Energy

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Basic Concepts

Basic Concepts, pt. 1

- Energy: the ability to do stuff
- Types of Energy:
  - **Kinetic**
  - **Gravitational**
  - **Elastic**
  - Heat
  - Chemical
  - Electrical
  - Nuclear
  - **Potential**

Basic Concepts, pt. 2

- Work: the energy needed to enact a force through some displacement
- Work Equation:
  - $W = F_{//} d$ (force parallel x displacement)
  - Parallel b/c only the parallel force to the displacement can do work.

Basic Concepts, pt. 3

- Energy is the ability to do **WORK**
- Kinetic Energy: the energy of motion
- $KE=mv^2$
- Work Energy Theorem: **NET** Work is equal to the change in KE.
- $W=\frac{1}{2}(mv_2^2-mv_1^2)$

Basic Concepts, pt. 4

- Potential Energy: how much energy an object has by virtue of its position or configuration
- PE_g=mass x gravity x height
- $W_g = \Delta PE_g$
- Spring Force: Hooke's Law
  - $F_s = -kx$

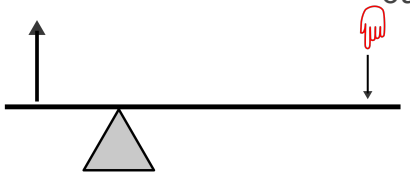
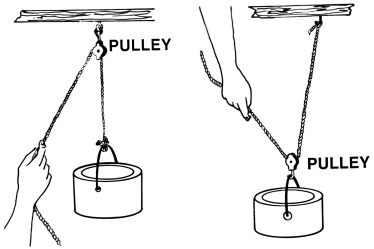
k=spring constant
x=stretch/compress displacement

Basic Concepts, pt. 5

- TOTAL MECHANICAL ENERGY: $E = KE + PE$
- Conservation of Energy: $KE_1 + PE_1 = KE_2 + PE_2$
- Dissipative Forces: forces that reduce total mechanical energy (friction)
- Mass Energy: $E=mc^2$
- Mass ≠ measured amount of matter
    - Mass = how hard it is to accelerate an object or how much gravitational force an object will feel.
    - Ex: A running watch has more mass than a stopped watch.

Basic Concepts, pt. 6

Machines!

- Mechanical Advantage= F_{out} / F_{in}
- Levers:  Pulleys: 

- Mechanical Advantage: $MA_{lever}=L_{in}/L_{out}$ MA_{pulley}=number of pulleys
- All mechanical advantage is F_{in}/F_{out}

Basic Concepts, pt. 7

- Efficiency= output work/input work
- Power: Average power is the taste at which work is done
- Power Equation: P=W/t

Common Mistakes and Misconceptions

Common Mistakes or Misconceptions

Misconception: When speed remains constant and direction changes, velocity stays the same.

When an object changes speed and direction, velocity also changes.Velocity is a vector which mean it has magnitude and direction, so when direction changes so does its velocity. Kinetic energy stays the same because direction does not matter and the speed it constant.

Common Mistakes or Misconceptions

Misconception: The total potential energy is not equal to the work done on the object.

PE=mgh the “work done” by gravity in bringing an object down is converted into potential energy. Work done= change in PE this only applies to isolated systems. If a system is not isolated then potential energy is not conserved.

Common Mistakes or Misconceptions

Misconception: If an object attached to a string and being swung in a circle, work is done by the tension in the string.

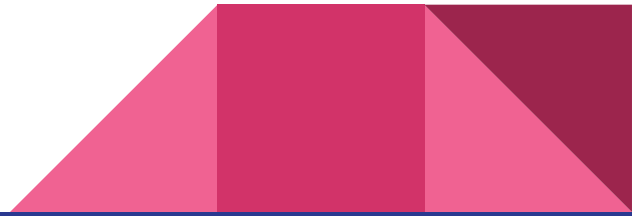
No work is done by the tension in the string because work requires displacement. The force of tension is moving inwards not in a circular path.

Common Mistakes or Misconceptions

Common Mistakes

Forgetting to convert units

Fout/Fin= Lout/Lin



Best Way to Understand the Topic

How do you figure out what the question is asking?

- The best way to look at these problems is pulling out what you know based on the information they give to you.
- Then you find out what you're looking for creating an main idea of what formula is needed in order to solve it correctly.

I lift a box from the ground upwards onto a table that is 1.3 meters high. If the box has a mass of 20.42 kilograms, how much work did you do against gravity?

Example

Example

Work Done Against gravity

I lift a box from the ground upwards onto a table that is 1.3 meters high. If the box has a mass of 20.42 kilograms, how much work did you do against gravity?

Looking for:

The amount of work done against gravity.

Given:

Mass of box= 20.42 kg

Acceleration due to gravity= 9.81 m/sec^2

Height= 1.3 m

Relationship: W=mgh

W=(20.42 kg)x(9.81 m/sec^2)x(1.3 m)

W=260 J

The end.