

Earth Science Regents Review #3

Energy, Water, Climate

Topics Reviewed:

Electromagnetic Energy

Heating of Earth

Water Cycle

Groundwater

Climate Factors

PLUS 25 Practice Regents

Questions with Answers

© **Kaitlin Coder**

<https://www.teacherspayteachers.com/Store/Nys-Earth-Science-And-Living-Environment-Regents>

REGENTS REVIEW #3
ATMOSPHERIC ENERGY, WATER & CLIMATE

16) ENERGY

a) Electromagnetic Spectrum (**ESRT page 14: Electromagnetic Spectrum**)

- i) **Electromagnetic energy** (energy that travels in waves) are classified based on their wavelength.

b) Heating of Earth

- i) **Insolation** (sunlight) heats Earth's surface and atmosphere unequally due to variations in intensity caused by differences in:

(1) **Angle of insolation** which vary with time of day, latitude, and season.

(2) **Atmospheric transparency:** clearness of atmosphere

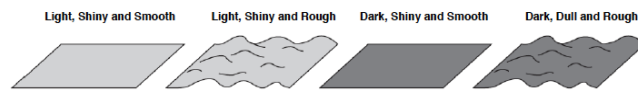
(i) **Decrease:** by clouds, dust from pollution, volcanic eruptions, forest fires

(ii) **Increase:** after precipitation occurs

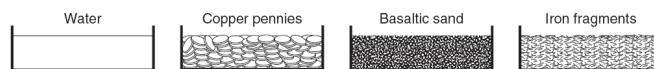
(3) Characteristics of the materials absorbing the energy such as:

(a) **Color:** dark colors absorb energy better than light colors

(b) **Texture:** rough textures absorb energy better than smooth textures



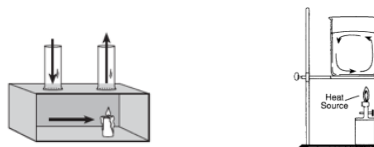
(c) **Specific heat:** The higher the specific heat, the longer it takes for a material to heat up and cool down. (**ESRT page 1 – Specific Heat of Common Materials**)



- ii) The transfer of heat energy within the atmosphere, the hydrosphere, and Earth's surface occurs as the result of **radiation, convection, and conduction**.

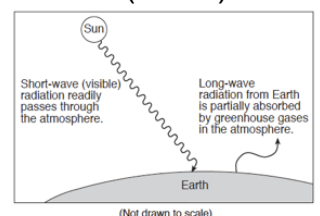
(1) **Radiation:** Energy that travels in the form of waves (any medium)

(2) **Convection:** Heat transferred due to differences in density. Warm substances rise (less dense) and cool substances sink (more dense). (liquids and gases)



(3) **Conduction:** Heat transferred when molecules collide with other molecules (solids)

- iii) **Greenhouse gases**, such as **carbon dioxide, water vapor, and methane**, allow **visible light** to pass through the atmosphere, but trap **infrared heat** that is trying to escape.



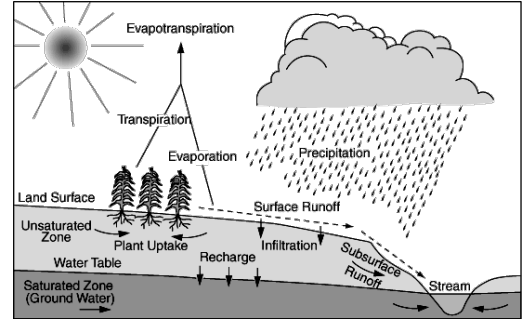
- iv) Earth's atmosphere blocks harmful radiation.

(1) Example: **ozone layer** blocks **ultraviolet radiation** which can cause skin cancer

17) **WATER**

a) **Water Cycle:** Constant recirculating water at and near Earth's surface

- i) **Evaporation:** liquid water becomes water vapor (gas) and enters atmosphere
- ii) **Transpiration:** water vapor leaves plants and enters atmosphere
- iii) **Condensation:** water vapor becomes liquid water, forming clouds
- iv) **Precipitation:** liquid water that falls from clouds
- v) The amount of energy needed for water phase changes to occur can be found on **ESRT page 1 – Properties of Water.**



b) **Groundwater:** When precipitation reaches land it will **runoff** or **infiltrate** the ground to become stored as groundwater.

