كلية الهندسة	الكود: BAS 1015	امتحان مادة الكيمياء الهندسية		جامعة المنصورة
قسم الرياضيات والفيزياء الهندسية	الفصل الدراسي الأول ٢٠١٠/٢٠١١	الفرقة الإعدادية		
	الأحد ٢٠١١/١/٩	الزمن: ٣ ساعات		

مسموح باستخدام الجداول الكيميائية (النسخة الخاصة بامتحانات الكيمياء الهندسية)

Answer the following questions   **Total Marks 80**   أجب عن الأسئلة الآتية:

Question No. (1):   **(15 Marks)**

(a) Explain the concept of an ideal gas as described through the assumptions of kinetic theory of gases? **(3 Marks)**

(b) Predict the values of the universal gas constant (R) in three different units of energy? **(6 Marks)**

(c) An exhust gas is prodused from a combusion of fuel by a rate of 10 mole/sec, the exhust gas analysis as follows:- CO_2 = 20%, O_2 = 5%, N_2 = 60% and H_2O = 15% by volume. If a blower is to be used to deliver air to reduce the concentration of CO_2 to=0.8% by volume. Calculate the volumetric flow rate of air delivery in m^3/hr at S.T.P? **(6 Marks)**

Question No. (2):   **(15 Marks)**

(a) Explain the term: "Internal energy" and discribe how it is implied in the first law of thermodynamic? **(6 Marks)**

(b) Calculate the change in internal energy, (ΔE), when 32 gm of methane gas (CH_4), are expanded from 5.00 liters to 15.00 liters by raising the temperature of the gas, isobarically at 4.92 atm. ? (consider methane behaves as an ideal gas during this process). **(9 Marks)**

Question No. (3):   **(15 Marks)**

(a) What are the main sources of liquid fuels? **(5 Marks)**

(b) Calculate the theoretical flame temperature when sulfur dioxide gas, (SO_2), is oxidized in 100% excess air with 80% conversion to SO_3. The gases enter the converter at 25°C ? **(10 Marks)**

Question No. (4):   **(15 Marks)**

(a) Explain Raoult's law for ideal solutions and show how deviations from ideality could occur? **(5 Marks)**

(b) Calculate freezing point and boiling point of a solution containing 10% ethylene glycole ($C_2H_6O_2$) by weight in water (H_2O)? **(6 Marks)**

(c) A gaseous mixture of hydrogen and oxygen contains 60% hydrogen and 40% oxygen by volume. If the gaseous mixture at a pressure of 2 atm. (excluding the vapor pressure of water). Find the mole fraction of both hydrogen and oxygen in water, if the given mixture is allowed to saturate water at 30°C? **(4 Marks)**

Question No. (5):   **(20 Marks)**

(a) The given figure represents the phase diagram of H_2O, draw the features of heating or cooling curves from thefollowing isobaric paths given in the figure, illustrating the main feature of each curve: **(6 Marks)**

1- Path from A to B,   (A → B)

2- Path from C to D,   (C → D)

3- Path from E to F,   (E → F)

4- Path from G to H,   (G → H)
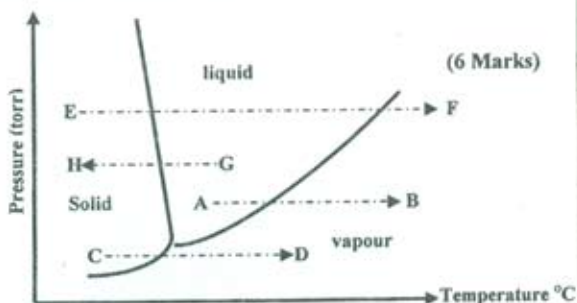
(b) Calculate the boiling point of water, corresponding to a vapor pressure of water is 380 mmHg.? **(3 Marks)**

(c) At 27°C and1 atm, N_2O_4 is 20% dissociated into NO_2, find : **(7 Marks)**

    i) The equilibrium constant, (K_P);

    ii) The percent dissociation at 27°C and a total pressure of 0.1atm and

(d) Calculate the pH, at equilibrium condition and at 25°C for:- **(4 Marks)**

    i) 0.2 molar acetic acid solution,   and   ii) 0.50 molar NH_3

Question No. (6):   **(10 Marks)**

(a) Give different five examples of anodic reactions and different four examples of cathodic reactions? **(4 Marks)**

(b) Based on the relation between electrode potentials and free energy change, derive the Nernst equation? **(2 Marks)**

(c) For the reaction: $Cu^{++} + Zn = Cu + Zn^{++}$ **(6 Marks)**

    i) Calculate $E°_{cell}$

    ii) What is the potential of the cell containing (Zn^{++}/Zn) and(Cu^{++}/Cu)couples if the Zn^{++} and Cu^{++} concentrations are 0.1and 10^{-9} molar, respectively, at a temperature of 25°C.

