

**PART I**  
**Total Value: 60%**

**Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.**

1. Which best represents the statement below?

*Plate tectonics, instead of continental drift, is accepted by scientists to explain the origins of mountains, earthquakes and volcanic activity through the movement of crustal plates.*

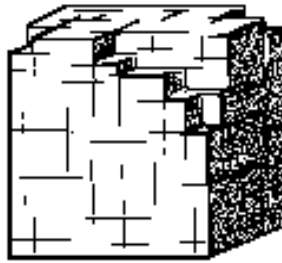
- (A) evidence
  - (B) hypothesis
  - (C) law
  - (D) paradigm
2. Which major branch of Earth Science involves the study of how Earth's materials, structures, processes and organisms change over time?
- (A) astronomy
  - (B) geology
  - (C) meteorology
  - (D) oceanography
3. Based on the Solar Nebular Hypothesis, which occurred first?
- (A) atmosphere
  - (B) biosphere
  - (C) geosphere
  - (D) hydrosphere
4. Which is the shortest unit on the geological time scale?
- (A) Eon
  - (B) Epoch
  - (C) Era
  - (D) Period
5. Which radioactive isotope would be used to date the bones of an ancient mummy?
- (A) Carbon-14
  - (B) Potassium- 40
  - (C) Rubidium- 87
  - (D) Uranium-238

6. What is the age of the rock described below?

*A granite sample is dated using the radioactive isotope K-40, which has a half-life of 1.3 billion years. The rock contains 1/8 of the original K-40.*

- (A) 2.6 billion years
  - (B) 3.9 billion years
  - (C) 4.2 billion years
  - (D) 5.5 billion years
7. Which of Earth's spheres includes rocks and minerals?
- (A) atmosphere
  - (B) biosphere
  - (C) geosphere
  - (D) hydrosphere
8. Which reservoir of water is least available for human use due to its geographical location?
- (A) ground water
  - (B) polar ice
  - (C) salt water
  - (D) tropical lakes
9. In which layer of Earth does convection occur resulting in plate movement?
- (A) asthenosphere
  - (B) inner core
  - (C) lithosphere
  - (D) outer core
10. Which process explains the origin of the atmosphere and the hydrosphere?
- (A) gravitational forces
  - (B) lithification
  - (C) segregation
  - (D) volcanic outgassing
11. Which is the upper limit of groundwater?
- (A) surface water
  - (B) water table
  - (C) zone of aeration
  - (D) zone of saturation
12. Which refers to the ability of water to flow through an aquifer?
- (A) aquiclude
  - (B) aquitard
  - (C) permeability
  - (D) porosity

13. Which is true regarding a mineral?
- (A) It is a gas.
  - (B) It is an organic compound.
  - (C) It is impure.
  - (D) It is naturally occurring.
14. In which mineral group does olivine ( $\text{Mg}_2\text{SiO}_4$ ) belong?
- (A) carbonate
  - (B) halide
  - (C) silicate
  - (D) sulfate
15. Which mineral displays the cleavage pattern shown below?

