Thermodynamics 1 DEN107

Problem Set 02 (due week 4, Mon 2012jan30)

Insert the SEMS homework coverpage as 1st page; this question sheet with original signatures as the 2nd page; then attach your solutions in subsequent pages. Your solutions are due before 3.30 pm on Monday January 30th 2012 in the cabinet outside the SEMS office.

By signing below I certify that I will not obtain the teaching assistant's (TA) signature for students other than myself, and that I will not forge the TA's signature on this page. Violators will be prosecuted in accordance to QMUL procedures. Please fill in the five items below.

Student Surname:	
Student Forenames:	
Student ID (9 digits):	
Student signature:	
TA confirms tutorial attendance (signature):	

50% of the assignment grade will be deducted if the TA signature above is missing

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HINT: Read the problems in part A of the exam scripts from the last three years (available in the module webpages). From this homework on your solutions must be provided handwritten.

Problem 1
Give the formal definition of adiabatic process using a perfect (frictionless) mechanical analogue (preferably the rope-pulley-weight system). Discuss the implication for entropy flows in and out of the system, and for the effects of losses inside the system to entropy. - Note, you will not be able to fully answer the latter part of the question until later on, when we will have defined entropy. You will be marked for trying to answer the entropy pat of the question, but not for giving the correct or wrong answer to this part of the problem.

Problem 2
State the first law of thermodynamics. Then give the formal definition of energy, with an equation, and using the definition of adiabatic process in problem 1.

Problem 3
Prove that for an adiabatic process where there is no net external effect outside the system (the net external effect outside the system is null, zero), energy is conserved.

Problem 4
Give the formal definition of work as an interaction between two thermodynamic systems, A and B, and describe the test that must be conducted to each interacting system in order to conclude that the interaction is work. Give an example of work in which the interaction between the two systems incurs no losses. Give an example of work in which the interaction between the two systems incurs finite losses. Give an example of interaction between two systems which fails the work definition (an example of heat interaction, osmosis, diffusion etc).

Problem 5
Prove that a perpetual motion machine of the first kind (PMM1) is impossible.

Problem 6
Problem 3.21 from the textbook. Write out the full problem statement followed by the fully worked out solution explaining where the numbers came from (do not just copy the solution at the back of the book)