

National Exams May 2017

04-BS-14, Geology

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is advised 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. Three (3) questions constitute a complete exam paper. YOU MUST ANSWER QUESTIONS 1 TO 3.
4. On Question 3, the first two (2) 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. The total number of marks for the exam is 100

Question 1. Multiple Choice / True and False 60 Marks

1. During earthquakes, instantaneous displacements of _____ occur along pre-existing faults
 - a. Several kilometers
 - b. Several millimeters
 - c. Several meters
 - d. Several 1000 kilometers
2. The _____ is the most recent glaciation episode during the Pleistocene in North America
 - a. Wisconsin
 - b. Kansan
 - c. Manitoban
 - d. Dakotan
3. The _____ of the geologic time scale occurs within the time of Earth's most recent "Ice Age."
 - a. Proterozoic Eon
 - b. Pleistocene Epoch
 - c. Permian Period
 - d. Pliocene Epoch
4. Most crustal deformation occurs in active tectonic zones _____.
 - a. deep within old plate interiors
 - b. at the base of sedimentary basins
 - c. in thick piles of unconsolidated sedimentary strata
 - d. along plate margins
5. Which one of the following stress situations results in folding of flat-lying, sedimentary strata?
 - a. horizontally directed, extensional stresses
 - b. vertically oriented digital stresses
 - c. vertically directed, extensional or stretching stresses
 - d. horizontally directed, compressive stresses
6. How does elastic deformation of rocks differ from brittle or plastic deformation?
 - a. It only happens to rocks that can bounce .
 - b. It can only occur once and never happens in cycles.
 - c. It only occurs are very fast or high strain rates.
 - d. It is reversible or recoverable and when the stress is removed, the rocks snap back to their original shape or position.
7. Brittle deformation would be favoured over plastic deformation in which of the following conditions?
 - a. warmer temperatures and high confining pressures
 - b. cooler temperatures and low confining pressures
 - c. shallow depths
 - d. high confining pressures

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. 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
11. 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.
12. Minerals consist of an ordered array of atoms or ions that are _____.
- all the same size and charge
 - always packed together in cubes or octahedra
 - physically attached to each other by shared protons
 - chemically bonded in a regular crystalline structure
13. Silicate igneous rocks make up the _____.
- majority of shallow rocks covering the continents but everything deeper is sedimentary and metamorphic
 - bulk of the Earth's crust and mantle
 - densest rocks and are mainly found in the core
 - bulk of volcanic mountains but not much else on Earth
14. Explosive volcanic eruptions occur _____.
- when violently escaping gases evolve suddenly to drop the magma density and propel molten magma from the chamber
 - in response to deflation of the volcano
 - when crystallization forces exceed the strength of the volcano
 - whenever basaltic magma extrudes on the seafloor

15. 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
16. 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
17. The main direct geologic effect(s) of glaciers is (are) to _____.
- raise global sea level by depressing the crust
 - warm the global climate by absorbing more solar radiation
 - erode the continental landscape and to transport and deposit sediments
 - reduce high latitude marine sedimentation by reducing biologic productivity
18. 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
19. Abrasion and plucking generally involve what part of a glacier?
- the snout zone
 - the surface, brittle zone
 - the internal, flowage zone
 - the basal, sliding zone
20. A _____ is an erosional feature specifically produced by alpine glaciation.
- V-shaped valley
 - U-shaped valley
 - Kame
 - lateral moraine
21. A fjord is _____.
- a glacier-cut valley which sinks below sea level due to glacial rebound after the ice melts
 - a large, kettle-pocked moraine left as an island when sea level rises following melting of the ice
 - a stream valley deepened by glacial erosion, that floods as sea level rises
 - a glacier-cut valley that is dammed by an end moraine and a large lake is formed
22. Which of the following best describes the term glacial drift?
- slow, plastic flow in the brittle zone of a glacier
 - the sedimentary materials outwash and till
 - the slow, southward advance of the continental ice sheets over Canada and North America during the Pleistocene
 - floating of icebergs southward from the north polar seas