- i) The amount of runoff or infiltration is mainly influenced by soil **permeability, saturation, and land slope.**
 - (1) **Permeability** (rate at which water enters the ground): the larger the soil particles, the more permeable the soil, and the faster water will infiltrate the soil.
 - (2) Soil that is **unsaturated** (not full) allows more water in.
 - (3) Land with a **gentle slope** (flat land) allows for more infiltration.
- ii) The **water table** will move up and down depending upon the amount of water entering vs. exiting the ground.
- iii) The amount of water in the ground is affected by:
 - (1) **Porosity:** amount of pore space between particles
 - (2) **Water retention:** smaller particles hold more water
 - (3) **Capillarity:** upward movement of water between small particles
- iv) Summary of sediment size on groundwater:

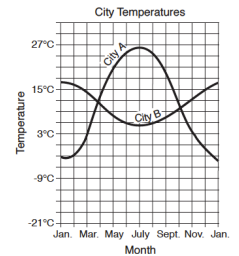
	Beads of 0.15-cm diameter	Beads of 0.70-cm diameter
Permeability	Lowest	Highest
Porosity	Equal	Equal
Retention	Highest	Lowest
Capillarity	Highest	Lowest

18) CLIMATE FACTORS

a) **Climate:** long term temperature and humidity of a large area

b) **Latitude:** largest influence on climate

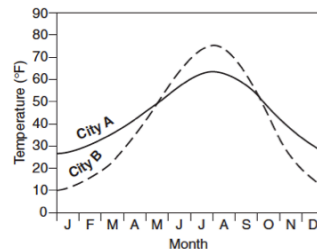
- i) Locations close to equator are warm & locations near poles are cold.
- ii) Locations in the Southern Hemisphere have the opposite seasons than the Northern Hemisphere.



c) **Elevation:** as you increase elevation, temperature decreases.

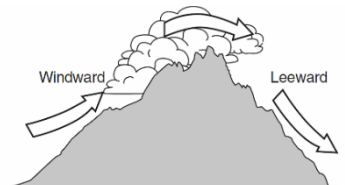
d) **Large Bodies of Water:** water modifies climate due to its high specific heat

- i) **Coastal locations** have a small temperature range (warmer winter; cooler summer).
- ii) **Inland locations** have a larger temperature range (colder winter; warmer summer).



e) **Mountain Ranges:** block winds causing differences in climate on sides of mountain

- i) **Windward** side (wind is hitting) is cool and humid.
 - (1) Air rises, expands, and cools causing condensation (clouds) and precipitation.
- ii) **Leeward** side (wind is not hitting) is warm and dry.
 - (1) Air sinks, compresses, and warms. No condensation and precipitation occurs.



f) **Ocean Currents:** warm surface currents warm coastal areas; cool surface currents cool coastal area (**ESRT page 4 – Surface Ocean Currents**)

g) **Prevailing winds:** **ESRT p.14 – Prevailing Wind and Moisture Belts in the Troposphere**

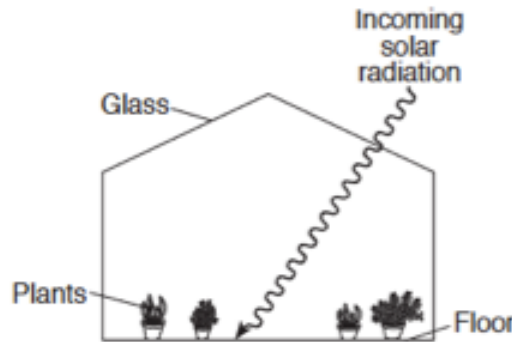
- i) Latitudes 0°, 60°N, & 60°S are moist due to converging, rising air.
- ii) Latitudes 30°N, 30°S, 90°N, 90°S are dry due to sinking, diverging air

