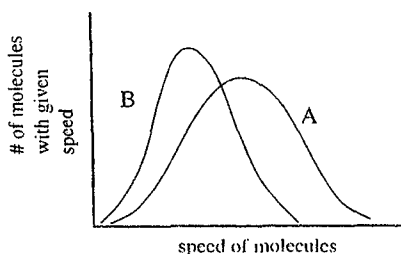


※ 請在答案卷上標明題號依序作答

**Part I Single Choice (40 %)**

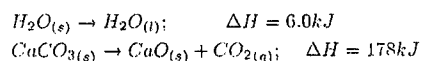
- The Van der Waals equation of state for non-ideal gases differs from the ideal gas law in that it accounts for:
  - The mass of each molecule of the gas.
  - The volume of each molecule of the gas.
  - The attractive forces between molecules of the gas.
 (a) I and II only; (b) II and III only; (c) I and III only; (d) I, II, and III; (e) None of the above.

2.



The above graph represents the Maxwell-Boltzmann distribution of molecular speeds of two samples of  $O_2(g)$ , A and B. Which statement is true about these two samples

- A and B are at equal temperature
  - A and B have equal kinetic energy
  - A is at a higher temperature than B
  - B is at a higher temperature than A
  - sample A is dissociated into O atom
- For the isothermal isobaric expansion of an ideal gas which of the following is true?
    - Energy change ( $\Delta E$ ) = 0
    - Heat = work ( $Q = W$ )
    - $\Delta H \neq 0$
 (a) I only; (b) II and III; (c) I and II; (d) III only; (e) I and II
  - The area under a plot of heat capacity at constant pressure vs. the absolute temperature is directly related to
    - $W$ ; (b)  $\Delta U$ ; (c)  $\Delta H$ ; (d)  $\Delta G$ ; (e)  $Q$ .
  - Consider the two reactions below:



Which of the following statements concerning these reactions is (are) correct?

- The reactions are spontaneous and exothermic

接 背 面

國立臺灣大學九十三年學年度轉學生入學考試試題

科目：普通化學(C)

題號：39

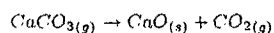
共 3 頁之第 2 頁

- (2) Both reactions occur with an increase in the systems's disorder  
 (3) The entropy change ( $\Delta S^\circ$ ) for the first equation is most likely positive.  
 (a) (1) only; (b) (1) and (2) only; (c) (2) and (3) only; (d) None of the statements; (e) All of the statements.

6. Which of the following sets of conditions describes a system undergoing a reversible change?

	$\Delta S_{system}$	$\Delta S_{surroundings}$	$\Delta S_{total}$
(a)	positive	zero	positive
(b)	positive	negative	zero
(c)	negative	positive	positive
(d)	positive	positive	zero
(e)	negative	zero	negative

7. In an adiabatic system, if work is done, the temperature must:  
 (a) increase; (b) decrease; (c) remain the same; (d) increase then decrease; (e) decrease then increase.
8. For the reaction below:



when taking place at a high temperature the following is true:

- (a)  $\Delta H < 0$ ,  $\Delta G \geq 0$  and  $\Delta S > 0$   
 (b)  $\Delta H \leq 0$ ,  $\Delta G < 0$  and  $\Delta S < 0$   
 (c)  $\Delta S > 0$ ,  $\Delta G < 0$  and  $\Delta H > 0$   
 (d)  $\Delta G \geq 0$ ,  $\Delta H \geq 0$  and  $\Delta S > 0$   
 (e)  $\Delta S < 0$ ,  $\Delta H > 0$  and  $\Delta G < 0$

**Part II Problems (60 %)**

1. Butadiene,  $H_2C = CH - CH = CH_2$ , is polymerized to make buna rubber. Write an equation representing this process. 5%
2. (a) Discuss what happens to the energy levels for an electron trapped in a one-dimensional box as the length of the box increases. 5%  
 (b) Which has the lowest (ground-state) energy, an electron trapped in a one-dimensional box of the length  $10^{-6}$  or one with length  $10^{-10}$ ? 5%
3. One of the biggest challenges in preparing fuel for nuclear power plants is to separate the isotopes of uranium. 10%  
 (a) Why is it not possible to separate the isotopes of uranium by chemical means?  
 (b) How are the isotopes of uranium separated?

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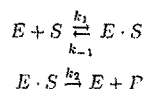
國立臺灣大學九十三年學年度轉學生入學考試試題

科目：普通化學(C)

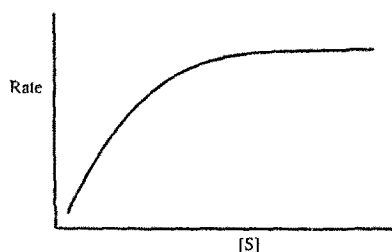
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4. An important observation supporting the need for resonance in the localized electron model was that there are only three different structures of dichlorobenzene ( $C_6H_4Cl_2$ ). How does this fact support the need for the concept of resonance. 5%
5. The most stable state of elemental nitrogen is the  $N_2$  molecule characterized by a strong triple bond. The most stable state of elemental phosphorus, on the other hand, is the  $P_4$  molecule characterized as a tetrahedron of phosphorus atoms (shown below) held together by strong single bonds. Comment on this difference. 10%
6. A certain reaction is first order: after 540 seconds, 30.5% of the reactant remains. 10%
- (a) Calculate the rate constant for the reaction.
- (b) What length of time would be required for 25% of the reactant to be decomposed?
7. For enzyme-catalyzed reactions that follow the mechanism



a graph of the rate as a function of  $[S]$ , the concentration of the substrate, has the following general appearance:



- (a) The rate determining step is the decomposition of the intermediate enzyme-substrate complex (ES) to products (P). Under these conditions, show that the overall rate of product formation is

$$rate = \frac{d[P]}{dt} = \frac{k_1 k_2 [E]_T [S]}{k_{-1} + k_2 + k_1 [S]}$$

where  $[E]_T$  equals the total enzyme concentration:

5%

$$[E]_T = [E] + [ES]$$

- (b) Note that at high substrate concentrations the rate no longer changes with  $[S]$ . Suggest a reason for this. 5%

**試題必須隨卷繳回**