

Choose five out of the following six questions (20% each).

1. The action potential can propagate a long distance without decrement, while the graded potential is only effective in short distances. Can our neural network function with action potential alone? Explain why.
2. Which hormones are lipid-soluble? How can these hormones be transported in the blood and how can they move across the capillary walls to reach their target cells?
3. A patient has a left ventricular systolic pressure of 180 mmHg and an aortic systolic pressure of 110 mmHg. Explain why.
4. Hypoxia can be classified in four general categories.
  - a. List the four categories and give an example for each category (4%)
  - b. Describe the cause for each category (4%)
  - c. What will happen to  $\text{PaO}_2$  and  $\text{O}_2$  content in each category when compared to the normal control? (4%)
  - d. Which category cannot be ameliorated by inspired oxygen treatment? Why? (8%)
5. Patients with severe uncontrolled diabetes mellitus (DM) produce large quantities of certain organic acids.
  - i. Based on your knowledge about carbohydrate metabolism, please explain why the patients produce large quantities of organic acids. (5%)
  - ii. Please predict the possible changes in their respiration pattern and explain why the respiration pattern changes (5%)
  - iii. Please describe the changes in the arterial concentrations of hydrogen ion, bicarbonate, and carbon dioxide (3%)
  - iv. Please draw a picture and explain how the kidney handles the large quantities of organic acids (7%)
6. 17beta-estradiol is an important steroid hormone.
  - i. Based on Two-cell theory, please explain how 17beta-estradiol is synthesized (5%).
  - ii. List 5 17beta-estradiol-targeted organs (5%)
  - iii. For each organ, please provide a physiological condition and explain its action under that condition. (10%)