

國立成功大學  
110學年度碩士班招生考試試題

編 號： 272

系 所： 生理學研究所

科 目： 生命科學

日 期： 0203

節 次： 第 1 節

備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、After coming to graduate school, you chose a lab that is working on Coronavirus. Your advisor asks you to study some background knowledge. Please answer the following questions in as much detail as possible.

(1) First, Are Coronavirus DNA or RNA viruses? (5%). Viruses do not grow through cell division. Instead, they need host cells to produce copies. Could you explain how Coronavirus replicates the genome after infection? (10%)

(2) Coronavirus can cause irreversible respiratory syndromes. Please explain how we breathe under normal physiological conditions, significantly how we increase the thoracic cavity volume. (10%)

(3) A recent study published in The Lancet Neurology indicated Coronavirus affects the respiratory system and the nerve system. The nerve system consists of the central nervous system and peripheral nervous system. Please explain what CNS and PNS are. And try to compare the difference between these two systems. (10%)

(4) Next, your advisor asks you to prepare a solution and drug (Q drug) before doing experiments.

1. You need to prepare 3000 milliliters (mL) of 75 % EtOH by using 95 % EtOH. How many milliliters of water and 95 % EtOH you need to add? (5%)

2. You need to prepare 10 ml of a 5 mM drug. The molecular weight of this drug is 35. How many milligrams of this drug you need to add? (5%)

3. How do you determine which dose of the Q drug shows the best effects on killing the virus? Please describe the experimental design (5%).

二、One of the biomedical advances in the twenty-first century is Regenerative Medicine. Please define the characteristics and describe the functions of stem cell in regenerative medicine. (10%)

三、Paracrine and autocrine functions play important roles in cell growth, differentiation and migration. It is now accepted that exosomes may be the carriers for cell execution of paracrine, autocrine or even endocrine functions. Exosome is a kind of extracellular vesicles with the size of 40-100 nm. Please describe the content and characteristics of exosome. (10%)

四、Desert animals, such as kangaroo rat, develop highly efficient urine concentration system, namely countercurrent multiplier system. Please describe the structure and function of this system. (10%)

五、Unlike humans, marine mammals such as whale can dive deep for a long period of time. Please describe how whales develop such advantages in their Respiratory, circulatory and blood system. (10%)

六、Three scientists shared Nobel prize of 2019 due to their discovery of Hypoxia inducible factors  $1\alpha$  (HIF- $1\alpha$ ). Please describe the mechanisms of how hypoxia triggers expression of HIF- $1\alpha$  and the functions of HIF- $1\alpha$ . (10%)