PART I
Total Value: 60%

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

1. Which is a formal statement in which a natural phenomena is described under given conditions?

   (A) evidence
   (B) hypothesis
   (C) law
   (D) paradigm

2. Which branch of earth science is studied when a geologist and biologist work together?

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

3. Which illustrates a logical progression of scientific thought as a result of new evidence?

   (A) Continental Drift ➜ Plate Tectonics
   (B) Radiometric Dating ➜ Relative Dating
   (C) Solar Nebular ➜ Big Bang
   (D) Uniformitarinism ➜ Catastrophism

4. Which type of dating would be used to tell the age of a tree using tree rings?

   (A) absolute
   (B) isotope
   (C) radiometric
   (D) relative

5. The half life of an element in a sample is 2000 years. If 50% of the element has decayed, how old is the sample?

   (A) 1000 years
   (B) 1500 years
   (C) 2000 years
   (D) 4000 years

6. Which evolutionary sequence is ordered from youngest to oldest?

   (A) fishes ➜ reptiles ➜ invertebrates ➜ amphibians
   (B) invertebrates ➜ fishes ➜ reptiles ➜ amphibians
   (C) reptiles ➜ amphibians ➜ fishes ➜ invertebrates
   (D) reptiles ➜ fishes ➜ amphibians ➜ invertebrates

7. Which best describes continental crust?

   (A) 7 kilometres thick; higher density than ocean crust
   (B) 7 kilometres thick; lower density than ocean crust
   (C) 35-40 kilometres thick; higher density than ocean crust
   (D) 35-40 kilometres thick; lower density than ocean crust

8. Which is the correct sequence of Earth's layers from the surface to the center?

Surface ⟶ Center

(A) crust - inner core - outer core - mantle
(B) crust - mantle - outer core - inner core
(C) mantle - crust - inner core - outer core
(D) mantle - outer core - inner core - crust

9. Which is the largest source of freshwater on Earth?

(A) glaciers
(B) groundwater
(C) oceans
(D) rivers

10. Which correctly describes permeability and porosity?

	Permeability	Porosity
(A)	amount of pore space	movement of water
(B)	movement of water	amount of pore space
(C)	quality of water	amount of pore space
(D)	quality of water	movement of water

11. Which will prevent the seepage of agrichemicals into an aquifer?

(A) cavernous limestone
(B) clay
(C) gravel
(D) permeable sandstone

12. Which is responsible for the formation of Earth's hydrosphere?

(A) meteorite impact
(B) radioactive decay
(C) respiration
(D) volcanic outgassing

13. Which is a substance that is solid, inorganic, occurs naturally, and exhibits a definite chemical composition and molecular structure?

(A) electron
(B) isotope
(C) mineral
(D) rock

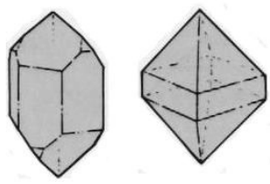
14. Which is a sulfate mineral?

(A) $CaMg(CO_3)_2$
(B) $CaSO_4 \bullet 2\ H_2O$
(C) KCl
(D) ZnS

15. A mineral sample with a mass of 75 g is placed in a graduated cylinder with 100 ml of water. The water level rises to 125 ml in the cylinder. What is the specific gravity of the mineral?

