
UNIVERSITI SAINS MALAYSIA

Final Examination
Academic Session 2007/2008

April 2008

JIK 101 – GENERAL CHEMISTRY I
[KIMIA AM I]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains EIGHT printed pages before you begin the examination.

Answer **FIVE** questions. You may answer **either** in Bahasa Malaysia or in English.

All answers must be written in the answer booklet provided.

Each questions is worth 20 marks and the marks for each sub question is given at the end of that question.

Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.

*Jawab **LIMA** soalan. Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.*

Setiap jawapan mesti dijawab di dalam buku jawapan yang disediakan.

Setiap soalan bernilai 20 markah dan markah subsoalan diperlihatkan di penghujung subsoalan itu.

1. (a) Calculate the frequency of light (in s^{-1}) that has a wavelength of 3.12×10^{-3} cm.

Kira frekuensi cahaya (dalam s^{-1}) yang mempunyai jarak gelombang 3.12×10^{-3} cm.

(5 marks)

- (b) Calculate the energy of a photon that has a wavelength of 9.0 m.

Kira tenaga untuk satu foton yang mempunyai jarak gelombang 9.0 m.

(5 marks)

- (c) Write the electronic configuration of

- (i) Co
- (ii) Mg
- (iii) F
- (iv) Cu
- (v) Cr

Tulis konfigurasi elektronik untuk

- (i) Co
- (ii) Mg
- (iii) F
- (iv) Cu
- (v) Cr

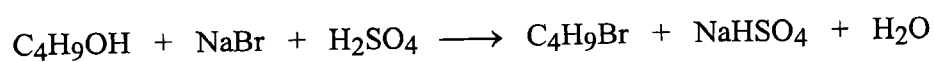
(5 marks)

- (d) Explain the Bohr model of the atom.

Jelaskan model Bohr bagi suatu atom.

(5 marks)

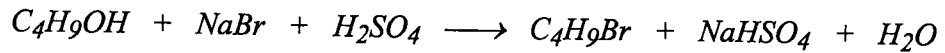
2. (a) The reaction of 15.0 g C_4H_9OH , 22.4 g NaBr and 32.7 g H_2SO_4 yields 17.1 g C_4H_9Br according to the equation below :



What are the theoretical yield, actual yield and percent yield of this reaction?

...3/-

Tindak balas 15.0 g C_4H_9OH , 22.4 g $NaBr$ dan 32.7 g H_2SO_4 menghasilkan 17.1 g C_4H_9Br mengikut persamaan di bawah :



Apakah hasil secara teori, hasil sebenar dan peratus hasil bagi tindak balas ini?

(4 marks)

- (b) How many mL of 0.650 M K_2CrO_4 are needed to precipitate all the silver in 415 mL of 0.186 M $AgNO_3$ as $Ag_2CrO_4(s)$?

Berapa mL larutan 0.650 M K_2CrO_4 diperlukan untuk memendakkan kesemua argentum dalam 0.186 M $AgNO_3$ sebagai $Ag_2CrO_4(p)$?

(4 marks)

- (c) What volume of 0.248 M calcium chloride solutions must be added to 335 mL of 0.186 M potassium chloride solution to produce a solution with a concentration of 0.250 M chloride? Assume that the solution volumes are additive.

Berapakah isipadu larutan 0.248 M kalsium klorida yang perlu ditambah kepada 335 mL 0.186 M larutan kalium klorida untuk menghasilkan suatu larutan yang mempunyai kepekatan 0.250 M klorida? Anggapkan semua larutan adalah tertambahkan.

(6 marks)

- (d) A dye has a percent composition by mass of 73.27% C, 3.48% H, 10.68% N and the remainder is oxygen. The molar mass is 263.3 g mol^{-1} . Calculate the molecular formula of the dye.

Suatu pewarna mempunyai peratus komposisi mengikut jisim 73.27% C, 3.84% H, 10.68% N dan selebihnya adalah oksigen. Nilai jisim molar ialah 263.3 g mol^{-1} . Kira formula molekul pewarna ini.

(6 marks)

3. Explain the following :

- (a) Heisenberg Uncertainty Principle
- (b) Pauli Exclusion Principle
- (c) Hund's Rule
- (d) The shielding of electrons by orbitals

Huraikan yang berikut :

- (a) *Prinsip Ketakpastian Heisenberg*
- (b) *Prinsip Penyingkiran Pauli*
- (c) *Hukum Hund*
- (d) *Perlindungan elektron oleh orbital*

(20 marks)

4. (a) Draw the Lewis structure for the following :

- (i) CO_3^{2-} ion
- (ii) CO_2

Lukiskan struktur Lewis untuk yang berikut :

- (i) *Ion CO_3^{2-}*
- (ii) *CO_2*

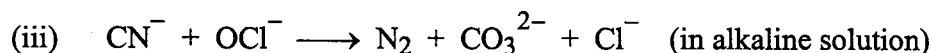
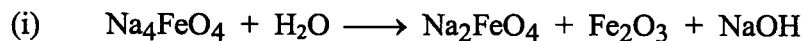
(10 marks)

(b) By giving suitable examples, explain the concept of hybridisation of orbital.

