Final Exam part I

17. Biomass: From Plants to Garbage.
    A. Introduction
    B. Biomass Conversion
    ~~C. Food, Fuel, Famine~~
    D. Municipal Solid Waste
    E. Wood Combustion
    F. Summary
18. Tapping the Earth's Heat: Geothermal Energy.
    A. Introduction
    B. Origin and Nature of Geothermal Energy
    C. Hydrothermal Systems
    D. Geothermal Exploration and Resources
    E. Low-Temperature Geothermal Resources
    F. Environmental Impacts
    G. Summary

16. Future Energy Alternatives: Fusion.
    A. Potential for Fusion Power
    B. Energy from the Stars: The Fusion Process
    C. Conditions for Fusion
    D. Magnetic Confinement Fusion Reactors
    E. Laser-Induced Fusion
    ~~F. Cold Fusion~~
    G. Summary and Outlook for Fusion

You should be familiar with the following equations that will appear on the exam:

Mechanical Energy

Work $W = F\,d$
if force and distance are along the same direction

$KE = ½\, m\, v^2$

$W = \Delta KE$

$GPE = m\, g\, h$ $g = 10\ \text{m/s}^2$

$ME = GPE + KE$

$ME_{\text{before}} = ME_{\text{after}}$
for a system with no unbalanced forces besides gravity.

Power = Work/time = J/s = Watt

Thermal Energy

$T(\text{K}) = T(°\text{C}) + 273$

Heat $= Q = m\, c\, \Delta T$ 1 cal = 4.19 J

First law: $\Delta E = Q_{\text{to}} + W_{\text{on}} = \Delta(\text{KE} + \text{PE} + \text{TE})$

Thermal conduction $\dfrac{Q}{t} = \dfrac{A\,\Delta T}{R}$

Heat engines: $e = \dfrac{W}{Q_{\text{H}}}$ actual, $1 - \dfrac{T_{\text{C}}}{T_{\text{H}}}$ max

$Q_H = Q_C + W$

Thermal Energy (cont'd)

Heat $= Q = m\, c\, \Delta T$ ***m**ass, spe**c**ific heat, **T**emperature*

Solar $Q = I\, \varepsilon\, A$ ***I**nsolation, **ε**fficiency, collector **A**rea*

Heat pump COP $= \dfrac{Q_{\text{H}}}{W}$

Wind Energy

$P = \left(2.83\times10^{-4}\right) D^2 v^3$ kW rotor **D**iameter (m), wind **v**elocity (m/s)

Electrical Energy

$\Delta V = I R$ V volts, I current (A), R resistance (Ω)

$P = VI = I^2R = V^2/R$ power (Watts)

transformers $\dfrac{V_s}{V_p} = \dfrac{N_s}{N_p}$ and $P_s = P_p$ (ideal)

$1\ \text{kWh} = 3.6\times10^6\ \text{J}$

Nuclear Energy

$E = mc^2$ ***E**nergy, **m**ass,* $c^2 = 9.0\times10^{16}\ \text{m}^2/\text{s}^2$

Radioactive Decay

$\dfrac{N}{N_0} = e^{-\lambda t} = \left(\dfrac{1}{2}\right)^x$ ***N**umber of nuclei,* x = # half-lives

half-life $\tau_{1/2} = \dfrac{\ln 2}{\lambda}$, where λ = decay constant