NATIONAL EXAMINATIONS – December 2012

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.

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

1.

a) In the accompanying map of the Earth (next page), the continents are shown in white and the oceans are shown in grey. In addition, the boundaries between tectonic plates are shown as solid black lines.

Do not mark anything on the map and do not hand it in with your exam booklet. Clearly write the answers in your exam booklet. *{5 marks}*

(i) Name the 2 tectonic plates on the map which are labelled 8 and 9.
(ii) Name each type of tectonic boundary indicated on the map by the capital letters (E, R, Q).

b) 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}*

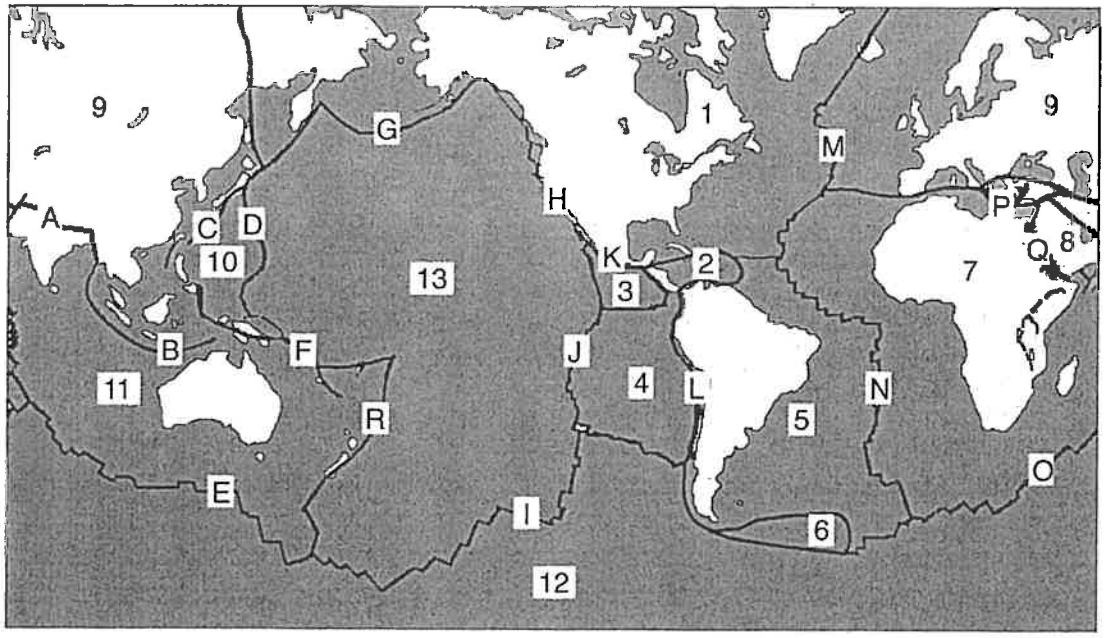
Records of earthquakes, called _____(i)_____, show a variety of energy waves associated with the earthquake event. Waves that travel through the earth's interior are called _____(ii)_____ waves and can be divided into two types – _____(iii)_____ waves and _____(iv)_____ waves. Of the various kinds of waves generated by an earthquake, _____(v)_____ waves always have the highest velocities.

c) Briefly define the following geologic terms. *{5 marks}*

(i) lithosphere
(ii) asthenosphere
(iii) oceanic arc
(iv) hot spot
(v) mantle

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

(i) Basalt is a mafic intrusive rock.
(ii) The major rock-forming minerals in a peridotite are olivine and biotite.
(iii) A welded tuff forms when ash from a volcanic eruption is quenched and cemented rapidly in water.
(iv) Batholiths are emplaced in a manner similar to salt domes.
(v) A pegmatite is an aphanitic igneous rock composed of abnormally large crystals.


9
G
1
M
9
A
C
D
10
H
K
2
3
13
P
Q
8
7
B
F
J
4
L
N
11
R
5
E
I
6
O
12

2.

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

(i) graphite - cleavage
(ii) apatite - hardness
(iii) pyrite – streak
(iv) malachite - colour
(v) calcite - physical property

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) calcite
(ii) limonite
(iii) graphite
(iv) gypsum
(v) augite

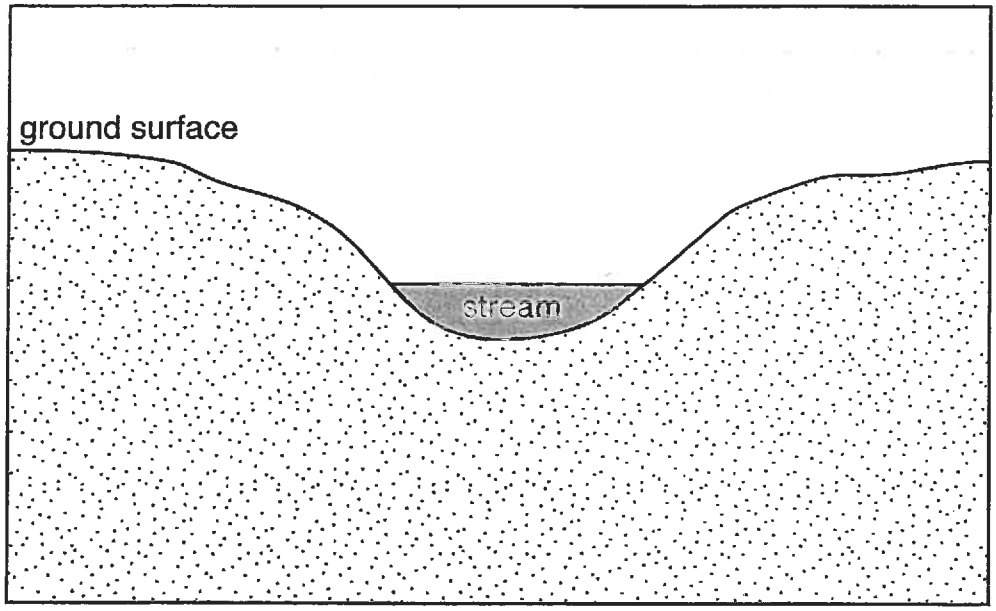
c) State the most appropriate rock name for the following: *{5 marks}*

