LAMPIRAN D3

UNIVERSITI SAINS MALAYSIA

APEX™

PENYEMAKAN KERTAS SOALAN PEPERIKSAAN
Proof-reading of Examination Question Paper

Untuk Kegunaan Seksyen Peperiksaan dan Pengijazahan	
Nombor Sampul	
Tarikh Peperiksaan	
Sesi Peperiksaan	PAGI / PETANG

Gunakan satu proforma untuk satu kertas soalan peperiksaan.
Use separate proforma for each Question Paper

Kepada : Ketua Penolong Pendaftar
Seksyen Peperiksaan dan Pengijazahan

SAYA/KAMI TELAH MENYEMAK SALINAN-SALINAN KERTAS SOALAN PEPERIKSAAN BERTAIP YANG DISEBUTKAN DI BAWAH INI :

I/We have checked the typed copies of the Examination Paper stated below :

Kod Kursus : *EBS 209/3*   Tajuk Kursus : *Mineralogy*
Course Code   *Course Title*   *Mineralogi*

Jangka Masa Peperiksaan : *3* Jam   Bilangan Muka Surat Bertaip : *12* Muka Surat   Bilangan Soalan Yang Perlu Dijawab : *5* Soalan
Duration of Examination *Hours*   *Number of typed pages*   *Pages*   *Number of questions required to be answered*   *Questions*

Soalan-soalan dijawab atas : *Questions to be answered in :* Sila (√) *Please (√)*	BUKU JAWAPAN *Answer Book*	OMR *OMR Form*	JAWAB DALAM KERTAS SOALAN *Answer In Question Paper*
	✓		

DENGAN INI DISAHKAN BAHAWA KERTAS SOALAN PEPERIKSAAN INI ADALAH TERATUR, BETUL DAN SEDIA UNTUK DICETAK.
Certified that this question paper is in order, correct and ready for printing.

Nama Pemeriksa : *Prof. Madya Dr. Khairul Anuar*   Tandatangan : _____   Tarikh : 10/11/2016
Name of Examiner(s)   *Signature*   *Date*
Huruf Besar   *Prof. Madya Dr. Hashim Hussin*   15/11/2016
In Block Capitals   *Dr. Suhaina Ismail*   14/11/2016

Tandatangan dan Cop Rasmi : **PROFESSOR DR. ZUHAILAWATI HUSSAIN**   Tarikh : 21.11.16
DEKAN/PENGARAH   *Date*
Signature and Official Stamp
Dean/Director School of Materials and Mineral Resources Engineering
Engineering Campus
Universiti Sains Malaysia

NOTA : Pemeriksa-pemeriksa yang menyediakan kertas soalan peperiksaan adalah bertanggungjawab atas ketepatan isi kandungan kertas soalan peperiksaan berkenaan.
NOTE : Accuracy of the contents of the question paper is the responsibility of the Examiner(s) who set the question paper.

UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

EBS 209/3 – Mineralogy
[Mineralogi]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains TWELVE printed pages before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi DUA BELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

This paper consists of SEVEN questions. ONE questions from PART A and SIX questions from PART B.
[Kertas soalan ini mengandungi TUJUH soalan. SATU soalan dari BAHAGIAN A dan ENAM soalan dari BAHAGIAN B.]

Instruction: Answer FIVE questions. Answer ALL questions from PART A and FOUR 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 EMPAT 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*

Answer all of the following questions

Jawab kesemua soalan-soalan berikut.

1. [a] If a face of a form on an orthorhombic crystal intersects the a-axis at 33.96 Å , the b-axis at 44.6 Å, and the c axis at 15.41 Å (all measured from the axes intersection or vortex) calculate

Sekiranya suatu muka bagi sebuah bentuk hablur ortorombik menyilang pada paksi a pada 33.96 Å, 44.6 Å pada paksi b, dan 15.41 Å pada paksi c (semuanya diukur dari titik persilangan atau vortek, kirakan

(i) The parameters of the face

parameter-parameter bagi muka tersebut

(ii) The Miller Indices

Indeks Miller

GIVEN: the unit cell dimensions:

DIBERIKAN : *dimensi unit sel*

a = 11.32 Å   b = 22.30 Å   c = 30.82 Å

(40 marks/*markah*)

[b]   (i)   Calculate the weight % of each oxide in the mineral having the formula, $PbMoO_4$, and

Kirakan peratus berat bagi setiap unsur oksida dalam mineral dengan formula $PbMoO_4$.

