Part I
Total Value: 50%

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

1. Which term defines a hypothesis that has survived extensive scrutiny?

   (A) fact
   (B) law
   (C) paradigm
   (D) theory

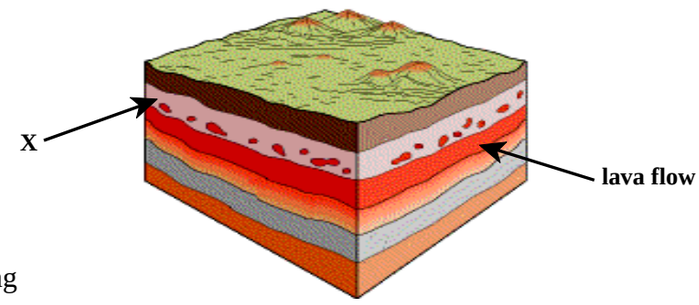
2. Which branch of Earth Science studies conditions in the atmosphere?

   (A) astronomy
   (B) geophysics
   (C) meteorology
   (D) paleontology

3. Radioactive atoms of potassium-40 will decay with a half-life of 1.3 billion years. How many billion years will it take for 20 000 atoms of potassium-40 to decay so that 2 500 atoms remain?

   (A) 1.3
   (B) 2.6
   (C) 3.9
   (D) 5.2

4. Which geologic feature is found in rock unit X below?



   (A) cross bedding
   (B) inclusions
   (C) intrusion
   (D) ripple marks

5. Which suggests that major Earth features are the result of sudden disasters of unknowable causes in Earth's past?

   (A) catastrophism
   (B) fundamentalism
   (C) superposition
   (D) uniformitarianism

6. Which idea suggests that the bodies of our solar system condensed under gravitational force from a huge cloud of dust and gas?

   (A) Big Bang
   (B) catastrophism
   (C) creationism
   (D) Solar Nebular

7. Which two Earth layers are separated by the Moho?

(A) crust and mantle
(B) inner core and outer core
(C) lower mantle and upper mantle
(D) outer core and mantle

8. Which part of the upper mantle is a hot, weak layer that has the ability to flow?

(A) asthenosphere
(B) lithosphere
(C) oceanic crust
(D) outer core

9. What would help prevent groundwater pollution from landfill dump sites?

(A) fast moving streams nearby
(B) impermeable soil
(C) permeable soil
(D) slow moving streams nearby

10. What does porosity measure in sediment or rock?

(A) extent to which open spaces are connected
(B) percentage of volume that is open space
(C) rate at which water will flow through open space
(D) shape and average size of open spaces

11. What percentage of Earth's water resources is ice?

(A) 1%
(B) 2%
(C) 50%
(D) 97%

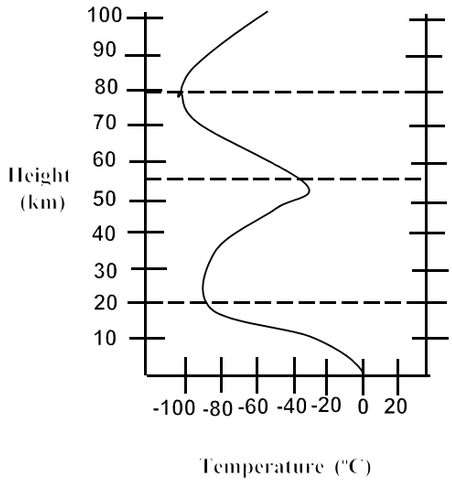
12. Which best explains the origin of Earth's atmosphere?

(A) fossil fuel burning
(B) glacier melting
(C) photosynthesis
(D) volcanic outgassing

13. Which is a possible explanation for the origin of life on Earth?

(A) chemosynthesis
(B) evaporation
(C) photosynthesis
(D) precipitation

14. In the graph below, which atmospheric layers show an increase in temperature as height increases?



(A) mesosphere and thermosphere
(B) mesosphere and troposphere
(C) stratosphere and thermosphere
(D) stratosphere and troposphere

15. Which is a native element of Earth's crust?

(A) aluminum
(B) copper
(C) iron
(D) nickel

16. Which are the most abundant elements in Earth's crust?

(A) aluminum and iron
(B) aluminum and silicon
(C) oxygen and iron
(D) oxygen and silicon

17. Given the information below, what is the order of minerals from softest to hardest?

- topaz scratches quartz
- quartz scratches fluorite
- fluorite scratches calcite

