I. 有机化學 PART I: ORGANIC CHEMISTRY

1. (42%) Write complete equations for the following reactions. If there are two or more products in a reaction, label the major and minor products. If there is no reaction, mark "No reaction".

a. 1-Chloro-1-methylcyclohexane + KOH $\xrightarrow{\text{ethanol}}$

b. 1,3-Butadiene + HBr ⟶

c. 1-Isopropylcyclopentene + HCl ⟶

d. Cyclohexanone + NaOH $\xrightarrow{\text{ethanol}}$

e. $CH_3CH_2CH_2CH{=}O$ + NaOH $\xrightarrow{NaBH_4,\ \text{ethanol}}$ $\xrightarrow{H_3O^+}$

f. Naphthalene $\xrightarrow[\text{heat}]{Br_2,\ Fe}$

g. Benzene + HCl $\xrightarrow{\text{ether}}$

h. p-Xylene + $KMnO_4$ ⟶

i. Toluene $\xrightarrow{H_2SO_4,\ SO_3}$

j. $CH_3CH_2CH_2$-MgBr + acetone ⟶ $\xrightarrow{H_2O}$

k. n-butyl bromide + phenol $\xrightarrow{\text{aq. NaOH}}$

l. Benzene + n-propyl chloride $\xrightarrow{AlCl_3,\ -18\ ^oC}$

m. Ethanol + formic acid $\xrightarrow{H^+}$

n. Aniline + Br_2 (aq) ⟶

2. (4%) PCBs are known to be a family of very toxic organic pollutants found in the environment. What is the full name for PCBs? Draw the structure of a PCB molecule and name it.

3. (4%) One of the largest classes of environmental carcinogens known today is the PAHs. What is the full name for PAHs? Draw the structure of a PAH which has a molecular weight higher than 160, and name it.

II. 分析化學部份

12 % 1. Explanation
(1) common ion effect (2) potentiometry
(3) indeterminate errors (4) nucleation and crystal growth
(5) relative supersaturation (6) back titration

6 % 2. (1) Differentiate (區別) "equivalent point" and "end point" in the titrimetric analysis.
(2) How to determine the end point in the acid-base titrimetric analysis ?

6 % 3. Write half-cell reactions of the following two reference electrodes: calomel electrode, silver-silver chloride electrode.

8 % 4. Calculate the equivalent weight of a weak dibasic acid if 47.63 ml of 0.1206 N NaOH is needed to titrate a 0.620 g to a phenolphthalin end point.

4 % 5. What are the common primary standards used for standardizing (1) acids, (2) bases, (3) reducing reagents, (4) oxidizing reagents ?

8 % 6. Given a hypothetical weak acid HA of Ka 1.7×10^{-6}, how many moles of A^- and HA^- are respectively(分別地) required to make 4-liter of 1.5 M buffer at pH 7.0 ?

6 % 7. Explain why the addition of chlorine into Feng San Water Purification Plant(鳳山淨水場) for treating a polluted water source(受污染水源) can increase the concentration of dissolved oxygen from 1 mg/l to 7.0～7.5 mg/l ?

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