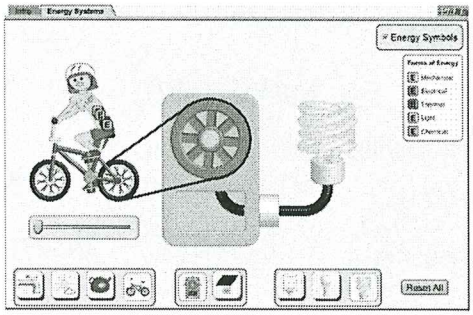
ANSWER KEY

6.1-6.5 Review

1. Fill out the following chart on the 5 main types of energy

Form of Energy	What is it?	Examples
Nuclear	Energy stored in nucleus of atom - can be released by fission, fusion, radioactivity	Nuclear power plants
Solar	The majority comes in the form of light and heat; created from fusion of hydrogen	Solar panels, plants/photosynthesis
Thermal	The sum of KE of all molecules within an object	Baking a cake; powering cars
Mechanical	Sum of Kinetic + Potential Energy	Kicking a soccer ball
Chemical	Energy that comes from Chemical Reactions	Digesting food; photosynthesis

2. Using the diagram below, state the different energy transformations that you think would occur:

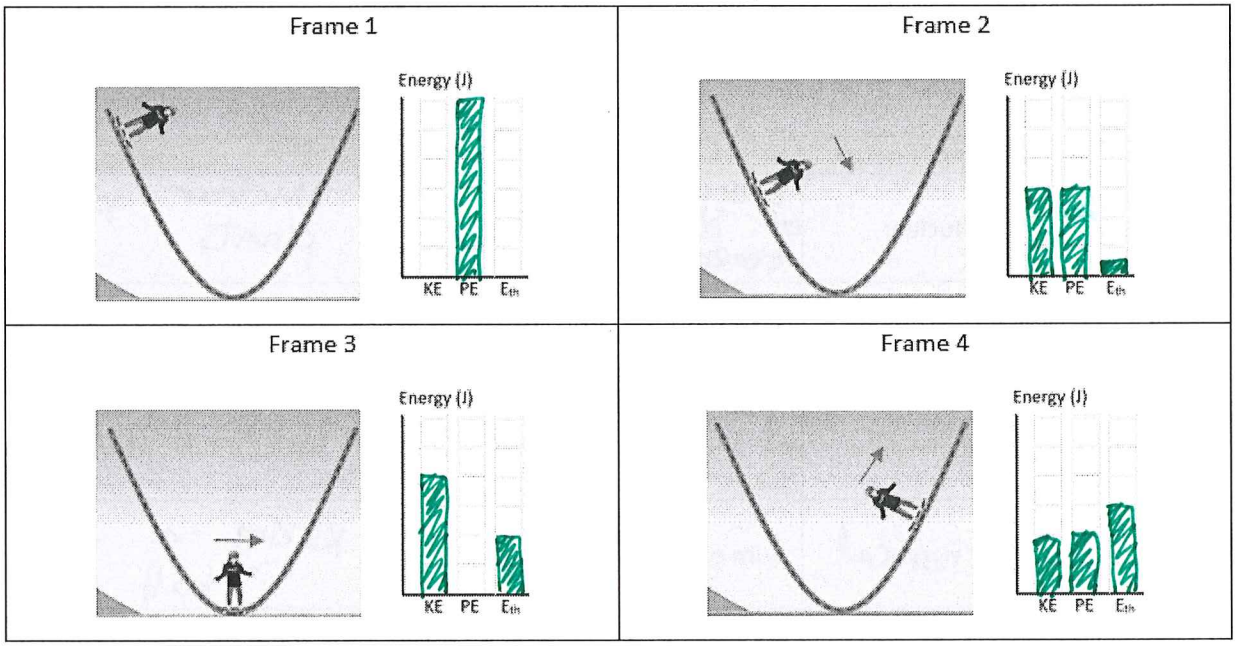


chemical (digesting food for energy) → mechanical (moving pedals/turbine) → electrical (through wire) → light/thermal (light bulb)

3. Write a sentence to summarize energy transformations using the following words: **Energy, change, created, destroyed**

Energy cannot be created or destroyed, it just changes from one form to another.

4. Complete the following energy bar graphs for the skateboarder.



5. What energy transformations are taking place in the following scenarios?
   a. A rabbit eats some lettuce that is growing in the ground

solar energy (photosynthesis to lettuce) → mechanical energy (rabbit tearing lettuce leaves) → chemical energy (digestion)

   b. A battery operated flashlight gets turned on

chemical energy (battery) → electrical energy (goes through wire) → light energy / thermal energy (from bulb)

* could have different answers! Just be sure to explain!

   c. A student rides their bicycle along a flat path to school

chemical energy (cellular respiration in muscles) → mechanical energy (in the form of Kinetic - moves bike) → thermal energy (friction)

   d. A soccer player kicks a soccer ball

chemical energy (cellular respiration in muscles) → mechanical energy (potential gets transformed to Kinetic) → thermal energy (due to friction)

$KE = \frac{1}{2}mv^2$ $PE = mgh$

6. Answer the following kinetic and potential energy questions. Be sure to include your formula and units in your final answer for full marks!

a. The largest land predator is the male polar bear, which has a mass of around 500.00 kg. If the top speed of a male polar bear is 11.0 m/s, how much KE does it have?

$m = 500$ kg
$v = 11$ m/s
$KE = ?$

$KE = \frac{1}{2}mv^2$
$= \frac{1}{2}(500)(11^2)$
$= 30,250$ J.

b. An object has a kinetic energy of 25 J and a mass of 34 kg, how fast is the object moving?

