

淡江大學九十四學年度碩士班招生考試試題 ³⁶⁻¹

系別：化學學系

科目：基礎化學

准帶項目請打「V」

簡單型計算機

本試題共 / 頁

- Using the molecular orbital model, write electron configurations for the following species and calculate the bond orders. Which ones are paramagnetic? (15 pts)
 F_2^+ , F_2 , F_2^-
- X-rays from a copper X-ray tube ($\lambda = 1.54 \text{ \AA}$) were diffracted at an angle of 30 degrees by a crystal of silicon. Assuming first order diffraction ($n = 1$ in the Bragg equation), what is the interplanar spacing in silicon? (15 pts)
- The allene molecule has the following structure:
 $H_2C=C=CH_2$
 Are all four hydrogen atoms in the same plane? Explain. (15 pts)
- Describe your understanding about:
 - liquid crystals (5 pts)
 - chemistry of air bags (5 pts)
 - octane ratings of gasoline (5 pts)
- (a) Draw an NH_3 molecule in an electric field and label the NH_3 molecule with dipolar direction. (10 pts)
 (b) Which of the following is polar? Explain your answer in detail. (10 pts)
 BF_3 , CF_4 , CO_2 , PF_5 , CO
- Order the following species with respect to carbon-oxygen bond length (longest to shortest). Explain. (10 pts)
 CO , CO_2 , CO_3^{2-} , CH_3OH
- (a) Give the maximum number of electrons in an atom that can have these quantum numbers: $n = 5$, $m_l = +1$. (5 pts)
 (b) Write the subshell notation ($3d$, for instance) and the number of orbitals having these quantum numbers: $n = 5$, $l = 2$. (5 pts)