

Assessment

Thermodynamics**Teacher Notes and Answers****10 Thermodynamics****THE FIRST LAW OF THERMODYNAMICS**

1. b
2. c
3. a
4. d
5. b
6. d

Given

$$Q_{\text{added}} = 2750 \text{ J}$$

$$Q_{\text{removed}} = 1550 \text{ J}$$

$$W = 850 \text{ J}$$

Solution

$$\Delta U = Q - W = (2750 \text{ J} - 1550 \text{ J}) - 850 \text{ J} = 350 \text{ J}$$

7. c
8. a
9. In a cyclic process, the temperature of the system does change, unlike an isothermal process. However, once the cycle is

complete, the system is at the same temperature as when it started the cycle, so the overall effect is as if there was no change in temperature. Like an isothermal process, the overall energy transferred as heat equals the overall work performed.

10. $1.36 \times 10^5 \text{ J}$

Given

$$Q_{\text{added}} = 6.60 \times 10^5 \text{ J}$$

$$Q_{\text{removed}} = 4.82 \times 10^5 \text{ J}$$

$$\Delta U = 4.2 \times 10^4 \text{ J}$$

Solution

$$\Delta U = Q - W$$

$$Q = Q_{\text{added}} - Q_{\text{removed}}$$

$$W = Q_{\text{added}} - Q_{\text{removed}} - \Delta U =$$

$$6.60 \times 10^5 \text{ J} - 4.82 \times 10^5 \text{ J} -$$

$$4.2 \times 10^4 \text{ J}$$

$$W = 1.36 \times 10^5 \text{ J}$$

Assessment

Thermodynamics

Section Quiz: The First Law of Thermodynamics

Write the letter of the correct answer in the space provided.

- _____ 1. Which concept does the first law of thermodynamics describe?
- conservation of mass
 - conservation of energy
 - work-heat equivalence
 - conservation of momentum
- _____ 2. What occurs when $Q = 0$, so that the first law of thermodynamics takes the form of $\Delta U = -W$?
- an isovolumetric process
 - an isothermal process
 - an adiabatic process
 - an isolated system
- _____ 3. What occurs when $W = 0$, so that the first law of thermodynamics takes the form of $\Delta U = Q$?
- an isovolumetric process
 - an isothermal process
 - an adiabatic process
 - an isolated system
- _____ 4. What process occurs when $Q = W = 0$, so that the first law of thermodynamics takes the form of $\Delta U = 0$?
- an isovolumetric process
 - an isothermal process
 - an adiabatic process
 - an isolated system
- _____ 5. What occurs when $\Delta U = 0$, so that the first law of thermodynamics takes the form of $Q = W$?
- an isovolumetric process
 - an isothermal process
 - an adiabatic process
 - an isolated system
- _____ 6. A steam engine takes in 2750 J of energy as heat, gives up 1550 J of energy as heat to its surroundings, and does 850 J of work. What is the change in the internal energy of the engine?
- 5150 J
 - 3450 J
 - 2050 J
 - 350 J

Thermodynamics *continued*

- _____ 7. Which of the following statements about ideal cyclic processes is correct?
- a. The energy added as heat is converted entirely to work.
 - b. The net work is greater than the net transfer of energy as heat.
 - c. The net work done equals the net transfer of energy as heat.
 - d. The net work is less than the net transfer of energy as heat.
- _____ 8. A refrigerator removes a quantity of energy as heat from inside the refrigerator and transfers this energy to the air outside the refrigerator. Which statement correctly describes how this is done?
- a. Work is done on the system, so that energy can be transferred as heat from a low temperature to a high temperature.
 - b. Work is done by the system, so that energy can be transferred as heat from a low temperature to a high temperature.
 - c. Energy is transferred as heat spontaneously from the high temperature inside the refrigerator to the low temperature outside.
 - d. Energy is transferred as heat spontaneously from the low temperature inside the refrigerator to the high temperature outside.

9. Explain how a cyclic process resembles and differs from an isothermal thermodynamic process.

10. An engine takes in 6.60×10^5 J of energy as heat and gives up 4.82×10^5 J of energy as heat to the surroundings. Because it is not an ideal engine, its internal energy increases by 4.2×10^4 J. How much work does the engine do?