23. Which one of the following statements concerning glacial deposits is false?
- Till is deposited directly from the ice; outwash is deposited by meltwater streams.
 - Outwash is mainly stratified sand and gravel.
 - Tills are poorly sorted and their fragments are mostly angular.
 - Glacial erratics are blocks of rock that are too large for the glacier to move.
24. Drumlin fields contain _____.
- mounds of outwash deposited by meltwater streams at the snout of a glacier
 - smooth, striated, bedrock ridges shaped and polished by a glacier's erosive action
 - bowl-shaped depressions eroded largely by frost action and glacial plucking
 - smooth, tapering, asymmetric ridges of till usually formed and shaped beneath a continental ice sheet
25. All of the following descriptions apply to stratified drift (not till) except for _____.
- commonly layered, well sorted sand and gravel beds
 - deposited in advance of the ice front on outwash plains, in glacial lakes, or fjords
 - deposited or redeposited by glacial meltwater
 - rock flour deposited directly from advancing ice
26. 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
27. Which one of the following prominent features were significantly larger than at present day during the Pleistocene glacial episodes?
- horns, arêtes, and cirques produced by alpine glaciation
 - the Great Lakes and Lake Agassiz
 - terminal moraines of continental ice sheets that moved south from Canada
 - subaerial fan deltas covering more extensive coastal plains
28. The best way to determine the age a pre-Cambrian rock is:
- Tree rings
 - Radioactive dating
 - Carbon14 dating
 - Asking the rock
29. Which of the following is mafic?
- Granite
 - Rhyolite
 - Basalt
 - Andesite

TRUE or FALSE

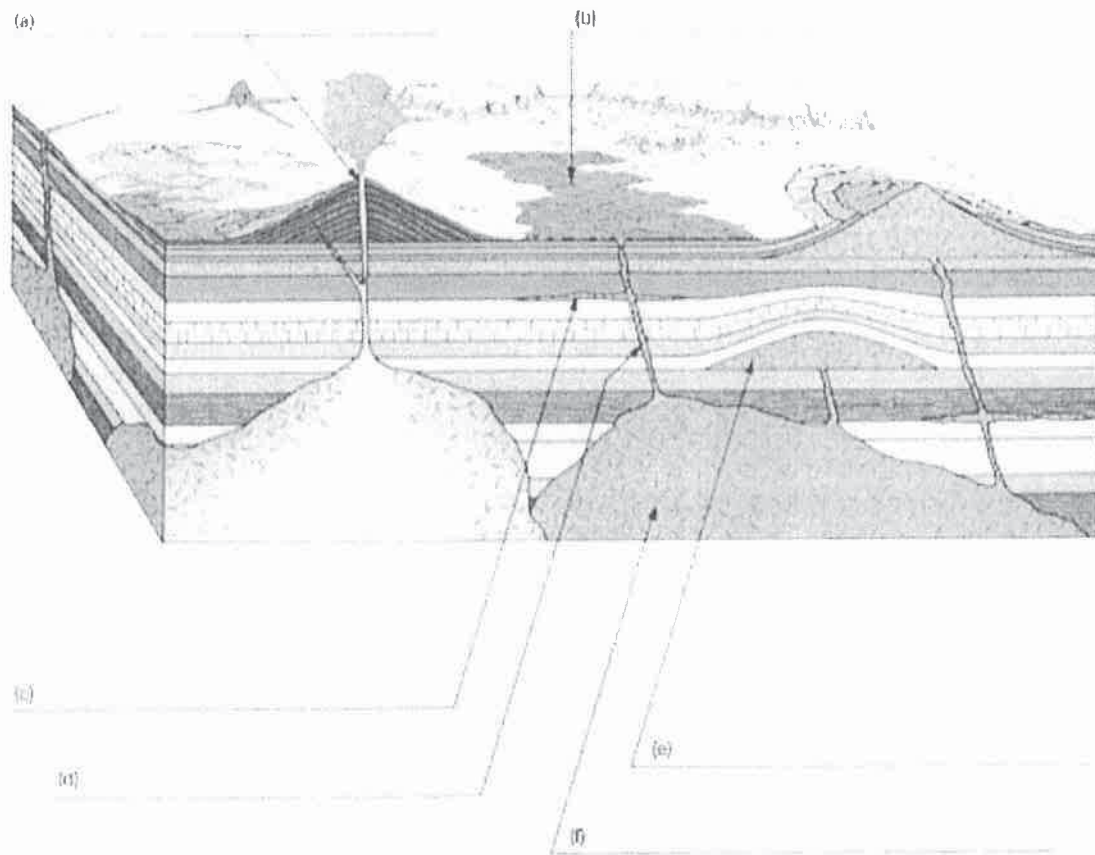
30. Evidence for the supercontinent Pangaea includes fit of continents, matching fossils and mountain chains separated by ocean basins, and ancient glaciated rocks in the southern hemisphere.
31. During various times in the geologic past, the polarity of Earth's magnetic field has been reversed.
32. As continents drift, they plow through the thinner ocean lithosphere like big rocky "ice breakers" and push it out of their way.
33. In general, rocks of the continental crust are less dense than rocks of the oceanic crust.
