Kinetic Energy Review

1. What is the Kinetic Energy of a 100 kg object that is moving with a speed of 35 m/s?

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

$= \frac{1}{2} \times 100\ kg \times (35 m/s)^2 = 61,250\ J$

2. An object has a kinetic energy of 625 J and a mass of 25 kg , how fast is the object moving?

$KE = \frac{1}{2} m v^2 \qquad v = \sqrt{\frac{2KE}{m}} = \frac{2(625)}{25} = 7.1\ m/s$

3. An object moving with a speed of 35 m/s and has a kinetic energy of 600 J, what is the mass of the object.

$KE = \frac{1}{2} m v^2 \Rightarrow m = \frac{2KE}{V^2} = \frac{2(600)}{35^2} = 0.98\ kg$

4. What is the Kinetic Energy of a 3500 kg object that is moving with a speed of 3.5 m/s?

$KE = \frac{1}{2} m v^2 = \frac{1}{2} \times 3500 \times (3.5)^2 = 21,438\ J$

5. An object has a kinetic energy of 67 J and a mass of 8 kg , how fast is the object moving?

$KE = \frac{1}{2} m v^2 \Rightarrow v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(67)}{8}} = 4.1\ m/s$

6. An object moving with a speed of 62 m/s and has a kinetic energy of 5600 J, what is the mass of the object.

$KE = \frac{1}{2} m v^2 \rightarrow m = \frac{2KE}{V^2} = \frac{2(5600)}{(62)^2} = 2.9\ Kg$

7. What is the Kinetic Energy of a 478 kg object that is moving with a speed of 75 m/s?

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \cdot 478 \cdot 75^2$

$= 1,344,375\ J$

8. An object has a kinetic energy of 809 J and a mass of 30 kg , how fast is the object moving?

$KE = \frac{1}{2}m^2 \rightarrow v = \sqrt{\frac{2KE}{m}} = \sqrt{\frac{2(809)}{30}} \approx 7.3\ m/s$

9. An object moving with a speed of 100 m/s and has a kinetic energy of 1000 J, what is the mass of the object.

$KE = \frac{1}{2}mv^2 \quad m = \frac{2KE}{v^2} = \frac{2(1000)}{100^2} = 0.2\ m/s$

10. What is the Kinetic Energy of a 100 kg object that is moving with a speed of 0.25 m/s

$KE = \frac{1}{2}mv^2 = \frac{1}{2}(100)(.25)^2 = 3,125\ J$

Conservation of Energy Review

1. According to the Law of Conservation of Energy, the total amount of energy in a system:
   a) Remains constant
   b) Decreases
   c) Increases
   d) Changes constantly

2. A globe is dropped outside of the school. If it reaches the floor at a speed of 3.2 m/s, from what height did it fall?

$\frac{1}{2}mv^2 = mgh \quad \frac{v^2}{2g} = h = \frac{(3.2)^2}{2(9.8)} \approx .52\ m$

$\frac{1}{2}v^2 = gh$

3. A chair is hurled down from the top of a 32m building. What is its velocity as it hits the ground?

$PE = KE$

$mgh = \frac{1}{2}mv^2$

$2gh = v^2$

$\sqrt{2gh} = v$

$\sqrt{2(9.8)(32)} = 25 m/s$

4. A 24.5 kg object is dropped from a height of 30.0 m above the ground. Calculate the speed of the object as it hits the ground.

$v = \sqrt{2gh} = \sqrt{2(9.8)(30)} = 24 m/s$

5. A 2200-kg boulder is 30 m above the ground.

a) What is its potential energy when it is 30 m above the ground?

$PE = mgh = 2200 \times 9.8 \times 30 = 646,800 J$

b) What is its kinetic energy when it is 30 m above the ground?

0 J because it is not moving

c) The boulder begins to fall. What is its potential energy when it is 20-m above the ground? Where did the "lost" potential energy go?

$PE = mgh = 2200 \cdot 9.8 \cdot 20$
$= 431,200 J$

d) What is the kinetic energy of the boulder when it has fallen 20-m?

$TME = PE + KE$

$TME - PE = KE$

$646,800 - 431,200 = 215,600 J$ KE

e) What is the kinetic energy of the boulder just before it hits the ground?

646,800 because TME is now all KE as PE = 0 on ground.

6. A boulder sits atop a steep cliff and someone pushes it off the edge. If the cliff is 245 metres high and the boulder is 20kg, what speed will the boulder hit the ground with? Ignore air friction in this case.

PE = KE

$mgh = \frac{1}{2}mv^2$

$2gh = v^2$

$\sqrt{2gh} = v$

$\sqrt{2(9.8)(245)} = v = 69\ m/s$

7. A child with a mass of 42 kg jumps from a diving board with a height of 4 m. How fast is the child moving when he hits the water?

$v = \sqrt{2gh} = \sqrt{2 \cdot 9.8 \cdot 4} = 8.9\ m/s$

Heat Energy and specific heat Review.

Substance	Specific heat capacity (J/kg°C) (c)
Water	4200
Air	990
Copper	390
Iron	450
Concrete	3400
Cotton	1400

1. What are the units for specific heat capacity?

$\frac{J}{kg\,°C}$

2. What is the unit for energy?

Joules

3. How much energy is needed to heat up 35kg of water by 15°C?

$E = mc\Delta T$

$E = 35\ kg \times 4200 \times 15 = 2{,}205{,}000\ J$

4. How much energy would be needed to raise the temperature of a 25 kg block of concrete by $5^{o}C$?

$E = mc\Delta T$

$= 25 \times 3400 \times 5 \quad = 425{,}000\ J$

5. Can you calculate the energy needed to increase the temperature of 1900kg of iron by $20^{o}C$?

$E = mc\Delta T$

$= 1900 \times 450 \times 20 \quad = 17{,}100{,}000\ J$

6. A 50kg concrete block is at $10^{o}C$ and is heated to$75^{o}C$. What is the energy used to heat this block?

$E = mc\Delta T$

$= 50 \times 3400 \times (75 - 10) \quad = 11{,}050{,}000\ J$

7. A 0.25 kg copper pipe is heated from $10^{o}C$ to $165^{o}C$. What is the energy needed to heat the pipe?

$E = mc\Delta T \quad = 0.25 \times 390 \times (165 - 10) \quad = 15{,}112.5\ J$

8. Can you rearrange the equation to calculate the temperature difference?

$E = mc\Delta T$

$$\Delta T = \frac{E}{mc}$$

Efficiency Review

1. What is the law of conservation of energy?

Energy can not be created or destroyed, only transformed

2. What is the formula for calculating the efficiency of a system?

$$\% \text{ Efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100\%$$

3. What does most of the energy of a system usually transform into?

heat

4. What is the efficiency of a car if the car uses 56000 J of chemical potential energy and only 4500J of kinetic energy is produced?

$$\text{Efficency} = \frac{4500\text{ J}}{56000\text{ J}} \times 100\% = 8.0\%$$

5. If an electric car is 85% efficient then how much electric potential energy is used by the car when 500 J of kinetic energy is produced?

$$\text{input Energy} = \frac{\text{energy output}}{\text{Efficiency}} = \frac{500\text{ J}}{0.85} = 588\text{ J}$$