

## **NATIONAL EXAMINATIONS – May 2015**

### **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:

- |                  |                 |              |
|------------------|-----------------|--------------|
| (i) galena       | (iii) scheelite | (v) ilmenite |
| (ii) cassiterite | (iv) sphalerite |              |

- a) For each ore mineral listed above, state its most common crystal form, as would be 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 unambiguously 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) aluminum (Al) | (iii) arsenic (As)  | (v) lithium (Li) |
| (ii) barium (Ba)  | (iv) manganese (Mn) |                  |

2. Ores can be classified into a variety of deposit types on the basis of ore genesis. For each genetic category below, briefly describe how such deposits form and list a deposit type that is characteristic of that category. {20 marks}

- (i) magmatic deposits
- (ii) pegmatitic deposits
- (iii) magmatic-hydrothermal deposits
- (iv) supergene deposits
- (v) allochthonous sedimentary deposits
- (vi) autochthonous sedimentary deposits
- (vii) diagenetic-hydrothermal deposits
- (viii) metamorphosed deposits

**3.**

- a) Concordant ore bodies can be hosted in a variety of rock types. Briefly discuss the various types of concordant ore bodies that can be found in sedimentary rocks and give a specific example of each. {15 marks}
- b) Explain the difference between stratiform and stratabound, and give a specific example of an ore deposit as an illustration. {5 marks}

4. Ores can form in a variety of geological environments resulting from a variety of processes. Briefly describe the genetic geological processes and environments in which the following types of ore deposits may be formed. {20 marks}
- (i) banded iron formation
  - (ii) sedimentary exhalative (SEDEX) deposits
  - (iii) lode gold deposits
  - (iv) porphyry copper deposits
  - (v) phosphorite deposits

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

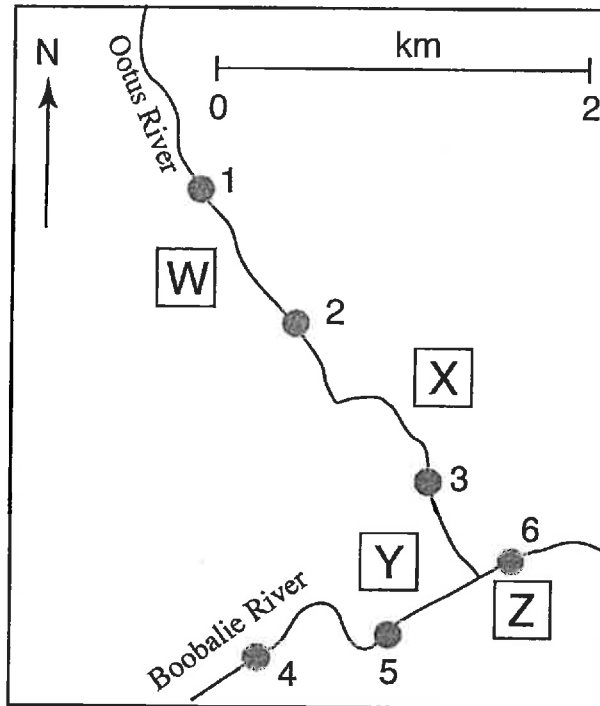
5. Many different geophysical surveying techniques can be used to find and delineate ore bodies.
- a) Briefly describe the five main methods of geophysical surveying. For each, state the physical property that is being measured. {10 marks}
- b) For each of the following ore deposits below, state which geophysical method would be the best one to use in order to detect it. {5 marks}
- (i) Mississippi-Valley-type deposit
  - (ii) banded iron formation
  - (iii) disseminated Au in metasediments
  - (iv) salt deposits in a sedimentary basin
  - (v) kimberlitic diamonds
- 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.

a) The design of an effective geochemical survey in the surficial environment depends on careful consideration of 5 important parameters. State what these parameters are and explain why they are relevant. {10 marks}

b) Consider the following map, showing two rivers – the Ootus and Boobalie Rivers, and six geochemical sampling stations (grey circles labelled 1 to 6).

The Ootus River flows towards the northwest and the Boobalie River flows towards the southwest.



- i) If a gold deposit was located at Y, indicate for each of the 6 stations whether the gold content of a stream-sediment sample would be zero, low, moderate or high, and briefly give reasons. {8 marks}
- ii) What should the optimum spacing be for a geochemical stream survey? Are the geochemical stations shown on the map at the optimum spacing? {2 marks}

7. Various kinds of methods for drilling boreholes have been developed for sampling different kinds of materials.
  - a) Briefly describe the various factors which must be taken into account when choosing a particular drilling method. *{10 marks}*
  - b) Rotary (or direct) drilling is a commonly used sampling method. Briefly describe the method, the conditions under which it is most effectively used, as well as its advantages and disadvantages. *{10 marks}*