

National Exams December 2015

**04-BS-14, Geology**

3 hours duration

**NOTES:**

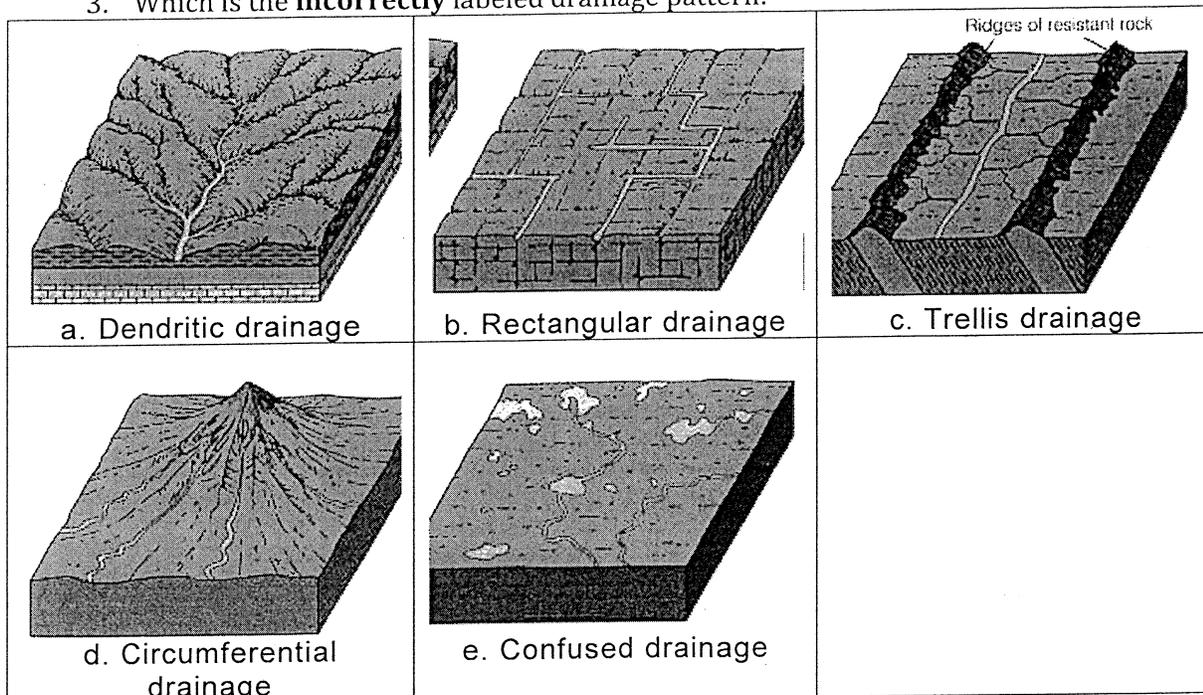
1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM. Candidates may use one of two calculators, the Casio or Sharp-approved models.
3. FIVE (5) questions constitute a complete exam paper. YOU MUST ANSWER QUESTIONS 1 TO 4. Candidates must choose one more question from the remaining questions. Where stated in the examination, please hand in any additional pages with your exam booklet.
4. 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.
5. The marks assigned to the subdivisions of each question are shown for information. Each question is worth 20 marks. The total number of marks for the exam is 100

### Question 1. Multiple Choice / True and False

(value 20)

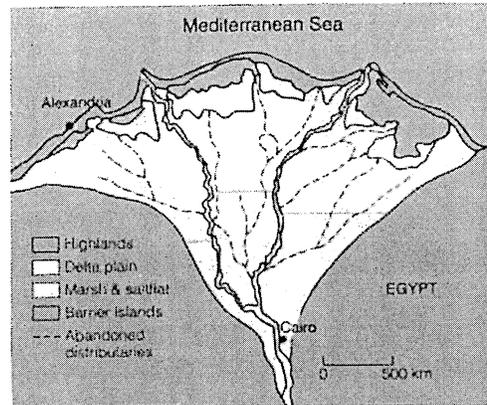
1. Geological types of mass wasting include:
  - a. Falls, slides/slumps, earth flows/mudflows, creep
  - b. Plunges, strikes and dips
  - c. Cirques, horns and arêtes
  - d. Throwing out food
  
