

## Fragile systems

1.

The count of all protons and neutrons in the nucleus of an atom is called the \_\_\_\_\_.

	Student Response	Correct Answer
A.	atomic number	
<input checked="" type="checkbox"/> B.	atomic mass number	<input checked="" type="checkbox"/>
C.	Avogadro's number	
D.	covalence	
E.	gluon number	

Score: 1/1

2.

Suppose that tornadoes of magnitude 3 on the Fujita scale occur roughly 6 times during the past 12 years of records in Canada. The return period (in years) for this category tornado is \_\_\_\_.

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	2	<input checked="" type="checkbox"/>
B.	3	
C.	4	
D.	6	
E.	12	

Score: 1/1

3.

The form of energy common to all the natural disasters to be studied in this course is \_\_\_\_\_.

	Student Response	Correct Answer
A.	impending energy	
B.	stress	
C.	kinetic energy	<input checked="" type="checkbox"/>
D.	work	
<input checked="" type="checkbox"/> E.	potential energy	

Score: 0/1

4.

If you double the force applied on an object, the amount of work \_\_\_\_\_

	Student Response	Correct Answer
A.	quarters	
B.	halves	
C.	remains constant	
<input checked="" type="checkbox"/> D.	doubles	<input checked="" type="checkbox"/>
E.	quadruples	

Score: 1/1

5.

Which is MOST dense?

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	0.1 g of granite	<input checked="" type="checkbox"/>
B.	1 g cork	
C.	$5 \times 10^3$ kg of water	
D.	2 kg of air	
E.	a 50 g donut	

Score: 1/1

6.

Which statement is TRUE?

Student Response	Correct Answer
A.	An object with mass $m$ will have less potential energy on a mountaintop than at sea-level.
B.	Events that happen more frequently have a greater return period.
C.	Potential energy increases with the square of velocity.
<input checked="" type="checkbox"/> D.	An object with a high latent heat of vapourisation boils at a high temperature.
E.	The change in sensible heat is proportional to the change in temperature. <input checked="" type="checkbox"/>

Score: 0/1

7.


Density is important because \_\_\_\_\_.


**Student Response    Correct Answer**

A. less dense objects sink and denser objects float

B. it has units of  $\text{kg/m}^2$

C. it is represented by the Greek symbol  $\rho$

D. it creates stratification in materials 

 E. heavy objects sink and light objects float

Score: 0/1

8.

An object that breaks when stresses are applied is called \_\_\_\_\_.

**Student Response    Correct Answer**

 A. brittle 

B. ductile

C. plastic

D. elastic

E. malleable


Score: 1/1

9.

The three greatest chemical elemental components of the Earth's crust are \_\_\_\_\_.

**Student Response    Correct Answer**

A. nitrogen, oxygen, hydrogen

 B. oxygen, silicon, aluminum 

C. silicon, iron, calcium

D. aluminum, carbon, sodium

E. silicon, magnesium, iron

Score: 1/1

**10.**

The International System (SI) standard unit for time is:

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.second		<input checked="" type="checkbox"/>
B.hour		
C.day		
D.year		
E.minute		

Score: 1/1

**11.**

When atoms in molecules line up in a regular lattice, the result is called:

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.crystal		<input checked="" type="checkbox"/>
B.glass		
C.metamorphic		
D.ironic		
E.mafic		

Score: 1/1

**12.**

Which of the following is TRUE?

Student Response	Correct Answer
A.Gases are the least compressible compared to liquids and solids.	
B.Fluids with low viscosity such as air resist flow more than those with high viscosity such as magma.	
<input checked="" type="checkbox"/> C.Heat of sublimation is released when solids become gases.	
D.The ability of solids to permanently change shape or deform when forced is called plastic.	<input checked="" type="checkbox"/>
E.Liquids and gases can change their shape easily, thus are not fluids.	

Score: 0/1

**13.**

Suppose 3 meteorite impact events of magnitude 10 on the Torino scale occurred within the past 600,000 years. The return period (in years) for such disaster events is \_\_\_\_\_.

	Student Response	Correct Answer
A.	18,000	
B.	30,000	
<input checked="" type="checkbox"/> C.	200,000	<input checked="" type="checkbox"/>
D.	300,000	
E.	1,800,000	

Score: 1/1

## 14.

Which statement is TRUE?

Student Response	Correct Answer
A. Compared to developing countries, Canada suffers more fatalities and more economic loss due to natural disasters.	
B. Human infrastructure will become easier to maintain with greater human populations.	
<input checked="" type="checkbox"/> C. Many disasters involve the gradual build-up and sudden release of energy.	<input checked="" type="checkbox"/>
D. The Earth has unlimited carrying capacity.	
E. Competition for resources will likely decrease in the near future.	

Score: 1/1


## 15.

Consider Object A with a mass of 10 kg and Object B with a mass of 20 kg, both moving at a speed of 1 m / sec. Which of the following statements is TRUE?


Student Response	Correct Answer
A. The kinetic energy of Object B is equal to the kinetic energy of Object A.	
<input checked="" type="checkbox"/> B. The kinetic energy of Object B is 2X the kinetic energy of Object A.	<input checked="" type="checkbox"/>
C. The kinetic energy of Object A is 2X the kinetic energy of Object B.	
D. The kinetic energy of Object A is 5 kg-m / sec.	
E. The kinetic energy of Object B is 20 kg-m <sup>2</sup> / sec <sup>2</sup> .	

Score: 1/1

## 16. Which statement is FALSE?


- A. The SI standard unit of time is the second.
- B. The SI standard unit of distance is the meter.
- ☒ C. The SI standard unit of mass is the gram. 
- D. The prefix "milli" means 1/1000.
- E. The prefix "mega" means million.

Score: 1/1

17. Every year, more people are affected by natural disasters MOSTLY because \_\_\_\_\_
- A. a population increases, more people live in high risk areas 
  - B. of global warming
  - C. the ozone hole allows more visible light to reach the earth's surface
  - D. \_\_\_\_\_ sea level is rising, putting large coastal cities at risk
  - E. natural disasters occur more frequently and of greater intensity

Score: 1/1


### 18. Which statement is TRUE?

Student Response	Correct Answer
A. The unit of energy is the Watt.	
B. Energy that is spread out in space is called gradual.	
C. Energy that is spread out in time is called diffuse.	
D. "Conservation of energy" means that energy cannot be transformed.	
<input checked="" type="checkbox"/> E. Natural disasters often involve energy conversions. 	

Score: 1/1

### 19.

Which statement is FALSE regarding water?

Student Response	Correct Answer
A. _____	Water is the only substance on Earth present in large quantities in solid, liquid, and vapor form.
B. Water has the highest heat capacity of all liquids.	
C. Water has the highest density of all materials on the surface of the Earth. 	
D. Water has the highest latent heat of vaporization of all substances.	

☐ E. On the surface of the Earth, most of the water resides in the oceans.

Score: 0/1

20.

Consider two countries, each with a population of 1 million in the year 2000. The annual population growth rate of Country X is 1% while that of Country Y is 2%. Assuming that the growth rates remain unchanged, which statement is FALSE?

**Student Response**

**Correct Answer**

A. By the year 2070, Country X will have a population of 2 million and Country Y will have 4 million.

B. Both countries are experiencing exponential population growth.

C. Over a period of 140 years, Country Y will have doubled its population 4 times.

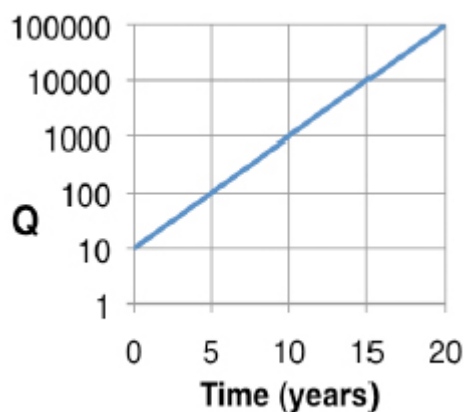
☐ D. The doubling time for the population of Country X is estimated as 1 million divided by 1%.



E. The population of Country Y is increasing much faster than that of the world.

Score: 1/1

1. The figure below shows that as time increases, the quantity Q \_\_\_\_\_.



**Student Response**

**Correct Answer**

A. increases by equal amounts

☒ B. increases by increasing amounts



C. decreases by smaller amounts

- D. decreases by increasing amounts  
E. (not enough info to answer)

Score: 1/1

**2.**For a situation with exponential population growth at a rate of 7% per year, the population doubling time is \_\_\_\_\_.

- |  | Student Response | Correct Answer                      |
|--|------------------|-------------------------------------|
| A.                                     | 2 years          |                                     |
| B.                                     | 7 years          |                                     |
| <input checked="" type="checkbox"/> C. | 10 years         | <input checked="" type="checkbox"/> |
| D.                                     | 14 years         |                                     |
| E.                                     | 70 years         |                                     |

Score: 1/1

**3.**Objects of low density relative to the fluid they are immersed in will generally \_\_\_\_\_.

- |  | Student Response            | Correct Answer                      |
|--|-----------------------------|-------------------------------------|
| A.                                     | become stratified           |                                     |
| <input checked="" type="checkbox"/> B. | rise due to buoyancy        | <input checked="" type="checkbox"/> |
| C.                                     | sink due to buoyancy        |                                     |
| D.                                     | become unstratified         |                                     |
| E.                                     | (not enough info to answer) |                                     |

Score: 1/1

**4.**The most common element in the Earth's crust is \_\_\_\_\_.

- |  | Student Response | Correct Answer                      |
|--|------------------|-------------------------------------|
| A.                                     | iron (Fe)        |                                     |
| B.                                     | nickel (Ni)      |                                     |
| C.                                     | silicon (Si)     |                                     |
| D.                                     | nitrogen (N)     |                                     |
| <input checked="" type="checkbox"/> E. | oxygen (O)       | <input checked="" type="checkbox"/> |

Score: 1/1



5. Gravity \_\_\_\_\_.

Student Response	Correct Answer
A. causes objects just above the Earth's surface to accelerate downward at $98 \text{ m/s}^2$	
B. is not relevant to any of the 5 types of energy that we discussed in this course	
C. is an important factor in determining the specific heat of materials	
<input checked="" type="checkbox"/> D. affects potential energy because you need to do work against it to lift objects	<input checked="" type="checkbox"/>
E. causes objects to move at a speed of $9.8 \text{ m/s}$	

Score: 1/1

6. Which natural cycle is most closely related to landslides?

Student Response	Correct Answer
<input checked="" type="checkbox"/> A. tectonic	
B. rock <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
C. hydrological	
D. biogeochemical	
E. cosmic	

Score: 0/1

7. A landslide accelerates downhill. The debris continues across a level valley, and rises part way up the mountain on the opposite side of the valley. Finally, the debris stops. During this sequence of events \_\_\_\_\_.

Student Response	Correct Answer
A. energy is conserved until the debris stops	
B. some of the initial potential energy is converted into kinetic energy as the debris coasts uphill	
C. latent heat causes the debris to accelerate downhill	
<input checked="" type="checkbox"/> D. all the initial potential energy is converted into other forms of energy <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
E. potential energy increases as the debris accelerates downhill	

Score: 1/1

8.If a major disaster such as a big earthquake actually happens in Vancouver, which is likely to be TRUE?

#### Student Response

#### Correct Answer

A.

come to your aid quickly.

B.You will be able to rely on your neighbors to help you through the worst of it.

C.News coverage will be thorough and complete, so you can make sound decisions on what to do.

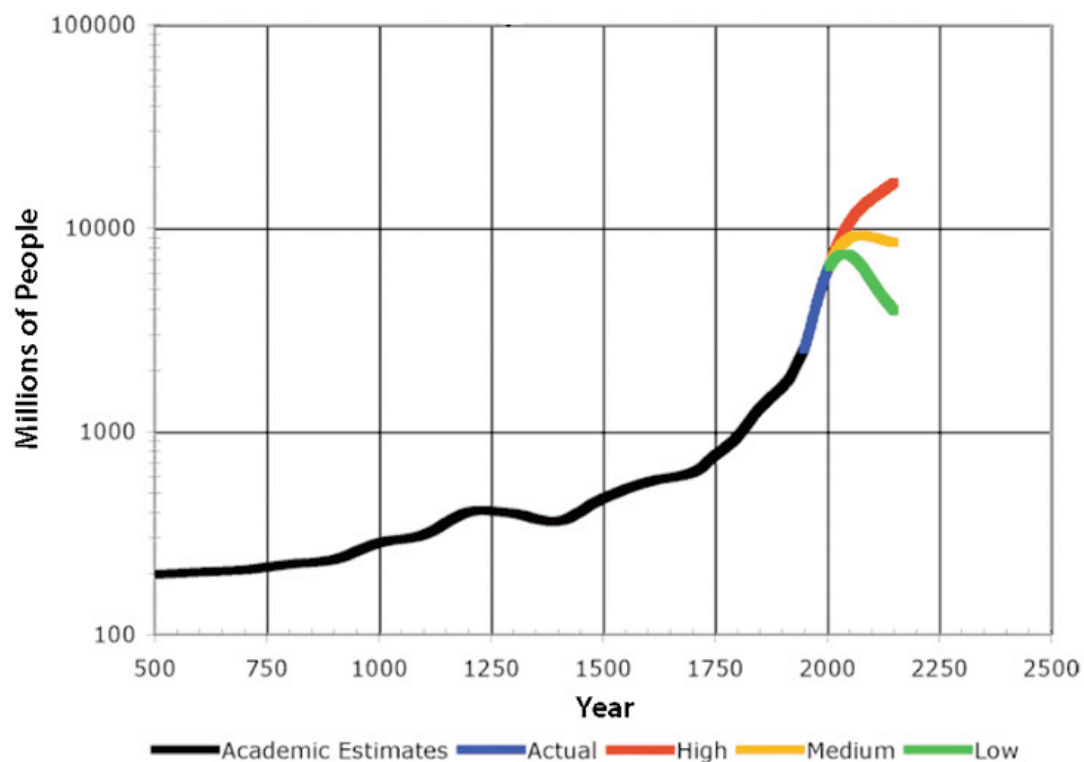
D.

There will be a lot of confusion and insufficient information to make appropriate decisions. ☒

E. There is only a slim chance that fires will sweep through the city.

Score: 0/1

9.The graph below shows population vs year. This graph suggests that in the past \_\_\_\_\_.



#### Student Response

#### Correct Answer

A. population was increasing linearly with time

B.population surpassed  $10^9$  people about year 1800 ☒

C.doubling time was about 250 years

D. population surpassed 1000 people about year 1800

☒ E. increasing logarithmically with time

Score: 0/1

**10.**Which statement is TRUE?

**Student Response**

**Correct Answer**

A. A disaster is more severe and affects more people than a catastrophe.

B.A risk is any natural process that threatens human life or property.

C.Risk equals the probable severity of a destructive event.

