

Name _____ Date: _____ Period: _____

Kinetic Energy

Useful Equation: $KE = \frac{1}{2} mv^2$

1. A table tennis ball has a mass of 2.45×10^{-3} kg. What is the KE of a ball hit across the table with a velocity of 4.0 m/s?

$$KE = \frac{1}{2} (.00245 \text{ kg}) (4.0)^2 = 0.020 \text{ J}$$

2. What is the KE of a 551 lbs. turtle traveling at a velocity of 9.78 m/s? (watch units)

$$\frac{551 \text{ lbs}}{2.2 \text{ lbs}} \times 1 \text{ kg} = 250. \text{ kg}$$

$$KE = \frac{1}{2} (250) (9.78)^2 = 1.20 \times 10^4 \text{ J}$$

3. A 65 kg skydiver jumps out of a plane and reaches a terminal velocity of 230 m/s, what is the skydiver's KE?

$$KE = \frac{1}{2} (65) (230)^2 = 1,700,000 \text{ J}$$

4. A tennis ball with a mass of 0.25 kg is hit with a velocity of 145 mph. How much kinetic energy does the ball have? (watch units)

$$\frac{145 \text{ mi/hr}}{1 \text{ hr}} \times \frac{1609 \text{ m}}{1 \text{ mi}} \times \frac{1}{3600 \text{ s}} = 64.81 \text{ m/s}$$

$$KE = \frac{1}{2} (0.25) (64.81)^2 = 520 \text{ J}$$

5. A bowling ball with a mass of 3 kg is rolled down a bowling lane with a velocity of 15 m/s. How much kinetic energy does the bowling ball have?

$$KE = \frac{1}{2} (3) (15)^2 = 300 \text{ J}$$

6. Which has more mass the tennis ball from problem 4 or the bowling ball from problem 5? Which one was traveling faster? Does mass or velocity have more of an effect of kinetic energy? tennis

↓
VELOCITY (exponential)

7. What is the mass of a golf ball that has 150 J of kinetic energy traveling at a velocity of 80 m/s?

$$m = \frac{2E_k}{v^2} = \frac{(2)(150)}{(80)^2} = 0.05 \text{ Kg}$$

8. What is the mass of a cheetah running with a kinetic energy of 1.80×10^4 J at a top speed of 30 m/s?

$$m = \frac{2E_k}{v^2} = \frac{2(1.80 \times 10^4)}{(30)^2} = 40 \text{ Kg}$$

9. A 725 kg car has a kinetic energy of 3.02×10^5 J as it travels along a highway. What is the cars speed?

$$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(3.02 \times 10^5)}{(725)}} = 28.9 \text{ m/s}$$

10. What is the velocity **in mph** of a 4 kg ball that has a kinetic energy of 5 J?

$$v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(5)}{4}} = 1.58 \text{ m/s}$$

$$\frac{1.58 \text{ m}}{1 \cancel{s}} \times \frac{3600 \cancel{s}}{1 \text{ hr}} \times \frac{1 \text{ mi}}{1609 \cancel{m}} = 3.54 \text{ mph}$$

Gravitational Potential Energy

Useful Equations: $PE = mgh$

1. 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?

82.0 kg

2. The tallest radio tower is in Fargo, ND. The tower is 2063 ft tall. If a bird lands on top of the tower, so that it has a gravitational PE of 2033 J, what is the bird's mass? (watch units)

0.3298 kg

3. In 1993 A Cuban athlete set the world record for the high jump. If the athlete's mass is 82 kg and he had a gravitational PE of 1970 J at the highest point of his jump, what was the height of his jump in feet? (watch units)

8.0 ft

4. The highest inhabited town in the world is the village of Aucanquilca, in Chile. It is located 5334 m above sea level. How much gravitational PE would a person with a weight of 141 lbs have? (watch units)

↓
64.09 kg

335 0000 J

5. The furthest point from the center of the earth is the extinct volcano Volcan Chimborazo in Ecuador. What is the gravitational potential energy of a mountain climber with a mass of 84 kg who reaches the summit 6267 m above sea level?

5200000J

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

0.16J

7. A 1750 kg weather satellite moves in a circular orbit with a gravitational potential energy of 1.69×10^{10} J. At its location, free-fall acceleration is only 6.44 m/s^2 . How high above Earth's surface is the satellite?

$150 \times 10^6 \text{ m}$

8. The Royal Gorge Bridge is situated 321 m above the Arkansas River in Colorado. If the gravitational potential energy associated with a tourist on the bridge is 1.73×10^5 J with respect to the river, what is the tourist's weight in lbs? (watch units)

121lbs

9. The most massive piece of equipment ever carried by a plane was a 1.24×10^5 kg generator built in Germany in 1993. How far above the ground was the generator when the potential energy associated with it was 9.17×10^8 J?

755m