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Kinetic Energy
Quiz: Solutions

1. **A breakfast cereal provides 100 Calories of energy per serving. Express the energy with units of joules.**

   100 Calories (1000 calories / 1 Calorie)(4.184 J / 1 calorie) = 418400 J

2. **Determine the speed of a 4 pound object with 5000 joules of kinetic energy.**

   $KE = \frac{1}{2} mv^2$
   $5000\ J = \frac{1}{2} [(4\ lbs)(1\ kg / 2.205\ lbs)] v^2$
   $v^2 = 5512.5\ m^2/s^2$
   $v = 74.2\ m/s$

3. **A 60 kg girl is running at a track and field stadium. Determine her kinetic energy when her speed is 2 m/s.**

   $KE = \frac{1}{2} mv^2$
   $KE = \frac{1}{2} (60\ kg)(2\ m/s)^2$
   $KE = 120\ J$

4. **A 60 kg girl is running at a track and field stadium. Determine her kinetic energy when her speed is 4 m/s.**

   $KE = \frac{1}{2} mv^2$
   $KE = \frac{1}{2} (60\ kg)(4\ m/s)^2$
   $KE = 480\ J$

5. **A 60 kg girl is running at a track and field stadium. Determine her kinetic energy when her speed is 6 m/s.**

   $KE = \frac{1}{2} mv^2$
   $KE = \frac{1}{2} (60\ kg)(6\ m/s)^2$
   $KE = 1080\ J$

6. A car has an v_o = 25 mi/hr and kinetic energy, KE_o. Determine the kinetic energy of the car when v = 75 mi/hr. Express your answer in terms of KE_o.

The mass is constant; $v = 3v_o$; $KE \propto v^2$; $KE = 9\ KE_o$

$KE = \frac{1}{2}\ mv^2$
$KE_o = \frac{1}{2}\ mv_o^2$
$KE / KE_o = (\frac{1}{2}\ mv^2) / (\frac{1}{2}\ mv_o^2) = v^2 / v_o^2 = (3\ v_o)^2 / v_o^2 = 9\ v_o^2 / v_o^2 = 9$
$KE = 9\ KE_o$
The final kinetic energy is nine times as much as the initial kinetic energy.

7. What ^oC temperature is twice as warm as 0 ^oC? (Hint: Use the Kelvin scale)

$T_K = T_C + 273.15$
$T_K = 0 + 273.15$
$T_K = 273.15\ K$

Twice as warm $= 2T_K = 546.3\ K$

$T_K = T_C + 273.15$
$546.3\ K = T_C + 273.15$
$T_C = 273.15\ ^oC$
273.15 ^oC is twice as warm as 0 ^oC.

8. If the mass of an object is constant and the kinetic energy increases by a factor of four, by what factor did the speed change?

$KE = \frac{1}{2}\ mv^2$
$KE_o = \frac{1}{2}\ mv_o^2$
$KE / KE_o = (\frac{1}{2}\ mv^2) / (\frac{1}{2}\ mv_o^2) = v^2 / v_o^2$

$KE = 4\ KE_o$
$KE / KE_o = 4$
$KE / KE_o = v^2 / v_o^2$
$4 = v^2 / v_o^2$
$\sqrt{(4)} = \sqrt{(v^2 / v_o^2)}$
$2 = v / v_o$
$v = 2\ v_o$
The final speed is twice the initial speed.

9. **If the speed of an object is constant and the mass doubles, by what factor did the kinetic energy change?**

$KE_o = \frac{1}{2} m v_o^2$
$KE = \frac{1}{2} m v^2$
$KE / KE_o = (\frac{1}{2} m v^2) / (\frac{1}{2} m_o v^2) = m / m_o$

$m = 2m_o$
$KE / KE_o = m / m_o = 2m_o / m_o = 2$
$KE = 2 KE_o$
The final kinetic energy is twice the initial kinetic energy.

10. **A car traveling at 50 m/s with a kinetic energy of 1.5×10^6 J. Determine the mass of the car.**

$KE = \frac{1}{2} m v^2$
$1.5 \times 10^6 \text{ J} = \frac{1}{2} m (50 \text{ m/s})^2$
$m = 1200 \text{ kg}$