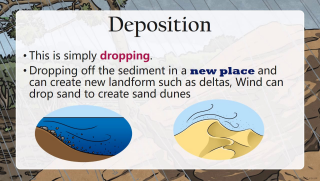
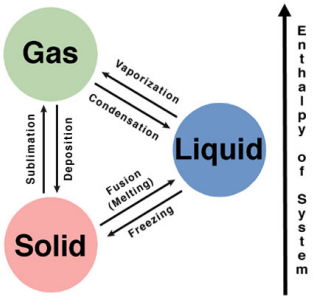


THE INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY – HCM

CHEMISTRY FOR ENGINEERS



ASSIGNMENT 3

Date : **18/1/2023**

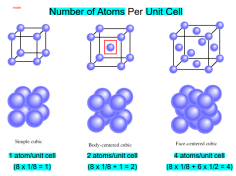
Duration : **29/1/2023**

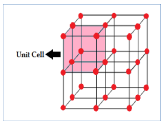
Solid --> Melting, Sublimation
Gas --> Condensation, Deposition
Liquid --> Freezing, Vaporization

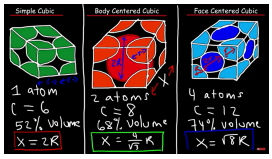
MULTIPLE CHOICE QUESTIONS (10pts)

1. Some solids can be converted directly to the vapor phase by heating. The process is called:
   a) fusion tan chảy melting SOLID --> LIQUID
   b) sublimation thăng hoa SOLID --> GAS
   c) vaporization bay hơi LIQUID --> GAS
   d) condensation ngưng tụ GAS --> LIQUID

2. In a body-centered cubic lattice, how many atoms are present per in a unit cell?
   a) one
   b) two
   c) three
   d) four



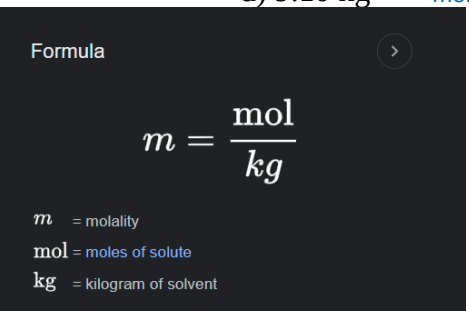




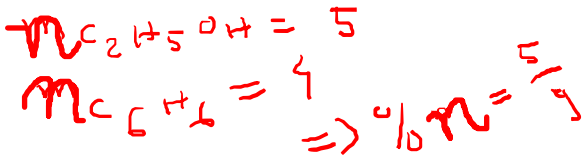
3. Which of the following descriptions of solid type is **INCORRECT**?
   a) Cu ; metallic metal
   b) $CaCl_2$; ionic + -
   c) H_2O ; molecular - -
   d) All of them are correct.

4. What the closet mass of water must be used to dissolve 20.0 grams of ethanol, C_2H_5OH, to prepare a 0.0500 molality solution of ethanol?
   a) 20.1 kg
   b) 11.0 kg
   c) 8.80 kg
   d) 9.10 kg

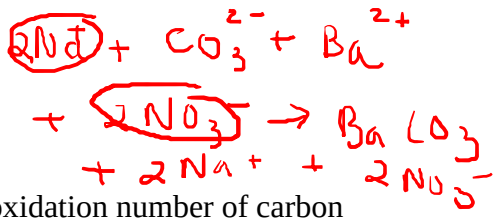
n = m / M
m = n*m
M = m / n
molality = mol / kg



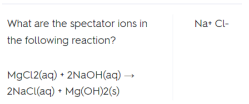
5. Calculate the closet mole fraction of ethyl alcohol, C_2H_5OH, in a solution that contains 230 grams of C_2H_5OH and 312 grams of benzene, C_6H_6.
   a) 2.3
   b) 0.57
   c) 0.44
   d) 1.8

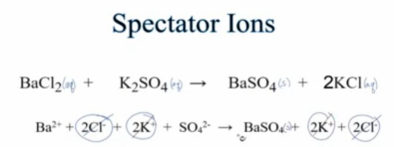


6. The spectator ion(s) in the following reaction is/are:
   $Na_2CO_3(aq) + Ba(NO_3)_2(aq) \longrightarrow BaCO_3(s) + 2NaNO_3(aq)$
   a) Na^+ and Ba^{2+}
   b) Ba^{2+} and CO_3^{2-}
   c) CO_3^{2-} and NO_3^-
   d) Na^+ and NO_3^-



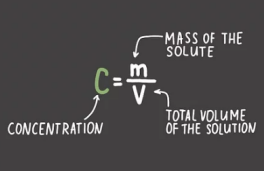
7. Determine the oxidation number of carbon in K_2CO_3.
   a) 0
   b) +2
   c) +4
   d) -2





8. Consider three 1 – L flasks containing gases at STP. Flask A contains H_2 gas, flask B contains O_2 gas and flask C contains H2S gas and. Which contains the largest number molecules?
   a) Flask A
   b) Flask B
   c) Flask C
   d) All of them.

