PHYSICS 1020

Homework set 2

31 March 1997

[**17.5**] Use Fig. 17.2 to estimate the percentage of U.S. energy resource consumption that came from coal in each of the following years: 1900, 1920, 1940, 1960, 1980. Do the same for oil.

Answer:

From the figure, we deduce the following numbers:

year	1900	1920	1940	1960	1980
% from coal	80	70	50	20	20
% from oil	0	10	30	40	45

[**17.6**] Total U.S. energy use was roughly exponential from 1880 to 1920. Use Fig. 17.2 to estimate its doubling time. Find its annual percentage increase.

Answer:

Energy use roughly doubled from 1880 to 1900, and then doubled again from 1900 to 1920, so the doubling time was roughly 20 years. In section 7.7 it was stated that the percent increase P in terms of the doubling time T is approximately given by $P = 70/T$. This leads to $P = 70/20 = 3.5\%$.

[**17.9**] Every heat engine has a thermal energy input, a work output, and a thermal energy output. At what places in a nuclear reactor (see fig. 17.6) does each of these occur?

Answer:

Thermal energy input is in the core of the reactor; work output is at the turbine which drives the electric generator; thermal energy output is at the condenser.

[**17.12**] Neutrons, created when particles from outer space hit the atmosphere, often hit Earth's surface. Could these neutrons start a fission chain reaction in natural uranium in the ground? Why?

Answer:

Since natural uranium contains only 0.7% of the fissile U-235, the neutrons from the cosmic radiation could not start a fission chain reaction in the uranium in the ground. Most of the neutrons generated in a fission process would be absorbed by a U-238 nucleus, and therefore no chain reaction could be sustained.