(ii)   Calculate the formula for the mineral which has the following weight % composition.

Kirakan formula bagi mineral yang mempunyai peratus berat komposisi seperti berikut

$$Ag^{+1} = 65.4\% \quad S^{-2} = 19.4\%, \quad As^{+3} = 15.2\%.$$

Given/*Diberi*

Valance *(Valensi)* $Mo = +6$,

Atomic Weight *(Berat atom)* $Ag = 107.9$, $As = 74.9$, $S = 32.06$

(30 marks/*markah*)

[c]   Both <u>Moh's hardness scale</u> and <u>Tenacity</u> are physical properties of minerals which relatively describe about the physical strength and behavior when subjected to force. Please elaborate such properties and how they are classified?

Kedua-dua <u>skala kekerasan Moh</u> dan <u>kebolehtempaan</u> adalah jenis sifat-sifat fizikal mineral yang secara relatifnya menerangkan kekuatan dan kelakuannya apabila dikenakan daya. Jelaskan sifat-sifat berkenaan dan bagaimana ianya diklasifikasikan ?

(30 marks/*markah*)

PART B / *BAHAGIAN B*

Answer any FOUR of the following questions.

Jawab hanya EMPAT (4) soalan daripada soalan-soalan berikut

2. [a] (i) Write down five (5) common non - silicate/metallic mineral groups with appropriate instants and formula?

   Tuliskan lima (5) kumpulan utama lazim mineral-mineral bukan-silikat/logam dengan contoh-contoh bersesuaian dengan formulanya.

   (ii) 32 possible combinations of symmetry elements define the 32 crystal classes. Write down four basic symmetries of crystals, including those common six crystal system based on symmetrical order?

   32 kombinasi unsur-unsur kesemetrian memungkin hablur digolong/ditakrif kepada 32 kelas. Tuliskan empat asas kesemetrian hablur, termasuk enam sistem hablur berdasarkan jujukan darjah kesemetriannya.

   (30 marks/*markah*)

[b] What is the minimum potential value in kV that is required to excite Cu Kα series radiation from a Cu-target X-ray tube? Given Absorption edge of Cu = 1.380 Å . For forsterite (Mg_2SiO_4) is an orthorhombic with a = 4.75; b = 10.20; c = 5.98 Å.

Atomic weight of Mg=24, Si=28 and O=16. Formula units Z=4 and Avogadro's number is = 6.023 x 10^{23}.

(i) calculate 2θ for the (201) lattice spacing for Cu kα (λ = 1.5405 Å).

(ii) calculate the volume of forsterite in cm^3

(iii) the molecular weight of forsterite in gram/mol

(iv) the density of forsterite in g/cm^3

(v) the specific gravity of forsterite

Apakah nilai minimum keupayan dalam kV yang diperlukan bagi menguja radiasi siri Cu Kα- daripada tiub sinar-x dengan sasaran-Cu.? Diberikan Sisian penyerapan bagi kuprum = 1.380 Å Bagi mineral fosterite (Mg_2SiO_4) sistem ortorombik dengan a = 4.75; b = 10.20; c = 5.98 Å.

Berat atom bagi Mg = 24, Si = 28 and O = 16. Unit formula Z = 4 dan Nombor Avogadro = 6.023 x 10^{23}

(i) *Kirakan sudut 2θ bagi ruang satah kekisi (201) dengan Cu kα (λ = 1.5405 Å).*

(ii) *Kirakan isipadu fosterit dalam cm padu*

(iii) *Berat molekul fosterit dalam g/mol*

(iv) *Ketumpatan fosterit dalam g/cm^3*

(v) *Graviti tentu fosterit*

(70 marks/*markah*)

3. [a] The formula of pyrrhotite is written as $Fe_{1-n}S$. Evaluate n in the following analysis.

Formula kimia pirhotit adalah $Fe_{1-n}S$. Tentukan nilai n dalam analisis berikut

Element *(elemen)*	Fe	Co	Ni	S	Insoluble *(Tak larut)*
Weight *(Berat)%*	57.49	1.50	4.30	35.71	0.33

Determine the formula and identify the minerals represented by the following analysis weight percentage?

