

National Exams December 2019

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. Four (4) questions constitute a complete exam paper. YOU MUST ANSWER QUESTIONS 1 TO 3.
4. On Question 4, the first four (4) answers, as they appear in the answer book, will be marked. The only exception will be if 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.
6. The total number of marks for the exam is 100

Question 1. Multiple Choice / True and False 20 Marks****NOTE** write your answers in the Exam Booklet (ie not on this page).**

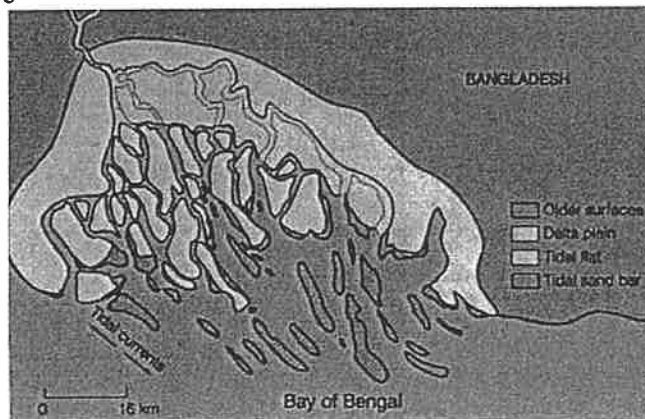
1. A volcanic arc is the result of:
 - a. compression of a continental plate beneath an oceanic plate
 - b. subduction of an oceanic plate under a continental plate
 - c. collision between two lithospheric plates
 - d. abduction of an oceanic crust on a continental plate

2. The greatest ocean depths are:
 - a. at the mid-ocean ridges
 - b. at passive margins
 - c. at the hot spots
 - d. at subduction zones

3. Plutonic rocks are emplaced at depth yet they can be seen at the Earth's surface due mainly to _____.
 - a. widespread igneous inversion
 - b. erosion of overlying rocks due to uplift
 - c. catastrophic violent upheavals that bring them to the surface
 - d. continual ongoing intrusion after the magma solidifies

4. Which of the following is a mafic rock?
 - a. Granite
 - b. Rhyolite
 - c. Basalt
 - d. Andesite

5. The following is an example of a _____ dominated delta.
 - a. Tide
 - b. Stream
 - c. Wave



6. Following an earthquake a seismograph detects Body Waves and Surface Waves in the order of:
- P-wave→S-wave→L-wave
 - S-wave→P-wave→L-wave
 - L-wave→P-wave→S-wave
 - S-wave→P-wave→L-wave→T-wave
7. _____ is one of the three ways a glacier can move over its bed.
- Frost heaving
 - Basal slip
 - Morainal sliding
 - Crevassal slip
8. During mountain building episodes, originally flat lying sedimentary and volcanic rocks are often bent into a series of _____.
- Folded anticlines and synclines
 - Box pleats
 - Horsts and grabens
 - Heaves and sags
9. The principal causes of mechanical fragmentation of rocks *in place* are _____:
- erosion and transport by moving wind, water, or ice
 - the relentless actions of Sisyphus
 - always inscrutable because they happened at some time in the past
 - biologic activity, expansion from unloading, frost wedging
10. The _____ of the geologic time scale occurs within the time of Earth's most recent "Ice Age."
- Proterozoic Eon
 - Pleistocene Epoch
 - Permian Period
 - Pliocene Epoch
11. 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
12. A syncline is _____.
- a fold with only one limb
 - a fold in which older flanking strata dip toward the axis
 - a paralytic drunken fold characterized by recumbent limbs
 - a fold in which the older central strata dip away from the axis

13. 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.
14. During major earthquakes, instantaneous displacements of _____ occur across pre-existing faults.
- a few kilometres
 - a few millimetres
 - a few metres
 - a few thousand kilometres
15. The physical removal of dissolved or disaggregated rock from the site of weathering by wind, water, or ice is termed _____.
- ablation
 - recidivism
 - solifluction
 - erosion
16. A(n) _____ represents a former meltwater channel or tunnel on, in, or beneath glacial ice, that became filled with sand and gravel
- drumlin
 - esker
 - valley train
 - kettle
17. The three major processes involved in chemical weathering are _____.
- dissolution, hydrolysis, and oxidation
 - precipitation, ion exchange reactions, and degasification
 - carbonation, dissimulation, and salinization
 - recrystallization, pitting, and rinsing

18. Plastic deformation would be favoured over brittle deformation in which of the following conditions?
- warmer temperatures and high confining pressures
 - cooler temperatures and low confining pressures
 - shallow depths
 - high confining pressures
19. Compared to earlier or subsequent streams in the same valleys, alpine glaciers move _____ but carry _____ sediment.
- faster; less
 - mainly in the winter; mostly very coarse
 - a little slower; only finer
 - very much slower; vastly more
20. Which one of the following stress situations results in faulting of flat-lying, sedimentary strata?
- horizontally directed, extensional stresses
 - vertically oriented digital stresses
 - vertically directed, extensional or stretching stresses
 - horizontally directed, compressive stresses

