

NATIONAL EXAMINATIONS – May 2018

09-Mmp-A1 General Geology and Exploration

3 hours duration

NOTES:

- A. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
- B. This is a CLOSED BOOK EXAM. Candidates may use one of two calculators, the Casio or Sharp approved models.
- C. FIVE (5) questions constitute a complete exam paper. YOU MUST ANSWER QUESTIONS 1 TO 4. Candidates must choose one more question from any of the remaining questions. Where stated in the examination, please hand in any additional pages with your exam booklet.
- D. The first of any of Questions 5 to 7 as it appears in the answer book will be marked, unless the candidate clearly indicates that another question should be substituted for a specified question that was answered previously.
- E. Each question is of equal value. The marks assigned to the subdivisions of each question are shown for information. The total marks for the exam is 100.

***** IMPORTANT: YOU MUST ANSWER QUESTIONS 1, 2, 3, and 4 *****

1. Consider the following 5 ore minerals:

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|--------------------|-----------------|
| (i) covellite | (iv) pyrrhotite |
| (ii) sphalerite | (v) pyrolusite |
| (iii) arsenopyrite | |

- a) For each ore mineral listed above, state its most common (typical) colour, as seen in a hand specimen. *{5 marks}*
- b) For each ore mineral listed above, state the element of the Periodic Table for which it is a major ore mineral. *{5 marks}*
- c) For each ore mineral listed above, state one diagnostic physical property which may be used to identify the mineral in a hand specimen. *{5 marks}*
- d) Excluding any of the ore minerals listed above, state an ore mineral for each of the following elements: *{5 marks}*

- | | |
|----------|---------|
| (i) Ni | (iv) Sn |
| (ii) Cr | (v) U |
| (iii) Cu | |

2.

a) Ore deposits can be hosted in a variety of rock types. Define the following rock types and state one kind of ore or ore deposit that can be typically found in each. {15 marks}

(i) shale

(ii) sandstone

(iii) kimberlite

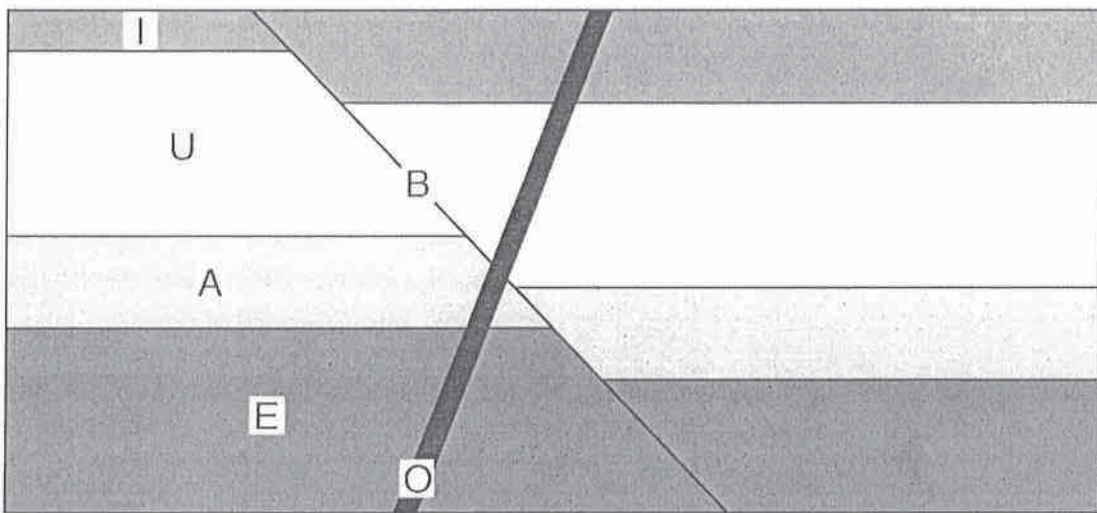
(iv) pegmatite

(v) norite

b) Placers are another source of ore. Define what a placer deposit is, how it forms, and list 5 ore minerals that are commonly found in placer settings. {5 marks}

3. Structural geology plays an important role in controlling the formation of ore deposits.

- a) With the aid of sketches, illustrate and define an anticline and a syncline. {4 marks}
- b) Consider the schematic geological cross-section in the diagram below. The rock units are labelled A, E, I, O and U and there is a geologic structure labelled B.



- (i) Name the geologic structure B. {2 marks}
- (ii) Name the geologic feature represented by the rock unit O. {2 marks}
- (iii) Briefly describe the geologic history recorded in the cross-section, clearly indicating the sequence of events from oldest to youngest. {6 marks}
- c) Define what a joint is in a geological context, and explain how joints can play a major role in controlling the formation of ore deposits. {6 marks}

4.

- (a) In terms of magmatic ore deposits, there are three main ways of concentrating ore minerals. Describe each of these ways and give an example of an ore deposit that can be formed in this way. {10 marks}
- (b) Ore deposits can be hosted in a variety of rock types. For each type of deposit listed below, state whether it is considered to be plutonic-related, volcanic-related, sedimentary-hosted, metamorphic-host, or vein-hosted. {10 marks}
- | | |
|------------------------------------|-----------------------------------------|
| (i) banded iron formation | (vi) lode gold deposits |
| (ii) iron-oxide-copper-gold (IOCG) | (vii) porphyry copper deposits |
| (iii) kimberlites | (viii) Mississippi Valley Type deposits |
| (iv) Kuroko ore deposits | (ix) skarns |
| (v) copper red beds | (x) layered mafic intrusions |

***** IMPORTANT: COMPLETE ONLY ONE MORE QUESTION ***
FROM QUESTIONS 5, 6, OR 7**

5.

- a) Briefly describe the five main methods of geophysical surveying. For each, state the physical property that is being measured. *{10 marks}*
- b) For each of the following ore deposits below, state which geophysical method would be the best one to use in order to detect it. *{5 marks}*
- (i) pyrrhotite massive sulphide in a layered mafic complex
 - (ii) buried stream channel containing placer gold
 - (iii) disseminated Pb and Zn in carbonate rocks
 - (iv) oil traps in a sedimentary basin
 - (v) uranium ore in a conglomerate
- c) For each of the five geophysical methods, state one complicating factor inherent to the natural environment which may affect the results. *{5 marks}*

6. Geochemical surveys in the surficial environment depend on sampling appropriate materials. Describe five different materials that can be sampled and state how this material may be useful in a geochemical survey. {20 marks}

7.

- a) Explain when drilling is usually employed in the life of a mineral-exploration program, and outline 3 main reasons for drilling. {7 marks}

- b) Describe the two main types of drilling employed in mineral exploration and outline the major differences. {7 marks}

- c) Briefly explain how drill data are typically interpreted. {6 marks}