

## NATIONAL EXAMINATIONS – May 2013

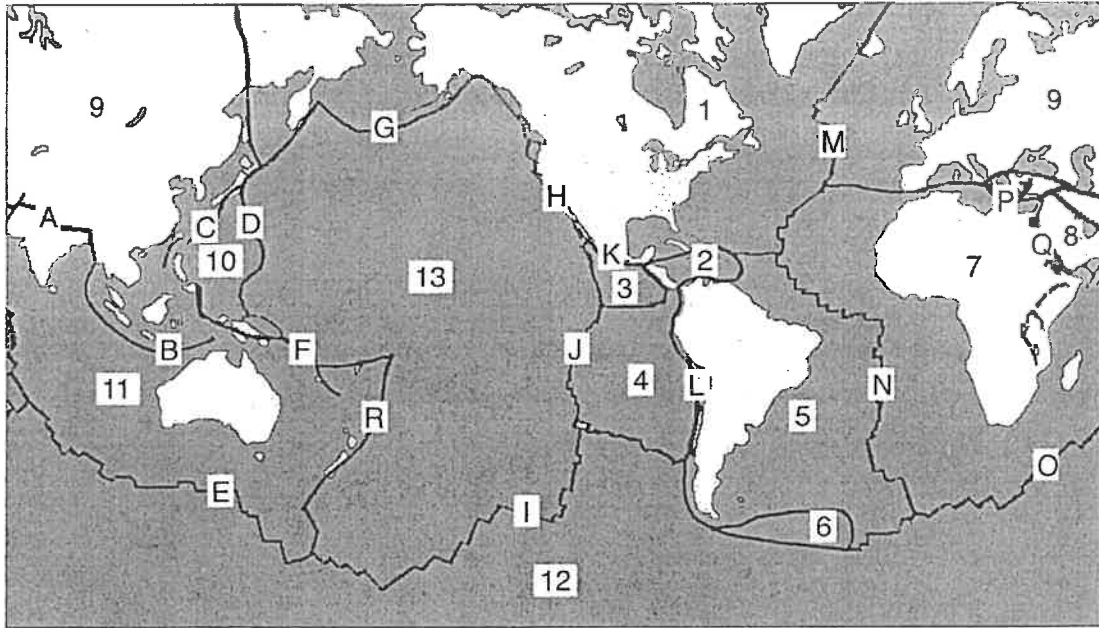
### 04-BS-14 Geology

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 number of marks for the exam is 100.





2.

a) For each mineral listed below, state the best descriptor of the requested physical property. {5 marks}

- |                         |                                  |
|-------------------------|----------------------------------|
| (i) gypsum - hardness   | (iv) potassium feldspar - colour |
| (ii) galena - cleavage  | (v) garnet - luster              |
| (iii) hematite – streak |                                  |

b) For each mineral listed below, state to which mineral group it belongs (i.e. silicate, sulfate, sulfide, oxide, carbonate, halide, hydroxide, phosphate, or a native element). {5 marks}

- |                |              |             |
|----------------|--------------|-------------|
| (i) diamond    | (iii) pyrite | (v) apatite |
| (ii) malachite | (iv) sylvite |             |

c) State the most appropriate rock name for the following: {5 marks}

- (i) a dark-coloured, glassy volcanic rock formed when silica-rich lava is quenched quickly
- (ii) a biochemical sedimentary rock consisting of altered plant remains
- (iii) a clastic sedimentary rock which splits into thin layers and consists of mud-sized particles
- (iv) a hard, non-foliated metamorphic rock commonly associated with contact metamorphism
- (v) a foliated metamorphic rock with a glossy sheen consisting mainly of micas

d) State whether the following sedimentary rocks are detrital or chemical. {5 marks}

- |                |              |               |
|----------------|--------------|---------------|
| (i) arkose     | (iii) chert  | (v) rock salt |
| (ii) graywacke | (iv) breccia |               |

3.

a) Briefly define the geologic terms. {10 marks}

- (i) influent stream
- (ii) perched water table
- (iii) drawdown
- (iv) subsidence
- (v) speleothems

b) Calculate the following: {6 marks}

(i) In a particular coastal area, the water table is 2 metres above sea level. Approximately how far below sea level does the fresh water reach?