☒ D. A hazard is any natural process that threatens human life or property. ☒

E. Human-caused destructive events are not called disasters.

Score: 1/1

**11.**Which prefix represents the largest value?

**Student Response**

**Correct Answer**

A. kilo

B.mega

C.tera ☒

D. pico

☒ E. nano

Score: 0/1

**12.**Choose the BEST answer. Stronger disasters happen \_\_\_\_\_ weaker ones.

**Student Response**

**Correct Answer**

A. more frequently than

B.roughly the same number of times as

☒ C. less frequently than ☒

D. with a smaller return period than

E. with roughly the same return period as

Score: 1/1

**13.**Ductile is most LIKE \_\_\_\_\_.

	Student Response	Correct Answer
A.	fracture	
B.	plastic	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> C.	elastic	
D.	fluid	
E.	rigid	

Score: 0/1

**14.**During the past 100 years of record, a disaster of intensity 5 occurred 25 times. Based on this, the next disaster of intensity 5 will happen \_\_\_\_\_ years after its last occurrence?

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	4	
B.	5	
C.	20	
D.	25	
E.	(not enough info to answer)	<input checked="" type="checkbox"/>

Score: 0/1

**15.**Which of the following is TRUE about power?

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	less power.	A fixed amount of work applied over a longer time implies <input checked="" type="checkbox"/>
B.	A fixed amount of work applied over a longer time implies more power.	
C.	More work always implies more power.	
D.	More heat implies more power.	
E.	Work and power are unrelated.	

Score: 1/1

**16.** Which disaster type results from a DILUTION of energy?

	Student Response	Correct Answer
A.	earthquakes	
B.	volcanic eruption	
C.	landslides	
D.	storms	
<input checked="" type="checkbox"/> E.	floods	<input checked="" type="checkbox"/>

Score: 1/1

**17.** Which is NOT one of the 5 types of energy we will study in this course?

	Student Response	Correct Answer
A.	sensible heat	
B.	latent heat	
C.	potential energy	
D.	kinetic energy	
<input checked="" type="checkbox"/> E.	gravity	<input checked="" type="checkbox"/>

Score: 1/1

**18.** The phase of material that is very compressible and very fluid is \_\_\_\_\_.

	Student Response	Correct Answer
A.	not naturally found on Earth	
B.	solid	
C.	liquid	
<input checked="" type="checkbox"/> D.	gas	<input checked="" type="checkbox"/>
E.	a liquid crystal	

Score: 1/1

**19.** Greater population usually implies \_\_\_\_\_.

Student Response	Correct Answer
------------------	----------------

- A.greater resilience to disasters
- ☒ B.less effective evacuation capability
- C.that carrying capacity is irrelevant
- D.less human tragedy due to disasters
- E.more robust infrastructure



Score: 1/1

**20.**

Land-use planning is \_\_\_\_\_.

**Student Response**

**Correct Answer**

- ☒ A.an environmentally sound and cost-effective adjustment to hazards
- B.best done after a disaster has happened, to better gauge the amount of possible destruction
- C.a passive response to natural hazards
- D.an alternative to using insurance to cover losses due to hazards
- E.an inappropriate way to handle natural hazards, given the high levels of technology available to mitigate the hazard



Score: 1/1

## VOLCANOES

**1.**Carbon dioxide CO<sub>2</sub> gas is a MAJOR hazard at active volcanoes because it \_\_\_\_\_.

**Student Response**



**Correct Answer**

- A.produces toxic gas carbon monoxide CO
- B.causes death by asphyxiation
- ☒ C. forms carbonic acid which is highly toxic
- D.is the most common gas emitted during eruptions
- E.causes acid rain





Score: 0/1

2. What are the two basic requirements for lahars?

	Student Response	Correct Answer
A. water and lava		
B. glaciers and ice		
C. steep slopes and volcanic bombs		
 D. tephra and water		
E. rivers and glaciers		

Score: 1/1



3. By volume, the largest type of volcanic landform is a \_\_\_\_\_.

	Student Response	Correct Answer
 A. shield volcano		
B. stratovolcano		
C. lava dome		
D. composite cone		
E. cinder cone		

Score: 1/1

4.

Pyroclastic flows can be caused by all of the following EXCEPT \_\_\_\_\_.

	Student Response	Correct Answer
 A. pressure release from melting snow		
B. dome collapse		
C. directed blast		
D. overspill of crater rim		
E. eruption column collapse		

Score: 1/1

5. Mount Rainier is dangerous for all of the following reasons EXCEPT \_\_\_\_\_.

- | Student Response   | Correct Answer                      |
|--|-------------------------------------|
| A. It has been more active than Mount St. Helens over the past 2000 years.         | <input checked="" type="checkbox"/> |
| B. It has a history of producing large lahars.                                     |                                     |
| C. It has a history of erupting pyroclastic flows and lava flows.                  |                                     |
| <input checked="" type="checkbox"/> D. It is the largest of the Cascade volcanoes. |                                     |
| E. It is covered with a large volume of ice and snow.                              |                                     |

Score: 0/1

6. All of the following are ways to detect ground deformation EXCEPT \_\_\_\_\_.

- | Student Response                           | Correct Answer                      |
|--|-------------------------------------|
| A. tiltmeters                              |                                     |
| <input checked="" type="checkbox"/> B. GPS |                                     |
| C. COSPEC                                  | <input checked="" type="checkbox"/> |
| D. InSAR                                   |                                     |
| E. a measuring tape                        |                                     |

Score: 0/1

7. A high volcano explosivity index (VEI) generally corresponds with \_\_\_\_\_.

- | Student Response   | Correct Answer                      |
|--|-------------------------------------|
| A. low and broad volcano shapes                                  |                                     |
| B. deep rift valleys   |                                     |
| C. large fissures in the side of the volcano                     |                                     |
| D. underwater volcanoes  |                                     |
| <input checked="" type="checkbox"/> E. long recurrence intervals | <input checked="" type="checkbox"/> |

Score: 1/1

8. Which lists the volcanic landforms from LARGEST to SMALLEST?

- | Student Response                               | Correct Answer |
|--|----------------|
| A. composite cone, cinder cone, shield volcano |                |



B. shield volcano, cinder cone, composite cone

C. cinder cone, composite cone, shield volcano

D. composite cone, shield volcano, cinder cone

☒ E. shield volcano, composite cone, cinder cone



Score: 1/1

9. The volcanoes that compose the Cascade Range are at a \_\_\_\_\_.

**Student Response      Correct Answer**

A. continent-continent collision zone

☒ B. subduction zone



C. transform plate boundary

D. triple junction

E. divergent plate boundary

Score: 1/1

10. Which is NOT a volcanic hazard or effect associated with large amounts of tephra/ash?

**Student Response      Correct Answer**

☒ A. lahars

B. an increase in global temperature



C. disruption of airline flights

D. an increase in respiratory problems

E. destruction of agricultural land

Score: 0/1

11. The North American plate is \_\_\_\_\_ relative to the Yellowstone hot spot.

**Student Response      Correct Answer**

☒ A. moving to the SW



B. moving to the SE

C. moving to the NW

D. moving to the NE

E. stationary

Score: 1/1

**12.** Volcanic landslides can be triggered by all of the following EXCEPT \_\_\_\_\_.

- |   | Student Response                    | Correct Answer |
|---|-------------------------------------|----------------|
| A. lahars   | <input checked="" type="checkbox"/> |                |
| B. volcanic activity                                    |                                     |                |
| <input checked="" type="checkbox"/> C. seismic activity |                                     |                |
| D. heavy rainfall                                       |                                     |                |
| E. rapid snow melt                                      |                                     |                |

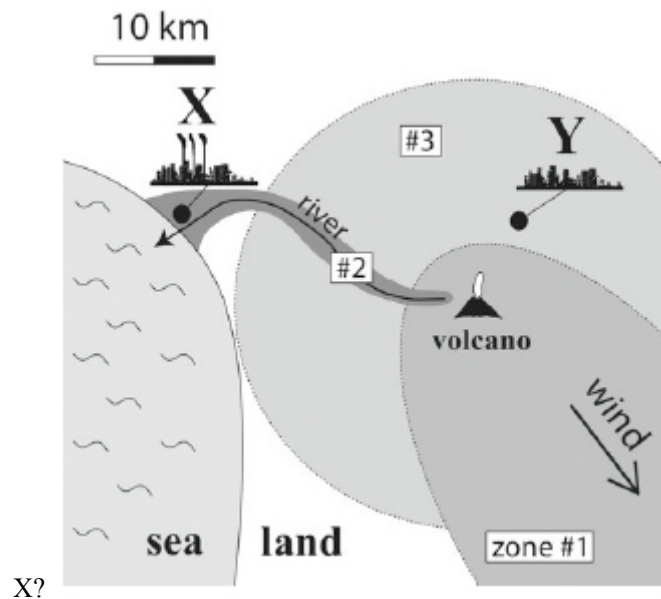
Score: 0/1

**13.** The volcanoes of the Cascade range are predominantly \_\_\_\_\_.

- |   | Student Response                    | Correct Answer |
|---|-------------------------------------|----------------|
| A. cinder cones   |                                     |                |
| B. composite volcanoes                                  | <input checked="" type="checkbox"/> |                |
| <input checked="" type="checkbox"/> C. shield volcanoes |                                     |                |
| D. basaltic   |                                     |                |
| E. non-explosive  |                                     |                |

Score: 0/1

**14.** In the figure below, what is the most significant volcano-related hazard for Town



X?

Student Response    Correct Answer

- A. bombs
- B. lahar ☒
- C. pyroclastic flows
- ☐ D. lava flows
- E. ash fallouts

Score: 0/1

**15.** The high viscosity of some lavas results from \_\_\_\_\_.


Student Response    Correct Answer

- A. low density
- B. high temperatures
- C. high temperatures and high  $\text{SiO}_2$  content
- ☒ D. high  $\text{SiO}_2$  content ☒
- E. low gas content

Score: 1/1


**16.** The most active Cascade arc volcano over the past 4,000 years is \_\_\_\_\_.

Student Response    Correct Answer

- A. Mount Hood
- B. Mount Baker
- ☒ C. Mount St. Helens 
- D. Mount Rainier
- E. Mount Shasta


Score: 1/1

**17.** Tiltmeters and InSar can help DIRECTLY infer which of the following?

- |  | Student Response  | Correct Answer |
|--|---|----------------|
| <input checked="" type="checkbox"/> A. | distribution of pyroclastic flow deposits   |                |
| B.                                     | earthquake distribution   |                |
| C.                                     | plate movement  |                |
| D.                                     | build-up of carbon dioxide in the lava dome   |                |
| E.                                     | near-surface magma movement  |                |





Score: 0/1

**18.** Most active volcanoes above sea level are found at \_\_\_\_\_.

- |  | Student Response   | Correct Answer |
|--|--|----------------|
| A.                                     | continental rifts zones  |                |
| <input checked="" type="checkbox"/> B. | mid-ocean ridges   |                |
| C.                                     | intraplate hot spots   |                |
| D.                                     | slide-past margins   |                |
| E.                                     | convergent margins  |                |

Score: 0/1

**19.** Which of the following factors did NOT contribute to the difficulty in issuing volcanic eruption warnings at Long Valley-Mammoth Lakes in California?

- |    | Student Response   | Correct Answer |
|----|--|----------------|
| A. | property values         |                |
| B. | tourism                 |                |
| C. | angry residents         |                |
| D. | the federal government  |                |

☒ E. people living in the proximity ☒

Score: 1/1

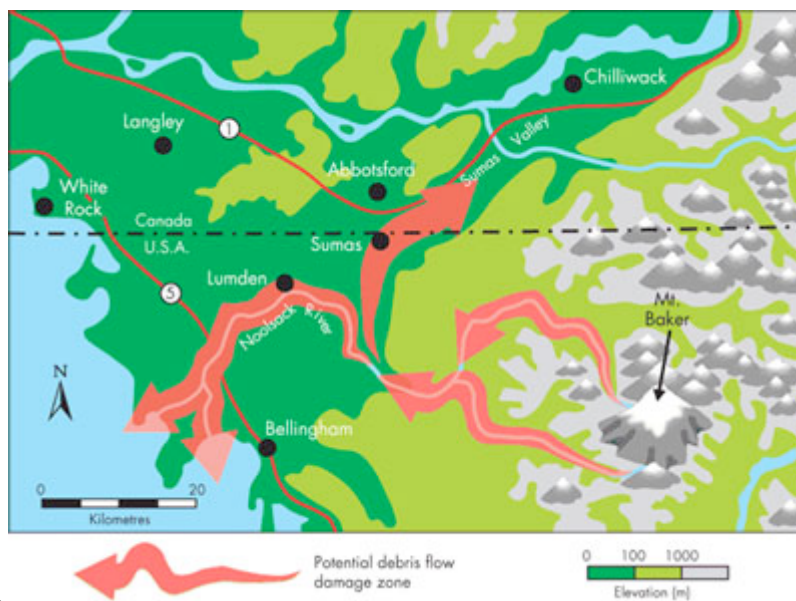
20. Which statement about volcanic hazards is FALSE?

Student Response

Correct Answer

- ☒ A. Lahars require only water and unconsolidated pyroclastic material to form.
- B. Hydrothermal alteration can promote volcanic landslides.
- C. Volcanic landslides commonly turn into mudflows.
- D. Volcanic gases form acid rain that destroy agriculture.
- E. Bombs and blocks affect areas up to 1000 km away from a volcano. ☒

1. What is the most significant hazard in the BC area across the border from Sumas associated with an eruption from Mt. Baker? Refer to the figure



Student Response



Value

Correct Answer

- A. lava flow
- B. ash fallout
- C. pyroclastic flow
- ☒ D. lahar 100% ☒
- E. sector collapse



Score: 1/1

2. The most active Cascade arc volcano over the past 4000 years has been \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	Mount Baker		
B.	Mount St. Helens		
 C.	Mount Rainier	0%	
D.	Mount Garibaldi		
E.	Mount Meager		



Score: 0/1

3. Which statement is TRUE?

	Student Response	Value	Correct Answer
A.	Lahars are hotter than pyroclastic flows.		
 B.	Pyroclastic flows can travel greater distances than lahars.	0%	
C.	Lahars only occur at snow-capped volcanoes.		
D.	Lahars and pyroclastic flows usually occur during cinder cone eruptions.		
E.	Pyroclastic flows travel faster than lahars.		

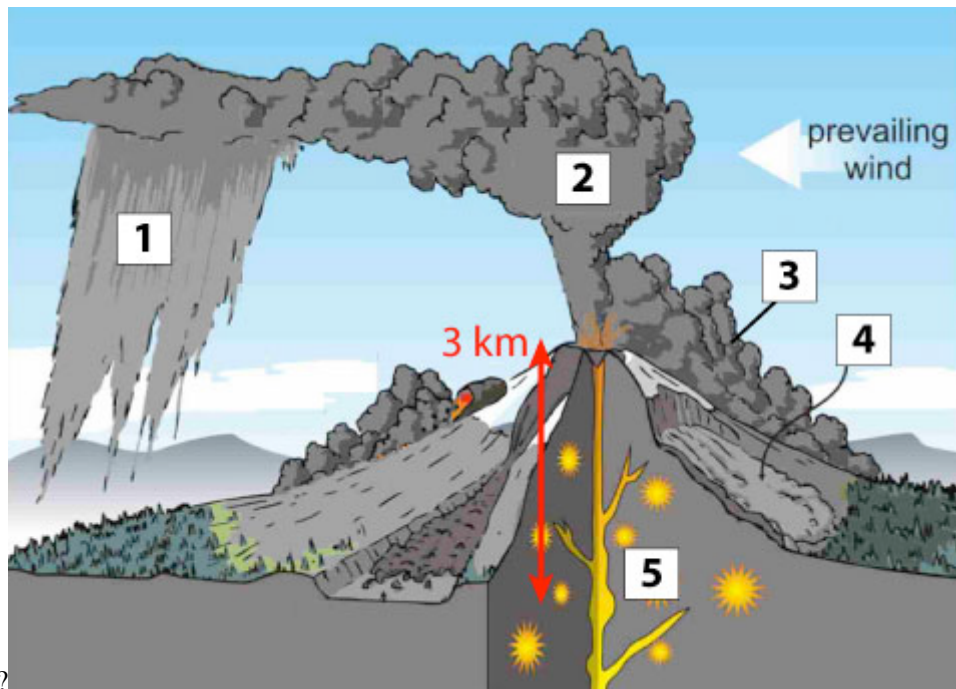
Score: 0/1

4. Which has the LOWEST viscosity?

	Student Response	Value	Correct Answer
 A.	water	100% 	
B.	basalt lava		
C.	rhyolite lava		
D.	gas-rich mafic magma		
E.	peanut butter		

Score: 1/1

5. Which of the following volcanoes is NOT of the type represented in the figure



below?

