Answers to Review Questions 5.1:

1. The concept of heat is there in student's textbook. Tell effects of heat and introduce them that most of these effects will be the concern of this unit. Effects of heating are:

- ▷ Raises temperature.
- ▷ Increases volume.
- ▷ Changes state.
- ▷ Brings about chemical action.
- ▷ Changes physical properties.

2. The temperature difference between two systems causes heat transfer. Spontaneously heat flows from hotter to colder region. By other external factors, heat may flow from colder region to hotter region as is observed in refrigerators. A pressure difference between two regions can also cause heat transfer.
3. Objects, in thermal equilibrium, exchange heat but there is no net heat flow between them.
4. It is possible to reduce net heat flow to zero. Internal energy can be reduced to zero at absolute temperature. Internal energy of a system is the sum of all the microscopic energies such as:

- ▷ translational kinetic energy.
- ▷ vibrational and rotational kinetic energy.
- ▷ potential energy from intermolecular forces.

Temperature is the measure of the sum of the average translational and rotational kinetic energies only, but not potential energy from intermolecular forces. Therefore, internal energy highly depends on temperature. However, it is not only change in temperature that affects the internal energy but the potential energy from intermolecular forces also affects it.

5. The two systems are different only in temperature.
   (a) We cannot say A or B has stored heat. It is meaningless to say A or B has higher heat.
   (b) Since they are identical except different in temperature, so A has higher internal energy than B.
   (c) A loses and B gains energy. The direction of heat flow is from A to B. The average kinetic energy of particles in B increase since it is gaining energy.

6. Assuming that the system is isolated.
   (a) The heat stores as internal energy of the gas.

(b) In this case, the internal energy is changing to work by then decreasing the internal energy of the system.
(c) In this case, the heat supplied into the system is equal to the internal energy converted to thermodynamic work.

7. Heat and work are two different ways of transferring energy from one system to another. Heat is the transfer of thermal energy between systems, while work is the transfer of mechanical energy between two systems.