

AP Physics – Thermo'Duh'Fermo - 5

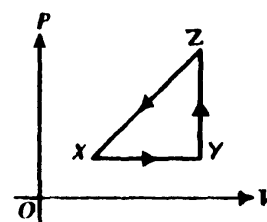
Co'Co'Cuh'Chew! _____

Per _____



The true measure of a man is what he would do if he knew he would never be caught. Lord Kelvin

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

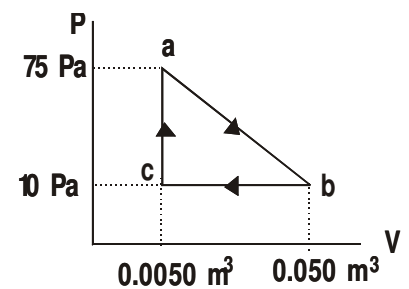
- (A) $W < 0$ and $\Delta U = 0$
- (B) $W = 0$ and $\Delta U < 0$
- (C) $W = 0$ and $\Delta U > 0$
- (D) $W > 0$ and $\Delta U = 0$
- (E) $W > 0$ and $\Delta U > 0$

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 $87 \text{ }^\circ\text{C}$ 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 $35 \text{ }^\circ\text{C}$. 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 $28.0\text{ }^{\circ}\text{C}$ 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 35.0 s? (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?

