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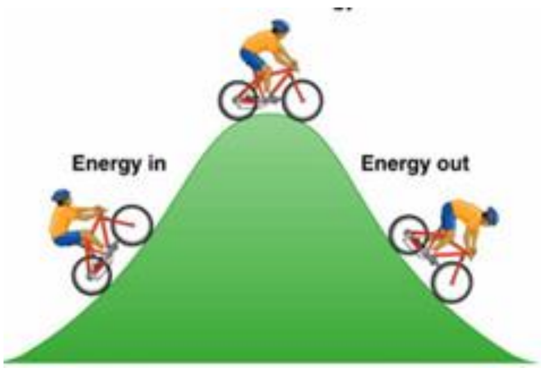
KIPP/2024/____________________

Remote Learning Packet
Assignment #3

Review of Potential and Kinetic Energy

Directions: Try the first 3 problems to help you remember the concepts from our second unit.

Using the picture below, state where the highest potential energy might be found for this cyclist. Explain why you chose that answer.



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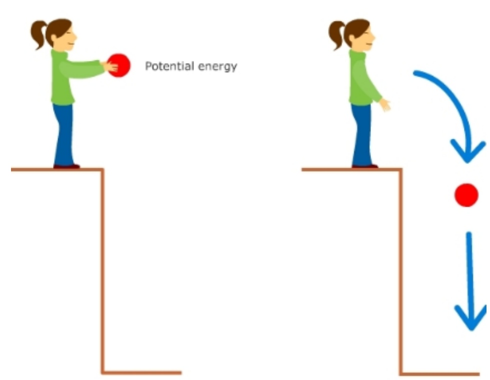
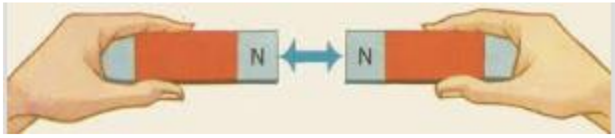
Where is the amount of potential energy the greatest? Where is the amount of kinetic energy the greatest?

a. The potential energy and kinetic energy is greatest before the object falls.
b. The potential energy is greatest before the object falls, the kinetic energy is greatest before it hits the ground.
c. The kinetic energy is greatest before the object falls, the potential energy is greatest before it hits the ground.
d. The potential energy and kinetic energy are the same throughout the fall.



What will happen to the potential energy of two repelling magnets as they get closer? Explain why this will occur.



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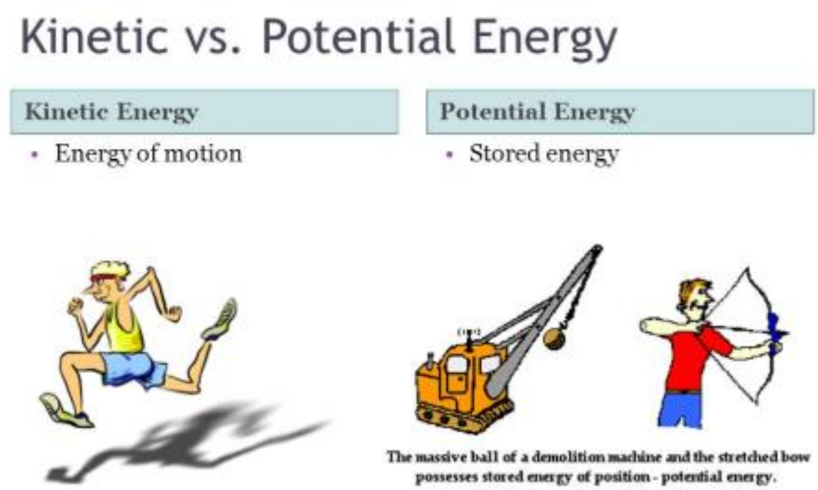
Directions: Read and **Annotate** the following text to help you to review PE and KE.

