WARNING. During different terms, we teach slightly different material, by different instructors, and sometimes in a different order. EOSC 114 is continually evolving. Thus, the material covered during a quiz, midterm exam, or final exam from a previous year does NOT necessarily represent the topics that will be covered on your exam this term.
We do NOT publish the answers to past exams. The reason is that students who memorize answers to past exams usually earn LOWER grades than those who actually study the subject material. We want you to learn the material.

EOSC 114 SAMPLE EXAM QUESTIONS FROM ALL LESSONS

1. The graph (Figure 1) shows the approximate population of humans on Earth for years 1960 and 2000. Considering only the exponential projection shown, you would expect the population (in billions) at year 2040 to be about:
   A) 8 B) 9 C) 10.5 D) 12 E) 14

2. Overall, the world growth rate curve is _____.
   A) linear B) quadratic C) flat D) sinusoidal E) exponential

3. In waves, the speed at which energy moves is called the _____.
   A) wavelength B) amplitude C) phase speed D) decay rate E) group velocity

4. Which is NOT a form of energy?
   A) potential B) kinetic C) heat D) work E) power

5. Which statement is FALSE?
   A) A sustainable society is resilient to natural hazards.
   B) Volcanoes, landslides, and earthquakes are natural disasters to the Earth.
   C) Energy can cause things to move or change.
   D) The unit of force is the Newton.
   E) Sensible heat is heat that you can feel.

6. Two objects of the same mass receive the same amount of heat, but the temperature of object A increases less than that of object B. The relationship between temperature change and heat input per unit mass is called _____.
   A) stress B) strain C) specific heat D) density E) the latent heat constant

7. Which statement is TRUE? The most common element in the _____.
   A) Earth's core is silicon B) Earth's crust is silicon
   C) Earth's crust is iron D) atmosphere is oxygen E) Earth's crust is oxygen

8. Which statement is FALSE?
   A) The three phases of matter discussed in class are solid, liquid and gas.
   B) Viscosity is a measure of how much fluids resist flowing.
   C) Strain is the change in shape, or deformation of a solid object.
   D) Stress is a force per unit area parallel to a surface.
   E) Objects that are not very plastic are said to be ductile.

9. For MOST disaster scales, a disaster of magnitude 6 has _____ times greater energy than a disaster of magnitude 2.
   A) 3 B) 4 C) 5 D) 10,000 E) 1,000,000

10. During a 300-day period, 900 earthquakes of magnitude 5 are typically observed. Thus, the return period for a magnitude 5 earthquake is _____.
    A) 900 years B) 300 years C) 5 years D) 3 days E) 1/3 of a day

11. Which statement about the Cascadia zone is FALSE?
    A) In this region, the Juan de Fuca plate is subducting under the North American Plate.
    B) This subduction zone was the location of a huge earthquake at 9:00 PM local time on January 26, 1700.
    C) There have been no major devastating catastrophes in the Cascadia region in recorded history.
    D) The timing of the next major Cascadia earthquake cannot be accurately predicted.
    E) Relative motion along this strike-slip fault is on the order of a few centimetres per year.

12. Which statement is FALSE?
    A) Subduction zone earthquakes are the most frequent.
    B) Earthquakes at spreading centres are nearly always small and shallow.
    C) Earthquakes along transform boundaries are generally of smaller magnitude than those at subduction zones.
    D) The deepest earthquakes occur where one plate is being forced to dive under a second plate.
    E) Earthquakes at strike-slip plate boundaries between two oceanic plates are frequent but rarely large.

13. _____ is the term used to characterize the energy released at an earthquake's hypocenter.
    A) moment B) magnitude C) intensity D) size E) duration

14. The “moment magnitude” is found by multiplying _____.
    A) rock strength, fault depth and slip distance
    B) rock strength, slip distance and fault area
    C) fault depth, slip distance and fault area
    D) rock strength, time of shaking and fault length
    E) fault length, fault area and fault depth

15. When a fault ruptures DEEP in the crust, the energy is released mainly by _____.
    A) P-waves that dissipate perpendicularly (at a 90º angle) from the fault plane
    B) S-waves that dissipate perpendicularly (at a 90º angle) from the fault plane
    C) Raleigh waves that dissipate away from the fault plane
    D) Both P-waves and S-waves that dissipate in all directions away from the fault plane
    E) P-waves, S-waves and Raleigh waves that dissipate in all directions away from the fault plane

16. Why is soil liquefaction dangerous to buildings?
    A) It causes floods.
    B) It enhances side-to-side ground motion.
    C) It always causes landslides.
    D) It causes soil to lose its strength.
    E) Liquefied soil gets into building foundations, weakening them.