(A) calcite, fluorite, quartz, topaz
(B) fluorite, quartz, topaz, calcite
(C) quartz, calcite, topaz, fluorite
(D) topaz, calcite, fluorite, quartz

18. Which chemical formula is matched with its mineral group?

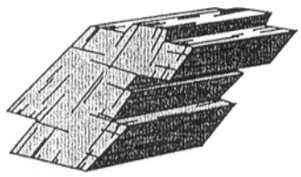
	Chemical Formula	Mineral Group
(A)	Al_2O_3	halides
(B)	$CaCO_3$	oxides
(C)	PbS	sulfides
(D)	ZnS	sulfates

19. Which describes basalt?

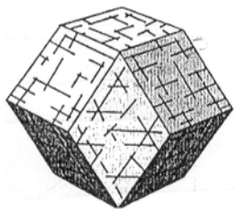
(A) coarse-grained light colored igneous rock
(B) fine-grained dark colored igneous rock
(C) foliated metamorphic rock
(D) non-foliated metamorphic rock

20. Which best represents a mineral sample with three cleavage directions at 90^{o} to each other?

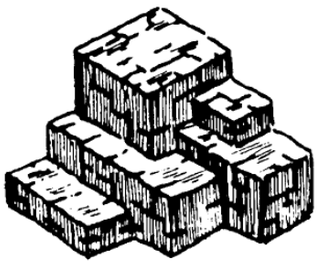
(A)



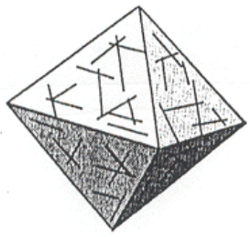
(B)



(C)



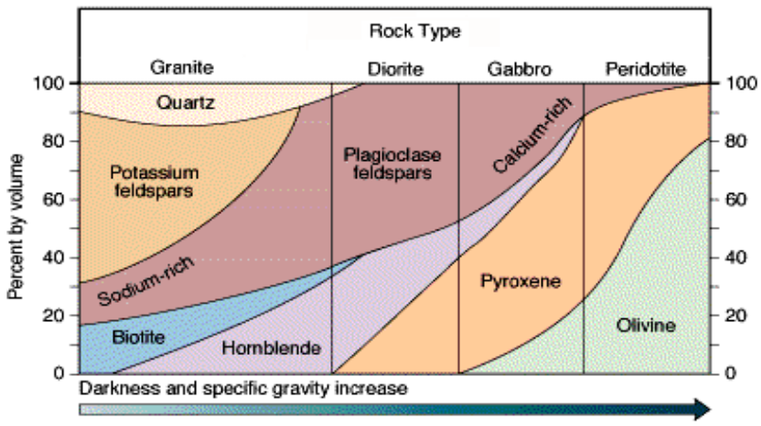
(D)



21. Which is a major component of the suspended load in a slow-moving stream?

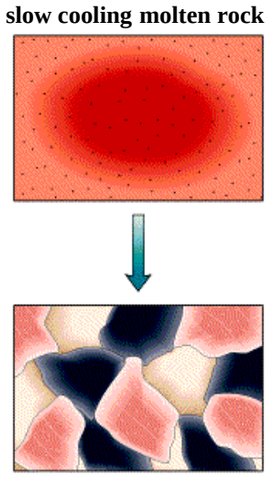
(A) boulder
(B) clay
(C) gravel
(D) pebble

22. Which rock type below contains the highest percentage of olivine and pyroxene?



(A) diorite
(B) gabbro
(C) granite
(D) peridotite

23. Which rock would form as a result of the process shown below?



(A) basalt
(B) conglomerate
(C) gneiss
(D) granite

24. Which sedimentary feature is seen below?

(A) drumlin
(B) erratic
(C) sea stack
(D) stalactite

25. Which sedimentary feature consists of relatively thin layers inclined at an angle to the main bedding?

(A) cross bedding
(B) graded bedding
(C) mud cracks
(D) ripple marks

26. Which two factors have the greatest influence on the settling rate of particles in water?

(A) hardness and colour
(B) hardness and shape
(C) size and colour
(D) size and shape

27. What type of metamorphism affects the largest volume of crust?

(A) contact
(B) hydrothermal
(C) pyroclastic
(D) regional

28. Which rock is formed when limestone undergoes metamorphism?

(A) gneiss
(B) marble
(C) quartzite
(D) slate

29. What are the agents of metamorphism in rocks?

(A) contact and regional deformation
(B) foliation and deposition
(C) heat, pressure and chemical fluids
(D) uplifting and folding

