Part I：50%

1. The following reagents are often used in protein chemistry:
   CNBr; Phenyl isothiocyanate; Urea; Chymotrypsin; Mercaptoethanol; 6N HCl; Trypsin; Ninhydrin.
   Which one is the best suited for accomplishing each of the following tasks? (10%)
   (a) Reversible denaturation of a protein devoid of disulfide bonds. Which additional reagent would you need if disulfide bonds were present?
   (b) Hydrolysis of peptide bonds on the carboxyl side of aromatic residues.
   (c) Cleavage of peptide bonds on the carboxyl side of methionines.

2. Write the sequences of the mRNA molecule synthesized from a DNA template strand having the sequence: (3%)
   5'–ATCGTACCGTTA-3'

3. How is pyruvate used to replenish intermediates in the citric acid cycle? Select the correct answer. (3%)
   (a) Pyruvate ←→lactate ←→succinate
   (b) Pyruvate ←→ malate
   (c) Pyruvate ←→PEP←→oxaloacetate
   (d) Pyruvate ←→ oxaloacetate

4. According to the Beer's law: A=E×C×L. A is the absorbance of light at a given wavelength; is the extinction coefficient; C is the concentration of protein solution; while L is the length through which the light passes. For tryptophan, absorption is maximum at 280 nm and the extinction coefficient is 3400 M^{-1} cm^{-1}. A solution of a protein whose sequence includes two tryptophan residues, no tyrosine residues and no phenylalanine residues has an absorbance of 0.1 at 280 nm in a cell with a path length of 1 cm. Estimate the concentration of the protein in units of molarity. If the protein has a molecular mass of 100 kDa, estimate the concentration in units of milligrams of protein per milliliter of solutions. (5%)

5. Which of the following statements about the citric acid cycle are true? **(multiple choice)** (5%)
   (a) It generates three NADH, and one GTP for each acetyl CoA.

(b) It is the only metabolic process in aerobic organisms that produces ATP
(c) Its intermediates may be removed to make the amino acids glutamate and aspartate
(d) It is linked to the electron transport chain through succinate dehydrogenase

6. Describe two biochemical effects of each of the following hormones. (10%)
(a) insulin
(b) glucagon
(c) epinephrine

7. Avidin, a protein found in egg white, is a specific inhibitor of biotin-containing enzymes. Which of the following metabolic processes would be blocked by avidin? (6%)
(a) Glucose→ 2 glyceraldehyde 3-phosphate
(b) Glucose→ 2 lactate
(c) 2 lactate → glucose
(d) Pyruvate → oxaloacetate
(e) Pyruvate → phosphoenopyruvate
(f) Fructose → 2 pyruvate

8. What is the function of the phospholipids in lipoprotein? (5%)

9. Briefly describe of the following terms: (3%)
(a) plasmid
(b) RFLP
(c) PCR amplification

Part II：50%

(1) The covalent modification of proteins with SUMO (small ubiquitin-like modifier) is known to regulate a wide range of cellular processes, such as transcription and the cell cycle. Please discuss the roles of the SUMO pathways in nuclear integrity, chromosome segregation and embryonic viability (10%).

(2) Technological advances in mammalian systems are providing new tools to identify the molecular components of signaling pathways. Foremost among these tools is the ability to knock down gene function through the use of RNA interference (RNAi). The fact that RNAi can be scaled up for use in high-throughput techniques has motivated the creation of genome-wide RNAi reagents. Please discuss the power of RNAi for large-scale functional discovery in mammalian cells (10%).

(3) Define neurotransmitter and give three examples of neurotransmitters (10%).

(4) Receptor tyrosine kinases (RTKs) have a key role in tumor growth and survival. Stimulated by the success of kinase inhibitors in cancer treatment — in particular, imatinib mesylate (Gleevec; Novartis) in the treatment of chronic myeloid leukaemia — many RTK inhibitors are now being developed as potential anticancer drugs. How might the effect of an oncogenic mutation be reversed by a small molecule? Propose a search strategy for such a drug. (10%)

(5) Cells respond to stress stimuli through coordinated changes in gene expression. The regulation of translation is often used under these circumstances because it allows immediate and selective changes in protein levels. There are many examples of translational control in response to stress. Please give an example to illustrate the importance of translational control in the cellular stress response and apoptosis. (10%)

（背面仍有題目，請繼續作答）