本試題是否可以使用計算機： □可使用 ， ☑不可使用 （請命題老師勾選） 考試日期：0302，節次：2

本試題分為三部份，請清楚標示題號

第一部份 (33 points)

I. 單選題(20 points; 2 points each question):

1. The main blood buffer system is
   A) H_3CO_3 / HCO_3^- B) HCO_3^- / CO_3^{2-}
   C) H_2CO_3 / CO_3^{2-} D) none of the above
2. The pK'a values of the amino groups of common amino acids
   A) occur at very low pH values B) occur in a range from pH 9 to pH 11
   C) all occur at around pH 8 D) all occur above pH 12
3. The affinity of fetal hemoglobin for oxygen (is)
   A) has not been studied
   B) the same as that of adult hemoglobin
   C) lower than that of maternal hemoglobin
   D) higher than that of maternal hemoglobin
4. In isoelectric focusing gel electrophoresis
   A) particular care is taken to insure the same pH along the length of the gel
   B) there is a pH gradient that parallels the electric field gradient
   C) the electric circuitry of the apparatus must be very well insulated
   D) the electric current is allowed to fluctuate
5. According to the steady-state assumption
   A) once the reaction starts, it proceeds a constant rate
   B) a highly stable enzyme-substrate complex forms
   C) the concentration of enzyme-substrate complex remains constant
   D) the enzyme activity does not vary with time
6. The hydrolysis of ATP can be used to drive reactions that have a $\Delta G°$, that is
   A) greater than +30.5 kJ/mol
   B) less that +30.5 kJ/mol
   C) between +20 and +40 kJ/mol
   D) not possible to determine from each different reaction
7. At the control point of the citric acid cycle the regulatory enzymes are
   A) inhibited by ADP and NAD^+ B) inhibited by ATP and NADH
   C) activated by ATP and NADH D) activated by ADP and NAD^+
8. An alternate mode of entry into the electron transport chain is the oxidation of
   A) malate to oxalosuccinate B) succinate to fumarate
   C) isocitrate to α–ketoglutarate D) α–ketoglutarate to succinyl-CoA
9. Glycogen synthase and glycogen phosphorylase in liver
   A) are modified by the same enzymes
   B) are not subject to allosteric control
   C) are not subject to covalent modification
   D) none of the above
10. The Cori cycle involves
    A) net synthesis of ATP
    B) net synthesis of GTP
    C) net synthesis of ATP and GTP
    D) net hydrolysis of ATP and GTP

II. 問答題 (13%):

1. Describe the main control mechanism between glycolysis and gluconeogenesis in human being (7%).
2. Give some possible correlations between the rates of turnover and the structure and function of enzymes (6%).

(背面仍有題目,請繼續作答)

第二部份 (33 points)

I. Multiple-choice questions 複選題 (15 points; 3 points each question)

1. A cloned yeast gene of unknown function was subjected to *in vitro* mutagenesis in which a serine codon was replaced by arginine at amino acid position 10 in the open reading frame. This gene was used to replace the resident wild-type gene. The resulting cell still showed a wild-type phenotype. Why did this occur?
   A) The amino acids have equivalent function at that position.
   B) There is another copy of the wild-type gene present in the genome.
   C) The mutant gene did not replace wild-type but inserted ectopically.
   D) The gene has no function; it is an inactive pseudogene.
   E) All of the above are correct.
2. Which of the below is true about the location of enhancers?
   A) They can be found upstream of the transcription initiation site.
   B) They can be found downstream of the promoter.
   C) They can be found in introns.
   D) They can be found 3′ of the polyadenylation site.
   E) The position of the enhancer has no effect on gene regulation.
3. Which of the below are genes whose levels would need to be regulated?
   A) histones.
   B) constitutive genes.
   C) developmental genes.
   D) heat tolerance genes in animal.
   E) genes for nutrient metabolism.
4. How does a nonsense suppressor mutation prevent amber mutants from terminating their polypeptides prematurely?
   A) The mutation turns the amber codon back into a wild-type codon.
   B) The mutation alters a tRNA so that it reads the amber codon and inserts an amino acid.
   C) The mutation alters the release factors that would halt synthesis.
   D) The mutation results in a wobble that allows synthesis to continue.
   E) The mutation replaces the amber codon with an ochre codon.
5. In the cell, gene interaction is seen by physical interaction between (select all correct answers):
   A) proteins and proteins
   B) proteins and RNA
   C) proteins and DNA
   D) DNA and DNA.
   E) RNA and DNA.

II. 簡答題 (18 points)

1. Scientists used to believe that RNA played a passive role in gene expression, as mere conveyors of information like messenger RNA. However, recent investigation have shown that RNA plays a variety of role, from catalysis to regulation. Except rRNA, mRNA and tRNA, eukaryotic cells contain additional small RNA molecules. Please give at least **three** of small RNA and describe their functions, respectively. (6%)

2. Polymerase usually add only about 10 nucleotides to a DNA strand before dissociating. However, during replication, DNA polymerase III can add tens of thousands of nucleotides at a moving fork. How is this addition accomplished? (4%)

3. A mutant has no activity for the enzyme isocitrate lyase. Does this result prove that the mutation is in the gene coding isocitrate lyase? Why? (4%)

4. What mechanisms are thought to be responsible for the inheritance of epigenetic information? (4%)

第三部份 (34 points)

I. 單選題(10 points; 2 points each question)

1. The thymidylate synthase reaction is unique because:
   A) tetrahydrofolate (THF) is regenerated by the same enzyme.
   B) THF is regenerated via a two-step reaction.
   C) THF is oxidized to dihydrofolate; no other reaction alters the THF oxidation state.
   D) none of the above
   E) all of the above

2. The disease gout is characterized by high levels of ____, forming which forms crystal deposits of _____, resulting in painful joints.
   A) urea, uric acid
   B) uric acid, sodium urate
   C) sodium urate, urea
   D) uric acid, urea
   E) none of the above

3. Which of the following statements is <u>not</u> true about apolipoproteins (with the possible exception of apoB-100)?
   A) The apolipoproteins are water-soluble and loosely associate with the lipoproteins.
   B) The apolipoproteins contain helices with hydrophobic and hydrophilic groups on opposite sides of the helical cylinder.
   C) The apolipoproteins are synthesized in the intestinal tissues.
   D) The apolipoproteins appear to float on the surface of phospholipids.
   E) A and C are not true.

4. Heme biosythesis:
   A) requires the molecules acetate and glycine as the contributors of the N and C atoms.
   B) is inhibited by in lead poisoning.
   C) requires synthetic stepsenzymes in both the cytosol and mitochondria.
   D) A and B
   E) A, B, and C

5. The _____ are synthesized from C_{20} fatty acids such as _____, and trigger pain and inflammation.
   A) cardiolipins, palmitate
   B) prostaglandins, arachidonate
   C) analgesics, salicylic acid
   D) NSAIDS, COX-1
   E) none of the above

II. 問答題 (8 points each question)

1. A membrane consisting only of phospholipids undergoes a sharp transition from an ordered form to the fluid form as it is heated. However, a membrane containing 80% phospholipid and 20% cholesterol undergoes a more gradual change from ordered to fluid form when heated over the same temperature range. Explain why.

2. What is one cause of severe combined immunodeficiency disease (SCID)?

3. What factors impact regulate fatty acid catabolic metabolic pathways?