2. Which of the following is mafic?
  - a. Granite
  - b. Rhyolite
  - c. Basalt
  - d. Andesite

3. Which is the **incorrectly** labeled drainage pattern:



4. The furthest south glaciers have advanced in North America (from evidence of end moraines) was:
  - a. North edge of Texas
  - b. North edge of Mexico
  - c. 49<sup>th</sup> parallel
  - d. Southern edge of Illinois
  - e. Southern tip of Ontario
  
5. Following an earthquake a seismograph detects Body Waves and Surface Waves in the order of:
  - a. P-wave→S-wave→L-wave
  - b. S-wave→P-wave→L-wave
  - c. L-wave→P-wave→S-wave
  - d. S-wave→P-wave→L-wave→T-wave

6. The following is an example of a \_\_\_\_\_ dominated delta.
- Tide
  - Stream
  - Wave



7. The most widespread metamorphic rocks exposed at the Earth's surface are formed by:
- Regional metamorphism
  - Hydrothermal metamorphism
  - Contact metamorphism
  - Burial metamorphism
  - Meteorite impact metamorphism
8. When does permanent rock deformation occur?
- once its elastic limit is surpassed
  - when it goes on a real bender
  - once it is completely lithified and becomes inflexible
  - only after it comes to be located on a plate margin
9. When do rocks succumb to ductile deformation?
- at great depth under active mountain belts with high confining pressure and low strain rates or prolonged strain
  - in fault zones with intermittent high strain rates
  - at shallow depth, at low confining pressure, and low temperature
  - on the rims of meteorite impact craters

10. Which of the following best defines a mineral and a rock?
- A rock has an orderly, repetitive, geometric, internal arrangement of minerals; a mineral is a lithified or consolidated aggregate of rocks.
  - A rock consists of atoms bonded in a regular, geometrically predictable arrangement; a mineral is a consolidated aggregate of different rock particles.
  - In a mineral the constituent atoms are bonded in a regular, repetitive, internal structure; a rock is a lithified or consolidated aggregate of minerals.
  - A mineral consists of its constituent atoms arranged in a geometrically repetitive structure; in a rock, the atoms are randomly bonded without any geometric pattern.

### TRUE or FALSE

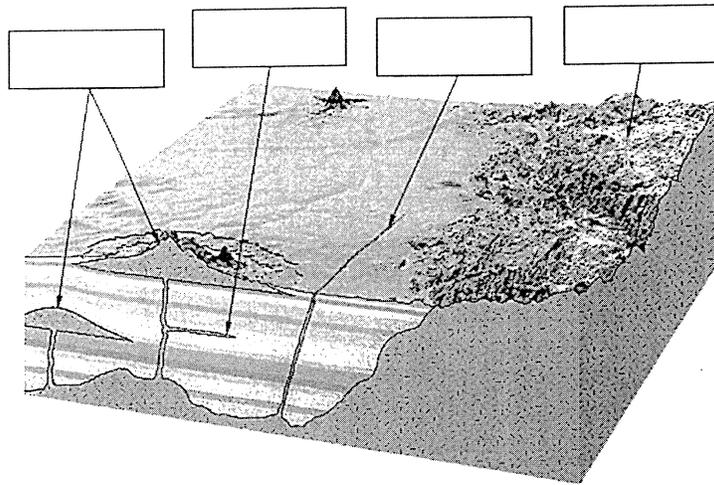
- In locations with continuous permafrost the active layer never melts.
- Silicates are, after carbonates, the second most abundant minerals in the crust of the Earth.
- An aquifer is an impermeable layer which serves as a confining layer above an aquiclude which has the capacity for transmitting groundwater.
- A spring is a place where the groundwater flows into the ground.
- Oxbow lakes form when a mature meandering stream cuts off a meander.
- Drumlins and roche moutonnees have the same overall shape however drumlins are composed of till with and roche moutonnees are composed of rock.
- Normal faults are caused by extensional tectonic forces and reverse faults are caused by compressional tectonic forces.
- The water velocity required to mobilize a grain of silt is greater than that which will mobilize a grain of sand.
- Quartz is a three dimensional arrangement of silica tetrahedra, while biotite is a chain-like arrangement.
- A mineral's color and streak are always a consistent and reliable property for identification.

