

UNIT I: MECHANICS

Chapter 9: Energy

IMPORTANT TERMS:

- Efficiency
- Energy
- Fulcrum
- Joule
- Kinetic energy
- Law of conservation of energy
- Lever
- Machine
- Mechanical advantage
- Mechanical energy
- Potential energy
- Power
- Pulley
- Watt
- Work
- Work-energy theorem

EQUATIONS:

$$W = Fd$$

$$\text{Power} = \frac{\text{Work done}}{\text{Time interval}}$$

$$PE = mgh$$

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

$$Fd = \frac{1}{2}mv^2$$

$$\text{Work} = E$$

I. Work (9.1)

A. Work– Force _____ distance

1. Two things enter into every case when work is done.

a. The application of a _____

b. The _____ of something by that force

2. Equation **work = _____ X _____**



3. If object **does not move** then **no** _____ done on the object.

B. Work falls into **two** categories

1. **Work done against another _____** (ie. Work against elastic force, against gravity-lifting object, against friction)

2. Work done to **change _____** of an object (ie. Speeding up or slowing down of a car)

C. Units of Work

1. Combine units of _____ (**N**) with _____ (**m**)

2. A **N-m** is called a _____ (**J**)

a. A joule of work is done when force of _____ is exerted over distance of _____.

b. **kilojoules (KJ)** = _____ joules

c. **megajoules (MJ)** = _____ of joules

II. Power (9.1)

A. **Power** - the _____ at which _____ is done

1. Equals the **amount of work done** divided by **time interval** during which the work is done.

2.



B. Unit of Power is the joule per second– also known as the _____ (in honor of James Watt)

1. **One watt (W) of power is expended when one joule of _____ is done in one _____**

2. **Kilowatt** = _____ watts

3. **megawatt** = _____ watts

4. **One horse power (hp)** = _____

III. Mechanical Energy (9.3)

A. Something has been acquired by object that enables the object to do _____.

1. compression of atoms in material of object

2. physical separation of attracting bodies or rearrangement of electric charges in the molecules of a substance

B. **Energy** –the “something” that enables an object to do work.

1. Like work, measured in _____

2. Energy appears in many forms

3. Two most common forms of mechanical energy

a. Energy due to _____ of something
(Potential Energy)

b. or the _____ of something
(Kinetic Energy)

IV. Potential Energy (9.4)

A. Object may store energy by virtue of its _____

1. **Potential Energy (PE)** - energy _____ and held in readiness

a. Has **potential for doing** _____

b. Many types of PE - compressed spring, stretched rubber band, chemical energy (fossil fuels, food, etc.)

B. **Gravitational Potential Energy** - PE due to _____ positions

1. **Gravitational PE = work done against**

_____ **in** _____ **it.**

2. gravitational PE = _____ x _____

3.

a. **height** = distance above some chosen _____ **level** (such as ground or floor of building)

b. **gravitational PE** only depends on _____

c. Gravitational PE **does not depend** on the _____ taken to get it there

V. Kinetic Energy (9.5)

A. **Kinetic energy** = “energy in _____”

1. Object that is **moving** has potential of doing _____

2. **KE** depends on **mass** of object as well as **speed**

B. KE of moving object =

1. work required to bring it to that speed from _____

2. or the work the object can do while being brought to rest

VI. Work-Energy Theorem (9.6)

A. Work _____ amount of energy

B. If no change in energy than no _____ done

C. When work is done _____ changes



VII. Conservation of Energy (9.7)

A. Law of conservation of Energy

1. Energy cannot be _____ or _____.
2. It can be _____ from **one form to another**
3. **Total amount of energy** _____ **changes**

B. Many forms of energy transformation

1. **PE to KE or KE to PE**
2. Thermonuclear, light, heat, chemical, electrical, etc.

