國立中央大學 110 學年度碩士班考試入學試題

所別： 大氣科學學系大氣物理 碩士班 不分組(一般生)
大氣科學學系大氣物理 碩士班 不分組(在職生)

科目： 普通化學

本科考試禁用計算器

＊請在答案卷(卡)內作答

問答題(1、2)與計算題(3、4、5、6)

1. Multiple choice. Please complete this problem by matching the following chemical species to each of questions. The proper answer to each of questions may be more than one choice.

   (A) NO (J) CO_2
   (B) NO_2 (K) CH_4
   (C) N_2O (L) O
   (D) HNO_3 (M) O_2
   (E) COS (N) O_3
   (F) H_2S (O) CFCs
   (G) SO_2 (P) F
   (H) H_2SO_4 (Q) Cl
   (I) CO (R) Non-methane organic compounds

   (a) Which four species are the primary greenhouse gases? (5 points)

   (b) Which species can be regarded as an indicator of urban air pollution? (5 points)

   (c) What industrial product (products) has been entirely banned since 1996 according to Montreal Protocol for saving the atmospheric ozone? (5 points)

2. List the types of chemical bond and tell the difference. Also give some examples for each type of chemical bond. (15 points)

3. What volume of a 0.100 M HCl solution is needed to neutralize 25.0 mL of a 0.350 M NaOH solution? (15 points)

4. Calculate the pOH and the pH of a solution in which 10.0 mL of 0.100 M HCl is added to 25.0 mL of 0.100 M NaOH. (15 points)

5. Considering only the following two reactions:
   $H + CO + M \rightarrow HCO + M$, $k_1 = 1.0\times10^{-34}$ cm^6 $molecule^{-2}$ s^{-1}
   $H + HCO \rightarrow H_2 + CO$, $k_2 = 3.0\times10^{-10}$ cm^3 $molecule^{-1}$ s^{-1}
   If this cycle were in steady state, and if the concentrations of CO and M were 1.0×10^{12} and 2.5×10^{19} molecule cm^{-3}, respectively, what would have been the concentration of the radical HCO? (20 points)

6. Concentrations of ozone were 60 ppb, 2.5×10^{12} molecules cm^{-3}, and 72 μg m^{-3} in Taipei, Taoyuan and Taichung, respectively. Assuming temperature was 25°C and pressure was 1 atm at all the three cities, which city had the highest ozone concentration? MW of ozone is 48 g/mole and the universal gas constant is 0.082 L atm K^{-1} $mole^{-1}$. (20 points)