

Introduction to biochemistry essay sample



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Mg²⁺ has 10 electrons. A magnesium atom has 12 electrons with 2 of the 12 being valence electrons. Therefore the atom will lose the valence electrons which are located on the outermost shell to stabilize itself (outermost shell) as atoms tend to do what is easiest. Since magnesium lost 2 electrons it becomes positive as it is giving away electrons to stabilize other atoms. Hence magnesium then becomes Mg²⁺ because it lost 2 of the 12 electrons. Given that the half-life of the radioisotope Carbon -14 is 5730 years. How useful do you think the isotope would be for dating bones that are over a million years? (2 marks)

Living plants and animals incorporate Carbon -14 into their tissues through the nutrients they consume and the air that they breathe. Once they die, the incorporation of Carbon -14 ends, and is now decaying at a constant rate. Being that the half-life is 5730 years, after 40,000 years there is less than 1% of Carbon -14 left in the tissue. Therefore the isotope Carbon -14 is not useful in dating material older than 40,000 years old, because there is not enough of the isotope in the tissues to determine the age of the bones. Summarize the four major types of biochemical reactions studied in this lesson. For each type, give its name, a work summary of what happens during the reaction and an example of where the reaction might be biologically important. (12 marks)

Hydrolysis

Condensation

Oxidation and Reduction (Redox)

Neutralization

For the following chemical reaction

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$$

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Identify:

The substance being oxidized

The carbon atoms in glucose are being oxidized

The substance being reduced

The O₂ atoms are being reduced

For each of the following four macromolecules, list their

Monomers

Functional groups

Linkage types

Primary function

Macromolecules

Carbohydrates

i. Monomers: monosaccharides

ii. Functional groups: ketone or aldehyde

iii. Linkage types: glycosidic

iv. Primary function: carbohydrates are used as building materials for energy, cell identification and communication

Proteins

i. Monomers: amino acids

ii. Functional groups: amino group, carboxyl group

iii. Linkage types: peptide bond linkage

iv. Primary function: proteins are used in the building and repairing of body tissues, regulation of body process and formation of enzymes and hormones

Lipids

i. Monomers: fatty acid and glycerol

ii. Functional groups: ester group

iii. Linkage types: ester linkage

iv. Primary function: lipids serve as physical and thermal insulation for the body and act as raw materials for the synthesis of hormones. Nucleic Acids

i. Monomers: nucleotide

ii. Functional groups: phosphate group and ribose group

iii. Linkage types: phosphodiester linkage

iv. Primary function: nucleic acids are used to store and transfer genetic information Show how a peptide bond forms between the two amino acids, glycine and valine. Draw the structural formulas for the reactants and the product. Label the functional groups and linkages present. (5 marks)

Chocolate milk has been a choice for many athletes, as it is a good source of protein, carbohydrates and lipids. Suppose you were to conduct nutrient testing The test you would perform and the reagents you would use. (2 marks) The tests that would be performed are the Benedict's reagent test that tests for simple sugars using the blue reagents, the Sudan IV lipid test that tests for lipids and the Biuret's protein test that tests for protein. The results you would expect to find (2marks)

Using the Benedict's reagent tests, once the blue reagent was added to the chocolate milk color, the color would change according to the sugar percentage. The chocolate milk would change from light green, to green/yellow, orange or from red to brown. A sample of the chocolate milk would change to a red color for the lipids present and also another sample of the chocolate milk would change to a deep purple once the Biuret's reagent is added from the protein in the chocolate milk. Explain how an enzyme catalyzes the synthesis of a large molecule from two smaller molecules. Explain how the following environmental factors affect enzyme activity: PH:

ph affects the activity of enzymes as they always have a range of ph where they function optimally. At an extreme ph value, the enzyme will break down/ denature.

This means the enzyme will begin to come apart and no longer be able to function properly. Enzyme and substrate concentration: the increasing concentration of an enzyme and/or substrate will increase the number of successful enzyme-substrate collision. This is because they have been sped up to the point of saturation, increasing the enzyme's activity. Once its enzyme has reached its threshold, there is no further increase in the enzyme activity. Due to saturation where all the enzyme molecules are occupied with substrate, adding more substrate will not increase the rate of reaction because the enzymes is already operating at its fullest capacity. Examine the following data for three enzymes (A, B and C). Each has been tested at a number of temperature and ph levels to measure their activities. Based on these results, for each enzyme, list: The optimal temperature

The optimal PH

Enzyme A: the optimal temperature is 37oC , the optimal PH is 4 Enzyme B: the optimal temperature is 37oC , the optimal PH is 7 Enzyme C: the optimal temperature is 20oC , the optimal PH is 7 Describe three benefits of using enzymes in food technology Replacing synthetic chemicals, which lowers the amount of waste and energy consumed to produce the food product Allowing some reactions to occur that otherwise may not have occurred naturally Providing specific action that allows for very specialized food products to be produced efficiently. Why would muscle cells require more mitochondria than fat cells? (3marks) Mitochondria are defined as the power house of the cell,

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by turning nutrients and oxygen into fuel for the body. Muscles require more mitochondria because they are constantly working and contracting, while fat cells are not working as much, so they release energy slowly, which require less energy. Distinguish between diffusion and active transport, in terms of Energy movement (2 marks)

Diffusion is a spontaneous process, since all the energy required is inherent in the concentration gradient. While active transport goes against the energy of the concentration gradient, and thus must have an energy source to overcome that energy. In the cells, this energy is typically derived from ATP. Direction of molecular flow (2marks)

Diffusion goes from high to low concentration, while active transport goes from low to high. Describe two ways that receptor-mediated endocytosis is different from phagocytosis. (2 marks) Receptor mediated Endocytosis (RME) enables the cell to acquire large quantities of specific substances that the cell requires. This is done with the use of receptors for the particular substance to attach to the cell, while phagocytosis engulfs large solid particles and does not use any receptors. Describe the function of integral proteins and cholesterol in the cell membrane. (2 marks) Cholesterol makes the membrane sturdy and more rigid than it would be without. Integral proteins allow polar molecules like water to pass through the non-polar interior on the membrane.