

Physics 103 Quiz # 7, Thursday (3/7/2013)

Show all work in order to obtain points for problems

Key

Name: _____

1. (2 pts) The volume of an ideal gas changes from 0.40 to 0.55 m^3 although its pressure remains constant at $50\,000 \text{ Pa}$. What work is done on the system by its environment?

- a. $-7\,500 \text{ J}$
- b. $-200\,000 \text{ J}$
- c. $7\,500 \text{ J}$
- d. $200\,000 \text{ J}$

Work done on system
 $= -P\Delta V = 50000(0.55 - 0.4)$
 $= -7500$

2. (2 pts) Three Carnot engines operate between temperature reservoirs as follows: Engine A: $T_h = 1\,300 \text{ K}$, $T_c = 1\,000 \text{ K}$; Engine B: $T_h = 1\,000 \text{ K}$, $T_c = 700 \text{ K}$; Engine C: $T_h = 650 \text{ K}$, $T_c = 500 \text{ K}$. Which two engines have the same thermal efficiency?

- a. A and B
- b. B and C
- c. A and C
- d. No two have the same thermal efficiency.

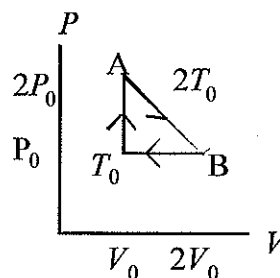
$e_c = 1 - T_c/T_h$

A	$1 - \frac{1000}{1300}$	B	$1 - \frac{700}{1000}$	C	$1 - \frac{500}{650}$
	$= 0.23$		$= 0.3$		$= 0.23$

3. (2 pts.) An ideal gas at pressure, volume, and temperature, P_0 , V_0 , and T_0 , respectively, is heated to point A, allowed to expand to point B also at A's temperature $2T_0$, and then returned to the original condition. The internal energy increases by $3P_0V_0/2$ going from point T_0 to point A. How much heat entered the gas from point T_0 to point A?

- a. 0
- b. $P_0V_0/2$
- c. $3P_0V_0/2$
- d. $5P_0V_0/2$

$\Delta U = Q + W$
 $W = P\Delta V \quad \Delta V = 0$
 $\Delta U = Q$
 $\Rightarrow Q = 3P_0V_0/2$



4. (4 pts.) If a heat engine has an efficiency of 30% and its power output is 600 W, what is the rate of heat input from the combustion phase?

- a. 1 800 W
- b. 2 400 W
- c. 2 000 W
- d. 3 000 W

$P_{out} = P_{tot} * 0.3$
 $P_{tot} = \frac{P_{out}}{0.3} = \frac{600}{0.3} = 2000 \text{ W}$