Chemistry Department

2017 / 2018

Second Semester

No of exam papers 5	**60 Marks**	**Time 2 hrs**	**course name** **General Chemistry II** **Course code Chem 102**	**1st level**

Instructions

الإمتحان عبارة عن ٥ أسئلة موزعة على ٥ صفحات

نرجوا إجابة كل سؤال فى المساحة المخصصة له ولن يلتفت إلى أى إجابة ليست فى المكان المخصص لها

الإجابة بالقلم الجاف وبخط واضح

Answer the following questions:

Question 1 **(12 marks)**

Question 2 **(12 marks)**

Question 3 **(12 marks)**

Question 4 **(12 marks)**

Question 5 **(12 marks)**

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		د. محمد محمود	*د. أحمد محمود*
	Good luck		

Answer the following questions:

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I) a) Solve the following:

i) A certain beaker was weighed by three different balances and the readings were (50.6192 g ، 50.62 g ، 50.6 g). Calculate the average reading if the rules of significant figures are applied. (1 Mark)

ii) Among several measurements of the same quantity, show what is the difference between accuracy and precision? (1 Mark)

. . . . . .

. . . . . .

iii) If 1 mile = 1.60934 km, convert a speed of 62 m s^{-1} into miles per hour. (2 Marks)

b) Define each of the following: (4 Marks)

- Weak electrolyte: . . . . . .

. . . . . .

- Lewis base: . . . . . .

. . . . . .

- *Osmosis*: . . . . . .

. . . . . .

- Henry's law: . . . . . .

. . . . . .

c) i) A given mass of gas in a rigid container (constant volume) is heated from 100 °C to 500 °C. Show by calculation what will happen to its pressure? (2 Marks)

ii) What volume of CH_4 at 0 °C and 1.0 atm contains the same number of moles as 0.5 L of N_2 measured at 27 °C and 1.5 atm? (2 Marks)

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II) a) i) Underline the correct word between brackets: (2 Marks)

- The isolated system allows the transfer of (***heat – work – heat and work – neither heat nor work***) between a system and its surroundings.
- The solubility of a certain salt in water is an endothermic process, increasing the temperature will (***increase***, ***decrease***, ***not affect***) the solubility.
- The direct change from the gas to the solid phase without passing by the liquid phase is called (***deposition – sublimation – boiling – melting)***.
- Which of the following does affect the rate at which a liquid evaporates? (***surface area of the liquid*** , ***name of the liquid*** , ***colour of the liquid*** , ***odour of the liquid***).

ii) At the same temperature, compare between the rate of effusion of methane gas and helium gas. (2 Marks)

b) i) With the aid of these two thermochemical equations: (3 Marks)

$2\ Na_2O_2\ (s) + 2\ H_2O\ (\ell) \rightarrow 4\ NaOH\ (s) + O_2\ (g)$ $\quad \Delta H_1^o = -126.4$ kJ/mol

$NaOH\ (s) + HCl\ (g) \rightarrow NaCl\ (s) + H_2O\ (\ell)$ $\quad \Delta H_2^o = -179.2$ kJ/mol

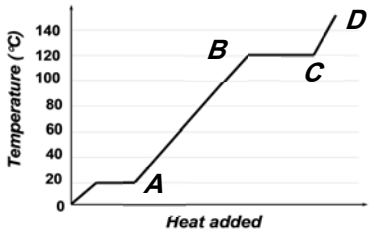
Calculate the standard enthalpy of the reaction:

$2\ Na_2O_2\ (s) + 4\ HCl\ (g) \rightarrow 4\ NaCl\ (s) + 2\ H_2O\ (\ell) + O_2\ (g)$

ii) Is the reaction exothermic or endothermic? (1 Mark)

c) i) Consider the following heating curve of a certain material: (2 Marks)

- The freezing point of the liquid is: . . . . . .
- The boiling point of the liquid is: . . . . . .
- Line A-B represents: . . . . . .
- Line C-D represents: . . . . . .



ii) Write the expression of k_c for each of the following reactions: (2 Marks)

- $4CuO\ (s) + CH_4\ (g) \rightleftharpoons CO_2\ (g) + 4Cu\ (s) + 2H_2O\ (g)$ . . . . . .

- $PCl_3\ (g) + Cl_2\ (g) \rightarrow PCl_5\ (g)$ . . . . . .

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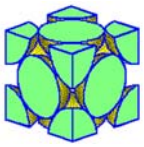
III) a) i) What type of crystalline solid will each of the following substances form? (2 Marks)

- SiO_2 . . . . . - H_2O . . . . . .
- $CaCO_3$ . . . . . - Na . . . . . .

ii) Consider the following diagrams that represent the unit cell of some crystals and complete the table: (2 Marks)

		
The type of crystal structure:		
The number of atoms in the unit cell:		

b) Give reasons for each of the following: (4 Marks)

i) The boiling point of sea water is higher than that of pure water.

