

系所組別： 奈米科技暨微系統工程研究所

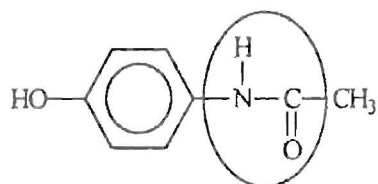
考試科目： 普通化學

考試日期：0219，節次：4

※ 考生請注意：本試題 可 不可 使用計算機

一、簡答題(共 83 分)

- (16) Starting from the equation $H = E + PV$, (a). show how the relationship $\Delta H = q_p$ is derived. Clearly indicate any necessary assumptions or conditions. (b). In one sentence, state in full what is meant by the equation: $\Delta H = q_p$.
- (8) A piece of copper metal is initially at 100.0°C . It is dropped into a coffee cup calorimeter containing 50.0 g of water at a temperature of 20.0°C . After stirring, the final temperature of both copper and water is 25.0°C . Assuming no heat losses, and that the specific heat (capacity) of water is $4.18 \text{ J}/(\text{g} \cdot \text{K})$, what is the heat capacity of the copper in J/K ?
- (16) (a). Calculate the wavelength in nm of a photon whose energy is $6.00 \times 10^{-19} \text{ J}$. (b). Would the photon in (a) have enough energy to ionize a hydrogen atom in its ground state (i.e., to separate the proton and electron completely)? Use the Bohr equation (Rydberg constant = $1.1 \times 10^7 \text{ m}^{-1}$) to calculate the needed energy.
- (15) Define and give one example each for ionic bonding, covalent bonding, and metallic bonding.
- (5) Acetaminophen is a widely used and an effective pain reliever. Name the functional group circled.



- (8) What is the pH of 375 mL of solution containing 0.150 mol of propenoic acid (HA) and 0.250 mol of sodium propenoate (NaA)? (K_a for propenoic acid is 5.52×10^{-5})
- (15) Compare one mole of ice with one mole of liquid water, both at 1.0 atm and 0°C . The melting point of ice at 1.0 atm is 0°C . For the process $\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)$ under these conditions predict whether each of the following quantities will be greater than, less than, or equal to, zero (i.e., > 0 , < 0 or $= 0$). Explain each prediction in one sentence.
 - ΔH° ;
 - ΔS° ;
 - ΔG°

(背面仍有題目,請繼續作答)

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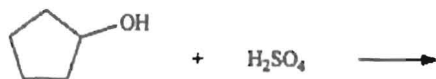
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二. 選擇題(共 17 分)

1. (5) Identify the organic product when cyclopentanol reacts with sulfuric acid.



- A.
- B.
- C.
- D.

2. (6) Hydrogen forms metallic (interstitial) hydrides with the d and f transition elements. Which of the following statements is correct?
- A. These substances have distinct stoichiometric formulas like ionic hydrides.
- B. Hydrogen forms bonds with the metals by donating its electron to the valence band of the metal.
- C. Hydrogen molecules and atoms occupy holes within the crystal structure of the metal.
- D. These substances are useful catalysts.
- E. These hydrides are stabilized by hydrogen bonding forces.
3. (6) The polymers containing silicon differ from polymers of carbon in which of the following ways?
- A. Silicon-based polymers are larger molecules than carbon-based polymers.
- B. Silicon-based polymers generally have a repeating silicon-oxygen link while carbon-based polymers can have carbon-carbon links.
- C. Silicon-based polymers generally have inorganic elements attached to the chain while carbon-based polymers generally have organic groups attached.
- D. Silicon-based polymers tend to be rigid while carbon-based polymers are generally flexible.
- E. Silicon forms stronger bonds than carbon.