2B27 Problem Sheet 1 2005

To be handed in by February 10th 2005 A.D.Aylward 27 January 2005

The following constants may be used

Average molecular weight of species in the atmosphere	M=28.96 kg kmole^{-1}
Radius of the Earth	R_E=6370km
Atmospheric pressure at ground level	=10^5 Pa
Acceleration due to gravity	g=9.81 ms^{-2}

1. Sketch the temperature profile of the atmosphere as a function of height to 300 km altitude. Name the different regions and explain why each has the height profile it does. [10]

2. The mole fraction of CO_2 in the atmosphere is 0.00033 and the residence time is 5-10 years. Using these figures and the constants given above, estimate the amount of CO_2 that enters the atmosphere every year. (The molecular weight of CO_2 is 44) [6]

3. The oceans contain approximately 5 x 10^{17} kg of CO_2 in dissolved form. Calculate the residence time of CO_2 in the oceans if 60% of the CO_2 entering the atmosphere comes from the oceans. What do these numbers tell you about the importance of the oceans in the carbon cycle? [4]

4. Approximately 2 x 108 kg of sulphuric acid (H2SO4) are deposited in rain per year over the UK. The total annual rainfall over the UK is about 600mm and the area of the UK is 245,000 km2. Calculate the pH of the rain assuming that sulphuric acid is the only significant source of acidity. Atomic weights are H=1, O=16, S=32. [5]

   Would you expect the results of your calculation to be an accurate estimate of the pH of the air in Gordon Street in January? Give reasons for your answer. [5]