Question 2. True and False

10 marks

****NOTE** write your answers in the Exam Booklet (ie not on this page).**

21. Iceland is located over a hot spot.
22. In locations with continuous permafrost the active layer never melts.
23. Silicates are, after carbonates, the second most abundant minerals in the crust of the Earth.
24. An aquifer is a permeable layer which serves as a confining layer above an aquiclude which has the capacity for transmitting groundwater.
25. Evidence for the supercontinent Pangaea includes fit of continents, matching fossils and mountain chains separated by ocean basins, and ancient glaciated rocks in the southern hemisphere.
26. Oxbow lakes form when a mature meandering stream cuts off a meander.
27. The epicentre of an earthquake is on the surface of the Earth directly above the focus.
28. Normal faults are caused by extensional tectonic forces and reverse faults are caused by compressional tectonic forces.
29. A porphyry is a rock which exhibits two significantly different grain sizes.
30. Graphite and diamond have the same chemical composition and different crystalline structures.
31. Quartz is a three dimensional arrangement of silica tetrahedra, while biotite is a sheet-like arrangement.

Question 3. Short Answer

30 marks

32. 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.

10 marks

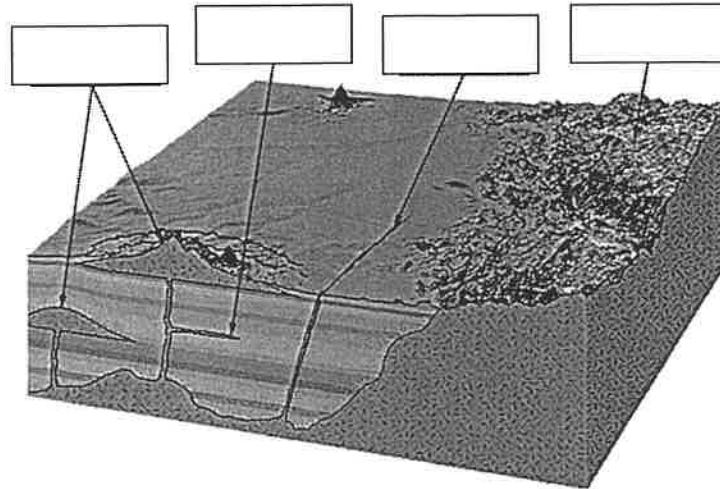


Figure Q3-1 – Fill in the four blanks above indicating the structures shown

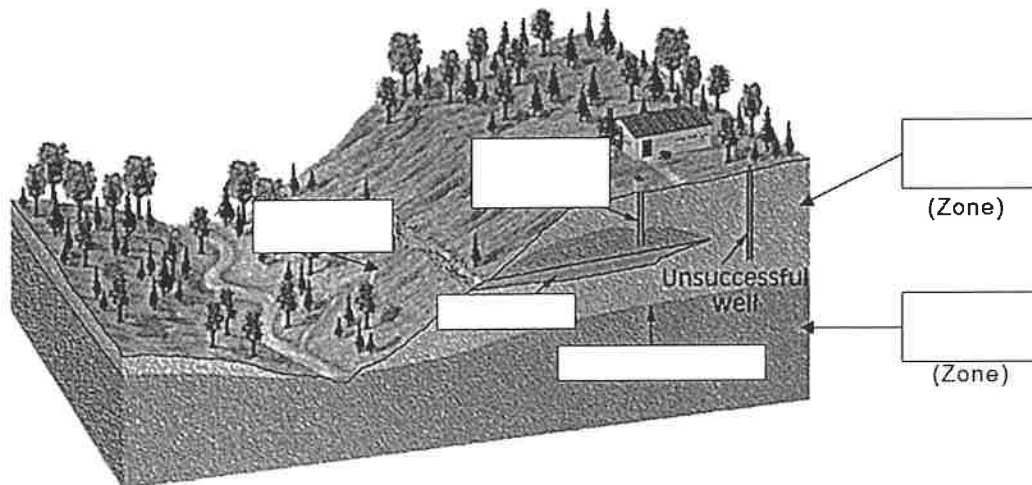
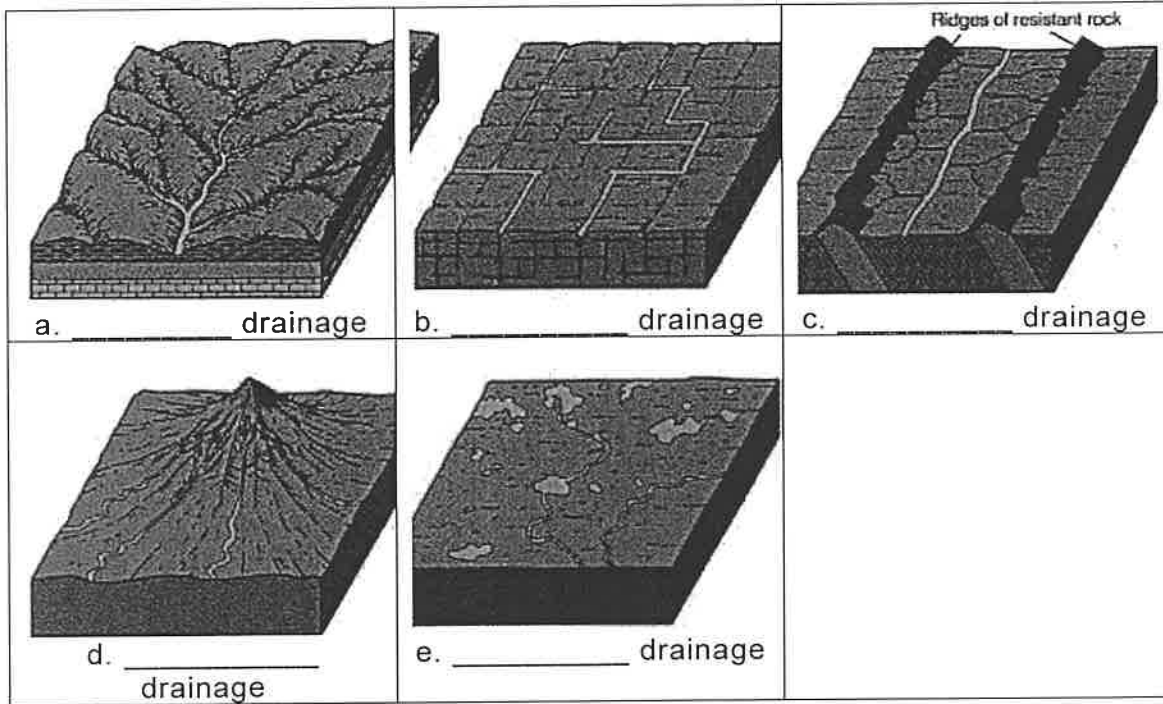


