

國立臺北科技大學九十八學年度碩士班招生考試

系所組別：3520 化學工程研究所乙組

第一節 物理化學 試題

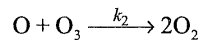
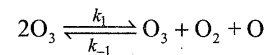
第一頁 共一頁

注意事項：

1. 本試題共 6 題，配分共 100 分。第 1~5 題各 17 分，第 6 題 15 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The temperature of a building maintained at 20°C by means of a heat pump, and on a particular day the external temperature is 10°C. The work is supplied to the heat pump by a heat engine that burns fuel at 1000°C and operates at 20°C. Calculate the performance factor for the system (i.e. the ratio of the heat delivered to the building to the heat produced by the fuel in the heat engine). Assume perfect efficiencies of the pump and the engine.

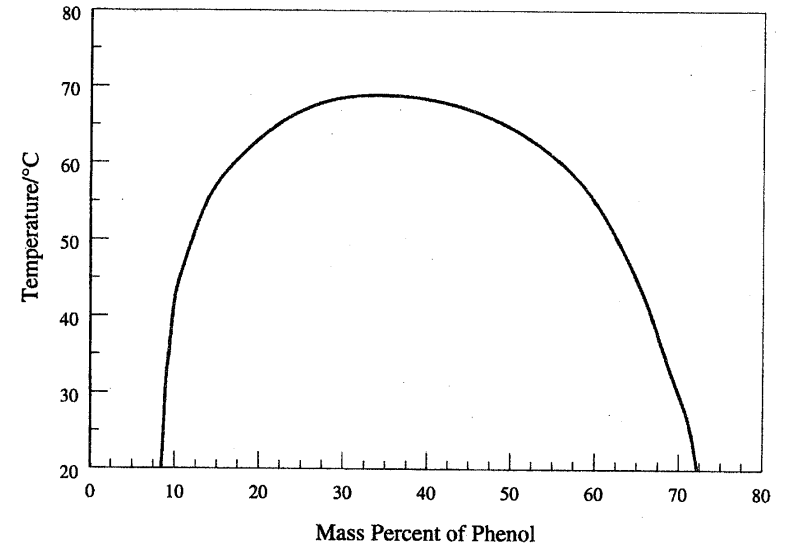
2. The following mechanism has been proposed for the thermal decomposition of pure ozone in the gas phase:



Derive the rate equation.

3. A solution of LiCl was electrolyzed in Hittorf cell. After a current of 0.85 A had been passed for 1 h, the mass of LiCl in the anode compartment had decreased by 0.452 g. (Li = 6.941, Cl = 35.45). (a) Calculate the transport numbers of the Li⁺ and Cl⁻ ions. (b) If $\Lambda^\circ(\text{LiCl})$ is 114.97 $\Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$, what are the molar ionic conductivities and the ionic mobilities?

4. Answer the following questions, using the phase diagram of phenol-water system.



- a. What will be the compositions of the layers formed from a solution of 30 g phenol and 70 g water maintained at 40°C? 5%
 - b. A solution of 20 g phenol and 80 g water is prepared at 75°C. How many phases will be present? 6%
 - c. At what temperature will two phases appear if the solution in part (b) is cooled gradually? What will be the compositions of the two phases? 6%
5. A sample of liquid benzene weighing 0.633 g is burned in a bomb calorimeter at 25°C, and 26.54 kJ of heat are evolved.
 - a. Calculate ΔU per mole of benzene. 8%
 - b. Calculate ΔH per mole of benzene. 9%
 6. A balloon 15 m in diameter is inflated with helium at 20°C.
 - a. What is the mass of helium in the balloon, assuming the gas to be ideal? 7%
 - b. How much work is done by the balloon during the process of inflation against an external pressure of 101.325 kPa, from an initial volume of zero to the final volume? 8%

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