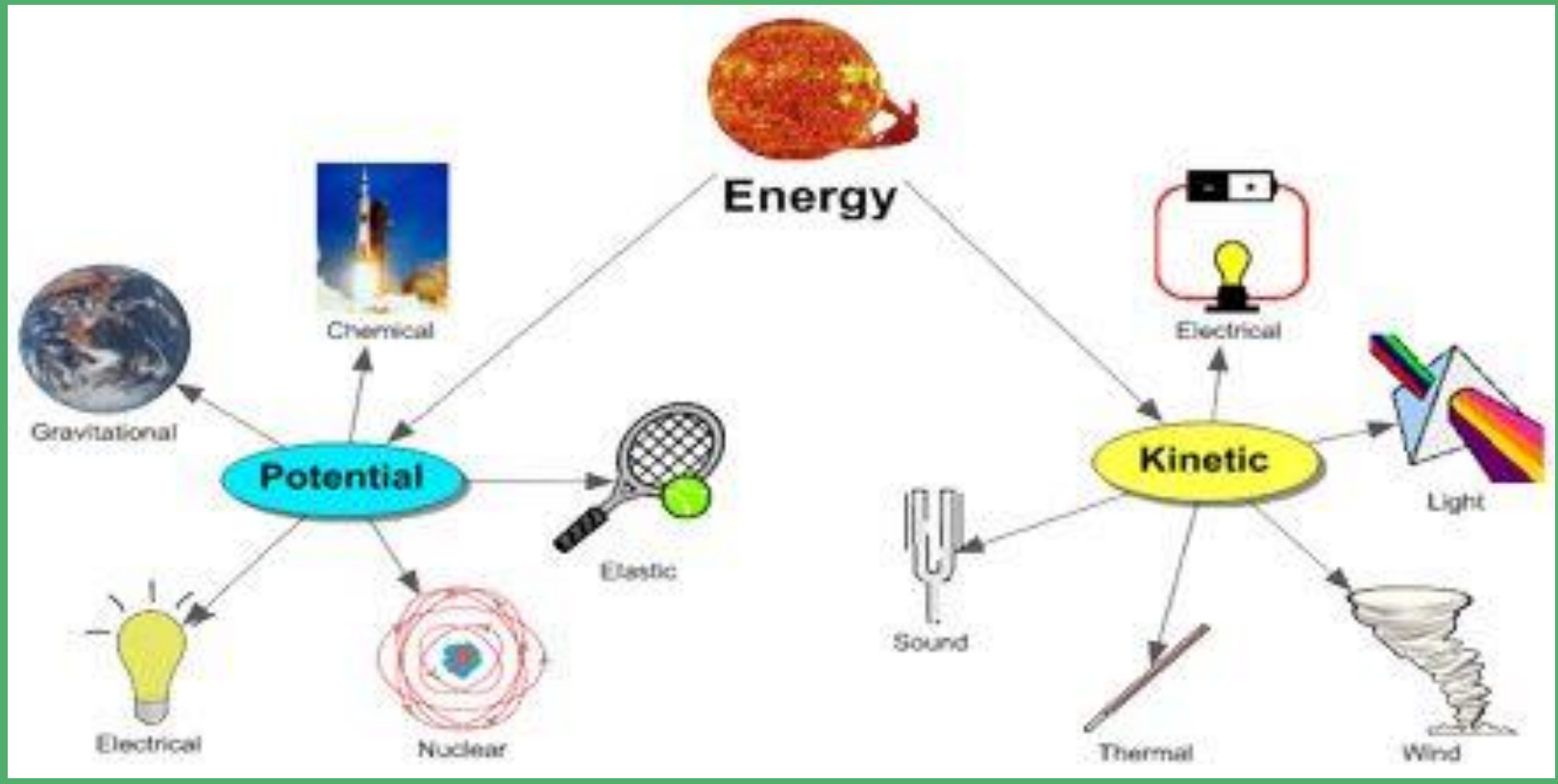
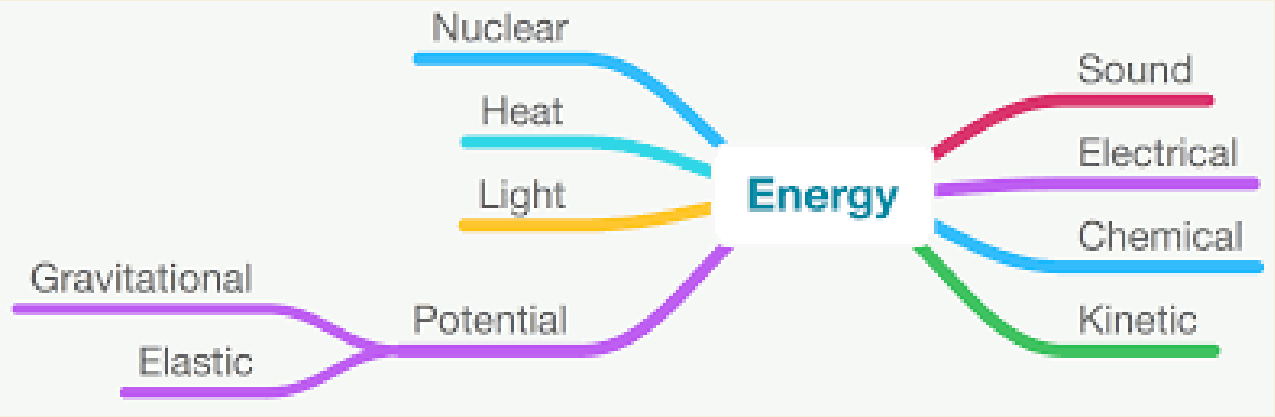
ENERGY


