ID4212 – Principles of Atmospheric Science
Mid-Semester Examination: 20th February 2019
Total marks: 20; Time allotted: 1 hour 30 min
Calculations must be shown for numerical problems.

1) We use number density of gases as the preferred measurement unit while estimating gaseous reaction rates in the atmosphere. Explain why. (2)

2) Consider surface air over the tropical oceans with a water vapor content of 3%. What is the molecular weight of this moist air? (2)

3) Calculate the mixing ratio of O_3 (in ppbv) at the peak of the O_3 layer (height = 25 km, P = 35 hPa, T = 220 K). Assume an O_3 number density of 5×10^{12} molecules cm^{-3} at this altitude. (2)

4) With the help of a diagram, describe the balance of forces and the direction of movement of geostrophic winds around a high pressure system in the SH. Ignore friction. (2)

5) The position of the polar front is variable – justify the statement. (2)

5) Termination reactions in a radical-assisted reaction chain are generally slower than propagation reactions – justify the statement. (2)

OR

5) Stratospheric O_3 depletion leads to a small amount of surface cooling (if the climate forcing from O_3 depleting substances is ignored) – justify the statement. (2)

6) Why don't we generally observe an Arctic O_3 hole? (3)

7) Describe with the help of equations the Chapman cycle. Identify the reactions that lead to an increase in temperature with altitude in the stratosphere. (2+1)

8) Br is ~60 times more effective at O_3 destruction than Cl on a per-atom basis – justify. (2)

20/2/19