



Human Body Systems

Virtual Learning

9-12th PLTW[®] HBS

PLTW[®] 4.4.1 The Body's Response to Exercise

April 27, 2020



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Lesson: April 27, 2020

Objective/Learning Target:

Students will be able to identify the three main body energy systems: phosphagen system (phosphate energy system), anaerobic respiration (the glycogen-lactic acid system), and aerobic respiration. (*Reference: PLTW[®] 4.4.1 The Body's Response to Exercise*)



Let's Get Started/Warm Up Activities:

Before we start our lesson today, watch the following videos:

- [Aerobic & Anaerobic Respiration](#)
- [Anaerobic Respiration in Muscles](#)



Lesson/Activity:

Go to this website article:

[The 3 Energy Systems & When You Need Them](#)

Activity #1:

- Click [HERE](#) and draw the energy system comparison table on a piece of paper or in your notebook.
- Read the website article above about the human body's three major energy systems. As you are reading, complete the table.



Lesson/Activity continued:

Activity #2:

- Click [HERE](#) and rewatch the warm-up video. Pause at 1:43 min and record the information about aerobic and anaerobic respiration on your piece of paper or in your notebook. Make sure to include the reactions for aerobic and anaerobic respiration.

Activity #3:

- Click [HERE](#) and the video. Draw a diagram illustrating how cells in the phosphagen system (also called phosphate energy system) use creatine phosphate to make ATP.

Lesson/Activity Answers:

Activity #1 Answer(s):

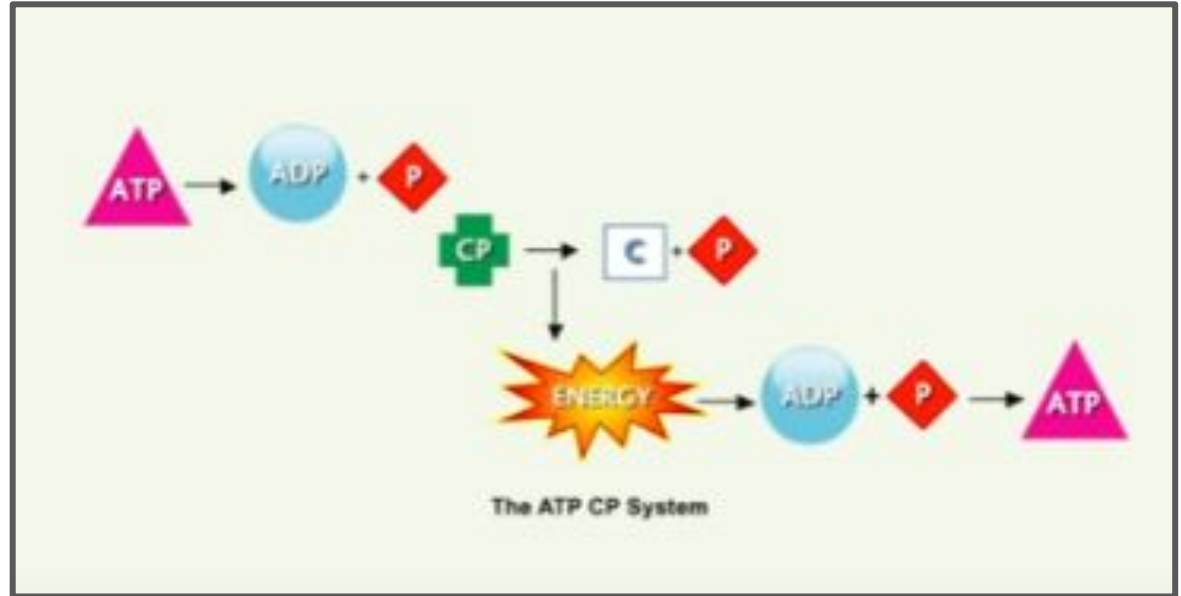
Click [HERE](#) or see the completed energy systems table below.

Energy Systems of the Body	Type of energy? (long-term, immediate, short-term)	Is oxygen required?	How is energy created?	Example exercise that uses this energy?	How much energy is supplied? (time)
phosphagen system	immediate	No oxygen required	ATP created by using creatine phosphate	Short burst intense activity like a max weight lift or a short race	Approximately 5 seconds
anaerobic respiration (the glycogen – lactic acid system)	short-term	No oxygen required	Glycolysis: breakdown of glucose; breakdown creates ATP as glucose is converted into 2 molecules of pyruvate	End of a race sprint	1-3 minutes of intense activity
aerobic respiration	long-term	Oxygen is required	Uses oxygen to break down carbohydrates, fats, or proteins into ATP.	System is used more heavily during low-intensity activity, but actually, most races, even a 5k, mostly use the aerobic system.	It depends: In prolonged activities where intensity is low, the body will use fat as a main energy source and spare the use of muscle glycogen and blood glucose so that it is available for use if exercise intensity increases and oxygen availability is decreased. Therefore, time varies.

Lesson/Activity Answers:

Activity #3 Answer(s):

Click [HERE](#) and pause at 1:14 min or see diagram on the right.





Practice:

Watch video: [13-Year-Old Runs the 400m in 48 Seconds!](#)

Practice: In the video above, 13-year-old Mekhi Gammons completed the 400-meter dash in 47.86 seconds to break the world record for his age group! Before, during and after the race, Mekhi would have used energy from different sources: phosphagen system, anaerobic respiration (the glycogen-lactic acid system), and aerobic respiration. For each of the following, decide 1) which system was the most likely to provide Mekhi energy, and 2) explain your reasoning for your choice.

- A. Mekhi had to walk a mile from his mother's car to the race track.
- B. Mekhi had a burst of energy when the whistle was blown to start the race, and Mekhi took the lead immediately.
- C. Mekhi ran as fast as he could for 400 meters (approximately a quarter of a mile).
- D. After the race, Mekhi cooled down by walking slowly around the track.

Practice Answers:

Practice: Before, during and after the race, Mekhi would have used energy from different sources: phosphagen system, anaerobic respiration (the glycogen-lactic acid system), and aerobic respiration. For each of the following, decide 1) which system was the most likely to provide Mekhi energy, and 2) explain your reasoning for your choice.

- A. Mekhi had to walk a mile from his mother's car to the race track. **Aerobic respiration is the most likely source since Mekhi had available oxygen to use and was not using large amounts of energy while walking.**
- B. Mekhi had a burst of energy when the whistle was blown to start the race, and Mekhi took the lead immediately. **Aerobic energy since he had available oxygen to use at the beginning of the race.**
- C. Mekhi ran as fast as he could for 400 meters (approximately a quarter of a mile). **Anaerobic respiration is the most likely source since he would have been low on oxygen.**
- D. At the very last seconds of the race, Mekhi gave all the energy he could muster to increase his speed. **Anaerobic and phosphagen systems: Mekhi would have needed to use creatine phosphate during the phosphagen phase for the burst of energy.**
- E. After the race, Mekhi cooled down by walking slowly around the track. **It is possible that Mekhi was using energy from both anaerobic and aerobic depending on his available oxygen levels.**



Additional Practice and/or Resources:

Learn More:

[HBS Unit 4.4.1 Flashcards](#)

Test your knowledge by clicking on the link above.

[ATP Energy In The Body](#)

Storage of ATP in the muscles is limited: any movement that lasts longer than a few seconds requires more ATP to be produced. Learn ways to that you can train your body to utilize the three energy systems more efficiently.

[Aerobic vs. Anaerobic Differences](#)

Learn even more about aerobic and anaerobic processes in the body by exploring Glycolysis, the Krebs Cycle, and the Electron Transport Chain.