	Student Response	Value	Correct Answer
A.	Mt. Baker, USA		
B.	Mt. St. Helens, USA		
C.	Mt. Meager, Canada		
<input checked="" type="checkbox"/> D.	Mauna Kea, USA	100%	<input checked="" type="checkbox"/>
E.	Mt. Pinatubo, Philippines		

Score: 1/1

6. Which of the following does NOT contribute to Volcanic Explosivity Index (VEI) \_\_\_\_\_?

	Student Response	Value	Correct Answer
A.	erupted volume		
B.	eruption recurrence rate	<input checked="" type="checkbox"/>	
C.	eruption column height		
<input checked="" type="checkbox"/> D.	eruption duration	0%	<input checked="" type="checkbox"/>
E.	style of eruption		

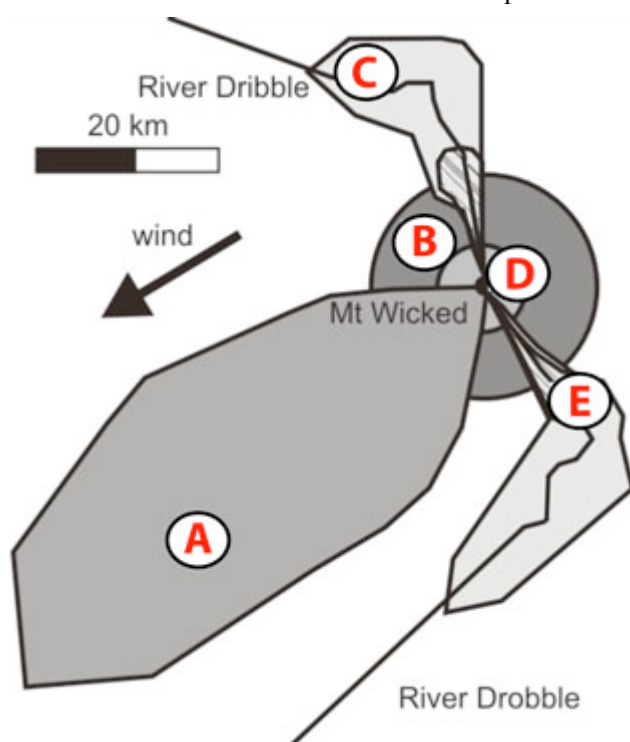
Score: 0/1

7. Which of the following gases produced by volcanic eruptions form acidic solutions when dissolved in water?

	Student Response	Value	Correct Answer
A.	H <sub>2</sub> O, water		
B.	CO, carbon monoxide		
<input checked="" type="checkbox"/> C.	SO <sub>2</sub> , sulfur dioxide	100%	✓
D.	CH <sub>4</sub> , methane		
E.	O <sub>2</sub> , oxygen		

Score: 1/1

8. Which zone on the stratovolcano hazard map shown below is most likely to be for LAHARS?



	Student Response	Value	Correct Answer
A.	A		
B.	B		
<input checked="" type="checkbox"/> C.	C	100%	✓
D.	D		
E.	E		

Score: 1/1

9. A lava dome \_\_\_\_\_.



	Student Response	Value	Correct Answer
A.	is a very small basaltic lava flow		
B.	is often found on cinder cones		
<input checked="" type="checkbox"/> C.	can collapse to form pyroclastic flows	100%	<input checked="" type="checkbox"/>
D.	is never found on stratovolcanoes		
E.	glows at night because it is hotter than 1500 °C		

Score: 1/1

10. A correlation spectrometer (COSPEC) measures \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	the ratio of CO <sub>2</sub> to SO <sub>2</sub> in an eruption cloud over time		
B.	the amount of CO <sub>2</sub> in an eruption cloud compared to the standard atmospheric value		
C.	the time that it takes for H <sub>2</sub> O vapor in an eruption cloud to dissipate		
<input checked="" type="checkbox"/> D.	the solar ultraviolet light that is absorbed by SO <sub>2</sub> in an eruption cloud	100%	<input checked="" type="checkbox"/>
E.	the composition of gases escaping from the vent		

Score: 1/1

11. The figure below shows an example of \_\_\_\_\_.





	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	a Hawaiian fire fountain	100%	<input checked="" type="checkbox"/>

- B. a pyroclastic flow
- C. a dome eruption
- D. lahar
- E. a'a flow



Score: 1/1

**12.** Which of the following statements is FALSE?

	Student Response	Value	Correct Answer
A.	Granite is a plutonic felsic rock.		
B.	Magma intrusions in Hawaii are likely to be hotter than granitic magma.		
 C.	Intrusive volcanic rocks cool slowly, thus consist of large crystals.	0%	
D.	Rhyolite is a felsic extrusive rock.		
E.	Basalt and andesite form from intermediate magma.		



Score: 0/1

**13.** The MOST important factor controlling explosive versus non-explosive behaviour is \_\_\_\_\_.

	Student Response	Value	Correct Answer
 A.	dissolved gas content	0%	
B.	crystal size in magma		
C.	magma composition		
D.	location of volcano		
E.	topography		

Score: 0/1

**14.** Which volcano on average erupts the LOWEST viscosity lava?

	Student Response	Value	Correct Answer
A.	Mt. Pinatubo		
 B.	Mauna Loa	100%	
C.	Mt. St. Helens		
D.	Mt. Baker		

E. Yellowstone

**15.** Which statement about the Cascades is FALSE?

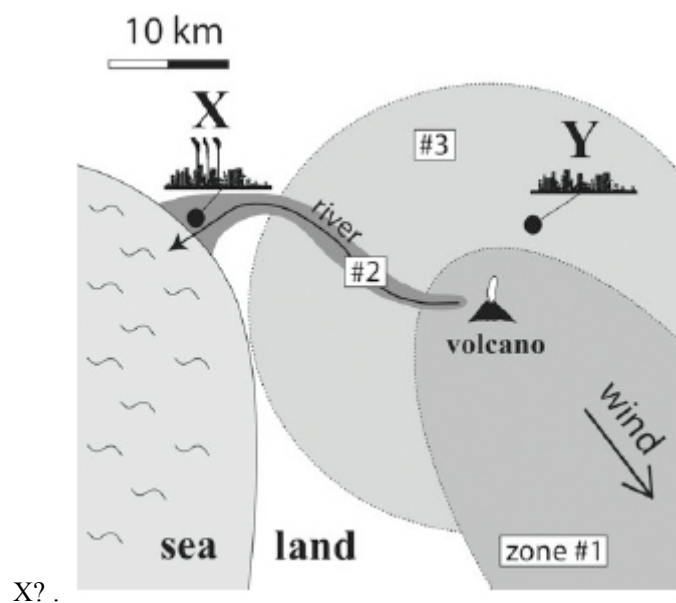
- |  | Student Response  | Value                               | Correct Answer |
|--|---|-------------------------------------|----------------|
| A.                                     | The Cascades are part of the Ring of Fire.              |                                     |                |
| <input checked="" type="checkbox"/> B. | The Cascades are formed over a subduction zone.         | 0%                                  |                |
| C.                                     | The Cascades are predominantly stratovolcanoes.         |                                     |                |
| D.                                     | Yellowstone is part of the Cascades.                    | <input checked="" type="checkbox"/> |                |
| E.                                     | The Cascades are currently considered active volcanoes. |                                     |                |

Score: 0/1


**16.** The slopes of stratovolcanoes are \_\_\_\_\_ because they erupt \_\_\_\_\_ viscosity magma of mostly \_\_\_\_\_ composition.

- |  | Student Response           | Value                               | Correct Answer |
|--|----------------------------|-------------------------------------|----------------|
| A.                                     | steep, high, mafic         |                                     |                |
| <input checked="" type="checkbox"/> B. | shallow, high, felsic      | 0%                                  |                |
| C.                                     | shallow, low, intermediate |                                     |                |
| D.                                     | steep, high, intermediate  | <input checked="" type="checkbox"/> |                |
| E.                                     | steep, low, felsic         |                                     |                |

**17.** Which of the following is the BEST way to minimize the risk to human life in Town




Student Response	Value	Correct Answer
------------------	-------	----------------

- A. build a dam between the town and the volcano
- ☒ B. setup acoustic flow monitors along the river valley 0% 
- C. prevent construction of new houses along the river valley
- D. setup gas monitors on the volcano
- E. setup seismic stations

Score: 0/1

**18.** \_\_\_\_\_ is a rock formed by magma that produce the MOST explosive volcanic eruptions.

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A. rhyolite	100% 		
B. basalt			
C. dacite			
D. granite			
E. andesite			

Score: 1/1

**19.** You live on a hill top 10 km away and downwind from a STRATOVOLCANO. List the following hazards to expect in order of EXTREMELY hazardous to NOT VERY hazardous.

[-----] EXTREMELY hazardous

[-----]

[-----]

[-----] NOT VERY hazardous

Student Response	Value	Correct Answer
You live on a hill top 10 km away and downwind from a STRATOVOLCANO. List the following hazards to expect in order of EXTREMELY hazardous to NOT VERY hazardous.		

[pyroclastic flow] EXTREMELY hazardous

[ash fall]

[lahar]

[lava flow] NOT VERY hazardous 100.0% You live on a hill top 10 km away and downwind from a STRATOVOLCANO. List the following hazards to expect in order of EXTREMELY hazardous to NOT VERY hazardous.

[pyroclastic flow] EXTREMELY hazardous

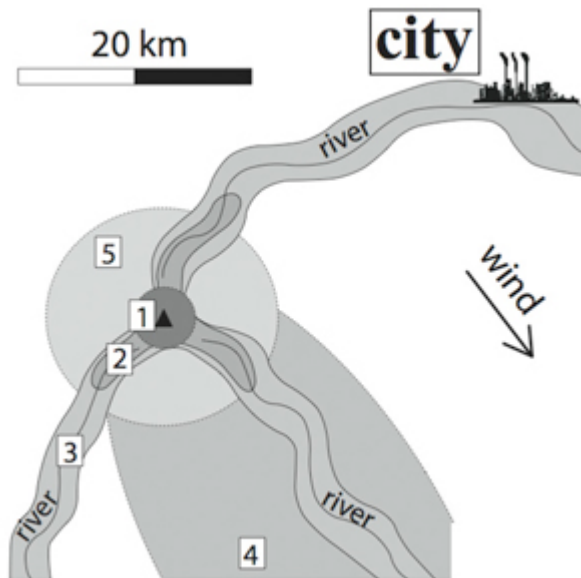
[ash fall]

[lahar]

[lava flow] NOT VERY hazardous (100.0%)

Score: 1/1

20. On the figure below, what hazard is most significant in zone #4?



	Student Response	Value	Correct Answer
A.	lava flow		
B.	ash fallout	✓	
<input checked="" type="checkbox"/> C.	pyroclastic flow	0%	
D.	lahar		
E.	bombs		

Score: 0/1

# Earthquakes

1.

Intraplate earthquakes \_\_\_\_\_.

	Student Response	Correct Answer
A.	occur at the junction of plates	
<input checked="" type="checkbox"/> B.	occur within the interior of continents	<input checked="" type="checkbox"/>
C.	are caused by hotspots	
D.	are the most well understood of earthquake types	
E.	are caused by activity of a deep subducting plate under a continent	

Score: 1/1

2. How does a layer of soft sediment at the ground surface affect shaking?

	Student Response	Correct Answer
A.	vertical shaking is increased; no effect on horizontal shaking	
B.	no measureable effect	
<input checked="" type="checkbox"/> C.	shaking is amplified	<input checked="" type="checkbox"/>
D.	low-frequency shaking is damped out (canceled)	
E.	body waves are amplified; no effect on surface waves	

Score: 1/1

3. Which of the following CORRECTLY describe how faults rupture?

	Student Response	Correct Answer
A.	Maximum slip occurs at the hypocenter.	
<input checked="" type="checkbox"/> B.	The amount of slip is uniform along the rupture surface.	
C.	Maximum fault slip occurs at the epicenter.	
D.	The amount of slip along a fault is not measurable.	
E.	The greatest amount of slip can occur some distance from the hypocentre.	<input checked="" type="checkbox"/>

Score: 0/1

4. When a fault ruptures DEEP in the lithosphere, the energy is released mainly by \_\_\_\_\_.

Student Response	Correct Answer
A.	P-waves that dissipate perpendicularly (at a 90°
	angle) from the fault plane
B.	S-waves that dissipate perpendicularly (at a 90° angle) from the fault plane
C.	Raleigh waves that dissipate away from the fault plane
<input checked="" type="checkbox"/> D.	both P-waves and S-waves that dissipate in all
	directions away from the fault plane <input checked="" type="checkbox"/>
E.	P-waves, S-waves and Raleigh waves that dissipate in all directions away from the fault plane

Score: 1/1

5. Evidence that rocks can deform plastically can be found \_\_\_\_\_.

Student Response	Correct Answer
A.	only by scientific presumption because the process takes so
	long to occur
B.	as cracks and fissures in the ground or in cliff faces and road-cuts
C.	when a seismometer records the motion of a seismic wave passing
D.	only in the desert where there is no vegetation to cover the visible rock
<input checked="" type="checkbox"/> E.	in the curves and bends of the layers seen in some mountain ranges <input checked="" type="checkbox"/>

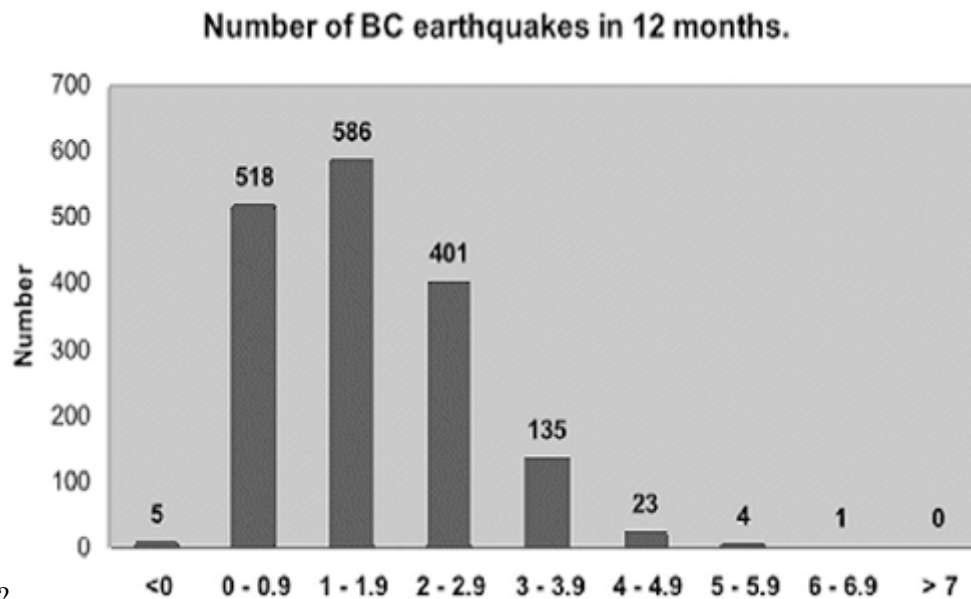
Score: 1/1

6. One important distinction between earthquake magnitude and felt intensity is \_\_\_\_\_.

Student Response	Correct Answer
A.	instruments measuring felt intensity have recently become more accurate while those measuring
	magnitude is still uncertain
B.	the value of magnitude depends upon where the measurement is made
C.	felt intensity has units of energy whereas magnitude is just a number
D.	felt intensity is subjective whereas magnitude is measured <input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> E.	magnitude means size whereas intensity means energy

Score: 0/1

7. What does the figure (below) tell us about earthquakes in British Columbia in a 12-month



period?

