



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2010/2011**

COURSE NAME : CHEMISTRY

COURSE CODE : DAS 12102/DSK 1912

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

EXAMINATION DATE : APRIL/MAY 2011

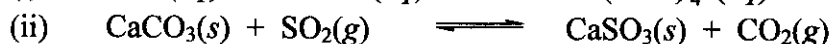
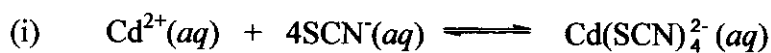
DURATION : 2 ½ HOURS

INSTRUCTIONS : ANSWER ALL QUESTIONS IN
PART A AND FOUR (4)
QUESTIONS IN PART B

THIS QUESTION PAPER CONSISTS OF THIRTEEN (13) PAGES

PART A

Q1 (a) Write the equilibrium expression, K_c and or K_p for the following equations:



(4 marks)

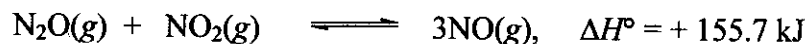
(b) At 25 °C, $K_c = 0.145$ for the following reaction.



If the initial concentration of BrCl in the solution is 0.050 M, find the concentrations of Br₂ and Cl₂ at equilibrium.

(8 marks)

(c) Consider the equilibrium



In which direction will the equilibrium be shifted by the following changes?

- (i) adding N₂O
- (ii) removing NO₂
- (iii) increasing the temperature of the reaction mixture.

(3 marks)

Q2 (a) Write the formula for

- (i) the conjugate acid of F⁻.
- (ii) the conjugate base of HCN.

(2 marks)

(b) Identify the acid, base and conjugate acid-base pairs in the following reaction

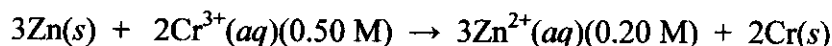


(2 marks)

- (c) Calculate the concentrations of H^+ , OH^- and pOH in a solution with a pH value of 2.56.
($K_w = 1.0 \times 10^{-14}$)

(6 marks)

- Q3 (a) Given the following oxidation-reduction reaction :



- (i) Write the cell notation and the half-cell reactions at the anode and cathode.
(ii) Calculate E_{cell}° and E_{cell} ($E_{Zn^{2+}/Zn}^{\circ} = -0.76 V$, $E_{Cr^{3+}/Cr}^{\circ} = -0.74 V$)

(12 marks)

- (b) In a copper plating experiment, copper metal is deposited from a copper (II) solution. What mass of copper is deposited if a current of 1.0 A is applied for 2.6 hours?
(Relative atomic mass : $Cu = 63.5$, $F = 96500 C$)

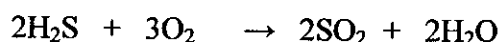
(3 marks)

PART B

- Q4 (a) A normal person inhales approximately 2.5 g oxygen in a minute. Find the number of oxygen molecules inhaled.
(Relative atomic mass : $O = 16$, $N_A = 6.022 \times 10^{23}$)

(3 marks)

- (b) In the reaction :



If 21 g H_2S reacts with 38 g O_2 ,

- (i) Determine the limiting reactant.
(ii) What mass of SO_2 is produced?
(iii) Calculate the percentage yield if the actual mass of SO_2 is 31 g.
(Relative atomic mass : $H = 1$, $O = 16$, $S = 32$)

(8 marks)

- (c) Calculate the mass of CH_3COOH in 21.2 mL of 6.8 M solution of CH_3COOH .

(Relative atomic mass : H = 1, O = 16, C = 12)

(4 marks)

- Q5** (a) What is the maximum number of unpaired electrons that can be placed in a $5d$ subshell?

(1 mark)

- (b) For an atom, M with electronic configuration: $[\text{Ar}]4s^23d^6$

- (i) Determine the group and period in which M belongs.
- (ii) Predict the possible M ion charges.
- (iii) Write down the electronic configuration of M ion.
- (iv) Write down the full set of quantum numbers (n, ℓ, m_ℓ, m_s) for the electrons left (or gained) if M atom forms M ion.

(5 marks)

- (c) (i) Define electron affinity.
 (ii) Explain the trends in electron affinity from aluminium to chlorine.
 (Atomic number, Z : Al = 13, Cl = 17).

(5 marks)

- (d) (i) Write a balanced equation of a metal oxide, YO with water.
 (ii) If Y is a metal, predict whether the product in reaction d(i) will be acidic or basic.
 (iii) If X is a metal before Y in a group in the Periodic Table, will X be more basic or more acidic?

(4 marks)

- Q6** (a) Give the group number and general electron configuration of an element with the following Lewis dot symbol.