Tentukan formula dan kenalpasti mineral yang diwakili oleh keputusan analisis kimia berikut? (peratus berat)

Cu: 63.3%; Fe: 11.1%; S: 25.6%.

(40 marks/*markah*)

[b] Given the following mineral formulas determine the valence (charge and number) of the element labeled "X" in each formula below.

Bagi formula-formula kimia mineral-mineral berikut, tentukan valensi (cas dan nombor) bagi elemen yang dilabelkan 'X'

(i) $Al_6XPO_4(OH)_8.2H_2O$ **Given: P = +5**

(ii) $X_3Al_2Si_6O_{18}$

(iii) $KAlX_3O_8$

(iv) $Mg_3X_2Si_3O_{12}$

(v) $CaAl_2X_2(Al_2Si_2O_{10})$

(30 marks/*markah*)

[c]　Given the following unit cell dimensions in Å (Angstrom), calculate the axial ratios for each of the two minerals (i), and (ii)

Berikut diberikan dimensi sel unit (Angstroms, Å), kirakan nisbah paksi bagi kedua-dua mineral berikut (i) dan (ii).

(i)　a = 5.0,　b = 8.1, c = 14.3　　　(ii)　a = 7.0, b = 4.3, c = 23.1

(30 marks/*markah*)

4.　[a]　Magnetic minerals result from properties that is specific from a number of elements. State and describe main types of magnetism, and its relation to the presence of such elements, and the unit of magnetism

Mineral magnetik berpunca daripada sifat sebilangan elemen/unsur tertentu. Nyata dan terangkan jenis-jenis kemagnetan, dan hubungkaitnya dengan kehadiran unsur-unsur tertentu itu, dan apakah unit pengukurannya.

(30 marks/*markah*)

[b]　Explain how the specific gravity of an aggregate can be measured with a pycnometer. Calculate the density of ferberite ($FeWO_4$), which is monoclinic with axes:

Jelaskan bagaimana graviti spesifik untuk satu agregat dapat diukur

a = 4.73; b = 5.70; c = 4.95; β = 90.01; Z = 2,

where the V = abc sin β (Monoclinic),
Avogadro's number = 6.02 x10^{23}.

(40 marks/*markah*)

[c]   Sketch and illustrate the possible polymerization structures (the silicate class) of the SiO_4 tetrahedra for the following silicate minerals

Lakar dan ilustrasikan struktur polimerisasi (kelas silikat) tetrahedral SiO₄ yang mungkin bagi mineral silikat bagi mineral-mineral silikat berikut.

(a) Feldspar ($NaAlSi_3O_8$)
(b) Olivin ($(Mg,Fe)_2SiO_4$)
(c) Quartz (SiO_2)

(30 marks/*markah*)

5.   [a]   Define density and specific gravity. Calculate the specific gravity of a mineral with the following given information

Composition: $BeO = 19.8\%$; $Al_2O_3 = 80.2\%$ $Z = 4$

Axial dimensions of unit cell: $a = 5.47\ Å$ $b = 9.39\ Å$ $c = 4.42\ Å$

Takrifkan ketumpatan dan graviti tentu. Kira graviti tentu bagi mineral dengan maklumat yang diberikan:

Kandungan: BeO = 19.8%; Al₂O₃ = 80.2%   Z = 4

Dimensi paksi unit sel : a = 5.47 Å   b = 9.39 Å   c = 4.42 Å

Atomic weight/ *Berat atom*: Be:9.01, Al: 26.98

(30 marks/*markah*)

[b]   For the following mineral, calculate the weight percent of the oxides

Untuk mineral berikut, kirakan peratus berat oksida - oksida

(i)   Kyanite: Al_2SiO_5 (SiO_2 & Al_2O_3)
       Kyanit : Al_2SiO_5 (SiO_2 & Al_2O_3)

(ii)   Zircon: $ZrSiO_2$ (ZrO & SiO_2)
       Zirkon : $ZrSiO_2$ (ZrO & SiO_2)

(iii) Wolastonite: $CaSiO_3$ (CaO & SiO_2)
       Wolastonit : $CaSiO_3$ (CaO & SiO_2)

Atomic weight/*Berat atom*: Al: 26.98, Si: 28.09, Zr: 91.22, Ca: 40.08

(30 marks/*markah*)

[c]   Consider a pyroxene solid solution of 40% Jadeite ($NaAlSi_2O_6$) and 60% Aegirine ($NaFe_3Si_2O_6$). Calculate the weight percent oxides. Formula is $Na(Al_{0.4}Fe_{0.6})Si_2O_6$.

