

Thermodynamics and energetics I: Exercise 1

The exercise reviews identification of systems and their boundaries, and uses examples applying this to force balances. The conversion of units is refreshed.

1. Determine whether the following systems are **open or closed** systems based on the schematics in Figure 1.

- Tea pot on the stove
- Thermos flask
- Turbine in an electrical power plant
- Combustion chamber in automotive engine
- Family house with PV panels and heat pump for warm water

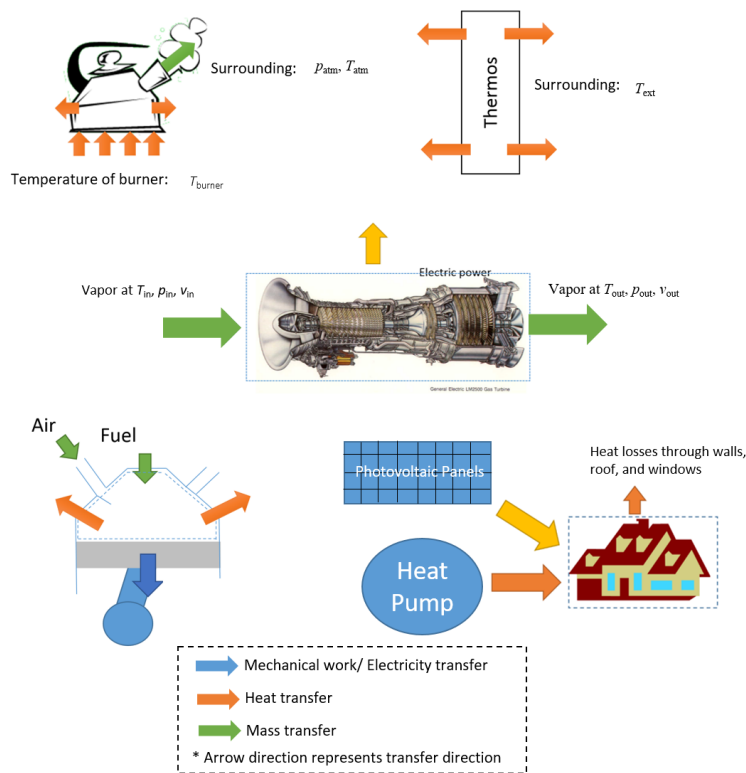


Figure 1: Sketches illustrating the systems and their boundaries.

2. A cylinder of compacted scrap metal ($L = 2$ m, $D = 0.5$ m) is suspended from a spring scale at a location where $g = 9.81$ m/s². Determine the scale reading in [N] for a density of the scrap metal varying with position z according to $\rho = 7800 - 360(z/L)^2$.

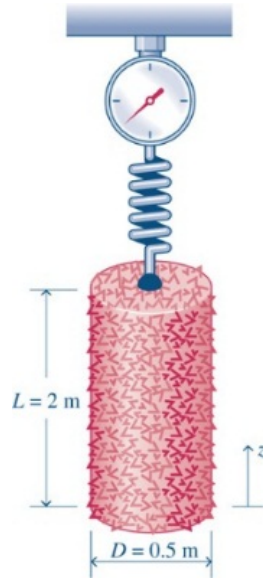


Figure 2: Cylindrical weight hanging on a spring.

3. Fill in the tables.

- Pressure:

bar	kPa	atm	N/m ²
1	1000	1	1000

- Temperature:

K	°C
250	20

- Mass flow:

kg/s	kg/min	kg/h	t/h
0.1	20	10	10