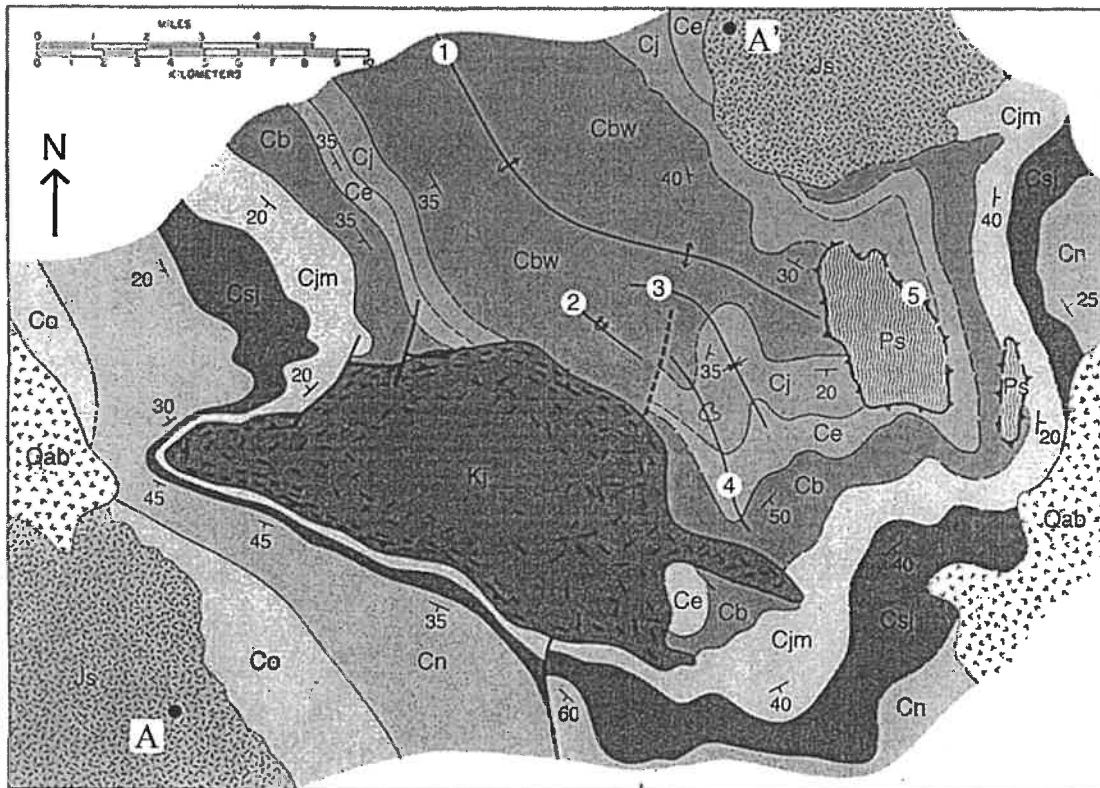
(ii) If Point A is at an elevation of 12 m above sea level and Point B is at an elevation of 58 m above sea level, what is the hydraulic gradient between A and B if both points are on the water table and are separated by a horizontal distance of 360 m?

(iii) The estimated groundwater velocity of an aquifer having an effective porosity of 0.45 from Point X to Y is about  $2.1 \times 10^{-6}$  m/s. If the distance between X and Y is 87 m, the hydraulic conductivity K is  $0.6 \times 10^{-5}$  m/s, and the elevation of Point Y is 28 m above sea level, what is the elevation of Point X?

c) Briefly explain how a heavily pumped well located on one property could result in the contamination of another well located on another nearby property. {4 marks}

4. The geologic map below shows the geologic structure of a region in which there are several different rock formations. The formations are labelled with the following symbols (arranged in alphabetical order) corresponding to the age and rock type of each formation (in brackets):

Cb	= Boobalie Formation	(Cambrian greywacke)
Cbw	= Bigwen Formation	(Cambrian conglomerate)
Ce	= Emilywrx Formation	(Cambrian sandstone)
Cj	= Jennyfur Formation	(Cambrian limestone)
Cjm	= Jillmattsky Formation	(Cambrian shale)
Cn	= Nathanatrix Formation	(Cambrian mudstone)
Co	= Ootie Formation	(Cambrian limestone)
Csj	= Simonjo Formation	(Cambrian chert)
Js	= Sallymander Formation	(Jurassic granodiorite)
Kj	= Jimly Formation	(Cretaceous granite)
Ps	= Sambushmaster Formation	(Proterozoic gneiss)
Qab	= Angela-Bacon Formation	(Quaternary basalt)



- a) With the aid of the geologic map, rearrange the list of formations above, in order from youngest (at the top) to oldest (at the bottom). This is commonly called a "stratigraphic column". {5 marks}
- b) There are five geologic symbols identified on the map by white circles with the numbers 1 to 5. For each number, state the corresponding geologic structure represented by the symbol. Note, for #4, please state the geologic structure as well as what the symbol should look like. {5 marks}
- c) Answer the following questions about the geology of this area. Remember to indicate all answers only in your examination booklet. {4 marks}
- i) What kind of geologic feature is represented by the Jimly and Sallymander Formations?
- ii) Along its western contact, the granite is concordant with the country rock structure. True or False?
- iii) Along the western contact of the granite, the country rock dips moderately towards it. True or False?
- iv) The Sambushmaster Formation was likely derived in-situ, i.e. in place. True or False?
- d) Sketch a geologic cross-section from Point A (black dot labelled A on map) to Point A' (black dot labelled A' on map). Ensure that you label all formations using their corresponding map symbols. {6 marks}

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

5.

