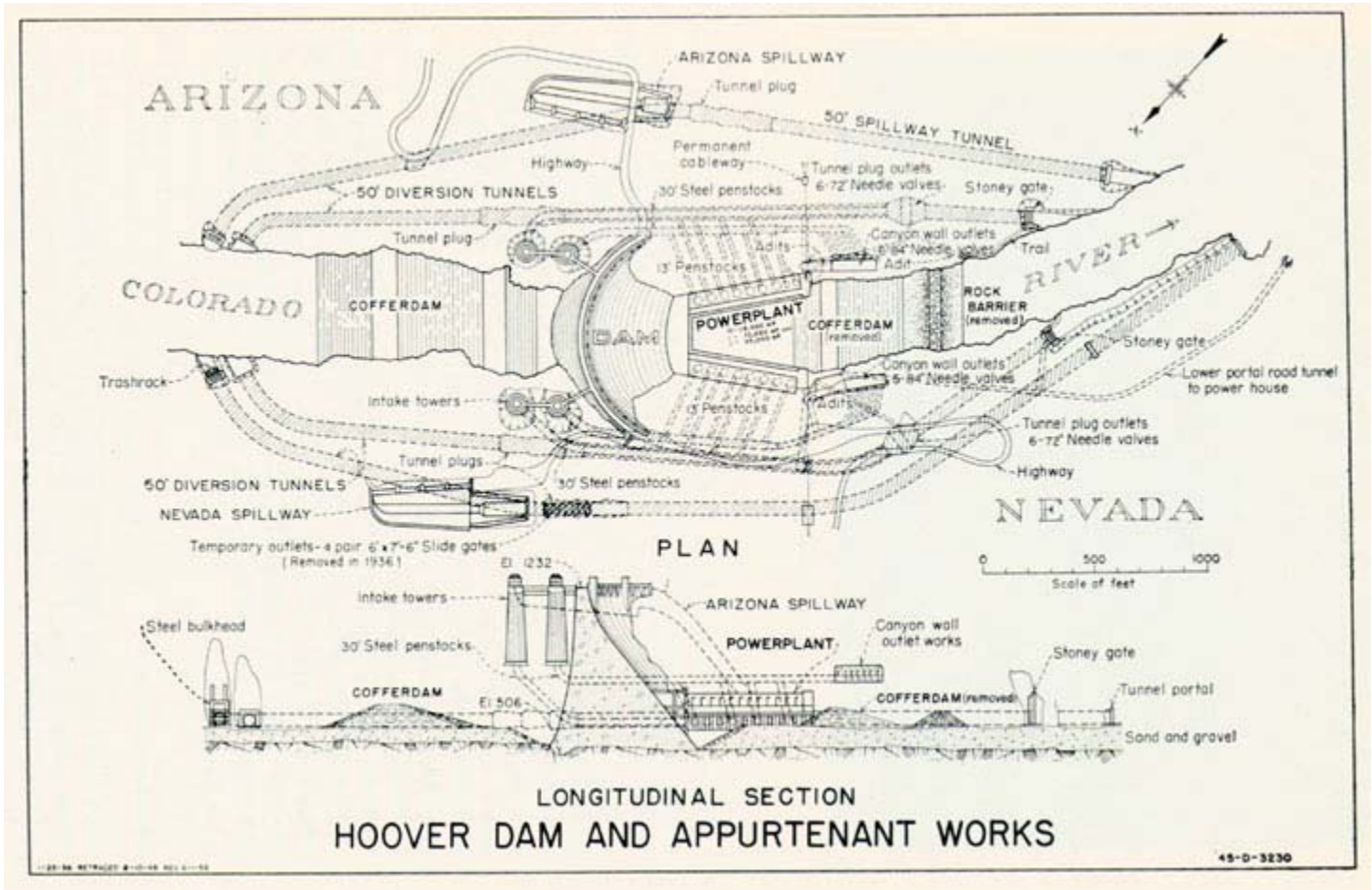


Everyday Energy

Edward I. Maxwell



The pitcher gets into her set. Her glove and pitching hand come together by her chin, and she then lowers them to her belt. She looks at the catcher and nods. She brings her front leg up and pauses, standing perfectly balanced on her back leg. Then, in an instant, she steps forward with her front leg. Her whole body lurches toward home plate and her pitching arm swings out after it like a whip. At the furthest point, when a whip would crack, she lets the ball fly toward the catcher's mitt. The batter steps forward with her front leg and rotates her torso, swinging the bat with her eyes fixed on the incoming fastball.

"STRIKE THREE! BATTER'S OUT!"

Moments like these happen all across the physical world, whether on the molecular or cosmic level. Potential energy is the energy, chemical or physical, stored within an object, atom or molecule. Think about a car at the top of a roller-coaster, pausing just before it plunges into the next turn. A log resting in a fireplace just before it is about to be lit, is a treasure trove of potential energy. As the log burns, the connections between carbon atoms that make up the wood are being broken down, and the potential energy stored within those connections is being released as heat and light. As a comet approaches a planet or star, it slows, momentarily affected by the larger body's gravity. The potential energy builds and then reaches a breaking point, as the comet accelerates around the larger body and is slingshotted out the other side.

Sports showcase countless examples every day of potential energy being converted into kinetic energy. Kinetic energy is the energy of movement. When an archer draws and holds her arrow, her bow is brimming with stored potential energy. When she releases the bowstring, all the potential energy is quickly converted into kinetic energy, which is transferred to the arrow that takes flight. The transfer of kinetic energy from the bow to the arrow is not a perfectly efficient process. What this means is that some of the energy does not make it to the arrow. Instead, the energy might be absorbed by the archer's arm, causing it to jerk to the side when the bow twangs. The most important thing to remember is that although the transfer of energy between objects may be inefficient, the energy still exists. It has simply been transferred along a different pathway. Therefore, the total sum of energy is still conserved.

