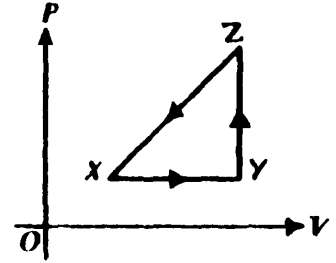


Name: _____

1. A thermodynamic system is taken from an initial state X along the path $XYZX$ as shown in the PV-diagram to the right.



a. For the process $X \rightarrow Y$, ΔU is greater than zero and

- a) $Q < 0$ and $W = 0$
- b) $Q < 0$ and $W > 0$
- c) $Q > 0$ and $W < 0$
- d) $Q > 0$ and $W = 0$
- e) $Q > 0$ and $W > 0$

b. For the process $Y \rightarrow Z$, Q is greater than zero and

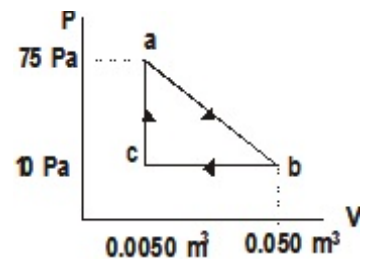
- a) $W < 0$ and $\Delta U = 0$
- b) $W = 0$ and $\Delta U < 0$
- c) $W = 0$ and $\Delta U > 0$
- d) $W > 0$ and $\Delta U = 0$
- e) $W > 0$ and $\Delta U > 0$

2. A piece of metal with a mass of 1.20 kilograms, specific heat of $390 \text{ J/kg} \cdot \text{C}^\circ$, and initial temperature of 87°C is dropped into an insulated jar that contains 4.5 kg of water at 20.0°C . The metal is removed after 12 seconds, at which time its temperature is 35°C . Neglect any effects of heat transfer to the air or to the insulated jar. What is the temperature of the liquid after the metal is removed?

3. A steam engine operates on a warm 28.0°C day. If the ideal efficiency for this engine is 24%, what is the high temperature for the engine?

4. What is the average velocity of the particles of nitrogen at 22.0°C ?

5. A gas undergoes a thermodynamic expansion process as shown. Process **ab** represents the output work, process **bc** represents input work, all three processes involve heat transfer. (a) what is the work accomplished along path **ca**? (b) What is the work along path **ab**, (c) What is the work along path **bc**? (d) What is the net work for the entire thermo cycle?



6. A heat engine makes use of 785 kJ of heat to produce 245 kJ of work. It operates at a temperature of 285°C. It exhausts heat to the 22.5°C atmosphere. What is (a) its ideal efficiency and (b) its actual efficiency? (c) Why are these two quantities so different?

7. A circuit exists as shown below – the three resistors are immersed in a tank of water. The battery is connected to the resistors for 12.0 min. (a) How much heat is generated in the 12.0 min? (b) The water in the tank has a mass of 1.25 kg and a beginning temperature of 24.0 °C, so what is the final temperature of the water if all the heat goes into it?

