ENERGY

Objective: Lab 6.1

Agenda

- Theory: Total Energy
- Theory: Conservation of Energy
- Examples
- Lab 6.1: Conservation of energy

Energy - Definitions

- **Energy** – The capacity to do work.
- **Potential Energy (PE)** – Energy associated with forces that depend on the position or configuration of a body. It is measured in Joules (J).

$$GPE = mgh$$

- **Kinetic Energy (KE)-** Energy of motion. It is measured in Joules (J) Energy = Joules (J)

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

Why do we study Total Energy & Conservation?

We use total energy to study kinematics problems from a different perspective. All of the problems and exercises that we will talk about can be solve either using kinematics or newton’s laws.

TOTAL ENERGY

UNIT 6: ENERGY

Total Energy (E_T)

Total energy refers to the **addition** of both types of energy that we have talked about so far.

At any point along a path, the total energy is the sum of the kinetic energy and the potential energy.

This is also known as mechanical energy.

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

This allows us to find other types of information about certain situations

Total Energy (E_T)- Examples

Example I: Ball

A ball is suspended 2.00 m above the ground. If the ball has a mass of 150 g, what is the total energy at 2.00 m, 1.00 m, and just above the ground (0.00 m)? Calculate KE and PE at each point.

Total Energy (E_T)- Examples

Example II: Johnny Knoxville

Johnny Knoxville stands on top of a 12.0 m tall roof. What is the total energy of this 40.0 kg man:

- Before he falls from the roof,
- Half way down,
- As he reaches the ground?

Total Energy (E_T)- Examples

Example III: Cannon

A cannon fires a cannonball straight up at a velocity of 100 m/s. What is the maximum height of the 50.0 kg cannonball?

CONSERVATION OF ENERGY

UNIT 6: ENERGY

Conservation of Energy

The Principle of Conservation of Mechanical Energy: The mechanical energy of a system neither increases nor decreases in any process. It stays constant and is conserved.

$$\text{Total Energy}_1 = \text{Total Energy}_2$$

$$KE_1 + PE_1 = KE_2 + PE_2$$

$$\tfrac{1}{2} mv_1^2 + mgh_1 = \tfrac{1}{2} mv_2^2 + mgh_2$$

Total Energy (E_T)- Examples

Example I: Rock

A rock is dropped from the top of a 150 m cliff. If the 50.0 kg rock falls to the ground, what is the velocity of the rock just before it hits?

Use the conservation of energy.

Use constant acceleration formulas.

Total Energy (E_T)- Examples I

Example II: Total Energy of a Pendulum

A pendulum is released from rest and swings from h_1 to h_2 as it travels through its cycle. h is 1.50 m. Determine the velocity of the bob at h_2.

LAB 6.2

UNIT 6: ENERGY

Lab 6.1: Conservation of Energy

Read the lab first!

Pay attention to the explanation of the lab

Follow the instructions of the lab

You can do the lab in groups of 4

Everyone needs to do their own lab report in the lab notebook

Ask questions if you have any

If you start getting to loud or to out of control, I will stop the lab and we will continue with class.

LAB 6.1 report - Expectations

Your lab report should have the following items

- **Title of the experiment and date**. These will go at the top of the first page of each lab.
- **Objective/purpose** (look at the objective above and paraphrase) Give a brief statement of what you are attempting to do in the lab.
- **Data-** Record all your data directly in your notebook. Organize your data in a neat and orderly form. This is where your tables should go.
- **Result-** Include equations/formulas used. Your calculation should go in this section. Remember you only have to a sample calculation for each value determined.
- **Summary-** This section should have a brief summary of the point/purpose of the lab. Include here your opinion of the lab, focusing on what you learned. Your percent error calculation should go in this section. Any questions that the lab asks you be answer here. Re-write the question if you have to.
- **Conclusion-** The wrap-up of the research based on the data and information retained. Answer the following questions: Was your hypothesis supported? (not right or wrong)
- What data or support do you have that shows if your hypothesis was supported or not?
- What should the person do next base on this information?