

國立清華大學 106 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、丁組

考試科目（代碼）：生物學(0502、0802)

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*請在【答案卷】作答

簡答題（20%）

1. Natural killer cells (2%)
2. Recombinant subunit vaccine (2%)
3. Describe the functions of reverse transcriptase during human immunodeficiency virus replication and transcription. (4%)
4. What are the antigenic shift and antigenic draft? (4%) Why antigenic shift and antigenic draft are so important in infectious disease spreading? (4%)
5. Describe the roles of interferons in innate immunity. (4%)

申論題（60%）

6. Please describe the steps of the β clamp controlling association of core enzyme with DNA on the lagging strand during DNA replication in *E. coli*. (10%)
7. Please describe the detailed steps of Homologous Recombination in *E. coli*. (10%)
8. What is imprinting? How to distinguish it from other types of learning? How conservation biologists have taken advantage of imprinting in programs to save the whooping crane from extinction? (10%)
9. The Nobel Prize in Physiology or Medicine 2016 was awarded to Yoshinori Ohsumi for his discoveries of mechanisms for autophagy. Use the endomembrane system to describe this process. (10%)
10. Why are leaves green? Design an experiment to obtain the action spectrum of chlorophyll. (10%)

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Table 53.3 Logistic Growth of a Hypothetical Population
($K = 1,500$)

Popu- lation Size (N)	Maximum Rate of Increase (r_{inst})	$\frac{(K - N)}{K}$	Per Capita Rate of Increase: $r_{inst} \frac{(K - N)}{K}$	Population Growth Rate:* $r_{inst} N \frac{(K - N)}{K}$
25	1.0	0.98	0.98	+25
100	1.0	0.93	0.93	+93
250	1.0	0.83	0.83	+208
500	1.0	0.67	0.67	+333
750	1.0	0.50	0.50	+375
1,000	1.0	0.33	0.33	+333
1,500	1.0	0.00	0.00	0

*Rounded to the nearest whole number.

11. Why is the carrying capacity (K) important in the logistic growth model? Draw a population growth curve based on this hypothetical data. Note: X-axis is Number of generations, and Y-axis is Population size (N). (10%)

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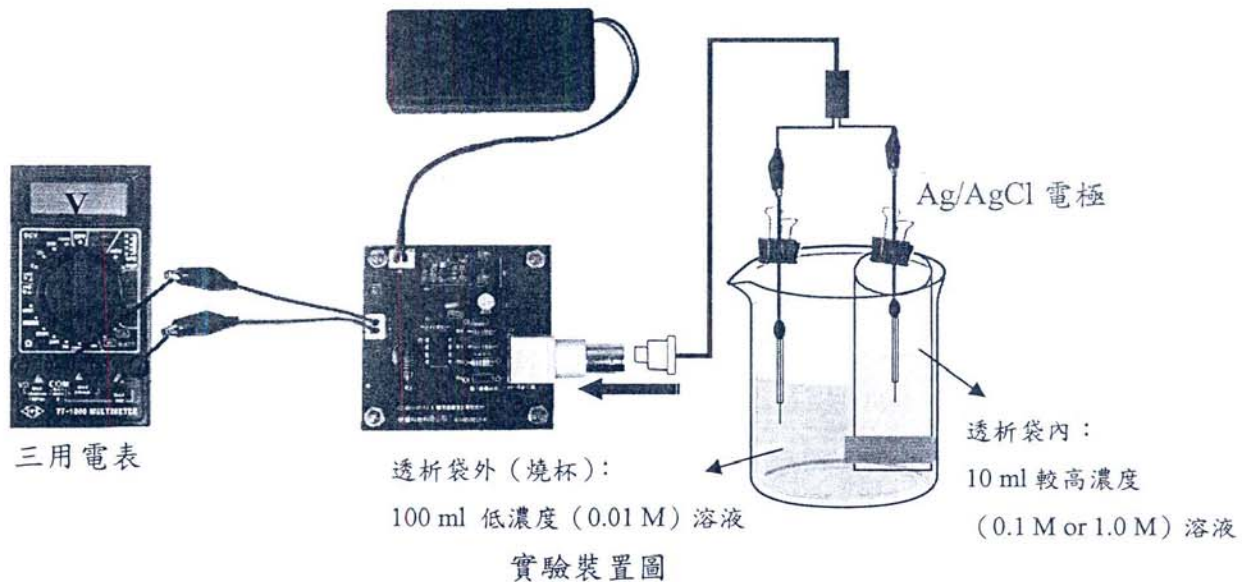
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實驗題 (20%)



以下為使用上圖所量測的實驗數據，透析袋內外溶液不同濃度的電壓差值

透析袋內外濃度/ 溶液	NaCl	KCl	HCl	NaOH
0.01 M 內/ 0.01 M 外	-3 mV	-6 mV	-2 mV	-3 mV
0.1 M 內/ 0.01 M 外	-52 mV	-57 mV	-60 mV	-1 mV
1 M 內/ 0.01 M 外	-97 mV	-99 mV	-115 mV	-2 mV

注意：透析袋是透析蛋白質大分子用，不同離子進出完全無差別

請回答以下問題：

12. 請解釋為何(除 NaOH 外)透析袋內外溶液不同濃度有電壓差，且接近-60 mV? (4%)
13. 請解釋為何(除 NaOH 外)透析袋內外溶液濃度較低之組合卻又沒有電壓差? (4%)
14. 請解釋為何透析袋內外 NaOH 溶液三種不同濃度的組合都沒有電壓差? (4%)
15. 根據此實驗，到底證明或推翻“膜內外離子濃度差造成細胞膜電位”此一說法 (靜止細胞膜與透析袋特性相似，但透析袋較利於離子流動) (4%)
16. 請解釋到底細胞為何會有細胞靜止膜電位? (4%)