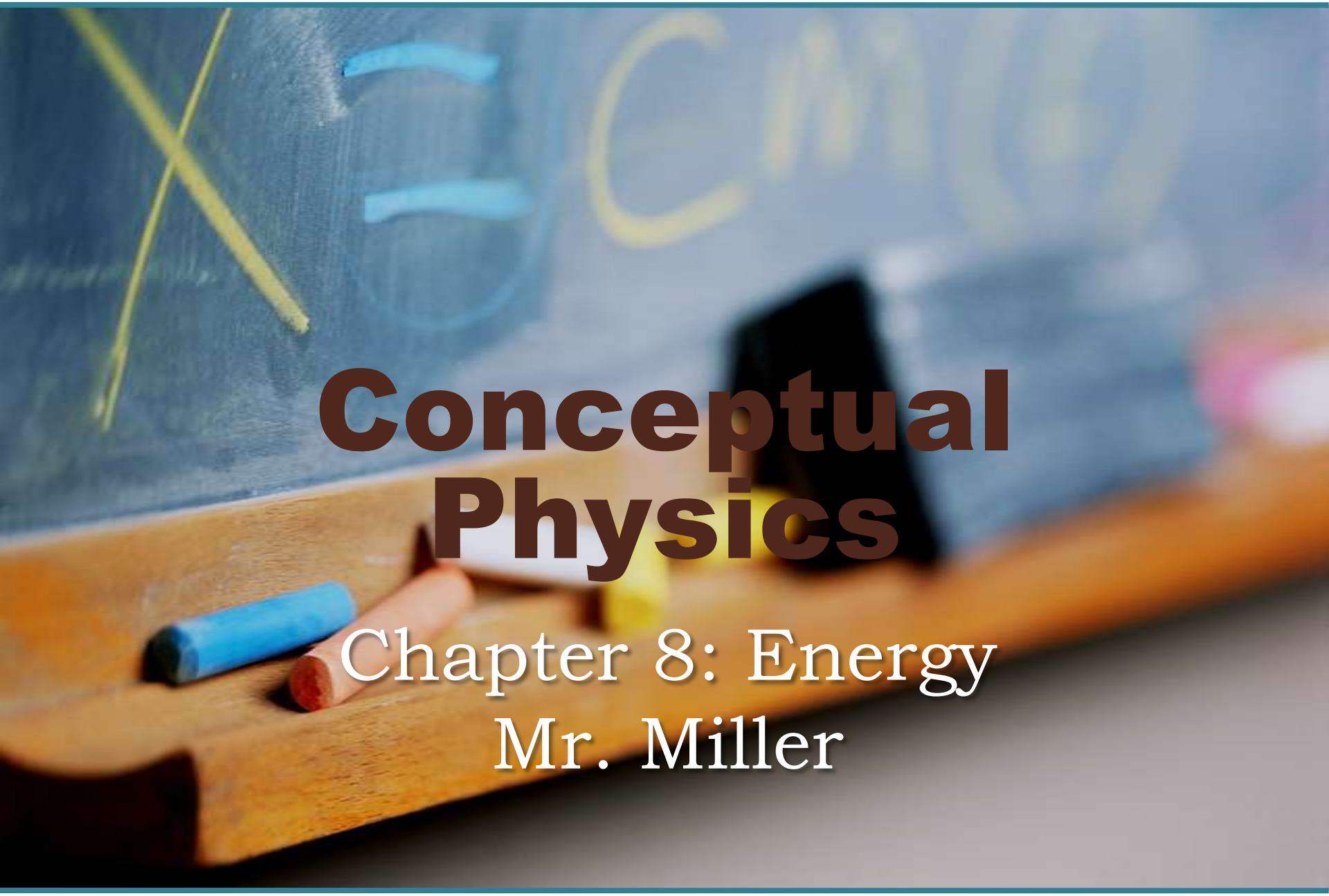


Conceptual Physics

Chapter 8: Energy

Mr. Miller

Work

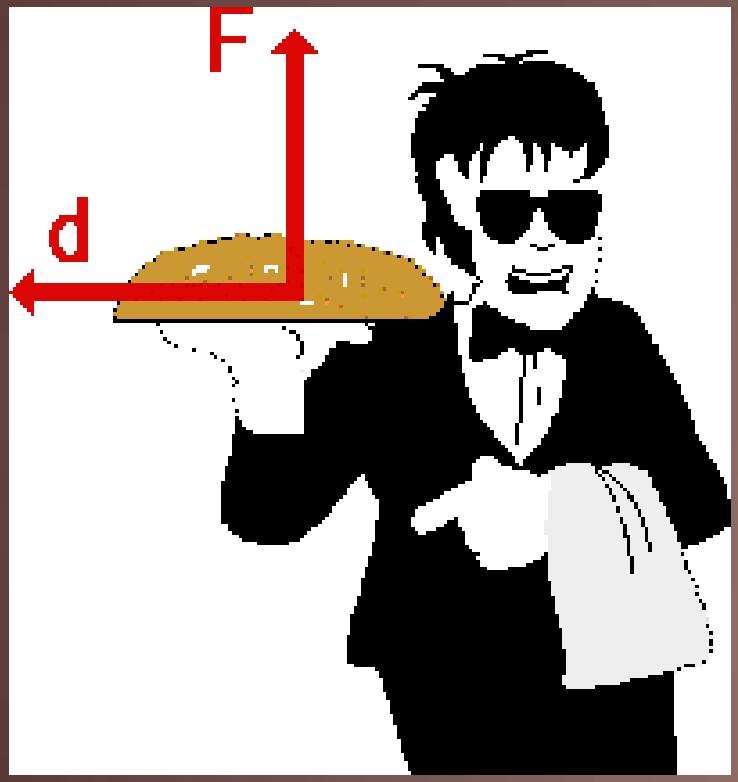
- The product of the force on an object and the displacement through which the object is moved.

Work

- You must apply a force in the same direction or the opposite direction of the displacement to do any work.

Work

- The waiter does no work because the force is perpendicular to the displacement.



Work

Is any work being done in the following situation?

A teacher applies a force to a wall and becomes exhausted.

Work

Is any work being done in the following situation?