30. Which evidence was used by Alfred Wegener to support continental drift?

(A) chains of undersea volcanoes
(B) deep-focus earthquakes at subduction zones
(C) matching fossils on separated land masses
(D) movement along the San Andreas fault

31. Which is most likely a driving mechanism for the movement of Earth's tectonic plates?

(A) crustal uplifting
(B) isostatic adjustment
(C) magnetic reversals
(D) mantle convection

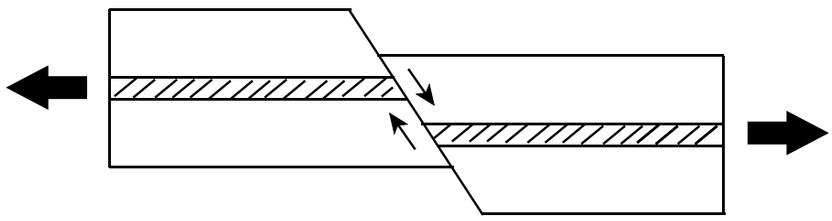
32. Which is an example of a divergent plate boundary?

(A) Aleutian Trench
(B) Hawaiian Islands
(C) Mid-Atlantic Ridge
(D) San Andreas Fault

33. Which best explains why earthquakes occur?

(A) Continental Drift Theory
(B) Elastic Rebound Theory
(C) liquefaction
(D) paleomagnetism

34. Which fault and its corresponding force are demonstrated in the diagram below?

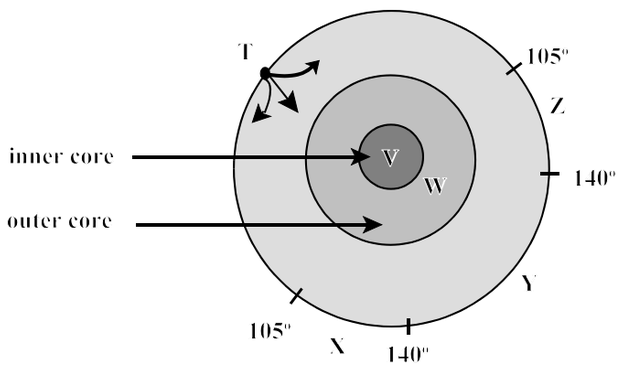


	fault	force
(A)	normal	compressional
(B)	normal	tensional
(C)	reverse	compressional
(D)	reverse	tensional

35. What determines the distance from a seismograph station to an earthquake epicenter?

(A) amount of aftershocks occurring after the earthquake
(B) difference in arrival times between the first P wave and S wave
(C) distance the crust has moved along major faults
(D) magnitude of the earthquake, divided by its duration

36. If a large earthquake occurs at location T in the diagram below, which areas would be included in the P-wave shadow zone?



(A) V, W, and Y
(B) X and Z
(C) X, Y, and Z
(D) Y only

37. Which type of volcano is built by successive basaltic lava flows?

(A) cinder
(B) composite
(C) shield
(D) strata

38. Which uses fossils to match rock layers from different locations?

(A) correlation
(B) included fragments
(C) original horizontality
(D) superposition

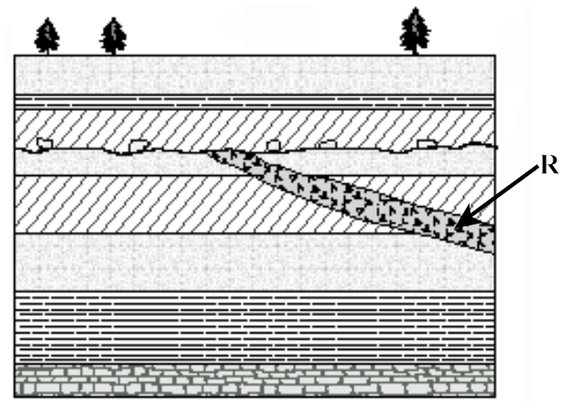
39. Which economic rock is paired with its use?

	rock	use
(A)	diorite	drill muds
(B)	granite	agri-chemicals
(C)	limestone	concrete
(D)	slate	fertilizer

40. Which mineral is a source of metal used to produce home electrical wiring?

(A) chalcopyrite ($CuFeS_2$)
(B) galena (PbS)
(C) pyrite (FeS_2)
(D) sphalerite (ZnS)

41. Which geologic concept in the diagram below demonstrates that rock unit "R" is younger than the rock strata it intrudes?