**Question 2. Short (paragraph) Answer**

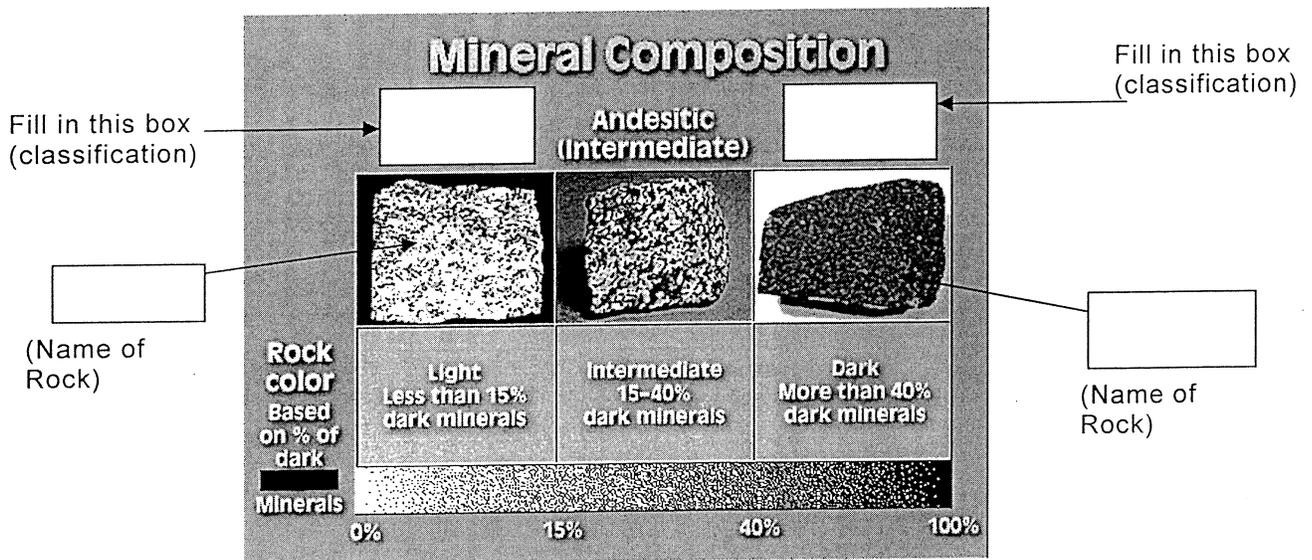
- 1) Draw, label and explain the Bowen's Reaction Series. Ensure to include the continuous and discontinuous components. (value 10)
  
- 2) Describe the structure of the interior of the Earth, providing some qualitative judgment of the thickness of the various units and a description of the nature of the materials involved (value 10)

**Question 3. Fill in the Blank**

- 1) Describe the rock cycle, in prose and with a sketch. Remember to define the processes and the resultant materials. (value 10)
- 2) Figures Q3-1 and Q3-2 shown below have white boxes that must be filled in. Fill in the boxes with the appropriate words/concepts/structures etc. (value 10)