A book falls off a table and free falls to the ground.

Work

Is any work being done in the following situation?

A rocket accelerates through space.

Work

Is any work being done in the following situation?

A waiter carries a tray full of meals above his head by one arm across the room.

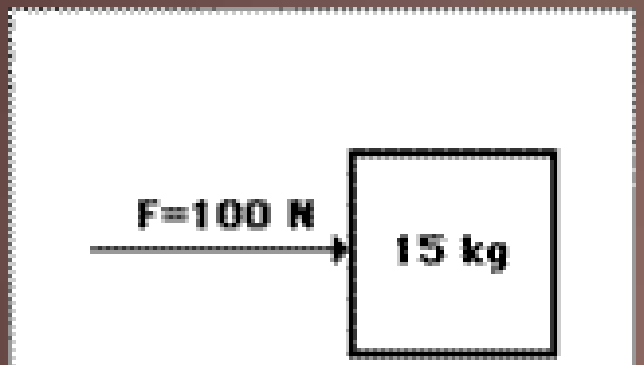
Work

$$W = Fd$$

Measured in Joules (J)

Work

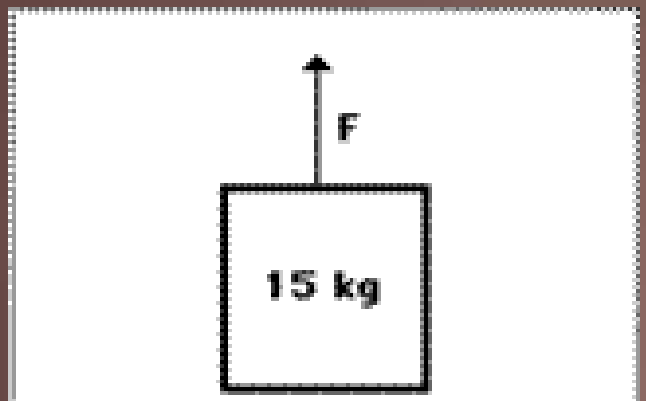
Determine the amount of work being done in the following situation:



A 100 N force is applied to move a 15 kg object a horizontal distance of 5 meters at constant speed.

