※ 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 statement of the third law of thermodynamics. **(10%)**

2. Describe the molecular orbital electron configurations of N_2 molecule. **(10%)**

3. Nickel has a face-centered cubic unit cell. The density of nickel is 6.84 g/cm^3. (Ni: 57 g/mol, $N=6 \times 10^{23}$)

   (A) How many Ni atoms in each unit cell?

   (B) Calculate cube edge length of Ni unit cell.

   (C) Calculate a value for the atomic radius of nickel. **(20%)**

4. Calculate the $[H^+]$ in 1 L solution of HCN, $Ka=6.4 \times 10^{-10}$ **(10%)**

5. For the species O_2, O_2^+, and O_2^-, give the electron configuration and the bond order for each. Which has the strongest bond? **(10%)**

6. Determine the rate constant for the first-order A→B, given that the concentration of A decreases form 0.6 M to 0.4 M in 25 sec. **(10%)**

7. Write down the English names of the three allotropes of Carbon and describe their structures. **(10%)**

8. You heat 3.8 g of mixture of Fe_3O_4 and FeO to form 4.05 g Fe_2O_3. What was the mass percent of FeO originally in the mixture? [Fe=55.85, O=16.0] **(10%)**

9. If 25 mL of 0.75 M HCl are added to 100 mL of 0.25 M NaOH, what is the final pH? **(10%)**