

※ 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 chemical structure and describe the usage of the following chemicals in the industry. (25%, 5% for each)
  - (1) Chloronaphthalene
  - (2) Hexabromocyclododecane (HBCD)
  - (3) Hexachlorobutadiene
  - (4) Decabromodiphenyl ether (Deca-BDE)
  - (5) Short chain chlorinated paraffins (SCCPs)
2. Balance the following equations: (25%, 5% for each)
  - (1) Oxidation of  $I^-$  to  $I_2$  and reduction of  $MnO_2$  to  $Mn^{2+}$
  - (2) Oxidation of  $S_2O_3^{2-}$  to  $SO_4^{2-}$  and reduction of  $Cl_2$  to  $Cl^-$
  - (3) Oxidation of  $NH_4^+$  to  $NO_3^-$  and reduction of  $O_2$  to  $H_2O$
  - (4) Oxidation of  $CH_3COO^-$  to  $CO_2$  and reduction of  $Cr_2O_7^-$  to  $Cr^{3+}$
  - (5) Oxidation of  $C_6H_{12}O_6$  to  $CO_2$  and reduction of  $NO_3^-$  to  $N_2$
3. Please define the Total suspended particulate (TSP),  $PM_{10}$  and  $PM_{2.5}$  (9%) and use reaction equation to describe how the  $SO_2$  and  $NO_x$  convert to secondary  $PM_{2.5}$ ? (16%)
4. Please explain the formation mechanism of "Crown corrosion" in the public sewage system? (10%)
5. Ozone depletion (OD) is originated from the chemical destruction of the stratospheric ozone layer beyond natural reactions where stratospheric ozone is constantly being created and destroyed through natural cycles. Nowadays, OD has become an important issue globally. Please answer the following questions related to OD.
  - (1) Please explain why we care about the OD? (3%)
  - (2) How does ozone depletion occur (specific reaction mechanism is preferred)? (6%)
  - (3) How do we know that natural sources are not responsible for ozone depletion? (3%)
  - (4) Will the ozone layer recover? Can we make more ozone to fill in the hole? (3%)