

NATIONAL EXAMINATIONS – December 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. A ruler is required and a protractor may be useful, for Question #6.
- D. SEVEN (7) questions constitute a complete exam paper. YOU MUST ANSWER QUESTION 1. Candidates must choose six questions from any of the remaining eight questions.
- E. Only the first six of any of Questions 2 to 9 as they appear 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.
- F. The total number of marks for the exam is 100.

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Question #1 (40 Points)

Define and differentiate all of the following pairs of terms. Use diagrams, graphs, figures and equations where appropriate (5 points each).

- a) Foliated and Non-foliated texture
- b) Metamorphic Facies and Types of Metamorphism
- c) Porosity and Permeability
- d) Depositional Contacts and Types of Unconformities
- e) Physical Weathering and Chemical Weathering
- f) Moraines and Eskers
- g) Apparent and True Dip
- h) Aquifer and Aquitard

Question #2 (10 Points)

State the most appropriate rock name for the following: (5 Points each)

- a. a volcanic igneous rock that exhibits a vesicular texture;
- b. a sedimentary rock consisting of sand particles that are predominantly feldspar
- c. a sedimentary rock that consists of cemented gravels and rounded pebbles
- d. a strongly foliated rock consisting mainly of intermediate-sized mica flakes giving the rock a scaly appearance
- e. a hard, non-foliated metamorphic rock commonly found in contact aureoles

Question #3 (10 Points)

Answer the following questions with respect to Mass Wasting:

- a. Name and describe two types of Mass Wasting. (4 points)

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- b. What are sensitive clays, and what conditions lead to their creation?(4 Points)
- c. Identify the factor that is common to all Mass Wasting problems. (2 points)

Question #4 (10 Points)

Briefly define, with the aid of sketches (if desired), the following structural geology terms: (5 Points each)

- a. Strike;
- b. Graben;
- c. Disconformity;
- d. Hanging wall;
- e. Joint.

Question #5 (10 Points)

The Darcy equation is used to relate the specific discharge (or Darcy velocity; units of length per time) to the hydraulic gradient along a particular groundwater flow path.

- a. Write the equation and define all the terms. (3 Points)
- b. For the one term of the equation (parameter) that is related to both soil and fluid properties, name the soil properties and the fluid properties that affect it and state how they affect it (eg, does an increase in the selected soil or fluid property, increase or decrease the parameter?) (4 Points)
- c. How do we estimate the actual groundwater flow velocity (seepage velocity), knowing the specific discharge? (3 points)

Question #6 (10 Marks)

Three beds (conglomerate, sandstone and shale) outcrop in the area shown on the geological map in **Figure Q6**. Sections of the geological boundaries between the beds are also shown. Assuming that all the beds have the same strike and dip:

- a. Find the strike and dip of the beds. (4 Points)
- b. Complete the traces of the boundaries between the units and shade the area underlain by shale. (4 Points)

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- c. Assuming that the beds were not overturned, what is the sequence of deposition? (2 Points)

Question #7 (10 Points)

Name three distinct forms of glacial deposit. For each form, describe the soil composing it, the shape of the landform and how they were created.

Question #8 (10 Points)

Discuss the role of Plate Tectonics on the creation and transformation of the various rocks of the Earth's crust. Make reference to and illustrate the Rock Cycle.

Question #9 (10 Points)

The following are terms describing surface drainage development: Dendritic, Radial and Trellis. What can be inferred about the structure and composition of the ground in which each of these forms develops?

