※ 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 definitions of calibration sensitivity and analytical sensitivity. Describe the differences between these two terms. (15%)

2. Give the definitions of limit of detection (LOD) and limit of quantitation (LOQ). Describe the differences between these two terms. (15%)

3. Describe the working principle and applications of a photomultiplier tube. (10%)

4. Give the definitions of selectivity factor and resolution in chromatographic science. Describe the differences between these two terms. (15%)

5. Draw a diagram showing components of a mass spectrometer system and describe the functions of these components. (15%)

6. Describe how the precision, bias, sensitivity, detection limit, dynamic range, and selectivity of a high performance liquid chromatography-mass spectrometry (HPLC-MS) method for measuring phthalate metabolite levels in human urine samples can be assessed. (15%)

7. Draw block diagrams to illustrate the components of the following three types of instruments for optical spectroscopy: absorption, fluorescence, and chemiluminescence spectrometers. Use the diagrams to explain how these instruments work and the major differences among them. (15%)