**Figure Q3-1** – Fill in the four blanks above indicating the structures shown

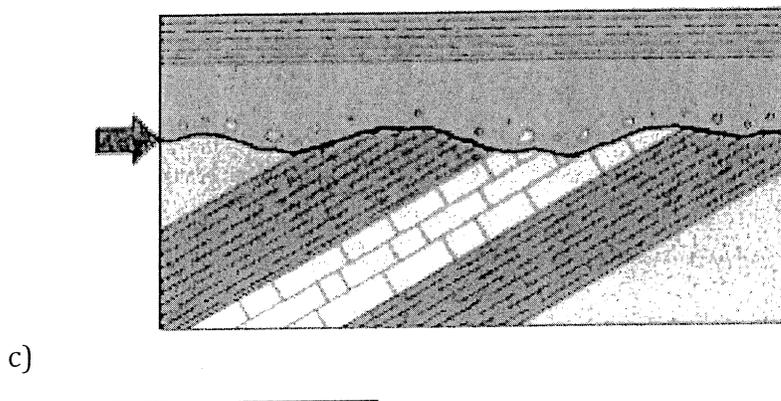
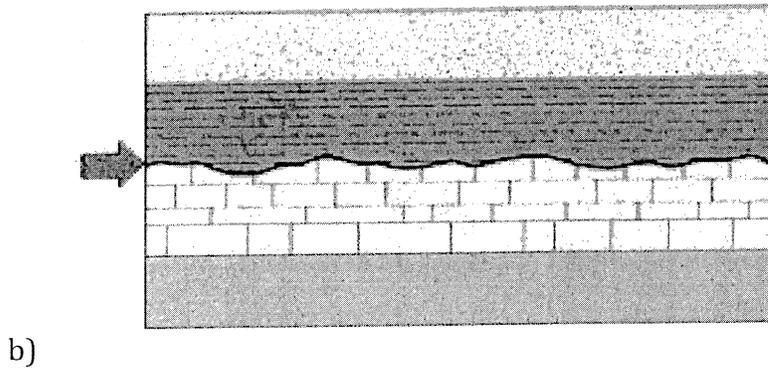
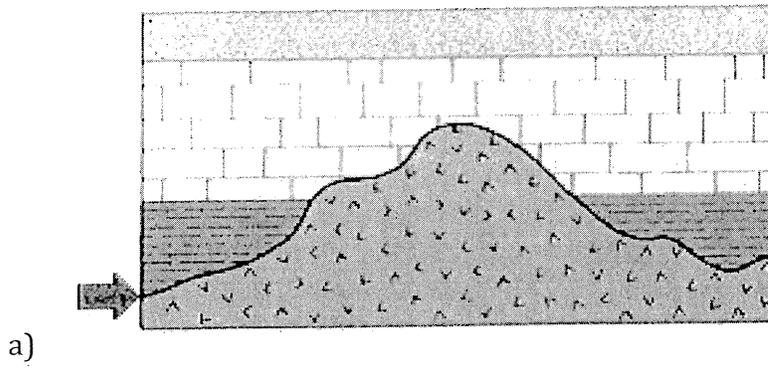


**Figure Q3-2** – Classification of a certain Rock Type

**Question 4. Relative Dating and Map**

1) On the blank provided beside each geologic cross section below, write the name of the specific type of unconformity that is labeled with an arrow. The v-pattern indicates igneous rocks. All other patterns are different types of sedimentary rocks.

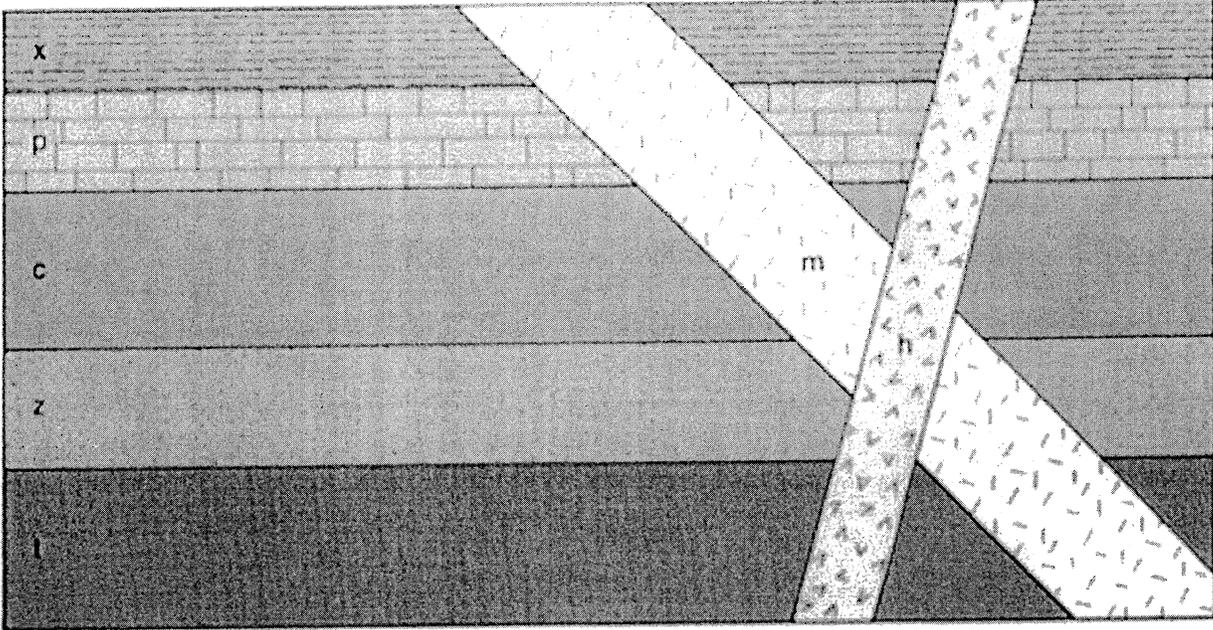
(value 6)