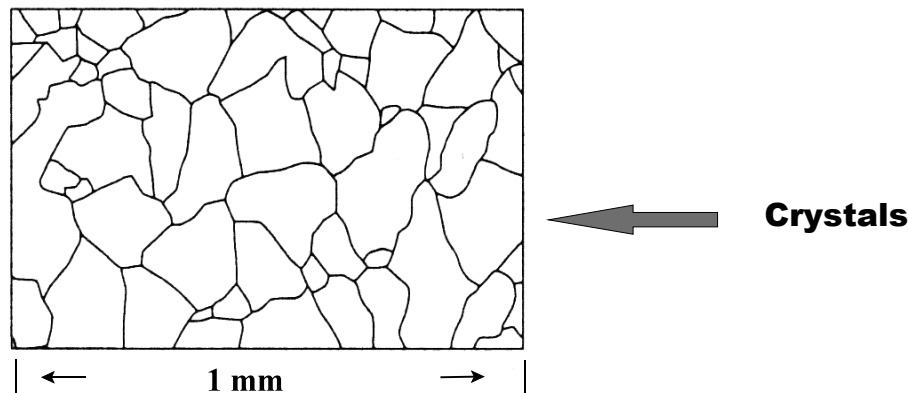


- (A) feldspar
  - (B) halite
  - (C) mica
  - (D) quartz
16. Which is the least useful property used to identify a mineral?
- (A) cleavage
  - (B) colour
  - (C) hardness
  - (D) specific gravity
17. Which explains why diamond is harder than graphite?
- (A) atoms of carbon are more closely packed in graphite
  - (B) atoms of carbon have stronger chemical bonds in diamond
  - (C) impurities exist within the chemical structure of graphite
  - (D) diamond has layers of carbon atoms which are weakly bonded
18. Which forms from the crystallization of magma?
- (A) clastic
  - (B) evaporite
  - (C) igneous
  - (D) metamorphic

19. Which igneous rock is matched with its correct texture?

	Rock	Texture
(A)	Basalt	Glassy
(B)	Granite	Coarse
(C)	Obsidian	Fine
(D)	Rhyolite	Porphyritic

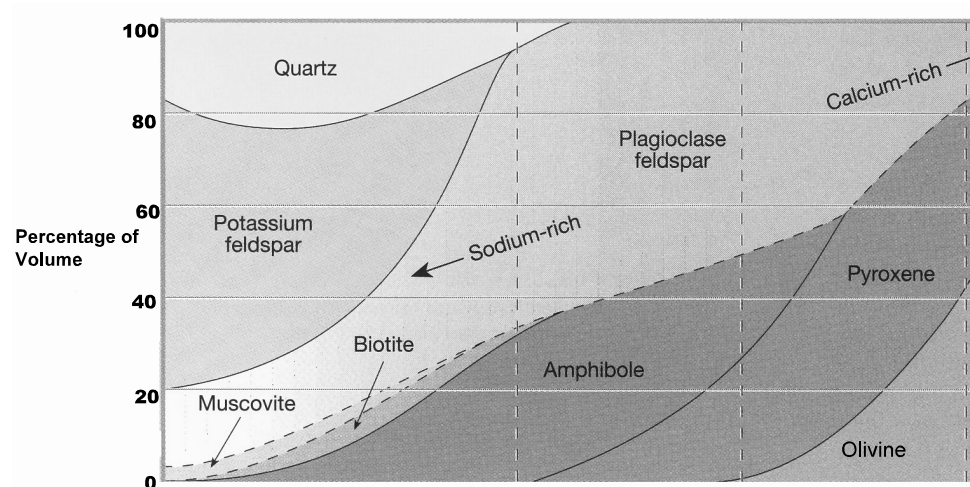
20. Based on the diagram below of an igneous rock, which rate of cooling matches its texture?



- (A) rapid and coarse grained
- (B) rapid and fine grained
- (C) slow and coarse grained
- (D) slow and fine grained

21. Using the description and diagram below, which is the rock’s classification and type?

- *coarse-grained*
- *20 % olivine*
- *50 % pyroxene*
- *30 % calcium-rich plagioclase feldspar*



- (A) felsic and granite
- (B) felsic and rhyolite
- (C) mafic and basalt
- (D) mafic and gabbro