(A) 0.33
(B) 3.0
(C) 50.0
(D) 75.0

16. What mineral identification property is shown in the diagram below?



(A) crystal shape
(B) hardness
(C) luster
(D) specific gravity

17. Which mineral property is found by scraping a mineral across an unglazed porcelain tile?

(A) double refraction
(B) hardness
(C) lustre
(D) streak

18. Which rock forms from a silica-rich magma?

(A) andesite
(B) basalt
(C) gabbro
(D) rhyolite

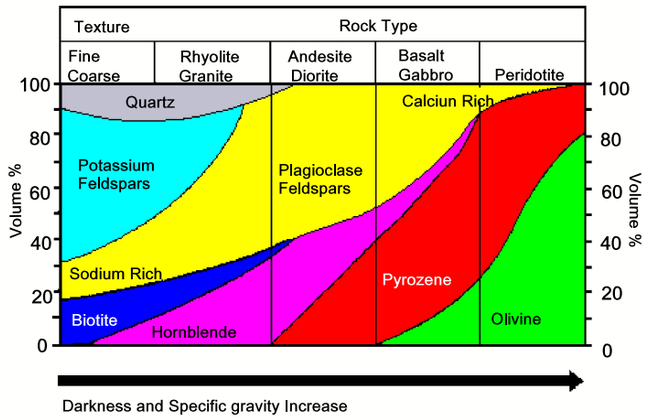
19. What is the correct match for magma composition and environment?

	Magma Composition	Environment
(A)	felsic	divergent boundary
(B)	felsic	hot spots
(C)	mafic	ridge
(D)	mafic	transform boundary

20. Which describes the cooling rate and crystal size of lava that cools at Earth's surface?

	Cooling Rate	Crystal Size
(A)	fast	large
(B)	fast	small
(C)	slow	large
(D)	slow	small

21. Based on the diagram below, which mineral is found in most igneous rocks?



(A) biotite
(B) olivine
(C) plagioclase feldspar
(D) potassium feldspar

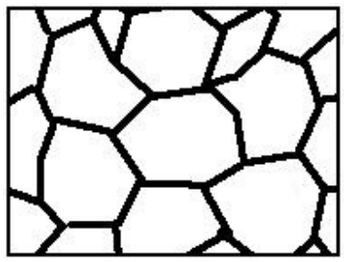
22. Which mineral forms in a hot, shallow marine environment?

(A) feldspar
(B) gypsum
(C) olivine
(D) quartz

23. Which is an organic sedimentary rock?

(A) andesite
(B) gneiss
(C) lignite
(D) shale

24. Which sedimentary feature is evident in the diagram below?



(A) cross-bedding
(B) mud cracks
(C) striations
(D) varves

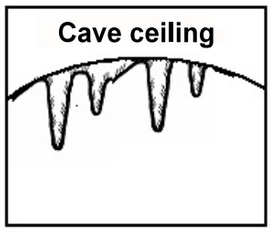
25. Which are used to determine the direction of glacier movement?

(A) erratics, cirques, and eskers
(B) horns, arêtes and ground moraine
(C) striations, drumlins and terminal moraines
(D) u-shaped valleys, horns, and erratics

26. Which is the most abundant type of deposit associated with deep-sea fans?

(A) basalt
(B) granite
(C) tillite
(D) turbidite

27. Which sedimentary feature is illustrated in the diagram below?



(A) arêtes
(B) horns
(C) stalactites
(D) stalagmites

28. Which is an erosional feature associated with shoreline environments?

(A) delta
(B) sand dune
(C) sea stack
(D) striations

29. What can be used to determine current direction?

(A) cross bedding
(B) fossils
(C) mud cracks
(D) varves

30. Which rock is formed when a layer of shale becomes metamorphosed?

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

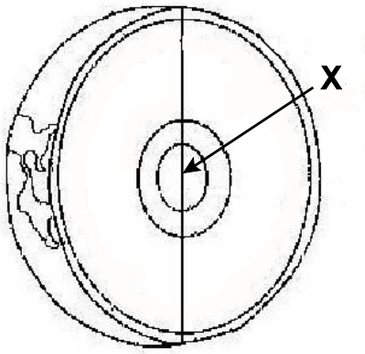
31. In which of Earth's layers does convection occur?

(A) crust
(B) inner core
(C) lithosphere
(D) mantle

32. What texture is evident in the rock sample below?

(A) foliated
(B) glassy
(C) porphyritic
(D) pyroclastic

33. Which layer of Earth's structure is represented by **X**?



(A) asthenosphere
(B) inner core
(C) lithosphere
(D) outer core

34. Which describes a transform plate boundary?

(A) Composite volcanoes accompany the plate boundary.
(B) Lithosphere is neither created nor destroyed.
(C) One plate subducts below the other plate.
(D) Up-welling of basalt fills the area between two plates.