17. Which method is an “active” technique for making buildings safer during an earthquake?
    A) adding shear walls to the building's exterior
    B) isolating the building from the ground using huge rubber pads
    C) including cross-bracing to make the building stiffer
    D) bolting the building firmly to the basement rock
    E) building a shear core into the interior of the building to make it resist side-to-side motion

18. When we say that buildings will “resonate”, we are stating that _____.
    A) the ground motion has a period of between 1 and 2 seconds
    B) the frequency of lateral ground motion is the same as the natural frequency of the building
    C) after-shocks arrive at just the right time interval to shake the building apart
    D) the ground's natural frequency is the same as the that of a building's top floor
    E) the contents of the building will be shaken of their supports

19. What type of motion occurs when a Rayleigh wave passes?
    A) forwards and backwards motion parallel to the direction of wave travel
    B) side to side motion parallel to the direction of wave travel
    C) sideways rotating motion parallel to the direction of wave travel
    D) purely up and down motion perpendicular (at a 90º angle) to the direction of travel
    E) backwards rotating motion parallel to the direction of wave travel

20. Which combination of factors is most likely to topple a high-rise building?
    A) short duration and high frequency ground motion on bedrock
    B) short duration and low frequency ground motion on bedrock
    C) long duration and high frequency ground motion on soft ground
    D) long duration and low frequency ground motion on soft ground
    E) short duration and low frequency ground motion on soft ground

21. Which monitoring technique is most useful for predicting volcanic eruptions?
    A) seismology (earthquakes detection)
    B) tiltmeters
    C) gas monitoring
    D) global positioning systems
    E) lahar detectors

22. Which order of hazards (from EXTREMELY hazardous to NOT VERY) correctly describes the situation if you lived in a valley 500 km away and downwind from an active supervolcano
    A) pyroclastic flow, ash fall, climate change, lava flow
    B) lava flow, pyroclastic flow, ash fall, climate change
    C) ash fall, climate change, pyroclastic flow, lava flow
    D) pyroclastic flow, lahar, ash fall, climate change lava flow
    E) pyroclastic flow, climate change, lahar, ash fall, lava flow

23. Which zone on the stratovolcano hazard map (Figure 2) is most likely to be for pyroclastic flows?
    A) A B) B C) C D) D E) E

24. Carbon dioxide (CO_2) gas is a MAJOR hazard at active volcanoes because it _____.
    A) is the most common gas emitted during eruptions
    B) disassociates to form H_2S, which is highly toxic
    C) causes death by asphyxiation
    D) reacts with sunlight to form carbon monoxide (CO) which is highly toxic
    E) reacts with water to form carbonic acid, which then reacts with man-made structures (the acid rain phenomena)

25. Pyroclastic flows can occur due to _____.
    A) collapse of massive eruption plumes
    B) erosion of solidified lava flows
    C) mixing of hot lava with large amounts of water
    D) popping of hot mafic lava bubbles
    E) mixing of hot ash with large amounts of water

26. Which statement is TRUE?
    A) Eruption warning levels are standardized and use the Alaskan Volcano Observatory's color-coded system.
    B) Volcanic hazard maps are only useful for eruptions of non-explosive volcanoes.
    C) Aerial infrared surveys yield information regarding gas flux out of the volcano.
    D) Geochemistry is used to help determine the explosivity of a volcano based on past eruption deposits.
    E) The volcanic explosivity index is based exclusively on the volume of material erupted, height of the eruption column, and the furthest extent of pyroclastic flows.

