DO NOT WRITE ON THE BLUE TABLES. RETURN THE BLUE TABLES WITH YOUR EXAM. DO NOT STAPLE THE EXAM SHEETS TOGETHER. Put your answers on the same sheet as the question, Use at least 5 significant digits in your computations and answers where possible. You must give the units of your answers. You must write clearly. Encircle the right answer number in multiple choice. To correct, erase the wrong circle as well as you can and encircle the corrected answer number twice. Best possible answer for multiple choice. For questions asking a number, putting the clear correct formula(s) below the question might result in partial credit even if the answer is wrong. *Not following those requirements will result in reduced or no credit.*

1. (5%) The specific heat at constant volume of acetylene at 226.85°C equals 1.7532 kJ/kg K.

2. (5%) Air at 25°C and 100 kPa is expanding at a rate of 0.015 m^3/kg s, causing the temperature to drop by 2°C/s. The heat that leaks into the air is 0.066 kW/kg.

3. (5%) To heat 0.5 L of liquid lead from 350°C to 400°C requires 42.64 kJ of heat.

4. (5%) If the temperature of argon changes from 300 to 500 K in an isobaric process, its internal energy changes by 62.4 kJ/kg.

5. (5%) Suppose the enthalpy was missing from the saturated tables. How could you most quickly find h_{fg}? $u_{fg} + Pv_{fg}$

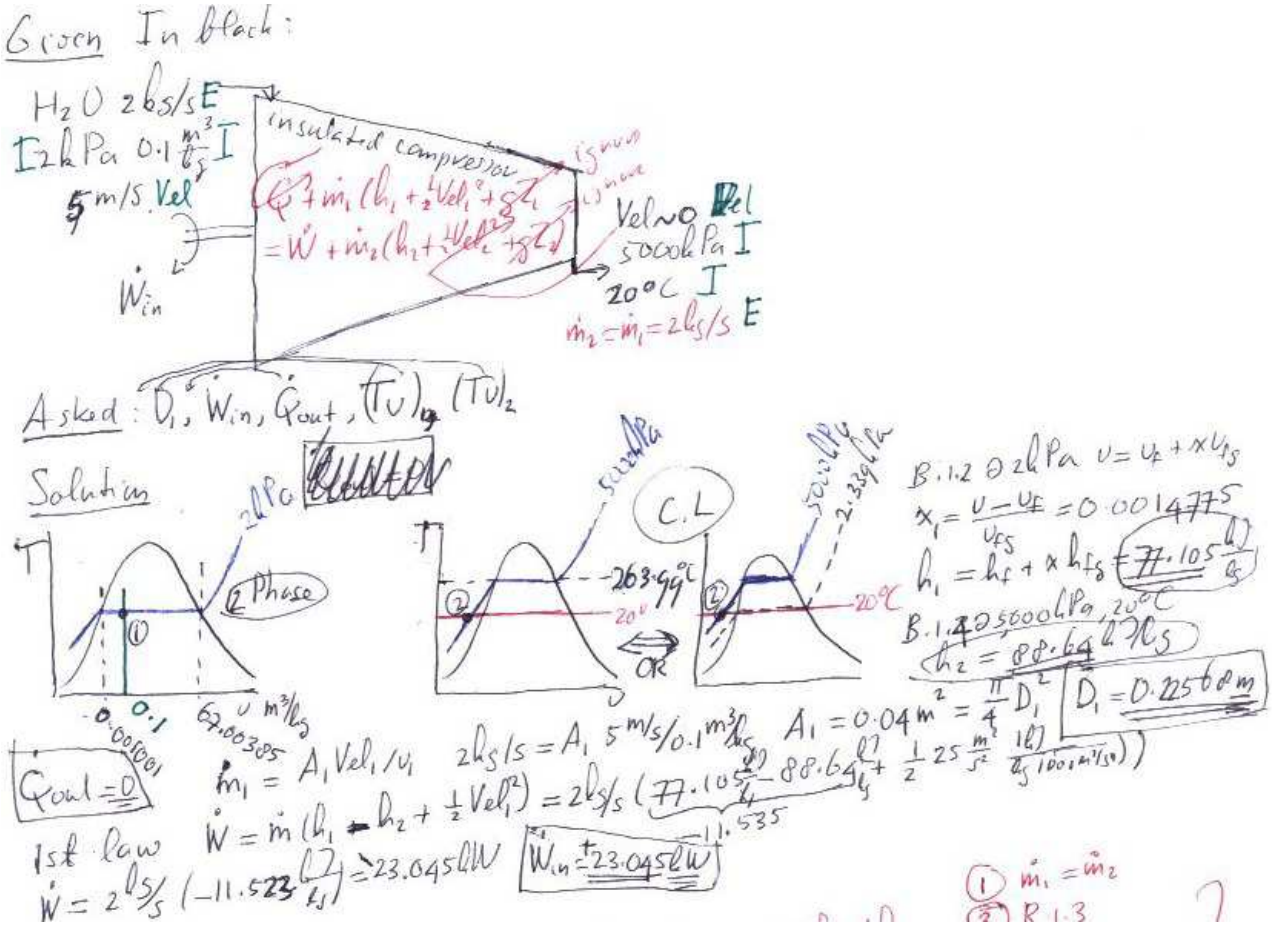
6. (5%) Given substance data on on ideal gas, what is enough info to find the specific volume: (1) P and h; (2) T and u; (3) u and h. 1

7. (5%) Below a floating piston, 3 kg of water at 25°C and 100 kPa is being heated at a rate of 0.5 kW. The temperature increases by 0.039872 °C/s. Accepted due to unintended original phrasing: 0.089031 °C/s.

8. (33%) A 2 kg/s stream of water at 2 kPa and 0.1 m^3/kg enters an insulated compressor with a speed of 5 m/s. The compressor compresses the water to 5,000 kPa and 20°C and it comes out with negligible velocity.

   - Construct the phase of the entering stream in a very neat Tv-diagram, marking all lines and points used to do it with their values. Do not put more info in the diagram than is needed to construct the phase. State the phase.
   - Construct the phase of the exiting stream in a second Tv-diagram, otherwise meeting the same criteria as the first.
   - What is the diameter of the pipe through which the water enters?
   - What is the power needed to run the compressor? What is the heat that comes out of the compressor?

   You must show the derivations and reasoning completely and correctly for full credit. You must give simplified units for your answers. Most accurate procedure only unless stated otherwise. Use at least 5 significant digits in your computations and answers. *Give the source of every number.*



9. (32%) A piston is used to compress the nitrogen inside a cylinder from an initial 2m^3 at 100 kPa and 126.85°C to 300 kPa. Assume that the process is polytropic with $n = 1.4$. Find the final mass, the' work done by the nitrogen and the heat that it releases.

   You must show the derivations and reasoning completely and correctly for full credit. You must give simplified units for your answers. Most accurate procedure only unless stated otherwise. Use at least 5 significant digits in your computations and answers. *Give the source of every number.*