

University Mechanical Engineering

Name: _____ Score: _____

1. Saturation pressure of water at 100 degrees C (two decimals, kPa)?

_____ kPa

2. Isobaric work 200 kPa, 0.3 to 0.9 m³ (one decimal, kJ)?

_____ kJ

3. Isentropic turbine exit quality at 50 kPa (four decimals)?

4. Carnot efficiency between 800 K and 300 K (three decimals)?

5. Baseline turbine exit quality at 10 kPa (four decimals)?

6. The coefficient of performance is defined as:

- ☐ cost over benefit - w_{in} divided by q_L
- ☐ work out over heat in, like an engine
- ☐ the ratio of the two absolute temperatures
- ☐ benefit over cost - q_L or q_H divided by w_{in}

7. Inside the saturation dome, quality x is:

- ☐ the temperature span across the dome
- ☐ the ratio of actual to saturation pressure
- ☐ the vapour mass fraction of the mixture
- ☐ the vapour volume fraction of the mixture

8. Which of these is a state function?

- ☐ Boundary work
- ☐ Shaft work
- ☐ Enthalpy
- ☐ Heat transferred

9. Across an adiabatic nozzle with no shaft work:

- ☐ entropy stays exactly constant

- ☐ enthalpy rises by the kinetic-energy gain
- ☐ enthalpy drops by the kinetic-energy gain
- ☐ pressure stays constant

10. $ds = \delta q / T$ may be applied directly when:

- ☐ the fluid is an ideal gas
- ☐ the path is reversible - otherwise use the entropy balance with σ
- ☐ the device is adiabatic
- ☐ the process is cyclic

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1. **101.35 kPa**

Read from the saturated-water temperature table.

2. **120.0 kJ**

$$W = p \, dV.$$

3. **0.8966**

$$x = (6.9212 - 1.0910)/6.5029.$$

4. **0.625**

$$1 - 300/800.$$

5. **0.7227**

$$(6.0700 - 0.6492)/7.5009.$$

6. **benefit over cost - q_L or q_H divided by w_{in}**

COP is benefit over cost; the reversed-Carnot bound caps it.

7. **the vapour mass fraction of the mixture**

Quality is defined on a mass basis - averaging by volume is the classic slip.

8. **Enthalpy**

Work and heat are path quantities; $h = u + pv$ depends only on the state.

9. **enthalpy drops by the kinetic-energy gain**

$$q - w = 0, \text{ so } dh = -d(ke).$$

10. **the path is reversible - otherwise use the entropy balance with σ**

The definition needs q_{rev} ; σ catches the rest.