Work

Determine the amount of work being done in the following situation:

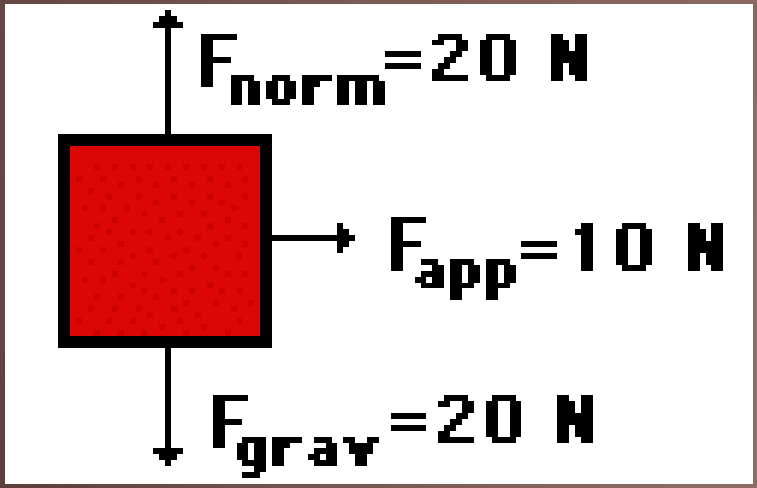


An upward force is applied to lift a 15 kg object to a height of 5 meters at constant speed.

Work

Which forces are doing work? How much?

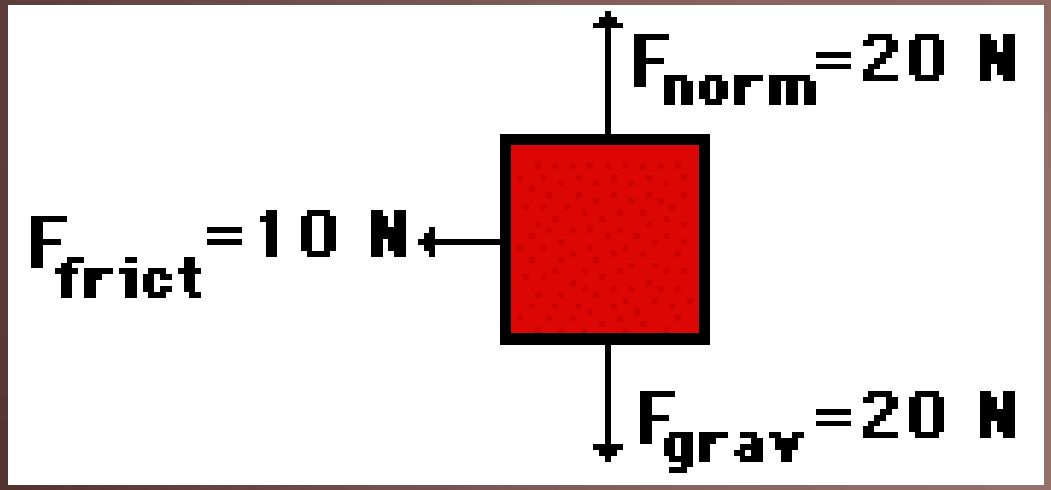
A 10-N forces is applied to push a block across a friction free surface for a displacement of 5.0 m to the right.



Work

Which forces are doing work? How much?

