

What is NRG and the Conservation of NRG

13.3-13.4

What is NRG

13.3

Key Ideas

- What is the relationship between NRG and work?
- Why is potential NRG called *NRG of position*?
- What factors does kinetic NRG depend on?
- What is nonmechanical NRG?

NRG and Work

- **NRG** is the ability to do work
- Whenever work is done, NRG is being transferred or transformed
 - PE → KE
 - KE → Electrical NRG
- NRG is measured in Joules (J)



Potential NRG



- **Potential NRG** is stored NRG
 - Elastic NRG: Stretched rubber band
 - Gravitational: Due to height
 - This is also called *NRG due to position*



$$PE = mgh$$

$$J = \text{Kg} \cdot \text{m} / \text{s}^2 \cdot \text{m}$$

Question...

- What would happen to the PE if the mass is doubled?
- If the mass stays the same but the PE was reduced by half, what happened to the height?

Example

- A 2.5 kg create is hanging from a building. If the building is 25 meters tall, how much PE does the create have?
- What is the mass of a box if it has 313.6 J of PE and is on top of a 4 meter tall table?

Practice

- Get into groups of 2-3 and complete the following
 - Page 446
 - 1a
 - 2
 - 3



Kinetic NRG

- **Kinetic NRG** is the NRG of motion

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

$$J = \frac{1}{2} * kg * (m/s)^2$$

- So, does increasing the mass or the speed have more of an impact? Explain.

Examples

- What is the KE of an object that has a speed of 6.5 m/s and a mass of 16 kg?
- What is the speed of an object that has 1500 J of NRG and a mass of 12 kg?

Practice

- Get into groups of 2-3 and complete the following
 - Page 448
 - 1
 - 2

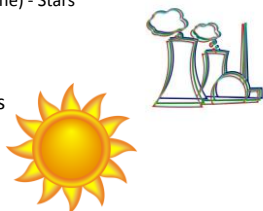
Other Forms of NRG

- **Mechanical NRG** is the sum of all PE and KE
 - You can think of it as the amount of work something can do because of its KE or PE
- Chemical NRG
 - This is NRG stored in bonds



Other Forms of NRG

- Nuclear energy
 - stored by forces between subatomic particles
 - Nuclear Fission (division) – bomb, power plant
 - Nuclear Fusion (Combine) - Stars



- Radiant energy
 - electromagnetic waves
 - Light energy

Assignment

- Math Skills – KE and GPE
- 13.3 Concept Review
- EOSQ (1-6, 2)
- You have a work day on Monday!!

Conservation of NRG

13.4

Key Ideas

- How does NRG Change?
- What is the Law of Conservation of NRG?
- How much of the work done by a machine is actually useful?

NRG Transformations

- Energy cannot be created or destroyed, but it can change forms.

Group Activity

- In groups of 2-3 complete the following.
 - Describe how electrical NRG is transformed in an alarm clock.
 - Describe how electrical NRG is transformed in a light bulb.
 - Describe how potential NRG is transformed when you drop a ball
- Make a model that shows the conversion of potential energy to other forms of energy. Try to use as many forms of energy as you can.
 - Heat, sound, electrical, chemical, potential (gravitational, chemical, etc.), kinetic, ...

NRG Transformations

- **Mechanical energy**- total amount of potential and kinetic energy in a system.
 - (Remember this from section 3?)
 - PE and KE can be converted to each other, but the overall mechanical energy will remain the same.

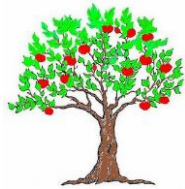
Quick Activity

Take a paper clip and bend it back and forth until it breaks

- Place it on the bottom of your wrist
- What do you notice?

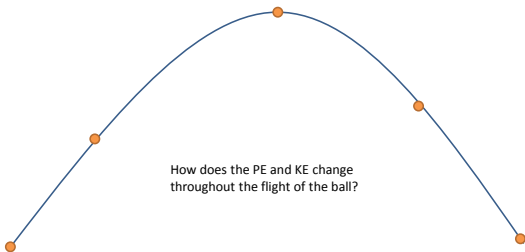
Example

- Attached to tree: Apple has maximum PE & minimum KE
- As apple falls: PE being transformed to KE
- Right before apple hits ground: Apple has minimum PE and maximum KE
- What happens to mechanical energy?



Which apple has the most PE?

Example



Law of Conservation of NRG

- The **Law of Conservation of NRG** states that NRG cannot be created or destroyed.
 - It can only be transferred or transformed
 - What are some examples?

Efficiency of Machines

- Only a portion of the work done by a machine is “useful”
 - Friction
 - Heat
 - Sound

Efficiency Practice

$$Efficiency = \frac{Work_{out}}{Work_{in}}$$

- You input 450 J of work and the machine outputs 300 J of work. What is the efficiency of the machine?
- How could you increase the efficiency?

Practice

- Get into groups of 2-3 and complete the following
 - Page 460
 - 1 - 3

Assignment

- 13.4 Concept Review
- EOSQ (1, 3, 4, 6)
- MS – Efficiency
