

國立嘉義大學九十六學年度
應用化學系碩士班招生考試(甲組)試題

科目：綜合化學 I

I. Inorganic Chemistry

- (a) Draw the molecular orbital (MO) energy level diagram for cyanide ion (CN⁻)?
(b) What is the bond order of CN⁻? (c) Is this compound paramagnetic or diamagnetic? (10 points)
- (a) The size of transition metal atoms of lanthanide series decreases slightly from left to right in the periodic table, which is known as **lanthanide contraction**. Offer an explanation for the phenomena?
(b) Using Slater's rules to determine the Z* for 4f electrons in Ce (Z=58) and Nd(Z=60). Both are the lanthanide series elements.
(c) Which atom has the smaller Z* value? (10 points)
- LiBr has a density of 3.464 g/cm³ with the NaCl rock salt crystal structure, as shown in Figure (1). Calculate (a) the volume (m³) of unit cell (b) the unit cell length of the compound? (c) the inter-ionic distance (r₊ + r₋) of Li-Br? (Li = 6.939 g/mole, Br = 79.904g/mole) (10 points)

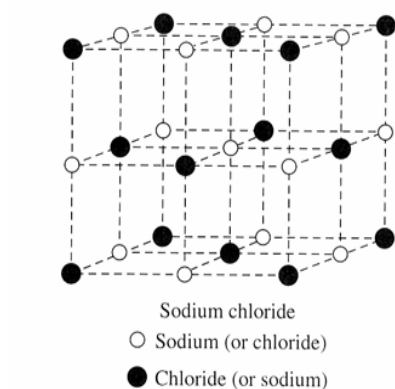
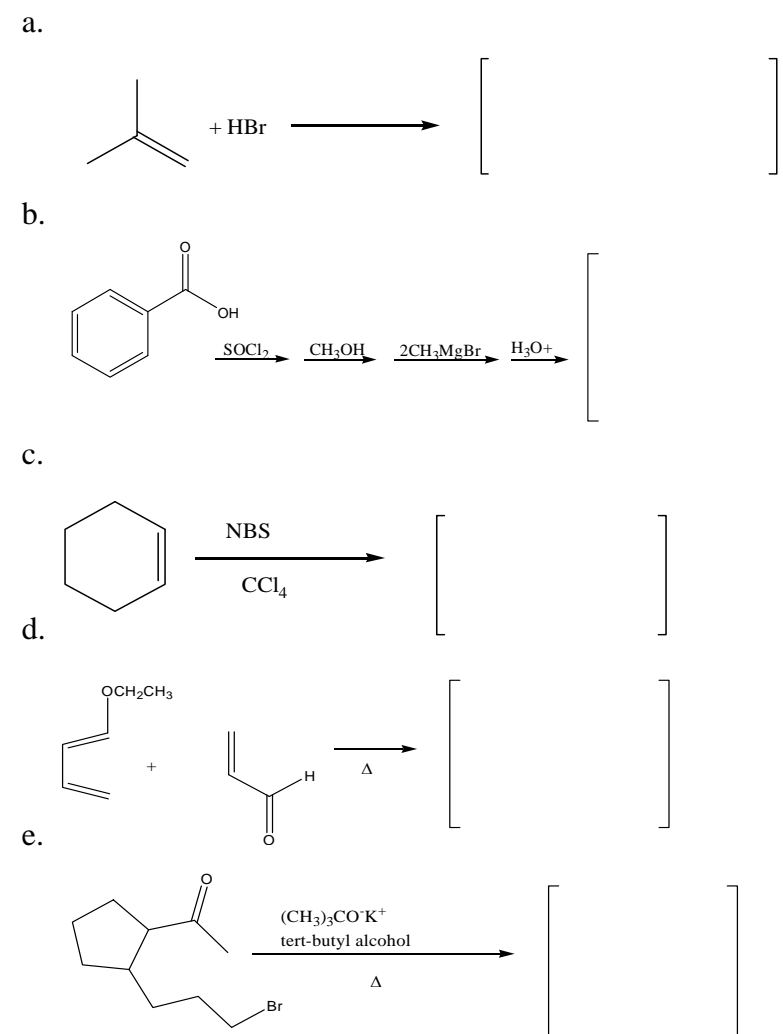


Figure (1)

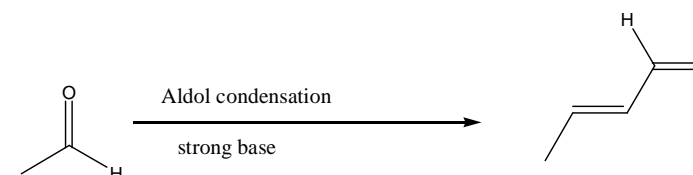
- Use Cu (II) (d⁹), and Cr (II) (d⁴ low spin), to explain the Jahn-Teller effect applied in these two cases. For example, Cu(II), usually is an octahedral with elongation distortion, but an octahedral with tetragonal distortion for Cr(II) low spin: (10 points)
- Calculate the spin-only moment, i.e. μ_s , and ground term (without J coupling) with the great multiplicity for the following elements: (10 points)
(a) Fe²⁺ (b) Cu

II. Organic Chemistry

- Predict the **major** products of the following reaction: (20 points)



- The NMR spectrum of compound A has band at δ 7.9(2H, doublet), 6.9(2H, doublet), 3.9(3H, singlet), 2.05(3H, singlet). The molecular weight is 150. This compound absorbs strongly in the infrared at 1676 cm⁻¹. Draw the structure of compound A. (10 points)
- For the following reaction: (10 points)



Write the mechanism of this reaction

- Arrange the **acidity order** for the following compound: (10 points) **And Explain why?**