27. A correlation spectrometer (COSPEC) measures _____.
    A) eruption cloud density based on ash particle size compared to a standard
    B) the solar ultraviolet light that is absorbed by an eruption cloud
    C) the time that it takes for H_2O vapor in an eruption cloud to dissipate
    D) the amount of CO_2 in an eruption cloud compared to the standard atmospheric value
    E) the ratio of CO_2 to SO_2 in an eruption cloud

28. Hot spot volcanoes form because _____.
    A) mantle plumes originate at the asthenosphere-lithosphere interface, causing mantle upwelling and magmatism
    B) subducted water interacts with mantle lithosphere to produce magma
    C) hot material from the core-mantle boundary rises into the lithosphere. forms magma, and melts the overlying crust
    D) hot spots in the upper mantle move beneath the crust, forming a line of volcanoes with a definite age progression
    E) hot areas in the plates partially melt along fault zones, forming a line of volcanoes with a definite age progression

29. The explosivity of magmatic eruptions is most dependent on _____.
    A) how often eruptions occur
    B) the volume of magma erupted
    C) how close people are when an eruption occurs
    D) if the volcano is in a convergent plate setting
    E) how easily dissolved gases can escape from the magma

30. The high hazard potential at Mount Rainier is due to _____.
    A) high poisonous gas emissions
    B) voluminous lahars
    C) the great potential for landslides within the summit crater
    D) an increased frequency of pyroclastic flow eruptions there over the past 200 years.
    E) frequent eruption of lava flows over the past 200 years

31. The landslide that occurred at Turtle Mountain in Alberta in 1903 was a _____.
    A) long run-out debris flow
    B) small rock fall
    C) slump
    D) lahar
    E) rock block topple

32. Quick clay landslides are most common in which Canadian province?
    A) British Columbia
    B) Alberta
    C) Nova Scotia
    D) Ontario
    E) Québec

33. The driving and resisting masses within a slope will NOT be affected by _____.
    A) rainfall
    B) adding material to the top of the slope
    C) excavating material at the toe of the slope
    D) a uniform slope composition
    E) anthropogenic activity

34. According to the landslide classification, the term 'debris' is defined as _____.
    A) earth
    B) sorted soil
    C) unsorted soil
    D) a combination of broken trees and earth
    E) a mixture of sand and clay

35. The factor of safety is the ratio of _____.
    A) G_p to G_t
    B) shear stress to shear strength
    C) shear strength to shear stress
    D) the sum of G_p and G_t to shear strength
    E) shear strength divided by G_p

36. The cliffs surrounding UBC are landslide-prone. This is PRIMARILY due to _____.
    A) coastal erosion
    B) daylighted bedding
    C) quick clays
    D) past debris flows
    E) frequent earthquakes

37. Which of the following may DECREASE the shear strength of unconsolidated sediment?
    A) cementation
    B) increasing pore pressure
    C) water's surface tension
    D) electrostatic forces
    E) compaction and dewatering

38. Which statement is TRUE?
    A) Falls involve the rock detaching from a steep slope along a surface where little shear displacement takes place.
    B) Topples involve the backward rotation of a rock block, with the toe of the block moving outwards first.
    C) Translational slides move in a rotational manner, accommodated by deformation of the weak soil.
    D) Liquefaction is usually related to slow creep-like movements of a soil slope.
    E) Flows move downslope as a coherent mass.

39. All landslide flows are characterized by _____.
    A) velocities in excess of 30 km/hour B) turbulent flow
    C) fully saturated debris D) channelization E) debris fans

40. Which was NOT a factor that promoted the Frank slide?
    A) a water reservoir B) coal mining C) faulted and fractured bedrock
    D) limestone bedrock E) the bedrock structure (anticline)

41. If condensation of water vapour in clouds did NOT release any latent heat, then _____.
    A) thunderstorms would not occur because there would be no condensation to make cloud droplets
    B) thunderstorms would not occur because rising air cools at the adiabatic rate of 9.8 °C/km
    C) there would be no change in thunderstorms
    D) thunderstorms would occur and be less powerful because rising air would be less buoyant
    E) thunderstorms would occur and be more powerful because no latent heat would be lost from the storm

42. The most fatal hurricane-related hazard is the _____.
    A) storm surge B) lightning C) tornadoes D) strong winds E) low pressure

43. The region of the globe suffering the most hurricane-related deaths is _____.
    A) Hawaii B) Australia C) Florida D) Japan E) Bangladesh

44. Which statement is TRUE?
    A) A “tornado watch” means a tornado is happening now and heading in your direction.
    B) Tornado damage paths are usually wider than about 2 km.
    C) More intense tornadoes happen more frequently than weak ones.
    D) Very short-lived thunderstorms are called “pulse storms”
    E) The official name for a thunderstorm cloud is “nimbostratus”.