REGENTS REVIEW #3
ATMOSPHERIC ENERGY, WATER & CLIMATE

PRACTICE REGENTS QUESTIONS

1. Cosmic microwave background radiation is classified as a form of electromagnetic energy because it
 - (1) travels in waves through space
 - (2) moves faster than the speed of light
 - (3) is visible to humans
 - (4) moves due to particle collisions
2. An increase in the transparency of Earth's atmosphere is often caused by
 - (1) a decrease in cloud cover
 - (2) a decrease in solar radiation
 - (3) an increase in airborne dust particles
 - (4) an increase in the duration of insolation
3. Which transfer of energy occurs mainly through the process of convection?
 - (1) electromagnetic energy transferred from the Sun to the Moon
 - (2) solar energy transferred through space to Earth's surface
 - (3) heated air in the lower atmosphere transferred upward by density differences
 - (4) heat from radioactive decay transferred by molecular collisions to surrounding mantle rock

Base your answers to questions 4 and 5 on the diagram below, which shows incoming solar radiation passing through the glass of a greenhouse and then striking the floor.



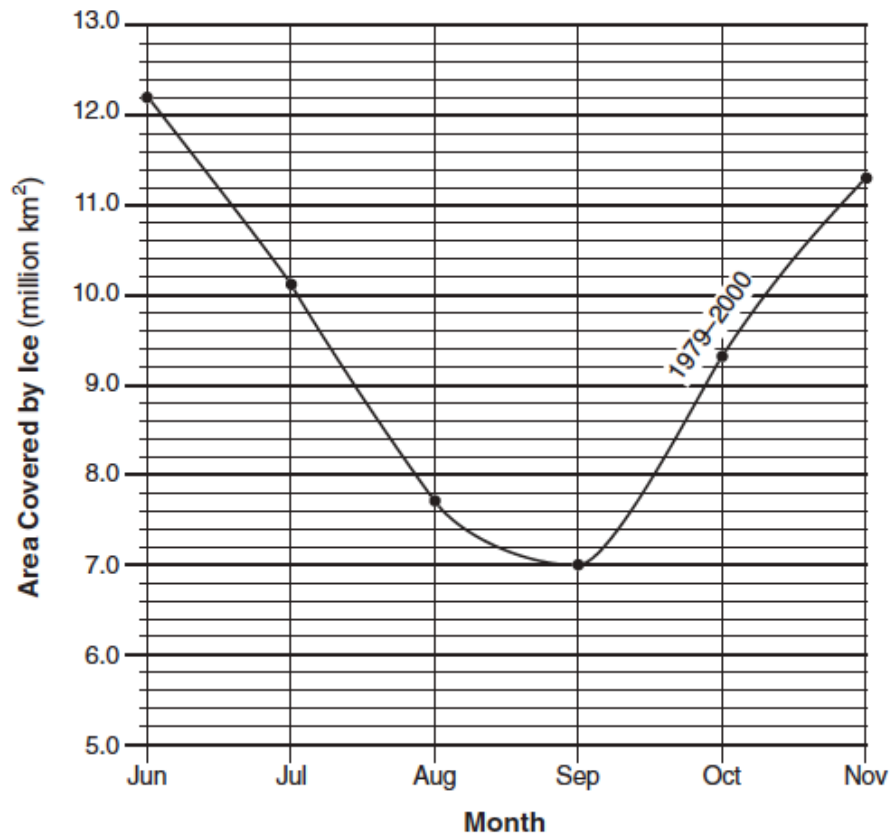
4. Some of the incoming solar radiation is absorbed by the floor. Identify the type of electromagnetic energy reradiated by the floor.
5. Describe one way the glass in the greenhouse acts like the greenhouse gases in Earth's atmosphere.

Base your answers to questions 6 through 8 on the data table below and on your knowledge of Earth science. The table shows the area, in million square kilometers, of the Arctic Ocean covered by ice from June through November. The average area covered by ice from 1979 to 2000 from June to November is compared to the area covered by ice in 2005 for the same time period.

