

考試科目	生物化學	所別	8151 神經科學研究所	考試時間	3月7日(日) 第1節
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**A. Single-Choice Questions (3 points for each)**

- The free energy ( $\Delta G$ ) in a reaction is a measure of the
  - work that can be performed
  - increase in energy generation
  - rate of the reaction
  - work that is performed
  - heat generated
- Which of the following amino acids contain a  $-S-CH_3$  group
  - cysteine
  - tyrosine
  - histidine
  - methionine
  - serine
- In myoglobin and hemoglobin, oxygen binds directly to
  - $Fe^{2+}$  in the heme
  - $Fe^{3+}$  in the heme
  - $Fe^{4+}$  in the heme
  - the proximal histidine
  - the distal histidine
- Which of the following statements about introns in pre-mRNA is true
  - the size is less than 1000 nucleotides
  - they are found in all prokaryotic and eukaryotic genes
  - they have consensus sequences located at the junctions with the exons
  - they are removed from all expressed genes
  - they are removed in the cytosol before translation
- During DNA synthesis which enzyme includes an associated RNA that can act as a template?
  - RNase H

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- b. Telomerase
- c. Nucleotidyl transferase
- d. DNA ligase
- e. Reverse transcriptase

6. Which of the following biomolecules does not normally exist in biological membranes?

- a. Protein
- b. Lipid
- c. Nucleic acid
- d. Carbohydrate

7. What is the pH of a 0.1 mM solution of HCl?

- a. 4
- b. 6
- c. 7
- d. 8
- e. 11

8. TCA cycle activity is usually regulated by what ratio in most tissues?

- a. DNA/RNA
- b. ADP/ATP
- c. GDP/GTP
- d. Amino acid/glucose
- e.  $\text{NAD}^+$ /NADH

9. In resting muscle, which of the following molecules is the most important allosteric inhibitor of glycolysis?

- a. AMP
- b. ATP
- c.  $\text{Ca}^{2+}$
- d. GDP
- e. Fructose 2,6 bisphosphate

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10. The LDL receptor binds with highest affinity to

- Apo A-IV
- Apo B-100
- Apo C-I
- Apo C-III
- Apo D

### B. Essay Questions

11. A scientist discovered a new enzyme and tried to purify it. Below is a purification table he generated.

Procedure	Total protein (mg)	Activity (units)
1. Crude extract	30,000	6,000,000
2. Precipitation (pH)	7,500	4,500,000
3. Precipitation (salt)	6,000	1,500,000
4. Ion-exchange chromatography	400	1,600,000
5. Size-exclusion chromatography	100	1,500,000
6. Affinity chromatography	90	1,350,000

- What is the specific activity the enzyme solution after each purification procedure? (12 points)
- Which of the purification procedures for this enzyme is most effective? (2 points)
- What else can be done to purify this enzyme and estimate the molecular weight? (8 points)

12. A student has isolated two DNA samples from two unidentified species of bacteria, X and Y. He found "adenine" makes up 36% and 16% of the total bases in X and Y respectively.

- Base on what assumption you think the relative proportions of adenine, guanine, thymine, and cytosine in X and Y are? (12 points)
- One of these species was isolated from a hot spring (65°C). Which one would you suggest? (2 points) Why? (4 points)

13. Mitochondria generate most of the cell's supply of ATP.

- Please explain the Q cycle of the electron transport chain. (10 points)
- Please describe the binding-change mechanism of ATP synthase. (10 points)

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14. Please describe how to prepare 100ml of 5mM glutamate solution (pH=7.4). The molecular formula of glutamate is  $C_5H_9NO_4$ . (10 points)

