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
(ii) cassiterite
(iii) scheelite
(iv) sphalerite
(v) ilmenite

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)
(ii) barium (Ba)
(iii) arsenic (As)
(iv) manganese (Mn)
(v) lithium (Li)

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

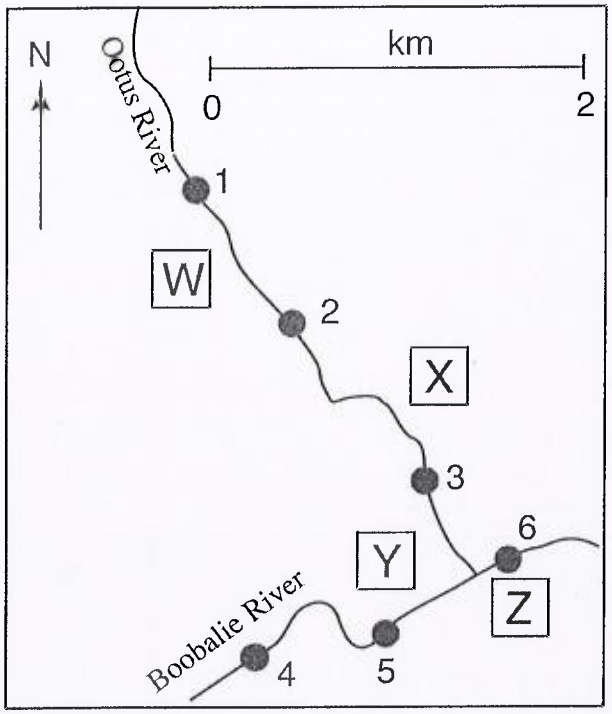
c) For each of the five geophysical methods, state one complicating factor inherent to the natural environment which may affect the results. {*5 marks*}

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 <u>each</u> 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*}