(2 marks)

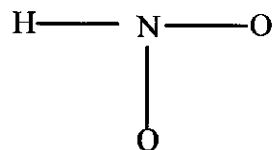
- (b) Write Lewis structure of SrCl_2 .
(Atomic number, Z: Sr = 38, Cl = 17)

(4 marks)

- (c) Is the H-O bond in water pure covalent, polar covalent or ionic? Define each term in a simple word and explain your choice.

(4 marks)

- (d) Below are two skeleton structures for nitrous acid, HNO_2 . Which is the best arrangement of atoms, on the basis of formal charge?
(Atomic number, Z: H = 1, N = 7, O = 8)



(5 marks)

- Q7** (a) A student is having a 20 mL of chlorine trifluoride gas at 699 mmHg and 45 °C. Calculate the mass of the sample in gram.
(Relative atomic mass: Cl = 35.5, F = 19, $R = 0.0821 \text{ L.atm.mol}^{-1}.\text{K}^{-1}$)

(6 marks)

- (b) At 1400 mmHg and 286 K, a skin diver exhales a 208-mL bubble of air that is 77% N_2 , 17% O_2 and 6.0% CO_2 by volume. How many mL would the volume of the bubble be if it were exhaled at the surface at 1 atm and 298 K?
($R = 0.0821 \text{ L.atm/mol.K}$)

(6 marks)

- (c) Under conditions in which the density of CO_2 is 1.96 gL^{-1} and that of N_2 is 1.25 gL^{-1} , which gas will effuse more rapidly?

(3 marks)

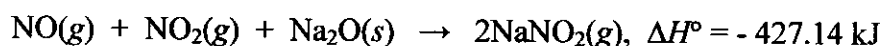
Q8 (a) For the reaction :



- (i) How much energy is needed to produce 35 moles of $\text{NO}(\text{g})$?
 (ii) How much energy is produced when 10 g of NO is decomposed to N_2 and O_2 ?
 (Relative atomic mass: $\text{N} = 14$, $\text{O} = 16$)

(4 marks)

(b) Find the enthalpy of formation, ΔH_f° of NaNO_2 from the following equation



Given :

$$\Delta H_f^\circ [\text{NO}(\text{g})] = 90.25 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{NO}_2(\text{g})] = 33.2 \text{ kJ/mol}$$

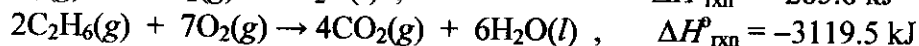
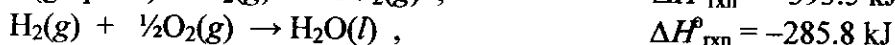
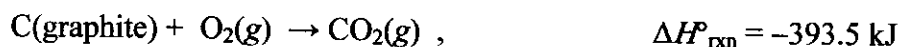
$$\Delta H_f^\circ [\text{Na}_2\text{O}(\text{s})] = -414.22 \text{ kJ/mol}$$

(4 marks)

(c) Calculate the enthalpy change for the reaction

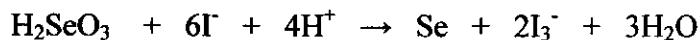


Given :



(7 marks)

Q9 (a) For the reaction :



- (i) Write the rate expression.
- (ii) The rate law for the reaction is $\text{Rate} = k[\text{H}_2\text{SeO}_3][\text{I}^-]^3[\text{H}^+]^2$. What is the overall order of the reaction?
- (iii) Calculate the rate of the reaction given :
 - $k = 5.0 \times 10^5 \text{ M}^{-5} \text{ s}^{-1}$
 - $[\text{H}_2\text{SeO}_3] = 2.0 \times 10^{-2} \text{ M}$
 - $[\text{I}^-] = 2.0 \times 10^{-3} \text{ M}$
 - $[\text{H}^+] = 1.0 \times 10^{-3} \text{ M}$

(7 marks)

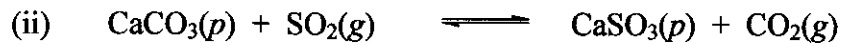
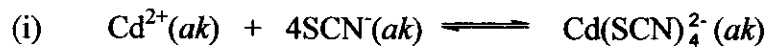
(b) If the initial concentration of a reactant in a first order reaction is 0.64 M and the half-life, $t_{1/2}$ is 30 s,

- (i) Find the rate constant, k .
- (ii) Calculate the concentration of reactant after 1 minute
- (iii) How long does take for the concentration of reactant to drop to 0.04M?

(8 marks)

BAHAGIAN A

S1 (a) Tuliskan ungkapan keseimbangan, K_C dan atau K_P bagi persamaan berikut:



(4 markah)

(b) Pada 25 °C, $K_C = 0.145$ bagi tindak balas berikut:



Jika kepekatan asal bagi BrCl dalam larutan ialah 0.050 M, kirakan kepekatan Br₂ dan Cl₂ pada keseimbangan.