35. Which feature would most likely form from compressional forces?

(A) divergent boundary
(B) normal fault
(C) reverse fault
(D) transform boundary

36. Which supports the concept of sea floor spreading based on evidence collected in the 1960's?

(A) Evidence of glaciation is found in both South America and Africa.
(B) Similar fossils are found on both sides of the Atlantic Ocean.
(C) The age of oceanic crust increases as you move away from a mid-oceanic ridge.
(D) The continents fit together like a jigsaw puzzle.

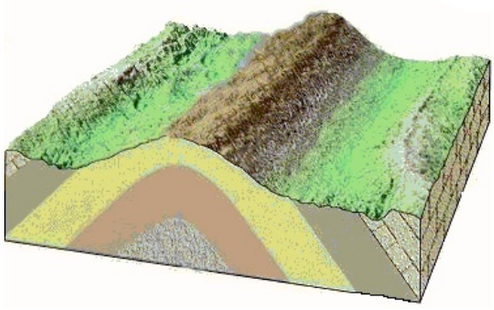
37. Earthquake X is 3.5 on the Richter scale. Earthquake Y releases approximately 27 000 times more energy than earthquake X. What is the Richter scale reading of earthquake Y?

(A) 4.5
(B) 5.5
(C) 6.5
(D) 8.5

38. What is the correct pairing of rock type and plate boundary?

	Rock Type	Plate Boundary
(A)	basalt	ocean-ocean divergent
(B)	gabbro	convergent
(C)	granite	divergent
(D)	gypsum	ocean-continent convergent

39. What produced the structure in the diagram below?



(A) compressional forces
(B) faulting
(C) shear forces
(D) tensional forces

40. Where do the majority of earthquakes occur?

(A) centre of continents
(B) continental shelves
(C) deep ocean basins
(D) plate boundaries

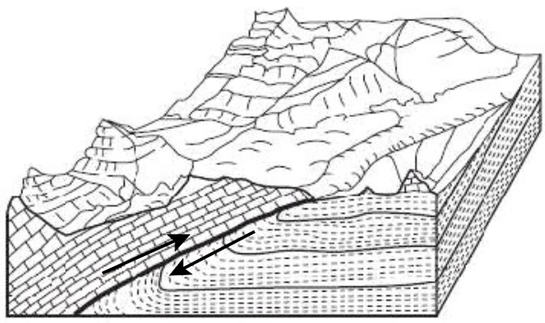
41. What happens to the speed of seismic waves when they pass from the crust to the mantle?

(A) remains the same
(B) slows down
(C) speeds up
(D) stops

42. Which geological setting would be the site of violent volcanic eruptions?

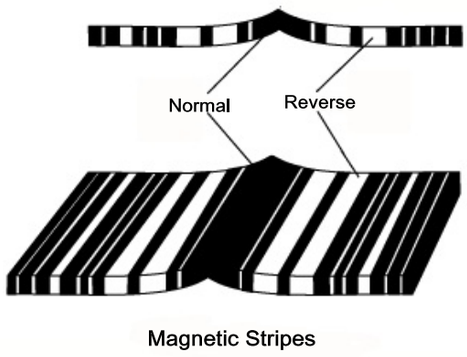
(A) convergent plate boundary
(B) divergent plate boundary
(C) mid-oceanic hot spot
(D) transform plate boundary

43. Which type of plate boundary and force is illustrated in the diagram below?



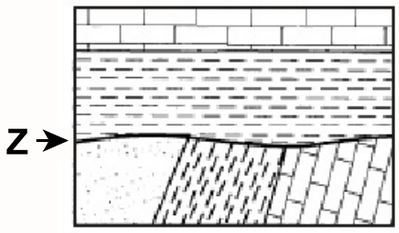
(A) convergent - compressional
(B) convergent - tensional
(C) divergent - compressional
(D) divergent - tensional

