
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2014/2015 Academic Session

December 2014 / January 2015

EBS 209/3 – Mineralogy [Mineralogi]

Duration : 3 hours
[Masa : 3 jam]

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

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEPULUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

This paper consists of SEVEN questions. TWO question in PART A and FIVE questions in PART B.

[Kertas soalan ini mengandungi TUJUH soalan. DUA soalan di BAHAGIAN A dan LIMA soalan di BAHAGIAN B.]

Instruction: Answer FIVE questions. Answer ALL questions from PART A and THREE questions from PART B. If a candidate answers more than five questions only the first five questions answered in the answer script would be examined.

[Arahan: Jawab LIMA soalan. Jawab SEMUA soalan dari BAHAGIAN A dan TIGA soalan dari BAHAGIAN B. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]

The answers to all questions must start on a new page.

[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]

You may answer a question either in Bahasa Malaysia or in English.

[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

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

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

PART A / BAHAGIAN A

1. [a] Calculate the molecular weight (%) of the mineral chalcopyrite (CuFeS_2) and olivine (Mg_2SiO_4) as well as their respective mineral group and class. Also state the name of the cation oxides given below.

Kirakan berat molekul (%) mineral kalkopirit (CuFeS_2) dan olivin (Mg_2SiO_4), termasuk kumpulan mineral dan kelas masing-masing. Nyatakan juga nama-nama oksida kation atau kelas mineral yang diberikan di bawah.

- | | |
|-------------------------------|----------------------------|
| (i) CaO | (iv) Na_2O |
| (ii) TiO_2 | (v) $(\text{PO}_4)^{-3}$ |
| (iii) Al_2O_3 | (vi) S^{-2} |

(30 marks/markah)

- [b] Minerals have distinguishing physical properties, that in most cases can be used for identification (identifying tool). State and describe four (4) such common physical properties. Based on the selected typical physical properties, how can the following minerals be distinguished:

- | | | |
|------------|-------------|---------------|
| (i) Quartz | (ii) Galena | (iii) Calcite |
|------------|-------------|---------------|

Mineral mempunyai sifat-sifat fizikal unik yang dapat membantu dalam pengecaman identitinya (alat pengecaman). Nyatakan dan terangkan empat (4) sifat-sifat fizikal lazim berkenaan. Berdasarkan sifat-sifat fizikal lazim terpilih, bagaimanakah mineral-mineral berikut boleh dikenalpasti:

- | | | |
|------------|-------------|--------------|
| (i) Kuarza | (ii) Galena | (iii) Kalsit |
|------------|-------------|--------------|

(30 marks/markah)

- [c] Define density and specific gravity (S.G.). Explain the main factors that govern specific gravity of minerals?

If a common sulfide mineral, pyrite (FeS_2) has a density of 5.02 g/cm^3 and unit cell edge of 5.42\AA , calculate Z, that is the number of formula units per cell.

Takrifkan ketumpatan dan graviti tentu (S.G.). Terangkan faktor utama yang mengawal ketumpatan tentu sesuatu mineral itu?

Sekiranya mineral sulfida yang lazim iaitu pirit (FeS_2) mempunyai ketumpatan 5.02 g/cm^3 dan sistem sel unit 5.42\AA , kirakan nilai Z, iaitu bilangan unit-unit formula per unit sel.

(40 marks/markah)

2. [a] (i) For the given elements below, state those elements which belong to the native element group of minerals?

Cs, Ba, As, Re, Au, C, B, F, Na, Sb, Fe, S, Cu and Ag

Bagi elemen-elemen yang tersenarai di bawah, nyatakan unsur-unsur yang manakah tergolong dalam kumpulan unsur jati?

Cs, Ba, As, Re, Au, C, B, F, Na, Sb, Fe, S, Cu dan Ag

- (ii) Calculate the empirical formula for the following copper-bearing mineral which has the following weight % composition.

$\text{Cu}^{+2} = 63.3\%$ $\text{S}^{-2} = 25.5\%$, $\text{Fe}^{+3} = 11.2\%$

Kirakan formula empirik bagi mineral kuprum yang mempunyai peratus berat komposisi seperti berikut.

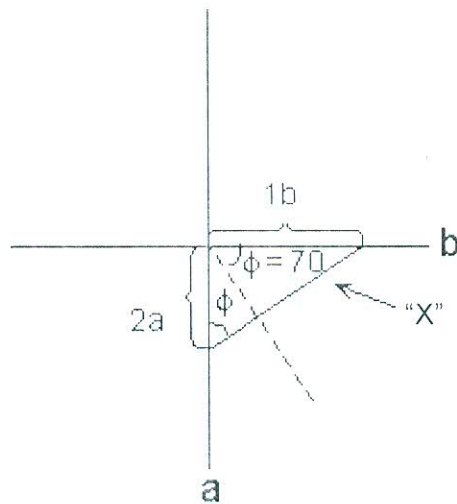
$\text{Cu}^{+2} = 63.3\%$ $\text{S}^{-2} = 25.5\%$, $\text{Fe}^{+3} = 11.2\%$

(40 marks/markah)

...4/-

- [b] Determine what would be the Miller Index assigned to this crystallographic planes and the respective axial ratio between a and b .

Tentukan apakah Indeks Miller bagi satah kristalografi yang ditunjukkan dan nilai nisbah paksi antara a dan b .



(30 marks/markah)

- [c] Describe briefly the main principle of X-ray Fluorescence spectrometer (XRF). Sketch a basic component of an X-ray Fluorescence spectrometer. Also discuss briefly the effect of sample matrix in XRF determination.

Huraikan secara ringkas prinsip utama Pembelauan Sinar-X spektrometer. Lakarkan komponen asas alatan Pembelauan Sinar-X spektrometer dan juga bincangkan secara ringkas pengaruh matriks sampel dalam penentuan XRF itu.

(30 marks/markah)

PART B / BAHAGIAN B

3. [a] What is electro neutrality? Determine and write the electro neutrality components for mineral orthoclase (KAlSi_3O_8) and wollastonite (CaSiO_3).

Apakah itu keneutralan elektro? Tentu dan tuliskan komponen-komponen keneutralan elektro bagi mineral ortoklas (KAlSi_3O_8) dan wollastonit (CaSiO_3).

(30 marks/markah)

- [b] Magnetic minerals result from properties that are specific to a number of elements. Describe the differences between diamagnetic, ferromagnetic and paramagnetic minerals giving appropriate examples.

Mineral-mineral magnetik berpunca daripada sifat-sifat yang khusus kepada beberapa unsur-unsur. Perihalkan perbezaan antara mineral-mineral diamagnetik, feromagnetik dan paramagnetik dengan memberikan contoh-contoh bersesuaian.

(40 marks/markah)

- [c] Define Miller Index in crystallography. Given the following parameters, calculate the Miller Indices.

Takrifkan Indeks Miller dalam kristalografi. Untuk parameter-parameter berikut, kirakan Indeks Miller.

- | | | | |
|------|----------------------------|-------|-----------|
| (i) | a: 2a: b: 3c | (iii) | a: a: 3c |
| (ii) | a: infinity b: infinity: c | (iv) | 2a: b: 5c |

(30 marks/markah)