Energy
Potential
Kinetic
Chemical
Gravitational
Elastic
Electrical
Nuclear
Electrical
Light
Sound
Thermal
Wind

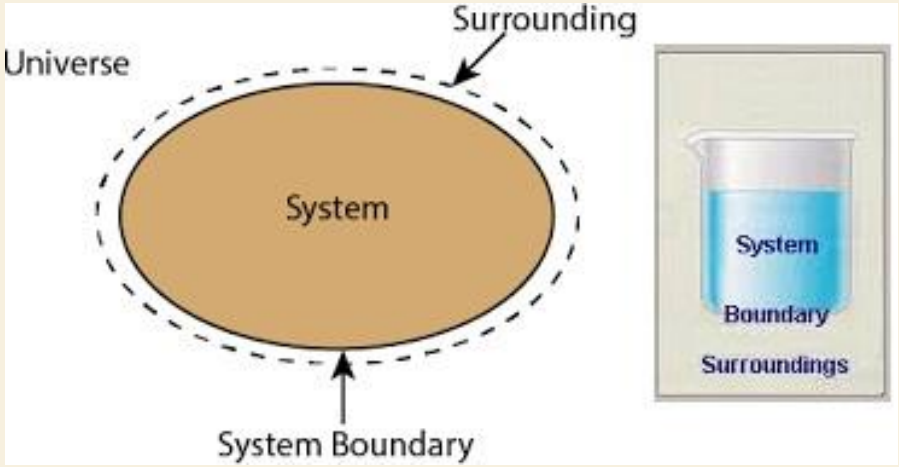
ENERGY CAN PRODUCE CHANGE IN A SYSTEM

- There are different forms of energy that exist.
- These forms of energy can be transferred to an object or transformed into another form of energy.



ENERGY AND SYSTEMS

- **Recall:**
  - **System:** anything that is under observation
    - Defined by the observer
  - **Surroundings:** anything that is not part of a system
  - Universe = system + surroundings



DEFINING ENERGY AND SYSTEMS

- A system is something we define
  - May be defined differently depending on the scientist
  - We define the system so that we can study it or the way it interacts with the surroundings.