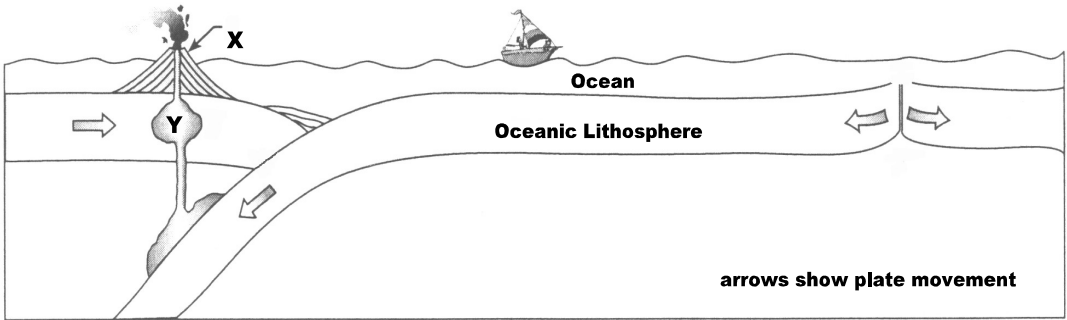
22. Which is the correct sequence in the formation of sedimentary rock?
- (A) compaction → deposition → weathering → cementation → erosion
  - (B) deposition → erosion → cementation → weathering → compaction
  - (C) erosion → weathering → deposition → cementation → compaction
  - (D) weathering → erosion → deposition → compaction → cementation
23. Which rock is classified as igneous extrusive?
- (A) diorite
  - (B) gabbro
  - (C) granite
  - (D) rhyolite
24. Which is a common feature of sedimentary rocks?
- (A) crystals
  - (B) foliation
  - (C) stratification
  - (D) vesicles
25. Which erosional agent creates u-shaped valleys?
- (A) glacier
  - (B) running water
  - (C) wave action
  - (D) wind
26. Which feature will form in a tidal flat after water has evaporated?
- (A) cross bedding
  - (B) graded bedding
  - (C) mud cracks
  - (D) ripple marks
27. Which is a depositional feature produced by a glacier?
- (A) arête
  - (B) cirque
  - (C) drumlin
  - (D) fiord
28. Which feature is found in a deep ocean environment?
- (A) baymouth bar
  - (B) delta
  - (C) lagoon
  - (D) submarine canyon

29. Which feature identifies the metamorphic rock below?



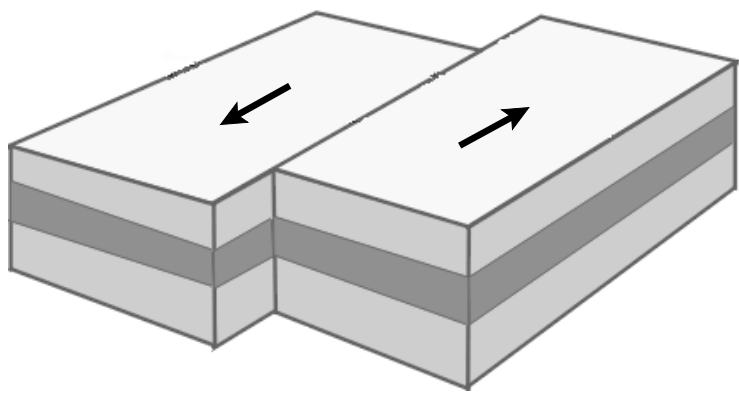
- (A) bedding
  - (B) foliation
  - (C) striation
  - (D) varves
30. Which is the main factor causing contact metamorphism?
- (A) chemical fluids
  - (B) heat
  - (C) original rock
  - (D) pressure
31. Which scientist proposed the existence of a supercontinent called Pangaea?
- (A) Alfred Wegener
  - (B) Arthur Holmes
  - (C) Harry Hess
  - (D) Tuzo Wilson
32. At which location is oceanic crust consumed?
- (A) convergent boundary
  - (B) divergent boundary
  - (C) hotspot
  - (D) ridge
33. At which location is an island arc produced?
- (A) continental-oceanic collision area
  - (B) normal fault area
  - (C) oceanic-oceanic collision area
  - (D) transform fault area
34. Which location contains the oldest rocks on the ocean floor?
- (A) continental shelf
  - (B) transform fault
  - (C) trench
  - (D) ridge

35. Which type of fault is formed by tension?
- (A) normal  
(B) reversal  
(C) thrust  
(D) transform
36. What is the point on Earth’s surface directly above an earthquake’s origin?
- (A) aftershock  
(B) epicenter  
(C) focus  
(D) foreshock
37. Which aspect of earthquakes is recorded by the Modified Mercalli Scale?
- (A) amplitude  
(B) intensity  
(C) location  
(D) magnitude
38. Which earthquake wave can travel through both solids and liquids?
- (A) primary  
(B) rayleigh  
(C) secondary  
(D) shear
39. Which type of volcano is the smallest with the steepest slope?
- (A) cinder  
(B) composite  
(C) shield  
(D) strato
40. Which landform at location X and rock type at location Y is shown in the diagram below?

