1. Explain the terms (briefly explain their function, meaning and applicability) (10%)
   a. Phagemid
   b. Primer extension
   c. Antisense RNA
   d. Transcription
   e. Polymerase chain reaction

2. Please give at least five functions and examples of microorganism to explain how the microbial / micro-biotechnology were used to improve agriculture, medicine, food, environmental protection and industry in human society? (10%)

3. What is the last results if we use EcoRI first and then use HaeIII to cut DNA fragment ” AAGTTGGCCCTTCGCGAATTCCGCGC”. (HaeIII 5’GG ↓ CC 3’; EcoRI 5’G↓ AATTC3’) (10%)

4. What are the difficulties in producing recombinant proteins in E. coli? (10%)

5. What is Monoclonal antibody? How to produce Monoclonal antibody? (10%)

6. Balance the following oxidation-reduction reactions that occur in basic solution.
   (a) $\text{Al} (s) + \text{MnO}_4^- (aq) \rightarrow \text{MnO}_2 (s) + \text{Al(OH)}_4^- (aq)$
   (b) $\text{Cl}_2 (g) \rightarrow \text{Cl}^- (aq) + \text{OCl}^- (aq)$
   (c) $\text{NO}_2^- (aq) + \text{Al} (s) \rightarrow \text{NH}_3 (g) + \text{AlO}_2^- (aq)$ (10%)
7. Commercial brass, an alloy of Zn and Cu, reacts with hydrochloric acid as follows:

\[
\text{Zn (s)} + 2 \text{HCl (aq)} \rightarrow \text{ZnCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}
\]

(Cu does not react with HCl.) When 0.5065 g of a certain brass alloy is reacted with excess HCl, 0.0985 g ZnCl\(_2\) is eventually isolated.

(a) What is the composition of the brass by mass? (10%)

(b) How could this result be checked without changing the above procedure?

8. Methanol can be manufactured by CO and H\(_2\). If 68.5 kg of CO(g) is reacted with 8.60 kg of H\(_2\)(g). Calculate the CH\(_3\)OH actually produced (in kg) if the theoretical yield is 52%. (10%)

The balanced equation is 2H\(_2\)(g) + CO(g) \(\rightarrow\) CH\(_3\)OH(l).

9. What volume of a 0.100 M HCl solution is needed to neutralize 25.0 mL of 0.200 M KOH solution? (10%)

10. Using enthalpies of formation (\(\Delta H_f^0\)), calculate the standard change in enthalpy for the termite reaction: 2Al(s) + Fe\(_2\)O\(_3\)(s) \(\rightarrow\) Al\(_2\)O\(_3\)(s) + 2Fe(s) (Fe\(_2\)O\(_3\) (s), \(\Delta H_f^0 = -826 \text{ kJ/mol}\) (Al\(_2\)O\(_3\)(s), \(\Delta H_f^0 = -1676 \text{ kJ/mol}\)) (10%)