45. The amount of heat needed to evaporate a kilogram of water is called the _____.
    A) latent heat of fusion B) latent heat of vaporization C) specific gravity
    D) latent heat of deposition E) specific heat

46. Which statement is TRUE about thunderstorms?
    A) The cumulus stage consists of up and downdrafts.
    B) The mature stage consists of updrafts and precipitation.
    C) The cumulus stage usually has an anvil.
    D) The dissipating stage consists of only updrafts.
    E) The heaviest rain is likely during the dissipating stage.

47. Which statement is FALSE?
    A) Tornado outbreaks are when many tornadoes happen during a day or two.
    B) Tornado deaths in North America have generally decreased during the past 50 years.
    C) Where basements are not easy to construct, above-ground safe rooms can be built instead.
    D) Tornadoes generally move toward the southeast.
    E) Tornadoes have stronger winds than hurricanes.

48. Which statement is TRUE?
    A) The eye of hurricanes usually contains downdrafts.
    B) Hurricanes in the Northern Hemisphere usually rotate clockwise.
    C) Hurricanes usually form over the equator.
    D) Tropical storms are usually stronger than hurricanes.
    E) Atlantic hurricanes usually form in the Bermuda High center.

49. Which statement is FALSE?
    A) Cold air can hold more water vapor at saturation than warm air.
    B) Air can rise if it is warmer than it's surroundings.
    C) Condensation releases latent heat and warms the air.
    D) Water vapor mixing ratio is conserved in rising air parcels.
    E) Rainfall can be used to estimate the net heating in a storm.

50. Which statement is TRUE?
    A) Zero force implies zero velocity.
    B) An air parcel in a warm environment is more buoyant than one in a cold environment.
    C) Horizontal temperature gradients can cause buoyancy-related vertical motions.
    D) Newton's law says that force equals mass divided by acceleration.
    E) Hurricanes are organized to create their own fuel by wind-enhanced evaporation.

51. A force that generates tsunami is _____ and the restoring force is _____.
    A) earthquake/surface tension B) wind/gravity C) landslide/gravity
    D) change in atmospheric pressure/surface tension E) landslide/wind

52. Regarding tsunami prediction, what aspect can we be MOST confident about?
    A) wavelength B) number of successive waves C) wave height
    D) arrival time E) wave period

53. If the waves are approaching Vancouver Island from the south and the Island lies on a northwest to southeast direction, the longshore transport will be directed from _____.
    A) southeast to northwest B) northwest to southeast C) south to north
    D) north to south E) southwest to northeast

54. Which is TRUE?
    A) Refracting tsunami prevent damage and destruction of coastal towns in the “safe” side of islands.
    B) Waves approaching the coast at an angle will refract.
    C) Refracting waves bend towards the faster end (towards shore).
    D) Wave refraction refers to the slowing of waves in shallow water.
    E) Waves refract when one crest slows down while the crest behind continues at full speed.

55. Consider waves with different wavelengths (L): wave A has L = 10 m, B has L = 20 m, C has L = 40 m, D has L = 60 m. Knowing that the water depth is 0.5 m, arrange the waves according to wave speed.
    A) D > C > B > A B) A > B > C > D C) D = C = B = A
    D) D > C > B = A E) D = C > B = A

56. The predicted 30 cm sea level rise in BC over the next 50 years will NOT cause _____.
    A) drowning of tidal marshes and loss of habitat for waterfowl
    B) bigger surf at Long Beach in Tofino
    C) the shoreline to move inland by about 300 meters in Richmond
    D) flooding of coastal areas in Delta and Langley
    E) increased erosion at Point Grey

57. Most typhoon-related death occur _____.
    A) from rapid spread of diseases B) due to starvation C) from injuries from the high winds
    D) when struck by lightning E) by drowning

58. If you observe wave crests in the Pacific Ocean that are 80 meters apart and behave as deep water waves, you know that the water must be at least _____ meters deep.
    A) 80 B) 40 C) 20 D) 10 E) 4

