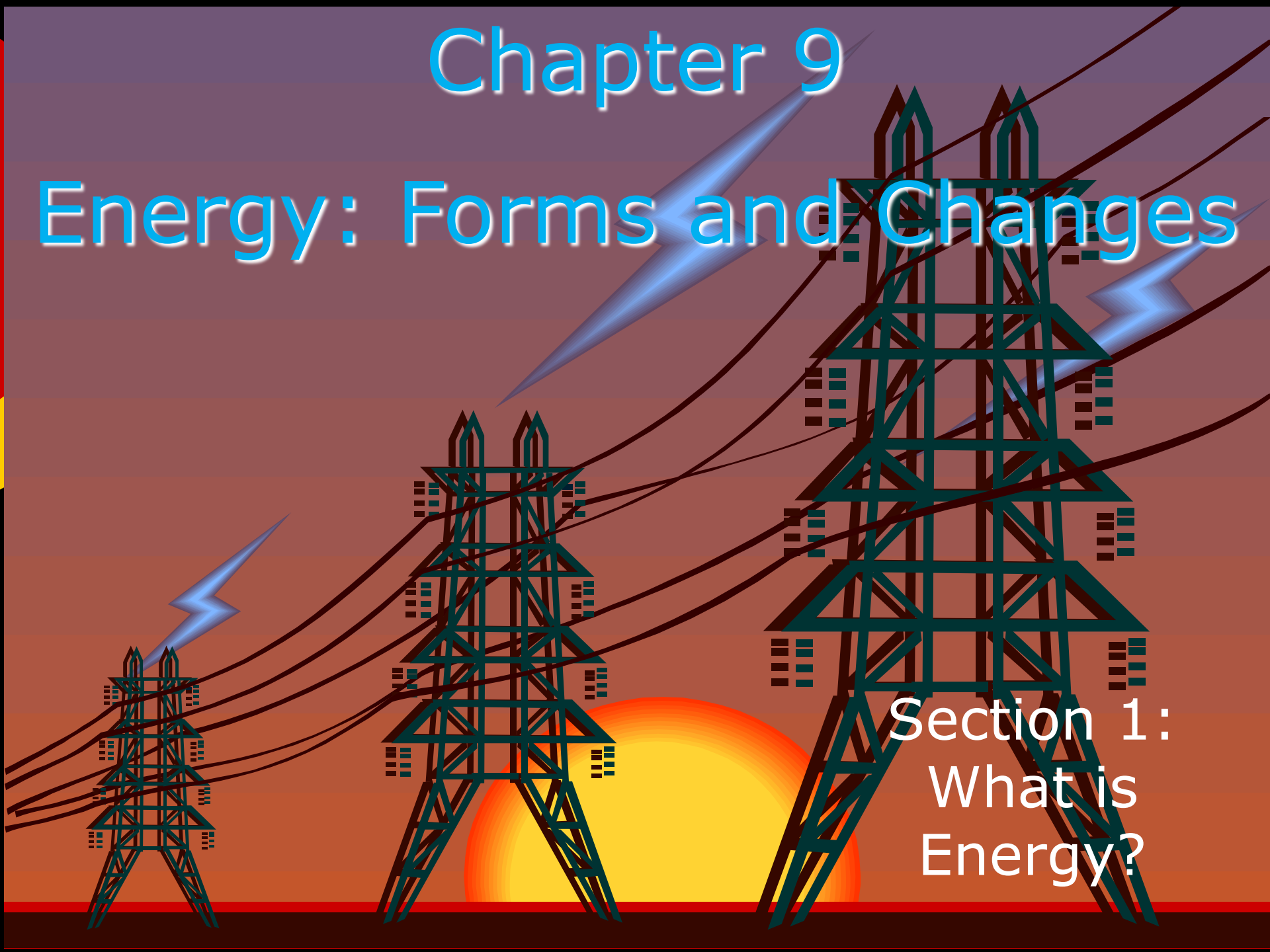


# Chapter 9

## Energy: Forms and Changes



Section 1:  
What is  
Energy?



# Essential questions

---

- What is the relationship between energy and work?
- What is the difference between kinetic and potential energy?
- Identify the different forms of energy and tell about each one.

# Nature of Energy

---

- Energy is all around you!
  - You can hear energy as sound.
  - You can see energy as light.
  - And you can feel it as wind.



# Nature of Energy

---

- You use energy when you:
  - hit a softball.
  - lift your book bag.
  - compress a spring.