- a) Fill in the blanks in the following passage. **Please record your answers in the answer booklet. Do NOT answer on this exam paper. {5 marks}**

Many relatively small glaciers can be found in mountainous areas, where they are known as \_\_\_\_\_ (i) \_\_\_\_\_ glaciers. In contrast to these types of glaciers, \_\_\_\_\_ (ii) \_\_\_\_\_ exist on a much larger scale, covering vast areas of land. In coastal regions, glacial ice can flow out into bays, creating large flat masses of floating ice that still remain attached to land, known as \_\_\_\_\_ (iii) \_\_\_\_\_. Tongues of ice that flow outwards from ice caps are called \_\_\_\_\_ (iv) \_\_\_\_\_. \_\_\_\_\_ (v) \_\_\_\_\_ glaciers occupy broad lowlands at the base of steep mountains, formed when advancing glaciers spread out to form a broad sheet.

- b) Briefly define the following geologic terms. {8 marks}

(i) glacial budget

(iii) col

(ii) rock flour

(iv) valley train

- c) Indicate in your examination booklet whether each statement below is either true (T) or false (F): {5 marks}

(i) 80 percent of the world's ice and nearly two-third of the Earth's fresh water are contained in Greenland's ice sheet

(ii) Glaciers can advance several tens of metres in a day.

(iii) Glacial striations indicate the direction of ice flow.

(iv) Terminal and recessional moraines are two types of end moraines.

(v) Ice-contact stratified drift in the form of a mound is called an esker.

- d) Permafrost is found over a large part of Canada. Explain how a simple act like removing trees may cause problems in permafrost regions. {2 marks}



6.

a) Briefly describe how the nature of runoff resulting from rainfall can evolve with time, defining the following terms as part of your explanation. {9 marks}

(i) sheet flow                      (ii) infiltration capacity      (iii) rill

b) Briefly define the following geologic terms. {6 marks}

(i) alluvial fan                      (ii) delta                              (iii) distributary

c) Fill in the blanks in the following passage. **Please record your answers in the answer booklet. Do NOT answer on this exam paper.** {5 marks}

A cross-section view of a stream from its source area to its mouth as called a \_\_\_\_\_ (i) \_\_\_\_\_. In general, the stream gradient is typically \_\_\_\_\_ (ii) \_\_\_\_\_ near the source than at its mouth. A stream can lengthen its course by a process known as \_\_\_\_\_ (iii) \_\_\_\_\_. This can result in the diversion of the drainage of another stream in a process known as \_\_\_\_\_ (iv) \_\_\_\_\_. When a river valley cuts through a ridge or mountain that lies in its path, this is commonly called a \_\_\_\_\_ (v) \_\_\_\_\_.

7.

a) Briefly define the following geologic terms. {8 marks}

(i) beach drift

(iii) jetty

(ii) baymouth bar

(iv) beach nourishment

b) Fill in the blanks in the following passage. **Please record your answers in the answer booklet. Do NOT answer on this exam paper.** {6 marks}

The \_\_\_\_\_ (i) \_\_\_\_\_ load carried by wind consists of sand grains. Such sand grains skip and bounce along the surface in a process known as \_\_\_\_\_ (ii) \_\_\_\_\_ . On the other hand, fine-grained silt particles commonly make up the \_\_\_\_\_ (iii) \_\_\_\_\_ load carried by wind. Where the prevailing winds are steady, \_\_\_\_\_ (iv) \_\_\_\_\_ dunes form a series of long ridges oriented perpendicular to the prevailing wind direction. Deposits of windblown silt are known as \_\_\_\_\_ (v) \_\_\_\_\_. The layers of sand within a dune often form sloping layers called \_\_\_\_\_ (vi) \_\_\_\_\_ beds, which are oriented with the wind direction.

c) Mass-wasting processes can involve falls, slides and flows. Categorize the following mass wasting features or processes as being representative of a fall, slide, or flow. {6 marks}

(i) slump

(iii) solifluction

(v) talus slope

(ii) lahar

(iv) avalanche

(vi) alluvial fan