$KE = 25$ J.
$m = 34$ kg
$v = ?$

$v^2 = \frac{KE \cdot 2}{m}$
$v^2 = \frac{(25)(2)}{34}$
$v^2 = 1.47$ m/s

$v = \sqrt{1.47}$ m/s
$= 1.21$ m/s

c. What is the mass of a baseball that has a kinetic energy of 105 J and is traveling at 10 m/s?

$KE = 105$ J
$v = 10$ m/s
$m = ?$

$m = \frac{KE \cdot 2}{v^2}$
$= \frac{(105\text{ J}) \cdot 2}{10^2}$
$= 2.1$ kg

d. What is the velocity of a roller coaster if it has 1,200,000J of energy and a mass 1200kg?

$v = ?$
$KE = 1,200,000$J
$m = 1200$ kg

$v^2 = \frac{KE \cdot 2}{m}$
$v^2 = \frac{(1,200,000)(2)}{1200}$
$v^2 = 2000$ m/s

$v = \sqrt{2000}$ m/s
$= 44.7$ m/s

e. A 120kg bicycle is at the top of a 12m hill. What is the bicycle's potential energy?

$m = 120$ kg
$h = 12$ m
$PE = ?$

$PE = mgh$
$= (120)(9.81)(12)$
$= 14,126$ J.

f. A box has a mass of 5.8kg. The box is lifted from the garage floor and placed on a shelf. If the box gains 145J of Potential Energy (Ep), how high is the shelf?

$m = 5.8\,kg$
$PE = 145\,J$
$h = ?$

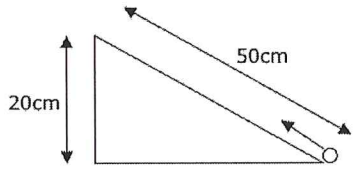
$$h = \frac{PE}{mg} = \frac{145}{(5.8)(9.81)} = 2.5\,m$$

g. A man climbs on to a wall that is 3.6m high and gains 2268J of potential energy. What is the mass of the man?

$h = 3.6\,m$
$PE = 2268\,J$
$m = ?$

$$m = \frac{PE}{hg} = \frac{2268}{(3.6)(9.81)} = 64\,kg$$

h. A 800g ball is pulled up a slope as shown in the diagram. Calculate the potential energy it gains.



$m = 0.8\,kg$
$h = 20\,cm = 0.2\,m$
$PE = ?$

$PE = mgh$
$= (0.8)(9.81)(0.2)$
$= 1.57\,J$

7. What happens to the particles of an object when it rubs against another surface?

They start moving faster, which causes them to heat up.

8. The **faster/slower** something is moving, the **more/less** friction it creates.

9. When discussing friction, Kinetic energy gets transformed into thermal energy.

10. When would you want a high coefficient of friction?

- Snow tires
- Starting a running race (don't want to slip)
- grip tape on bottom of bath tub

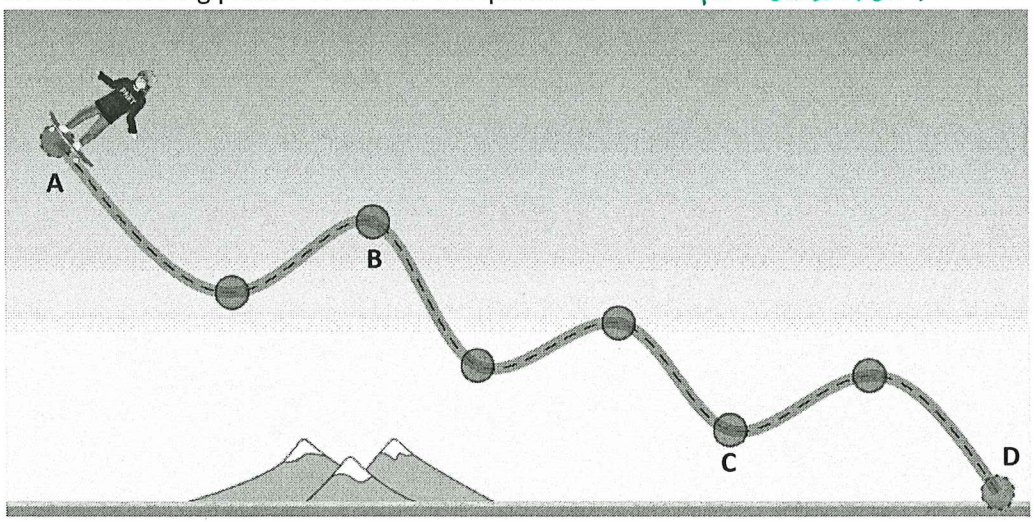
11. When would you want a low coefficient of friction?

- hockey player on skates (wants to go quickly)
- bobsled race
- airplane (low air resistance is better - goes faster)

12. Define "total energy" of a system.

Total energy is a sum of all types of energy present in a system. It doesn't change, just transforms from one type to another.

13. Use the following picture to answer the questions



a. At which point is PE the highest? Explain why.

A - the skater is at highest point

b. At which point has the most energy been converted to thermal? Explain.

D - thermal energy will continue to increase throughout the course (KE gets transformed to E_{th})

c. Describe which types of energy are present at point B.

High PE, medium KE, low (but some) E_{th}

d. Discuss the total energy between points A and C. Explain what types are present at each.

Total energy will be the same!

A = 100% PE, 0% KE, 0% E_{th}

C = 10% PE, 70% KE, 20% E_{th} (yours might be slightly different)