- Energy produces a change in the system.
- Energy may be added to the system from its surroundings or released from the system to the surroundings

DISCUSSION QUESTIONS

1. a) Why can it be a challenge to observe energy directly?

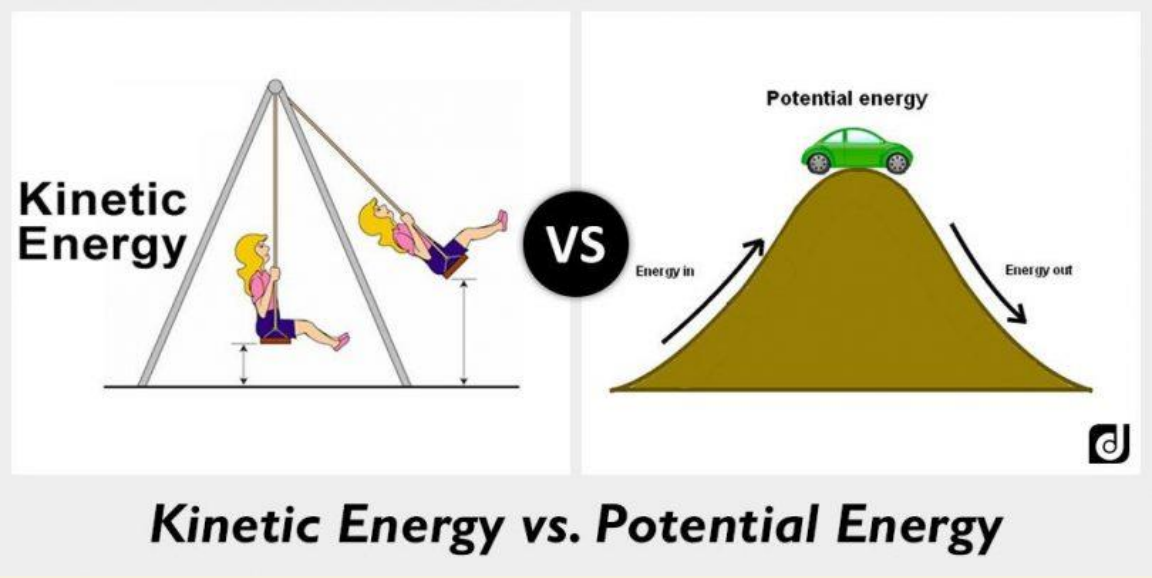
   b) How can this challenge be overcome?

2. a) Describe a system that could be applied to your classroom.

   b) What makes up the surroundings of the system you defined?

THERE ARE DIFFERENT FORMS OF ENERGY

- There are two main types of energy:
  1) **Kinetic energy:** the energy of motion
  2) **Potential energy:** the stored energy of an object as a result of its condition or its position



Kinetic Energy vs. Potential Energy

KINETIC ENERGY

- Types of kinetic energy:
  1) **Mechanical kinetic energy:** energy of an object that is in motion
  2) **Radiant energy:** energy of electromagnetic waves from an energy source
  3) **Thermal energy:** energy of random motion of particles in a substance

p. 203 Kinetic energy

KINETIC ENERGY (CONT'D)

4) Sound energy: energy of vibrations of particles

5) Electrical kinetic energy: energy of electrons moving along a wire

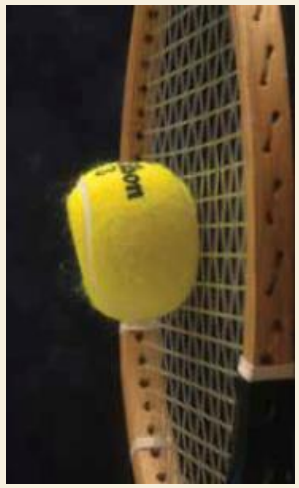
p. 203 Kinetic energy

POTENTIAL ENERGY

- Types of potential energy:

  1) Elastic potential energy: energy stored in a stretched or compressed object

  2) Chemical potential energy: energy stored in chemical bonds



p. 204 Potential energy

POTENTIAL ENERGY (CONT'D)

3) **Gravitational potential energy:** energy due to the position of an object

4) **Nuclear energy:** energy stored in the nucleus of an atom

pp. 204 and 205
Potential energy

POTENTIAL ENERGY (CONT'D)

5) **Electrical potential energy:** energy is stored by a separation of positive and negative charges

6) **Magnetic potential energy:** energy stored in a magnetic field

p. 205
Potential energy

TIME OUT

- Describing Forms of Energy worksheet
- Pg 132 in workbook

Complete the table below.

