
UNIVERSITI SAINS MALAYSIA

Final Examination
2015/2016 Academic Session

May/June 2016

JIK 225 – Inorganic Chemistry I
[Kimia Takorganik I]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains **TEN** 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 question is worth 20 marks and the mark for each sub question is given at the end of that question.

In the event of any discrepancies in the exam questions, the English version shall be used.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEPULUH** 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.

Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

1. (a) Explain the reactivity of alkali metals towards water.
Terangkan kereaktifan logam alkali terhadap air.
(5 marks/markah)
- (b) How does alkali metals react with halogens?
Bagaimanakah logam alkali bertindak balas dengan halogen?
(5 marks/markah)
- (c) Why do the the alkali metals give blue solution, when reacted with liquid NH_3 ?
Mengapakah logam alkali menghasilkan larutan berwarna biru, apabila bertindak balas dengan cecair NH_3 ?
(6 marks/markah)
- (d) What are *s*-block elements? Write the general electronic configuration of *s*-block elements.
Apakah unsur-unsur blok-s? Tuliskan konfigurasi elektronik umum unsur-unsur blok-s.
(4 marks/markah)
2. (a) Name the hydrides categories.
Namakan kategori hidrida.
(3 marks/markah)
- (b) Complete the following chemical reactions.
Lengkapkan tindak balas kimia berikut.
- (i) $\text{PbS}_{(s)} + \text{H}_2\text{O}_2_{(aq)} \rightarrow$
- (ii) $\text{MnO}_4^- + \text{H}_2\text{O}_2_{(aq)} \rightarrow$
- (iii) $\text{CaO} + \text{H}_2\text{O}_{(g)} \rightarrow$
- (iv) $\text{AlCl}_3 + \text{H}_2\text{O}_{(l)} \rightarrow$
- (v) $\text{Ca}_3\text{N}_2 + \text{H}_2\text{O}_{(l)} \rightarrow$

Classify the above equation(s) either as (a) hydrolysis, (b) redox or (c) hydration reactions.

Kelaskan persamaan-persamaan di atas sebagai tindak balas (a) hidrolisis, (a) redoks atau (c) penghidratan.

(10 marks/markah)

- (c) When hydrogen is passed over a black solid compound **A**, the products are brown metal **B** and a colourless liquid **C**. The metal **B** displaces silver from silver nitrate and reacts with dilute hydrochloric acid to give hydrogen.

- (i) Name **A**, **B**, and **C**.
 (ii) Give the chemical equation involved.

*Apabila hidrogen disalurkan melalui sebatian pepejal berwarna hitam **A**, produk yang terbentuk adalah logam berwarna coklat **B** dan cecair tidak berwarna **C**. Logam **B** menyesarkan argentum dari argentum nitrat dan bertindak balas dengan asid hidroklorik cair untuk menghasilkan hidrogen.*

- (i) Namakan **A**, **B**, dan **C**.
 (ii) Berikan persamaan kimia yang terlibat.

(4 marks/markah)

- (d) Would you expect the hydrides of N, O and F to have lower boiling points than the hydrides of their subsequent group members? Give reason(s).

Adakah anda menjangkakan hidrida N, O dan F mempunyai takat didih yang lebih rendah daripada ahli-ahli kumpulan hidrida yang berikutnya? Berikan alasan.

(3 marks/markah)

3. (a) Give the resonating structures of NO_2 and N_2O_5 .

Berikan struktur resonans NO_2 dan N_2O_5 .

(5 marks/markah)

- (b) Why does the reactivity of nitrogen differ from phosphorus?

Mengapakah kereaktifan nitrogen berbeza daripada fosforus?

