SPH4U UNIVERSITY PHYSICS

ENERGY & MOMENTUM

- Conservation of Energy (P.184-191)

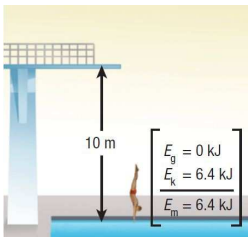
Energy Transformations & The Law of …

Scientists have studied energy and energy transformations and have arrived at some important generalizations. For example, they noticed that when one form of energy is transformed into another form (or forms) of energy, the quantity of one form is reduced by the same amount that the quantity of the other form (or forms) is increased. This generalization, known as the ***law of conservation of energy****, is stated as follows:*

Law of Conservation of Energy
Energy is neither created nor destroyed. It can only change form.

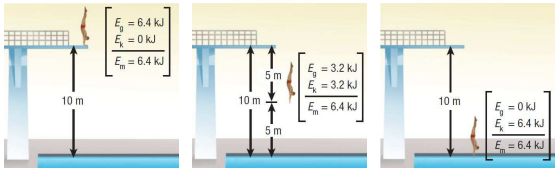
Law of Conservation of Energy

For example, consider 65 kg diver who performs a handstand dive from a 10 m high diving platform into the water below.



Law of Conservation of Energy

As you can see, while the diver's gravitational potential energy is transformed into kinetic energy throughout the dive, his total mechanical energy does not change – it is conserved.



Law of Conservation of Energy

LAW OF CONSERVATION OF ENERGY

- energy is neither created nor destroyed
- when energy changes from one form to another no energy is lost

$$E_{TOTAL\ @\ START} = E_{TOTAL\ DURING} = E_{TOTAL\ @\ END}$$

NOTE!

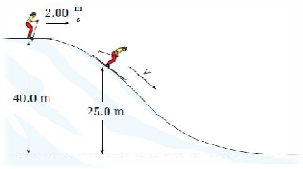
For situations involving only gravitational potential energy and kinetic energy, the equation becomes:

$$E_{gi} + E_{ki} = E_{gf} + E_{kf}$$

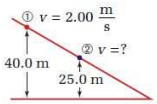
Law of Conservation of Energy

PRACTICE

1. A skier is gliding along with a speed of 2.0 m/s at the top of a ski hill 40 m high. The skier then begins to slide down the icy (frictionless) hill.
   (a) What will be the skier's speed at a height of 25 m?



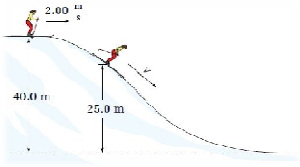
(a) v = 17 m/s



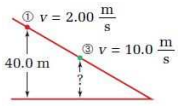
Law of Conservation of Energy

PRACTICE

1. A skier is gliding along with a speed of 2.0 m/s at the top of a ski hill 40 m high. The skier then begins to slide down the icy (frictionless) hill.
   (b) At what height will the skier have a speed of 10 m/s?



(b) h = 35 m

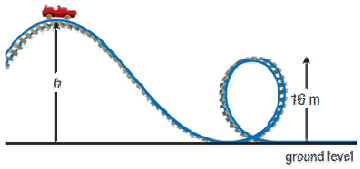


Law of Conservation of Energy

PRACTICE

2. Many roller coasters have loops where carts roll on a track that curves sharply up into the air. In the roller coaster shown, the cart must have a minimum speed of 10 m/s at the top of the loop to make it around safely. Assuming that the roller coaster starts from rest at the top of the first hill and there is no friction on the roller coaster, what is the minimum height of the first hill?

h = 21 m



System of Particles

The law of conservation of energy is an example of a conservation law that applies to a system of particles that is completely isolated from outside influences – an isolated system. Any group of objects can be defined as a ***system of particles****.*

System of Particles

*Scientists classify systems according to their interaction with their surroundings. An **open system** can exchange both matter and energy with its surroundings. Matter does not enter or leave a **closed system**, but energy can enter or leave. Neither matter nor energy can enter or leave an **isolated system**.*

System of Particles

For example, an open pot of potatoes boiling on the stove represents an open system, because heat is entering the pot and water vapour is leaving the system. A pressure cooker prevents any matter from escaping but heat is entering, so the pressure cooker represents a closed system. If the pot is place inside a perfect insulator, neither heat nor water can enter or leave the system, making it an isolated system.

System of Particles

NOTE!

Physicists sometimes refer to an isolated system as a closed system to contrast it with an open system.

	exchanges the following with its surroundings?	
System of Particles	matter	energy
Open	✔	✔
Closed	✘	✔
Isolated (Closed)	✘	✘

✔ Check Your Learning

TEXTBOOK

P.191 Q.2-5,7 (Review)

WIKI (ENERGY & MOMENTUM)

✎.... 4U2 - LAB#1 (Fizzix Coaster Analysis)