

QUIZ 2

*This is an open book 60 minutes exam.*

*It is recommended that you read the whole exam before you start solving.*

*Make sure that the units are consistent.*

*Write your name on both the question and answer sheets.*

*Clearly identify your control mass / control volume.*

*State any assumptions you need and provide a convincing justification.*

**Problem 1**

A cyclic machine (Refrigerator), extracts 100 kJ from a  $-10\text{ }^\circ\text{C}$  energy reservoir. It rejects 110 kJ to a  $25\text{ }^\circ\text{C}$  energy reservoir and the cycle needs 10 kJ of work as input.

Is this cycle reversible, irreversible, or impossible?

Draw a thermodynamic scheme of this refrigerator showing the different variables of the problem.

**Problem 2**

The rigid tank illustrated in the figure below has a volume of  $0.06\text{ m}^3$  and initially contains a two-phase liquid-vapor mixture of  $\text{H}_2\text{O}$  at a pressure of 1500 kPa and a quality of 20 %. As the tank contents are heated, a pressure regulating valve keeps pressure constant in the tank by allowing saturated vapor to escape. Heating continues until the mass of liquid in the tank has decreased to half its initial value. The saturated vapor enters a turbine at 1500 kPa and is discharged to the atmosphere as saturated vapor at 100 kPa.

Neglecting kinetic and potential energy effects, determine:

- The amount of heat transfer.
- The mass of vapor that escapes.
- The turbine work.