At standard temperature and pressure (STP), 1 L of any gas contains Avogadro's number of molecules (6.022 x 10^23). Therefore, all three flasks A, B, and C contain the same number of molecules (6.022 x 10^23).
It doesn't matter what type of gas is in the flasks, as long as the volume and temperature are held constant, the number of molecules will be the same.

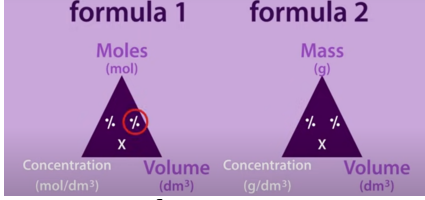


Molar mass: M

$$density = \frac{mass}{volume}$$

dm3 = litre

D = m / v



9. The concentration of $[Ag^+]$ ion when putting 1.00 mole of AgCl into 1.00 L distilled water?

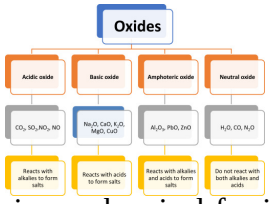
a) 1.00 M b) 10.0 M

c) 0.1 M d) Can not calculated!!!

10. Metal oxides are _____ and react with water to generate _____.

a) basic, H^+ b) acidic, H^+

c) basic, OH^- d) acidic, OH



CONSTRUCTED QUESTIONS (90pts)

1. (8pts) Calcium carbide, CaC_2, is an important preliminary chemical for industries producing synthetic fabrics and plastics. CaC_2 may be produced by heating calcium oxide with coke:

$$CaO + 3C \longrightarrow CaC_2 + CO$$

0.85 0.85/3

--> m Cac2 = (0.85/3) * 64 = 18.13g

What is the amount of CaC_2 which can be produced from the reaction of excess calcium oxide and 10.2 g of carbon? (Assume 100% efficiency of reaction for purposes of this problem.)

$2z + 2a = 4x + y \Rightarrow 2a = 4x + y - 2z$

???

2. (25pts) Complete chemical reactions below, write net ionic equation (if possible) and figure out what types of those reaction.

$\rightarrow a = 2x + \frac{y}{2} - z$

a) $2C_xH_yO_zN_t + \frac{2x}{2}O_2 \rightarrow 2xCO_2 + yH_2O + tN_2$ ($\Delta H < 0$)

b) $Cu + Cl_2 \rightarrow \ldots\ldots$ $CuCl_2$ Redox reaction

c) $2H_3PO_4 + 3Ba(OH)_2 \rightarrow Ba_3(PO_4)_2 + 6H_2O$ neutralization reaction

d) $FeCl_2 + H_2SO_4 + HNO_3 \rightarrow Fe_2(SO4)_3 + FeCl_3 + NO + H_2O$ redox reaction

e) $SO_3 + H_2O \rightarrow H_2SO_4$ combination reaction

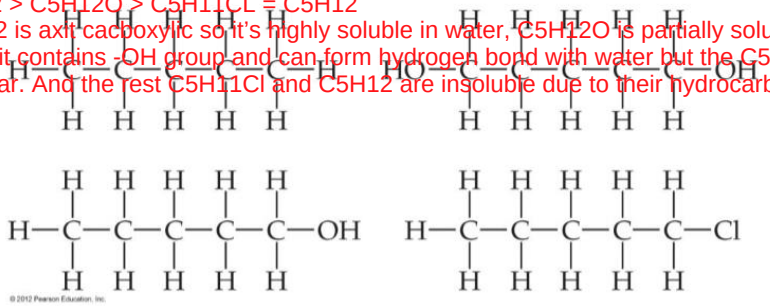
$2H_3PO_4 + 3Ba^{2+} + 6OH^- \rightarrow Ba_3(PO_4)_2 + 6H_2O$

???