(6 marks/markah)

- (c) Illustrate how copper metal can give different products on reaction with :

(i) Concentrated HNO_3

(ii) Dilute HNO_3

Ilustrasikan bagaimana logam kuprum boleh memberi produk yang berbeza apabila bertindak balas dengan:

(i) HNO_3 pekat

(ii) HNO_3 cair

(4 marks/markah)

- (d) What are the oxidation states of S in

Apakah keadaan pengoksidaan S dalam

(i) PbS

(ii) SO_2

(iii) SF_6

(iv) $\text{Na}_2\text{S}_2\text{O}_3$

(v) H_2SO_3

(5 marks/markah)

4. (a) State whether the following oxides are acidic, basic, neutral or amphoteric:
Nyatakan sama ada oksida-oksida berikut berasid, beralkali, neutral atau amfoterik:

- (i) CO_2
- (ii) P_2O_5
- (iii) Al_2O_3
- (iv) MgO
- (v) K_2O

(5 marks/markah)

- (b) Which hydrogen bond would be stronger : $\text{S-H}\cdots\text{O}$ or $\text{O-H}\cdots\text{S}$? Give reason(s).

Ikatan hidrogen yang mana lebih kuat: $\text{S-H} \cdots \text{O}$ atau $\text{O-H} \cdots \text{S}$? Berikan alasan.

(4 marks/markah)

- (c) When a H bond is symbolised as $\text{X-H}\cdots\text{Y}$, what do the solid and dashes lines mean? Which distance is shorter?

Apabila ikatan H dilambangkan sebagai $\text{X-H} \cdots \text{Y}$, apakah maksud garisan berterusan dan garisan putus-putus? Jarak yang mana lebih pendek?

(2 marks/markah)

- (d) Why are Cu, Ag, and Au considered as transition metals?

Mengapakah Cu, Ag, dan Au dianggap sebagai logam peralihan?

(3 marks/markah)

(e) What do you understand by :

- (i) Inert pair effect
- (ii) Allotropy
- (iii) Catenation

Apakah yang anda faham dengan :

- (i) Kesan pasangan lengai*
- (ii) Alotrop*
- (iii) Untaian*

(6 marks/markah)

5. (a) List the elements in Groups 15 and indicate the ones that are :

- (i) diatomic gases
- (ii) nonmetals
- (iii) metalloids
- (iv) metal

Indicate those elements that display the inert pair effect.

List in a table form.

Senaraikan unsur-unsur dalam Kumpulan 15 dan nyatakan yang mana adalah:

- (i) gas dwiatom*
- (ii) bukan logam*
- (iii) metaloid*
- (iv) logam*

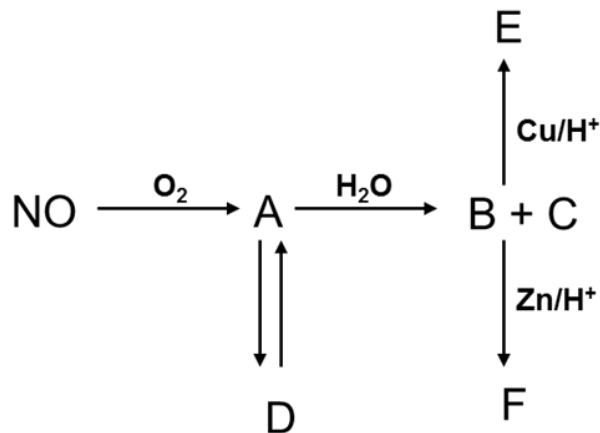
Nyatakan unsur-unsur yang memaparkan kesan pasangan lengai.

Senaraikan dalam bentuk jadual.

(10 marks/markah)

- (b) Identify the nitrogen compounds **A**, **B**, **C**, **D** and **E**. Give the complete reaction for each compound formations.

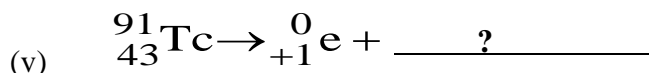
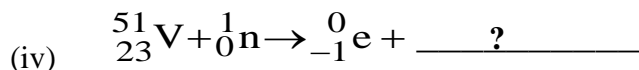
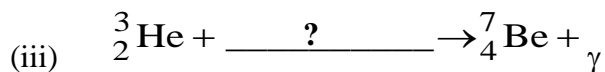
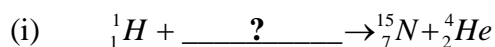
Kenal pasti sebatian nitrogen A, B, C, D dan E. Berikan tindak balas yang lengkap bagi pembentukan setiap sebatian.