2) Examine the geologic cross section below.

(value 4)

- a) Which feature is the youngest?
- b) Which feature is the oldest?



Examine the words and/or phrases for each question below and determine the relationship among the majority of words/phrases. Choose the option that does not fit the pattern and write it in the EXAM BOOKLET.

(value 10)

- |                     |                      |                  |                    |
|---------------------|----------------------|------------------|--------------------|
| 3) A) plutonic      | B) lava              | C) extrusive     | D) volcanic        |
| 4) A) felsic        | B) intermediate      | C) graphic       | D) mafic           |
| 5) A) lithification | B) cementation       | C) weathering    | D) compaction      |
| 6) A) phyllite      | B) quartzite         | C) slate         | D) schist          |
| 7) A) P wave        | B) S wave            | C) surface wave  | D) body wave       |
| 8) A) aphanitic     | B) phaneritic        | C) porphyritic   | D) glassy          |
| 9) A) shale         | B) sandstone         | C) breccia       | D) conglomerate    |
| 10) A) pressure     | B) recrystallization | C) melting       | D) chemical fluids |
| 11) A) non-flowing  | B) flowing           | C) artesian well | D) aquitard        |
| 12) A) dendritic    | B) radial            | C) circular      | D) rectangular     |

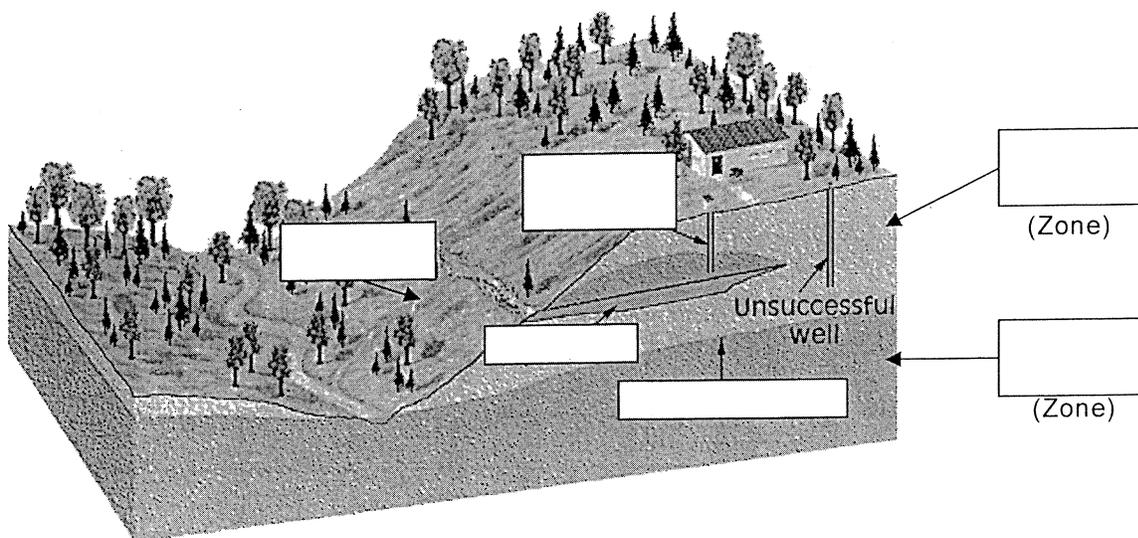
**Question 5. Short Answer (paragraph) and Fill in the Blank**

