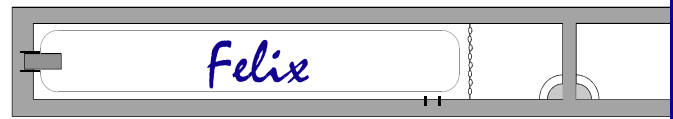


# PHYZ SPRINGBOARD: POTENTIAL ENERGY



A nail is partially driven into a block of wood. An iron ball is dropped onto the nail, driving the nail some depth into the wood. Without changing any characteristics of the wood or nail, how could a dropped iron ball drive the nail deeper into the wood?

## 1. Factor 1

a. One way a dropped iron ball could drive the nail even deeper into the wood is if...

*the ball were dropped from a greater height*

b. So the drive depth is (\_\_\_directly \_\_\_inversely) proportional to...

*drop height*

c. In symbols,  $D \propto h$

## 2. Factor 2

a. One way a dropped iron ball could drive the nail even deeper into the wood is if...

*the ball were more massive.*

b. So the drive depth is (\_\_\_directly \_\_\_inversely) proportional to...

*the ball's mass*

c. In symbols,  $D \propto m$

## 3. Factor 3

a. One way a dropped iron ball could drive the nail even deeper into the wood is if...

*everything were brought to a place with greater gravitational acceleration (e. g., Jupiter).*

b. So the drive depth is (\_\_\_directly \_\_\_inversely) proportional to...

*gravitational acceleration*

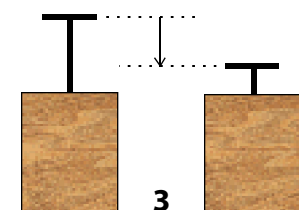
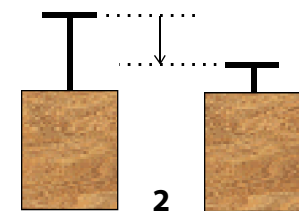
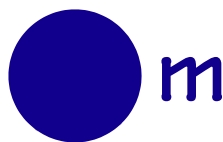
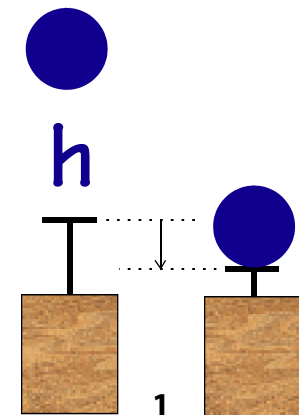
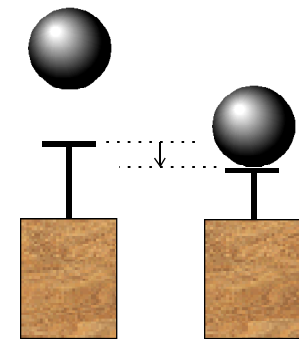
c. In symbols,  $D \propto g$

4. The extent to which a dropped ball can drive in a nail is called its gravitational potential energy.

a. What determines a body's gravitational potential energy?

*It's height, mass, and the local gravitational acceleration.*

b. Write an equation for gravitational potential energy.:  $PE = mgh$



5. What are the units of potential energy?

$$PE = mgh$$

$$\text{kg} \cdot \text{m}/\text{s}^2 \cdot \text{m} = \text{kg} \cdot \text{m}^2 / \text{s}^2 = \text{J (joule)}$$

6. What is the potential energy of a block that has a mass of 7 kg and a height of 4 m?

$$PE = mgh = 7 \text{ kg} \cdot 9.8 \text{ m/s}^2 \cdot 4 \text{ m} = 274 \text{ J}$$

7. Solve the equation for the other variables.

$$PE = mgh$$

$$m = PE/gh$$

$$g = PE/mh$$

$$h = PE/mg$$

8. Write a numerical problem in which factor 1 is the unknown to be solved for.

9. Write a numerical problem in which factor 2 is the unknown to be solved for.

10. Write a numerical problem in which factor 3 is the unknown to be solved for.