

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Give the formal chemical names in English or chemical formula of the compounds listed as follows. (20%)

(1) HOCl, (2) AlCl₃, (3) CaCO₃, (4) hydrogen cyanide, (5) dichloroamine.

2. What is the Henderson-Hasselbalch equation? (6%) Please use the acid-base couple of HCO₃⁻ and CO₃²⁻ as an example to answer this question. The pK_a of HCO₃⁻ is 10.25 (i.e., K_a = 5.6 × 10⁻¹¹). What is the pH when mixing an equal volume of 0.2 M NaHCO₃ and 0.1 M Na₂CO₃? (7%) Give a recipe (i.e., the constituents) for preparing a NaHCO₃-Na₂CO₃ buffer solution that results in a pH of 10.4. (7%)

3. Balance the redox reaction of Fe²⁺ and Cr₂O₇²⁻. (6%) What are the equivalent weights of Fe²⁺ and Cr₂O₇²⁻, respectively? (4%) The atomic weights of Fe and Cr are 56 and 52. How much O₂ is needed to completely oxidize 5mM Fe²⁺ in the presence of 0.5 mM Cr₂O₇²⁻? (10%)

4. Which type of light has greater energy per photon, visible light or ultraviolet light? (5%) Ultraviolet light with a wavelength of 254 nm is used in water disinfection. What is the frequency (s⁻¹) of 254 nm light given the light speed of 3.0 × 10⁸ m/s? (5%) What is the ratio of energy per photon for 254 nm to 400 nm light? (10%)

5. What is the rate expression of the compound A for the reaction as follows? (5%) What is the integrated rate equation for A? (5%) What is the order of the reaction? (5%) What is the unit of rate constant (use M and s for the unit)? (5%)

A + A → B, with a rate constant k. The reaction is elementary.