. . . . . .
. . . . . .
. . . . . .

ii) Evaporation of a certain liquid is an endothermic process.

. . . . . .
. . . . . .

iii) State **TWO** of the postulates of the kinetic molecular theory of an ideal gas.

. . . . . .
. . . . . .

iv) Describe the negative deviation of solutions from Raoult's law.

. . . . . .
. . . . . .
. . . . . .

c) What mass of ethanol, C_2H_5OH must be added to 10.0 L of water to give a solution that freezes at −10.0°C? Assume the density of water is 1.0 g/mL. K_f of water is 1.86°C/m. (4 Marks)

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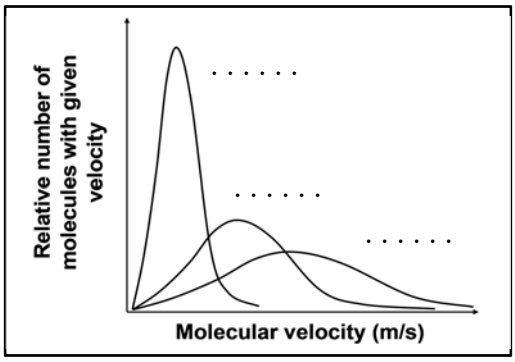
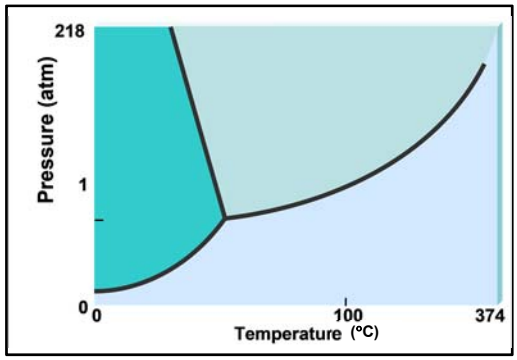
IV) a) According to the provided graphs, write all information in each graph. (4 Marks)

1) The molecular velocity distribution curves of H_2, He and N_2 gases. Deduce the curve of each gas.



2) The pressure-temperature diagram (the phase diagram) of pure water. Define all areas, lines and points.



b) i) A solution containing 14.3 g of NaCl in 42.2 g of water. What is the molal concentration of NaCl in this solution? (2 Marks)

ii) Mark true (√) or false (X) and correct the false one for each of the following: (2 Marks)

- For an ideal solution of two Liquids A and B at 40 °C, the vapour phase will be rich in the more volatile liquid. ( )

. . . . . .

-The solubility of CO_2 gas in water increases with decreasing the gas pressure. ( )

. . . . . .

. . . . . .

c) Liquids A and B form an ideal solution. At 50 °C, the total vapour pressure of a solution composed of 1 mole of A and 2 moles of B is 250 mmHg. On addition of 1 mole of A to the solution, the vapour pressure of the solution increases by 50 mmHg. Calculate P^{o}_{A} and P^{o}_{B}? (4 Marks)

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V) a) i) In the following reaction: $H_2O + H_2O \rightarrow H_3O^+ + OH^-$, identify the conjugate acid and the conjugate base. (2 Marks)

- the conjugated acid is: . . . . . .
- the conjugated base is: . . . . . .

ii) Using Henderson-Hasselbalch equation, calculate the pH of a buffered solution contains 0.25 M NH_3 ($K_b = 1.8 \times 10^{-5}$) and 0.40 M NH_4Cl? (2 Marks)

b) Complete the following: (4 Marks)

- In the phase diagram of water, ice can be transferred into vapor at a value of pressure below . . . . . and the process is called . . . . . .

- The main factor affecting dipole-dipole forces is:

. . . . . .

- Solubility is defined as: . . . . . .

. . . . . .

- Viscosity of a liquid is:

. . . . . .

c) Consider the decomposition of nitrous oxide, laughing gas: (4 Marks)

$$2\ N_2O\ (g) \rightleftharpoons 2\ N_2\ (g) + O_2\ (g)$$

At 25 °C, K_c is 7.3×10^{34}. Based on the information given:

i) what is the effect of increasing the volume of the reaction mixture?

. . . . . .

ii) does nitrous oxide have a tendency to decompose into nitrogen and oxygen?

. . . . . .

. . . . . .

iii) What is the value of K_p for the reaction at 25 °C?

vi) What is the value of $K_{c'}$ for the reaction: $N_2O\ (g) \rightleftharpoons N_2\ (g) + ½\ O_2\ (g)$?

(H = 1, He = 4, C = 12, O = 16, Na = 23, Cl = 35.5)

(R = 0.082 L. atm. $mol^{-1}\ K^{-1}$, R = 8.314 J $mol^{-1}\ K^{-1}$)

إنتهت الأسئلة