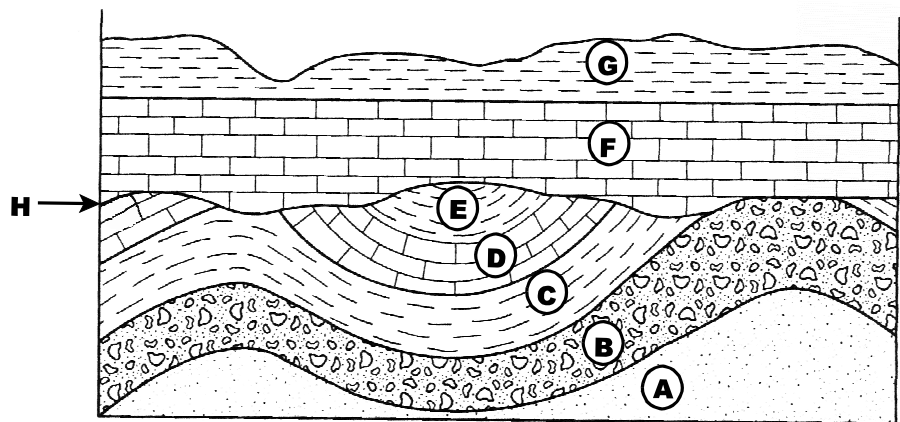


	Location X	Location Y
(A)	island arc	basalt
(B)	island arc	gabbro
(C)	volcanic arc	basalt
(D)	volcanic arc	gabbro

41. Which type of fault is illustrated below?



- (A) dip-slip
  - (B) reverse
  - (C) strike-slip
  - (D) thrust
42. If letters **A** through **G** represent rock layers in the diagram below, which sequence of geological events caused the unconformity indicated by letter **H**?



- (A) deposition → uplift → erosion → folding
  - (B) erosion → folding → deposition → intrusion
  - (C) folding → uplift → erosion → deposition
  - (D) intrusion → erosion → folding → uplift
43. Which process will produce mineral deposits from enriched hot fluids?
- (A) evaporite
  - (B) hydrothermal
  - (C) placer
  - (D) residual
44. Which is the correct match between a mineral and its economic use?

	Mineral	Economic Use
(A)	graphite	pencil leads
(B)	gypsum	steel
(C)	hematite	plaster
(D)	nickel	wall board

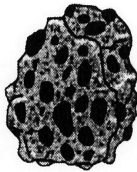


45. Which grade of coal is classified as a metamorphic rock?
- (A) anthracite
  - (B) bituminous
  - (C) lignite
  - (D) peat
46. Which is a characteristic of a cap rock found in an oil trap?
- (A) fractured
  - (B) impermeable
  - (C) oxidized
  - (D) permeable
47. Which layer of Earth is believed to be liquid due to the behavior of seismic waves?
- (A) crust
  - (B) inner core
  - (C) lithosphere
  - (D) outer core
48. Which glacial feature is shown below?




- (A) arête
  - (B) drumlin
  - (C) erratic
  - (D) horn
49. On which plate boundary is Iceland located?
- (A) convergent
  - (B) divergent
  - (C) destructive
  - (D) transform
50. Which rock is commonly used as floor tiles and roof shingles?
- (A) basalt
  - (B) granite
  - (C) limestone
  - (D) slate

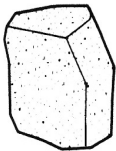
51. Which table below correctly classifies the rocks?




**A**  
Conglomerate




**B**  
Breccia



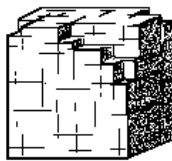
**C**  
Sandstone



**D**  
Shale



**E**  
Limestone



**F**  
Rock Salt

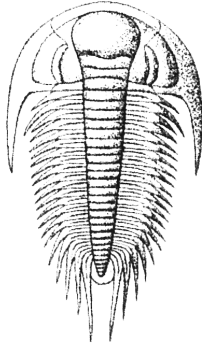
- (A)
- | Classification | clastic | biochemical | evaporite |
|----------------|---------|-------------|-----------|
| Rocks          | A,B,C,D | E           | F         |
- (B)
- | Classification | clastic | biochemical | evaporite |
|----------------|---------|-------------|-----------|
| Rocks          | A,B,C   | D           | E,F       |
- (C)
- | Classification | clastic | biochemical | evaporite |
|----------------|---------|-------------|-----------|
| Rocks          | A,C     | B,E         | D,F       |
- (D)
- | Classification | clastic | biochemical | evaporite |
|----------------|---------|-------------|-----------|
| Rocks          | A,B,F   | E           | C,D       |