Data Table

Month	Average Area Covered by Ice 1979–2000 (million km ²)	Area Covered by Ice 2005 (million km ²)
June	12.2	11.3
July	10.1	8.9
August	7.7	6.3
September	7.0	5.6
October	9.3	8.5
November	11.3	10.5

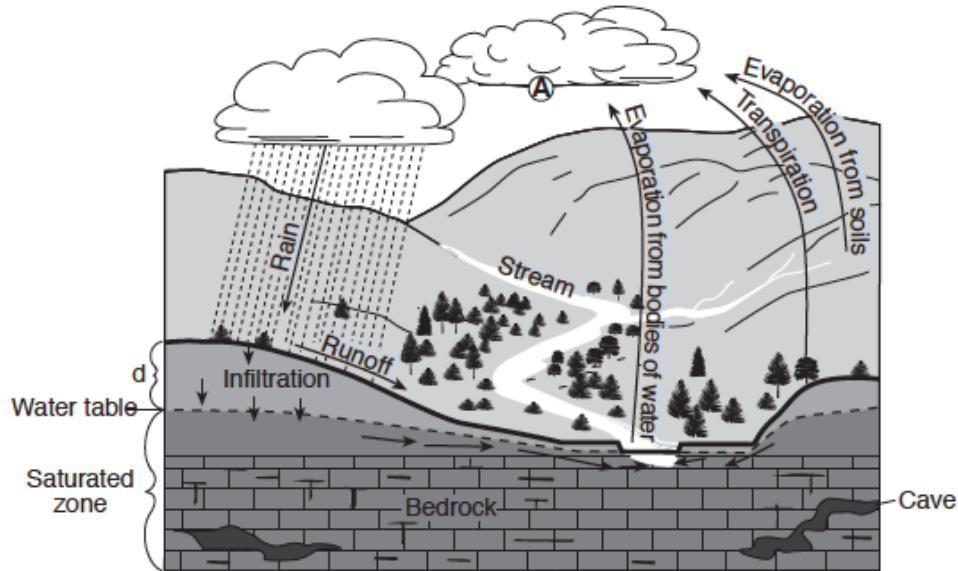
6. Use the information in the data table to construct a line graph. On the grid on the next page, plot the data for the area covered by ice in 2005 for each month shown on the data table and connect the plots with a line. The average area covered by ice for 1979–2000 has been plotted and labeled on the grid.



7. Scientists have noted that since 2002, the area of the Arctic Ocean covered by ice during these warmer months has shown an overall decrease from the long-term average (1979–2000). State one way in which this ice coverage since 2002 and the ice coverage shown in the 2005 data above provide evidence of global warming, when compared to this long-term average.

8. Identify one greenhouse gas that is believed to cause global warming. _____

Base your answers to questions 9 through 13 on the diagram below and on your knowledge of Earth science. The diagram represents a portion of a stream and its surrounding bedrock. The arrows represent the movement of water molecules by the processes of the water cycle. The water table is indicated by a dashed line. Letter A represents a water cycle process occurring at a specific location. Letter d represents the distance between the water table and the land surface.



9. Identify water cycle process A, which produces cloud droplets. _____

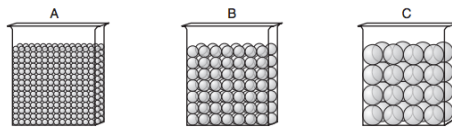
10. Describe the soil permeability and the land surface slope that allow the most infiltration of rainwater and the least runoff.

Soil permeability: _____ Land slope: _____

11. Explain why the distance, d, from the water table to the land surface would decrease after several days of heavy rainfall.

12. How many joules of heat energy are required to evaporate 2 grams of water from the stream surface?

13. The diagrams below represent three containers, A, B, and C, which were filled with equal volumes of uniformly sorted plastic beads. Water was poured into each container to determine porosity and infiltration time.



(Not drawn to scale)

Which data table best represents the porosity and infiltration time of the beads in the three containers?

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	5.2
B	40	2.8
C	40	0.4

(1)

Beaker	Porosity (%)	Infiltration Time (sec)
A	40	0.4
B	40	2.8
C	40	5.2

(2)

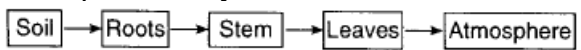
Beaker	Porosity (%)	Infiltration Time (sec)
A	20	5.2
B	30	2.8
C	40	0.4

(3)

Beaker	Porosity (%)	Infiltration Time (sec)
A	20	0.4
B	30	2.8
C	40	5.2

(4)

14. The flowchart below shows one process by which moisture enters the atmosphere.



The last step of this process is known as

- (1) condensation
- (2) convection
- (3) radiation
- (4) transpiration

15. Sediment samples A through D below have the same volume and packing, but contain different percentages of various particle sizes.

