

Study Guide for Nonrenewable Energy

- Be able to state and explain the 1st Law of Thermodynamics (Law of Conservation of energy).
- Be able to state and explain the 2nd Law of Thermodynamics. Be able to define entropy. Understand the implications of the 2nd Law of Thermodynamics on energy quality; after an energy transformation there is always some decrease in energy-quality and that heat is a low-quality form of energy.
- Be able to explain the difference between primary, secondary and tertiary oil recovery. Explain which type of recovery has the highest net energy ratio. Be able to explain advantages and disadvantages of oil.
- Be able to explain the basic process of crude oil refining of separating the different components of crude oil based on their differing boiling points.
- Be able to explain what OPEC is and know **some** of the 13 nations in OPEC.
- Be able to define oil sand (tar sand) and oil shale. Be able to explain how the net energy ratios of these sources of oil compare to traditional oil. Be able to explain additional environmental impacts of using these sources of oil.
- Understand the concept of peak oil production and what projections are for the future of our oil supplies.
- Know about the effects of oil spills. Know about methods to clean-up oil spills. Know that using a double hulled boat is one strategy to reduce the likelihood of a spill due to a shipping accident, and know reasons why actions to require double-hulled boats have not been fully effective.
- Know the basics of the Exxon Valdez oil spill and the Deepwater Horizon oil spill (general location, basic cause, scale of spill)
- Be able to name the main component of natural gas. Know that natural gas is often found above oil deposits (conventional natural gas). Know other advantages and disadvantages of natural gas. Be able to explain the basic process of the new extraction technique of hydraulic fracturing (fracking) and some concerns about this process.
- Know about unconventional natural gas deposits such as methane hydrates.
- Be able to compare the different heat, carbon and sulfur contents of the 3 types of coal (lignite, bituminous and anthracite.)

- Know that 25% of world's electricity and 75% of the energy for steel production comes from coal. Know that coal is a major source of mercury pollution. Know that coal results in $\frac{2}{3}$ of all SO_2 and $\frac{1}{4}$ of all NO_x , and that these gases form sulfuric acid and nitric acid in the atmosphere- leading to acid rain. Know other disadvantages and advantages of coal. Know countries with large coal reserves.
- Explain the **basic** process of how electricity is produced from coal.
- Be able to define work, energy and power. Know the following formulas: Power = Energy/Time. Also, be able to solve for energy (Energy = Power x Time). Know that joules, calories, BTU's (British Thermal Units) and Kilowatt-hours are units of work or energy. Know that Watts (which equals 1 joule/second), kilowatts are units of power.
- Know the following metric prefixes: kilo (10^3), mega (10^6), giga (10^9), tera 10^{12})
- Be able to perform dimensional analysis to solve energy/power problems, like the AP Free Response questions. All necessary conversion factors will be provided.