

Name _____

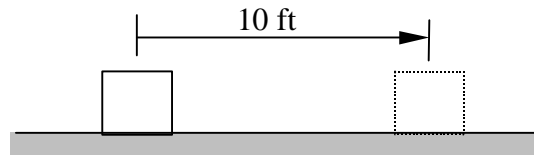
ES201
Examination III
November 11, 1996

Problem	Score
1	/30
2	/35
3	/35
Total	/100

Show all work for credit
AND
Box your answer with appropriate units
AND
Turn in your signed help sheet

No partial credit will be given for any part of this problem. Carefully check numerical values and units.

- a) A block weighing 10 lbs moves 10 ft on a horizontal surface. The coefficients of kinetic and static friction between the block and the surface are 0.2 and 0.25 respectively. What is the work done by friction?



- b) A motor operates at 1000 rpm and has a torque output of 100 N-m. What is the shaft power of the motor?

- c) Given the following table for a cycle:

Process	Q (J)	W (J)	ΔU (J)
1-2	0	38.3	38.3
2-3	-85.0	0	-85.0
3-4	65.2	-18.5	46.7
Sum	-19.8	19.8	0

Is it a power cycle or a refrigeration/heat pump cycle?

- d) A power cycle loses 500 KJ of energy by heat transfer and produces 1000 KJ of work . What is the thermal efficiency of the cycle?

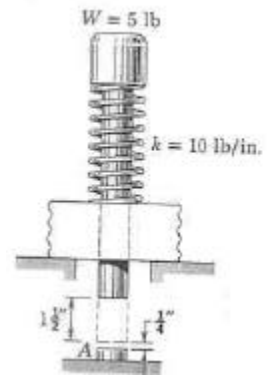
- e) Mass entering a system has an internal energy of 400 BTU/lbm and a density of 64 lbm/ft³. If the pressure at the inlet is 15,000 lb/ft² what is the enthalpy of the input stream?
- f) A 10 lbm object is traveling at 3 ft/s. What is the kinetic energy of the object in ft-lb?
- g) A volume of gas is subjected to a three step process. In the third step the pressure is increased from 100 psi to 300 psi at a constant volume of 100 in³. What is the work done in the third step of the process in in-lb?
- h) Convert 16 ft²/s² to hp-s/lbm.
- i) A motor operating at steady state has an input current and voltage of 0.5 A and 220 V respectively. The output work of the shaft is 90 W. What is the heat transfer rate from the motor?
- j) A mass is placed on a cubic spring whose force-displacement relationship is given by $F=4000 x^3$ N. What is the work done by the spring on the mass if it deflects 0.2 m.

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Problem 2

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The shank of the 5-lb vertical plunger occupies the dotted position when resting in equilibrium against the spring of stiffness $k=10$ lb/in. The upper end of the spring is welded to the plunger, and the lower end is welded to the base plate. If the plunger is lifted 1.5 inches above its equilibrium position and released from rest, calculate its velocity as it strikes the button A. Assume friction is negligible.



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Problem 3

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Two fluids flow through a heat exchanger operating at steady state. Fluid A flows at a rate of 300 kg/hr, entering with an enthalpy of 321.6 kJ/kg and leaving with an enthalpy of 344.0 kJ/kg. Fluid B flows at a rate of 165 kg/hr and enters with an enthalpy of 42.0 kJ/kg. All fluid velocities are low, and it is estimated that 10% of the heat removed from the higher temperature fluid B is lost as heat to the surroundings because the insulation of the heat exchanger is not perfect.

Determine:

- the enthalpy of fluid B as it leaves the heat exchanger.
- the heat transfer to the surroundings.