**Student Response**

**Correct Answer**

- A. Only 5 people felt the smallest earthquakes ( $M < 0$ ).
- B. 586 earthquakes had magnitude around 600.
- C. 5 earthquakes were catastrophic.
- D. Only 1 earthquake could have caused any damage of any kind.
- ☒ E. Most earthquakes in BC are small ( $M = 4$  and below). ☒

Score: 1/1

8. Which of the following wave types travels slowest through the interior rocks?

**Student Response**

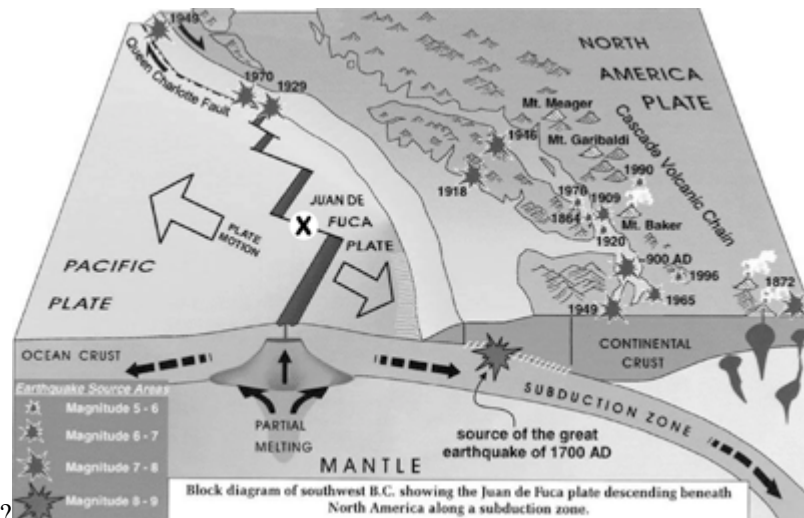
**Correct Answer**

- A. P-waves
- B. S-waves ☒
- ☒ C. Rayleigh waves
- D. Love waves
- E. They all travel with the same velocity

Score: 0/1



9. This figure shows three types of tectonic boundary located close to Vancouver. Which type of



boundary does X mark?

Student Response      Correct Answer

- A.          divergent
- ☒ B.          transform ☒
- C. subduction zone
- D.          convergent
- E. hot spot

Score:    1/1

10. According to the latest renewal forecasts, the probability of a M9 Cascadia subduction zone earthquake in the next 50 years is \_\_\_\_\_.

Student Response      Correct Answer

- A.          less than 1%
- B. 15% ☒
- ☒ C.          35%
- D.          54%
- E. 100%

Score:    0/1

11. The type of damage shown in the photo could have been prevented most effectively by



- |  | Student Response                                      | Correct Answer                      |
|--|---|-------------------------------------|
| A.                                     | adding dynamic shock absorbers                        |                                     |
| <input checked="" type="checkbox"/> B. | making the ground more dense to minimize liquefaction |                                     |
| C.                                     | building a stronger concrete foundation               |                                     |
| D.                                     | using stronger building materials                     |                                     |
| E.                                     | adding shear walls                                    | <input checked="" type="checkbox"/> |

Score: 0/1

**12.**In a conventional forecast, the probability of an earthquake \_\_\_\_\_ with time, but in a renewal forecast, the probability of an earthquake \_\_\_\_\_ with time.

- |  | Student Response          | Correct Answer                      |
|--|---------------------------|-------------------------------------|
| A.                                     | increases, decreases      |                                     |
| B.                                     | stays the same, decreases |                                     |
| <input checked="" type="checkbox"/> C. | stays the same, increases | <input checked="" type="checkbox"/> |
| D.                                     | decreases, stays the same |                                     |
| E.                                     | increases, stays the same |                                     |

Score: 1/1

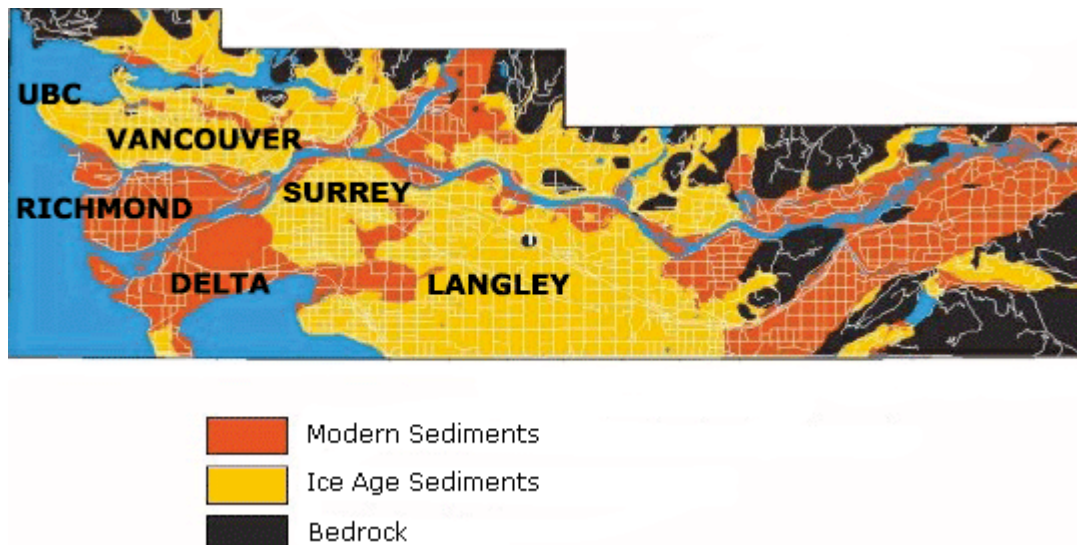
**13.**The exact time of the last megaquake in the Pacific Northwest was determined by \_\_\_\_\_.

- |    | Student Response                               | Correct Answer |
|----|--|----------------|
| A. | seismometer measurements from around the world |                |

- ☒ B. Japanese tsunami records ☒
- C. historic records from Europe
- D. geologic patterns across the relevant active fault
- E. radio-carbon dates from buried prehistoric cave dwellers

Score: 1/1

**14.**Where would you be safest in the event of a magnitude 9 Cascadia earthquake?




- | Student Response   | Correct Answer |
|--|----------------|
| A. in an apartment on the top floor of a 15-story apartment building in Richmond                                   |                |
| B. in an older 4-story brick building near UBC   |                |
| C. on Lion's Gate Bridge   |                |
| D. in a 5 story building that is touching the neighbouring 10 story building                                       |                |
| <input checked="" type="checkbox"/> E. in a one-story house in North Vancouver <input checked="" type="checkbox"/> |                |

Score: 1/1

**15.**What kind of deformation is most frequently and easily visible in rocks?


- | Student Response | Correct Answer |
|------------------|----------------|
| A. normal        |                |

- B. fluid
- C. brittle
- ☒ D. plastic 
- E. elastic

Score: 1/1

**16.** A building's resonant frequency is related to \_\_\_\_\_.


**Student Response    Correct Answer**

- A. its age
- B. its use
- ☒ C. its height 
- D. how close it is to the earthquake epicenter
- E. the earthquake magnitude

Score: 1/1

**17.** In order to estimate an earthquake's location using seismograms, what do you need to know along with the P-wave and S-wave arrival times?


**Student Response    Correct Answer**

- A. the velocity of the Raleigh wave
- ☒ B. The velocities of the P-wave and S-wave. 
- C. The frequencies of the P-wave and S-wave.
- D. The duration of shaking during the earthquake.
- E. the depth of the earthquake

Score: 1/1

**18.** Although recent earthquakes that occurred south of Seattle, Washington (Feb 2001), in Kobe, Japan (1995) and at Bam, Iran (2003) were of similar magnitude, the Seattle earthquake did NOT cause as much devastation because \_\_\_\_\_.

**Student Response    Correct Answer**

- A. fewer people lived in the region
- B. its hypocentre was much deeper than the other earthquakes 
- ☒ C. the ground around Seattle was not so dangerously soft

- D. there were more warnings issued, allowing people to prepare themselves
- E. of the time of day when it occurred

Score: 0/1

**19.** Which types of faults pose the LEAST risk to residents of southwest BC?

**Student Response    Correct Answer**

- A. strike-slip faults
- B. thrust faults in the continental upper crust
- C. subduction zone thrust faults
- D. faults within the subducting slab
- ☒ E. normal faults in the continental upper crust ☒

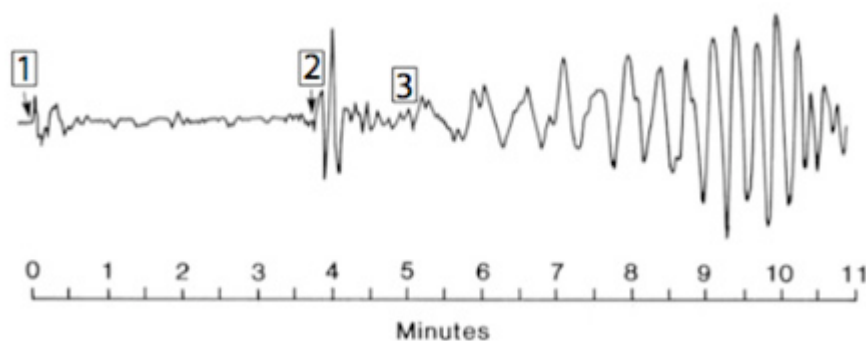
Score: 1/1

**20.** Which combination of factors is most likely to topple a high-rise building?


**Student Response    Correct Answer**

- 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.

**1.** On the figure below, which the following information is necessary to determine the distance between the station and the earthquake?




**Student Response      Correct Answer**

- A. the arrival time of the wave #1
- ☒ B. the arrival times of waves #1 and #2 
- C. the arrival times of waves #1 and #3
- D. the arrival times of waves #2 and #3
- E. the arrival time of wave #3

Score: 1/1

**2.**What is the BEST explanation of how earthquakes are globally distributed?


**Student Response      Correct Answer**

- A. Earthquakes happen anywhere and at any time.
- B. Earthquakes are evenly distributed over the globe.
- C. Earthquakes mainly take place along the edges of continents.
- D. Earthquakes are mainly located within plate boundaries.
- ☒ E. Earthquakes mainly take place along the edges of plate boundaries. 

Score: 1/1

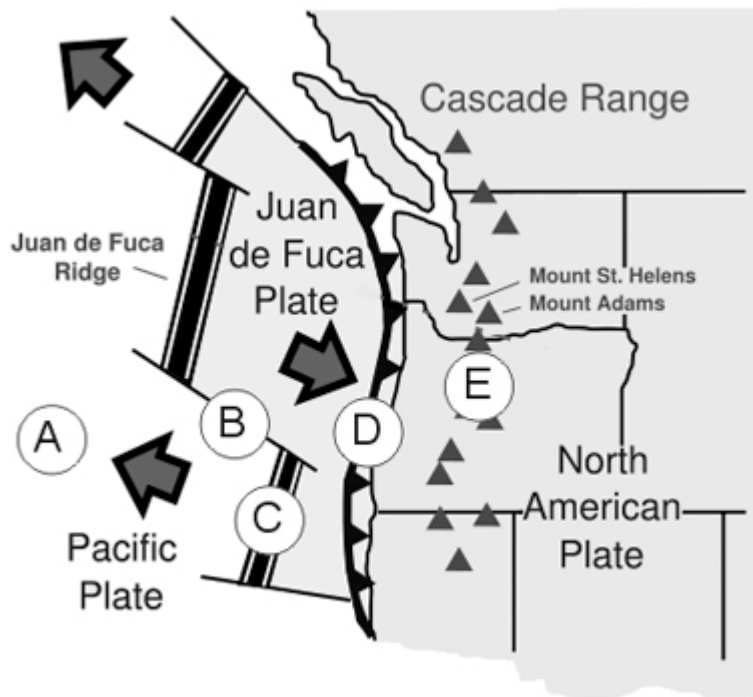
**3.**Imagine you're in your kitchen when an earthquake occurs. Amidst all the shaking, which of the following actions will likely keep you SAFE?

**Student Response      Correct Answer**

- A. hold on to the fridge
- B. duck and cover
- C. run outdoors
- ☒ D. hide under the sturdy dining table 
- E. run upstairs to grab your earthquake kit

Score: 1/1

**4.**On the figure below which letter indicates a zone where tensional stresses



dominate?

- A.A
- B.B
- C.C ☒
- ☒ D. D
- E.E

Score: 0/1

5.

Which of the following factors does NOT influence the Modified Mercalli intensity of an earthquake?

- |  | Student Response                       | Correct Answer                      |
|--|--|-------------------------------------|
| A.                                     | the nature of the ground               |                                     |
| B.                                     | the structural resistance of buildings |                                     |
| C.                                     | the energy released at the source      |                                     |
| D.                                     | the distance from the source           |                                     |
| <input checked="" type="checkbox"/> E. | the distribution of seismic stations   | <input checked="" type="checkbox"/> |

Score: 1/1

6. What is the importance of the recurrence interval (frequency through time) of large earthquakes along a fault?

	Student Response	Correct Answer
A.		It gives an estimate of the probability of small earthquakes.
B.		It is used to predict the kind of shaking an earthquake will cause.
C.		It is used to predict whether the earthquake will generate a tsunami.
D.		It is used in the prediction of the cost of the next earthquake.
<input checked="" type="checkbox"/> E.		It is an estimate of the probability of a future damaging earthquake. <input checked="" type="checkbox"/>

Score: 1/1

7. Earthquakes are expected in Cascadia because \_\_\_\_\_.

	Student Response	Correct Answer
A.		the Pacific Plate is locked with the North American Plate and is causing strain
B.		part of the continent is attached to the Pacific Plate and is sliding northward
<input checked="" type="checkbox"/> C.		the Juan de Fuca plate is subducting under the North American Plate <input checked="" type="checkbox"/>
D.		an earthquake will not occur at the Cascadia subduction zone
E.		the North American Plate has lost almost all of its stored elastic potential energy

Score: 1/1

8.

There are as many as 1500 to 2000 earthquakes in western Canada every year. Most of them tend to be \_\_\_\_\_.

