

**NAME:**

ME 327

Examination 1

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### 1. Interpolation (10)

Material:  $H_2O$ ,  $P = 12.3 \text{ kPa}$ ,  $v = 8.0 \text{ m}^3/\text{kg}$ . Find  $T$  and  $x$  if saturated mixture. Use linear interpolation if necessary.

### 2. Ideal Gas Problem (45)

10 kg of air ( $R = 0.287 \text{ kJ/kg/K}$ ) is in a piston-confined cylinder of diameter 20 mm. The air inside the cylinder is initially at 120,000 Pa and  $100^\circ\text{C}$ . A linear spring *restrains* the piston. The spring constant is  $k = 100 \text{ kN/m}$ . The air is heated to a final temperature of  $200^\circ\text{C}$ .

- What is the final total volume of the cylinder?
- How much total work is done by the air?
- Accurately sketch the process in  $P-v$ ,  $T-v$ , and  $P-T$  planes; label your axes; include units; clearly show numerical values for each state.

### 3. Steam Problem (45)

A mass, 5 kg, of  $H_2O$  initially at  $P = 50 \text{ kPa}$ ,  $v = 1.0 \frac{\text{m}^3}{\text{kg}}$  is first heated isobarically to  $T = 400^\circ\text{C}$ . It then undergoes an isothermal process until  $P = 400 \text{ kPa}$ .

- What is the final total volume?
- Accurately sketch the total process in the  $P-v$ ,  $T-v$ , and  $P-T$  planes. Label each state in your sketch giving numerical values for  $P, T, v$ . Include the vapor dome in its correct position.
- Calculate the total work done in the isobaric portion of the process.
- Give a reasonable estimate of the work done in the isothermal portion of the process.