Kinetic, potential and mechanical energy worksheet

1. A car travels at a speed of 60.0 km/h and has a mass of 1 005 kg. What is its kinetic energy?

$K = .5mv^2$ $.5 \times 1005 \times (16.7^2) =$ $\left(\frac{60.0 \times 1000}{3600}\right) = 16.7$

140 000 J or 1.40×10^5 J

2. A quarterback throws a football weighing 205 g at a speed of 2.78 m/s at a height of 20.0 m. What is the football's mechanical energy?

$K = .5mv^2$ $.5 \times 205 \times (2.78)^2 = .792$ J

$P = mgh$ $.205 \times 9.8 \times 20.0 = 40.2$ J

$40.2 + .792 = 41.05$

3. A truck weighing 12 000 kg has 91 000 J of kinetic energy. What speed it is travelling at?

$v^2 = \frac{k}{.5m}$ $\frac{91000}{.5 \times 12000} = \sqrt{15.16} = 3.9$ m/s

4. A van travels at a speed of 40.0 km/h with a kinetic energy of 7 600 J. What is the van's mass?

$m = \frac{K}{.5v^2}$ $\frac{7600}{.5 \times (11.1^2)}$ $\left(\frac{40.0 \times 1000}{3600}\right) = 11.1$

120 kg or 1.2×10^2 kg

5. A hammer weighing 200.0 g is raised 3.0 m above the ground. What is its potential energy?

$P = mgh$ $.2000 \times 9.8 \times 3.0 = 5.9$ J

$K = .5mv^2$

6. A four cylinder Toyota can reach a maximum of 150.0 km/h while a six cylinder Toyota can reach a maximum of 180 km/h. If they both weigh 1 500 kg, what is the maximum kinetic energy each car can have?

$\frac{150 \times 1000}{3600} = 41.67$

$.5 \times 1500 \times (41.67^2)$

$1.3 \times 10^6 J$

$\frac{180 \times 1000}{3600} = 50$

$.5 \times 1500 \times (50^2)$

$1.9 \times 10^6 J$

7. A ball is raised 5.0 m off the ground and weighs 750 g. What is its potential energy?

$P = mgh$ $.75 \times 5.0 \times 9.8$

$37 J$

8. An electric toy car weighs 150.0 g and travels at 0.50 km/h. What is its kinetic energy?

$K = .5mv^2$

$.5 \times .1500 \times (.14^2)$

$1.5 \times 10^{-3} J$

$\frac{.50 \times 1000}{3600} = .14$

9. You will attempt to ski for the first time. On a good day you weigh 50.0 kg. You are now at the top of a 15 m hill trying to get courage to go down. How fast will you be travelling when you reach the bottom of the hill?

$v^2 = \frac{K}{.5m}$ $\frac{50.0 \times 9.8 \times 15}{.5 \times 50.0} = \sqrt{294} = 17 m/s$

$K = P = mgh$

10. A truck weighing 17 000 kg has 9 100 J of kinetic energy. What is the speed it is travelling at?

$v^2 = \frac{K}{.5m}$ $\frac{9100}{.5 \times 17000} = \sqrt{1.070\ldots} = 1.0 m/s$

11. Tiger Woods is very upset about all his personal problems and he decides to go golfing to release his pent up anger. He hits a golf ball weighing 400.0 g at a speed of 4.0 km/h and reaches a height of 30.0 m. What is the ball's mechanical energy?

$K = .5mv^2$

$.5 \times .4000 \times (1.1)^2$

$.24 J$

$\frac{4.0 \times 1000}{3600} = 1.1$

$P = mgh$

$.4000 \times 9.8 \times 30.0$

$= 118 J$

$118 + .24 = 118 J$

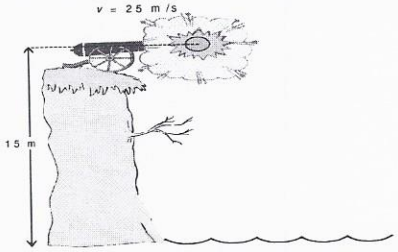
12. A group of students are attempting to throw a 55 g ball as high as they can, vertically upwards. The record height that they have achieved so far is 6 meters. Jeremy wishes to break the record of 6 meters. He throws the 55 g ball vertically upwards with a speed of 11.2 m/s.

Will Jeremy exceed the record height of 6 meters? Explain your answer. *Neglect air resistance*

$h = \frac{P}{mg}$ $\quad \frac{.5 \times .055 \times (11.2)^2}{.055 \times 9.8} =$ 6.4 m yes he broke the record.

$P = K = .5mv^2$

13. The special effects department of a Hollywood film company is working on a movie about pirates. They are testing the performance of their cannons. They fire a cannonball, with a mass of 2.5 kg, from the top of a cliff. The cannonball has a velocity of 25 m/s and is 15 m above the water when it leaves the cannon.



a) What is the total energy of the cannonball the moment it is fired?

$P = mgh$ $\quad 2.5 \times 9.8 \times 15$ $\quad$ 370 J

$K = .5mv^2$ $\quad .5 \times 2.5 \times (25)^2$ $\quad$ 780 J

\+ 1150 J

b) Assuming complete transfer of energy, what is the speed of the cannonball right before entering the water? *Neglect resistance forces.*

$v^2 = \frac{K}{.5m}$ $\quad \frac{1150}{.5 \times 2.5} =$ 920 $\quad$ 30 m/s or 3.0×10^1 m/s