

NATIONAL EXAMINATIONS - May, 2003

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 Casio 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 also of equal value.

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- 1 A. Sketch a fully labelled cross-section showing what happens when an oceanic plate collides with a continental plate.
- B. Describe one fundamental difference between a granite and a:  
(a) Syenite. (b) Pegmatite. (c) Rhyolite. (d) Granite Porphyry. (e) Granite Gneiss.
- C. Draw a labelled cross-section (or cross-sections) to show a:  
(a) Dyke (or Dike). (b) Sill. (c) Laccolith. (d) Xenolith. (e) Caldera.
- D Explain briefly how or why the following form.  
(a) Pahoehoe. (b) Volcanic Breccia. (c) Amygdule. (d) Columnar Basalt. (e) Lahar.
- 2 A. In what crystal system do the following minerals crystallize?  
(a) Halite. (b) Quartz. (c) Orthoclase (K-feldspar). (d) Galena.
- B. Name and give the chemical formula for an ore mineral of:  
(a) Zinc. (b) Copper. (c) Iron. (d) Gold.
- C. State one essential difference between:  
(a) Sandstone and Quartzite.  
(b) Arkose and Greywacke.  
(c) Limestone and Dolomite.  
(d) Conglomerate and Breccia.
- D. Describe briefly the changes that occur as a shale is subjected to increasingly higher temperatures and pressures. Name the rocks that are formed at each stage,
- E. Explain briefly how the following form:  
(a) Concretions. (b) Cross-bedding. (c) Mud Crack. (d) Oscillation Ripple Mark.
3. Describe as fully as possible the formation of depositional glacial landforms, and explain how the earth materials contained in these landforms might be an engineering resource.
- 4 A. What drainage pattern would you expect to find in an area of:  
(a) Flat-lying beds of shale? (b) Moderately dipping sedimentary rocks?  
(c) Strongly jointed granite? (d) Cinder cones
- B. Describe the formation of deltas.

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- C. Draw a cross-section of a river as it would appear at a sharp turn or bend in the river's course. On your section, indicate the location of (a) the maximum stream velocity, (b) the maximum sediment deposition, (c) the maximum erosion, (d) the slip-off slope.
- D. What is meant by the following terms as they apply to the fluvial environment?  
(a) Rejuvenation. (b) Saltation. (c) Oxbow. (d) Wetted perimeter.
- E. Explain briefly how:  
(a) Urbanization affects a stream hydrograph.  
(b) Damming a stream affects its longitudinal profile.
- 5 A. Explain the following hydrologic terms:  
(a) Capillary Fringe. (b) Influent Stream. (c) Specific Yield. (d) Cone of Depression..
- B. Describe with the aid of sketches how local relief and surficial soil type affect the position of the water table.
- C. Darcy's Law can be expressed as  $V = K \cdot h/p$ . What do each of the symbols in the equation stand for?
- D. With the aid of before and after diagrams, show how excessive pumping of a coastal well can lead to salt water intrusion.
- E. Describe briefly geological features that are specifically associated with a Karst region.
- 6 A. Using a sketch or block diagram, show a (a) Nonconformity. (b) Plunging Syncline.  
(c) Overturned Anticline. (d) Monocline (e) Oblique-slip Normal Fault.
- B. Consider the following scenario. A river has cut into a plateau underlain by moderately dipping rocks, such that a steep-sided valley is formed which runs parallel to the strike of the sedimentary rocks. Using this information, first draw a geologic cross-section of this valley. If a road is to be built connecting the valley floor to the upland plateau, indicate on your cross-section which side of the valley the road should be built. Justify your choice. If you are forced to use the opposite side, give the names of engineering measures that might be undertaken to minimize geologic hazards along the road.
- C. Explain how the distance from a seismograph to the epicentre of an earthquake can be determined. Based on your knowledge of the internal structure of the earth, explain a situation whereby the distance to a severe earthquake cannot be determined, even with the best quality seismograph.

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D. Describe the origin and propagation of a tsunami wave, and explain clearly why or how they can be extremely destructive.

7 A. (a) Explain the terms:

(i) Critical Angle of Repose. (ii) Soil Creep. (iii) Mud Flow. (iv) Active Zone. (v) Pingo.

(b) In a sentence or two, explain how the following form.

(i) Loess. (ii) Barchans. (iii) Ventifacts. (iv) Desert Pavement. (v) Star Dunes.

B. Below is a sketch of an aerial view of a submergent coastline. Name the features numbered 1 to 8 on the sketch. Explain the purpose of each of the numbered engineering structures.