59. Rogue waves are notorious off the Cape of Good Hope in South Africa because _____.
    A) of the high energy waves from the Antarctic Ocean (Southern Ocean)
    B) the Cape causes waves to constantly refract and reflect resulting in constructive interference
    C) the large Antarctic Ocean waves approach the Cape very rapidly, thus growing to great heights
    D) of the constructive interference between strong currents and large wind waves
    E) hurricane-generated storm surges constructively interfere with the currents

60. Rogue waves are best described as _____.
    A) waves rapidly approaching shallow water that grow to unexpectedly great heights
    B) abrupt bulge of water driven ashore by strong winds
    C) the average of the third-highest waves in a swell
    D) a strong rocking motion within a sea
    E) a single massive wave that suddenly develops and disappears in the open ocean

61. Tsunami CANNOT be detected by ships in the middle of the open ocean because _____.
    A) tsunami wave steepness is < < 1
    B) tsunami wavelength is typically 200 km
    C) tsunami periods are typically 1 hour long
    D) tsunami travel at very high speed, thus pass by ships very quickly
    E) ships do not have the proper instrument to measure tsunami wave height

62. The most influential agent that changes the shape of the coast is _____.
A) freezing and thawing of coastal cliffs B) wave action C) prevailing winds
D) hurricanes and storm surges E) the tidal range

63. Eustatic changes are _____.
A) the advance and retreat of the polar ice caps
B) increase in ocean surface temperature due to greenhouse warming
C) caused by the increased use of man-made structures to protect the coast
D) an important issue for low-lying islands and coasts only
E) variations in sea level that can be measured all over the world ocean

64. Your beach front property has a steep, narrow, rocky beach year-round. It is located in an area _____.
A) with spilling waves B) with high wave energy C) with steep waves
D) where sediment deposition processes dominate E) with high population density

65. Arrange in order from shortest to longest wavelength:
A) wind wave, tide, tsunami, seiche. B) seiche, tsunami, capillary wave, tide.
C) wind wave, tsunami, seiche, tide. D) tide, seiche, tsunami, wind wave.
E) capillary wave, seiche, tsunami, tide.

66. In Hawaii, what local process is MOST likely to trigger a very large tsunami?
A) subduction-related earthquakes B) gases released from underwater volcanic eruptions
C) underwater lava flows D) huge landslides
E) earthquakes associated with the hotspot

67. In which location on the map (Figure 3) would a ship be most at risk of being hit by a rogue wave?
A B C D E

68. When a large earthquake occurs, people want to know whether or not it generated a tsunami, and therefore whether or not evacuation is needed. What measurements can we collect with today's technology that MOST HELP directly determine whether a tsunami is on its way, before it arrives?
A) earthquake magnitude and location B) pressure changes in the deep ocean
C) displacement along the fault that ruptured D) sea level heights observed from ships
E) Sea level heights observed from airplanes

69. If you were a geologist trying to reconstruct the history of tsunami on a particular coastline (prior to written or oral records), what type of evidence would you look for?
A) pieces of shocked quartz and breccia B) thin salt deposits far inland from the coast
C) archeological remains of boats buried by sand D) thin layers of sand between layers of marsh deposits
E) salt deposits alternating with mud deposits of the same thickness

70. On the coast of North Carolina, eastern North America, if sea level rises 1 meter, the shoreline will move inland approximately _____ meters.
A) 10 B) 100 C) 500 D) 1000 E) 5000

71. Approximately how quickly can a tsunami generated in the Aleutian Islands (Alaska) reach Hawaii?
A) less than one hour B) 1-2 hours C) 5-6 hours D) 10-12 hours E) 18-20 hours

72. Which of the following processes has been the LARGEST contributor to global sea level rise in the past few decades?
A) melting ice from Greenland B) melting ice from Antarctica
C) melting permafrost D) melting sea ice (floating icebergs)
E) expansion of ocean water as it warms up

73. Which of the following waves is traveling the fastest?
A) A wave with wavelength = 100 metres, traveling through water that is 100 metres deep
B) A wave with wavelength = 100 metres, traveling through water that is 40 metres deep
C) A wave with wavelength = 100 metres, traveling through water that is 5 metres deep
D) A wave with wavelength = 200 metres, traveling through water that is 5 metres deep
E) A wave with wavelength = 200 metres, traveling through water that is 2 metres deep

