

30. The lid of a pressure cooker forms a nearly airtight seal. Steam builds up pressure and increases temperature within the pressure cooker so that food cooks faster than it does in an ordinary pot. The system is defined as the pressure cooker and the water and steam within it. Suppose that 2.0 g of water is sealed in a pressure cooker and then vaporized by heating.
- a. What happens to the water's internal energy?
 - b. Is energy transferred as heat to or from the system?
 - c. Is energy transferred as work to or from the system?
 - d. If 5175 J must be added as heat to completely vaporize the water, what is the change in the water's internal energy?

Alternative Assessment

1. Imagine that an inventor is asking you to invest your savings in the development of a new turbine that will produce cheap electricity. The turbine will take in 1000 J of energy from fuel to supply 650 J of work, which can then be used to power a generator. The energy removed as heat to a cooling system will raise the temperature of 0.10 kg of water by 1.2°C. Are these figures consistent with the first and second laws of thermodynamics? Would you consider investing in this project? Write a business letter to the inventor explaining how your analysis affected your decision.
2. Talk to someone who works on air conditioners or refrigerators to find out what fluids are used in these systems. What properties should refrigerant fluids have? Research the use of freon and freon substitutes. Why is using freon forbidden by international treaty? What fluids are now used in refrigerators and car air conditioners? For what temperature ranges are these fluids appropriate? What are the advantages and disadvantages of each fluid? Summarize your research in the form of a presentation or report.
3. Research how an internal-combustion engine operates. Describe the four steps of a combustion cycle. What materials go in and out of the engine during each step? How many cylinders are involved in one cycle? What energy processes take place during each stroke? In which steps is work done? Summarize your findings with diagrams or in a report. Contact an expert auto mechanic, and ask the mechanic to review your report for accuracy.
4. The law of entropy can also be called the law of increasing disorder, but this law seems to contradict the existence of living organisms that are able to organize chemicals into organic molecules. Prepare for a class debate on the validity of the following arguments:
 - a. Living things are not subject to the laws of thermodynamics.
 - b. The increase in the universe's entropy due to life processes is greater than the decrease in entropy within a living organism.
5. Work in groups to create a classroom presentation on the life, times, and work of James Watt, inventor of the first commercially successful steam engine in the early nineteenth century. Include material about how this machine affected transportation and industry in the United States.
6. Most major appliances are required by law to have an *EnergyGuide* label attached to them. The label indicates the average amount of energy used by the appliance in a year, and gives the average cost of using the appliance based on a national average of cost per energy unit. In a store, look at the *EnergyGuide* labels attached to three different models of one brand of a major appliance. Create a graph showing the total yearly cost of each appliance over ten years (including the initial cost of the appliance with year one). Determine which model you would purchase, and write a paragraph defending your choice.