

Ph.D. Qualifying Examination

Thermodynamics

Fall 2015

Logistics Notes:

- Time allowed: 2 hours.
- Exam is open-book (one book) and closed-notes; one sheet (8.50 in. × 11.00 in.) of notes is allowed.
- Calculators are allowed.
- Laptops, cell phones, and similar electronic devices are not allowed.

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2 hours, Open book (one book, one sheet of note), calculator is allowed
State your assumptions

1. (60 points) An insulated rigid tank is divided into two parts, A and B, by a diaphragm. Each part has a volume of 1 m^3 . Initially, part A contains water at room temperature, 20°C , with quality of 50%, while part B is evacuated. The diaphragm then ruptures and the water fills the total volume. Determine the irreversibility of this process.

2. (40 points) One kilogram of air contained in a cylinder fitted with a piston at a pressure of 400 kPa and a temperature of 600 K. The air is expanded to 150 kPa in a reversible adiabatic process. Calculate the work done by the air.

NOTE: Do not assume C_p of air is constant and take its variation with respect to temperature into account.
