

Choose any five of the following seven questions and answer them as clear as you can. You can only answer five questions. If more than five questions are answered, the first five will be graded and the rest will be disregarded. So read all the seven questions first and then decide which five you want to answer.

Question 1. The genetic information is stored as the form of deoxyribonucleic acid (DNA). How can the entire genetic information be transferred from generation to generation? Please describe the mechanisms as detailed as you can. (20%)

Question 2. Survival of a species depends on maintaining the nucleotide intact. However, the genetic material is subject to constant challenge during DNA replication, RNA transcription, and even during resting state. Damage of genetic material leads to mutation, which is usually lethal. Please list types of mutation and describe the mechanisms of DNA repair. (20%)

Question 3: a) The time is 11:30 am. You are hungry. Your blood sugar level is low. If your blood sugar level does not replenished, it will cause shock! But you are working on a very important experiment which prevent you from eating anything. Don't worry! Your body has emergent back up plan which will keep your blood glucose level return to the normal level by hydrolysis of glycogen. Please describe the hormone(s), mechanisms involve in this rescue process (10%).

b) Finally, you finished your experiment. You went to McDonald's and ordered a big Mac, a quarter pounder, a super size French fries and a huge cup of Coke. You ate them all and feel satisfied. Now, your blood sugar level is too high. Your body needs to keep the blood glucose level down. Please describe the hormone(s) and mechanisms involve in keeping your blood glucose down to the normal level (10%).

Question 4: a) Hormones have very unique characteristics compared to other substances. Please list 5 common characteristics of hormones. (10%)
b) List name, source, and function of 5 hormones you know. (10%)

Question 5: In the movie "Jurassic Park", scientists reproduced dinosaurs from genetic material (DNA) they discovered in a mosquito fossil. Suppose you are the chief scientist of the group, you need to develop a protocol for all other scientists to conduct the experiment. You have unlimited sources of reagents, equipment that a modern biochemical laboratory has. Please describe your strategies, methods, and protocols for successfully accomplishing this task. (20%)

Question 6: Respiration has two quite different meanings: (1) the exchanges of oxygen and carbon dioxide between an organism and the external environment, and (2) utilization of oxygen in the metabolism of organic molecules by cells. The later is called cell respiration, which occurs in 3 major stages. The first stage breaks down organic molecules (carbohydrates, fatty acids, or some amino acids) into 2-carbon fragments. The second stage enzymatically degrades these 2-carbon fragments into CO_2 and energy-rich hydrogen atom. The third stage utilizes these energy-rich hydrogen atoms and converts them into H_2O and energy (in the form of ATP). Use carbohydrate as an example, describe how it goes through these three stages of cell respiration. (20%)

Question 7: a) The building blocks for DNA are nucleotides. Nucleotides are further divided into two groups, each contains two kinds of nucleotides. A nucleotide consists of 3 different parts. Please describe the 3 parts of a nucleotide, the name of the four nucleotide and classify them into 2 different groups by their nature. (20%)