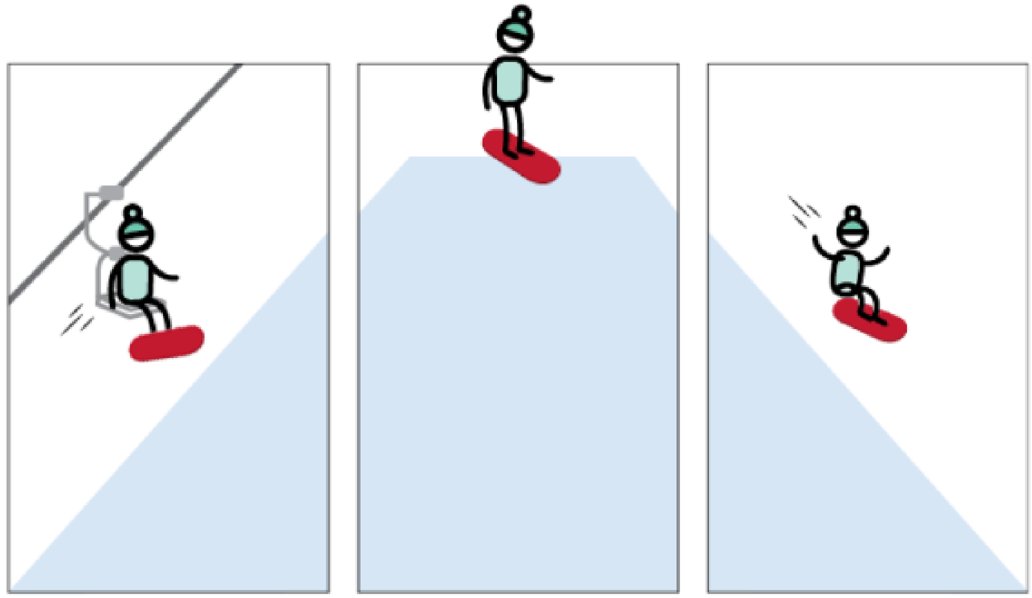
Potential and Kinetic Energy



Can you fly through the air? Can you zoom down a snowy mountain at 80 kilometers per hour (50 miles per hour)? With a little extra equipment and some practice, you probably can: extreme sports allow us to do exhilarating things our bodies can't do on their own. To get the speed and height we like so much, these sports rely on two kinds of energy—kinetic energy, which is the energy of motion, and potential energy, which is stored energy. By adding a force to the mix, these two types of energy can be converted back and forth— motion energy can become stored energy, and stored energy can become motion energy. For extreme athletes, that conversion usually means speed, height, or both!

Is there any bigger thrill than weaving down a mountain on a snowboard? The world record for speed on a snowboard is a whopping 203 kilometers per hour (126 miles per hour), and advanced snowboarders regularly reach speeds of 65-70 kph (40-45 mph) to launch themselves high into the air off ramps in the snow. Going that fast requires a lot of kinetic energy. Kinetic energy can't appear out of nowhere, although it can be transferred or converted from a different form of energy. How do snowboarders get the kinetic energy they need to launch themselves into the air?

It's all about gravity. Gravity is a pulling force that can change the motion of an object. When Earth pulls objects toward itself with the force of gravity, it can transfer energy between the parts of systems. The snowboarder and Earth form a system. When the ski lift pushes the snowboarder to the top of the mountain, the ski lift is pushing against the force of gravity. The ski lift transfers energy into the snowboarder-Earth system, where it is stored as potential energy in that system. When the snowboarder starts going downhill, the force of gravity transfers this potential energy to the snowboarder and converts it to kinetic energy.



the ski lift force transfers energy into the snowboarder-Earth system

potential energy is stored in the gravitational field between the snowboarder and Earth

the gravitational force converts potential energy into kinetic energy, giving the snowboarder speed

As a result, the snowboarder goes faster and faster. We say energy is stored in the system when the snowboarder is pushed away from Earth by the ski lift, but what does that actually mean? The system of Earth and the snowboarder is kind of like a rubber band. If you stretch a rubber band, the energy you're using to pull the rubber band apart is stored in the rubber band itself. When the rubber band snaps back to its unstretched shape, the stored energy is released. There is no invisible rubber band between a snowboarder and Earth, so where is the energy stored?

Earth and the snowboarder are connected by Earth's gravitational field, the space in which Earth can pull on objects at a distance. Even if we can't see the gravitational field, we can feel it—it's what keeps our feet on the ground and brings us back to Earth when we jump up and down. When the ski lift carries the snowboarder upward and away from Earth, potential energy is stored in the gravitational field between Earth and the snowboarder. When Earth pulls the snowboarder down the hill again, the force of gravity transfers potential energy from the gravitational field to the snowboarder in the form of kinetic energy. So reaching top speed on the mountain isn't just about great snow and a cool board. Without gravity, snowboarders wouldn't go anywhere!

Post Reading Questions:

1. When a snowboarder rides up a ski lift, she is traveling against what force?

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2. When the snowboarder reaches the top of the lift, all of the energy in that system exists as

   ________________________________ energy.

3. Explain the energy transfer that occurs when the snowboarder starts to go downhill. What force causes this transfer of energy? What types of energy are being transferred?

