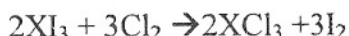


國立清華大學 命題紙

96 學年度 微機電系統工程研究所 (所) \_\_\_\_\_ 組碩士班入學考試

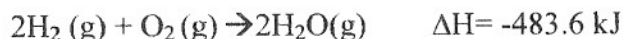
科目 化學 科目代碼 1905 共 1 頁第 1 頁 \*請在【答案卷卡】內作答

1. (5 %) An element X forms an iodide ( $XI_3$ ) and a chloride ( $XCl_3$ ). The iodide is quantitatively converted to the chloride when it is heated in a stream of chlorine:

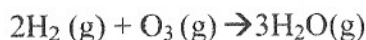


If 0.500 g of  $XI_3$  is treated, 0.236 g of  $XCl_3$  is obtained. (a) Calculate the atomic weight of the element X. (b) Identify the element X. (Atomic weights: Cl, 35.5; I, 127)

2. (15 %) Will precipitation occur when the following solutions are mixed? If so, write a balance chemical equation for the reaction. (a)  $Na_2CO_3$  and  $AgNO_3$ ; (b)  $NaNO_3$  and  $NiSO_4$ ; (c)  $FeSO_4$  and  $Pb(NO_3)_2$ .
3. (10 %) An aqueous solution of an unknown solute is tested with litmus paper and found to be acidic. The solution is weakly conducting compared with a solution of  $NaCl$  of the same concentration. Which of the following substances could the unknown be:  $KOH$ ,  $NH_3$ ,  $HNO_3$ ,  $KClO_2$ ,  $H_3PO_3$ ,  $CH_3COCH_3$ . Explain your choice.
4. (5 %) From the heats of the reaction



calculate the heat of the reaction



5. (10 %) What is wrong with the following electron configurations of atoms in their ground states? (a)  $1s^2 2s^2 3s^1$ ; (b)  $[Ne] 2s^2 2p^3$ ; (c)  $[Ne] 3s^2 3d^5$ .
6. (10 %) Consider S, Cl and K and their most common ions. (a) List the atoms in order of increasing size. (b) List the ions in order of increasing size. Explain the differences in the orders.
7. (10 %) Draw Lewis structures for the following (a)  $SiH_4$ ; (b)  $SF_2$ ; (c)  $CO$ ; (d)  $H_2SO_4$ ; (e)  $SCN^-$ .
8. (10 %) Indicate the hybrid orbital set used by the central atom in each of the following molecules and ions: (a)  $BCl_3$ ; (b)  $AlCl_4^-$ ; (c)  $CS_2$ ; (d)  $HCN$  (e)  $SiCl_4$ .
9. (15 %) Which member of the following pairs has the larger London dispersion forces: (a)  $H_2O$  or  $H_2S$ ; (b)  $CO_2$  or  $CO$ ; (c)  $CH_4$  or  $CCl_4$ .
10. (10 %) Place the following substances in order of increasing volatility:  $CH_4$ ,  $CBr_4$ ,  $CH_2Cl_2$ ,  $CH_3Cl$ ,  $CHBr_3$ ,  $CH_2Br_2$ . Explain your answer.