

國立中央大學97學年度碩士班考試入學試題卷

所別：生物物理研究所碩士班 科目：普通生物 共 2 頁 第 1 頁

\*請在試卷答案卷(卡)內作答

參考用

1. (共 35 分)

- (a) (5 分) What is an ATP molecule? What is the major role of the ATP molecule in living organisms?
- (b) (10 分) An experiment was conducted to investigate the effects of two inhibitors, A and B, on the activity of the enzyme ATPase (ATPase causes the hydrolysis of ATP). ATPase was allowed to act on ATP under the presence or absence of the inhibitors A and/or B. The ATP hydrolysis rates were measured and summarized in the following table:

[ATP] ( $\mu\text{mol dm}^{-3}$ )	Hydrolysis rate ( $\mu\text{mol dm}^{-3} \text{ s}^{-1}$ )		
	No inhibitor added	A added	B added
0.01	0.06	0.00	0.03
0.02	0.09	0.00	0.05
0.04	0.14	0.01	0.07
0.08	0.18	0.04	0.09
0.12	0.19	0.10	0.10
0.16	0.19	0.16	0.10
0.20	0.19	0.18	0.10
0.24	0.19	0.19	0.10

Plot the hydrolysis rates as a function of ATP concentrations under different conditions of the inhibitors in the same graph. (Plot the graph on the paper provided.)

Parts (c)-(e) refer to the experiment in (b).

- (c) (8 分) State two conditions which must be kept constant throughout the experiment. Explain how one of these conditions affects the ATP hydrolysis rate.
- (d) (4 分) Suggest a parameter which can be measured in experiment to represent the rate of ATP hydrolysis.
- (e) (8 分) Explain the mode of inhibition on the ATPase activity for the two inhibitors A and B respectively.

2. (共 20 分)

- (a) (10 分) Name 4 enzymes that are essential in DNA replication. Describe in detail their functions in DNA replication.
- (b) (10 分) Describe in details the cell cycle of a eukaryotic cell. Describe each phase in the cell cycle in detail, with suitable drawings.

3. (共 20 分) Sickle cell anaemia is a defect due to a recessive mutant gene. The mutant allele leads to the production of a wrong type of polypeptide chain which makes up

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haemoglobin. The amino acid sequence of a part of the normal polypeptide chain and a table for the codons for 10 common amino acids are listed below:

Val - His - Leu - Thr - Pro - Glu - Glu - Lys ...  
 1    2    3    4    5    6    7    8

<b>Codon</b>	AAU	AAA	ACU	CAU	CCU	GAA	GCU	GUU	UAU	UUA
<b>Amino acid</b>	Asn	Lys	Thr	His	Pro	Glu	Ala	Val	Tyr	Leu

參考用

- (a) (9 分) Find the base sequence of the messenger RNA which codes the above polypeptide segment. Hence find the corresponding base sequence of the DNA strand from which the mRNA is produced.
- (b) (3 分) In the abnormal polypeptide chain, the 6<sup>th</sup> amino acid is replaced by Val. Rewrite the base sequence of the mRNA.
- (c) (8 分) Describe the disease of sickle cell anaemia. Explain how the abnormal haemoglobin gives rise to sickle cell anaemia.
4. (共 25 分) Write a short essay (more than 400 words) to describe a topic you learned in biology that you think that is most interesting to you. Are physical principles useful/essential in the topic you described? Explain your reasons no matter your answer is yes or no.

注意：背面有試題