

Please answer the questions below to the best of your ability either in the space provided. Everything should be scanned and submitted through [gradescope.com](https://www.gradescope.com).

Objective: *I can use thermal energy and heat along with the energy principle to determine temperature changes in the system.*

1. Suppose you have a tall mug (1 L) of hot chocolate that is unfortunately too hot to drink at 98°C . To cool things down, you add 100 mL of 3°C milk. The 600 g mug is made of ceramic and is initially at a room temperature of 20°C . The table below has some useful constants.

Material	Specific Heat kJ/(kg K)	Density kg/m ³
Hot Chocolate	4.18	1200
Milk	3.93	1030
Ceramic	0.88	

- (5) (a) Assuming that the hot chocolate, milk and mug are an isolated system, determine the final equilibrium temperature.

- (5) (b) In truth, some energy is going to be radiated into the surrounding air as well (not a perfectly insulated system). Suppose the system lost 15 kJ of energy to heating the surrounding air. Now what is the final equilibrium temperature? (of the hot chocolate, milk, and mug system)