74. A fully developed sea is when _____.
A) the sea state reaches Beaufort Force 12
B) the wind has been blowing at 30 knots for at least 42 hours
C) the wind speed is as high as physically possible for a given atmospheric temperature and pressure
D) a 30 knot wind blows over a fetch of at least 650 kilometres for at least 42 hours
E) the wind energy building up the waves equals the energy dissipated through waves breaking

75. The tsunami that caused the most deaths in Canada in the past century occurred in _____.
A) British Columbia B) Newfoundland C) Nunavut
D) Prince Edward Island E) Yukon

76. The majority of the bases of geological periods during the Phanerozoic are defined by _____.
A) the appearance of new species following a mass extinction event
B) mass extinction events C) the extinction of one specific species
D) iridium clay layers E) impact craters

77. The evolution of new species following a mass extinction is called _____.
A) a radiation B) a fossil range C) a biosphere D) an impact event E) a greenhouse event

78. William Smith discovered that _____.
A) fossil mammoths once existed in Europe
B) rocks over 500 million years old contain no fossils
C) fossils from different parts of the world will show no similarities
D) fossils are creatures that have become extinct
E) fossils can be used to characterize certain geological strata (layers)

79. Which geological time "unit" is the longest?
A) Phanerozoic B) Silurian C) Precambrian D) Cretaceous E) Cambrian

80. How did Usher calculate the age of the Earth?
A) by calculating all the days mentioned in the Bible
B) by counting the life span of all the creatures thought to have existed since the Cambrian
C) by comparing the age of craters on Mercury and Mars with those found on the Earth and the Moon
D) by carefully examining the biostratigraphy of dinosaurs and other Mesozoic creatures
E) by deductive logic based on the rates that sediments are being deposited in the oceans today and comparing that to the thickness of strata presented in the geological record

81. Concerning the Permo-Triassic extinction, which statement is FALSE?
A) The continents were grouped together in a land mass called Pangaea.
B) Trilobites went into extinction.
C) Over 95% of all species became extinct.
D) The extinction was largely restricted to land based creatures.
E) The Siberian Traps may have contributed to the mass extinction event.

82. Concerning the Cretaceous-Tertiary Extinction, which statement is TRUE?
A) Almost of all of the ammonites became extinct.
B) With the exception of marine reptiles, the extinction didn't really impact marine species.
C) The Cretaceous biosphere was healthy prior to the impact at Chicxulub.
D) The diversity (number of species) of dinosaurs was falling prior to the impact at Chicxulub.
E) Tektites were generated by impact related earthquakes.

83. Which statement regarding fossil fern spores around the time of the proposed impact at Chicxulub is TRUE?
A) The abundance of fern spores drops just before the impact.
B) The abundance of fern spores relative to pollen remains constant before, during and after the impact.
C) Fern spores show an increase in abundance in the earliest Tertiary.
D) Fern spores are not present after the impact event.
E) Ferns had colonized much of the Ordovician landscape prior to the impact at Chicxulub.

84. Which of would be the most effective way to cause a mass extinction today?
A) Exterminate the majority of the creatures at the base of the food chain.
B) Exterminate all fresh water fish. C) Acidify major inland lakes.
D) Cut down 50% of Canadian forests. E) Exterminate all top predators in North America.

85. What are evaporites?
A) gases in the atmosphere that combine with water to form acid rain
B) sedimentary rocks composed of the bones and shells of sea creatures
C) sedimentary rocks that can be formed by the concentration of elements present in sea water
D) volcanic rocks found specifically at impact sites
E) "stressed / compressed" rocks caused by impact events that were particularly common in the latest Cretaceous

86. Where did most of the carbon dioxide released into the atmosphere due to the impact at Chicxulub came from?
A) from the vaporized comet B) from burning dinosaurs
C) from evaporites D) from the vaporization of limestone
E) from combining elements in the atmosphere after the initial blast

87. Which has NOT been used as supporting evidence for an impact event in the late Cretaceous?
A) mass extinction of at least 50% of species
B) the presence of elevated levels of iridium in the latest Cretaceous
C) the extinction of trilobites
D) the presence of soot layers around the K/T boundary
E) the extinction of the ammonites

88. Which best describes the climatic effect that the Chicxulub impact had on global climate?
A) A period of cold that lasted over 50,000 years.
B) Icehouse conditions that resulted in the formation of glaciers that existed on the planet for millions of years.
C) Nuclear winter caused by greenhouse gasses such as CO_2.
D) A cold period lasting less than a year followed by a very warm period.
E) Immediate greenhouse conditions produced by elevated levels of water vapor and CO_2 in the atmosphere.

