WORK, FORCE AND ENERGY

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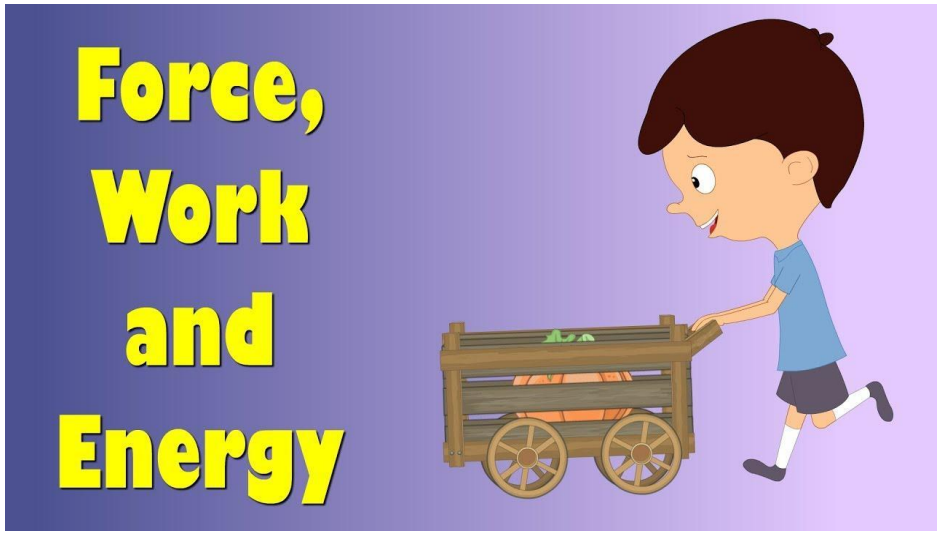
MOST ESSENTIAL LEARNING COMPETENCIES

Objectives:

Lesson 2: Work, Force, and Energy.

By the end of this lesson, students will be able to:

1. Define and differentiate between work, force, and energy.
2. Apply the concepts of work, force, and energy to solve simple problems.
3. Define its units



INTRODUCTION

What Are Work, Force, And Energy?

WORK	FORCE	ENERGY
Work is the application of energy to a system in order to cause motion.	A force is any pushing or pulling action that is applied to an object.	The capacity to perform work is one definition of energy.
Work done is always the same.	**Force** is a **vector** quantity as it has **direction** and **magnitude**.	There are various forms of energy, including kinetic and potential.
Where F is the applied force and d is the displacement, W is the mathematical expression of work.	The work that is done never changes. For any given mass, an increase in the force acting on it will result in a greater acceleration.	The capacity to perform work is one definition of energy. Where m is mass, v is velocity, g is the acceleration due to gravity, and h is height, the mathematical representation of energy is KE = 1/2 mv2, and PE = mgh.

LESSON 1: WORK, FORCE AND ENERGY

The Epic Water Slide combines Work, Force, and Energy!

Imagine standing on top of a giant water slide, a soaring thrill ride. You get excited looking down. You breathe deeply and dive into physics' thrilling adventure!

Work, Force, and Energy:

Work: As you slide down, gravity becomes your best buddy, helping you work. As you descend, you exert a force against gravity. This force multiplied by slide distance produces work.

Force: Your slide ride shows force. Gravity accelerates you down the slide. The slide's surface pushes against gravity, keeping you from falling. These forces balance for a thrilling ride.

Energy: Energy controls the water slide. Your location is relative to the earth stores potential energy at

the top. Potential energy becomes kinetic energy as you drop. Speed increases kinetic energy. Energy changes keep you stimulated as you twist and turn.

LET'S TRY THIS!

Direction: Arrange the following jumbled letters.

1. WPERO

2. NEEYRG

3. CFERO

4. ISDCENTA

5. RWKO

6. IKITCEN EENRYG

7. FROEC

8. OTILAPENT

WORK

There are some key distinctions between the common understanding of "work" and the scientific one. Work, as defined by a scientist, does not include activities such as taking a test or carrying a heavy burden on flat land. According to the scientific definition, work is directly related to energy transfer.

