

大同大學 九十三 學年度 轉學考試 試題

考試科目：化學 系別：材料工程學系

第 頁，共 $\frac{1}{4}$ 頁

註：本次考試不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

1. (20%) Answer the following questions briefly:

- What are the differences between natural law and theory?
- What are the major differences between ionic and molecular compounds?
- Give the three definitions for acids and bases.
- There are five kinds of crystalline solids, write them please.
- What factors can influence the reaction rate of a reaction?

2. (20%) If you have prepared an organic compound composed with C, H, and O atoms, please illustrate how can you determine the molecular formula of the compound?

3. (20%) Give the trends of atomic size, first ionization, and electron affinity across a period and down a group in the periodic table. Please also give the reasons of the trends.

4. (20%) The following data were collected for the rate of the reaction $2 \text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$:

| Experiment | [NO] (M) | [O ₂] (M) | Initial rate (M/s) |
|------------|----------|-----------------------|-----------------------|
| 1 | 0.0126 | 0.0125 | 1.41×10^{-2} |
| 2 | 0.0252 | 0.0250 | 1.13×10^{-1} |
| 3 | 0.0252 | 0.0125 | 5.64×10^{-2} |

- Determine the rate law and the value of the rate constant.
- Propose a possible reaction mechanism for the reaction.

5. (20%) Thermodynamics has been recognized as an important tool to predict whether a reaction is spontaneous or not. Please illustrate the criteria of a spontaneous process. If a reaction is nonspontaneous at a given temperature, how can you make the reaction occur spontaneously?