Things to know by heart---Review for test 2

	Equation	Units
Momentum = Mass x Velocity;	$P \equiv mv$	$\frac{kg \cdot m}{\sec}$
Momentum is a vector;		
Change in momentum = Mass x change in velocity;	$\Delta P \equiv m\Delta v$	$\frac{kg \cdot m}{\sec}$
Impulse=Force x time the force is applied; The only way to change an object's momentum is to apply an Iimpuse. Impulse is a vector.	$\text{Impulse} \equiv F\Delta T$	$\frac{kg \cdot m}{\sec}$
Impulse = change in momentum;	$F\Delta t = m\Delta v$	$\frac{kg \cdot m}{\sec}$
Work = Force x displacement in the direction of motion;	$W \equiv F\Delta X$	$\frac{kg \cdot m^2}{\sec^2}$, joules
Gravitational potential energy is the energy an object has because of the work that was done in lifting it against the force of gravity.		
Gravitational Potential Energy = mass x g x height;	$\text{GPE} \equiv mgh$	$\frac{kg \cdot m^2}{\sec^2}$, joules
Kinetic energy is the energy that an object has because of its motion. The faster it moves, the greater its kinetic energy. An object's mass also contributes to its kinetic energy.		
Kinetic Energy $\equiv \frac{1}{2} mass\, x\, velocity^2$;	$\text{K.E.} \equiv \frac{1}{2}mv^2$	$\frac{kg \cdot m^2}{\sec^2}$, joules
Power	$Power \equiv \frac{Energy}{time}$	$\frac{joules}{\sec}; watts$
Pressure is force per unit area;	$P \equiv \frac{F}{A}$	$\frac{N}{m^2}$, Pascal
Pressure caused by the weight of a fluid equals the density of the fluid x g x depth of fluid	$P = \rho gh$	$\frac{N}{m^2}$, Pascal
The density of water is $1000\frac{kg}{m^3} = 1\frac{g}{cm^3}$		
A buoyant force is caused by the difference in pressure on the top and bottom of an object that is submerged in a fluid. The buoyant force equals the density of the fluid x g x submerged volume of the object.	$B.F. = \rho gV$	N, newtons
Temperature is a measure of an object's average kinetic energy.		Celsius, Kelvin
Heat is the amount of energy that is transferred between substances because of their temperature difference.		calories, joules
When there is a temperature change, the heat can be calculated by multiplying the object's mass by its specific heat capacity and by the temperature change.	Q=mcΔt	joules, calories
When a solid is melted, or a liquid frozen, the heat required can be calculated by multiplying its heat of fusion by its mass.	$Q = H_f m$	joules, calories
When a liquid is turned to a gas or a gas changes to a liquid, the energy transferred is found by multiplying its heat of vaporization by its mass.	$Q = H_v m$	joules, calories

Things to know by heart---Review for test 2 continued

Some important constants for water are: $C_{liquid} = 1\frac{cal}{g\cdot^\circ C}$; $C_{ice} = .5\frac{cal}{g\cdot^\circ C}$; $C_{vapor} = .5\frac{cal}{g\cdot^\circ C}$

$H_f = 80\frac{cal}{gram}$; $H_v = 540\frac{cal}{gram}$

First Law of Thermodynamics indicates that energy is conserved. $\Delta U = \pm Q \pm W$ joules, calories
- There is no free lunch.

The Second Law of Thermodynamics
states that the natural tendency of a system is to have its entropy increase. A consequence of the second law is that heat flows from objects of higher temperature to those of lower temperature.

Here is a 10 point sample question for test 2:

How much heat is required t change 2 grams of ice at -10 degrees Celsius to water vapor at 130 degrees
Celsius?

Step 1. Warm the ice to the melting point. The melting point of water is 0 degrees Celsius. When warming from -10 to 0 degrees, Δt = 10 degrees.

$$Q = mc\Delta t = 2g\left(\frac{.5cal}{g\cdot^\circ C}\right)10^\circ C = 10 calories$$

Step 2. Melt the solid.

$$Q = H_f m = \left(80\frac{cal}{g}\right)2g = 160 calories$$

Step 3. Warm the liquid to the boiling point. The boiling point of water is 100 degrees Celsius. The liquid's temperature rises from 0 to 100 degrees Celsius, therefore Δt = 100 degrees Celsius.

$$Q = mc\Delta t = 2g\left(\frac{1cal}{g\cdot^\circ C}\right)100^\circ C = 200 calories$$

Step 4. Boil the liquid.

$$Q = H_v m = \left(540\frac{cal}{g}\right)2g = 1080 calories$$

Step 5. Warm the vapor. The vapor's temperature will rise from 100 to 130 degrees Celsius, therefore Δt=30 degrees.

$$Q = mc\Delta t = 2g\left(\frac{.5cal}{g\cdot^\circ C}\right)30^\circ C = 30 calories$$

The total energy required is found by taking the sum of all the individual steps.

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   10 calories
  160 calories
  200 calories
 1080 calories
+  30 calories
 1480 calories
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Total heat = 1480 calories **Study hard and good luck on the exam.**