Form of Energy	Definition	Classified as kinetic energy or potential energy
mechanical kinetic energy		kinetic energy
	the energy of the random motion of the particles that make up a substance	kinetic energy
sound energy		
	the energy due to the position of an object relative to a reference point, such as the	potential energy

DISCUSSION QUESTIONS
*WE WILL DO TOGETHER

1. Use a Venn diagram to compare kinetic and potential energy.

2. Give one example of each of the following:

   a) a form of kinetic energy

   b) a form of potential energy

   c) a form of energy that has both kinetic and potential energy

ENERGY CAN BE TRANSFERRED OR TRANSFORMED.

- **Law of conservation of energy:** law stating that energy is neither created nor destroyed, but is transformed from one form of energy to another

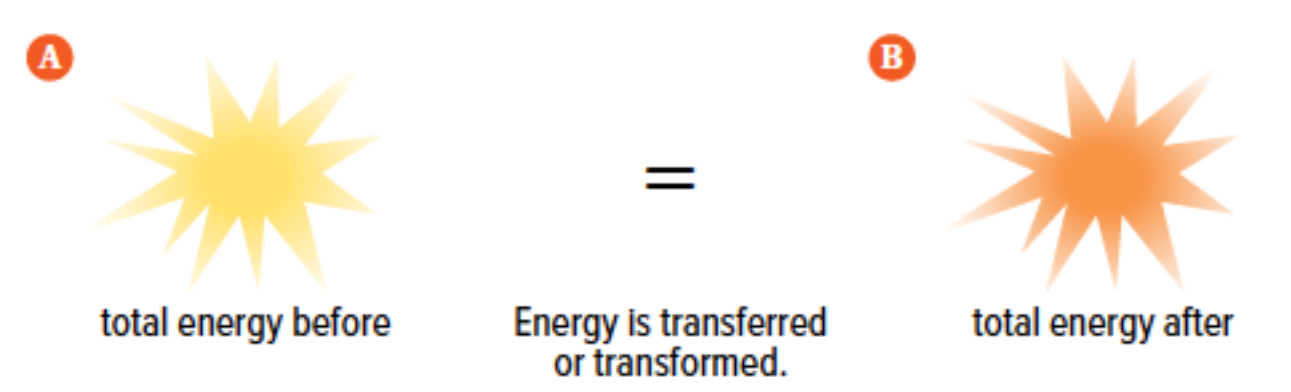


Figure 3.4: According to the law of conservation of energy, energy present before energy transfer or transformation (A) is equal to energy present afterward (B). The form of energy may change (the shapes differ in colour), but the amount of energy remains equal (the size of the shape is the same).

ENERGY TRANSFORMATION, ENERGY TRANSFER, AND SYSTEMS

- When energy transformations occur, some of the energy is converted into a form that is not useful and it is considered to be “lost.”