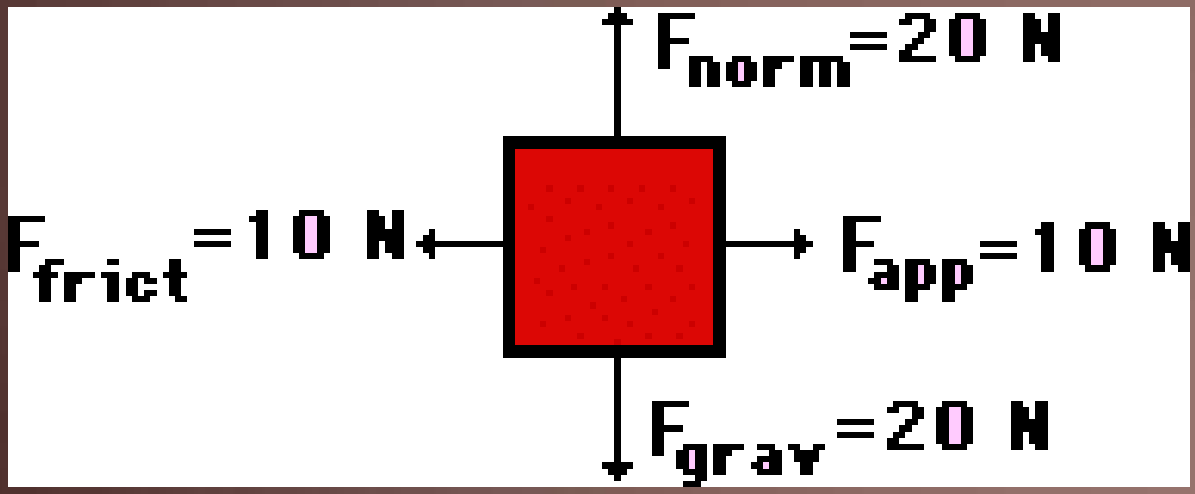
A 10-N frictional force slows a moving block to a stop after a displacement of 5.0 m to the right.



Work

Which forces are doing work? How much?

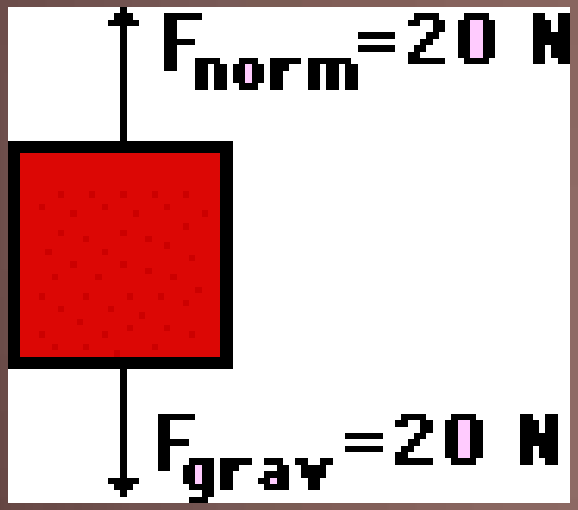
A 10-N force is applied to push a block across a frictional surface at constant speed for a displacement of 5.0 m to the right.



Work

Which forces are doing work? How much?

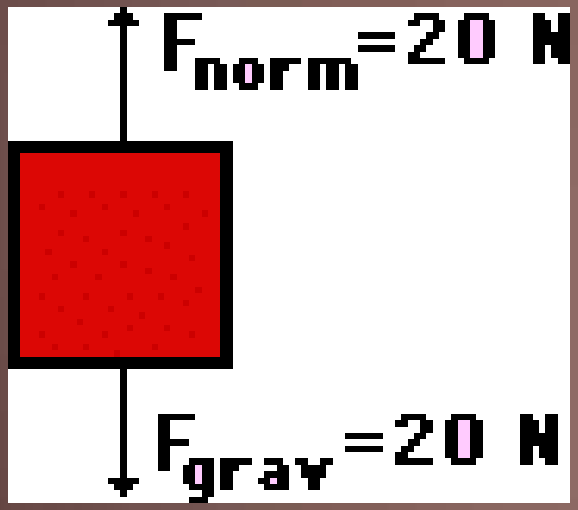
A 2-kg object is sliding at constant speed across a friction free surface for a displacement of 5 m to the right.



