
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
Academic Session 2007/2008

April 2008

EBS 242/3 - Petrography & Ore Microscopy **[Petrografi & Mikroskopi Bijih]**

Duration : 3 hours
[Masa : 3 jam]

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

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

This paper contains SEVEN questions. TWO questions 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.]

Instructions: 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 in the answer sheet will be graded.

[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.]

Answer to any question must start on a new page.

[Mulakan jawapan anda untuk setiap 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.]

PART B**BAHAGIAN B**

Please answer any three (3) of the following questions in this section.

Sila jawab mana-mana tiga (3) soalan berikut.

3. Please answer any two (2) of the following questions.

- (a) Write down the recommended procedures for the preparation of "polished section" samples for ore microscopy analyses.
- (b) Genetically, metamorphic rocks are classified into a few main classes or categories. Please state and describe these classes with appropriate (rock types) examples.
- (c) What determines the retardation of mineral crystal and its governing factors? Please determine the birefringence of mineral augite with R.I. values for $n_s = 1.724$ and $n_f = 1.700$ respectively for standard thin section.

Sila jawab mana-mana dua (2) soalan berikut.

- (a) *Tuliskan tatacara yang lazim disyorkan dalam penyediaan spesimen "keratan bergilap" untuk analisis mikroskopi bijih.*
- (b) *Secara genetik, batuan metamorf telah dikelaskan kepada beberapa kategori utama. Sila nyata dan terangkan kelas-kelas ini beserta dengan contoh-contoh bersesuaian.*
- (c) *Apakah yang menentukan nilai pembantutan hablur mineral dan faktor kebergantungannya? Sila tentukan nilai dwibalikan mineral augit yang mempunyai I.B. masing-masing $n_s = 1.724$ dan $n_f = 1.700$ untuk keratan nipis piawai.*

(20 marks/markah)

4. Please answer any two (2) of the following questions.

- (a) There are numerous ways of estimating hardness in polished surface. How do you estimate and relatively determine this property?
- (b) The anisotropy shown by non-cubic crystals in their physical properties can also be shown by their absorption - this phenomenon is called pleochroism and is a useful distinguishing property. Define and how such property is determined under polarizing microscope?
- (c) Briefly define or describe the following:
 - (i) Porphyritic and Aphanitic textures (igneous rock)
 - (ii) Metasomatism and neomineralization

Sila jawab mana-mana dua (2) soalan berikut.

- (a) *Terdapat pelbagai pendekatan dalam menganggar kekerasan mineral pada keratan bergilap. Bagaimana anda menganggar dan menentukan sifat ini secara relatif.*
- (b) *Ketakisotropian yang ditunjukkan oleh hablur-hablur mineral bukan kubus dalam sifat fiziknya juga boleh ditunjukkan oleh keboleherapannya – fenomena ini dipanggil “pleokroisma” dan merupakan sifat pengecaman penting. Takrifkan dan bagaimana sifat ini ditentukan di bawah mikroskop pengutub?*
- (c) *Secara ringkas berikan tarikan atau keterangan mengenai perkara berikut:*
 - (i) *Tekstur porforitik dan Aphanitik*
 - (ii) *Metasomatisma dan neo permineralan*

(20 marks/markah)

5. Please answer any two (2) of the following questions.

- (a) Defines extinction. State various types of extinctions which are having direct relationship to crystal system they are belong to.
- (b) Briefly define or describe the following:
 - (i) Anisotropy and Polarization colour (ore microscopy)
 - (ii) Isotropic and anisotropic minerals (mineralogy optic)
 - (iii) Privilege direction and how to determine (mineralogy optic)
- (c) "Texture" which describe about the fabric and grain size nature of igneous rocks is an important criteria in naming these rocks. Please define or briefly describe the following "textures" that typify igneous rocks.
 - (i) Holocrystalline and hypocrytalline
 - (ii) Phenocrystalline and aphanitic
 - (iii) Crystal shapes

Sila jawab mana-mana dua (2) soalan berikut.

- (a) *Takrifkan pepadaman. Nyatakan jenis-jenis pepadaman yang mempunyai kaitan langsung dengan sistem hablur kepunyaannya.*
- (b) *Secara ringkas takrif dan terangkan perkara-perkara berikut:*
 - (i) *Anisotropi dan warna pengutuban (mikroskopi bijih)*
 - (ii) *Mineral-mineral isotrop dan tak isotrop (mineralogi optik)*
 - (iii) *Arah istimewa pengutub dan cara penentuan (mineralogi optik)*
- (c) *"Tekstur" yang menjelaskan mengenai tabii fabrik dan saiz butiran yang terdapat pada batuan igneous adalah keteria penting dalam penamaan batuan ini. Takrif atau secara ringkas terangkan pengertian "tekstur" yang mencirikan batuan igneous.*
 - (i) *Holokristalin dan hipokristalin*
 - (ii) *Fenokristalin dan aphanitik*
 - (iii) *Bentuk-bentuk hablur*

(20 marks/markah)

6. Answer any two (2) of the following questions.

- (a) Minerals in metamorphic rocks have crystallized from other minerals rather than from melts and need not be stable to such high temperatures. Please discuss the concept of "geobarometry" and "geothermometry" in metamorphic rocks.
- (b) Discuss the concept of "bedding" and "lamination" structures in sedimentary rocks. What are the differences and similarities between clastic and non-clastic sedimentary rocks?
- (c) Pyroclastic rocks are classified based on mixtures of size classes. Please construct or plot the classification diagram for these categories of rocks as illustrated by Fisher, 1966.

Sila jawab mana-mana dua (2) soalan berikut.

- (a) *Mineral-mineral metamorf adalah terhablur daripada mineral lain yang sedia wujud selain daripada leburan dan tidak perlu stabil pada suhu yang sedemikian tinggi. Sila bincangkan konsep "geobarometri" dan "geotermometer" bagi batuan metamorf.*
- (b) *Bincangkan konsep struktur "perlapisan" dan "laminasi" batuan sediment. Apakah perbezaan dan persamaan antara batuan klastik dan bukan klastik?*
- (c) *Batuan piroklastik dikelaskan berdasarkan kepada percampuran kelas-kelas saiz partikel yang membentuknya. Sila lukis atau plotkan gambarajah pengelasan kategori batuan ini menurut Fisher, 1966?*

(20 marks/markah)

7. Answer all the following questions.

- (a) What "unpolarized" and "polarized" lights are?
- (b) Relief (in optical mineralogy).
- (c) States the optical properties between the two pair of the following mineral:
 - (i) Biotite and Tourmaline (silicate minerals)
 - (ii) Pyrite and Covellite (metallic mineral)

Sila jawab semua soalan berikut.

- (a) Apakah itu cahaya "tak terkutub" dan "terkutub"?*
- (b) Jasad timbul (dalam mineralogi optik)*
- (c) Nyatakan sifat-sifat optik bagi pasangan-pasangan mineral berikut:*
 - (i) Biotik dan Turmalin (mineral silikat)*
 - (ii) Pirit dan Kovelit (mineral logam)*

(20 marks/markah)