(i) a sedimentary rock that consists of mud-sized particles and splits into thin layers
(ii) a sedimentary rock consisting of inorganic microcrystalline quartz
(iii) a clastic sedimentary rock that consists of angular, gravel-sized rock fragments
(iv) a metamorphosed conglomerate in which the pebbles have been heated and stretched
(v) a hard, fine-grained, foliated metamorphic rock resulting from intense deformation and ductile flow

d) State a typical rock type that would have been the original source rock for the following metamorphic rocks. *{5 marks}*

(i) slate
(ii) garnet-mica schist
(iii) tektite
(iv) gneiss
(v) migmatite

3. Consider the following cross-sectional sketch of a stream and surrounding, uniformly permeable bedrock.



a) Reproduce this sketch in your examination booklet. If this was in a humid environment with ample rainfall, sketch the outline of the expected water table and show the corresponding groundwater flow lines from the surface to the stream across the entire diagram. What is the name for this type of stream? *{5 marks}*

b) Reproduce this sketch again in your examination booklet. If this was in an arid environment with little rainfall, sketch the outline of the expected water table and show the corresponding groundwater flow lines from the surface to the stream across the entire diagram. What is the name for this type of stream? *{5 marks}*

c) Briefly define the geologic terms. *{6 marks}*

(i) artesian well
(ii) hydraulic gradient
(iii) hydraulic head

d) Groundwater contamination is a serious engineering concern. List 4 ways in which contaminated groundwater can be remediated or prevented. *{4 marks}*

4.

a) The strike and dip are two fundamental geological measurements which are commonly taken in the field. Define strike and dip. What is the purpose of obtaining the strike and dip and what are the geologic features to which strike and dip measurements are commonly applied? *{4 marks}*

b) Consider a region which originally contains flat-lying sediments and has subsequently been gently deformed. Sketch a single geologic cross-section showing the two different kinds of geologic folds that may occur. Name them and clearly show the age relationships of the layers from depth to the surface. *{8 marks}*

c) Briefly define the following geologic terms and use a sketch to illustrate each one. *{8 marks}*

(i) normal fault
(ii) left-lateral strike-slip fault
(iii) angular unconformity
(iv) nonconformity

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

5.

a) Briefly define the following geologic terms. *{4 marks}*

(i) zone of wastage
(ii) calving
(iii) glacial surge
(iv) firn

b) Indicate whether the following features are characteristic of alpine or continental glaciation and then briefly define each. *{8 marks}*

(i) arête
(ii) end moraine
(iii) drumlin
(iv) cirque

c) Fill in the blanks in the following passage. **Please record your answers in the answer booklet. Do NOT answer on this exam paper.** *{4 marks}*

We know that glaciers have covered the Earth at various times throughout earth history. The best evidence for early glaciations comes from deposits known as _____(i)_____ , which result when glacial deposits become lithified. Probably the most reasonable explanation for why extensive glaciations have only occurred a few times in the past comes from the theory of _____(ii)_____ . However, this theory cannot explain the alternation between glacial and interglacial climates that occurred during the Pleistocene epoch. Instead, this was likely caused by _____(iii)_____ . Today, we know that the last major Ice Age began around _____(iv)_____ million years ago.

d) Permafrost is found over a large part of Canada. Describe the most common form of mass wasting in permafrost regions and explain the mechanics of how it occurs. *{4 marks}*

6.

a) Briefly explain the Earth's hydrologic cycle, and the define the following terms as part of your explanation. {*10 marks*}

(i) infiltration (ii) runoff (iii) transpiration

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

(i) base level (ii) settling velocity (iii) stream competence

c) Fill in the blanks in the following passage. **Please record your answers in the answer booklet. Do NOT answer on this exam paper.** {*4 marks*}

Sand and gravel deposits can form in a number of environments. Deposits which form on the inside bend of stream are called _____(i)_____ because of a decrease in stream velocity around the bend. _____(ii)_____ typically develop where a fast-flowing stream leaves a valley and empties out on a broad, flat plain. If a stream enters the ocean or a lake, the slowing current can deposit its load of sediments in a structure known as a _____(iii)_____ . in this case, the main channel often divides into several smaller ones called _____(iv)_____ .

7.

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

(i) wadi
(ii) deflation
(iii) cross bed
(iv) transverse dune

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*}

Waves have enormous potential to affect manmade structures. The transportation of sand and pebbles along the shoreline due to wave action is called ____(i)____ . A ____(ii)____ is a ridge of sand that connects an island to the mainland; ____(iii)____ are low ridges of sand that can parallel the cost several kilometres offshore. The submergence of a coast may result in a drowned river mouth known as an ____(iv)____ . Tides can also affect the shorelines. ____(v)____ tides create the largest daily tidal range. Areas affected by alternating tidal currents are known as ____(vi)____ .

c) Mass-wasting processes impact societies around the world. List and define the three basic physical mechanisms of mass wasting. {*6 marks*}