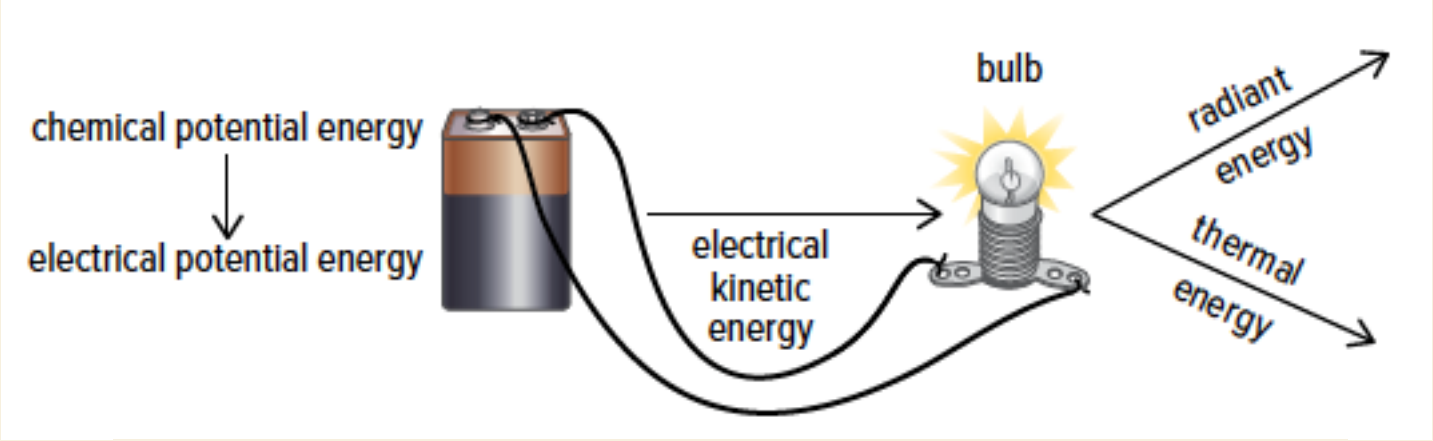
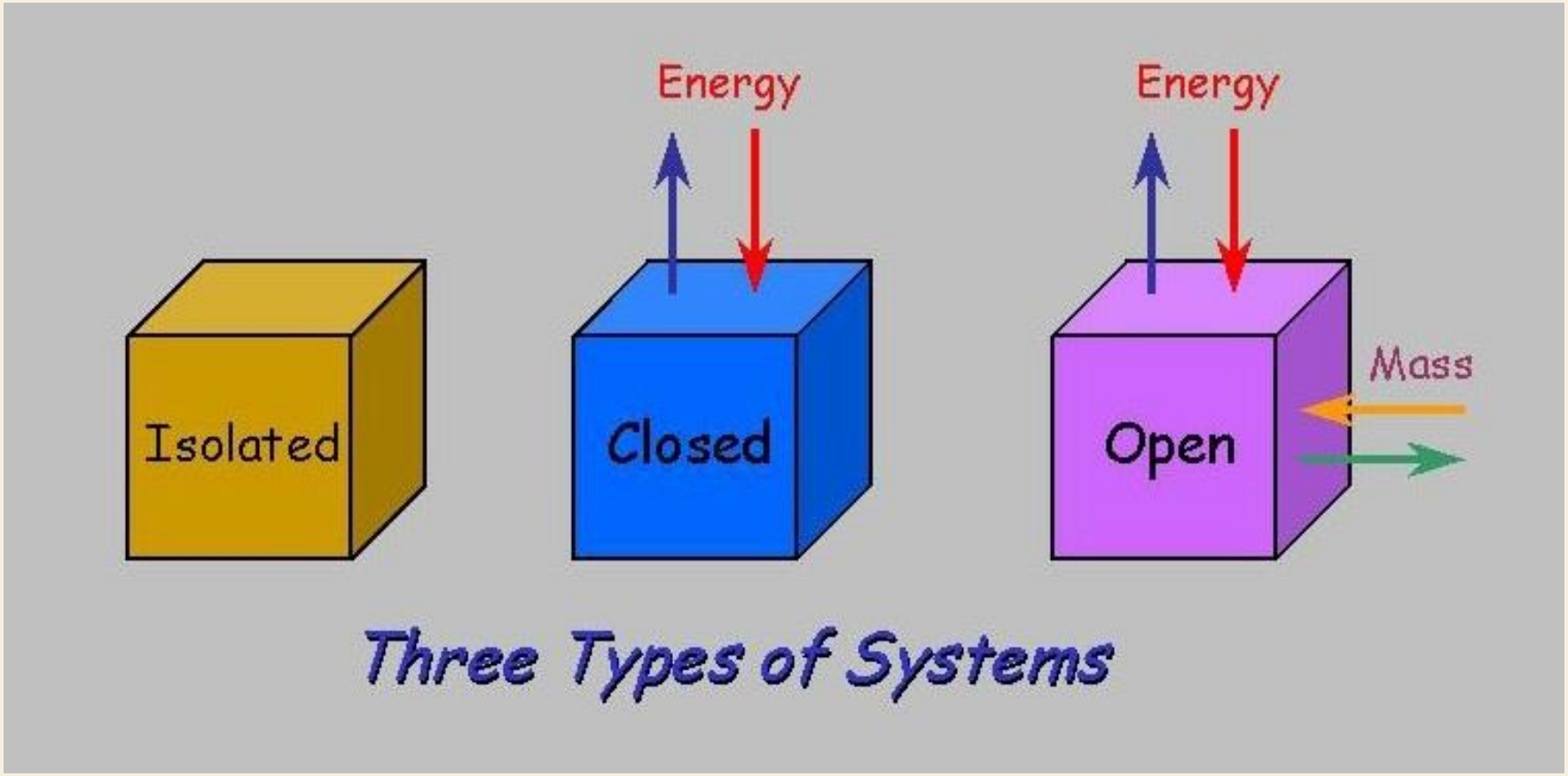