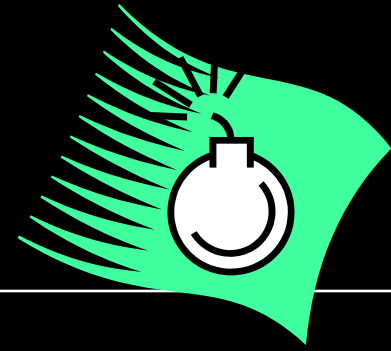


# Nature of Energy



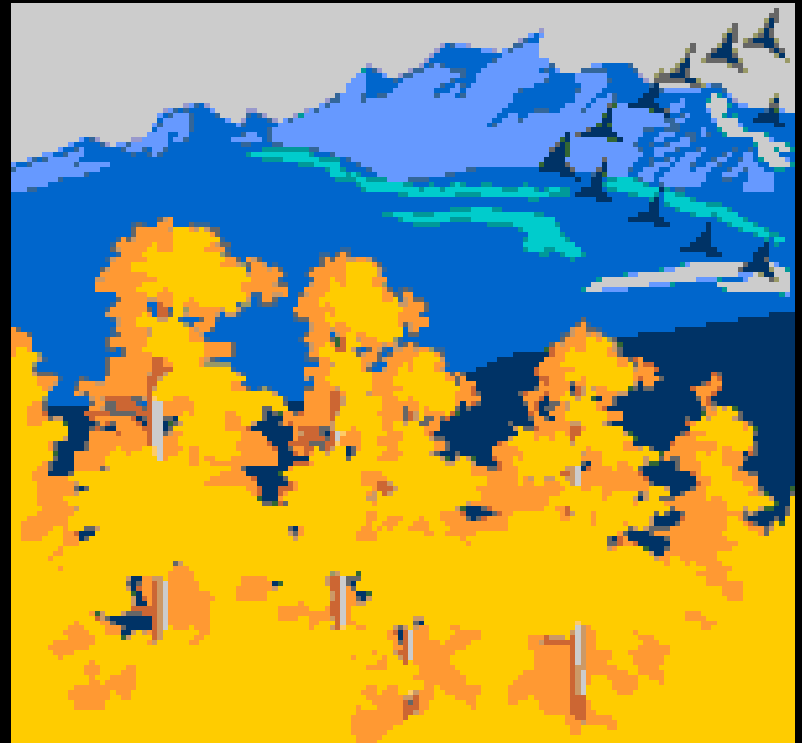
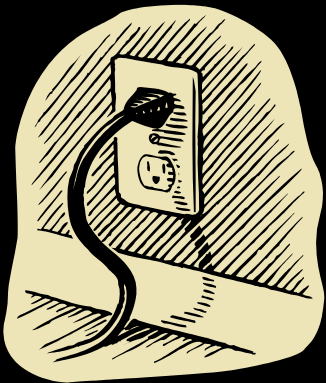
Living organisms need energy for growth and movement.

# Nature of Energy



○ Energy is involved when:

- a bird flies.
- a bomb explodes.
- rain falls from the sky.
- electricity flows in a wire.





# Nature of Energy

---

- What is energy that it can be involved in so many different activities?
  - Energy can be defined as the ability to do work.
  - If an object or organism does work (exerts a force over a distance to move an object) the object or organism uses energy.



# Nature of Energy

---

- Because of the direct connection between energy and work, energy is measured in the same unit as work: joules (J).
- In addition to using energy to do work, objects gain energy because work is being done on them.





## States of Energy:

### Kinetic and Potential Energy

---

- Kinetic Energy is the energy of motion.
- Potential Energy is stored energy.
- Mechanical energy is potential energy + kinetic energy.



# Kinetic Energy

---

- The energy of motion is called kinetic energy.
- The faster an object moves, the more kinetic energy it has.
- The greater the mass of a moving object, the more kinetic energy it has.
- Kinetic energy depends on both mass and velocity.



# Kinetic Energy

---

- Kinetic Energy = mass times velocity squared divided by two

$$\text{K.E.} = \frac{\text{mass} \times \text{velocity}^2}{2}$$

What has a greater affect on kinetic energy, mass or velocity? Why?



# Potential Energy

---

- Potential Energy is stored energy.
  - Stored chemically in fuel, the nucleus of atom, and in foods.
  - Or stored because of the work done on it:
    - Stretching a rubber band.
    - Winding a watch.
    - Pulling back on a bow's arrow.
    - Lifting a brick high in the air.