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.		too small to be felt by people <input checked="" type="checkbox"/>
B.		too small to register on instruments
C.		subduction zone earthquakes
D.		concentrated in the area underneath Victoria and Vancouver
E.		recorded by American seismic stations but not by Canadian stations





Score: 1/1

**9.**How does a map of stress change help “PREDICT” earthquakes?

**Student Response**

**Correct Answer**



- |   |   |
|---|---|
| A.<br>earthquake will occur.  | It can pinpoint the places where the next   |
| B.It identifies how long (in hours) it will be before the next earthquake will happen.                            |   |
|  C.<br>earthquake has increased. | It indicates regions where the probability of an<br> |
| D.<br>describe large earthquakes.   | It doesn't help - stress maps are only used to  |
| E.It maps out the cost in damage that can be expected, using red for more damage and blue for less damage.        |   |

Score: 1/1

**10.**Which is FALSE?

**Student Response**

**Correct Answer**

- |  |   |
|--|---|
| A.<br>frequent, but the least damaging because of their depth.   | Subduction zone earthquakes are the most<br> |
| B.Earthquakes at spreading centres are nearly always small and shallow.  |   |
| C.Earthquakes along strike-slip plate boundaries can be large but will never reach the maximum magnitude possible at subduction zones. |   |
|  D.<br>being forced to dive under a second plate.   | The deepest earthquakes occur where one plate is  |
| E.Earthquakes at strike-slip boundaries between two oceanic plates are frequent but rarely large.                                      |   |

Score: 0/1

**11.**Which of the following BEST defines the resonant frequency of a building?

**Student Response**

**Correct Answer**

- |  |  |
|--|--|
| A.<br>liquefaction under the foundations | the frequency of ground motion that will cause |
|--|--|

- B. the frequency at which the building will shake most naturally ☒
- C. the lowest frequency capable of destroying the building
- ☒ D. the rate at which ground motion has to accelerate in order to apply enough force to break the building
- E. the frequency that will make the building's shaking audible to the human ear

Score: 0/1

12. After a fault ruptures (moves) \_\_\_\_\_.

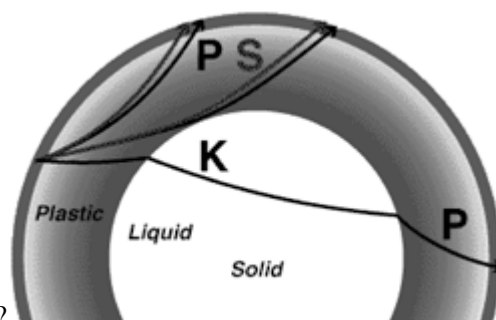
**Student Response**

**Correct Answer**

- A. stress is concentrated along the length of the rupture and released at the tips
- B. plastic deformation releases stress
- ☒ C. elastic deformation concentrates stress at the ends of the rupture ☒
- D. stress increases along the fault
- E. brittle deformation prevents energy from propagating

Score: 1/1

13. Why are the paths of body waves in the figure below NOT straight?



straight?

**Student Response**

**Correct Answer**

- ☒ A. S waves can't travel through liquid ☒
- B. P waves can't travel through high temperature liquid
- C. body waves reflect at boundaries
- D. wave velocities are affected by changes in material ☒
- E. S waves bend while traveling through liquid

Score: 0/1

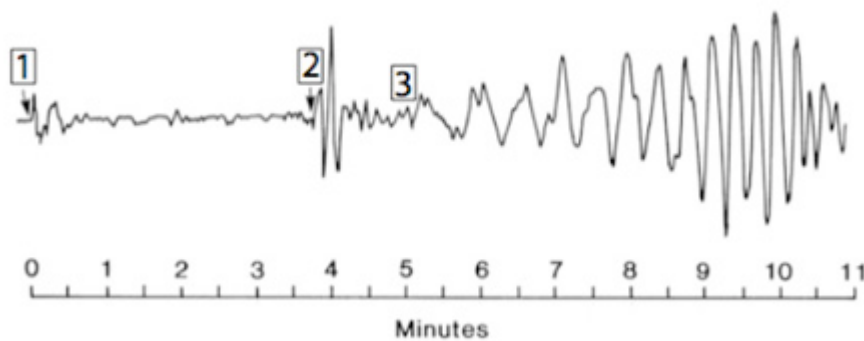
**14.** Which of the following hazards will NOT likely cause major damage in the event of a M9.0 earthquake in BC?

**Student Response    Correct Answer**

- A. tsunami
- B. landslide
- C. ground rupture
- ☒ D. liquefaction
- E. pyroclastic flow ☒

Score: 0/1

**15.** On the figure below, the wave indicated by #1 is a



\_\_\_\_\_.

**Student Response    Correct Answer**

- A. Love wave
- ☒ B. P wave
- C. Rayleigh wave
- D. surface wave
- ☒ E. S wave

Score: 0/1

**16.**

Which of the following will make this statement

FALSE?

"During movement on a fault, \_\_\_\_\_."

**Student Response    Correct Answer**

- ☒ A. P-waves are generated
- B. stress is released
- C. fault blocks return to their original position ☒
- D. an earthquake is generated
- E. elastic and brittle deformation occurs

Score: 0/1

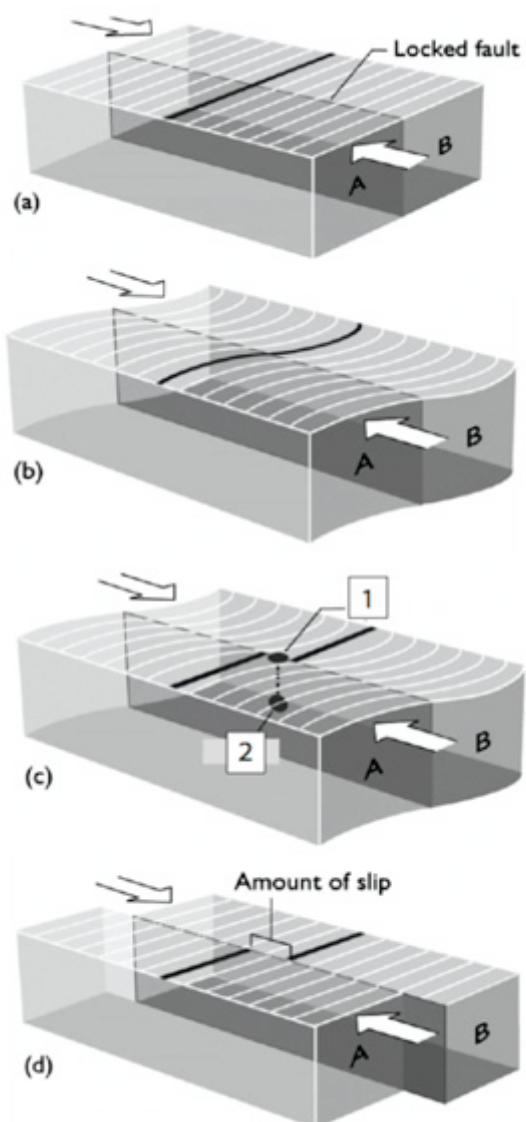
**17.** The Richter scale is no longer in use to measure earthquake magnitude because \_\_\_\_\_.

**Student Response                      Correct Answer**

- A. It is logarithmic and thus covers a wide range of events.
- B. It only measures the energy released from an earthquake.
- C. It is not accurate for large earthquakes or those not occurring in California. ☒
- ☒ D. It is not well known outside of the United States.
- E. It is the same as the Moment Magnitude scale.

Score: 0/1

**18.** What is being shown in part (d) in the figure



below?

Student Response	Correct Answer
<input checked="" type="checkbox"/> A. strain causing stress	
B. permanent deformation of blocks	
C. elastic strain of blocks	
D. a decrease in stress along the fault	
E. brittle deformation <input checked="" type="checkbox"/>	

Score: 0/1

19.

Which is MOST likely to damage a building?

Student Response	Correct Answer
A. move up and down at its natural frequency	vertical ground motion causing the building to
<input checked="" type="checkbox"/> B. move up and down more rapidly than its natural frequency	vertical ground motion causing the building to
C. horizontal ground motion causing the building to move side to side at its natural frequency	<input checked="" type="checkbox"/>
D. move side to side more rapidly than its natural frequency	horizontal ground motion causing the building to
E. a vertical jolt causing permanent plastic deformation of the ground	

Score: 0/1

20. What type of fault is shown by the displaced lines on this



field?

Student Response	Correct Answer
<input checked="" type="checkbox"/> A. Strike slip	<input checked="" type="checkbox"/>
B. Oblique slip	
C. Normal	
D. Reverse	
E. Thrust	

# Landslides

1. Which of the following statements is FALSE?

	Student Response	Correct Answer
A.	Increased pore pressures weaken slopes.	
B.	Small amounts of water make slopes more stable.	
<input checked="" type="checkbox"/> C.	Extra water favors rotational slides over translational slides.	<input checked="" type="checkbox"/>
D.	Large amounts of precipitation weaken slopes.	
E.	The weight of water contributes to the likelihood of a landslide.	

Score: 1/1

2. A sudden vertical movement of unsorted soil is called a(n) \_\_\_\_\_.

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	debris fall	<input checked="" type="checkbox"/>
B.	debris topple	
C.	rock slide	
D.	earth topple	
E.	earth fall	

Score: 1/1

3. Which is TRUE of a debris avalanche?

	Student Response	Correct Answer
A.	Increasing the water content increases viscosity, which decreases velocity and destruction.	
B.	Increasing the water content decreases viscosity, which increases velocity and destruction.	<input checked="" type="checkbox"/>
C.	Increasing the water content decreases viscosity, which decreases velocity and destruction.	
D.	Decreasing the water content decreases viscosity, which decreases velocity and destruction.	
<input checked="" type="checkbox"/> E.	Decreasing the water content increases viscosity, which increases velocity and destruction.	

Score: 0/1

4. Which of the following did NOT contribute to the Frank slide in the Eastern Rocky Mountains?

	Student Response	Correct Answer
A.		dissolution cavities in bedrock
<input checked="" type="checkbox"/> B.		weak, fractured, and faulted bedrock
C.	bedding planes of sedimentary bedrock parallel to the slope	
D.		wet weather in years preceding the slide
E.	removal of vegetation above the slide	<input checked="" type="checkbox"/>

Score: 0/1

5. Which of the following causes of landslides is LEAST important in British Columbia?

	Student Response	Correct Answer
A.	climate	
B.	slope angle	
<input checked="" type="checkbox"/> C.	quick clays	<input checked="" type="checkbox"/>
D.	removal of vegetation	
E.	overloading	

Score: 1/1

6. Debris flows are common in our coastal mountains because \_\_\_\_\_.



	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.		of heavy rains falling on steep slopes covered by loose sediments <input checked="" type="checkbox"/>
B.	irrigation for golf courses and farming add significant amounts of water to the ground	
C.	we are situated in a subduction zone that generates increased earthquake activity	
D.		of increased population density and land development on steep slopes
E.	it suits the agenda of large corporations	

Score: 1/1

7. Most landslides on record in this province are located in southern British Columbia because





**Student Response****Correct Answer**

- A. southern B.C. is more at risk from landslides associated with subduction zone earthquakes
- B. the population density is much higher in southern B.C. and so landslides are considered natural disasters 
- C. landslides are uncommon in northern B.C.
-  D. southern B.C. receives more precipitation than the rest of the province
- E. southern B.C. has steeper slopes than the rest of the province

Score: 0/1

**8.**Based on how an avalanche starts and moves, which category of mass movement would this type of landslide BEST fit into?



**Student Response      Correct Answer**

- A. falls
-  B. flows
- C. debris flows
- D. rotational slides
- E. complex movements 

Score: 0/1

**9.**Which of the following is FALSE about creep?

**Student Response      Correct Answer**

- A. Creep occurs slowly.
-  B. Creep can happen on flat surfaces. 
- C. Freezing and thawing of surface soil can cause creep.
- D. Wetting and drying of surface soil can cause creep.
- E. Creep can result in tilted telephone poles and curved tree trunks.

Score: 1/1

**10.**If a slope has a calculated factor of safety = 1.05 it means that a landslide \_\_\_\_\_.

	Student Response	Correct Answer
A.	has already occurred	
B.	will happen within 24 hours	
C.	is likely to occur in the future	✓
<input checked="" type="checkbox"/> D.	is highly unlikely	
E.	will never occur	

Score: 0/1

**11.** Which statement about causes and triggers of landslides is TRUE?

	Student Response	Correct Answer
A.	Causes are always short-lived events.	
B.	Triggers develop instability in a slope.	
C.	There is usually one cause for a landslide event.	
<input checked="" type="checkbox"/> D.	Causes can trigger landslides in some situations.	✓
E.	There can be many triggers for one event.	

Score: 1/1

**12.** A community discovering that their homes are built on a slow creeping landslide will need to \_\_\_\_\_.

	Student Response	Correct Answer
<input checked="" type="checkbox"/> A.	do nothing since there are no concerns	
B.	perform annual maintenance of road and building damage	✓
C.	have the geology replaced	
D.	plant trees at the bottom of the slope	
E.	flee and abandon their homes	

Score: 0/1

**13.** Which of the following factors would be MOST likely to trigger a landslide on the coast of BC?

	Student Response	Correct Answer
A.	earthquake	
B.	undercutting	

C. overloading

☒ D. heavy rainfall 

E. removal of vegetation

Score: 1/1

**14.** Increased vulnerability to landslide hazards may result from all of the following EXCEPT \_\_\_\_\_.

Student Response	Correct Answer
------------------	----------------

A. logging on unstable slopes	
-------------------------------	--

B. deep infiltration of water	
-------------------------------	--

C. clearcutting	
-----------------	--

<input checked="" type="checkbox"/> D. legislation 	
--	--

E. urbanization	
-----------------	--

Score: 1/1

**15.** Which of the following is FALSE?

Student Response	Correct Answer
------------------	----------------

A. Shear strength is related to friction and cohesion.	
--	--

B. Creep causes the most long-term economic damage because it is not often detected until damage is done.	
---	--

C. Complex landslides are a combination of two or more different landslide types.	
---	--

<input checked="" type="checkbox"/> D. Landslides are classified according to mass, slope, and velocity. 	
--	--

E. Hydrothermal alteration can result in lowering the factor of safety of a slope.	
--	--

Score: 1/1

**16.** In slope stability analyses, the effective stress is \_\_\_\_\_.

Student Response	Correct Answer
------------------	----------------

A. the intergranular stress	
-----------------------------	--

B. the grain to grain contact forces resulting in frictional strength	
---	--

<input checked="" type="checkbox"/> C. the total stress minus any pore water pressures	
--	--

- D. All of the above ☒
- E. None of the above

Score: 0/1

**17.**With regard to landslides, shear strength is \_\_\_\_\_.

Student Response	Correct Answer
A.	the cohesion between grains in a rock or sediment sample
B.the degree to which the surface tension of water holds material together	
<input checked="" type="checkbox"/> C.	a combination of all the factors causing geologic materials to resist shear stress <input checked="" type="checkbox"/>
D.	a combination of composition, density, and electromagnetic attraction within geologic materials
E.slope steepness plus composition	

Score: 1/1

**18.**Tensioning a rock anchor helps to stabilize a slope by\_\_\_\_\_.

Student Response	Correct Answer
A.	reducing gravity
B.preventing rain water from infiltrating into the slope and reducing the effective stresses	
C.breaking the rock, allowing it to be easily removed	
<input checked="" type="checkbox"/> D.	increasing the normal stress and therefore increasing the frictional strength <input checked="" type="checkbox"/>
E.increasing the tensile strength of the slope	

Score: 1/1

**19.**The following sentence BEST describes which type of landslide?

"Material moves along a curved plane of weakness, then dropping off vertically from a precipice."

