Question 1 (1 point) ✓ *Saved*

A liquid enters a device with an entrance velocity of 3 m/s. When it exits the device, it has negligible velocity, and the same temperature. The exit is located 12 m below the entrance. If the mass flow rate is 3 kg/s, how much power is being exchanged during the process?

- ○ 61.951 W
- ○ 52.115 W
- ● 366.66 W
- ○ 9.465 W

Question 2 (1 point) ✓ *Saved*

We consider complete combustion of propane, according to the reaction:

$C_3H_8 + 5\,O_2 \rightarrow 3\,CO_2 + 4\,H_2O$

How much energy is liberated if 1 kg of propane is combusted in standard conditions?

- ○ 9.6658 kJ
- ○ 83.94 kJ
- ○ 162.09 kJ
- ● 50.324 kJ

Question 3 (1 point) ✓ *Saved*

For a compressor with an isentropic efficiency less than 1, the entropy at the compressor exit will be:

- ○ Lower than at the compressor inlet
- ● Higher than the compressor inlet
- ○ Equal to the compressor inlet

Question 4 (2 points) ✓ *Saved*

A vapor/water mixture at pressure 0.3 MPa has specific entropy equal to 5 kJ/(kg K).
How much heat per unit mass should be provided in order for the mixture to be entirely converted into vapor?

- ● 0.81016 MJ/kg
- ○ 8.4466 MJ/kg
- ○ 6.8912 MJ/kg
- ○ 4.1681 MJ/kg

Question 5 (2 points) ✓ *Saved*

A mass of 0.2 kg of Nitrogen is inside a container which and kept at constant pressure. The gas may exchange heat through the base of the container with a heat reservoir at 0°C. The base area is 0.16 m^2, the thickness 1 cm, and thermal conductivity 50 W/(m K). The initial temperature of the gas is 70°C. How long will it take for the gas to reach 40°C?

- ○ 0.1153 s
- ○ 0.0331 s
- ○ 0.2506 s
- ● 0.1458 s

Question 6 (3 points) ✓ *Saved*

A body at a uniform temperature T=130°C is losing heat to the environment, which is at temperature T_env = 20°C. The surface area of the object is 50 cm^2, and the emissivity is 0.4. The thermal conductance between the object and the surrounding is denoted by G.

What should the value of G be in order for the conductive and radiative heat losses to be equal to each other?

- ○ 33.24 mW/K
- ○ 33.625 mW/K
- ● 19.619 mW/K
- ○ 7.3153 mW/K

Question 7 (2 points) ✓ *Saved*

The saturation pressure of a substance at the temperature T1 = 120 °C is P1 = 130 kPa.

The molar mass of the substance is 27 g/mol.

What is the saturation pressure at T2 = 300 °C if the latent heat of vaporisation is 1300 kJ / kg?

- (●) 3.7894 MPa
- ( ) 27.981 MPa
- ( ) 93.783 MPa
- ( ) 34.825 MPa

Question 8 (3 points) ✓ *Saved*

An ideal gas with molar mass of 44 g/mol undergoes a reversible process. Before the process, the temperature of the gas is 33°C and the specific volume is 0.3 m^3/kg.

After the process, the specific volume is 0.5 m^3/kg. The specific heat capacity at constant volume is c_v = 0.653 kJ/(kg K).

If during the process the specific entropy increased by 269.73 J/(kg K), what's the final temperature of the gas?

- ( ) 190.45 K
- ( ) 38.056 K
- ( ) 74.042 K
- (●) 399.15 K

Question 9 (3 points) ✓ *Saved*

Steam exits a turbine at a quality of 0 and a pressure of 200 kPa. The inlet pressure of the steam is 10 MPa. The power output of the turbine is 5 MW and the flow rate of steam is 2 kg/s. What is the temperature entering the turbine?

- ○ 421 °C
- ● 372 °C
- ○ 311 °C
- ○ 120 °C

Question 10 (3 points) ✓ *Saved*

The compression process in an air standard Otto cycle has an isentropic efficiency of 0.85 rather than being isentropic. If the compression starts with air at 300 K and 100 kPa and ends at a pressure of 2200 kPa, what will the air temperature be at the end of the compression process.

- ○ 652 K
- ○ 1114 K
- ● 779 K
- ○ 711 K

Question 11 (3 points)

An ideal gas having heat capacity ratio γ = 1.044 and molar mass of 114.23 g/mol is brought from P1 = 1 MPa, v1 = 0.6 m^3/kg, to P2 = 2 MPa with an isentropic process. The work per unit mass exchanged during this isentropic process is denoted by w_A. Now we consider an alternative 2-step process where the gas is brought to the same final state with an isothermal process followed by an isochoric one. The specific work exchanged in this case is denoted by w_B. What is the difference between the work in the two cases?

- 1848.7 J/kg
- 5875.7 J/kg
- 602.15 J/kg
- 40263 J/kg

Question 12 (2 points) ✔ *Saved*

A Carnot power cycle operates at a temperature span of 400 K. It can be installed either at a location with an average temperature 280 K or a location with an average temperature of 300 K. Which location would give a better efficiency for power generation?

- (●) The location with 280 K average temperature
- Both will have the same efficiency
- The location with 300 K average temperature