3. Arrange the following substances in order of increasing solubility in water and show your reasons: (10pts)

3) Order of increasing solubility in water:
C5H1202 > C5H12O > C5H11CL = C5H12
C5H12O2 is axit cacboxylic so it's highly soluble in water, C5H12O is partially soluble because it contains -OH group and can form hydrogen bond with water but the C5H12 is nonpolar. And the rest C5H11Cl and C5H12 are insoluble due to their hydrocarbon part.

C_5H_{12} $C_5H_{12}O_2$



$C_5H_{12}O$ $C_5H_{11}Cl$

The solubility of a compound in water depends on the secondary interaction between the solute and solvent. In the case of water acting as the solvent, solubility is highest in compounds which have hydrogen bonding, than in those which have dipole-dipole interactions, and lowest in those which have only dispersion forces1.

4. There is a relationship between **intermolecular forces**, **temperature**, and **the temperatures** at which the **solid**, **liquid**, and **gas** phases exist. Each blank will be filled in with **ONE** of the words in bold. You may use each word more than once. (12pts)

A. At low temperatures, materials are in the _____(1)solid_____ phase. In this phase, _____(2)Intermolecular force_____ are strong enough to keep the particles in the material (atoms, ions, or molecules) close enough such that the particles have 3- dimensional order.

There are five basic types of chemical reactions:
- combination, decomposition, single-replacement, double-replacement, and combustion
However, there are many other types of chemical reactions that can occur, such as
- redox reactions, acid-base reactions, and precipitation reactions.

neutralization react

B. Evaporation is a phase transition from the _____(3)_____ phase to the _____(4)_____ phase that occurs at _____(5)_____ below the boiling point at a given pressure. For molecules of a liquid to evaporate, they must be located near the surface, be moving in the proper direction, and have sufficient kinetic energy to overcome liquid-phase _____(6)_____.

(3): liquid
(4): gas
(5): The temperature
(6): intermolecular forces

5. What total gas volume (in liters) at 520°C and 880 torr would result from the decomposition of 33.0 g of potassium bicarbonate according to the equation: (10pts)

$$2KHCO_3(s) \rightarrow K_2CO_3(s) + CO_2(g) + H_2O(g)$$

Given that: R = 0.0821 L.atm.mol^{-1}.K^{-1} and 760 torr = 1 atm.

6. Calculate the concentration of CO_2 in a soft drink after the bottle is opened and equilibrates at 25°C under a CO_2 partial pressure of 3.0 x 10^{-4} atm. The Henry's law constant for CO_2 in water at this temperature is 3.4x10^{-2} mol/L.atm. (5pts)

$$P = K.C_M \leftrightarrow C_M = \frac{P}{K} = \frac{3.0 \times 10^{-4}\ atm}{3.4 \times 10^{-2}\ atm.L/mol} = 8.8 \times 10^{-3}\ mol/L$$

7. Show the Ideal – Gas Equation and relationship between temperature, pressure and volume in laws that you have learnt. (10pts)

8. Nguyen Hoang Long, a first year student, wants to learn about gases, therefore students, based on what you have learnt, please briefly describe the physical and chemical properties of gases.(10pts)

Good luck!!!

7.
PV = nRT

Where,

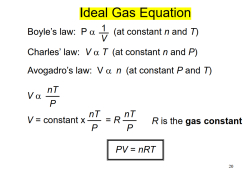
P is the pressure of the ideal gas.
V is the volume of the ideal gas.
n is the amount of ideal gas measured in terms of moles.
R is the universal gas constant.
T is the temperature.

Boyle's law Charles' law Avogadro's law

$$V \propto \frac{1}{P} \qquad V \propto T \qquad V \propto n$$

$$V \propto \frac{nT}{P} \qquad V = R\left(\frac{nT}{P}\right)$$

$$PV = nRT$$



8.
Physical properties of gases include:

They are highly compressible, meaning that their volume can be easily changed by applying pressure.
They are highly expandable, meaning that they will fill any container they are placed in.
They have low density compared to solids and liquids.
They are poor conductors of heat and electricity.
They have low viscosity and surface tension.
They are relatively easy to pump and compress.

Chemical properties of gases include:

They are highly reactive and can participate in a wide variety of chemical reactions.
They are typically colorless, odorless, and tasteless.
They often have low boiling and melting points.
They can be flammable or explosive under certain conditions.
They can be toxic or harmful if inhaled in large quantities.
They can be oxidizing or reducing agents.
They can be chemically inert or active.

Physical Characteristics of Gases

- Gases assume the volume and shape of their containers.
- Gases are the most compressible state of matter.
- Gases will mix evenly and completely when confined to the same container.
- Gases have much lower densities than liquids and solids.