Figure 3.5: Energy is both transformed and transferred in this image, but it is never destroyed. The result is that a useful task is carried out.

TYPES OF SYSTEMS

- There are three types of systems:
  1) Open system: a system that can exchange both energy and matter with its surroundings
  2) Closed system: a system that can exchange only energy but not matter with its surroundings
  3) Isolated system: a system that cannot exchange energy nor matter with its surroundings


Energy
Energy
Isolated
Closed
Open
Mass
Three Types of Systems

COMPARING ENERGY TRANSFER AND TRANSFORMATION

- When energy is *transferred*, it stays in the same form.
- When energy is *transformed*, it changes into another form of energy.

- How is energy transferred?
  Transformed?

DISCUSSION QUESTIONS

1. Describe the law of conservation of energy.

2. How do energy transfer and transformation differ? How are they similar?

3. Use an example from your everyday life to show how you could change an open system to

   a) a closed system

   b) an isolated system

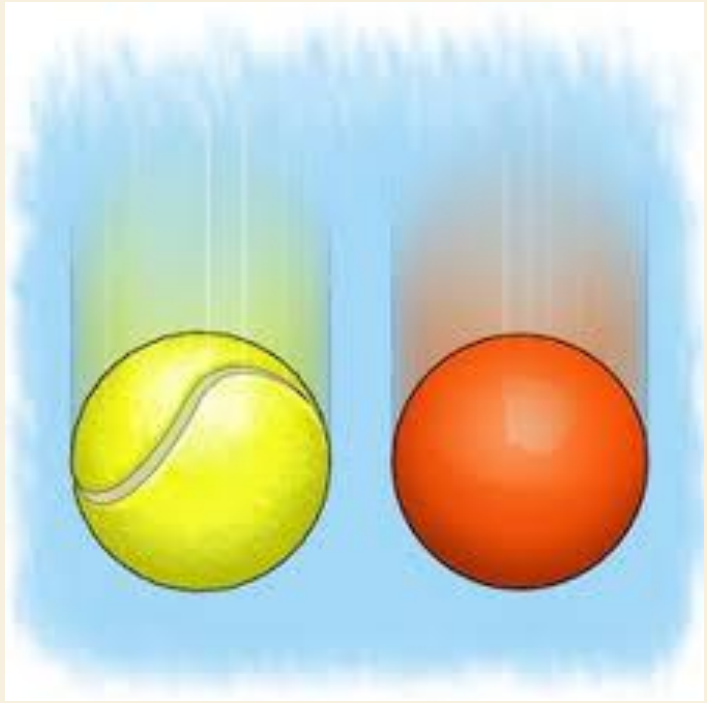
MODELLING ENERGY TRANSFER & TRANSFORMATION

TIME OUT

- Pg 133 in workbook

TIME OUT

- Energy Thought Experiment



PHYSICAL QUANTITIES CONTRIBUTE TO DIFFERENT FORMS OF ENERGY.