44. Which is confirmed by the discovery of parallel magnetic stripes on the ocean floor?



(A) contact metamorphism
(B) Earth's rotation
(C) polar wandering
(D) sea floor spreading

45. What type of boundary exists at **Z** in the diagram below?

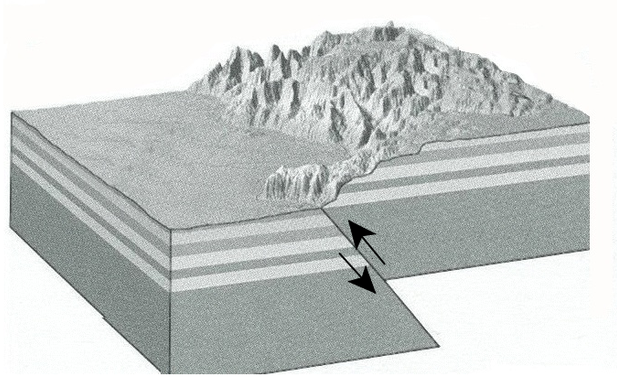


(A) angular unconformity
(B) bedding plane
(C) intrusion
(D) nonconformity

46. Which scientific device provided data to support the outer core being a liquid?

(A) magnetometer
(B) microscope
(C) seismograph
(D) telescope

47. What type of faulting is illustrated in the diagram below?



(A) normal
(B) reverse
(C) strike-slip
(D) transform

48. Which elements are currently being mined at Voisey's Bay, Labrador?

(A) copper and nickel
(B) lead and gold
(C) magnesium and silver
(D) zinc and aluminum

49. What mineral is the main source of iron?

(A) bauxite
(B) galena
(C) hematite
(D) sphalerite

50. What is the correct match between the resource and its economic use?

	Resource	Economic Use
(A)	gold	steel manufacturing
(B)	gypsum	jewelry
(C)	natural gas	fossil fuel
(D)	sulphur	building material

51. In which rock type do the oil and gas deposits of Hibernia occur?

(A) granite
(B) igneous
(C) metamorphic
(D) sedimentary

52. Which rock type would most likely contain well-preserved fossils?

(A) conglomerate
(B) granite
(C) schist
(D) shale

53. In what geological era would one find a rock layer containing numerous dinosaur fossils?

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

54. What method of fossilization preserve plants by depositing minerals in pore spaces?

(A) carbonization
(B) mold and cast
(C) petrification
(D) preservation

55. In which environment did these organisms live?

(A) desert
(B) glacial
(C) marine
(D) mountain

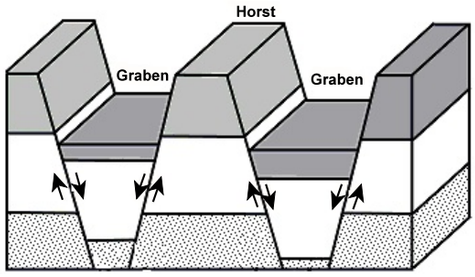
56. What life form was last to evolve?

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

57. Which process shows a direct link between the atmosphere and the geosphere?

(A) ground water pollution
(B) ozone depletion
(C) photosynthesis
(D) volcanic outgassing

58. At which plate boundary would the structure illustrated below occur?



(A) convergent
(B) divergent
(C) shear
(D) transform

59. What effect do large volcanic eruptions have on Earth's atmosphere?

(A) decrease in dust levels
(B) decrease in temperatures
(C) increase in pressure
(D) increase in solar radiation

60. Which is a non-renewable resource?

(A) coal
(B) forests
(C) solar energy
(D) wind energy

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) The parent isotope of a radioactive element has a half-life of 250 million years. If a sample contains 12.5% of the parent isotope, how old is the rock? Show all workings.

