

Topic 3.4 Assessment

Check Your Understanding Answers

Understanding Key Ideas

1. Students should give at least three positive and three negative effects in their graphic organizers.
2. Sample answer: a) Smog is linked to the transformation of chemical potential energy to kinetic energy in gas-powered vehicles and the transformation of chemical potential energy to thermal to kinetic energy in burning coal, both of which generate air pollution.
b) Smog can cause lung problems, like bronchitis and pneumonia.
3. Accept any responses that identify a personal action a student could take and indicate how that action would reduce a negative impact of technology-related energy transformation. For example, a comic strip could show how a student cycling to school could have an impact on a coral reef around the world by reducing the ocean warming caused by climate change. It could show that climate change is brought about by transforming the chemical potential energy in fossil fuels into forms of energy that human technology makes use of, such as electrical energy to run lights, thermal energy used to heat buildings, and mechanical kinetic energy used to move motor vehicles.
4. Answers should indicate that learning from the past is important because it helps us avoid making similar mistakes that have resulted in harmful impacts from human energy transformation.
5. a) Both cement and fuel cell technology can reduce the effects of climate change by reducing human emissions of carbon dioxide, a potent greenhouse gas that contributes to global climate change. Methane cracking is an emerging technology that can produce hydrogen from methane for use in fuel cells without releasing carbon dioxide. Evolving cement production technology can significantly reduce carbon dioxide emissions released when cement is made. Plus, work is underway on creating cement that absorbs carbon dioxide as it hardens.

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b) Sample answer 1: I think the cement technology will have a greater impact because it packs a double punch, reducing carbon dioxide emissions and reducing the amount of carbon dioxide that is already in the atmosphere.
Sample answer 2: I think the fuel cell technology will have a greater impact because it targets transportation-related carbon dioxide emissions. I think these contribute a lot more carbon dioxide to the atmosphere than cement production, so I think that fuel cells will have the greater effect.

Connecting Ideas

6. a) Nuclear fusion takes place in the tokamak reactor. During fusion a very high temperature needs to be sustained. Therefore, nuclear energy must be transformed into thermal energy.
- b) Students can describe any system they are observing. The reactor and fuel may be the system, for instance, or the reactor, fuel, and heat source that creates the high temperature required to initiate fusion may be the system.
- c) The surroundings are everything outside of the system identified in part b.
- d) The tokamak reactor allows fusion to occur in a controlled way by containing the super-heated reaction involved in fusion within powerful magnetic fields, keeping it away from the reactor walls, which would melt if exposed to such a high temperature.
- e) Students should indicate that magnetic potential energy, nuclear energy, and thermal energy all play a role.

Making New Connections

7. Accept any well-reasoned answers. However, the best answers will recognize that the fuel cells were a good way to provide electrical energy for the shuttles because if the reaction is 100% efficient it produces only water. This could provide the astronauts with water to drink.