(A) cross-cutting relationships
(B) original horizontality
(C) superposition
(D) uniformitarism

42. What are the most important characteristics of oil reservoir rocks?

(A) porous and impermeable
(B) porous and permeable
(C) non-porous and impermeable
(D) non-porous and permeable

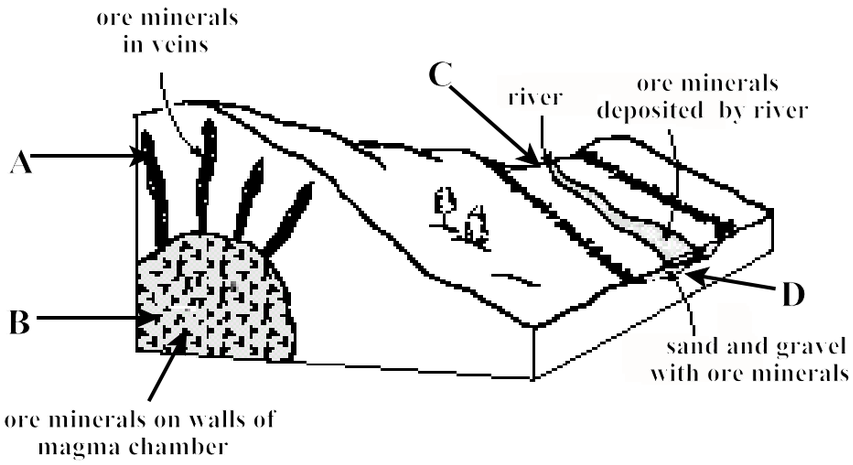
43. Which rock often contains fossils of organisms that lived in shallow marine environments?

(A) basalt
(B) conglomerate
(C) gneiss
(D) shale

44. Which feature was formed by continent-continent convergence?

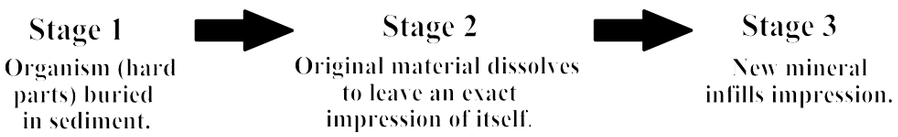
(A) Andes Mountains
(B) Hawaiian Islands
(C) Himalayan Mountains
(D) San Andreas Fault

45. At which location in the diagram would hydrothermal mineral deposits be concentrated?



(A) A
(B) B
(C) C
(D) D

46. What is being formed in the process below?



(A) mold and cast
(B) original remains
(C) petrified fossil
(D) trace fossil

47. Which time span is referred to as the “Age of Mammals”?

(A) Cenozoic
(B) Mesozoic
(C) Paleozoic
(D) Proterozoic

48. Which organisms had major extinctions at the end of the Mesozoic Era?

(A) amphibians
(B) invertebrates
(C) mammals
(D) reptiles

49. Which scientist would study the physical characteristics of the inner core?

(A) hydrologist
(B) meteorologist
(C) seismologist
(D) volcanologist

50. Which best describes how global temperature is affected by the eruption of a volcano?

(A) decreases over a long period of time
(B) decreases over a short period of time
(C) increases over a long period of time
(D) increases over a short period of time

Part II
Total Value: 50%

Instructions: Complete ALL questions in the space provided. You may use diagrams in any question to aid in your answer.

Value

3% 51.(a) With reference to specific examples of radioactive dating and superposition, describe the difference between absolute and relative time.

2% (b) A sample of carbon-14 has a half-life of 5730 years. If the parent isotope was 512 g, how many grams of parent isotope will remain after 34 380 years? Show all calculations.

2% (c) Describe the processes that changed the original form of Earth's interior, 4.6 billion years ago, to its present form.

Value

3% 51.(d) Using a labelled diagram, describe the geologic conditions necessary for an artesian well to form.

2% 52.(a) What are two reasons why CO_2(g) levels increase during springtime?

Value

2% 52.(b) Compare the reliability of using the physical properties of streak and colour when identifying minerals.

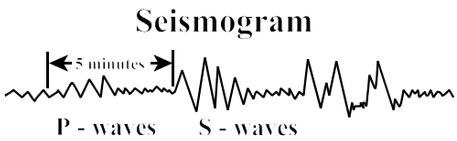
3% (c) Use an example to explain why two minerals with the same compositions can have different hardness and cleavage.

