**ME-371, Thermodynamics 1**

**1435, 1st Semester**

**Midterm 1**

**Student Name: Time allowed: 90 minutes**

**ID:**

**Problem 1 (6 points)**

(a) An orange loses 1.2 kJ of heat as it cools per °C drop in its temperature. What is the amount of heat loss from the orange per K drop in its temperature?

(b) Why does a bicyclist pick up speed on a downhill road even when he is not pedaling? Does this violate the conservation of energy principle?

(c) What are the three mechanisms of energy transfer to and from an open system?

(d) When you open the door of a refrigerator in an insulated room, would the temperature of the room increases or decreases and why?

**Problem 2 (4 points)**

(a) Calculate the amount of heat which is required to evaporate 2 L of saturated water in a ban where the pressure is 125 kPa? Assume 20% of the heat is lost to the ambient. (b) What is the heat rate if the water is to be totally evaporated in 10 minutes?

**Problem 3 (4 points)**

Complete the following table for H2O

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| T (oC) | P (kPa) | v (m3/kg) | h (kJ/kg) | Phase description |
|  | 100 | 1 |  |  |
| 25 | 100 |  |  |  |
| 225 | 500 |  |  |  |
| 100 |  |  | 2675.6 |  |

**Problem 4 (6 points)**

2 kilograms of R-134a at 220 kPa and 10oC fill a rigid tank. The tank is heated electrically for 2 minutes with 220 V and 0.1 A until its pressure reaches 240 kPa. Determine (a) final temperature, (b) change in internal energy, (c) net heat transfer, and (d) show the process on a T-v diagram.