VIII. Machines (9.8)

A. **machine** - device used to _____ **forces** or **change** _____ **of force**

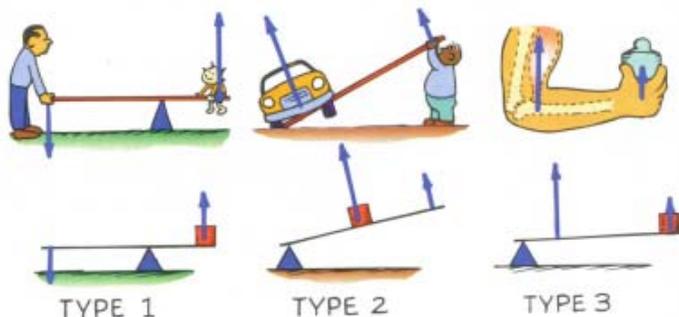
1. **Lever**– direction of force is changed.
2. **work input equals work output**
 - a. Since work equals force times time, we get:



3. **fulcrum**– _____ point of lever

B. **Mechanical advantage**– ratio of output force to input force

1. Three kinds of levers



2. **Pulley**– basically kind of lever can be used to change the direction of force and to multiply force

IX. Efficiency (9.9)

A. **efficiency** = ratio of useful work output to total work input



1. **Efficiency will always be a fraction less than** _____

2. Transforming 100% of thermal energy into mechanical energy is _____ **possible**

a. Engines lose energy in form of _____
(thermal energy)

b. Lose energy by _____

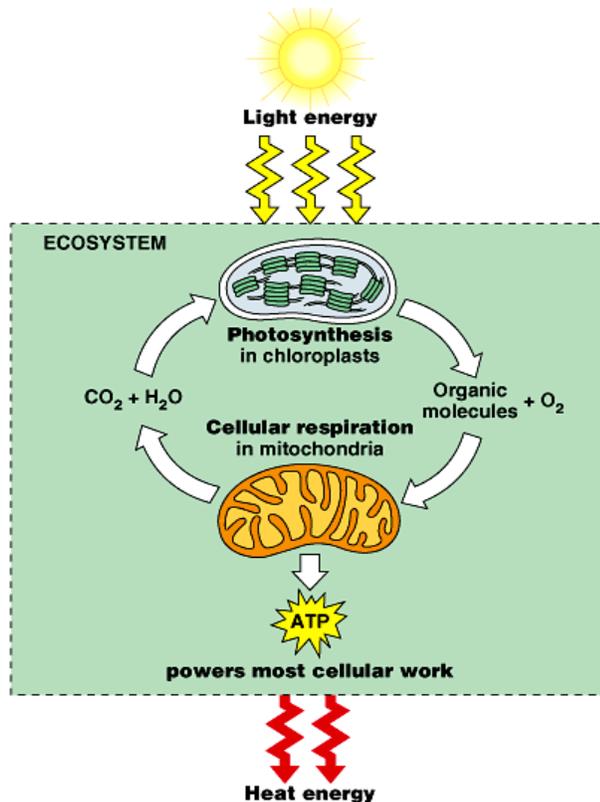
c. Best designed engines not more than _____% efficient.

X. Energy of Life (9.10)

A. Every cell in every organism is a machine

B. **Cellular respiration**- organisms gain energy from food

C. **Photosynthesis**– sunlight converted into chemical energy.



XI. Sources of Energy (9.11)

A. The sun is the source of practically all our energy on Earth

1. Exceptions are _____ and _____ energy

2. Fossil fuels (oil, natural gas, coal) comes from sun- created by _____

B. Solar Power-

1. Sunlight transformed into electricity by _____ cells

2. Use suns energy indirectly with _____ power

3, Energy of _____ created by suns warming of air

C. Fuel Cells- hydrogen and oxygen combine to form _____ and _____

D. Nuclear and Geothermal Energy

1. Most concentrated form of useable energy stored in uranium and plutonium (_____ fuels)

2. Byproduct of radioactivity in Earth's interior is _____