- 1) Elaborate on the glacial processes that are responsible for the creation of:
  - a) Erosional Landforms (name and describe at least 3)
  - b) Till Landforms (name and describe at least 3)

(value 14)

- 2) Fill in the blanks on the schematic:

(value 6)



**Figure 4 – Water Related Features**

## Question 6. Multiple Choice and Short (paragraph)

## Answer

(value 20)

- 1) What are the three types of *differential stress* in the Earth's lithosphere?
  - a) confined, unconfined, and directed
  - b) hydrostatic, lithostatic, and vibratory
  - c) compression, shear, and tension
  - d) upwards, downwards, and sideways
  
- 2) During mountain building episodes, originally flat lying sedimentary and volcanic rocks are often bent into a series of \_\_\_\_\_.
  - a) folded anticlines and synclines
  - b) box pleats
  - c) horsts and grabens
  - d) heaves and sags
  
- 3) The physical removal of dissolved or disaggregated rock from the site of weathering by wind, water, or ice is termed \_\_\_\_\_.
  - a) ablation
  - b) recidivism
  - c) solifluction
  - d) erosion
  
- 4) \_\_\_\_\_ is one of the three ways a glacier can move over its bed.
  - a) Frost heaving
  - b) Basal slip
  - c) Morainal sliding
  - d) Crevassal slip
  
- 5) A(n) \_\_\_\_\_ is a depositional feature composed primarily of till and usually associated with continental glaciation, not with alpine glaciers.
  - a) moraine
  - b) drumlin
  - c) cirque
  - d) outwash deposit
  
- 6) A syncline is \_\_\_\_\_.
  - a) a fold with only one limb
  - b) a fold in which older flanking strata dip toward the axis
  - c) a paralytic drunken fold characterized by recumbent limbs
  - d) a fold in which the older central strata dip away from the axis

- 7) Which of the following best defines a mineral and a rock?
- a) A rock has an orderly, repetitive, geometric, internal arrangement of minerals; a mineral is a lithified or consolidated aggregate of rocks.
  - b) A rock consists of atoms bonded in a regular, geometrically predictable arrangement; a mineral is a consolidated aggregate of different rock particles.
  - c) In a mineral the constituent atoms are bonded in a regular, repetitive, internal structure; a rock is a lithified or consolidated aggregate of minerals.
  - d) A mineral consists of its constituent atoms arranged in a geometrically repetitive structure; in a rock, the atoms are randomly bonded without any geometric pattern.
- 8) Which one of the following statements concerning glacial deposits is false?
- a) Till is deposited directly from the ice; outwash is deposited by meltwater streams.
  - b) Outwash is mainly stratified sand and gravel.
  - c) Tills are poorly sorted and their fragments are mostly angular.
  - d) Glacial erratics are blocks of rock that are too large for the glacier to move.
- 9) Drumlin fields contain \_\_\_\_\_.
- a) mounds of outwash deposited by meltwater streams at the snout of a glacier
  - b) smooth, striated, bedrock ridges shaped and polished by a glacier's erosive action
  - c) bowl-shaped depressions eroded largely by frost action and glacial plucking
  - d) smooth, tapering, asymmetric ridges of till usually formed and shaped beneath a continental ice sheet
- 10) \_\_\_\_\_ is the dissolution or decomposition of minerals and rocks.
- a) Mechanical weathering
  - b) Chemical weathering
  - c) Hydrolysis
  - d) Rendering

11) Describe and sketch three types of drainage basins (10 marks)

**Question 7. Short answer and Fill in the Blank**

Define and differentiate **FIVE (5)** of the following ten pair of terms. Use diagrams, graphs, figures and equations where appropriate. Remember to use technical-specific language when defining these terms.

(value 20)

- 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) Types of Physical Weathering and Types of Chemical Weathering
- f) Amphibole (Hornblende) and Feldspars
- g) Discontinuous and Continuous Reaction Series (Igneous Rocks)
- h) Mafic and felsic rocks
- i) Fault and fracture
- j) Syncline and anticline