

※ 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。

1. Apoptosis: Please define morphological changes of apoptosis and signal transduction mechanisms leading to apoptosis in a cell (10%)
2. Autophagy: Please define structural changes during autophagy and the molecular mechanisms involved (10%)
3. ER stress: Please define the cause and outcome of ER stress (10%)
4. Please describe basic cytoskeleton and how they are related to cell stiffness (10%)
5. Please define the functions of oncogenes and tumor suppressor genes (10%)
6. Heavy smokers or industrial workers exposed for a limited time to a chemical carcinogen that induces mutations in DNA do not usually begin to develop cancers characteristic of their habit or occupation until 10, 20, or even more years after the exposure. Please suggest molecular and cellular mechanisms for this long delay (14%).
7. Dr. James P. Allison and Tasuku Honjo won the 2018 Nobel Prize in Physiology or Medicine for their work on for their discovery of cancer therapy by inhibition of negative immune regulation. Importantly, by stimulating the inherent ability of our immune system to attack tumor cells Dr. James P. Allison and Tasuku Honjo have established an entirely new principle for cancer therapy. Please answer the following questions.
 - (A) Dr. Tasuku Honjo discovered a protein on immune cells but he did not know its functions. Using your knowledge of molecular and cellular mechanisms, what critical experiments could he do to study the functions of this protein, and explain why these experiments are critical (12%)?
 - (B) Please design experiments for cancer treatment strategies based on their discovery of “cancer therapy by inhibition of negative immune regulation”, and explain the rationale of your immunotherapy experiments, using your knowledge of molecular and cellular mechanisms (12%)?
 - (C) Do you think that current immunotherapy strategies against cancers will be always effective? In other words, is it possible that the cancer cells develop mechanisms of resistance against immunotherapy? Explain your answers using your knowledge of molecular and cellular mechanisms (12%).