

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF PHYSICAL SCIENCES

DEPARTMENT OF GEOGRAPHY

SECOND SEMESTER 2015/2016 SESSION UNDERGRADUATE EXAMINATION

COURSE CODE: MET322

COURSE TITLE: Atmospheric thermodynamics and precipitation processes (3units)

INSTRUCTION: Answer **any four** Questions (Credits will be given for proper usage of relevant illustrations and diagrams)

TIME ALLOWED: 2hrs

1. (a) Define the potential temperature of an air parcel  
(b) Suppose that a dry air parcel with temperature of 290K is at a pressure of 850hpa. The air parcels volume is  $1 \times 10^4 \text{ m}^3$  at this pressure.
  - (i) What is the potential temperature of the air parcel?
  - (ii) What is the density of the air parcel?  
(Take  $R/C_p = 0.286$  and  $R_d = 287 \text{ J deg}^{-1} \text{ K}^{-1}$ )
2. Explain the processes of heat and phase changes that take place when a unit mass of a snow ball vaporizes completely.
3. (a) State the Clasius Claperyon equation and explain each term of the equation.  
(b) The vapour pressure of ice at 268K and 273K are 2.965 and 4.560 respectively. Estimate the heat of sublimation of ice. (Assume that the ideal gas constant is 8.3145).
4. Define and explain the following concepts
  - (i) the equation of the ideal gas law
  - (ii) the equation of enthalpy
  - (iii) the first law of thermodynamics
5. (a) Show with diagrams which environmental lapse rates cause dry air parcel to be Statically stable and which caused dry air parcel to be statically unstable.  
(b) Explain why physically the specific heat capacity at constant pressure is greater than the specific heat capacity at constant volume and specific heat capacity of water vapour is greater than specific heat capacity of dry air.
6. (a) Define the Tephigram.  
(b) Identify the interface of a well constructed tephigram and discuss its uses in the study of the atmosphere.