

MAE 320 THERODYNAMICS
EXAM 1 - Practice

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Name: _____

You are allowed one sheet of notes.

1. What is the specific volume of superheated water vapor under the following conditions?
(Use Table A-4.)
 - a) $p = 0.700 \text{ bar}$, $T = 200 \text{ }^{\circ}\text{C}$
 - b) $p = 0.700 \text{ bar}$, $T = 220 \text{ }^{\circ}\text{C}$
 - c) $p = 0.800 \text{ bar}$, $T = 200 \text{ }^{\circ}\text{C}$
 - d) $p = 0.800 \text{ bar}$, $T = 220 \text{ }^{\circ}\text{C}$

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2. A refrigerator every cycle extracts 1.0 J of heat from its contents, while adding 2.5 J of heat to the room it is in, using 1.5 J of electricity. What is the coefficient of performance (β), of the refrigerator?

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3. A Sterling cycle engine has an efficiency of 20% and utilizes heat from a heat source at a rate of 200 W.
- a) How much power is generated by the engine?
 - b) What is the rate of heat transfer back into the environment?

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4. How much energy must be used to heat 0.5 kg of water from 20 °C to 100 °C at atmospheric pressure (1.014 bar)?

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5. How much energy must be used to completely evaporate 0.5 kg of water that is at 100 °C and atmospheric pressure (1.014 bar)? (I.e., bring the water from saturated liquid to saturated vapor.) The water is in an expandable container.

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6. By what factor will the water expand as it becomes steam (i.e., goes from saturated liquid to saturated vapor) at 100 °C and atmospheric pressure (1.014 bar)? (I.e., what is v_2/v_1 ?)

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7. How much energy must be added to bring 0.5 kg of steam from 100 °C to 200 °C, if it stays at a pressure of 1.0 bar in an expandable container?

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8. By what factor will the steam expand as it goes from 100 °C to 200 °C, if it stays at a pressure of 1.0 bar in an expandable container? (I.e., what is v_2/v_1 ?)

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9. How much heat must be added to a boiler (constant volume) to bring 1 kg of steam (saturated vapor) from 1.00 bar to 1.50 bar?

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10. One kg of a gas at 15 bar, $0.2 \text{ m}^3/\text{kg}$ is allowed to expand against a piston through a polytropic expansion with $n = 1$, until the pressure reduces to 5 bar. How much work is done in pressing against the piston?

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