Work

Which forces are doing work? How much?

A 2-kg object is pulled upward at constant speed by a 20-N force for a vertical displacement of 5 m.



Power

- The rate at which work gets done.

Power

$$P = \frac{W}{t}$$

Measured in Watts (W)

Power

- Engines are often rated in units of horsepower
- 1 horsepower = 750 Watts
- 134 horsepower engine = 100.5 kW

Energy

Enable an object to do work

Measured in Joules

Mechanical Energy

Mechanical Energy is the energy due to the position of something, or the movement of something.

It is in the form of Potential Energy, Kinetic Energy, or a combination of the two

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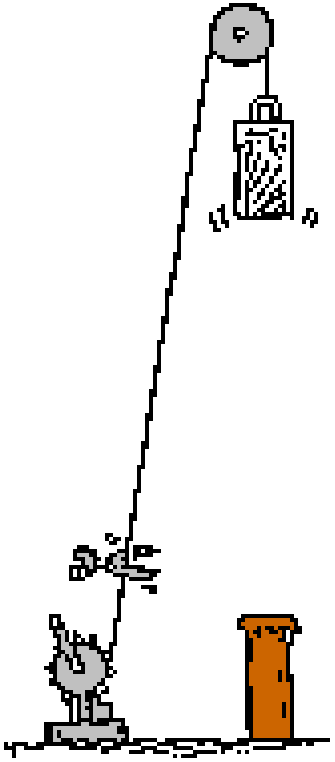
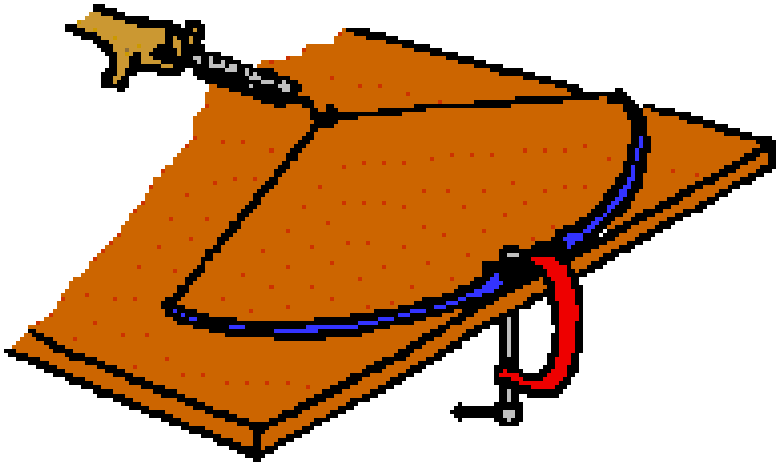
Potential Energy

An energy that is stored. It has the potential to do something.

Found in fossil fuels, electric batteries, and the food we eat.

Potential Energy





The heavy ram of a pile driver and the stretched bow possess stored energy of position – potential energy.

Potential Energy

The potential energy due to elevated positions is called **gravitational potential energy**