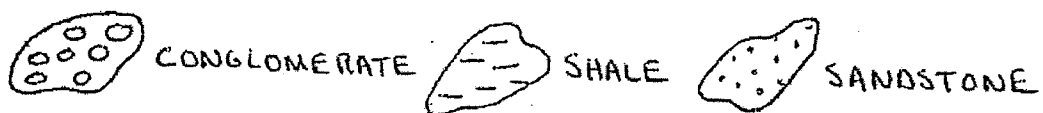
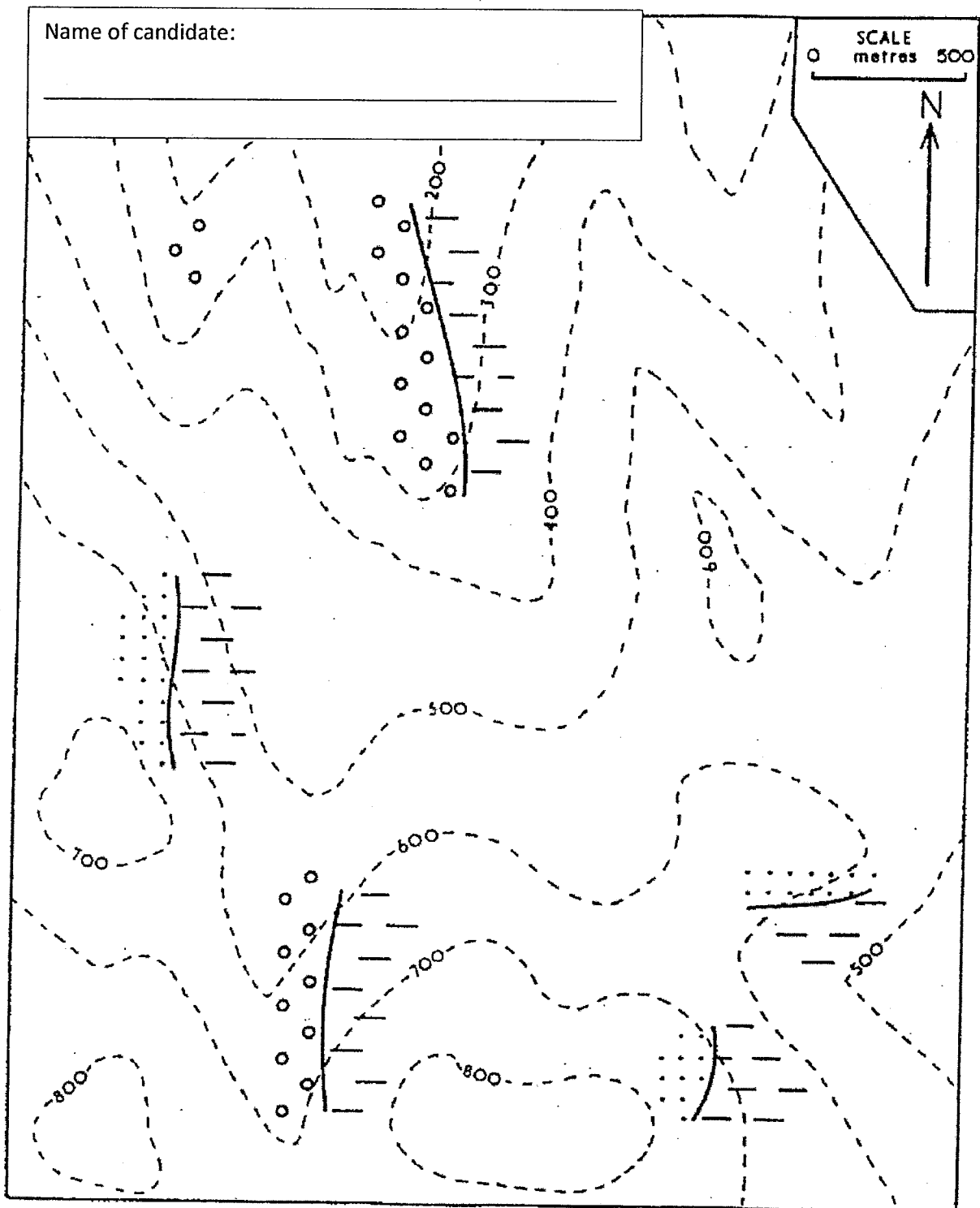


Figure Q6.