

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：物理化學及分析化學【化學系碩士班】

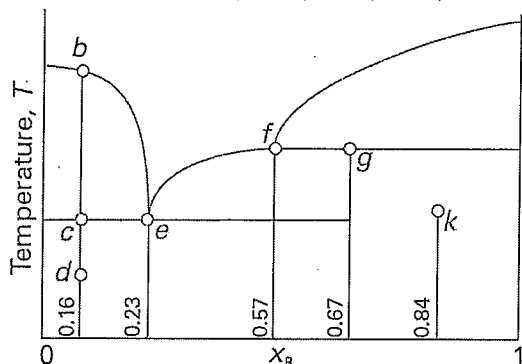
題號：422002

※本科目依簡章規定「不可以」使用計算機

共 2 頁 第 1 頁

物理化學部分

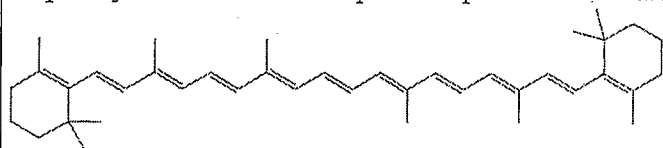
1. (5%) Consider the following phase diagram, which represents a solid - liquid equilibrium. Sketch cooling curves for compositions $x_B = 0.16, 0.23, 0.57, 0.67,$ and 0.84 .



2. (5%) Explain why the standard entropy of He gas is lower than the standard entropy of Kr gas under the same temperature.

3. (10%) Show that at constant temperature and pressure, the maximum non-expansion work is given by the change in Gibbs energy.

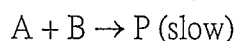
4. (10%) When β -carotene is oxidized in vivo, it breaks in half and forms two molecules of retinal, which is a precursor to the pigment in the retina responsible for vision. The conjugated system of retinal consists of 11 C atoms and one O atom. In the ground state of retinal, each level up to $n = 6$ is occupied by two electrons. Assuming an average internuclear distance of 140 pm, calculate (a) the separation in energy between the ground state and the first excited state in which one electron occupies the state with $n = 7$, and (b) the frequency of the radiation required to produce a transition between the two states.



β -carotene

5. (10%) The rotational constant for CO is 1.9314 cm^{-1} and 1.6116 cm^{-1} in the ground and first excited vibrational states, respectively. By how much does the internuclear distance change as a result of this transition?

6. (10%) The reaction mechanism



involves an intermediate A. Deduce the rate law for the reaction in two ways by (a) assuming a pre-equilibrium and (b) making a steady-state approximation.

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：物理化學及分析化學【化學系碩士班】

題號：422002

※本科目依簡章規定「不可以」使用計算機

共 2 頁第 2 頁

分析化學部分

7. Define the following terms

- (a) Systematic error and random error
 - (b) Buffer solution and buffer capacity
 - (c) Standard addition calibration method
- (5% each, 15% total)

8. Define the following terms

- (a) Fellgett advantage
 - (b) Source modulation in atomic absorption spectroscopy
 - (c) Anti-Stokes shift in Raman Spectroscopy
 - (d) Fluorescence emission spectrum and fluorescence excitation spectrum
 - (e) Electrospray ionization (ESI) source
- (5% each, 25% total)

9. Define the following terms

- (a) Plate height and number of plates
 - (b) Isocratic and gradient elution in liquid chromatography
- (5% each, 10% total)