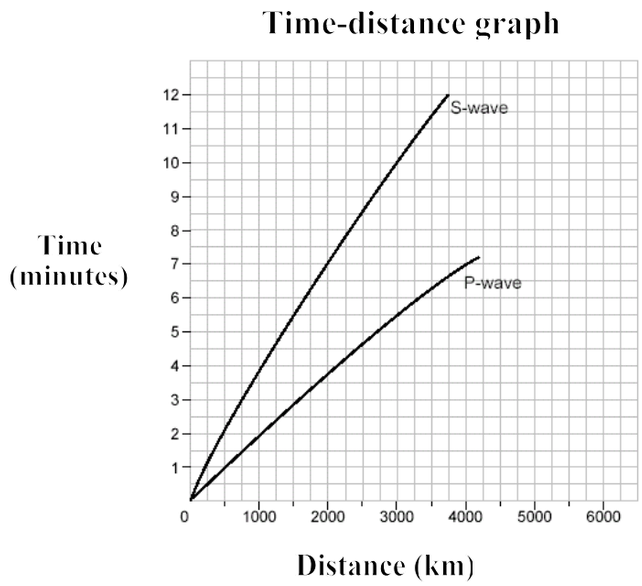
2% (d) What two pieces of information about glaciers can be determined from eskers and terminal moraines?

Value

2% 53.(a) Rhyolite and granite have very similar chemical compositions, yet they look quite different. Explain.

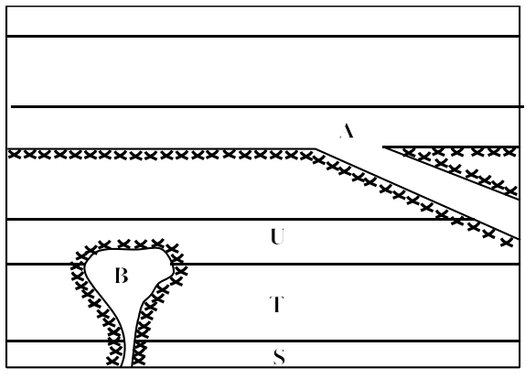
2% (b) At a seismic station, the P - and S - waves of an earthquake were recorded on a seismogram shown below. Using the travel time graph given, how far away was the earthquake from the seismic station? Justify your answer.





Value

53.(c) In the diagram below, A and B represent igneous rock units.



2% (i) State one igneous rock that could be represented by:

Rock unit "A"? _____

Rock unit "B"? _____

3% (ii) Which igneous formation from the diagram would display smaller crystals? Explain.

1% (iii) What does the symbol " ✕ " represent surrounding rock unit B?

2% (iv) Describe the effect rock unit B has on the layers S, T, and U.

Value

2% 53.(d) Describe the formation of ripple marks in a shallow water environment.

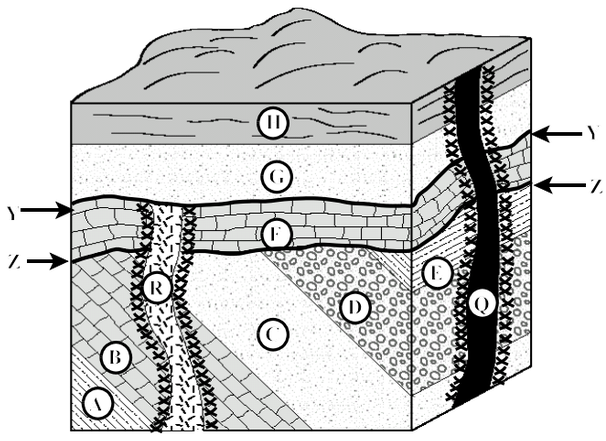
2% 54.(a) Using a labelled diagram, explain how the Hawaiian Islands support the theory of Plate Tectonics.

Value

2% 54.(b) If Earth is 4.6 billion years old, explain why the oldest oceanic rocks are less than 200 million years old?

2% (c) Which type of volcano is formed at ocean-continent convergent boundaries? Describe the composition of lava associated with these volcanoes.

2% (d) Arrange the letters from the diagram below in the order they occur, beginning with the oldest event and ending with the youngest event.



Oldest _____ Youngest

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Value

2% 54.(e) Complete the following chart.

Resource	How Formed	Use in Society
bauxite	secondary enrichment	aluminum foil
halite		
gold		

2% 55.(a) Use the Law of Uniformitarianism to explain why oil may be considered a renewable resource.

2% (b) Describe two possible reasons why jellyfish are poorly represented in the fossil record even though they were relatively abundant during the Paleozoic Era.

Value

3% 55.(c) Using specific examples that reference geologic time, explain how the fossil record demonstrates the progressive changing of life forms.