When an item is subjected to a force and it subsequently moves in the same direction as the applied force, a transfer of energy known as "work" takes place. When the thing moves in the direction of the force, work has been done.

The formula for calculating work (W)

Work = Force x Distance

$$W = F.d$$

- **W** stands for work, and its unit of measurement is joule (J).
- **F** is the force applied to the object, expressed as a newton (N).
- The change in position of the object in the force's direction, denoted by the symbol **d**, is measured in meters. (m)
- The angle between the force's and the displacement's sides is called theta (**θ**).

TRY THIS!

1. Calculate the work done by a 47 N force pushing a pencil 0.26 m.

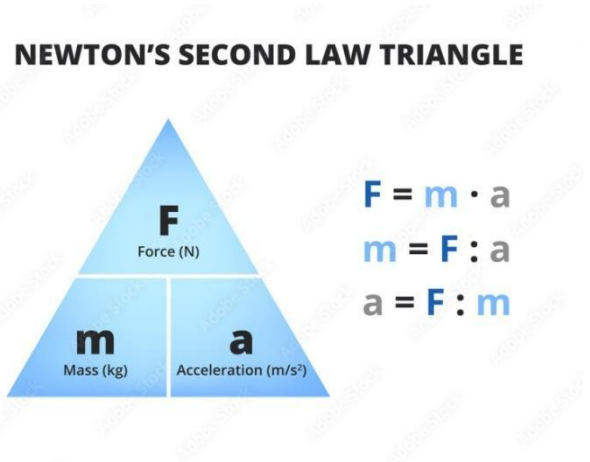
W= F x d

W= (47) (0.26) = **12.2J**

FORCE

In the fields of science, the concept of force is considered to be the most fundamental. It is the application of a force, such as a push or pull, to an object, which can cause the object to start to move, allow it to stop moving, or cause it to change its speed or direction. Due to the fact that it is a vector quantity, it includes both magnitude and direction. Newtons (N) are the standard units for measuring force. The work that is done never changes.

According to Newton's second law, the force exerted on an object results in an acceleration that is proportional to the magnitude of the force and inversely proportional to the mass of the object that is in motion. The representations form of Newton's second law is as follows:



where:

- **F** stands for force (expressed in newtons, **N**).
- The object's mass (**m**) is expressed in kilograms (**kg**), and
- Acceleration (**a**) is expressed in meters per second squared (**m/s²**).

LET'S TRY THIS!

Find the magnitude of force acting upon a cart weighing 100 N and accelerating at the rate of 2.5 m/s^2.

m= f/a

M= f/a

$$= \frac{100N}{(2.5\ m/s^2)}$$

= **16kg**

ENERGY

Energy is the ability to perform actions or to bring about changes in an object or a system. It can be found in many different forms, including thermal energy (heat energy), electrical energy, potential energy (energy stored in an object due to its position or state), and kinetic energy (energy of motion). Depending on the type of energy, joules (J) or other suitable units are used to measure it.

Energy can be transported or transformed between different forms and exists in various forms, but it is always conserved, thus it cannot be created or destroyed.

Here are a few common forms of energy:

Kinetic energy is the energy that an object produces as a result of motion.

$$K.E = \frac{1}{2} mv^2$$

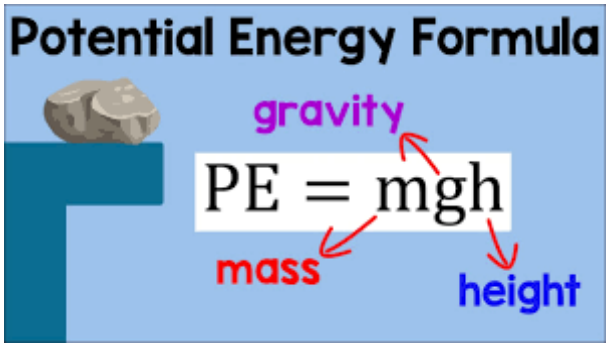
where:

- Kinetic energy (**KE**) is measured in joules, or **J.**
- The object's mass, **m**, is expressed in kilograms (**kg**), and
- its velocity, **v**, is expressed in meters per second (**m/s**).