2% (b) Two hikers sit together on a hilltop overlooking a steep-sided river valley. One hiker explains its formation using uniformitarianism while the other uses catastrophism. Summarize each hiker's explanation of how the valley formed.

2% 62.(a) Explain how the interaction between the hydrosphere and lithosphere influences landscapes.

Value

2% 62.(b) Describe the process that could lead to the segregation of layers within a newly-formed planet.

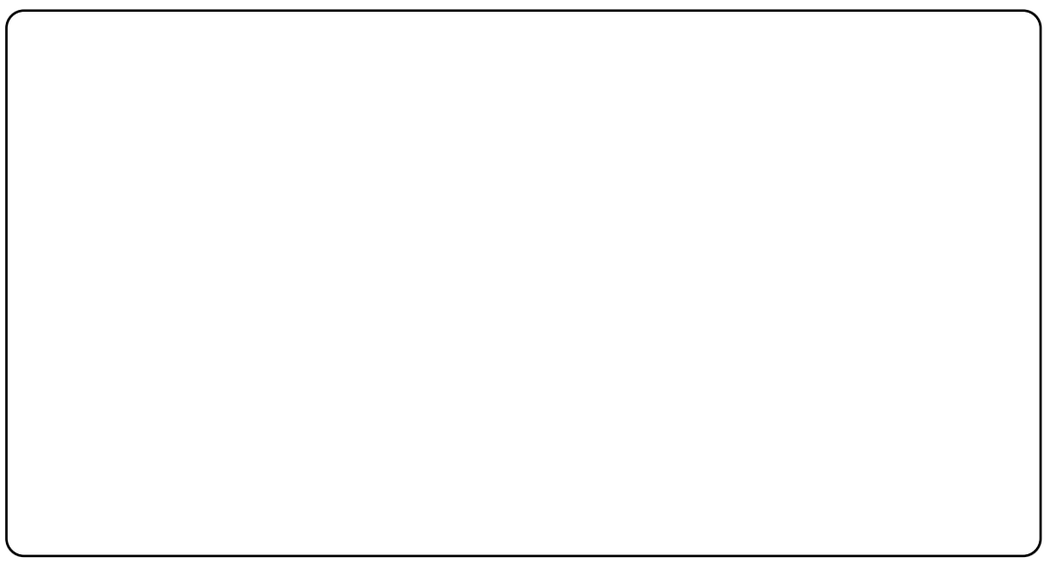
3% 63.(a) Briefly describe how a geologist would use texture and mineral composition to determine the type of igneous rock.

2% (b) Describe two features that would suggest to a geologist that a valley was subjected to alpine glaciation.

Value

2% 63.(c) Describe one erosional feature and one depositional feature related to rivers.

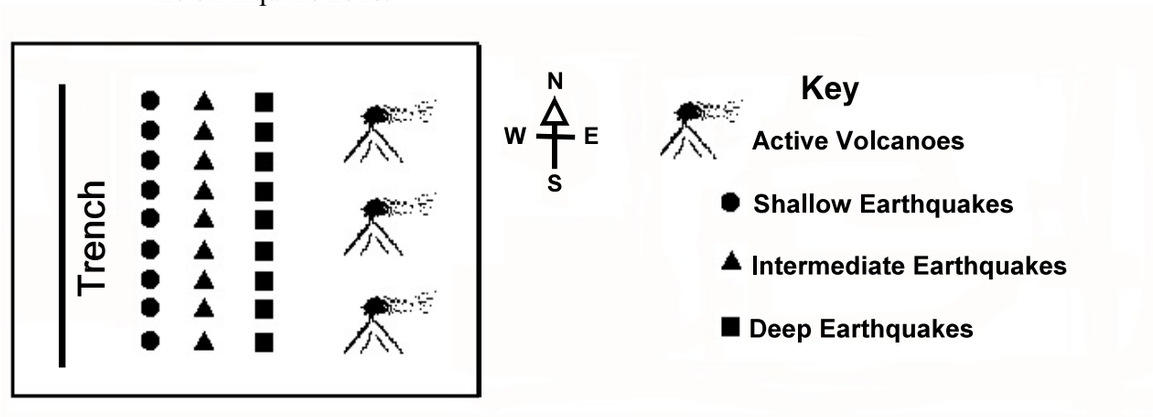
3% (d) Explain the difference between regional metamorphism and contact metamorphism within a mountain environment. Include a labeled diagram with your answer.