$$PE = mgh$$

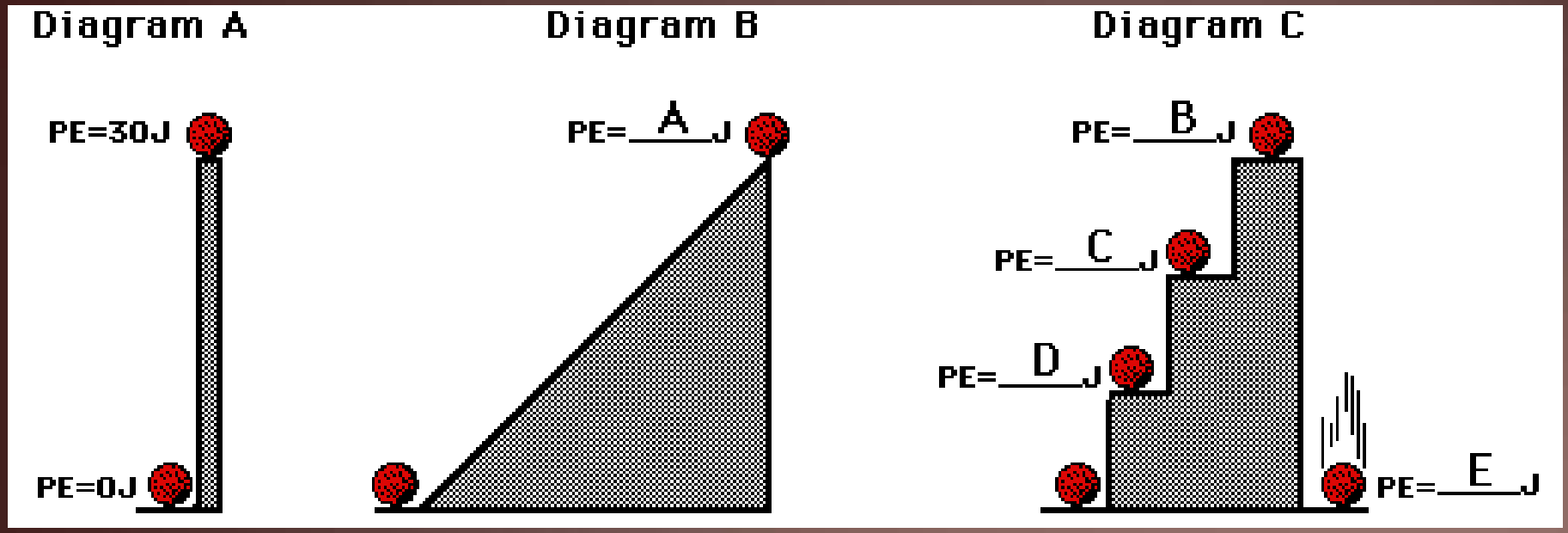
Potential Energy

gravitational potential energy: depends on the height and weight of an object, not the path taken.

Potential Energy

Time for a Gizmo!

Potential Energy



What is the PE at the 5 locations, A, B, C, D, and E?

A = 30 J, B = 30 J, C = 20 J, D = 10 J, E = 0 J

Kinetic Energy

If an object is moving, it has kinetic energy.

Kinetic Energy depends upon an object's mass and speed

Kinetic Energy

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

Kinetic Energy

Work is equal to the change in Kinetic Energy

$$W = \Delta KE$$

Kinetic Energy

Determine the kinetic energy of a 1000-kg roller coaster car that is moving with a speed of 20.0 m/s.

$$KE = 1/2mv^2$$

$$KE = (1/2)(1000)(20)^2$$

$$KE = 200{,}000 \text{ Joules}$$

Kinetic Energy

Missy Diwater, the former platform diver for the Ringling Brother's Circus had a kinetic energy of 15 000 J just prior to hitting the bucket of water. If Missy's mass is 50 kg, then what is her speed?