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4. **Think About It!** Compare the Earth's gravitational field to what we know about magnetic fields. What are 2 similarities between the two types of fields?

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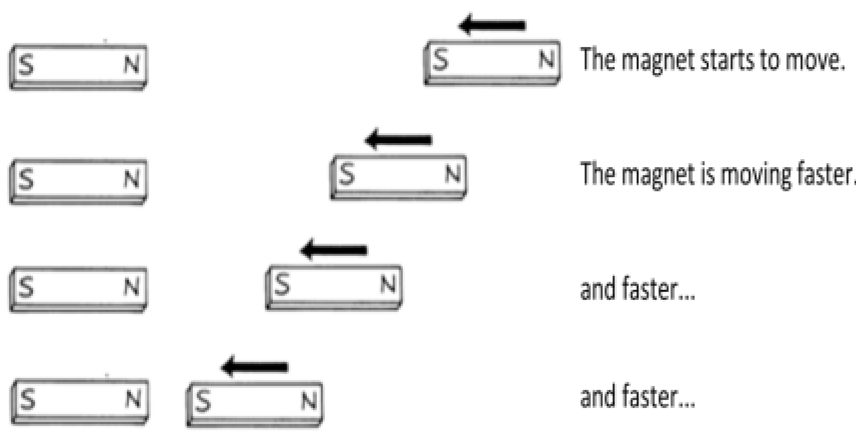
Independent Practice Problems

In the picture to the right, as the magnet starts to move, the speed increases. As the speed increases, the KE increases. As the KE increases, the PE decreases. As we already mentioned, the magnetic PE gets larger the further away the magnetic material moves from the magnet.



1. Using the picture, when was the KE the greatest?

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2. Using the picture, when was the KE the smallest?

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3. Using the picture, when was the PE the greatest?

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4. Using the picture, when was the PE the smallest?

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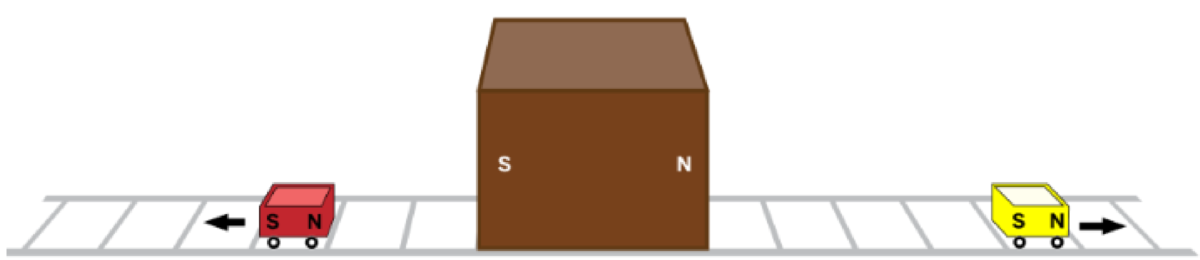
5. The PE of a magnet in the presence of another magnet is related to —
   a. only how close the magnets are together.
   b. only the direction in which the poles point.
   c. how close the magnets are together and how fast they are moving.
   d. how close the magnets are together and which direction the poles point.

6. To decrease the potential energy of two magnets, you need to _______________________.
   a. Move both magnets away from each other
   b. Move magnets against their magnetic fields
   c. Move both magnets towards each other
   d. Move magnets with their magnetic fields

Fernando is an engineer at an amusement park who is experimenting with changes to the setup for a magnetic roller coaster ride. In one ride, there are two identical roller coaster cars (red and yellow) that start on opposite sides of a large magnet located in the center of a station. He moves both cars, so each car ends up one space farther away from the large magnet.



Red Car Yellow Car

7. In which direction does the magnetic field “want” the ***red*** magnet to go?

 ____

8. In which direction does the magnetic field “want” the ***yellow*** magnet to go?

 ____

9. If you move the red magnet away from the larger magnet, you are moving it **(with or against)** the magnetic field? ____________________________

10. Does this increase or decrease the PE? ______________________________________

11. If you move the yellow magnet away from the larger magnet, you are moving it **(with or against)** the magnetic field? _________________________________

12. Does this increase or decrease the PE? ______________________________________

13. Which magnet will have a **greater change in PE** if you move it one space **away** from the center magnet? Explain your answer.

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