Pertimbangkan 'larutan pepejal' piroksin berkandungan 40% Jadeite ($NaAlSi_2O_6$) dan 60% Aegirin ($NaFe_3Si_2O_6$). Kira peratus berat oksida - Formula adalah Na ($Al_{0.4}Fe_{0.6}$) Si_2O_6

Oxide/*Oksida*: SiO_2 ; Al_2O_3 ; Fe_2O_3 ; Na_2O

(40 marks/*markah*)

6. [a] Physically, mineral can be identified or distinguished based on the appearance <u>colors</u> and <u>streak</u> properties. Please elaborate advantages and disadvantages of both properties, including the techniques in "streak color" determination?

Secara fizikal, mineral boleh dikenalpasti atau dibezakan berdasarkan kepada ciri-ciri perbezaan <u>warna</u> luaran dan <u>goresan, Sila jelaskan kebaikan dan kelemahan kedua-dua sifat berkenaan,</u> termasuk kaedah penentuan dengan teknik "warna goresan"

(30 marks/*markah*)

[b] Briefly describe the following
(Secara ringkas perihal perkara-perkara berikut)

    (i)   Mineral cleavage
        (Ira mineral)

    (ii)   Parting and Fracture
        (Ira mineral)

    (iii)   Tenacity and it types
        (Kekukuhan dan jenis-jenisnya)

(30 marks/*markah*)

[c] On what basis mineral are classified? Normally group into silicate and non-silicate minerals group. Please state or list down those groups with appropriate/common mineral instance?

Pada dasar apakah mineral diklasifikasikan? Lazimnya tergolong kepada kumpulan silikat dan bukan-silikat, Sila nama atau nyatakan kumpulan mineral-mineral berkenaan dengan contoh-contoh bersesuaian?

(40 marks/*markah*)

7.   [a]   The diffraction pattern of copper ore was measured with X-ray radiation of wavelength of 1.315 Å. The first order Bragg diffraction peak was found at a 2θ angle of 50.5 °. Calculate the d-spacing between the diffracting planes in the copper ore.

Corak pembelauan bijih tembaga diukur dengan sinar X dengan panjang gelombang 1.315 Å. Turutan pertama pembelauan puncak Bragg ditemui pada sudut 2θ sebanyak 50.5 °. Kira jarak-d antara satah pembelauan dalam bijih tembaga.

(30 marks/*markah*)

[b]   Mo Kα (λ= 0.71073 Å) and Cu Kα (λ= 1.54178 Å) most common laboratory X-ray sources. What influence does wavelength λ have on diffraction pattern? Explain why is Mo not the preferred X-ray source?

Mo Kα (λ = 0.71073 Å) dan Cu Kα (λ = 1.54178 Å) merupakan sumber sinar X yang paling biasa digunakan di makmal. Apakah pengaruh panjang gelombang, (λ) pada corak pembelauan? Terangkan kenapa Mo tidak menjadi sumber X-ray pilihan?

(20 marks/*markah*)

[c]   X-rays of = 0.1537 nm from a Cu target are diffracted from the (111) planes of an FCC metal. The Bragg angle is 19.2°. Calculate the Avogadro number if the density of the crystal is 2698 kg/m³ and the atomic weight 26.98.

Sinar X, dengan panjang gelombang 0.1537 nm dari sasaran Cu telah dibelaukan dari satah (111) daripada logam FCC. Sudut Bragg ialah 19.2°. Kira nombor Avogadro jika ketumpatan kristal adalah 2698 kg/m³ dan berat atom 26.98.

(40 marks/*markah*)

...12/-

[d]   Determine the d-spacing between the adjacent Miller planes if the first order reflection from X-rays of wavelength 2.29 occurs at 27°

Tentukan jarak d antara satah Miller jika aturan pertama dari pembelauan sinar X pada panjang gelombang 2.29 berlaku pada 27°

(10 marks/*markah*)

- oooOooo -