

NATIONAL EXAMINATIONS - May, 2004

98-BS-14 Geology

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of the assumptions made.
2. Candidates may use one of two calculators, the Casino or Sharp approved models. This is a Closed Book examination.
3. Five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked, unless the candidate clearly indicates that another question should be substituted for a specified question that was answered previously.
4. All questions are of equal value. The marks assigned to the subdivisions of each question are essentially of equal value.

1 A. As accurately as possible, give the geographic location of a tectonic plate margin that is a:

(i) Spreading centre. (ii) Subduction zone. (iii) Continental collision zone. (iv) Transform fault.

B. Define the following geologic terms:

(i) Asthenosphere. (ii) Lithosphere. (iii) Mantle. (iv) Moho discontinuity.

C. Explain why shield cones and stratocones (or composite cones) have different shapes.

D. Explain why the two branches of Bowen's Reaction Series are called "The discontinuous series" and "The continuous series".

E. Name:

(i) A mineral that must be present in a syenite.

(ii) A light-coloured mineral that commonly occurs in gabbro.

(iii) The first common silicate mineral to form in a cooling ultrabasic magma.

(iv) The last common silicate mineral to form in a cooling granite magma.

2 A. What crystal system is based on:

(i) Three axes, unequal in length, with no two axes intersecting at right angles?

(ii) Three axes of unequal length intersecting at right angles?

(iii) Three axes of equal length intersecting at right angles?

(iv) Three axes of equal length intersecting at 60 degrees on the same plane, and a fourth axis intersecting that plane at right angles?

B. (i) List in increasing order of hardness the minerals in Moh's Scale.

(ii) Explain the mineralogical terms:

(a) Malleable. (b) Hackly. (c) Conchoidal. (d) Polymorph.

C. (i) Name a mineral that is a:

(a) Sulphide. (b) Sulphate. (c) Phosphate. (d) Chromate.

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(ii) Name a mineral that has the following type of cleavage.

(a) Basal. (b) Prismatic. (c) Octahedral. (d) Rhombohedral.

D. Describe the environmental conditions that would lead to the formation of:

(i) A sandy limestone. (ii) An arkose.

E. Explain the following terms.

(i) Metasomatism. (ii) Hornfels. (iii) Gneissic. (iv) Migmatite.

3. A. Describe as fully as possible the formation of :

(i) Varves. (ii) Kettles. (iii) Fiords. (iv) Medial moraines. (v) Striae.

B. In a sentence or two, explain the meaning of the following glaciological terms.

(i) Kame. (ii) Arete. (iii) Equilibrium (or snow) line. (iv) Col. (v) Erratic.
(vi) Ablation. (vii) Drift. (viii) Esker. (ix) Calving. (x) Piedmont glacier.

4 A. (i) Describe how a stream carries its load.

(ii) Name 5 drainage patterns and explain specifically why they develop.

B. (i) Describe how landforms of stream deposition develop.

(ii) Draw a cross-section of a river as it would appear at a sharp bend in the river's course. Add labels to show the types and locations of fluvial activity in the section. Assign geologic names to each bank, and to the deepest point in the cross section.

5 A. Describe the various types of mass wasting involving slow movement.

B. Explain the terms:

(i) Loess. (ii) Barchan. (iii) Deflation. (iv) Ventifact. (v) Desert pavement.

C. Present a series of labelled sketches to show how:

(i) An atoll forms.

(ii) A tombolo forms.

D. Explain the coastal geomorphology or engineering terms:

- (i) Plunging wave. (ii) Barrier bar. (iii) Breakwater. (iv) Wave refraction. (v) Tsunami.

6 A. Explain the hydrogeologic terms:

- (i) Drawdown. (ii) Perched table. (iii) Aquifer. (iv) Travertine. (v) Hydraulic conductivity.

B. Use "before and after" labelled sketches to show cross-sections of:

- (i) Salt water intrusion.

- (ii) How heavy pumping of a new well can lead to contamination of an existing well.

C. The excavation for a 60 m x 40 m building will pass through a 50 cm layer of gravel with a hydraulic conductivity (K) of 10 cm/sec. The hydraulic gradient ($(h_1 - h_2)/l$) for the gravel is 0.2. Use Darcy's Law ($V = AK (h_1 - h_2)/l$) to calculate the inflow in m^3/sec . once the excavation is completely below the gravel layer.

D. Draw a labelled diagram to show the zoning of underground water.

E. Briefly describe geologic features found in Karst regions.

7 A. Sketch an:

- (i) Open symmetrical plunging anticline, labelled to show the axial plane and the axis of the fold.
- (ii) Oblique-slip normal fault, labelled to show the hanging wall block and the traces of slickensides on the fault face.

B. Use sketches to show the following:

- (i) Overturned syncline. (ii) Thrust fault. (iii) Disconformity. (iv) Nonconformity
(v) Two dikes that do not cross, with one dike obviously older than the other.

C. Describe 3 types of seismic waves generated by earthquakes. Comment on their relative velocities.

D. Define the seismological terms:

- (i) Epicentre. (ii) Magnitude. (iii) Shadow Zone. (iv) Benioff Zone