Exam 4

Study Strategy

Doing is better than reviewing. A couple of hours of practicing problems from scratch (quizzes and homework) and working to correct the "sticky spots" is much more efficient and effective than spending hours reviewing.

Learning Goals

Students will be able to:

Apply the idea of conservation of energy to a process identifying the exchange of energy between different forms such as radiation, nuclear, chemical, thermal, mechanical (kinetic, rotational kinetic, gravitational potential, elastic potential) and electrical.

Apply the idea of conservation of mass to any process including photosynthesis or metabolism in animals.

Define and Calculate the linear kinetic energy, the rotational kinetic energy, the gravitational potential energy or the potential spring energy of an object.

Solve problems involving the conservation of mechanical energy.

Identify when work is being done ON an object. Work = force x displacement (in the direction of the force)

Solve problems using the work energy theorem.

Identify when conservation of momentum applies to a situation and when conservation of mechanical energy applies to a situation. For example perfectly inelastic collisions, perfectly elastic collisions and those that are in between.

Solve problems involving any type of collision using a combination of conservation of momentum and conservation of energy.

Solve problems involving power, energy, work, time, force and velocity.

Convert between horsepower to watts.

Describe a kiloWatthour and show how it is a measure of energy.

Convert between kiloWatthours and Joules.

Use the molecular model of atoms and molecules to explain temperature, pressure, kinetic energy, thermal energy, evaporative cooling and the different phases of matter – gas, liquid and solid.

Use the concepts of collisions to explain why the molecules in a substance at a given temperature are not all moving at the same speed even though the definition of temperature is the average kinetic energy of the molecules.

Be able to explain real life phenomena in terms of the behavior of atoms and molecules. For example a suction cup, drinking straw, or why the pop cans were crushed when dipped into ice water after sitting on a hot plate.

Describe the three temperature scales (Kelvin, Celsius and Fahrenheit) and how a temperature of a material compares in each scale and how the size of a degree compares on each scale.

Convert a given temperature or temperature difference from one scale to the next.

Calculate the change in length, area or volume of a substance due to heating or cooling.

Calculate the average kinetic energy per molecule of gas based on the temperature of the gas.

Calculate the total thermal energy contained in a sample of gas.

Calculate the root mean square speed of the molecules in a gas.

Describe how a substance behaves when heat is added to it, including how the molecules move and are bound.

Solve calorimetry problems involving temperature changes and phase changes.

Convert between calories, Calories and Joules.

$W = F\,\Delta x = \Delta E$ $\quad K = \frac{1}{2} m v^2$ $\quad U_g = mgh$ $\quad U_s = \frac{1}{2} k x^2$

$g = 9.8\ \text{m/s}^2$ $\quad K_r = \frac{1}{2} I \omega^2$ $\quad P = W/\Delta t = F v$

$T_C = T - 273.15\,^\circ C$ $\quad T_F = (9\,^\circ F/5\,^\circ C)\, T_C + 32\,^\circ F$

$K_{avg} = 3/2\ k_B T$ $\quad E_{th} = 3/2\ N k_B T$ $\quad v_{rms} = \sqrt{\frac{3k_BT}{m}}$ $\quad k_B = 1.38 \times 10^{-23}$ J/K

$\Delta L = \alpha L_i \Delta T$ $\quad \Delta V = \beta V_i \Delta T$

$Q = Mc\Delta T$ $\quad Q = +/- ML_f$ $\quad Q = +/- ML_v$

$\vec{p} = m\vec{v}$ $\quad \vec{F}\,\Delta t = \Delta\,\vec{p}$ $\quad \vec{p}_i = \vec{p_f}$ $\quad \Sigma\vec{F} = m\vec{a}$

$v_x = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t}$ $\quad a_x = \frac{\Delta v_x}{\Delta t} = \frac{v_{xf} - v_{xi}}{\Delta t}$

$x_f = x_i + v_{xi}\Delta t + \frac{1}{2} a_x (\Delta t)^2$ $\quad v_{xf} = v_{xi} + a_x \Delta t$ $\quad v_{xf}^2 = v_{xi}^2 + 2a_x\,(\Delta x)$

$\sin\theta$ = opp/hyp $\quad \cos\theta$ = adj/hyp $\quad \tan\theta$ = opp/adj

$a^2 + b^2 = c^2$