

# 國立彰化師範大學104學年度碩士班招生考試試題

系所： 化學系

科目： 物理化學與有機化學

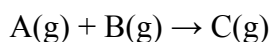
☆☆請在答案紙上作答☆☆

共 2 頁，第 1 頁

## I. Physical Chemistry: (50%)

1. Briefly explain the following terms using proper phase(s) and/or equation(s): (1) Gibbs energy, (2) Osmotic pressure, (3) Phase rule, (4) Standard heat of reaction, (5) Hess's Law in Thermodynamics, (6) Steady state approximation, (7) Transition state theory, (8) Wave number, (9) Time-independent Schrödinger equation, (10) Uncertainty principle. (20 %)

2. For the following reaction, use the data listed below to answer the questions: (12%)



Experiment	[A] <sub>0</sub> /(mol L <sup>-1</sup> )	[B] <sub>0</sub> /(mol L <sup>-1</sup> )	Initial rate (mol L <sup>-1</sup> min <sup>-1</sup> )
1	0.100	0.100	5.0
2	0.300	0.100	45.0
3	0.100	0.200	10.0
4	0.300	0.200	90.0

- (1) Write the differential rate law for the reaction.
- (2) What is the total reaction order for the reaction?
- (3) Calculate k for the reaction, including the unit of k in your answer.
3. 1.0 mole of ideal gas expands isothermally and reversibly at 300 K from 1.0 L to 2.0 L. Find q, w, ΔU, ΔS, ΔS<sub>surrounding</sub>, ΔH, ΔA, ΔG for the process. (8 %)
4. For a particle in a one-dimensional box (length=L), the wave function is given as:
- $$\psi(x) = \left(\frac{2}{L}\right)^{1/2} \sin\left(\frac{n\pi x}{L}\right),$$
- given n is an integral. What is the probability of finding the particle in the central third (盒長中間 1/3 的部分) of the box? Hint:  $\int \sin^2 bx \, dx = x/2 - (\sin 2bx)/4b$ . (10%)

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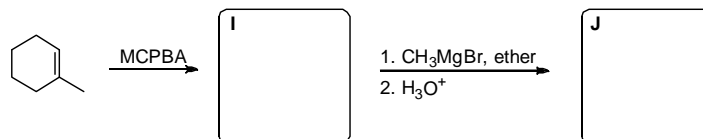
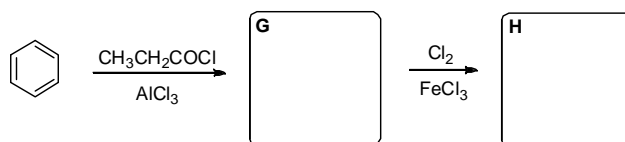
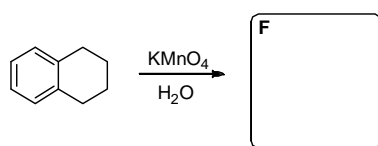
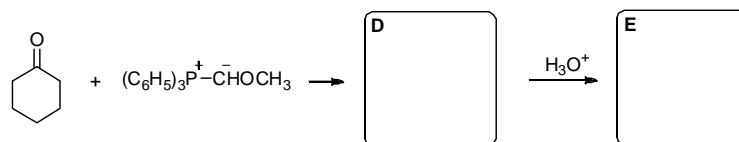
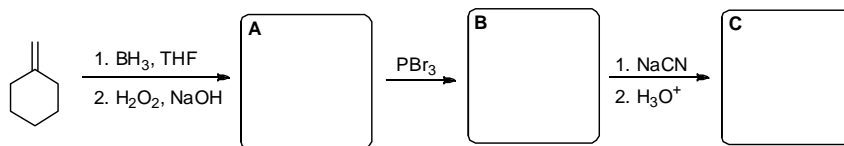
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## II. Organic Chemistry: (50%)

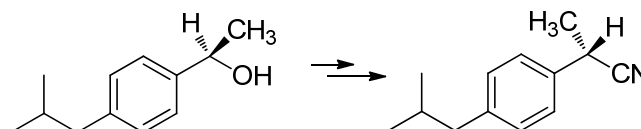
1. What products (A~J) would you expect to obtain from the following reactions? (30%)



2. Calicene has an unusually large dipole moment for a hydrocarbon. Explain, using resonance structures. (4%)



3. How would you carry out the following transformation, a step used in the commercial synthesis of (*S*)-ibuprofen? (6%)



4. Draw structures for the following: (10%)

- (1) Acetone
- (2) Ethanol
- (3) Dichloromethane
- (4) Tetrahydrofuran
- (5) Toluene