 amu, H = 1 amu and O = 16 amu):

A) $C_{10}H_{16}O_4$ C) $C_{10}H_{14}O_4$

B) $C_8H_{16}O_4$ D) $C_5H_8O_2$

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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:

$$2Ca + O_2 \longrightarrow 2CaO$$

The maximum mass of CaO formed when 4.0g of calcium is burnt in excess oxygen is (A_r 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 x 10^{23})mol^{-1}, calculate the total number of atoms in 7.1g of Cl-element (A_r value Cl = 35.5):

A) 1.2 x 10^{23} Cl-atoms C) 1.0 x 10^{23} Cl-atoms

B) 1.6 x 10^{23} Cl-atoms D) 1.5 x 10^{23} Cl-atoms

Q.39 Which one of the followings has same number of molecules as present in 11g of CO_2?

A) 4g of O_2 C) 4g of O

B) 4.5g of H_2O D) ¼ moles of NaCl

Q.40 28g of N_2 gas at STP will occupy the volume of:

A) 22.41dm^3 C) 44.82cm^3

B) 44.82dm^3 D) 2.241dm^3

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

Molar mass of Mg = 24g

= **6.022 x 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

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

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**

$$\therefore \mathbf{E \propto r \ldots i}$$

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**

$$\therefore \mathbf{H \propto \frac{1}{r} \ldots ii}$$

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

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

$$\mathbf{1amu} = \frac{1}{6.026\times10^{23}}g = 1.661\times10^{-24}g$$

$\therefore$ **1amu = 1.661 x 10^{-24}g**

= 1.661 x 10^{-27}kg

= 1.661 x 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) $2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$ ...

Volume ratio b/w C_2H_2 and O_2 = **2:5**

2cm³ of C_2H_2 requires O_2 **= 5cm³**

1cm³.....$= \frac{5}{2}$

5cm³..... $= \frac{5}{2} \times 5 = 12.5$ **cm³**

Total volume of oxygen gas required for complete combustion of ethyne = 12.5cm³

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

^{11}B ^{10}B

x $100 - x$

$$\frac{11(x) + 10(100 - x)}{100} = 10.8$$

$$11x + 1000 - 10x = 10.8 \times 100$$

$$x + 1000 = 1080$$

$$x = 1080 - 1000 = x = 80\%$$

$\therefore$ %age of $^{10}B = 100 - 80 = 20\%$

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

RTP = $1000cm^3$

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 **(CH_2O = 30g)**

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 = $3(CH_2O) = C_3H_6O_3$

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

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

$$2KOH + CO_2 \longrightarrow K_2CO_3 + H_2O$$

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

Q.19 (D) **$Mg(ClO_4)_2$** acts as **drying agent** and absorbs water**.** Conc. **H_2SO_4** and **CaO** also act as **drying agent.**

Q.20 (D) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$

Mg : H_2

1 : 1

0.5 : 0.5mole

- Number of moles of 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 x 2 = 1.0g**
- **Amount of H_2 = 1.0g**

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

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

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**

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 = **50.0cm^3**

%age of ethanol by volume

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

Q.26 (C) **$SiO_2 + 3C \longrightarrow SiC + 2CO$**

Mass of sand (SiO_2) is treated with

C = 0.3kg = 300g

Mass of Silicon carbide produced (actual yield)

= 0.1kg = 100g … i

Molar mass of sand (SiO_2) = 28 + 32

= 60.0gmol^{-1}

Molar mass of silicon carbide = 28 + 12

= 40gmol^{-1}

Theoretical Yield = $\frac{40}{60} \times 300 = 200g \ldots$ ii

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

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

∴ **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 $^{12}_{6}C$, $^{13}_{6}C$, $^{14}_{16}C$ but not $^{15}_{16}C$**

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 = $C_5H_8O_2$

Empirical formula mass = 100

Molecular formula = n(empirical formula)

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

∴ Molecular formula = $C_{10}H_{16}O_4$

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 = $C_4H_4O_3$

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

2.5 x 0.5 = 1.25moles.

Q.35 (C) Molality of pure water

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

$$= \frac{1000/18}{1} = \mathbf{55.5 moldm^{-3}}.$$

∴ molarity of pure water = 55.5moldm^{-3}

Q.36 (B) From the balanced equation

	Ca	:	CaO
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_2O
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 CO_2**

Q.40 (A) 1mole of N_2 gas = 28g

= 22.41dm^3 at STP

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