



More Energy

Remember to practice with the study questions on the BIOL 101 web site.

Atomic number	Mass number
Cooling tower	Nonionizing radiation
Electron	Proton
Element	Radiation
Half-life	Ultraviolet light
Heavy hydrogen	Visible light
Ionizing radiation	Wavelength
	α β γ x

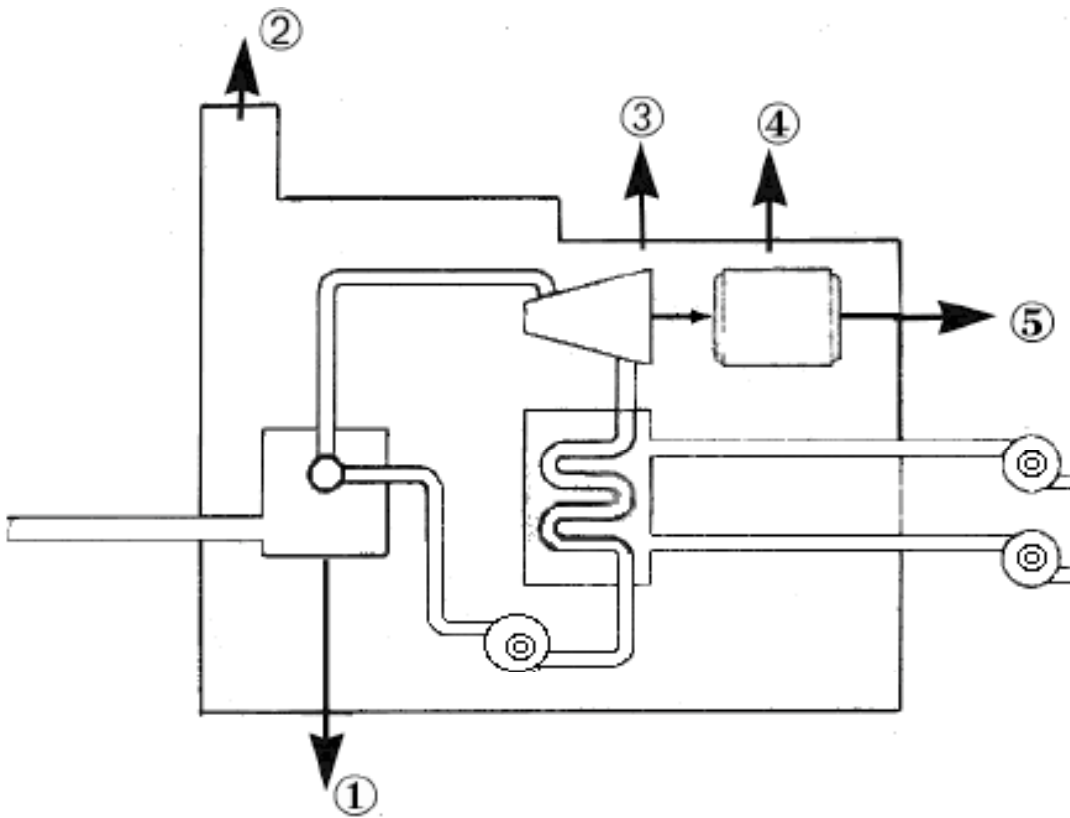
Some problems

1. Perpetual motion machines that create energy for free have appeared in drawings since the 8th century. In the 1500s, Leonardo da Vinci devised the chimney jack that rotated due to the effect of hot gases flowing up a chimney. It looked like a spit turned by hot air. He hoped this would create energy for free. Explain why generating energy for free is not possible according to the Laws of Thermodynamics.
2. Electric cars can reduce the emission of greenhouse gases. Why do these vehicles not reduce our consumption of energy?
3. Select one energy source for a fictional country and explain what happens to it between its collection and its use by the citizens. Identify one disadvantage of your choice. How will you mitigate this disadvantage?
4. Although fuel and electricity prices fluctuate, a snapshot of electricity-generating costs is given below. What factors need to be considered before a country makes a commitment to switch from oil to an alternative energy source?

Fuel	Cost per kilowatt-hour
Oil	\$0.12
Solar	\$0.21
Nuclear	\$0.03
Wind	\$0.10
Biomass	\$0.07

5. Electrical power is measured in watts, which is the energy consumed to do a task (1 watt=1 joule/second). Data from the United Nations for selected countries are given below. In addition to total population, what factors affect a country's energy needs?

Country	Kilowatt-hr consumed per person
United States	13,500
Japan	6600
China	1484
Haiti	73
Somalia	33



Source	Primary Advantage	Major Disadvantage	H ₂ O ¹	Overall ² +/-
Active solar				
Bioconversion				
Biodiesel				
Coal				
Coal Gasification/ liquefaction				
Geothermal				
Hydropower				
Natural gas				
Nuclear fission				
Nuclear fusion				
Oil shale				
OTEC				
Passive solar				
Petroleum				
Tidal				
Wind				
Wood				

¹ ✓ if electricity is generated by driving a turbine with highly pressurized hot water.

² Mark + if the advantages significantly outweigh disadvantages AND any disadvantages can be mitigated.