(10 marks/markah)

6. (a) Complete and balance each of the following nuclear reactions.

Lengkapkan dan seimbangkan setiap tindak balas nuklear berikut.



(5 marks/markah)

- (b) The isotope $^{137}_{55}\text{Cs}$ undergoes beta emission with a half-life of 30 years.
- (i) Write a balanced nuclear equation for this reaction.
 - (ii) A small fraction of Cs-137 remains in a sample of the isotope after 60 years. What is that fraction?
 - (iii) What mass of Cs will be left in a 24.0 g sample of $^{137}_{55}\text{Cs}$ after 90 years?
 - (iv) What is the fraction of Cs-137 that has decayed after 120 years?

Isotop $^{137}_{55}\text{Cs}$ menjalani pelepasan beta dengan separuh hayat 30 tahun.

- (i) Tulis persamaan nuklear yang seimbang untuk tindak balas ini.*
- (ii) Sebahagian kecil daripada Cs-137 kekal dalam sampel isotop selepas 60 tahun. Berapakah bahagian itu?*
- (iii) Berapakah jisim Cs yang akan tertinggal dalam 24.0 g sampel $^{137}_{55}\text{Cs}$ selepas 90 tahun?*
- (iv) Berapakah bahagian Cs-137 yang telah reput selepas 120 tahun?*

(8 marks/markah)

- (c) What is the half-life of an isotope that is 75% decayed after 16 days?
Apakah separuh hayat satu isotop yang mereput sebanyak 75% selepas 16 hari?

(3 marks/markah)

- (d) What new element is formed when K-40 decays by β -emission? Is the new element formed likely to be stable? Why?
Apakah elemen baru yang akan terbentuk apabila K-40 melalui pereputan oleh pelepasan- β ? Adakah elemen yang terbentuk stabil? Mengapa?

(4 marks/markah)

[APPENDIX JIK 225]

FUNDAMENTAL CONSTANTS

Atomic mass unit	$1 \text{ amu} = 1.66053873 \times 10^{-24} \text{ g}$
	$1 \text{ g} = 6.02214199 \times 10^{23} \text{ amu}$
Avogadro's number	$N_A = 6.02214199 \times 10^{23} \text{ mol}^{-1}$
Boltzmann's constant	$k_b = 1.3806503 \times 10^{-23} \text{ J K}^{-1}$
Electron charge	$e = 1.602176462 \times 10^{-19} \text{ C}$
Faraday's constant	$F = 9.64853415 \times 10^4 \text{ C mol}^{-1}$
Gas constant	$R = 0.082058205 \text{ L atm K}^{-1} \text{ mol}^{-1}$ $= 8.31447 \text{ J K}^{-1} \text{ mol}^{-1}$
Mass of electron	$m_e = 5.485799 \times 10^{-4} \text{ amu}$ $= 9.10938188 \times 10^{-28} \text{ g}$
Mass of neutron	$m_n = 1.0086649 \text{ amu}$ $= 1.67492716 \times 10^{-24} \text{ g}$
Mass of proton	$m_p = 1.0072765 \text{ amu}$ $= 1.67262158 \times 10^{-24} \text{ g}$
Pi	$\pi = 3.1415927$
Planck's constant	$h = 6.62606876 \times 10^{-34} \text{ J s}$
Rydberg Constant	$R_H = 3.28984 \times 10^{15} \text{ s}^{-1} \text{ (Hz)}$
Speed of light	$c = 2.99792458 \times 10^8 \text{ m s}^{-1}$

CONVERSIONS

Energy	$1 \text{ J} = 1 \text{ kg m}^2 \text{ s}^{-2}$
	$1 \text{ J} = 0.2390 \text{ cal}$
	$1 \text{ cal} = 4.184 \text{ J}$
	$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$

IUPAC Periodic Table of the Elements

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