$$KE = 1/2mv^2$$

$$15{,}000 = (1/2)(50)v^2$$

$$v = 24.5 \text{ m/s}$$

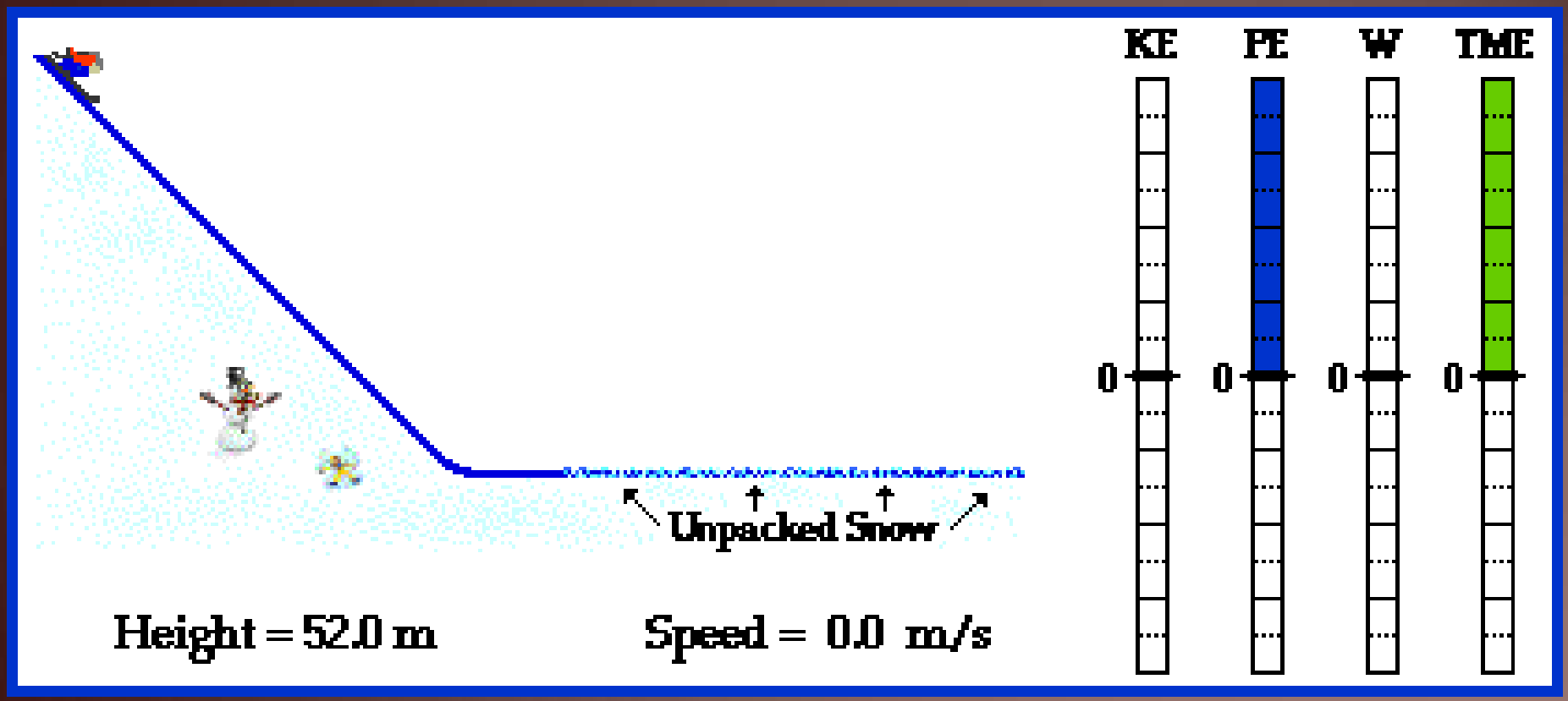
Conservation of Energy

Energy cannot be created not destroyed. It can be transformed from one form into another, but the total amount of energy never changes.