# Types of Potential Energy

---

- There are 3 types of Potential Energy
  - Gravitational
  - Elastic
  - Chemical

# Gravitational Potential Energy

---

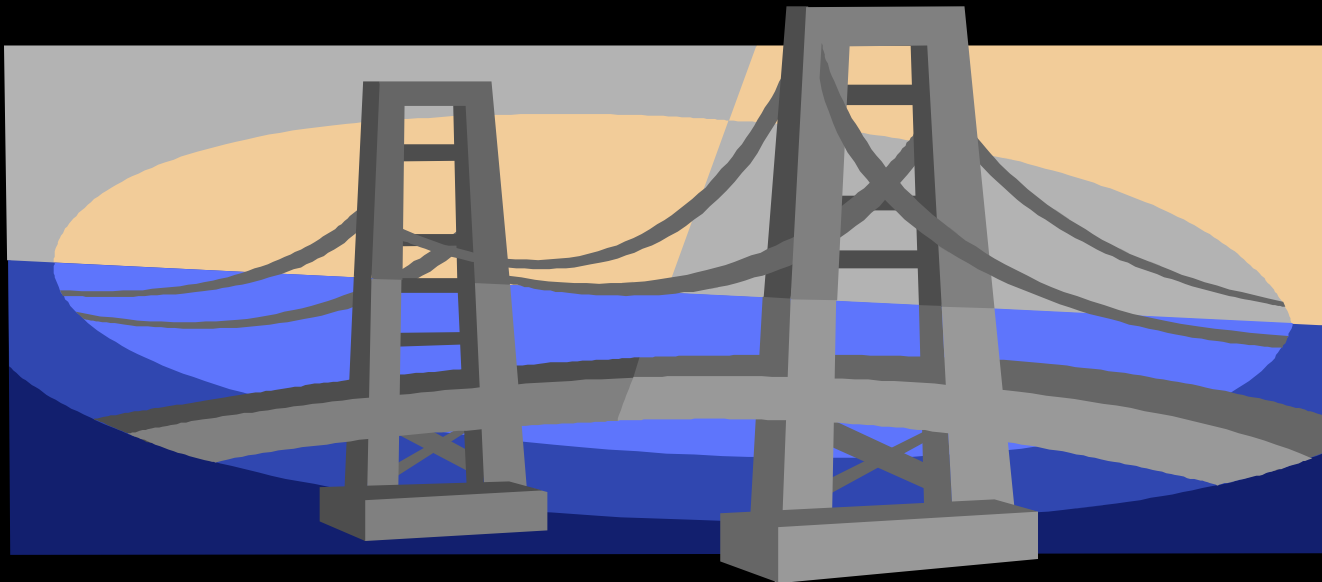
- Potential energy that is dependent on height is called gravitational potential energy.



# Gravitational Potential Energy

---

- A waterfall, a suspension bridge, and a falling snowflake all have gravitational potential energy.



# Gravitational Potential Energy

---

- If you stand on a 3-meter diving board, you have 3 times the G.P.E, than you had on a 1-meter diving board.







# Gravitational Potential Energy

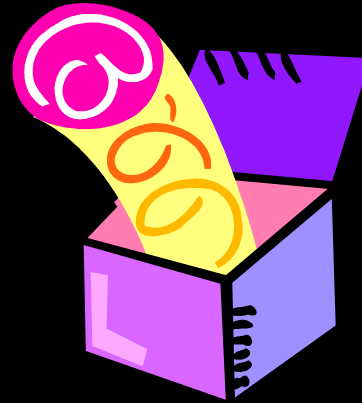
---

- “The bigger they are the harder they fall” is not just a saying. It’s true. Objects with more mass have greater G.P.E.
- The formula to find G.P.E. is  
$$\text{G.P.E.} = \text{Weight} \times \text{Height.}$$

# Elastic Potential Energy

---

- Energy that is stored due to being stretched or compressed is called elastic potential energy.





# Chemical Energy

---

- Chemical Energy is required to bond atoms together.
- And when bonds are broken, energy is released.
- Chemical energy is a form of potential energy because it depends on the position and arrangement of atoms.

# Chemical Energy

- Fuel and food are forms of stored chemical energy.





# Mechanical Energy

---

- When work is done to an object, it acquires energy. The energy it acquires is known as mechanical energy.
- Mechanical energy = potential energy + kinetic energy

# Mechanical Energy

---

- When you kick a football, you give mechanical energy to the football to make it move.



# Mechanical Energy

---



**When you throw a bowling ball, you give it energy. When that bowling ball hits the pins, some of the energy is transferred to the pins (transfer of momentum).**



# Forms of Energy

---

- The other main forms of energy are:
  - Thermal (heat)
  - Electrical
  - Sound
  - Light
  - Nuclear





