

Key

# Physical Science Chapter 4: Energy

## Wkst: Kinetic and Potential Energy Problems

Show all work!  $K = \frac{1}{2} MV^2$   $PE = mgh$

1. Calculate the kinetic energy of a car with a mass of 1500 kg moving at a speed of 18 m/s

Given:

$$KE = ?$$

$$m = 1500 \text{ Kg}$$

$$V = 18 \text{ m/s}$$

Soln:  $KE = \frac{1}{2} m v^2$

$$= \frac{1}{2} (1500 \text{ Kg}) (18 \text{ m/s})^2$$

$$\boxed{KE = 243000 \text{ J}}$$

2. A baseball with a mass of 0.15 kg is moving at a speed of 40 m/s. What is the kinetic energy of the baseball?

Given:

$$KE = ?$$

$$m = 0.15 \text{ Kg}$$

$$V = 40 \text{ m/s}$$

Soln:  $KE = \frac{1}{2} m v^2$

$$= \frac{1}{2} (0.15 \text{ Kg}) (40 \text{ m/s})^2$$

$$\boxed{KE = 120 \text{ J}}$$

3. A 35 kg child travels with a speed of 3 m/s sledding down a hill. How much KE does the child have at the bottom of the hill?

Given:

$$KE = ?$$

$$m = 35 \text{ Kg}$$

$$V = 3 \text{ m/s}$$

Soln:  $KE = \frac{1}{2} m v^2$

$$= \frac{1}{2} (35 \text{ Kg}) (3 \text{ m/s})^2$$

$$\boxed{KE = 157.5 \text{ J}}$$

4. Which has more KE, a person with a mass of 65 kg traveling with a speed of 5 m/s as they sled down a hill or the same person traveling with a speed of 15 m/s as they ski down a hill, why?

Given:

$$KE_{\text{sled}} = ?$$

$$m = 65 \text{ Kg}$$

$$V = 5 \text{ m/s}$$

$$KE_{\text{ski}} = ?$$

$$m = 65 \text{ Kg}$$

$$V = 15 \text{ m/s}$$

Soln: Sled

$$KE = \frac{1}{2} m v^2$$

$$= \frac{1}{2} (65 \text{ Kg}) (5 \text{ m/s})^2$$

$$= 812.5 \text{ J}$$

Ski

$$KE = \frac{1}{2} m v^2$$

$$= \frac{1}{2} (65 \text{ Kg}) (15 \text{ m/s})^2$$

$$= 7312.5 \text{ J}$$

Ski goes much faster so more KE!!

5. A bowling ball travels at a speed of 2 m/s and has 16 J of KE as it rolls down the lane. What is the mass of the bowling ball?

Given:

$$KE = 16 \text{ J}$$

$$m = ?$$

$$V = 2 \text{ m/s}$$

Soln:

$$KE = \frac{1}{2} m v^2$$

$$m = \frac{2 KE}{V^2}$$

$$m = \frac{2 (16 \text{ Kg m}^2/\text{s}^2)}{(2 \text{ m/s})^2}$$

$$= \frac{32 \text{ Kg m}^2/\text{s}^2}{4 \text{ m}^2/\text{s}^2}$$

$$\boxed{m = 8 \text{ Kg}}$$

6. (L2) An 8 kg history book is placed on a 1.25 m high desk. How much GPE does the book have?

Soln:

$$PE = ?$$

$$m = 8 \text{ Kg}$$

$$h = 1.25 \text{ m}$$

$$g = 9.8 \text{ m/s}^2$$

Soln:

$$PE = mgh$$

$$= (8 \text{ Kg}) (9.8 \text{ m/s}^2) (1.25 \text{ m})$$

$$\boxed{PE = 98 \text{ J}}$$

7. (L2) A 0.0050 kg leaf sits on a branch 4.0 m off the ground. How much GPE does the leaf have?

Given:

$$PE = ?$$

$$m = 0.0050 \text{ kg}$$

$$h = 4.0 \text{ m}$$

Soln:

$$PE = mgh$$

$$= (0.0050 \text{ kg})(9.8 \text{ m/s}^2)(4.0 \text{ m})$$

$$PE = 0.196 \text{ J}$$

8. One of the tallest radio towers is in Fargo, ND. The tower is 629 m tall. If a bird lands on top of the tower and has 2033 J of GPE, what is the mass of the bird?

Given:

$$PE = 2033 \text{ J}$$

$$m = ?$$

$$h = 629 \text{ m}$$

Soln:

$$PE = mgh$$

$$m = \frac{PE}{gh}$$

$$m = \frac{2033 \text{ kg m}^2/\text{s}^2}{(9.8 \text{ m/s}^2)(629 \text{ m})}$$

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

$$m = 0.330 \text{ kg}$$

9. A boulder has a mass of 500 kg. If it has 2,450,000 J of GPE as it sits on the edge of a cliff, how high is the cliff?

Given:

$$PE = 2,450,000 \text{ J}$$

$$m = 500 \text{ kg}$$

$$h = ?$$

Soln:

$$PE = mgh$$

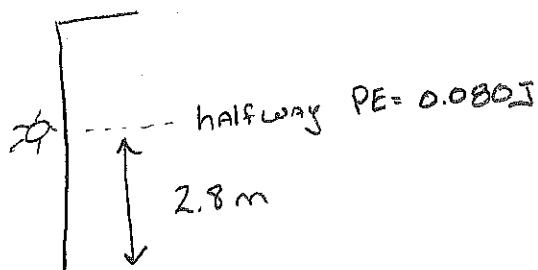
$$h = \frac{PE}{mg}$$

$$h = \frac{2,450,000 \text{ kg m}^2/\text{s}^2}{(500 \text{ kg})(9.8 \text{ m/s}^2)}$$

$$h = 500 \text{ m}$$

10. A spider has 0.080 J of GPE as it reaches the halfway point climbing up a 2.8 m wall. What is the GPE of the spider at the top of the wall?

Given:



Soln:

So distance doubles to 5.6 m  
 so PE will also double  
 to  $2 \times (0.080 \text{ J})$

$$\text{Top} = 0.16 \text{ J}$$

Find: PE at Top