The conversion of stored potential energy into kinetic energy can also be harnessed to power homes, factories and entire cities. The most notable example is the Hoover Dam. The Hoover Dam is an arch-gravity dam by design. This design name is the first clue as to how exactly the dam harnesses energy. Located in the Black Canyon of the Colorado River, the Hoover Dam formed, and now holds back, Lake Mead—the largest reservoir in the United States. The dam was built toward the beginning of the Great Depression. Constructed between 1931 and 1936, the dam had been the subject of planning and design sessions since 1900. Deliberations included discussions of potential catastrophes, should the dam fail or the lake grow beyond expectations.

Gravity acts as a force upon Lake Mead. Held at bay by the Hoover Dam, the waters of Lake Mead and the Colorado River gain greater potential energy with each passing moment. The

Arizona and Nevada spillways are two means by which the waters of Lake Mead can escape the dam. As the lake water tumbles over the walls into a spillway, potential energy is instantly converted into kinetic energy. The channels through which the water normally escapes every day are the four intake towers. These towers funnel the water through sluices, or passageways, to the powerhouse and hydroelectric generators. When the water reaches the intake towers and is allowed to flow down through the sluices, all the stored potential energy created by the force of gravity acting upon the water is converted into kinetic energy, just as when water flows over the wall into a spillway.

By harnessing the converted potential energy of Lake Mead, the Hoover Dam provides power to California, Nevada and Arizona. Well over a dozen turbines are housed within the power plant at the base of the dam. Electricity production varies annually depending on how much water is required downriver from the dam and the water levels of Lake Mead. The greatest amount of energy was produced during 1984; a year after floods brought the lake to its highest levels. As of 2009 the American Southwest has entered a prolonged period of seasonal droughts. As a result, compared to its peak periods of energy production, the Hoover Dam has been recently generating much less energy.

Name: _____ Date: _____

1. A rollercoaster car at the top of the hill, an archer preparing to release an arrow, and a lake that sits above a dam are all examples of what kind of energy?

- A potential energy
- B kinetic energy
- C gravitational energy
- D consumption of energy

2. What does the author describe in the passage?

- A the history of human energy use in the United States
- B the ways in which potential energy is converted to kinetic energy
- C the best reasons to build new dams in the American Southwest
- D the consequences of drought for people who rely on dams

3. The conversion of stored potential energy into kinetic energy can also be harnessed to power homes, factories and entire cities. Which example from the text supports this conclusion?

- A the softball pitcher
- B the slingshotting comet
- C the archer
- D the Hoover Dam

4. Which of the following conclusions is supported by the text?

- A Nuclear power is the most efficient kind of energy for powering cities.
- B Professional athletes should study the science of energy to play better.
- C Dams power cities by converting stored potential energy into kinetic energy.
- D Drought is a serious problem for farmers in the American Southwest.

5. What is this passage mainly about?

- A The movement of comets through our solar system.
- B The scientific forces behind our favorite roller-coasters.
- C The unusual properties of water molecules in rivers.
- D The conversion of potential energy into kinetic energy.

6. Read the following sentences: "The Arizona and Nevada spillways are two means by which the waters of Lake Mead can escape the dam. As the lake water tumbles over the walls into a **spillway**, potential energy is instantly converted into kinetic energy."

As used in the passage, what does the word "**spillway**" mean?

- A A place where water flows over the top of a dam, creating energy.
- B A place where water accidentally spills, causing problems for engineers.
- C A place where water flows underground, into tunnels.
- D A place where water flows into nearby farms, watering crops.

7. Choose the answer that best completes the sentence below.

"The conversion of stored potential energy into kinetic energy can be harnessed to power homes, factories and entire cities. _____, the Hoover Dam provides power to California, Nevada and Arizona.

- A Even though
- B Initially
- C For instance
- D However

8. How does the Hoover Dam provide power to California, Nevada and Arizona?

9. What two factors determine the energy production of the Hoover Dam?

10. Explain why the prolonged period of drought (a time where there is little rain, and little water flowing into rivers and lakes) would cause the Hoover Dam to generate much less energy since 2009. Use evidence from the text to support your answer.

Teacher Guide & Answers

Passage Reading Level: Lexile 1120

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- A Even though
- B Initially
- C **For instance**
- D However

8. How does the Hoover Dam provide power to California, Nevada and Arizona?

Suggested answer: The Hoover Dam provides power to California, Nevada and Arizona by harnessing the converted potential energy of Lake Mead.

9. What two factors determine the energy production of the Hoover Dam?

Suggested answer: How much water is required downriver from the dam and the water levels of Lake Mead determine the energy production of the Hoover Dam.

10. Explain why the prolonged period of drought (a time where there is little rain, and little water flowing into rivers and lakes) would cause the Hoover Dam to generate much less energy since 2009. Use evidence from the text to support your answer.

Suggested answer: Students should communicate that if there is a drought, then Lake Mead will have less water. If Lake Mead has less water, then there will be less potential energy stored in Lake Mead. If there is less potential energy, then there will be less kinetic energy created by water flowing through the Hoover Dam.

More advanced answers may provide details such as there would be less lake water to tumble over the walls into a spillway and move through four intake towers into the powerhouse and hydroelectric generators.