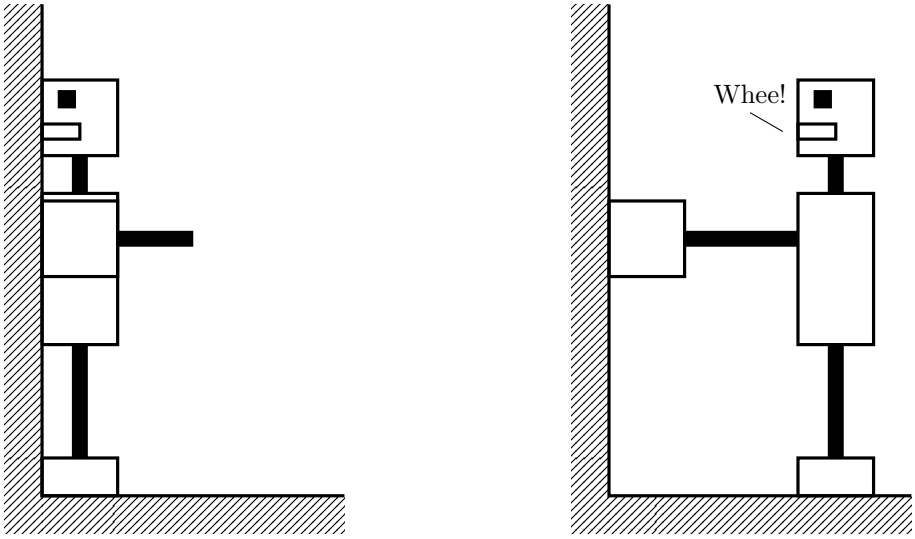
Please answer the questions below to the best of your ability either in the space provided. Everything should be scanned or photographed and submitted through gradescope.com. Show all your work and support your conclusions with figures!

Objective: *I can utilize both point and extended models of systems to determine internal energies.*

1. Robby the Robot is comprised of 6 main components: a torso, a head, two feet and two hands. Combined they have a mass of 60 kg. Connecting these components are servos and tubing whose mass is negligible. Robby is powered by a thermal engine, which uses up his thermal energy to create mechanical work. He is insulated from the outside world. Beginning at a toasty 100 °C, Robby is initially standing flush up against a wall. He then pushes directly off the wall with 10 kN of force (Robot power!!), causing his body to slide backwards. He does this until he can no longer reach the wall with his hands. Robby is made of iron with a specific heat of 4500 J/(kg °C). Acting against Robby (and pushing him toward the wall) is a wind that exerts a constant force of 500 N to Robby's torso. Robby's arms are 1 m long and he moves his center of mass back 80 cm in the process of the push.



   (a) How fast is Robby moving as he completes the push?

(b) What is the change in the total energy of Robby as he pushes back?

(c) What is the change in the thermal energy of Robby as he pushes back?

(d) What is Robby's temperature upon completing his push?