- Sample A: 75% clay and 25% silt
- Sample B: 25% clay and 75% sand
- Sample C: 50% pebbles and 50% sand
- Sample D: 50% pebbles and 50% cobbles

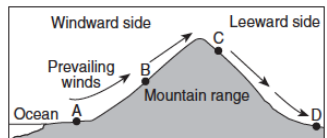
Which sample most likely has the greatest permeability?

- (1) A
- (2) B
- (3) C
- (4) D

16. A city located on the coast of North America has warmer winters and cooler summers than a city at the same elevation and latitude located near the center of North America. Which statement best explains the difference between the climates of the two cities?

- (1) Ocean surfaces change temperature more slowly than land surfaces.
- (2) Warm, moist air rises when it meets cool, dry air.
- (3) Wind speeds are usually greater over land than over ocean water.
- (4) Water has a lower specific heat than land.

17. The cross section below represents prevailing winds moving over a coastal mountain range. Letters A through D represent locations on Earth's surface.



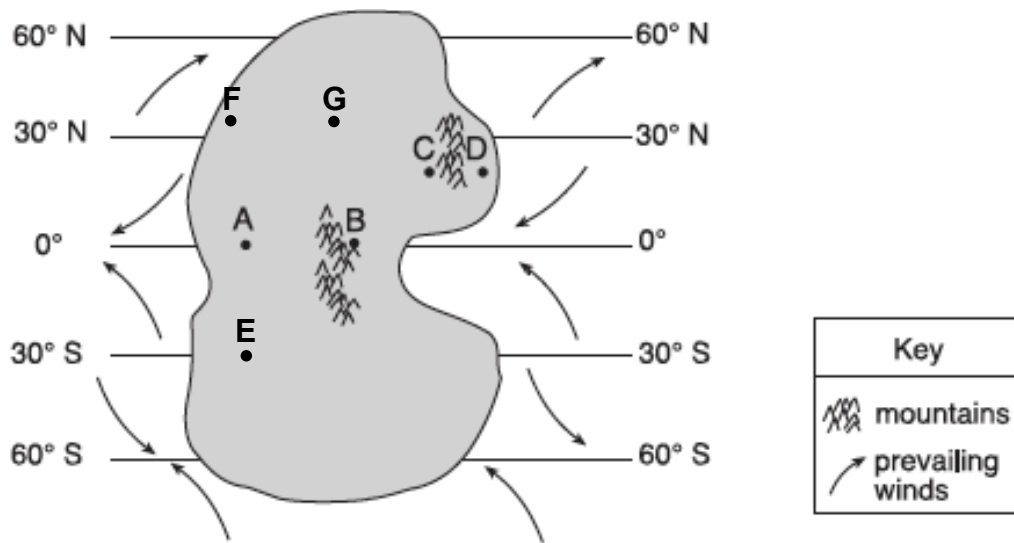
Which location will most likely have the least annual precipitation?

- (1) A
- (2) B
- (3) C
- (4) D

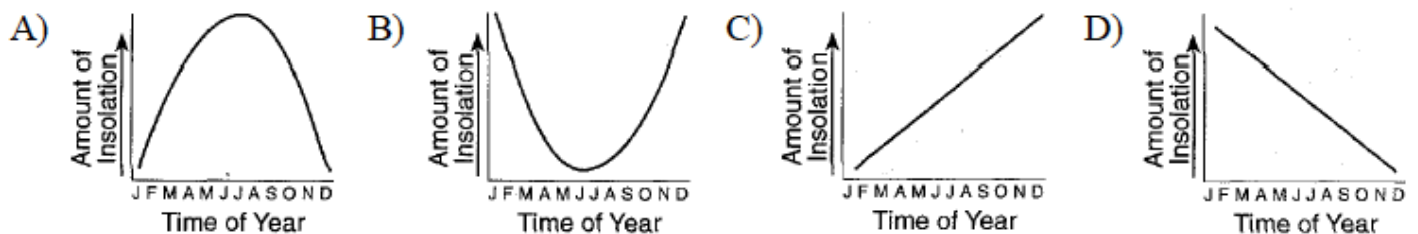
18. Which two 23.5°-latitude locations are influenced by cool surface ocean currents?

