Physics 100 Study Guide    Hinrichs and Kleinbach, *Energy: Its Use and the Environment*, 5th ed.
Prof. Menningen

## Exam II

10. Electricity: Circuits and Superconductors.
    - A. Introduction to "Electrification"
    - ~~B. Restructuring of the Electric Utility Industry~~
    - C. Electrical Charges and Currents
    - ~~D. Batteries and Electric Vehicles~~
    - E. Ohm's Law
    - ~~F. Superconductivity~~
    - G. Elementary Circuits
    - H. Electrical Power
    - I. Pricing Electrical Energy Use
    - ~~J. Fuel Cells~~ [discussed later]
    - K. Summary
    - ~~Special Topic: Electrostatics~~

11. Electromagnetism and the Generation of Electricity.
    - A. Magnetic Forces and Fields
    - B. The Generation of Electricity
    - C. Transmission of Electrical Energy
    - ~~D. Standard Steam-Electric Generating Plant Cycle~~
    - ~~E. Co-Generation~~
    - F. Summary

13. The Building Blocks of Matter: The Atom and Its Nucleus.
    - A. The Atomic Hypothesis
    - B. Building Blocks of the Atom
    - ~~C. Energy Levels~~
    - D. Nuclear Structure
    - E. Radioactivity
    - F. Nuclear Glue, or Binding Energy
    - G. The Joy of Atom-Smashing, or Nuclear Reactions
    - H. Fission
    - I. Summary
    - Special Topic: The Periodic Table

14. Nuclear Power: Fission.
    - A. Introduction
    - B. Chain Reactions
    - C. Assembling a Nuclear Reactor
    - ~~D. Types of Light Water Reactors~~
    - ~~E. The Nuclear Fuel Cycle~~
    - F. Radioactive Wastes
    - ~~G. Decommissioning~~
    - ~~H. Radioactive Releases~~
    - ~~I. Probabilistic Risk Assessment and Nuclear Safety~~
    - ~~J. Alternate Reactor Designs~~
    - ~~K. Nuclear Proliferation~~
    - L. Environmental and Economic Summary of Nuclear Power
    - M. Summary

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

**Thermal Energy**

Heat engines: $e = \dfrac{W}{Q_H}$ actual, $1 - \dfrac{T_C}{T_H}$ max

$$Q_H = Q_C + W$$

Power $P = W/t$ **P**ower, **W**ork or energy, **t**ime

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

**Electrical Energy**

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

$P = VI = I^2R = V^2/R$

**Electrical Energy (continued)**

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

**Nuclear Energy**

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

**Radioactive Decay**

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

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