انتهت الأسئلة مع أطيب التمنيات بالتوفيق والنجاح

أ.م.د/ محمد محمد الحلوانى   أ.د/ أحمد أحمد السروى   أ.د/ إبراهيم جار العلم راشد

	BAS 1015 :الكود امتحان تخلفات مادة الكيمياء الهندسية	
كلية الهندسة	الفصل الدراسي الأول ٢٠١٠/٢٠١١ الفرقة الإعدادية	جامعة المنصورة
قسم الرياضيات والفيزياء الهندسية	الزمن: ٣ ساعات	

مسموح باستخدام الجداول الكيميائية (النسخة الخاصة بامتحانات الكيمياء الهندسية)

Answer the following questions   **Total Marks 80**   :أجب عن الأسئلة الآتية

Question No. (1):   (15 Marks)

(a) Explain the concept of ideal gas as described through the assumptions of the kinetic theory of gases? (4 Marks)

(b) Define the concept of partial pressure and derive the relationship between partial pressure, total pressure and mole fraction of a component gas in a gas mixture?   (5 Marks)

(c) Compute the molecular weight of gas mixture and its density at 27 °C and 750 torr, if the mixture of gases has the following composition by weight: $CO_2=0.44\%$, $O_2=22.4\%$, $N_2=75.36\%$, $H_2O=1.8\%$?   (6 Marks)

Question No. (2):   (15 Marks)

(a) State the three laws of thermodynamic?   (4 Marks)

(b) Derive the relationship between C_P and C_v for Real gases?   (4 Marks)

(c) Reffering to the information in the table is at 25°C: (7 Marks)

(1) Calculate $\Delta S°$, at 25°C for the reaction:
$$CO_{(g)} + 2 H_{2(g)} = CH_3OH_{(l)}$$
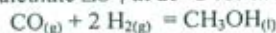
(2) Calculate $\Delta S°$ for $CO_{(g)}$ at 25°C.

(3) Discuss the effect of temperature on the spontaneity of the above reaction

Compound	$\Delta H°_f$ kcal/mole	$\Delta G°_f$ kcal/mole	$S°$ cal/mole K
$H_{2(g)}$	0.00	0.00	31.212
$CO_{(g)}$	-26.415	-32.808	-------
$CH_3OH_{(l)}$	-57.036	-39.747	30.26

Question No. (3):   (15 Marks)

(a) Define the heating value of fuel and how it is expressed ?   (3 Marks)

(b) For the production of sulfuric acid by the contact process, iron pyrites, (FeS_2), is burned with air in 100% excess of that required to oxidize all iron to Fe_2O_3 and all sulfur to SO_2. It may be assumed that the combustion of the pyrites is complete to form these products and that no SO_3 is formed in the burner. The gases from the burner are cleaned and coold then passed into a catalytic converter in which 80% of SO_2 is oxidized to SO_3 by combination with the oxygen present in the gases. The gases enter the converter at a temperature of 25°C. Assuming that the converter is thermally insulated so that heat loss is negligible. Calculate the temperature of the gases leaving the converter.   (12 Marks)

Question No. (4):   (15 Marks)

(a) Explain Raoult's law for ideal solutions and show how deviations from ideality could occur?   (3 Marks)

(b) Calculate freezing point and boiling point of a solution containing 10% ethylene glycole ($C_2H_6O_2$) by weight in water (H_2O)?   (6 Marks)

(c) What is the denisty at 17°C of aqueous solution containing 0.75 gm of sucrose, ($C_{12}H_{22}O_{11}$), per 2 litre of a solution developed a rise of 26.4 cm at osmotic equilibrium?   (6 Marks)

Question No. (5):   (20 Marks)

(a) Explain the main features of heating and cooling curves and interpret what happen in each portion? (6 Marks)

(b) Calculate the freezing point of water at 10 atm. pressure, where the density of liquid water at 0°C is given as 0.99 gm/cm³ and that for ice at 0°C is 0.92 gm/cm³?   (6 Marks)

(c) At 817°C, the equilibrium constant for reaction between pure CO_2 and excess hot graphite to form $2CO_{(g)}$ is 10,

(1) What is the analysis of the gases at equilibrium, at 817°C and at a total pressure of 4 atm?   (4 Marks)

(2) What is the total pressure when the gas mixture analyze 94% CO by volume?   (4 Marks)

Question No. (6):   (15 Marks)

(a) In a simplified flow sheet diagram, explain the main steps of Portland cement manufacture?   (3 Marks)

(b) Explain the main features of the kiln used for burning the raw mix to produce Portland cement and explain the main reactions occurring inside it?   (3 Mark)

(c) Explain the main stages of setting and hardening of Portland cement according to modern theory? (3 Marks)

(d) What are the main raw material resources for fertilizers industry?   (3 Marks)

(e) Explain the main reactions in acidulation process for the production of phosphoric acid from phosphate ore? What are the main problems facing this industry?   (3 Marks)