Conservation of Energy

$$TME = KE + PE$$

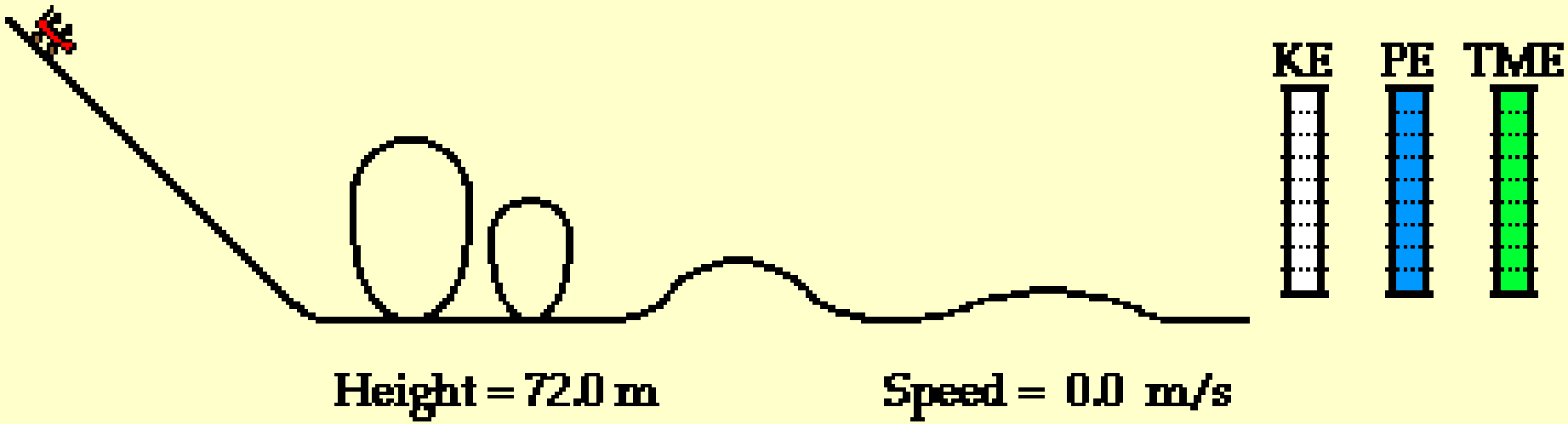
Conservation of Energy



Conservation of Energy

Time for a Gizmo!

Conservation of Energy



Conservation of Energy

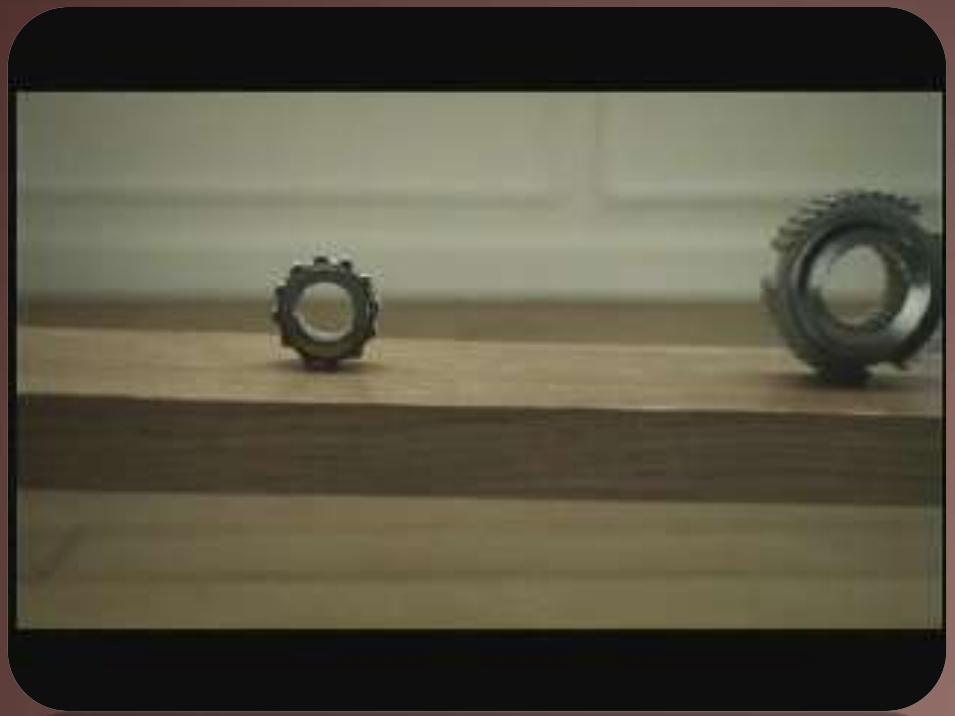
Time for a Gizmo!

Conservation of Energy

Honda COG Commercial

The commercial took 606 different takes to complete

Conservation of Energy



Making of the Honda COG Commercial