Student Response	Correct Answer
<input checked="" type="checkbox"/> A. rock slide	
B.rotational slide	

- C. flow
- D. rockfall
- E. complex movement ☒

Score: 0/1

## 20. Which statement is FALSE?

Student Response	Correct Answer
A. The 2005 La Conchita landslide was totally unexpected as the cause for previous landslides in the area had been dealt with. <input checked="" type="checkbox"/>	
B. A landslide trigger is the process that pushes the factor of safety to an unsafe number.	
<input checked="" type="checkbox"/> C. The most common landslide trigger in western British Columbia is heavy precipitation.	
D. One of the underlying causes of the landslide at Frank, Alberta was coal mining.	
E. One hypothesis to explain how sturzstroms can flow extremely far and fast is acoustic fluidization.	

## 1. Most landslides on record in this province are located in southern British Columbia because \_\_\_\_\_.

Student Response	Value	Correct Answer
A. southern B.C. has steeper slopes than the rest of the province		
B. the population density is much higher in southern B.C. and so landslides are considered natural disasters <input checked="" type="checkbox"/>		
C. southern B.C. is more at risk from landslides associated with subduction zone earthquakes		
<input checked="" type="checkbox"/> D. southern B.C. receives more precipitation than the rest of the province		
E. landslides are uncommon in northern B.C.		

Score: 0/1

## 2. The type of slope failure in the figure below commonly occurs in \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	rock where two fractures intersect		
B.	rock where weak bedding planes dip towards the valley		
C.	cohesive soils or weak, heavily fractured rock		
D.	soils that only have frictional strength		
<input checked="" type="checkbox"/> E.	soils where the rupture surface forms an arc or is curved	100%	<input checked="" type="checkbox"/>

Score: 1/1

**3.** Which of the following factors is MOST important in mass movement?

	Student Response	Value	Correct Answer
A.	slope angle		
<input checked="" type="checkbox"/> B.	gravity	100%	<input checked="" type="checkbox"/>
C.	water content		
D.	climate		
E.	overloading		

Score: 1/1

**4.** Which of the following was an important contributing factor to the 2005 La Conchita landslide fatalities in Southern California?

	Student Response	Value	Correct Answer
A.	presence of steep, high slopes		
B.	presence of weak rocks		
C.	prolonged and intense rainfall		
D.	presence of a previous landslide		
<input checked="" type="checkbox"/> E.	all of the above	100%	<input checked="" type="checkbox"/>

Score: 1/1

**5.** All things being equal, which landslide type may cause a significant amount of damage, while posing a low threat to life?

Student Response	Value	Correct Answer
------------------	-------	----------------

- A. rotational slide (slump) ☒
- ☐ B. debris flow 0%
- C. quick clay flow slide
- D. rock fall
- E. massive rock avalanche

Score: 0/1

**6.** You are asked to deal with large rockslides that may initiate along newly cut rock slopes blasted to widen the Sea-to-Sky Highway (Highway 99). To prevent MASSIVE sizes blocks (>1000 m<sup>3</sup>) from sliding onto the road, which approach to mitigation would you take?

	Student Response	Value	Correct Answer
<input type="checkbox"/> A.	prevention through rock bolts, anchors and drainage	100%	<input checked="" type="checkbox"/>
B.	avoidance by selecting an alternative route for the highway		
C.	protection by installing netting		
D.	prevention by planting trees		
E.	protection by building a containment channel		

Score: 1/1

**7.** Rockfall nets prevent and/or mitigate damage by \_\_\_\_\_.

*[There may be multiple correct answers. You MUST CHOOSE ALL that apply. There will be a penalty for wrong answers.]*


	Student Response	Value	Correct Answer
A.	controlling the impact of rockfall	<input checked="" type="checkbox"/>	
B.	preventing the rockfall from occurring		
C.	reducing the mass of the rockfall		
<input type="checkbox"/> D.	controlling the area of impact of rockfall	50%	<input checked="" type="checkbox"/>
E.	increasing the strength of the slope		

Score: 0.5/1

**8.** Which phrase will make this statement TRUE?


"Increased vulnerability to landslide hazards may result from \_\_\_\_\_."

**Student Response Value Correct Answer**

- A. increasing local population density
- B. use of marginal land
- C. rapid land-use change
- D. climate change
- ☒ E. all of the above 100% 


Score: 1/1

9. Which of the following is NOT an indication that a home may be on an unstable slope?

	Student Response	Value	Correct Answer
A.	trees in the backyard that are bent and leaning		
B.	cracked and shifted building foundation		
C.	backyard slope changing from day-to-day		
D.	record of previous landslides		
<input checked="" type="checkbox"/> E.	pools of water on the ground after a heavy rainfall	100%	


Score: 1/1

10. Which statement about causes and triggers of landslides is TRUE?

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	Triggers develop instability in a slope.	0%	
B.	There is usually one cause for a landslide event.		
C.	Causes are always short-lived events.		
D.	Causes can trigger landslides in some situations.		
E.	There can be many triggers for one event.		

Score: 0/1

11. Which of the following statements is FALSE?

Student Response	Value	Correct Answer
A. A landslide may be stabilized by applying a resisting force at the toe of the slope.		
B. Stabilization of a landslide may be achieved by clearing the trees from the slope.		
<input checked="" type="checkbox"/> C. The rapid infiltration of rainfall is the mechanism by		



which most shallow landslides are generated during storms. 0%

- D. Landslides may occur without an apparent trigger because of time-dependent processes that gradually bring the slope to failure.
- E. High pore pressures may adversely affect the stability of a slope due to a decrease in effective normal stress.

Score: 0/1

**12.** Other than through rapid erosion, a heavy rainfall event may also trigger a landslide by \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	increasing the slope's cohesive strength		
<input checked="" type="checkbox"/> B.	lubrication, making the slope material more slippery	0%	
C.	increasing the angle of repose		
D.	reducing gravity		
E.	reducing the effective stresses		<input checked="" type="checkbox"/>

Score: 0/1

**13.** In the Vaiont Dam disaster, \_\_\_\_\_ was both a cause and a trigger for the slide.

	Student Response	Value	Correct Answer
A.	adverse bedding orientation		
B.	water		<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> C.	inherently weak materials in the slope	0%	
D.	overloading		
E.	vegetation		

Score: 0/1

**14.** The quick clays along the St. Lawrence in Quebec and Ontario often lead to what type of landslide?

	Student Response	Value	Correct Answer
A.	Rotational slides		
B.	Translational slides		
C.	Liquefaction spreads		<input checked="" type="checkbox"/>

- ☒ D. Flows 0%
- E. Rockfalls

Score: 0/1

**15.** By definition, landslides may have several causes but only one \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	mitigation solution		
B.	plane of weakness		
C.	mode of failure		
<input checked="" type="checkbox"/> D.	trigger	100%	<input checked="" type="checkbox"/>
E.	safety factor		

Score: 1/1


**16.** The figure below illustrates forces of an unstable rock block on a hill slope. Which letter refers to the shear stress?

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	A	0%	
B.	B		
C.	C		
D.	D		
E.	E		<input checked="" type="checkbox"/>

Score: 0/1


**17.** In the Greater Vancouver area, the region that is MOST susceptible to liquefaction-type landslides is \_\_\_\_\_. (refer to the figure below)

	Student Response	Value	Correct Answer
A.	North Vancouver		
B.	Vancouver		

- C. Surrey
- ☒ D. Richmond/Delta 100% 
- E. Burnaby/Coquitlam


Score: 1/1

**18.** Which of the following is NOT an anthropogenic-related trigger of landslides?

	Student Response	Value	Correct Answer
A.	mining		
B.	deforestation		
C.	irrigation		
D.	glacial erosion		
<input checked="" type="checkbox"/> E.	climate change	0%	


Score: 0/1

**19.** What was the likely trigger for the massive 1903 rockslide that destroyed Frank, Alberta?

	Student Response	Value	Correct Answer
A.	an earthquake		
B.	road building		
C.	global warming		
D.	deforestation		
<input checked="" type="checkbox"/> E.	heavy rainfall	100% 	

Score: 1/1

**20.** The assessment of a slope's stability state (i.e. "Factor of Safety") is calculated based on \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	the ratio of driving forces to resisting forces		
B.	the ratio of shear stress to shear strength		
C.	the sum of driving forces and resisting forces		
D.	the multiplication of resisting forces by driving forces		
<input checked="" type="checkbox"/> E.	the ratio of resisting forces to driving forces	100% 	

# STORMS

1. When there is no heat transfer, the process is called \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	isothermal		
B.	isobaric		
C.	isotropic		
D.	baroclinic		
<input checked="" type="checkbox"/> E.	adiabatic	100%	<input checked="" type="checkbox"/>

Score: 1/1

2. If positive lightning strikes to ground were to cease, then there would likely be \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	no cloud-to-ground lightning		
B.	no intercloud lightning		
C.	fewer forest fires		<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> D.	less frequent thunderstorms	0%	
E.	no lightning at all		


Score: 0/1

3. In addition to the rotating tornadic winds, the other damaging winds from thunderstorms are straight-line winds near the \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	beaver's tail		
B.	altocumulus castellanus		
C.	wall cloud		
D.	mammatus clouds		
<input checked="" type="checkbox"/> E.	gust front	100%	<input checked="" type="checkbox"/>


Score: 1/1

4. In visible-light weather satellite images, thunderstorms are recognizable by their \_\_\_\_.

	Student Response	Value	Correct Answer
A.	well-defined eye		
B.	wave-like appearance		
C.	tops casting shadows on the ground		<input checked="" type="checkbox"/>
D.	lightning causing the whole cloud to glow during the daytime		
 E.	thunder that creates sound waves that propagate to the satellite	0%	


Score: 0/1

5. Which is FALSE?

	Student Response	Value	Correct Answer
A.	The MAJOR hazard associated with hurricanes is the strong winds.	<input checked="" type="checkbox"/>	
B.	The eye is a structure usually found in the center of hurricanes.		
C.	Stratiform clouds are generally layered clouds.		
D.	It is possible to survive a tornado by getting in a basement or "safe room".		
 E.	The most favourable month for North Atlantic hurricanes is September.	0%	

Score: 0/1

6. If a saturated air parcel and a dry air parcel start at the same altitude and both are lifted 2 km, the new temperature of the saturated air parcel will be \_\_\_\_\_ relative to that of the dry parcel.

	Student Response	Value	Correct Answer
A.	2 times warmer		
 B.	Cooler	0%	
C.	Warmer	<input checked="" type="checkbox"/>	
D.	Nearly the same		
E.	2 times cooler		

Score: 0/1

7. Near Japan and China, hurricanes are called \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	hurricanes		
B.	tropical cyclones		
C.	tornadoes		
<input checked="" type="checkbox"/> D.	typhoons	100%	<input checked="" type="checkbox"/>
E.	mesocyclones		

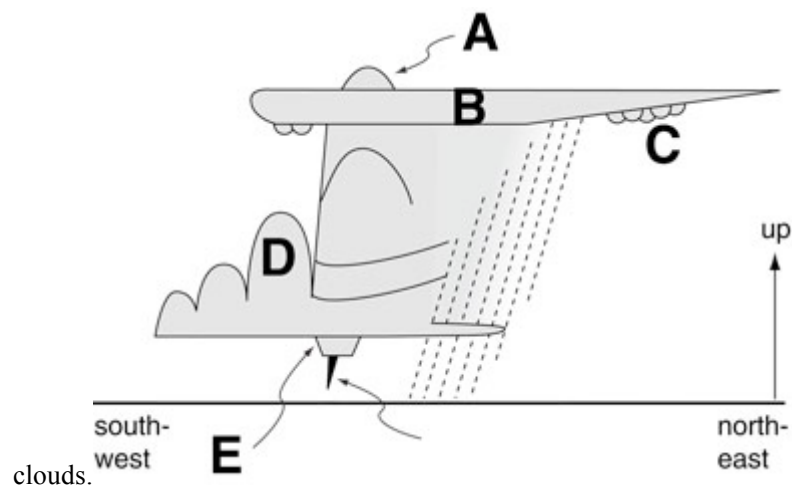
Score: 1/1

8. Which of the following is NOT a hazard of thunderstorms?

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	lightning	0%	
B.	downbursts		
C.	gustfronts		
D.	storm surge		<input checked="" type="checkbox"/>
E.	hail		

Score: 0/1

9. The clouds at location [i] in this figure is/are called \_\_\_\_\_



	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	anvil	0%	
B.	wall		
C.	flanking line		
D.	funnel		
E.	mammatus	<input checked="" type="checkbox"/>	
Score: 0/1			

**10.** Which has the strongest winds near the surface?


	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	tornado	100%	<input checked="" type="checkbox"/>
B.	gust front		
C.	thunderstorm		
D.	hurricane		
E.	derecho		
Score: 1/1			

**11.** When water condenses in an air parcel, it \_\_\_\_\_.

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	takes heat from the surrounding air	0%	
B.	increases the mixing ratio (r)		
C.	increases the static potential of an air parcel		
D.	decreases the saturation mixing ratio $r_s$		
E.	releases heat to the surrounding air	<input checked="" type="checkbox"/>	
Score: 0/1			


**12.** Thunderstorm cells have all updraft (no downdrafts, no rain) in the \_\_\_\_ stage of their life cycle.

	Student Response	Value	Correct Answer
A.	cirrus		
B.	mature		
C.	stratus		

- D. dissipating
- ☒ E. cumulus 100% 


Score: 1/1

### 13. Which statement is FALSE?

Student Response	Value	Correct Answer
A. Temperature ultimately affects the buoyancy of air parcels; buoyancy differences create vertical winds.		
B. Temperature ultimately affects the pressure exerted on air parcels; pressure gradients create horizontal winds.		
<input checked="" type="checkbox"/> C. Warmer air is less dense resulting in a net downward buoyancy force.	100%	
D. The pressure gradient force is caused by a change in pressure across a distance.		
E. A buoyancy force results from the difference in density between an air parcel and the surrounding air.		

Score: 1/1

### 14. Suppose the Sun warms the Earth's surface from sunrise to sunset BUT infrared cooling of the Earth's surface were to stop happening. Then, over each 24-hour period, thunderstorms \_\_\_\_\_.


Student Response	Value	Correct Answer
A. would occur any time of day		
B. would most likely occur around sunrise		
<input checked="" type="checkbox"/> C. would most likely occur around sunset	100%	
D. would be unlikely to occur at night		
E. would not occur at all		

Score: 1/1

### 15. Which statement is FALSE?


Student Response	Value	Correct Answer
A. Lightning often ranks in the top two of weather-related killers in North America.		
B. Lightning can shoot out of the side of a storm and hit the ground ten miles away from the storm.		