34. In general, seafloor sediments gradually thicken away from a mid-ocean ridge.
35. The epicentre of an earthquake is on the surface of the Earth directly above the focus.
36. Earthquakes result from the sudden release of elastic strain energy previously stored in rocks surrounding a zone of fault movement.
37. The energy released by an earthquake is very intense, and felt just as strongly in distant places, in accordance with its magnitude.
38. S waves are waves that can travel through solid and liquid media.
39. Horizontal vibrations, such as induced by strike-slip faulting, S-waves and some types of surface waves are generally much more dangerous to tall buildings than vertical up and down ground shaking.
40. 90% of all earthquakes occur below depths of 700 km.
41. The Richter earthquake magnitude scale is based on the total amount of energy released by the earthquake, as measured on a seismograph.
42. Unconsolidated, water-saturated soils or sediments provide good foundation materials for buildings and other structures because they absorb and dampen seismic vibrations.
43. The Mohorovicic discontinuity separates Earth's mantle and outer core.
44. All atoms of the same element have the same atomic number.
45. Graphite and diamond have the same chemical composition and different crystalline structures.
46. Diamond and quartz are both minerals composed of a single element.
47. Mineral lustre is broadly classified as either metallic or opaque.
48. Colour is one of the most diagnostic properties of minerals.
49. As silicate tetrahedra link together in larger units, more oxygens are shared and the size of the negative charge per silicon decreases.
50. Calcite and dolomite are both carbonate minerals.
51. Rocks always weather chemically before they undergo mechanical weathering.
52. Sheeting parallel to quarry floors, and rock bursts on fresh cuts and tunnels, are caused by unloading.
53. The addition of a small amount of acidity dramatically increases rates of dissolution and chemical weathering.
54. The natural decomposition of limestone through chemical weathering mostly produces solid, insoluble calcium hydroxide.
55. Quartz weathers readily to aluminum-rich clay minerals.