89. By which process could a meteorite impact generate acid rain?
A) combining nitrogen and oxygen to form oxides of nitrogen, which interacts with water to form nitric acid
B) vaporizing pure sandstone to form sulfuric acid that gets released directly into the atmosphere
C) the release of amino acids from the burning flesh of creatures on the land
D) the evaporation of sea water during the impact
E) the interaction of tektites with rainwater creating 'tektite rain' rich in hydrochloric and sulfuric acids

90. Which is TRUE? Most asteroids _____.
A) are located in a belt outside our solar system
B) include objects over 30,000 km in diameter
C) do not contain significant quantities of ice and water
D) develop a long tail of gas when approaching the sun
E) are located in a cloud of material beyond the orbit of Pluto

91. Which has NOT been used to explain the extinction periodicity of Raup and Sepkoski?
A) movement of the Earth through the galactic plane
B) the presence of a planet inside the orbit of Mars
C) the gravitational nudging of comets
D) the presence of a small companion Sun
E) the presence of a planet outside the orbit of Pluto

92. Regarding the Shoemaker-Levy 9 impact, which is TRUE?
A) It caused the death of the dinosaurs mostly by vaporization but also by degradation of the environment.
B) It caused an explosion that flattened 1000 km^2 of forest.
C) It may have actually been a natural gas explosion and not an impact event.
D) If it occurred on Earth it could have wiped out life down to the bacterial level.
E) It produced a crater on the dark side of the moon that was over 1000 km in diameter.

93. In preventing an impact from space, which is the MOST important factor?
A) Understanding the composition of the comet or asteroid.
B) Ensuring fragments will not be generated if the impacting body is exploded using nuclear warheads.
C) Covering the asteroid or comet in a sufficiently reflective material to permit “solar wind pushing.”
D) Having enough warning of the approaching asteroid or comet.
E) Development of high powered “space lasers” that could be used in steady state orbit adjustment.

94. “Nemesis” has been used to explain _____.
A) the existence of gravity wells within the inner solar system
B) Raup-Sepkoski periodicity
C) the existence of the Oort cloud outside the orbit of Pluto
D) gravitational kicks from the densest part of the galactic plane
E) the existence of black holes

95. The mid-Cretaceous was a time of high sea levels. What caused this rise?
A) increase in rate of bombardment of icy comets
B) increase in glacial ice at the poles
C) increased seafloor spreading rates
D) decreased seafloor spreading rates
E) decrease of glacial ice around the equator

96. Which continental configuration would have the greatest biodiversity?
A) 1 large land mass
B) 2 large land masses located at the equator
C) a high degree of continental fragmentation
D) 1 large land mass centred over the south pole
E) 1 large continent centred around the equator

97. Eruptions of flood basalts have often been associated with _____.
A) rapid periods of evolution
B) increases in average global temperature
C) decrease in average global temperature
D) decreased greenhouse effect
E) increased salinity of the oceans

98. What is the Oort cloud?
   A) A spherical cloud of comets surrounding the solar system beyond the orbit of Pluto.
   B) A rapidly moving cloud of hot ash and gas that flows down the flanks of a stratovolcano.
   C) The cloud of carbon dioxide that surrounded the Earth following the K/T impact event.
   D) A cloud of CO_2 that surrounded the Earth following large scale volcanic events in the Deccan area of India.
   E) A cloud of debris between the orbit of Mars and Jupiter.

99. Which of the following about the Ordovician biosphere is TRUE?
   A) The reptiles present in the oceans were dinosaurs.
   B) The creatures present in the Ordovician had evolved from forms that used to exist in the Cretaceous.
   C) Most of the creatures became extinct (either directly or indirectly) due to the poisoning of the oceans by acid rain.
   D) Continental drift would have a major role to play in causing mass extinction in the biosphere.
   E) The question is bogus. There was no biosphere during the Ordovician as life had yet to evolve.