- (1) the east coast of North America and the west coast of Australia
- (2) the east coast of Asia and the east coast of North America
- (3) the west coast of Africa and the east coast of South America
- (4) the west coast of North America and the west coast of South America

Base your answers to questions 19 through 21 on the map below, which shows an imaginary continent on a planet that has climate conditions similar to Earth. The continent is surrounded by oceans. Two mountain ranges are shown. Points A through G represent locations on the continent.

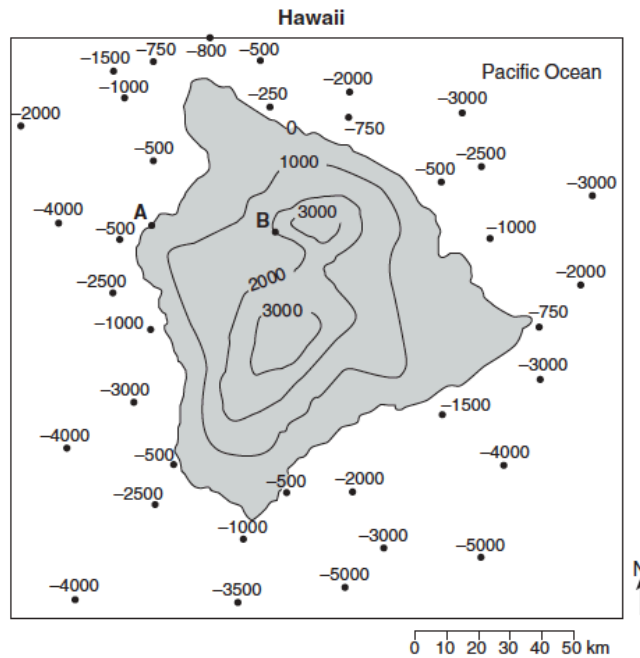


- Identify one labeled latitude on this continent where a high-pressure zone exists and dry air is sinking to the surface. Include both the unit and compass direction in your answer.
- Explain why city G has a greater difference between summer and winter temperatures than city F.
- Explain why location C has a warmer and drier climate than location D.
- Which graph best represents the relationship between time of year and amount of insolation at location E?



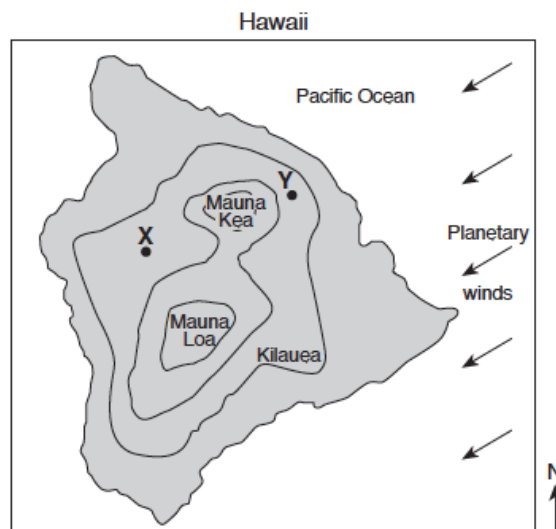
Base your answers to questions 23 through 25 on the topographic map of Hawaii in your answer booklet and on your knowledge of Earth science. Points A and B represent surface locations on the island. Land elevations and Pacific Ocean depths are shown in meters.

23. On the map in your answer booklet, draw the -1000-meter ocean-depth isoline. Extend the isoline to the edge of the map.



24. The average annual air temperature at location A is approximately 77°F, while the average annual air temperature at location B is approximately 55°F. Explain why location B has cooler average temperatures.

25. The map below shows the locations of three volcanoes on the island of Hawaii. The arrows represent the direction of the planetary winds. Points X and Y represent surface locations on the island.