(8 markah)

(c) Pertimbangkan keseimbangan berikut:



Pada arah manakah keseimbangan akan teranjak apabila perubahan berikut dilakukan?

- (i) Menambah N₂O
- (ii) Menyingkirkan NO₂
- (iii) Menaikkan suhu bagi campuran tindak balas

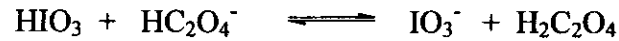
(3 markah)

S2 (a) Tuliskan formula bagi

- (i) Konjugat asid bagi F⁻
- (ii) Konjugat bes bagi CN⁻

(2 markah)

- (b) Kenalpasti asid, bes dan pasangan konjugat asid-bes bagi tindak balas berikut:



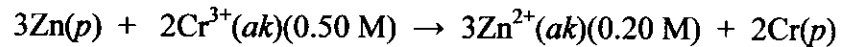
(2 markah)

- (c) Hitungkan kepekatan bagi H^+ , OH^- dan pOH bagi larutan dengan nilai pH 2.56.

$$(K_w = 1.0 \times 10^{-14})$$

(6 markah)

- S3 (a) Diberi persamaan tindak balas pengoksidaan-penurunan seperti berikut:



- (i) Tuliskan notasi sel dan tindak balas setengah yang berlaku di anod dan di katod.

- (ii) Kirakan E_{sel}° dan E_{sel} ($E_{\text{Zn}^{2+}/\text{Zn}}^\circ = -0.76 \text{ V}$, $E_{\text{Cr}^{3+}/\text{Cr}}^\circ = -0.74 \text{ V}$)

(12 markah)

- (b) Dalam eksperimen penyaduran kuprum, logam kuprum disasarkan daripada larutan kuprum (II). Hitungkan jisim kuprum yang disasarkan jika arus 1.0 A dialirkan selama 2.6 jam.

(Jisim atom relatif: $\text{Cu} = 63.5$, $F = 96500 \text{ C}$)

(3 markah)

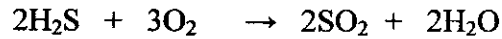
BAHAGIAN B

- S4 (a) Seorang manusia biasanya menyedut anggaran 2.5 g oksigen dalam masa 1 minit. Kirakan bilangan molekul oksigen yang disedut.

(Jisim atom relatif: $\text{O} = 16$, $N_A = 6.022 \times 10^{23}$)

(3 markah)

(b) Bagi tindak balas:



Jika 21 g H_2S bertindak balas dengan 38 g O_2 ,

- (i) Tentukan reaktan penghad
- (ii) Apakah jisim SO_2 yang dihasilkan?
- (iii) Hitungkan peratus hasilan jika jisim sebenar bagi SO_2 ialah 31 g.
(Jisim atom relatif: H = 1, O = 16, S = 32)

(8 markah)

(c) Hitungkan jisim CH_3COOH dalam 21.2 mL larutan CH_3COOH yang berkepekatan 6.8 M.

(Jisim atom relatif: H = 1, O = 16, C = 12)

(4 markah)

S5 (a) Hitungkan bilangan maksimum elektron tak berpasangan yang boleh menempati subpetala $5d$.

(1 markah)

(b) Bagi atom, M dengan konfigurasi elektron: $[\text{Ar}]4s^23d^6$

- (i) Tentukan kala dan kumpulan bagi M.
- (ii) Jangkakan cas bagi ion M.
- (iii) Tuliskan konfigurasi elektron bagi ion M.
- (iv) Tuliskan set nombor kuantum ((n, ℓ, m_ℓ, m_s)) bagi elektron yang disingkir (atau yang diperolehi) jika atom M membentuk ion.

(5 markah)

(c) (i) Takrifkan afiniti elektron.
(ii) Jelaskan perkalaan umum bagi afiniti elektron bermula daripada aluminium ($Z=13$) ke klorin ($Z=17$).

(5 markah)

- (d) (i) Tulis persamaan kimia yang seimbang bagi tindak balas oksida logam YO dengan air.
 (ii) Jika Y suatu logam, jangkakan hasil dari tindak balas di d(i) suatu asid atau bes.
 (iii) Jika X ialah logam sebelum Y di Jadual Berkala, adakah X akan berkelakuan lebih keasidan atau kebesan?

