



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013**

COURSE NAME : CHEMISTRY

COURSE CODE : DAS 12102 / DSK 1912

PROGRAMME : 1 DAE
2 DAE
3 DAE / DET / DEE / DAL

EXAMINATION DATE : OCTOBER 2012

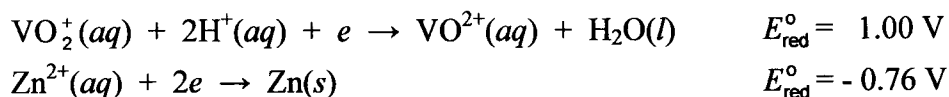
DURATION : 2½ HOURS

INSTRUCTIONS : ANSWER ALL QUESTIONS IN
PART A AND TWO (2)
QUESTIONS IN PART B

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

PART A

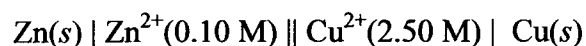
Q1 a) Based on the following half-reactions and E_{red}° values;



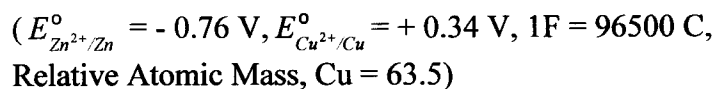
- i) Write the balanced redox equation representing the reaction occurs between VO_2^+ and Zn^{2+} .
- ii) Determine the anode and cathode of the system constructed in (i).
- iii) Calculate E_{cell}° .

(11 marks)

b) A zinc-copper battery is prepared as follows:



- i) Determine the cell potential, E_{cell}° when Zn/Zn^{2+} and Cu/Cu^{2+} react in standard condition.
- ii) Calculate the cell potential E_{cell} of the zinc-copper battery at $[\text{Zn}^{2+}] = 0.10 \text{ M}$ and $[\text{Cu}^{2+}] = 2.50 \text{ M}$.
- iii) Evaluate the mass reduced from copper (Cu) electrode after 10.0 A of current flows within 10.0 hours.



(14 marks)

- Q2** a)
 - i) Write an expression for the dissociation constant K_a for the weak acid HX.
 - ii) For HX, $K_a = 4.25 \times 10^{-5} \text{ M}$. Calculate the pH of 0.45 M solution of this acid.

(10 marks)

- b) The pH of 0.15 M solution of a weak acid, HA, is 2.82 at 300 K.
- Write an expression for the acid dissociation constant, K_a , of HA.
 - Determine the value of K_a for HA at 300 K and state its units.
 - The dissociation of HA into its ions in aqueous solution is an endothermic process. How would its pH change if the temperature is increased? Explain your answer.

(15 marks)

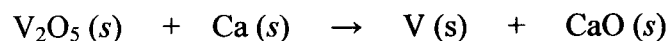
PART B

- Q3** a) Determine how many grams of sulfuric acid (H_2SO_4) solutes would be needed to make 250 mL of a 0.100 M solution.

(Relative Atomic Mass, H = 1, S = 32, O = 16)

(6 marks)

- b) Industrially, vanadium metal, V which is used in steel alloys, can be obtained by reacting vanadium (V) oxide, V_2O_5 with calcium (Ca) at high temperature. In this reaction, calcium oxide (CaO) will also be produced.



- Balance the above equation.
- What mass of V_2O_5 is needed to produce 2.5 Kg of vanadium?

(Relative Atomic Mass, V = 50.9, Ca = 40, O = 16)

(9 marks)

- c) The balanced equation shows a complete decomposition reaction of 10.5 g of potassium chlorate.

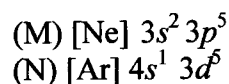
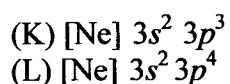


- Calculate the number of moles of KClO_3 used in the reaction.
- Calculate the number of moles of oxygen gas produced.
- Compute the volume of oxygen gas produced at 1.00 atm and 25 °C.

(Relative Atomic Mass, K = 39.1, Cl = 35.5, O = 16,
 $R = 0.0821 \text{ L.atm mol}^{-1}.\text{K}^{-1}$)

(10 marks)

- Q4** a) The electronic configurations of some elements K, L, M and N are given below.



- Which element will be the most metallic? Explain your answer
- Draw orbital diagram for valence electron of K element.

(10 marks)

- b) The values of ionization energy for elements of Na, Mg and Al are shown in Table Q4(b) below. Compare the values of ionization energies and explain.

Table Q4(b) : Ionization Energies of Na, Mg and Al

Element	Ionization energy (kJ.mol^{-1})		
	E_1	E_2	E_3
Na	496	4,560	-
Mg	738	1,450	7,730
Al	57	1,816	2,744

(8 marks)

- c) Define electronegativity. How does it vary across a period and down a group.

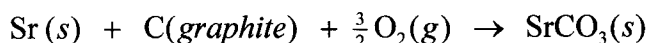
(7 marks)

- Q5** a) i) Write the Lewis dot structure and show the formal charges for PO_3^{3-}
 ii) Draw the resonance structure of NO_3^-

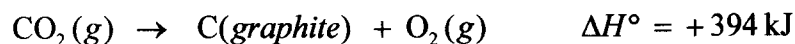
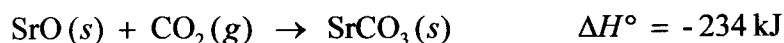
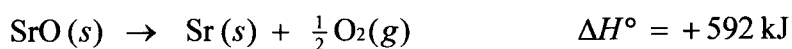
(Atomic number, Z : N = 7, P = 15, O = 8)

(10 marks)

- b) Calculate the standard enthalpy change, ΔH° , for the formation of 1 mol of strontium carbonate (the material that gives the red color in fireworks) from its elements.

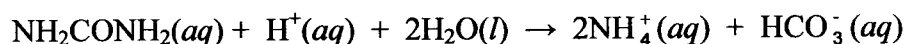


The information available is



(15 marks)

- Q6** a) Urea (NH_2CONH_2) is the end product in animal's protein metabolism. The decomposition of urea in 0.1 M HCl occurs according to the equation:



The reaction is first order in urea and first order overall.

When $[\text{NH}_2\text{CONH}_2] = 0.200 \text{ M}$, the rate at 60.5°C is $8.56 \times 10^{-5} \text{ M/s}$

- i) What is the rate constant, k ?
 ii) What is the concentration of urea in this solution after $4.00 \times 10^3 \text{ s}$ if the starting concentration is 0.500 M ?
 iii) What is the half-life for this reaction at 60.5°C ?
 iv) How long will it take for the initial concentration to become one-third?

(15 marks)

- b) Calculate K_c at 500°C , given the equilibrium concentrations, 0.5 M hydrogen gas, 0.5 M chlorine gas and 1.5 M hydrogen chloride gas.

(Hint : write the balanced equation)

(10 marks)