- C. Most lightning-caused forest fires are triggered by positive cloud-to-ground lightning.
- D. If you feel the hair standing up on your head or arms, there is a good chance that you are about to be struck by lightning in the next second or so.
- ☒ E. Some lightning occur with no thunder but where there is thunder, there must be lightning.
- 100% 


Score: 1/1

**16.** The location in North America with the most tornadoes is \_\_\_\_\_

	Student Response	Value	Correct Answer
A.	Florida		
<input checked="" type="checkbox"/> B.	Oklahoma	100% 	
C.	Alberta		
D.	Ontario		
E.	Colorado		


Score: 1/1

**17.** The primary force that drives horizontal winds is the \_\_\_\_\_ force.

	Student Response	Value	Correct Answer
A.	Coriolis		
<input checked="" type="checkbox"/> B.	pressure gradient	100% 	
C.	buoyancy		
D.	friction or drag		
E.	stress		

Score: 1/1

**18.** Which statement is FALSE?

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	Hurricanes can cross the equator.	100% 	
B.	Hurricanes have high pressure above the eye near the storm top.		
C.	Hurricanes have warm cores.		
D.	Hurricanes rarely form in the south Atlantic.		

E.Hurricane winds near the surface rotate counterclockwise in the Northern Hemisphere.

Score: 1/1

**19.**A Lyman-alpha hygrometer measures \_\_\_\_\_.

Student Response	Value	Correct Answer
A.dew point temperature by cooling a small mirror and noting the temperature a laser beam shining on its surface gets diffracted		
<input checked="" type="checkbox"/> B.humidity by beaming radiation from a transmitter to a detector and measuring attenuation of the beam	100%	<input checked="" type="checkbox"/>
C.humidity by measuring changing capacitance of a thin piece of plastic		
D.humidity by cooling a small mirror and noting the temperature a laser beam shining on its surface gets diffracted		
E.humidity by measuring changing resistance of a carbon-coated glass slide		

Score: 1/1

**20.**Which statement is FALSE?

Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.Weather radar "listens" for the echo of energy bouncing off moisture in air.	0%	
B.Thunderstorms can easily be recognized by their anvils.		
C.The altitude of stratiform cloud base is called the lifting condensation level.		<input checked="" type="checkbox"/>
D.The dry adiabatic lapse rate is 9.8 °C / km.		
E. In the Northern Hemisphere, the Coriolis effect causes wind to curve towards the right of the direction of its motion.		

**1.**Which thunderstorm hazard is NOT likely to kill you?

Student Response	Value	Correct Answer
A. tornado		
B. lightning		
<input checked="" type="checkbox"/> C. thunder	100%	<input checked="" type="checkbox"/>
D. downburst/gust-front		
E. downpours/flooding		

Score: 1/1

2. Which of the following primarily drive vertical motions in thunderstorms?

	Student Response	Value	Correct Answer
A.	continuity		
<input checked="" type="checkbox"/> B.	buoyancy	100%	<input checked="" type="checkbox"/>
C.	inertia		
D.	pressure-gradient force		
E.	lifting condensation level		

3. In North America, hail is most frequent in \_\_\_\_\_.

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	Oklahoma	100%	<input checked="" type="checkbox"/>
B.	Florida		
C.	Ontario		
D.	Alberta		
E.	British Columbia		

Score: 1/1

4. Which of the following will make this statement TRUE?



Individual tornadoes \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	rotate only clockwise in the Northern Hemisphere		
<input checked="" type="checkbox"/> B.	rotate only counterclockwise in the Northern Hemisphere	0%	<input checked="" type="checkbox"/>
C.	can be invisible		<input checked="" type="checkbox"/>
D.	can last for days during a tornado outbreak		
E.	often come out of mammatus clouds		

Score: 0/1



5. Which of the following statements is FALSE?

Student Response	Value	Correct Answer
------------------	-------	----------------

- A. Tornadoes can be visible due to cloud droplets and debris.
- B. Tornadoes are violently rotating columns of air in contact with the ground.
-  C. All violent tornadoes are attached to thunderstorms. 0%
- D. Supercell thunderstorms are the ones most likely to spawn the most violent tornadoes.
- E. The most violent tornadoes have the largest diameters. 



Score: 0/1

6. If you are in a wood frame building when a tornado approaches, you should \_\_\_\_\_.

- |  | Student Response  | Value   | Correct Answer |
|--|---|---|----------------|
| A.   | run outside   |   |                |
| B.   | wait for the sirens before packing up                                 |   |                |
|  C. | go to the top floor where the pressure gradient forces will be weaker | 0%  |                |
| D.   | go to the basement  |  |                |
| E.   | stay near a window where you can keep an eye on the tornado           |   |                |

Score: 0/1



7. Which of the following best describes the eye wall of a hurricane?

- |  | Student Response   | Value   | Correct Answer |
|--|--|---|----------------|
|  A. | The eye wall surrounds a smaller-diameter thunderstorm.        | 0%  |                |
| B.   | It consists of spiral bands of thunderstorms.                  |   |                |
| C.   | It surrounds the rain-free eye of the storm.                   |  |                |
| D.   | It is conical shaped with smaller diameter near the storm top. |   |                |
| E.   | The eye wall prevents the eye from moving very much.           |   |                |

Score: 0/1



8. The primary source of energy for hurricanes is the warm ocean, which in turn gets its energy

from \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	meteor impacts		
 B.	gravitational pull	0%	
C.	radioactive decay on earth		
D.	the Sun		
E.	the tides		



Score: 0/1

**9.** Given the shape and movement of typical thunderstorms in North America, if you saw a real thunderstorm that looked like the diagram below, then you would infer that the storm is \_\_\_\_\_.

	Student Response	Value	Correct Answer
 A.	nearly stationary, and is easy to view	0%	
B.	moving to the NE, and is easy to view		
C.	moving toward you, so you should seek shelter immediately		
D.	moving to the SW, and is easy to view		
E.	moving away from you, so it will soon be hard to see in the distance		



Score: 0/1

**10.** Thunderstorms are most likely \_\_\_\_\_.



	Student Response	Value	Correct Answer
A.	at noon		
 B.	in Vancouver	0%	
C.	in tornado alley		
D.	near sunset		
E.	in winter		

Score: 0/1

**11.** Which is TRUE?



	Student Response	Value	Correct Answer
 A.	typhoons spin in the opposite direction than hurricanes	0%	
B.	typhoons are stronger, on average, than hurricanes		
C.	tropical cyclones are strongest over the equator where the water is warmest		
D.	the strongest winds are found in the eye of the storm		
E.	most hurricane deaths are caused by high winds		

**12.**The ultimate source of energy for storms is \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	the hot core of the Earth		
B.	the Sun		
 C.	Coriolis force	0%	
D.	gravity		
E.	radioactive decay in the atmosphere		



Score: 0/1

**13.**Doppler radar \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	is too complicated to understand		
 B.	is used by police but not by meteorologists	0%	
C.	measures the speed that sound-waves travel		
D.	allows better detection of tornadoes		
E.	can measure the uplift of the Earth		

Score: 0/1



**14.**Positively charged cloud-to-ground (CG) lightning is the most dangerous because \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	positive charges are more dangerous than negative charges		
 B.	it is a higher voltage	100%	
C.	it dissipates negative charges		
D.	they are usually associated with tornadoes		

E. it flows from the ground to the cloud



Score: 1/1

**15.**When downbursts hit the ground, the air \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	bounces back as an updraft		
B.	stagnates as a large pool of cold air		
C.	starts swirling as a tornado		
D.	spreads out as a gust front		
 E.	warms and begins to rise	0%	

Score: 0/1

**16.**Cold air can hold less water vapour than warm air. This is important for thunderstorms because \_\_\_\_\_.

	Student Response	Value	Correct Answer
A.	thunderstorms usually form during winter when the air is cold		
B.	thunderstorms are common in the Arctic and Antarctic		
C.	water vapour adds weight to the air, making it more difficult for thunderstorms to accelerate the air		
 D.	humid air has less friction than dry air, making it easier for thunderstorms to accelerate the air	0%	
E.	air cools as it rises, causing water vapour to condense out and release latent heat		

Score: 0/1

**17.**Which is NOT a hazard associated with isolated thunderstorms?

	Student Response	Value	Correct Answer
A.	lightning		
B.	tornado		
C.	hail		

- D. downburst and gust front
- ☒ E. storm surge 100% ☒

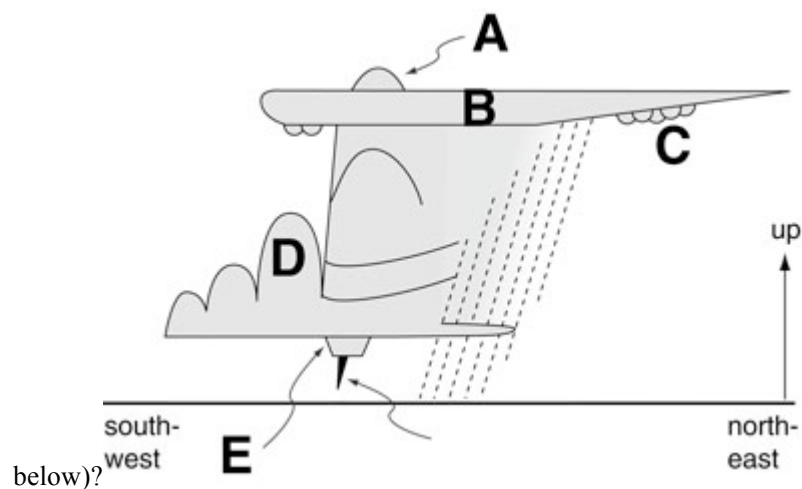
Score: 1/1

18. Hurricanes can exist for weeks because \_\_\_\_\_.

- |  | Student Response                           | Value                               | Correct Answer |
|--|--|-------------------------------------|----------------|
| A.                                     | of low friction over the ocean             |                                     |                |
| B.                                     | of strong condensation at the sea surface  |                                     |                |
| C.                                     | the inflow brings in lots of air molecules |                                     |                |
| <input checked="" type="checkbox"/> D. | Coriolis force is small near the equator   | 0%                                  |                |
| E.                                     | of heat stored in the ocean                | <input checked="" type="checkbox"/> |                |

Score: 0/1

19. Which part of a supercell thunderstorm is the anvil (refer to figure



- |  | Student Response | Value | Correct Answer                      |
|--|------------------|-------|-------------------------------------|
| A.                                     | A                |       |                                     |
| <input checked="" type="checkbox"/> B. | B                | 100%  | <input checked="" type="checkbox"/> |
| C.                                     | C                |       |                                     |
| D.                                     | D                |       |                                     |
| E.                                     | E                |       |                                     |

Score: 1/1



20. Attached to the underside of a thunderstorm anvil are sometimes \_\_\_\_\_.

	Student Response	Value	Correct Answer
<input checked="" type="checkbox"/> A.	mammatus clouds	100%	<input checked="" type="checkbox"/>
B.	haboob clouds		
C.	overshooting tops		
D.	flanking lines		
E.	gust fronts		

## Waves and Tsunami

1. Which does NOT contribute to the generation of a fully developed sea?

	Student Response	Value	Correct Answer	Feedback
A.	fetch			
<input checked="" type="checkbox"/> B.	constructive interference	100%	<input checked="" type="checkbox"/>	
C.	wind speed			
D.	wind duration			

Score: 1/1

2. Which of the following phrases will make this a TRUE statement?

"When a tsunami alert is issued after an earthquake occurs off the Alaskan coastline, \_\_\_\_\_."

Student Response	Value	Correct Answer	Feedback
A. residents living near protected inlets and harbors on the west coast of Vancouver Island do not have to evacuate			
B. residents on the west coast of Vancouver Island should wait for the typical sea level drawdown before evacuating			
C. boats must be securely anchored in harbors to avoid destruction			
D. coastlines are safe after the fourth wave has arrived			
<input checked="" type="checkbox"/> E. residents may retreat to higher floors of buildings if evacuation from the coastline is impossible	100%	<input checked="" type="checkbox"/>	

3. Where is the SAFEST PLACE for a ship to be during a tsunami?

Student Response	Value	Correct Answer	Feedback
A.out in the open ocean	<input checked="" type="checkbox"/>		
B.anchored in a harbor with a narrow opening			
<input checked="" type="checkbox"/> C.anchored in the middle of a Bay, where depth is 50 meters	0%		
D.anchored in a harbor on the opposite side of an island from the direction of tsunami approach			
E.tied securely to a dock			

4. Following a tsunami warning after an earthquake off the coast of Alaska, one of the worst places to be is \_\_\_\_\_.

Student Response	Value	Correct Answer	Feedback
A.on the 5th floor (or higher) of a reinforced concrete building on a beach in Japan			
B.on a sailboat off the coast of Halifax, NS			
C.lying on a beach in Hilo Bay, Hawaii	<input checked="" type="checkbox"/>		
D.on a submarine on the surface of the Pacific Ocean, where the water is at least 3500 meters deep			
<input checked="" type="checkbox"/> E.in a park located beyond the tsunami inundation zone	0%		

Score: 0/1

5. Which statement is FALSE?

Student Response	Value	Correct Answer	Feedback
A.Tsunami with longer wavelengths travel faster.	<input checked="" type="checkbox"/>		
B.The speed of a tsunami decreases as it approaches shore.			
<input checked="" type="checkbox"/> C.In the open ocean, tsunami crests are rounded and stable with typical wave heights of 0.5 – 1m.			
D.Restricted bays and harbours intensify the effects of a tsunami.			
E.The arrival of a tsunami can be predicted.			

Score: 0/1

6. Surging breakers occur \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	on mudflats			
<input checked="" type="checkbox"/> B.	on beaches with very steep slopes	100%		✓
C.	on flat, sandy beaches			
D.	on sandy beaches with average slopes			
E.	where the local wind is offshore			

Score: 1/1

7. The restoring force for rogue waves is \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	surface tension			
<input checked="" type="checkbox"/> B.	gravity	100%		✓
C.	tidal friction			
D.	atmospheric pressure at sea level			
E.	constructive interference			

Score: 1/1

8. Based on the diagram above, the wave steepness is \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	A/E			
<input checked="" type="checkbox"/> B.	D/A	100%		✓
C.	C/E			
D.	D/B			
E.	E/A			

Score: 1/1

9. Longshore drift occurs when \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	wave fronts approach the shoreline at an angle			✓
<input checked="" type="checkbox"/> B.	wave fronts hit the shore parallel to the shoreline	0%		

- C. waves hit rocky cliffs and erode material
- D. high energy waves carry sand offshore and deposit it in sandbars
- E. groins trap sand that has been moved by waves

Score: 0/1

**10.** The distance measured from trough to trough of a wave is the \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	orbital			
B.	wave height			
<input checked="" type="checkbox"/> C.	wavelength	100%		
D.	wave period			
E.	amplitude			

Score: 1/1


**11.** Which of the following processes has been the LARGEST contributor to global sea level rise in the past few decades?

	Student Response	Value	Correct Answer	Feedback
A.	melting ice from Greenland			
<input checked="" type="checkbox"/> B.	melting ice from glaciers elsewhere (other than Greenland and Antarctica)	0%		
C.	expansion of ocean water as it warms up			
D.	melting sea ice (floating icebergs)			
E.	melting ice from Antarctica			

Score: 0/1

**12.** Which of the following is TRUE?

	Student Response	Value	Correct Answer	Feedback
A.	With the advances of tsunami preparedness, people living on the Pacific rim are safe from tsunami, regardless of its origin 10,000 km or 8 km offshore.			
<input checked="" type="checkbox"/> B.	Ships in the middle of the Pacific rely on the International Tsunami Warning System to warn them of passing tsunami.	0%		



C. People living close to shore can prepare for a tsunami by evacuating to higher ground immediately after an earthquake is felt. 