(4 markah)

- S6 (a) Nyatakan kumpulan dalam Jadual Berkala dan konfigurasi elektron bagi unsur dengan simbol titik Lewis seperti di bawah:



(2 markah)

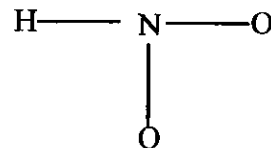
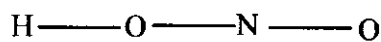
- (b) Lukiskan struktur Lewis bagi SrCl_2 . (Z: Sr = 38, Cl = 17)

(4 markah)

- (d) Adakah ikatan H-O dalam air kovalen tulen, kovalen berkutub atau ionik? Beri definisi setiap jenis ikatan dan terangkan pilihan anda.

(4 markah)

- (e) Di bawah adalah struktur rangka bagi asid nitrus, HNO_2 . Yang manakah antara berikut adalah susunan atom yang terbaik berasaskan cas formal? (Nombor atom, Z: H = 1, N = 7, O = 8)



(5 markah)

- S7 (a) Seorang pelajar memiliki 20 mL gas klorin triflorida pada 699 mmHg dan 45 °C. Hitungkan sampel gas ini dalam gram. (Jisim atom relatif: Cl = 35.5, F = 19, R = 0.0821 L.atm/mol.K)

(6 markah)

- (b) Pada 1400 mmHg dan 286 K, kulit seorang perenang menyedut satu gelembung udara 208 mL yang mengandungi 77% N₂, 17% O₂ dan 6.0% CO₂ mengikut isipadu. Berapa mL kah isipadu bagi gelembung tersebut jika ia disedut pada 1 atm dan 298 K?

(6 markah)

- (c) Di bawah keadaan di mana ketumpatan CO₂ ialah 1.96 gL⁻¹ dan bagi N₂ 1.25 gL⁻¹, tentukan gas manakah yang akan terbaaur lebih kerap?

(3 markah)

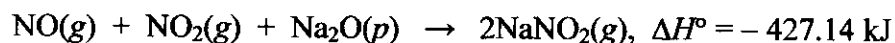
- S8 (a) Bagi tindak balas:



- (i) Berapakah tenaga yang diperlukan untuk menghasilkan 35 mol NO(g)?
 (ii) Berapakah tenaga yang dihasilkan apabila 10 g NO diuraikan kepada N₂ dan O₂?
 (Jisim atom relatif: N = 14, O = 16)

(4 markah)

- (b) Kirakan entalpi pembentukan, ΔH_f° bagi NaNO₂ daripada persamaan berikut:



Diberi:

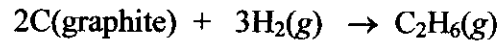
$$\Delta H_f^\circ [\text{NO}(\text{g})] = 90.25 \text{ kJ/mol}$$

$$\Delta H_f^\circ [\text{NO}_2(\text{g})] = 33.2 \text{ kJ/mol}$$

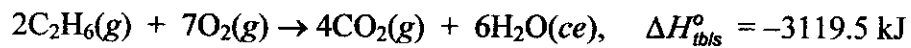
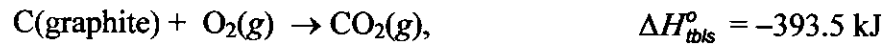
$$\Delta H_f^\circ [\text{Na}_2\text{O}(\text{p})] = -414.22 \text{ kJ/mol}$$

(4 markah)

- (c) Hitungkan perubahan entalpi bagi tindak balas:

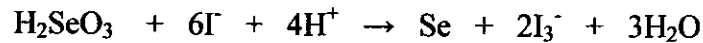


Diberi:



(7 markah)

- S9 (a) Bagi tindak balas:



- (i) Tuliskan persamaan kadar.
 (ii) Hukum kadar bagi tindak balas ialah kadar = $k[\text{H}_2\text{SeO}_3][\text{I}^-]^3[\text{H}^+]^2$.
 Apakah tertib bagi keseluruhan tindak balas?
 (iii) Hitungkan kadar bagi tindak balas, diberi:
 $k = 5.0 \times 10^5 \text{ M}^{-5} \text{ s}^{-1}$
 $[\text{H}_2\text{SeO}_3] = 2.0 \times 10^{-2} \text{ M}$
 $[\text{I}^-] = 2.0 \times 10^{-3} \text{ M}$
 $[\text{H}^+] = 1.0 \times 10^{-3} \text{ M}$

(7 markah)

- (b) Jika kepekatan asal bagi reaktan dalam tindak balas kadar pertama ialah 0.64 M dan tempoh setengah hayat,
- $t_{1/2}$
- ialah 30 s,

- (i) Dapatkan pemalar kadar, k .
 (ii) Hitungkan kepekatan reaktan selepas 1 minit.
 (iii) Berapakah lama masa yang diambil untuk kepekatan berkurang ke 0.04M?

(8 markah)