52. Which statement is true regarding the Miocene worm trace fossil?



- (A) hard parts were preserved by petrification
- (B) no part of the worm has been preserved
- (C) soft parts were preserved by carbonization
- (D) the worm has been preserved in its original form

53. In which era did the organism below exist?



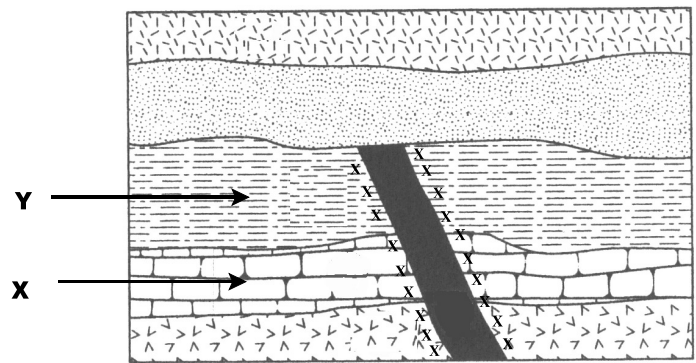
- (A) Cenozoic
  - (B) Mesozoic
  - (C) Paleozoic
  - (D) Precambrian
54. Which is a non-renewable resource?
- (A) fish
  - (B) natural gas
  - (C) trees
  - (D) wind
55. Which condition is necessary for the preservation of fossils?
- (A) coarse sediment
  - (B) large numbers
  - (C) rapid burial
  - (D) soft body parts
56. Which process would most likely preserve plant leaves?
- (A) carbonization
  - (B) mold and cast
  - (C) petrification
  - (D) replacement
57. Which gas was absent from the original atmosphere?
- (A) carbon dioxide
  - (B) water vapour
  - (C) nitrogen
  - (D) oxygen
58. Which is the name of the supercontinent that existed before Pangaea?
- (A) Gondwanaland
  - (B) Iapetus
  - (C) Laurasia
  - (D) Rodinia
59. Which region of Newfoundland is a remnant of an ancient ocean floor?
- (A) central
  - (B) eastern
  - (C) southern
  - (D) western

60. Which activity has contributed to changes in climate throughout geological time?
- (A) erosion
  - (B) earthquakes
  - (C) magnetic reversals
  - (D) volcanic activity

**PART II**  
**Total Value: 40%**

**Instructions:** Complete all items in this section. Your responses should be clearly presented in a well-organized manner.

Value  
2%      61.(a)



(i) Identify the geological principle which can be used to distinguish between the ages of rock layers **X** and **Y**.

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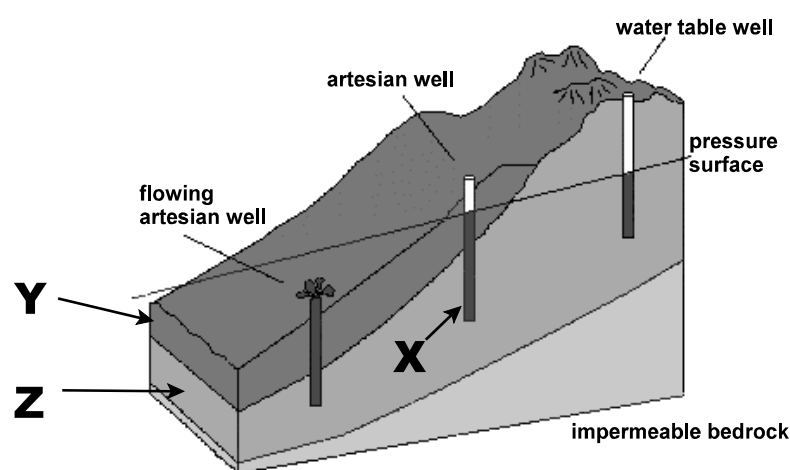
(ii) Explain your choice.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2%      (b) Using the data below, explain which pair of isotopes could most accurately be used to date an early Precambrian rock sample.