Potential Energy is the energy that an object can hold depending on its position or state. It can also take on many different forms, including chemical, elastic, and gravitational potential energy.

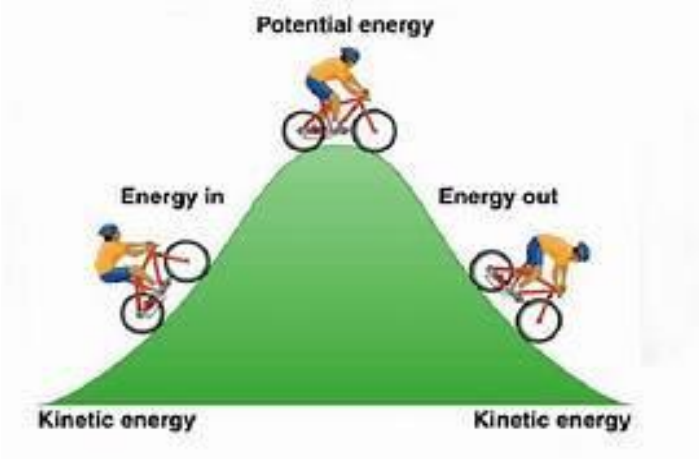
Gravitational potential energy, which is based on an object's position in relation to the Earth's surface, is

the most common kind of potential energy. The following formula gives the potential energy (PE):



where:

- Potential energy (**PE**) is denoted by the unit joules (**J**).
- The object's mass, **m**, is expressed in kilograms, **kg**.
- The acceleration brought on by gravity is known as **g**, and it is approximately **9.8 m/s²** on Earth's surface.
- **h** is an object's height or vertical separation from a reference point, expressed in meters (**m**).



LET'S TRY THIS!

Calculate the kinetic energy of a 45 gram golf ball traveling at:

(a) 20. m/s, (b) 40. m/s, (c) 60. m/s.

Convert the 45g □ kg

45g x 1kg = **0.045kg**

1 1000g

a. KE=1/2 mv²

=1/2 (0.045kg)(20m/s)²

=1/2 (0.045kg)(400mls)

= **9J**

b. KE=1/2 mv²

=1/2 (0.045kg)(40m/s)²

=1/2 (0.045kg)(1600m/s)

=**36J**

c. KE=1/2 mv²

=1/2 (0.045kg)(60m/s)²

=1/2 (0.045kg)(3600m/s)

=**81J**

Assessment

Instructions: Answer the following questions to test your understanding of work, force, and energy concepts. Choose the best option.

1. Which of the following best defines work in physics?

a) The application of force to an object.

b) The displacement of an object.

c) The transfer of energy when a force is applied to an object causing it to move.

d) The change in an object's shape or position.

2. What is the SI unit of force?

a) Newton

b) Kilogram

c) Watt

d) Joule

3. What is the formula for calculating kinetic energy?

a) KE = m * g * h

b) KE = (1/2) * m * v^2

c) KE = F * d * cos(theta)

d) KE = P * t

4. True or False: Energy can be created or destroyed.

a) True **b**) False

5. Which of the following is an example of potential energy?

a) A moving car

b) A stretched rubber band

c) A falling leaf

d) A spinning top

6. The rate at which work is done or energy is transferred is known as:

a) Power

b) Force

c) Energy

d) Velocity

7. Which of the following best describes the relationship between work, force, and displacement?

a) Work is directly proportional to force and displacement.

b) Work is inversely proportional to force and displacement.

c) Work is directly proportional to force and inversely proportional to displacement.

d) Work is inversely proportional to force and directly proportional to displacement.

ASSESSMENT

Answers:

1. c) The transfer of energy when a force is applied to an object causing it to move.
2. a) Newton
3. b) KE = (1/2) * m * v^2
4. b) False
5. b) A stretched rubber band
6. a) Power
7. c) Work is directly proportional to force and inversely proportional to displacement.