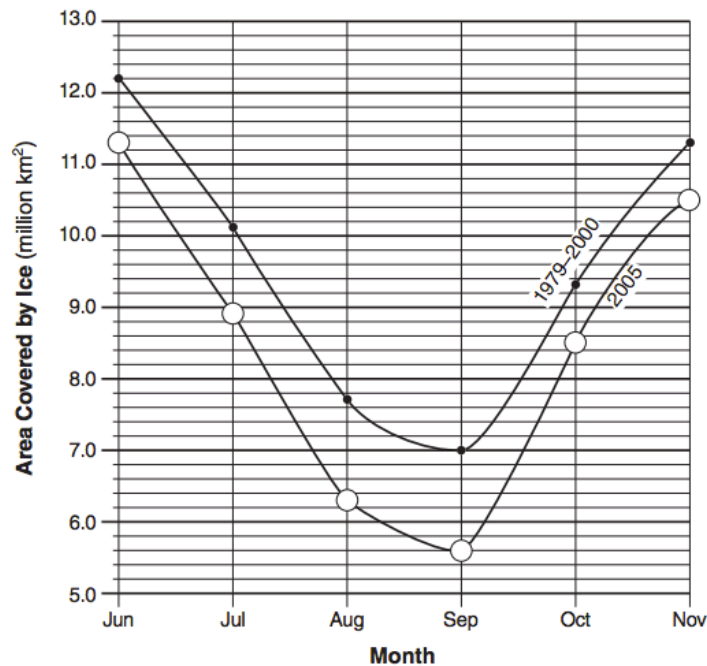


Explain why location Y usually receives more annual precipitation than location X.

REGENTS REVIEW #3
ATMOSPHERIC ENERGY, WATER & CLIMATE

PRACTICE REGENTS QUESTIONS – ANSWER KEY

1. 1 (See Fact 16a,i)
2. 1 (See Fact 16b,i,2)
3. 3 (See Fact 16b,ii)
4. Infrared energy (See Fact 16b,iii)
5. Greenhouse gases trap infrared energy (heat) like the glass in a greenhouse. (See Fact 16b,iii)
6. Allow 1 credit if the centers of all six plots are within the circles shown and are correctly connected with a line that passes within each circle.



7. The area covered by ice in 2005 was less than the average area covered by ice from 1979 to 2000.
8. Carbon dioxide; methane; water vapor (See Fact 16b,iii)
9. Condensation (See Fact 17a,iii)
10. Soil permeability: Highly permeable Land slope: Flat/gentle slope (See Fact 17b,i)
11. More water would infiltrate the soil, increasing the water table. (See Fact 17b,ii)
12. 4,520 Joules (See Fact 17a,v)
13. 1 (See Fact 17b,i and 17b,iii)
14. 4 (See Fact 17a,ii)
15. 4 (See Fact 17b,i,1; 17b,iv; ESRT page 6 Stream Velocity [for sediment sizes])
16. 1 (See Fact 18d)
17. 4 (See Fact 18e)
18. 4 (See Fact 18f and ESRT page 4)

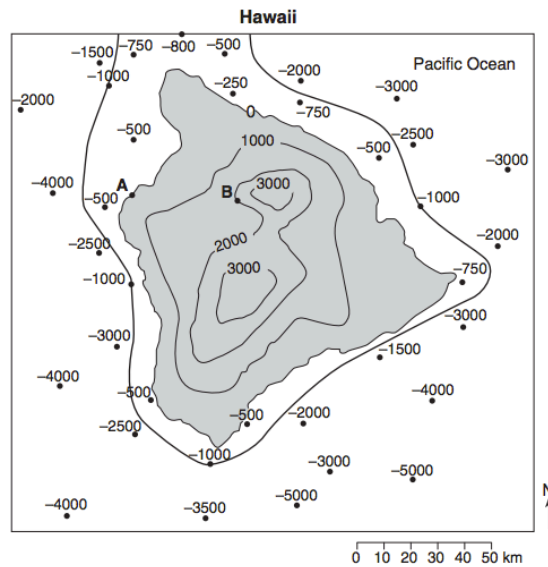
19. 30°N or 30°S (See Fact 18g and ESRT page 14 Planetary Winds)

20. City G is located inland while City F is coastal. (See Fact 18d)

21. City C is on the leeward side of the mountain while City D is on the windward side of the mountain. (See Fact 18e)

22. B (See Fact 18b,ii)

23. Allow 1 credit if the 1000 isoline is correctly drawn to the edge of the map. If additional isolines are drawn, all isolines must be correct to receive credit. (See Fact 6b)



24. B is higher in elevation than A. (See Fact 18c)

25. Location Y is on the windward side of a mountain; Location Y is closer to the ocean. (See Fact 18e)