Figure Q3-2 – Fill in the six blanks above indicating the groundwater features

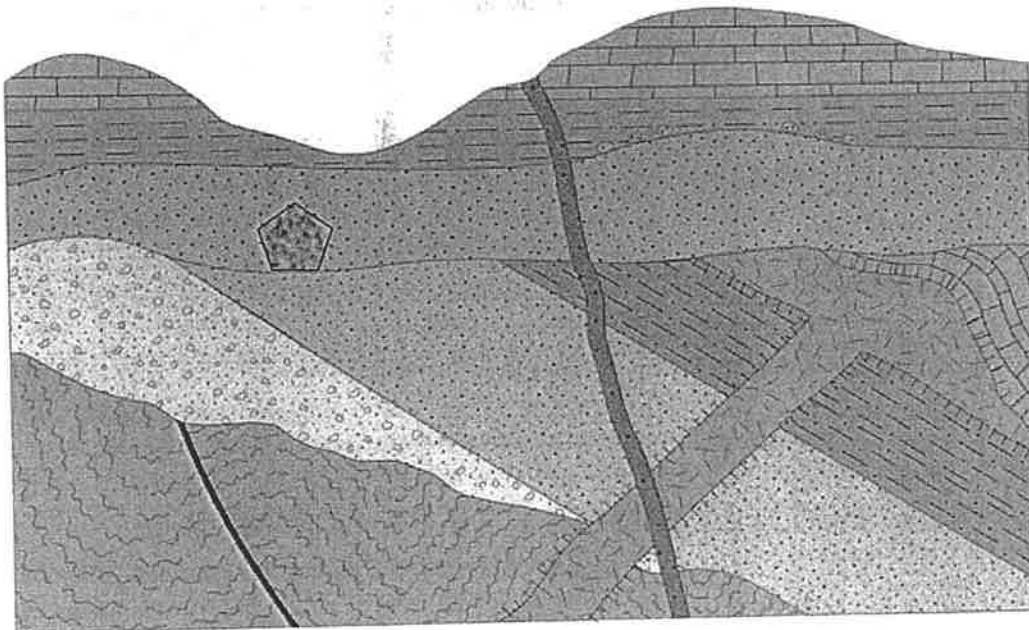
33. Label the drainage pattern:

5 marks



34. For the cross-section shown below, list the geologic events that caused the current configuration in chronological time.

15 marks



Question 4. Answer four (4) of the following questions: 40 marks

35. Describe the rock cycle, in prose and with a sketch. Remember to define the processes and the resultant materials.
36. List, sketch and describe three (3) types of landslides
37. List, sketch, and describe three (3) types of unconformities.
38. List and describe five (5) factors that influence mass wasting.
39. List and describe three (3) erosional features and three (3) depositional features associated with glaciers.
40. Name three (3) types of glaciers and give key characteristics of each.
41. Describe Bowen's Reaction Series.
42. List and describe five (5) types of volcanoes in terms of size, shape, and type of eruption they are associated with.
43. Draw a typical permafrost profile, label, and describe the layers. Beside the profile (i.e. correlating it to depth), sketch a graph of temperature versus depth for summer and winter.
44. Describe the structure of the interior of the Earth, providing estimates of the thickness of the various units and a description of the nature of the materials involved.
45. List, sketch and describe 3 types of tectonic plate boundaries.
46. List, sketch, and describe six (6) principles of relative dating.