56. Feldspars commonly decompose during weathering to clay minerals, silica, and soluble constituents.
57. Ferromagnesian minerals (like olivine and pyroxene) that crystallize at high temperatures in Bowen's reaction series are generally much less susceptible to chemical weathering than quartz.
58. In detail, there is no geologic evidence that mid-ocean ridges spread at uniform rates or even symmetrically.
59. As dense seafloor is subducted, it penetrates the surrounding mantle and ruptures it causing the largest earthquakes.as the mantle fractures.
60. Calcite and halite react with dilute acids to evolve carbon dioxide.

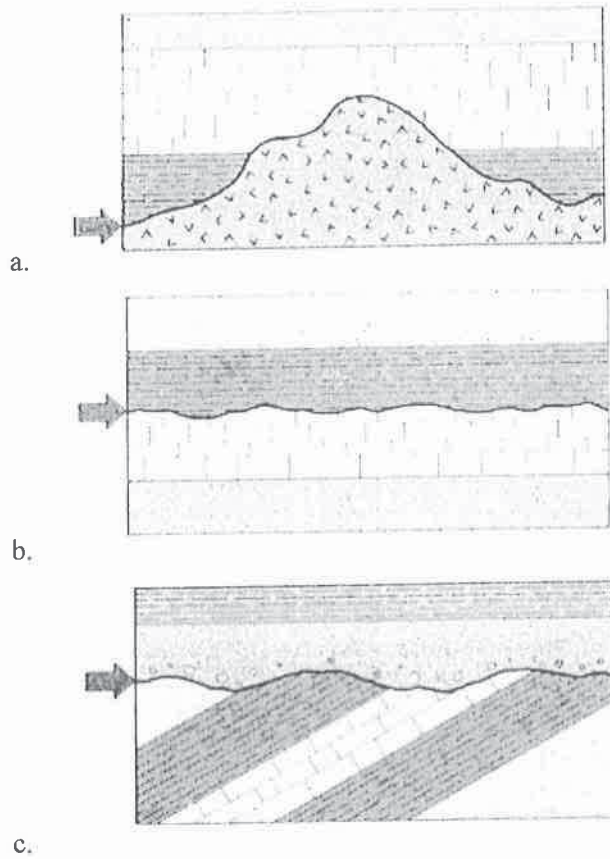
Question 2. Short Answer

20 Marks

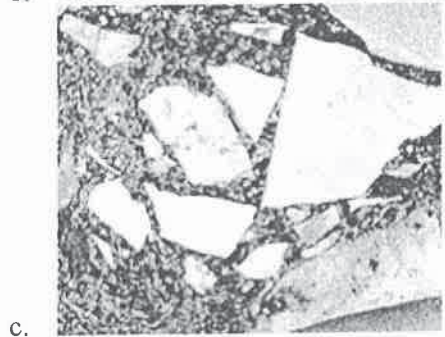
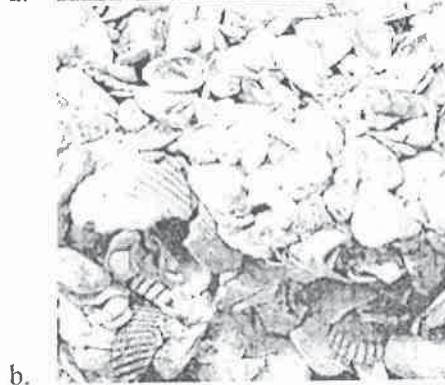
61. On the blanks provided, write the name of the feature labeled.



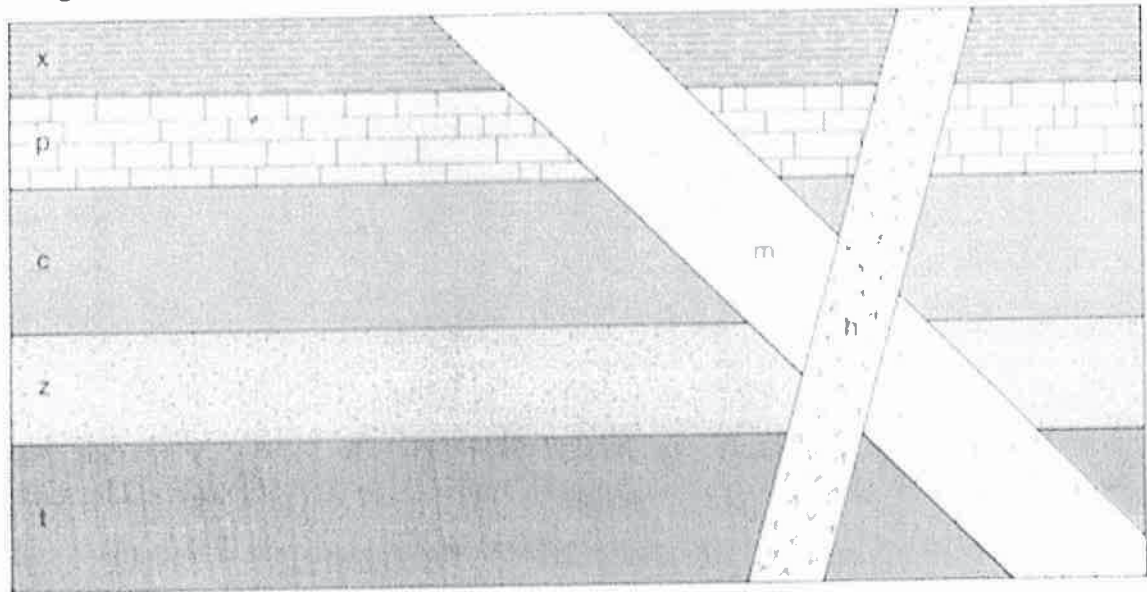
62. Name the specific type of unconformity that is labeled with an arrow. The v-pattern indicates igneous rocks. All other patterns are different types of sedimentary rocks.



63. Carefully observe each of the photographs below depicting sedimentary rocks. To the right of each sample, name the rock and describe its origin (i.e. how it formed and how it got to its current state shown in the photos).



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



Question 3. Write the answer to two (2) of the following questions: 20 Marks

65. List and describe the factors that influence mass wasting.
66. Describe and sketch four (4) types of drainage basins.
67. Sketch and describe the hydrologic cycle.
68. Name three (3) types of glaciers and give key characteristics of each.
69. List and describe three (3) erosional features and three (3) depositional features associated with glaciers.
70. Describe Bowen's Reaction Series.
71. Describe the theory of Plate Tectonics.
72. List and describe four (4) types of volcanoes.