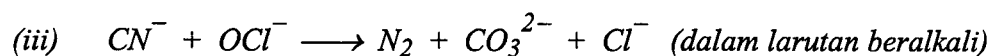
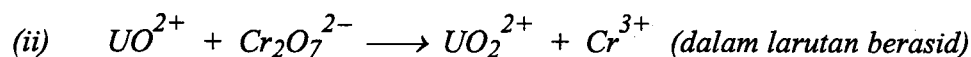
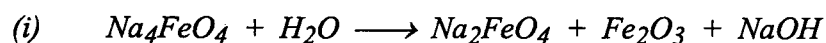
Jelaskan konsep penghibridan orbital. Anda dikehendaki memberikan contoh-contoh yang sesuai.

(10 marks)

5. (a) Balance the following chemical equations. The complete steps must be shown.



Imbangkan persamaan-persamaan kimia yang berikut. Langkah-langkah yang lengkap mestilah ditunjukkan.



(12 marks)

- (b) A 1.65 g sample of aluminium powder reacts with excess hydrogen chloride and the liberated hydrogen gas is collected at 25°C and 744 mmHg.

Write a balanced chemical equation for this reaction. What volume of hydrogen is collected?

Suatu sampel 1.65 g serbuk aluminium bertindak balas dengan hidrogen klorida berlebihan dan gas hidrogen yang terhasil dikutip pada 25°C dan 744 mmHg.

Tuliskan persamaan kimia yang seimbang untuk tindak balas ini. Berapakah isipadu hidrogen yang dikumpulkan?

(8 marks)

6. (a) Arrange the following compounds :

NaF, CsI and CaO.

in order of increasing lattice energy.

Susun sebatian berikut :

NaF, CsI dan CaO.

mengikut tenaga kekisi yang meningkat.

(5 marks)

- (b) Which substance would you expect to have the greatest lattice energy. Explain.

- (i) AgCl
- (ii) CuO
- (iii) CrN

Sebatian manakah di antara yang berikut dijangka mempunyai tenaga kekisi yang paling besar. Jelaskan.

- (i) AgCl
- (ii) CuO
- (iii) CrN

(5 marks)

(c)

Atom/Ion	Radii/Å
Ca	1.74
Ca ²⁺	0.99
Zn	1.31
Zn ²⁺	0.74

<i>Atom/Ion</i>	<i>Jejari/Å</i>
<i>Ca</i>	<i>1.74</i>
<i>Ca²⁺</i>	<i>0.99</i>
<i>Zn</i>	<i>1.31</i>
<i>Zn²⁺</i>	<i>0.74</i>

- (i) Explain why the ionic radius in each case is smaller than the atomic radius.

Jelaskan mengapa di dalam kes-kes di atas, nilai jejari ionik lebih kecil dari jejari atom.

(3 marks)

- (ii) Why the atomic radius of Ca is larger than that of zinc.

Mengapa jejari atom Ca lebih besar dari zink.

(3 marks)

- (iii) Suggest why the difference in the ionic radii is much less than the difference in the atomic radii.

Cadangkan mengapa perbezaan jejari ion adalah lebih kecil jika dibandingkan dengan perbezaan jejari atom.

(4 marks)

List of Constants and Relative Atomic Masses

Senarai Jisim Atom Relatif dan Pemalar

Ag	=	107.8	I	=	126.9
Al	=	27.0	K	=	39.1
B	=	10.8	Li	=	6.9
Ba	=	137.3	Mg	=	24.3
Be	=	9.0	Mn	=	54.9
Br	=	80.0	N	=	14.0
C	=	12.0	Na	=	23.0
Ca	=	40.1	O	=	16.0
Cl	=	35.5	P	=	31.0
Cr	=	52.0	Pb	=	207.2
Cu	=	63.5	S	=	32.0
F	=	19.0	Sb	=	121.8
Fe	=	55.8	Si	=	28.1
H	=	1.01	Xe	=	131.3
He	=	4.0	Zn	=	65.4
Hg	=	200.6			

$$R = 0.08206 \text{ l atm mol}^{-1} \text{ K}^{-1} \text{ or } 8.3144 \text{ J mol}^{-1} \text{ K}^{-1}$$

$$e = 1.602 \text{ C}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$h = 6.626 \times 10^{-34} \text{ Js (or kg m}^2 \text{ s}^{-1}\text{)}$$

$$R_H = 1.10 \times 10^5 \text{ cm}^{-1}$$

$$a_0 = 0.529 \text{ \AA}$$

$$c = 3.00 \times 10^8 \text{ ms}^{-1}$$