D. According to historical accounts, only people living close to shore in the Pacific rim are in danger of a tsunami.

E. People living along sheltered bays and inlets are less likely to be affected by tsunami.



Score: 0/1

**13.** The next time a big tsunami strikes the coast of Vancouver Island, what is it likely to leave behind that will record the event for future geologists?

	Student Response	Value	Correct Answer	Feedback
 A.	the remains of deep sea creatures carried far inland	0%		
B.	pieces of shocked quartz and breccia			
C.	a thin layer of clay enriched in iridium			
D.	a thick layer of salt			
E.	a thin layer of sand			


Score: 0/1


**14.** If you were the captain of a submarine, to what minimum depth would you submerge your vessel in order to avoid the effects of waves with wavelengths of 200 m?

	Student Response	Value	Correct Answer	Feedback
A.	5 m			
B.	10 m			
C.	30 m			
D.	50 m			
 E.	100 m	100%		

Score: 1/1



**15.** The tremendous killing power of tsunamis are due mostly to \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	the earthquake that generated the tsunami			
 B.	a large mass of water causing destruction as it rushes			

- inland and retreats back to the ocean 100% 
- C. waves with towering waveheights that crash on buildings
- D. the storm surge approaching shore with destructive force
- E. the rapid approach of several waves, usually within seconds of each other



Score: 1/1

**16.**Refraction causes waves to \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	travel over a barrier			
B.	bounce back towards its point of origin			
 C.	bend as much as 90° from the original direction	100%		
D.	become deep water waves			
E.	converge in embayments and semi-enclosed water bodies			

Score: 1/1


**17.**Tsunami may be generated by the following EXCEPT \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	icebergs falling from glaciers			
 B.	gustnado	100%		
C.	vertical submarine fault motion			
D.	asteroid impacts into the deep ocean			
E.	volcanic eruptions on the seafloor			

Score: 1/1

**18.**Imagine that you live in a house at the beach where longshore drift is from EAST to WEST. Your neighbour to the west builds two groins. The sand on the beach in front of YOUR house will \_\_\_\_\_.


Student Response	Value	Correct Answer	Feedback
------------------	-------	----------------	----------

- A. erode completely unless another source of sand contributes to your beach
- B. build up gradually as your neighbor's new groins catch sand 
- ☒ C. be carried to the WEST and deposited in front of your neighbor's house 0%
- D. be carried to the EAST and deposited in front of a different neighbor's house
- E. be carried around the groins and continue its journey to the WEST

Score: 0/1


## 19.

If a wave, with wavelength  $L=40$  meters and period  $T=8$  seconds is traveling in water depth of 1 meter, what is the velocity of the wave?

	Student Response	Value	Correct Answer	Feedback
A.	3.1 meters/sec			
<input checked="" type="checkbox"/> B.	5 meters/sec	0%		
C.	12.5 meters/sec			
D.	32 meters/sec			
E.	not enough data to determine velocity			

Score: 0/1

**20.** Assume that the diagram above is drawn to scale. Under what scenario would these waves be breaking?

	Student Response	Value	Correct Answer	Feedback
A.	When $B/D$ is greater than $1/7$ .			
B.	When $D/B$ is greater than $1/2$ .			
<input checked="" type="checkbox"/> C.	When $D/A$ is greater than $1/7$ .	100%		
D.	When $A/D$ is greater than $1/2$ .			
E.	When $E/C$ is greater than $1/2$ .			

**1.** Waves are the result of energy traveling across the ocean, but what ultimately happens to that energy?

Student Response	Value	Correct Answer	Feedback
A. The energy reflects off coasts, creating a new wave traveling in the opposite direction.			

- ☐ B. The energy is absorbed by the coast. 0%
- C. Friction causes the waves to slowly lose energy and die.
- D. Waves grow until they break in the open ocean.
- E. All of above. ☒

Score: 0/1

2. A wave with a frequency of 100 Hz is traveling across the ocean. The probable generating force for this wave was \_\_\_\_\_ and the restoring force will be \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	wind, gravity			
<input checked="" type="checkbox"/> B.	wind, surface tension	100%	<input checked="" type="checkbox"/>	
C.	an earthquake, gravity			
D.	gravity, friction			
E.	wind, friction			

Score: 1/1

3. Three waves are traveling through 5m deep water; one has a wavelength of 100m, another has a wavelength of 120m, and the third one has a wavelength of 140m. Which of the following is TRUE?

	Student Response	Value	Correct Answer	Feedback
A.	The 100m wave is moving faster than the others.			
B.	The 120m wave is moving faster than the others.			
C.	The 140m wave is moving faster than the others.			
<input checked="" type="checkbox"/> D.	All three of these waves travel with the same speed.	100%	<input checked="" type="checkbox"/>	
E.	There is not enough information to answer this question.			

Score: 1/1

4. A fully developed sea state occurs when \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	winds have been blowing steadily for at least 4 hours			



- B.the energy from the winds disturbs the ocean surface and forces it into motion
- C.the sea state has reached 12 on the Beaufort scale
- ☒ D.energy added to the ocean by wind equals energy lost by waves breaking 100% ☒
- E.never – the fully developed state is a theoretical "worst case scenario" that never occurs in the real ocean

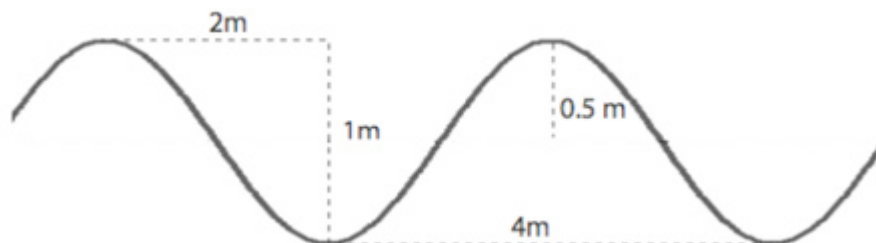
Score: 1/1

5.Waves \_\_\_\_\_ on headlands releasing \_\_\_\_\_ wave energy than in embayments.

	Student Response	Value	Correct Answer	Feedback
A.	diverge, more			
<input checked="" type="checkbox"/> B.	converge, more	100%	<input checked="" type="checkbox"/>	
C.	diverge, less			
D.	converge, less			
E.	break, less			

Score: 1/1

6.What is the amplitude of the wave train in the figure

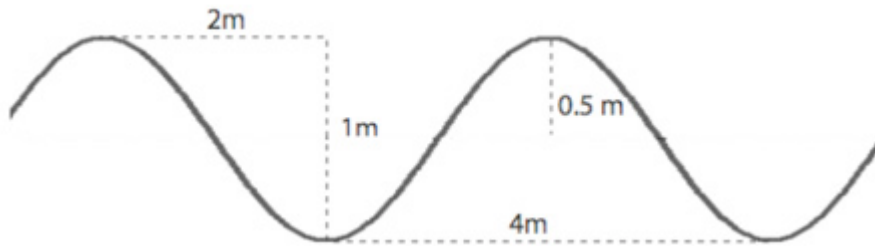


below?

	Student Response	Value	Correct Answer	Feedback
<input checked="" type="checkbox"/> A.	0.5 m	100%	<input checked="" type="checkbox"/>	
B.	1 m			
C.	2 m			
D.	4 m			
E.	8 m			

Score: 1/1

7.What is the steepness of the wave train in the figure



below?

	Student Response	Value	Correct Answer	Feedback
A.	1/2 s	<input checked="" type="checkbox"/>		
<input checked="" type="checkbox"/> B.	1/4 m	100%	<input checked="" type="checkbox"/>	
C.	0.5 Hz	<input checked="" type="checkbox"/>		
D.	2 m	<input checked="" type="checkbox"/>		
E.	4 s	<input checked="" type="checkbox"/>		

General Feedback: This question has been discarded because there is no correct answer. The correct answer is 1/4 (no units).

Score: 1/1

8. The Tsunami Warning Centre responsible for providing tsunami warning messages to people living along the coast of British Columbia is the \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	Pacific Tsunami Warning Centre			
B.	International Tsunami Warning Centre			
<input checked="" type="checkbox"/> C.	West Coast and Alaska Tsunami Warning Centre	100%	<input checked="" type="checkbox"/>	
D.	Canadian Tsunami Warning Centre			
E.	British Columbia Provincial Emergency Program			

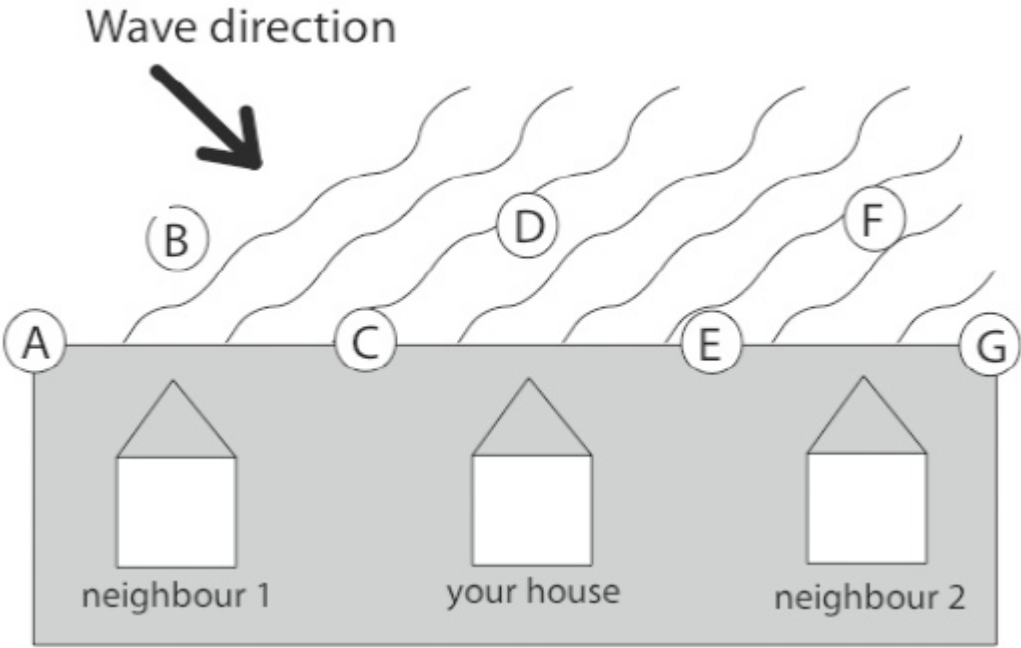
Score: 1/1

9. Which of the following artificial barriers do NOT modify sediment transport?

	Student Response	Value	Correct Answer	Feedback
A.	Seawall			
B.	Jetty			
C.	Groin			
D.	Tethered-float breakwater	<input checked="" type="checkbox"/>		
<input checked="" type="checkbox"/> E.	headland	0%		

Score: 0/1

10. You have a house on a beach where waves typically arrive from the northwest, as illustrated in the figure below. If you intend to protect the beach in front of your house ONLY, where would you build a groin?




Student Response		Value	Correct Answer	Feedback
A.	at position A			
B.	at position C			
<input checked="" type="checkbox"/> C.	at position E	100%		✓
D.	at position G			
E.	somewhere else			

Score: 1/1

11. Same beach and neighbors as shown in the figure above.  
time your neighbor tells you that instead of an ugly groin on the beach, he would prefer that you build a breakwater. Where would you build this breakwater to protect ONLY your beach?


Student Response		Value	Correct Answer	Feedback
------------------	--	-------	----------------	----------

- A. at position A
- B. at position B
- C. at position C
- ☒ D. at position D 100% 
- E. at position E

Score: 1/1


**12.** Same beach and neighbors as shown in the figure below.

Now neighbor #1 acted first and built a groin at position C. What should you do in response to protect the beach in front of your house?

	Student Response	Value	Correct Answer	Feedback
A.	nothing, because the beach will build up there anyway			
<input checked="" type="checkbox"/> B.	build a groin at position E	100%		
C.	build a breakwater between B and D positions			
D.	build a breakwater between D and F positions			
E.	build a seawall between C and E positions			

Score: 1/1

**13.** What happens when two different surface waves run into each other?

	Student Response	Value	Correct Answer	Feedback
A.	This cannot happen because ocean waves all move in the same direction.			
B.	The bigger wave absorbs the smaller wave's energy, and gets even bigger.			
C.	The smaller wave removes some of the bigger wave's energy.			
<input checked="" type="checkbox"/> D.	The effect of the two waves is added together, making a more complex wave.	100%		
E.	The waves crash together and break.			

Score: 1/1

**14.** When a tsunami hits a bay or a harbor, its effects can be amplified by \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	destructive interference with tides			
B.	the higher concentration of people and buildings along the Bay			
C.	concentration of wave energy along headlands			
D.	dispersion of wave energy in an embayment			
<input checked="" type="checkbox"/> E.	resonance, if the tsunami has the right frequency	100%		<input checked="" type="checkbox"/>

Score: 1/1

**15.** Which of the following are the most hazardous for ships at sea?

	Student Response	Value	Correct Answer	Feedback
<input type="checkbox"/> A.	tsunami	0%		
B.	rogue waves	<input checked="" type="checkbox"/>		
C.	seiches			
D.	storm surges			
E.	none of above are a significant risk to ships at sea			

Score: 0/1

**16.** Seiches are generated by \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	tsunami			
B.	earthquakes			
C.	landslides			
D.	strong winds			
<input checked="" type="checkbox"/> E.	All of the above	100%	<input checked="" type="checkbox"/>	

Score: 1/1

**17.** In an open ocean, tsunami have a typical wavelength of \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	3,000 km			
<input checked="" type="checkbox"/> B.	300 km	100%	<input checked="" type="checkbox"/>	

- C. 30 km
- D. 3 km
- E. 300 m

Score: 1/1

**18.**What aspect of a tsunami is the most predictable?

	Student Response	Value	Correct Answer	Feedback
A.	its speed	<input checked="" type="checkbox"/>		
B.	its wave height			
C.	its period			
D.	its wavelength			
<input checked="" type="checkbox"/> E.	its steepness	0%		

Score: 0/1

**19.**If you're at the beach and you notice the ocean water receding to an unusually low level, you should \_\_\_\_\_.

	Student Response	Value	Correct Answer	Feedback
A.	climb a tree at least 5 m high			
B.	follow the receding water and bag all the stranded fish			
C.	jump on a boat and head offshore fast			
<input checked="" type="checkbox"/> D.	run for higher ground and take your friends with you	100%		<input checked="" type="checkbox"/>
E.	wait for any hazard warnings			

Score: 1/1

**20.**Why are tsunami so common in the Pacific?

	Student Response	Value	Correct Answer	Feedback
A.	the Pacific is the largest ocean, so there is more chance of a tsunami occurring			
<input checked="" type="checkbox"/> B.	there is a large amount of tectonic and earthquake activity around the Pacific	100%		<input checked="" type="checkbox"/>
C.	the Pacific is the deepest ocean, allowing a tsunami to become larger			

D. Pacific coastlines are the most heavily populated, so Pacific tsunamis are more likely to be observed

E. the Pacific has the only Tsunami Warning Centre in the world, thus more tsunamis are observed and monitored