

Topic 3.3 Assessment

Check Your Understanding Answers

Understanding Key Ideas

1. a) Its surroundings are everything else in the universe.
b) The system absorbs incoming solar radiation from its surroundings, which include the Sun.

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BC Science Connections 10 Teaching Notes Topic 3.3 How does energy transformation affect global systems?

- c) It releases energy to its surroundings by radiating infrared radiation.
2. solar energy, gravitational potential energy, nuclear energy
3. Evaporation: When water absorbs the Sun's energy, its molecules begin to move faster as the solar energy is

transformed into thermal energy. If enough solar energy is transformed, water evaporates from Earth's surface. It enters the atmosphere as water vapour, bringing its thermal energy with it.

Transpiration: In transpiration, plants take up water from the ground, or bodies of water in the case of aquatic plants, and release it into the atmosphere as vapour. Like evaporation, transpiration moves thermal energy into the atmosphere.

Condensation: As water vapour rises in the atmosphere, it gains gravitational potential energy. It also releases thermal energy to air molecules through collisions. It then cools, condenses around particles in the atmosphere, and forms clouds. The condensation process releases more thermal energy to the atmosphere.

Precipitation: The water returns to Earth's surface through precipitation when it rains or snows. As the precipitation falls, its gravitational potential energy is transformed into mechanical kinetic energy. This transformation continues as water flows from higher to lower elevations on land. Thermal energy is also transferred to the atmosphere through friction as precipitation falls.

4. a) The greenhouse effect refers to the warming influence of greenhouse gases, including carbon dioxide, water vapour, nitrous oxide, and methane.
b) The greenhouse effect is important to life on Earth because it moderates Earth's average temperature to allow life as we know it or thrive.
5. Graphic organizers should convey an understanding of the following roles of absorption, radiation, conduction, and convection.
absorption: The surface and atmosphere absorb some incoming solar energy. The atmosphere absorbs infrared radiation and thermal energy from Earth's surface as well. Both are important in terms of warming the atmosphere.

radiation: Solar energy (radiation) reaches Earth from the Sun. After it is absorbed by the surface, infrared radiation warms the atmosphere.

conduction: After land and water absorb solar energy, their molecules collide more frequently with air molecules close to the surface. These collisions transfer thermal energy from the warmer surface to the cooler air by conduction. As a result, the temperature of the lower air comes close to the temperature of the land and water beneath it.

convection: Convection transfers thermal energy throughout the atmosphere by the movement of heated air. As the lower layer of the air warms, it expands, becoming less dense. Less-dense fluids rise, and more-dense fluids fall. As the cooler air falls, it takes the place of the rising warmer air and is warmed again.

6. Radioactive materials build up in soil in terrestrial ecosystems more than in aquatic ones, where they tend to be flushed through faster.

Connecting Ideas

7. Students should predict that winters will be colder, and summers will be hotter in Kamloops than in Vancouver on average. Explanations should discuss the fact that Vancouver, which is closer to the coast, is more influenced by the moderating effect of the ocean than Kamloops. Because water has a much higher specific heat capacity than land, it can store a large amount of thermal energy with very little change in temperature.

Even though the ocean and land absorb the same amount of thermal energy, water exhibits much less of a temperature change than land does. In summer, this results in cooler coastal temperatures, because the ocean prevents the temperature from rising. In winter, the coast remains milder because the thermal energy stored in the ocean has a warming effect on the coastal land. Overall, the ocean acts as a coastal air conditioner in summer and heater in winter.

8. Student procedures should provide steps indicating how their experiment determines the effects of warming oceans on coral reefs, as well as how they would set up a control for their experiment.

Making New Connections

9. Sample answer 1: As sea level rises, I predict that coastal terrestrial ecosystems will be changed to aquatic ecosystems because the oceans will invade these areas. As a result, aquatic animals will move inland as coastal areas are invaded by the sea, while terrestrial animals that live on the coast will lose their homes and have to move inland.

Sample answer 2: I predict that ecosystems that have both aquatic and terrestrial components, such as intertidal zones and estuaries, will be especially harmed because these areas will experience changes as sea level rises. First example, some tidal pools might be permanently submerged, and some estuaries will be drowned by the sea. The organisms that were specially adapted to life in these ecosystems might not survive if they cannot adapt to these changes to their homes.

10. Sample answer 1: I think that reports focus on carbon dioxide because it is produced when people drive cars, so people can act to directly reduce their greenhouse gas emissions. I know nitrous oxide is a natural greenhouse gas but I'm not sure how people produce it, so I would have no idea how I could decrease emission of this gas, or even if I could.

Sample answer 2: This question mentions that nitrous oxide is more potent than carbon dioxide as a greenhouse gas, but it does not mention amounts. If there is much more carbon dioxide in the atmosphere than nitrous oxide, that would explain why reports focus on carbon dioxide.