Chapter 4 Energy and Power page 11 Name Key

Worksheet: Determining Gravitational Potential Energy Period_____ Date_____

Frameworks Code)

Recall that the formula for calculating gravitational potential energy is: $PE=mgh$. Manipulate this formula to answer the following problems. Be sure to show the four step set-up.

1. What would the gravitational potential energy associated with a 64 kg boulder sitting on top of a 523 m high cliff?

Given: $m = 64\text{ kg}$, $h = 523\text{ m}$, $g = 9.81\text{ m/s}^2$, $PE = ?$

Soln: $PE = mgh$

$= (64\text{ kg})(9.81\text{ m/s}^2)(523\text{ m})$

$PE = 328026\text{ J}$

2. The Royal Gorge Bridge is situated 321 m above the Arkansas River. If the gravitational potential energy associated with a tourist on the bridge is 173,000 J with respect to the river, what is the tourist's mass?

Given: $m = ?$, $h = 321\text{ m}$, $g = 9.81\text{ m/s}^2$, $PE = 173{,}000\text{ J}$

Soln: $PE = mgh$

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

$m = \frac{173{,}000\text{ J}}{(9.81\text{ m/s}^2)(321\text{ m})}$

$m = 54.9\text{ kg}$

3. A high jumper with a mass of 82.0 kg. How how was his jump if he had a gravitational potential energy of 1970 J?

Given: $m = 82.0\text{ kg}$, $h = ?$, $g = 9.81\text{ m/s}^2$, $PE = 1970\text{ J}$

Soln: $PE = mgh$

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

$h = \frac{1970\text{ J}}{(82.0\text{ kg})(9.81\text{ m/s}^2)}$

$h = 2.4\text{ m}$

4. The world record for pole vaulting is 6.15 m. If the pole vaulter's gravitational potential energy is 4942 J, what is his mass?

Given: $m = ?$, $h = 6.15\text{ m}$, $g = 9.81\text{ m/s}^2$, $PE = 4942\text{ J}$

Soln: $PE = mgh$

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

$m = \frac{4942\text{ J}}{(9.81\text{ m/s}^2)(6.15\text{ m})}$

$m = 81.9\text{ kg}$

5. An airplane with a mass of 124,000 kg has a gravitational potential energy of 917,000,000. How far above the ground is the plane?

Given: $m = 124{,}000\text{ kg}$, $h = ?$, $g = 9.81\text{ m/s}^2$, $PE = 917{,}000{,}000\text{ J}$

Soln: $PE = mgh$

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

$h = \frac{917{,}000{,}000\text{ J}}{(124{,}000\text{ kg})(9.81\text{ m/s}^2)}$

$h = 753.8\text{ m}$

6. What is the gravitational potential energy associated with a 75 kg tourist at the top floor of the Sears Tower in Chicago, with respect to the street 436 m below?

Given: $m = 75\text{ kg}$, $h = 436\text{ m}$, $g = 9.81\text{ m/s}^2$, $PE = ?$

Soln: $PE = mgh$

$= (75\text{ kg})(9.81\text{ m/s}^2)(436\text{ m})$

$PE = 320787\text{ J}$

7. If a 87.5 kg mountain climber reaches the top of Mt. McKinley. If the summit is 6194 m above sea level, what is the gravitational potential energy of the climber (with respect to seal level)?

Given: $m = 87.5\text{ kg}$, $h = 6194\text{ m}$, $g = 9.81\text{ m/s}^2$, $PE = ?$

Soln: $PE = mgh$

$= (87.5\text{ kg})(9.81\text{ m/s}^2)(6194\text{ m})$

$PE = 5316774.8\text{ J}$

8. A bird lands on top of a radio tower that is 629 m. If the bird has 2003 J of gravitational potential energy, what is its mass?

Given: $m = ?$, $h = 629\text{ m}$, $PE = 2003\text{ J}$, $g = 9.81\text{ m/s}^2$

Soln: $PE = mgh$

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

$m = \frac{2003\text{ J}}{(9.81\text{ m/s}^2)(629\text{ m})}$

$m = .32\text{ kg}$