Isotope Pair	Half-Life
Uranium-238 and Lead-206	4.5 billion years
Uranium-235 and Lead-207	713 million years
Carbon-14 and Nitrogen-14	5730 years

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\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



(i) Label rock layers **Y** and **Z**.

**Y:** \_\_\_\_\_

**Z:** \_\_\_\_\_

(ii) Explain why the artesian well located at **X** is not flowing.

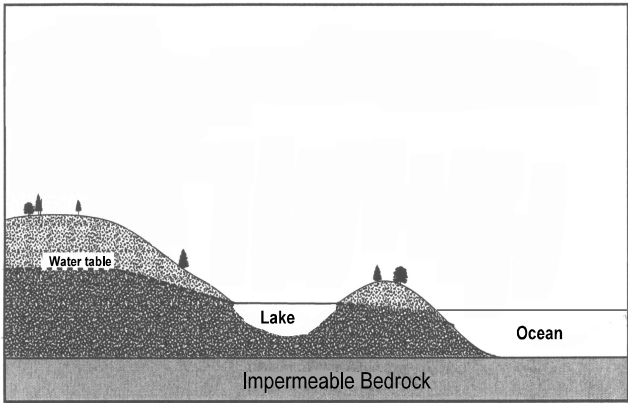
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2% (b)



During times of drought, the lake in the diagram above becomes salty. Using your knowledge of rock types and the hydrologic cycle, explain why this occurs.

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Value

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63.(a) Explain why specific gravity is a better property for identifying an unknown mineral rather than lustre.

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2%

(b) Explain the difference between a rock and a mineral. Provide an example of each.

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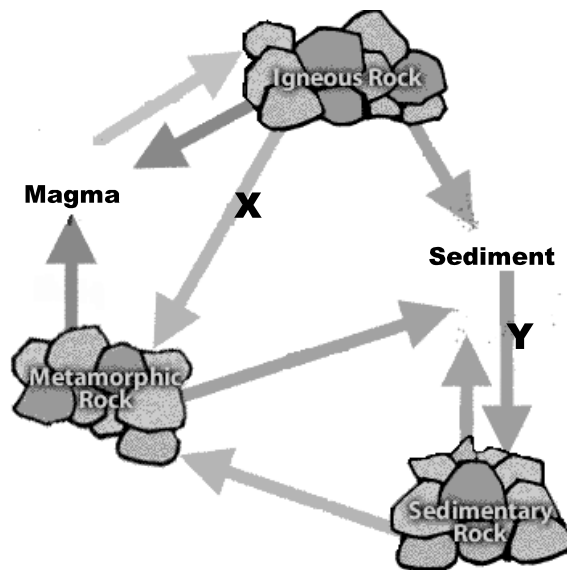
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- (c) Explain one process that occurs at location **X** and one process at location **Y**.



**Location X**

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**Location Y**

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2%

- (d) Explain the difference between igneous rocks that are extrusive and those that are intrusive. Provide an example of each.

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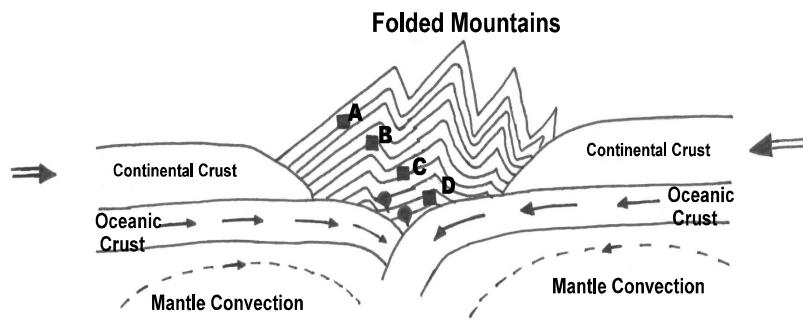
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Value

3%

- (e) Explain the sequence from **A** through **D** that will occur in shale as it is buried deeper within the folded mountains at a continent to continent plate collision.



