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淡江大學 102 學年度碩士班招生考試試題

系別：化學學系　　科目：物理化學

考試日期:3月10日(星期日) 第2節　　本試題共　五　大題，　二　頁

本試題雙面印刷

1)

a) Please write down the time-dependent Schrodinger (TDS) equation for the particle system in 3-dimensional system. (5%)

b) Please describe the physical meaning of each term within this TDS equation. (10%).

2)

a) Based on the "particle in a box" quantum system please write down the time independent Schrodinger equation and their corresponding solutions of wavefunction and energy. (10%)

b) Based on the solution of energy for the "particle in a box" quantum system please illustrate its application into the conjugate system of C=C-C=C in terms of the ability of electron donor and electron acceptor. (10%)

c) Based on the solution of energy for the "particle in a box" quantum system please illustrate its application into the conjugate system of C=C-C=C in terms of its frequency to transform from its ground state into its first excited state. (10%)

3)

Zero law of thermodynamics states that if object A is in thermal equilibrium with object B, and object B is in thermal equilibrium with object C, then object C is also in thermal equilibrium with object A. This law allows us to build thermometers.

a) Please briefly illustrate how the thermometer can be designed on the basis of zero law of thermodynamics. (10%)

b) Based on your design of the thermometer please point out the requirements needed to have a very good thermometer. (10%)

4)

Consider an ideal gas system and a reversible change such that $dQ = dU + PdV$.

a) Using $U = 3nRT/2$ and $P=nRT/V$, please prove that the dQ is not a state function. (10%)

b) Now if we allow dQ to be divided through by T, then $dQ/T = (3nR/2T)\,dT + (nR/V)dV$. Please prove that dQ/T is a state function. (10%).

5)

Two of the simplest rate laws are given below in both their differential and integrated form.

Reaction	Order	Differential form	Integrated form
$A \rightarrow P$	zeroth	$d[A]/dt = -k$	$[A] = [A]_0 - kt$
$A \rightarrow P$	first	$d[A]/dt = -k\,[A]$	$\ln[A] = \ln[A]_0 - kt$

/ 背面尚有試題

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a) **Please define what the half-life $t_{1/2}$ of a substance A is. (5%)**

b) **Please derive the equations for the half-lives for reactions of zeroth and first orders by substituting the values $t = t_{1/2}$ and $[A] = 1/2\ [A]_0$ into the integrated rate laws as shown above. (10%)**