100. Which has NOT been identified as a possible contributory cause of mass extinctions?
   A) changes in rates of sea floor spreading
   B) volcanic activity
   C) degree of continental fragmentation
   D) earthquakes on land
   E) composition of the oceans

END OF EXAM

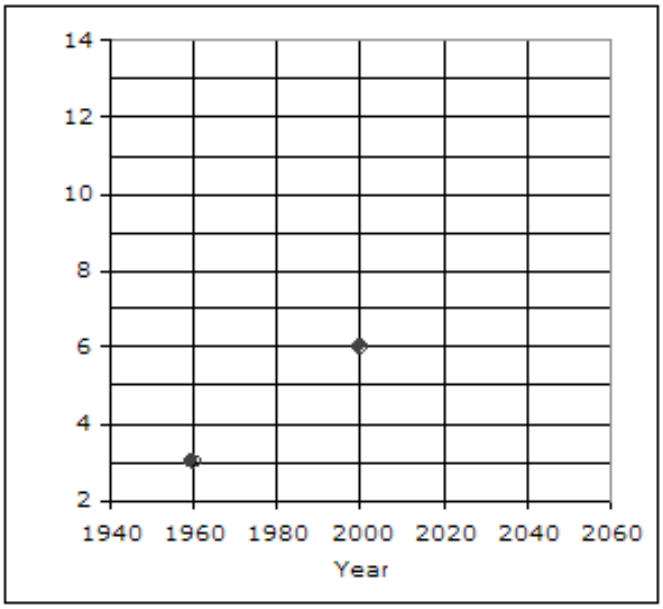

Figure 1.

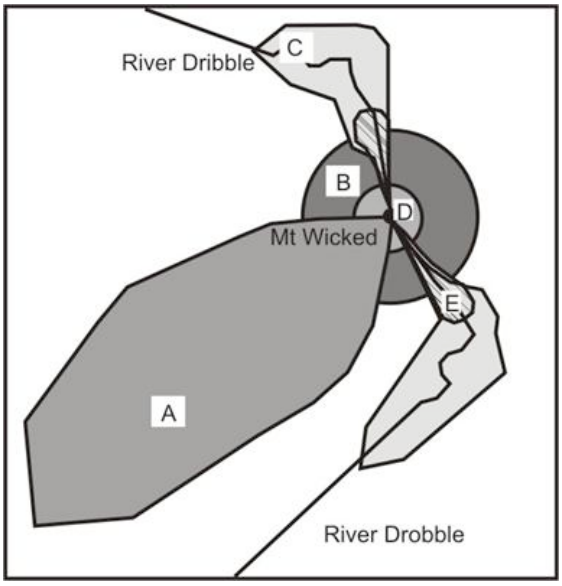

Figure 2.

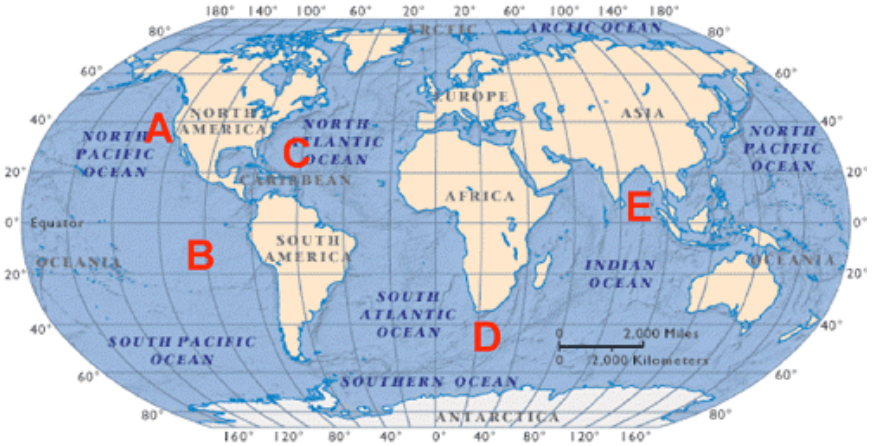

Figure 3.