Value

2% 63.(e) In relation to the rock cycle, explain two processes responsible for the formation of sedimentary rocks.

(f) The diagram below shows a vertical view of earthquake epicentres and volcanic activity in an area underlain by oceanic crust. Active volcanoes lie to the east of the earthquake zone.



2% (i) Sketch a cross-sectional diagram from west to east through the region.

1% (ii) What type of plate collision has occurred in the diagram above?

Value

2% 63.(g) Construct a labeled geological cross-section that represents the following sequence of events.

Sandstone (**SS**), shale (**S**) and then conglomerate (**C**) are deposited horizontally. Compressional forces cause folding of these layers to create a syncline and an anticline. Following folding, there is a period of erosion (**Event E**). Later, deposition places a thick layer of limestone (**L**) on top. Finally, magma (**M**) intrudes the entire sequence, and does not reach the surface.

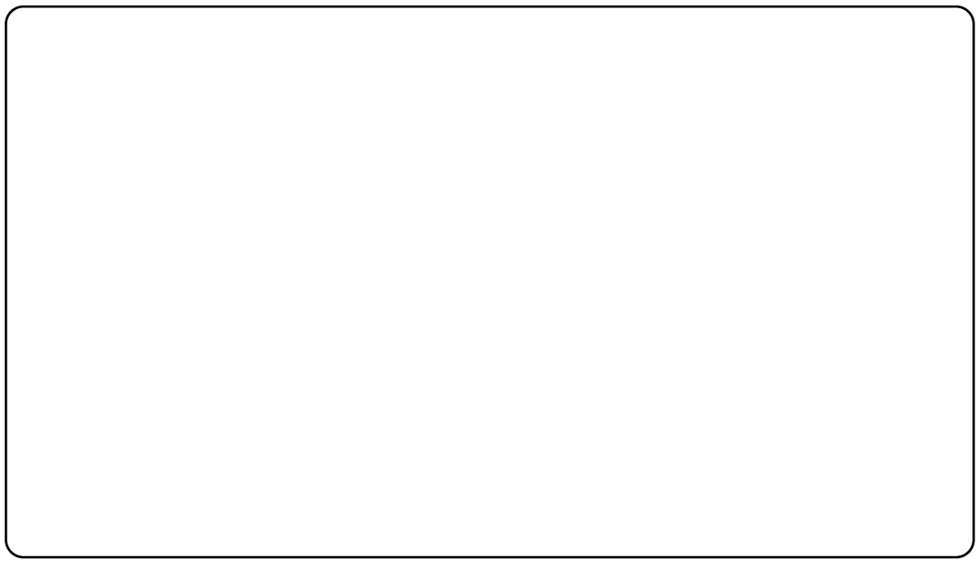
3% (h) Explain how symmetrical ripple marks would form in a beach environment. Use a diagram to assist in your answer.

2% 63.(i) Describe one type of mineral deposit that may be associated with a large igneous intrusion.

Value

2% 63.(j) Sketch an anticline oil trap. Include the following in your labeling:

- cap rock
- reservoir rock
- oil
- natural gas
- water



2% (k) Explain one way paleomagnetism supports Plate Tectonic theory.

Value

2% 64.(a) Explain how a plant leaf may become fossilized as a result of carbonization.

2% (b) Why does the island of Newfoundland have distinct geologic zones?

2% (c) What effects could prolonged volcanic activity have on the biosphere?