# Thermal Energy

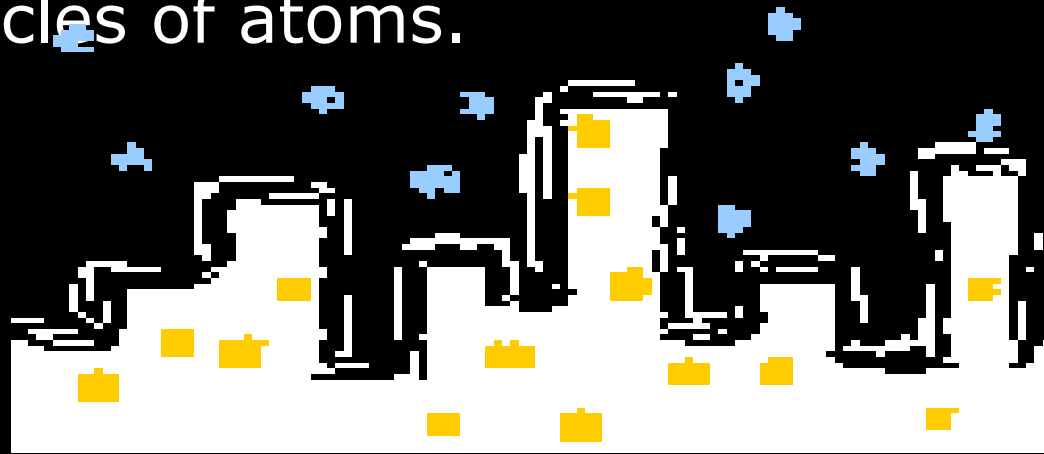
---

- The internal motion of the atoms is called thermal energy, because moving particles produce heat.
- Heat energy can be produced by friction. Faster the particles move, the more kinetic energy and the more heat they produce.
- Heat energy causes changes in temperature and phase of any form of matter.

# Electrical Energy

---

- Power lines carry electromagnetic energy into your home in the form of electricity.
- Electrical energy is the energy of moving electrons.
- Electrons are negatively charged particles of atoms.





# Sound Energy

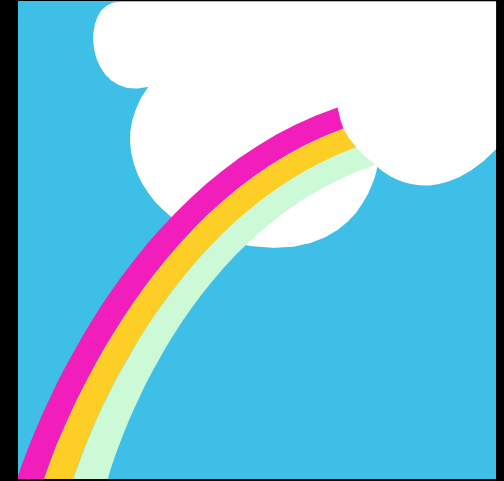
---

- Sound energy is caused by a vibrating object.
- The vibrations are transferred through the air to your ear and your ear deciphers it.

# Light Energy

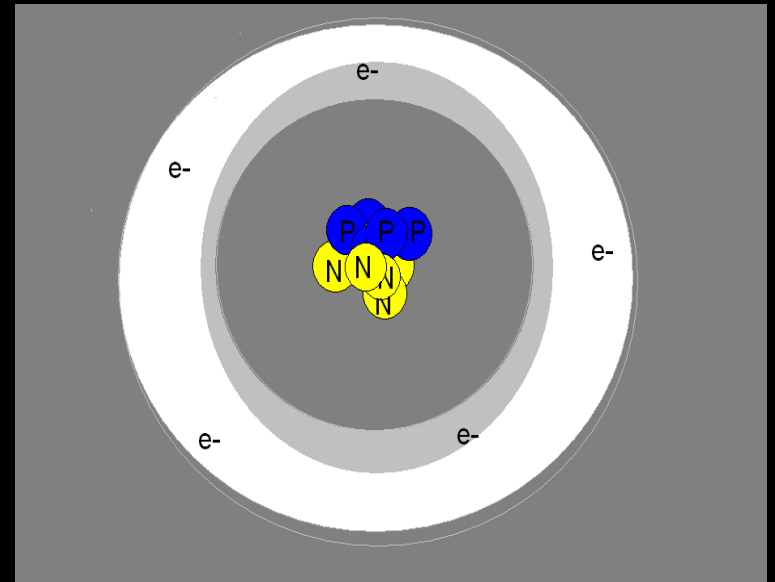
---

- Light is a form of electromagnetic energy.
- Light energy is produced by the vibrations of electrically charged particles.
- Each color of light (ROY G BIV) represents a different amount of electromagnetic energy.
- Electromagnetic Energy is also carried by X-rays, radio waves, and laser light.



# Nuclear Energy

- The nucleus of an atom is the source of nuclear energy.





# Nuclear Energy

---

- When the nucleus splits (fission), nuclear energy is released in the form of heat energy and light energy. Power plants use fission to generate electrical energy.
- Nuclear energy is also released when nuclei collide at high speeds and join (fusion).

# Nuclear Energy

---



- The sun's energy is produced from a nuclear fusion reaction in which hydrogen nuclei fuse to form helium nuclei.
- The sun's heat and light come from fusion.

# Nuclear Energy

---

- Nuclear energy is the most concentrated form of energy.

