

科目：普通化學 適用：應化系二

考生注意：

1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本試題

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1. As compared with CO and O₂, CS and S₂ are very unstable molecules. Give an explanation based on the relative abilities of the sulfur and oxygen atoms to form π bonds. (10 points)
2. For each of the following molecules, write a Lewis structure, predict the molecular structure (including bond angles), give the expected hybrid orbital on the central atom, and predict the overall polarity. (10 points)
a. NF₃ b. TeF₄ c. AsF₅ d. SeF₆ (a, b, c 小題各 2 分, d 小題各 3 分)
3. A certain first-order reaction has a half-life of 20.0 min. Hint: ($\ln 4.0 = 1.386$).
a. Calculate the rate constant for this reaction.
b. How much time is required for this reaction to be 75% complete? (10 points) 每小題各 5 分
4. Some water is placed in a sealed glass container connected to a vacuum pump, and the pump is turned on. The water appears to boil and then freezes. Explain these changes by using the phase diagram for water. What would happen to the ice if the vacuum pump was left on indefinitely? (10 points)
5. The band gap in aluminum phosphide, AlP, is 2.5 electron volts ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$). What wavelength of light is emitted by an AlP diode? (10 points)
6. How do the following physical properties of liquids depend on the strength of intermolecular forces? (10 points) (a, b 小題各 3 分, c, d 小題各 2 分)
(a) surface tension, (b) viscosity, (c) boiling point, (d) vapor pressure.
7. Before refrigeration became common, many foods were preserved by salting them heavily. Fruits were preserved by mixing them with a large amount of sugar (fruit preserves). How do salt and sugar act as preservatives? (10 points)
8. When pure methanol is mixed with water, the solution gets warmer to the touch. Would you expect this solution to be ideal? Explain. (10 points)
9. What type of semiconductor is formed when a Group 3A element is added as an impurity to Si or Ge? Explain. (10 points)
10. Tell the structure difference between "Starch" and "Cellulose". (10 points)