- Physical quantities (e.g., height, mass, speed, etc.) can affect different forms of energy.
- For example, the higher the object is above the ground, the more gravitational potential energy it has.

TURN TO PG 211

DISCUSSION QUESTIONS

1. What physical quantities affect
   a) mechanical kinetic energy and
   b) gravitational potential energy?

2. Why might it appear that the law of conservation of energy does not apply to the sled in Figure 3.11?

ENERGY EQUATIONS

- Equation for mechanical kinetic energy (KE):

$$E_k = \tfrac{1}{2} mv^2$$

E_k mechanical kinetic energy (J)

m mass (kg)

v velocity (m/s)

MECHANICAL KINETIC ENERGY EQUATION REARRANGED

$$V = \sqrt{\frac{2E_K}{m}}$$

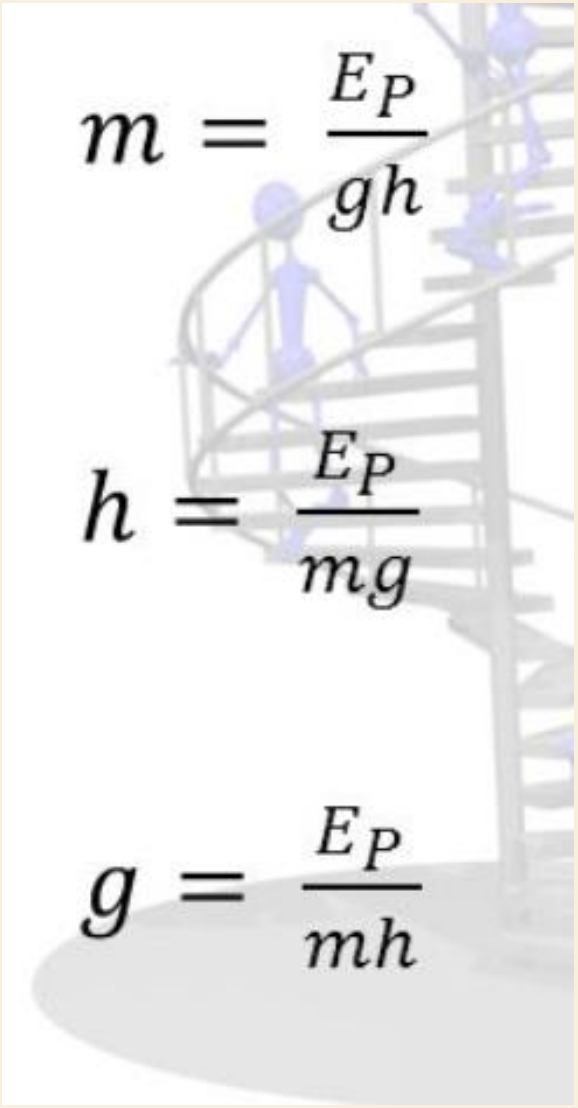
$$m = \frac{2E_K}{V^2}$$

ENERGY EQUATIONS (CONTINUED)

- Equation for gravitational potential energy (GPE):

$$E_g = mg\Delta h$$

E_g	gravitational potential energy (J)
m	mass (kg)
g	acceleration due to gravity (m/s^2)
h	height (m)



$$m = \frac{E_P}{gh}$$

$$h = \frac{E_P}{mg}$$

$$g = \frac{E_P}{mh}$$

PRACTICE PROBLEMS