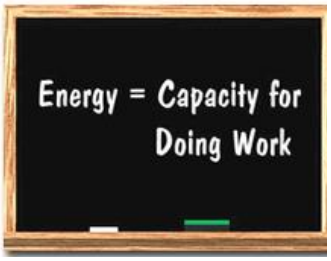
Week 27 – SCIENCE NOTE PAGE
Energy & Work

What is Energy?

- **Energy** – the ability to do **work**
  - Changes in the physical word are possible because of energy: change in speed, change in direction, change in temperature, etc.

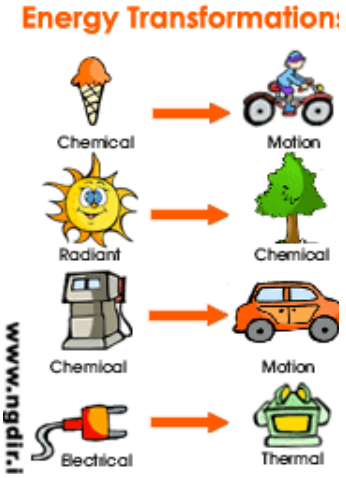


Forms of Energy

- **Mechanical Energy** – the energy of motion and position
- **Chemical Energy** – energy stored in chemical bonds
- **Electrical Energy** – associated with electric charges; electrons moving
- **Sound Energy** – caused due to the vibration of objects or matter
- **Light Energy** – a form of electromagnetic energy; vibration of electrically charged particles which sends light energy out into the space around them
- **Nuclear Energy** – when atoms are split during nuclear fission

Conservation of Energy

- **Law of Conservation of Energy** – states that energy can neither be **created** nor destroyed, but can be transformed
  - Energy can be transferred from place to place and can be converted between the different forms of energy
  - When transferred or converted the amount of energy does not change, it is **conserved**



Energy Transformed

- Energy transformations take place when energy **changes** from one form to another
  - Example: Gasoline contains chemical energy.
    - When it is burned, it is **transformed** into heat energy and mechanical energy.
      - ➢ No energy is lost or gained when the gasoline changes the form from chemical to heat and mechanical energy.

Energy Sources

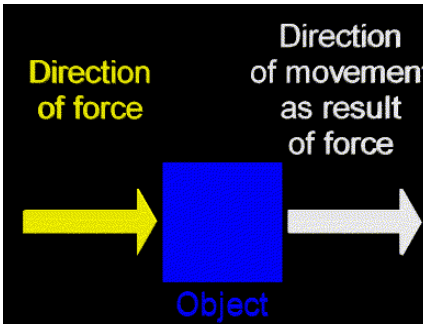
- **Renewable Sources**: can be replaced (in a lifetime);
  - Examples: **sunlight, wind, moving water, wood** _____
- **Non-renewable Sources**: cannot be replaced (in a lifetime);
  - Examples: **coal, oil, natural gas, uranium** _____

Measuring Energy

- **Joule –** is the SI unit for **energy**; 1 joule (J) = 1 Newton-meter (N-m)
  - one joule of energy is used when a force of one Newton is applied over a distance of one meter

What is Work?

- **Work** is when a **force** is exerted on an object and the object **moves** a distance in the direction of the force



Work Depends on Force and Distance

- *W* = Fd (Note: the *W* is in italics)
- Work = Force x distance
    - *W* (work) = How much **work** needs to be done to move a book with a force of 10 Newtons a distance of 1 meter?
    - F (Force) = 10 Newtons or 10 N
    - d (distance) = 1 meter or 1 m
        - *W* = 10 N x 1 m
        - *W* = **10** N-m or **10** joules or **10** J

Work and Time

- Work does not take into account the **time** it takes to complete a task: *W* = Fd
- If you do the work of moving a book using 10 N of force a distance of 1 meter in 2 seconds or 10 seconds or 50 seconds, you still will do 10 joules of work.

Power

- P = *W*/t
- Power = Work/time
    - Power (power) = How much **power** is needed to cut down a tree if using a hand saw or a chain saw?
        - Both a hand saw and a chain saw will do the same amount of work (joules)
            - the chain saw will do the work faster; faster means more power.

The Watt

- P = *W*/t which means power is work (joules) divided by time (seconds) or joules per second or J/s
- Joules per second (J/s) is the SI unit of **power**, also called **watts** or W (Note: the W is NOT in italics)

Power and Energy

- **Power** is the rate at which **work** is done
    - **Work requires energy**
        - Therefore, **power** can also be defined as the rate at which **energy** is used