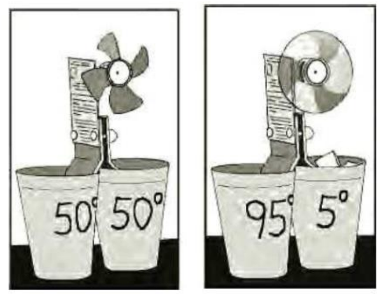
Questions for Module # 24

Q.1 The device shown here is called a thermoelectric converter. It uses a series of semiconductor cells to transform internal energy to electric potential energy. Both legs of the device are at the same temperature and no electric potential energy is produced. When one leg is at a higher temperature than the other as shown in the picture on the right, however, electric potential energy is produced as the device extracts energy from the hot reservoir and drives a small electric motor. (a) Why is the difference in temperature necessary to produce electric potential energy in this demonstration? (b) In what sense does this intriguing experiment demonstrate the second law of thermodynamics?



Solution

Q.2 What are some factors that affect the efficiency of automobile engines? Solution

Q.3 An ideal gas is taken through a Carnot cycle. The isothermal expansion occurs at 250°C, and the isothermal compression takes place at 50.0°C. The gas takes in 1.20 × 103 J of energy from the hot reservoir during the isothermal expansion. Find (a) the energy expelled to the cold reservoir in each cycle and (b) the net work done by the gas in each cycle. Solution

Q.4 In a cylinder of an automobile engine, immediately after combustion, the gas is confined to a volume of 50.0 cm^3 and has an initial pressure of 3.00×10^6 Pa. The piston moves outward to a final volume of 300 cm^3, and the gas expands without energy transfer by heat. (a) If $\gamma = 1.40$ for the gas, what is the final pressure? (b) How much work is done by the gas in expanding?

Solution

Q.5 The last question (find heat input) in video 1.5.

Q.6 Prove that no engine can be more efficient than a Carnot engine.

Q.7 The last question in video 2.1.

Q.8 Explain the logic of the last example solved in video 2.2. Is the answer in part b of that question realizable in practice?