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2%

- (f) With the aid of diagrams, explain two sedimentary features which can be used to determine if a rock outcrop has overturned.

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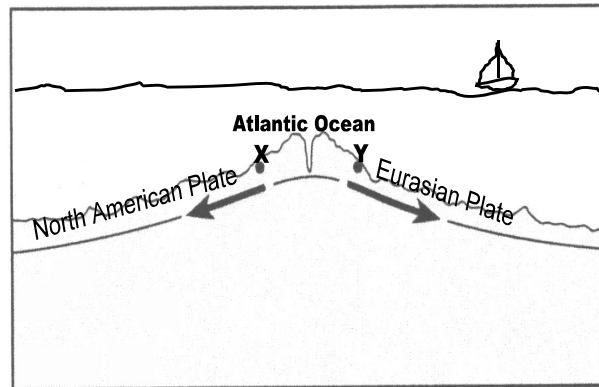
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(g)



(i) Name the type of plate boundary.

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(ii) Explain why the rocks at locations X and Y would be the same age.

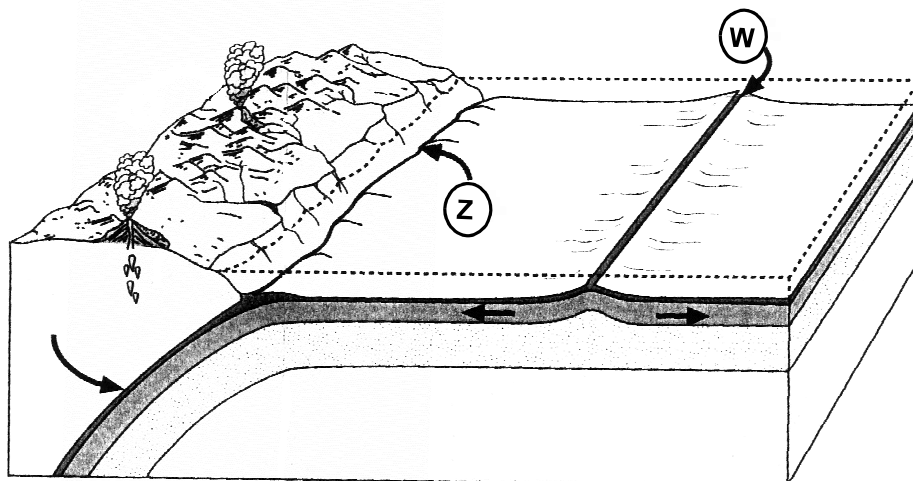
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3%

(h) Explain how the processes occurring at W and Z are related.



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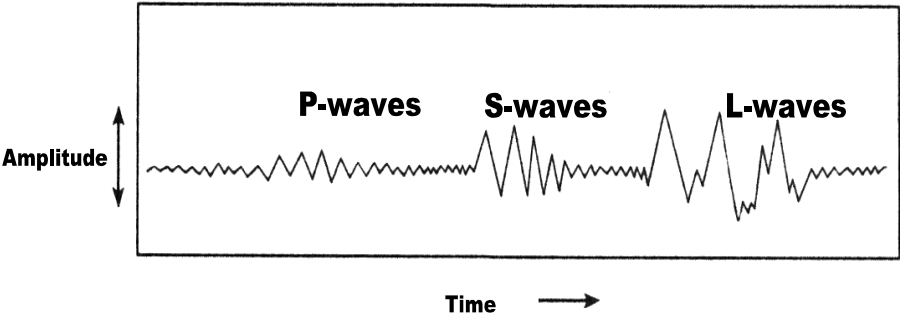
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Value  
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(i)



(i) Which seismic wave would cause the most destruction at Earth’s surface?

\_\_\_\_\_

(ii) Explain your choice.

\_\_\_\_\_

\_\_\_\_\_

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(j) With the aid of a labeled diagram, explain the conditions needed to form an oil trap.

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Value

3% 64. (a) Describe three pieces of evidence to contrast the Theory of Continental Drift and the Theory of Plate Tectonics.

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3% (b) With reference to plate tectonics, explain why Newfoundland has three major geological zones.

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