THE SCHOOL FOR EXCELLENCE
UNIT 3 BIOLOGY 2010
COMPLIMENTARY WRITTEN EXAMINATION 1 – SOLUTIONS

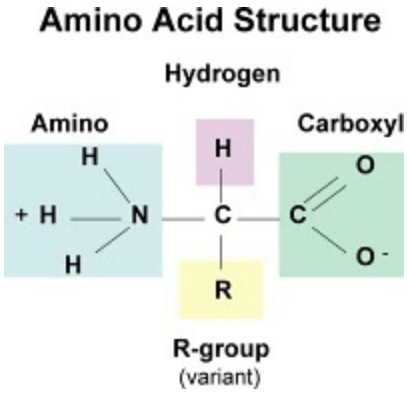
SECTION A – MULTIPLE CHOICE QUESTIONS

QUESTION 1 Answer is D
QUESTION 2 Answer is C
QUESTION 3 Answer is B
QUESTION 4 Answer is A
QUESTION 5 Answer is D
QUESTION 6 Answer is D
QUESTION 7 Answer is B
QUESTION 8 Answer is A
QUESTION 9 Answer is D
QUESTION 10 Answer is A
QUESTION 11 Answer is B
QUESTION 12 Answer is A
QUESTION 13 Answer is B
QUESTION 14 Answer is B
QUESTION 15 Answer is A
QUESTION 16 Answer is A
QUESTION 17 Answer is B
QUESTION 18 Answer is D
QUESTION 19 Answer is A
QUESTION 20 Answer is C
QUESTION 21 Answer is A
QUESTION 22 Answer is B
QUESTION 23 Answer is B
QUESTION 24 Answer is C
QUESTION 25 Answer is A

SECTION B – EXTENDED RESPONSE SOLUTIONS

QUESTION 1

(a) Drawing needs to be of an amino acid showing the amine group, the acid group and the R (variable) group



1 mark

(b) Secondary protein structure.

1 mark

(c) The silkworm would use its silk to make its cocoons so the silk needs to have structural properties. In fibroin, the polypeptide chains are arranged in parallel for extra support and the pleating strengthens the molecule. The strength is due to the many hydrogen bonds holding the beta sheets together. Since the protein forms a Beta sheet, when stretched the force is applied to these strong bonds and they do not break.

1 mark

(d) They are different in shape (elongated vs. spheroidal) (1) and in solubility (insoluble vs. soluble) (1).

2 marks

(e) Sericin is a combination of carbohydrate and protein (1) so has properties of each, increasing the functionality (1).

For example, the carbohydrate group would be soluble while the protein group would be insoluble. This would give it both adhesive and structural properties relating to its function in supporting the egg case of the silkworm

2 marks

Total 7 marks

QUESTION 2

(a) The plasma membrane is selectively permeable as it will allow certain molecules or ions to pass through it by diffusion and occasionally specialised "facilitated diffusion." (1). The rate of passage depends on the pressure, concentration, and temperature of the molecules or solutes on either side, as well as the permeability of the membrane to each solute. Permeability may also depend on solute size, solubility, properties, or chemistry (1).

2 marks

(b) FDA has low water solubility (1) so is lipophillic/hydrophobic and is able to dissolve in or mix uniformly with lipds and can pass readily through the phospholipids in the plasma membrane (1). It may also pass through active transport.

2 marks

(c) The conversion of FDA into a fluorescent molecule is a biochemical process . Enzymes lower the activation energy required for this reaction to proceed.

1 mark

(d) By determining how many cells in a organ are living or non living, or functioning or non functioning, you are able to make an assessment of the overall health of the organ. The higher the number of 'living' cells, the more viable the organ.

1 mark

Total 6 marks

QUESTION 3

(a) (i) Glucose
(ii) Water

1+1=2 marks

(b) (i) Inner compartment of mitochondria OR matrix of mitochondrion Or cytoplasm of prokaryotic cells.

(ii) For each molecule of pyruvate that passes through the Krebs cycle, three molecules of carbon dioxide are formed. Acetyl Coenzyme A, an intermediate product is formed. As the cycle proceeds, hydrogen atoms are gathered by acceptor molecules, with a total of 5 'loaded' acceptor molecules formed (4 NADH and 1 FADH2) for each pyruvate molecule. (1) The cycle contributes 2ATP molecules per glucose molecule. (1)

1+2=3 marks

Total 5 marks

QUESTION 4

(a) The internal environment of the body is the extracellular fluid that surrounds the cells.

1 mark

(b) NPH was effective for 12.5 hours.
Lantus was effective for 24 hours.

2 marks

(c) Lantus lasts almost twice as long as NPH which means it only needs to be administered once over a 24 hour period. The glucose uptake is also maintained within a more narrow limit, creating less stress on the homeostatic mechanisms of the patient.cc

1 mark

(d) Blood glucose regulation relies on negative feedback systems. If the glucose levels of blood slightly overshoots the optimal as a result of effector action, the counter negative feedback system will respond to correct the overshoot (1). These actions occur continuously in the body of a normal person so that optimal levels of blood glucose are continually fine-tuned (1).

2 marks

(e) An autoimmune disease occurs when the body identifies some self cells as non self and attacks them (1). In the case of diabetes mellitus, insulin-producing pancreas cells (beta cells) display improper antigens to T cells. This eventually leads to the production of antibodies that attack these beta cells (2).

2 marks

Total 8 marks

QUESTION 5

(a) Phtyohormone-most likely Abscisic Acid.

1 mark

(b) The plant cells responded to environmental stimulus of water stress (1). This involves a series of molecular steps called a signal transduction pathway where the information is relayed through secondary messenger molecules. Finally, a specific effector molecule-Protein X brings about the cellular response (1).

2 marks

(c) (i) Arginine-Proline-Leucine-Serine-Valine-Threonine-Alanine-Valine.

(ii) The first 7 amino acids have molecular masses corresponding to the known masses from Table 2. The last amino acid, Valine, was determined using simple arithmetic (842-743) following the pattern used on the grap and matching the calculated mass of 99 daltons to Table 2.

1+1=2 marks

(d) The primary structure of a protein consists of a sequence of amino acids. Each amino acid has individual properties based on the chamical composition of the R group. These properties include molecular mass and the charge (pI). A peptide can be taken from the protein and the amino acid sequence analysed and matched to a data base to determine its identity.

1 mark

(e) The task of studying the proteome has its share of challenges. One involves the sheer number of proteins that need to be identified. The 35,000 genes in the human genome can code for at least ten times as many proteins; in extreme cases a single gene alone can code for over 1,000. Another challenge is that amino acids – the base units of proteins – are so small. Each amino acid is made from anywhere between 7 and 24 atoms. This is far beyond the reach of even the most powerful microscopes.

2 marks

Total 8 marks

QUESTION 6

(a) Enzyme inhibitors are molecules that bind to enzymes and decrease their activity by stopping a substrate from entering the active site and/or hindering catalysis.

1 mark

(b) Create two groups, a control consisting of a test tube containing 5ml starch, 5ml amylase. And an experimental group consisting of 5ml starch and 5 ml amylase and one aspirin tablet (1). The controlled variables will be the size of the test tube, the amount of starch and amylase and the amount of aspirin. The experiment will need to be completed at the same time and at a constant room temperature.

Add 5 ml of Iodine to both test tubes and observe the colour after 20 minutes (1).

If the Iodine changes from blue black to brown, the amylase would have broken down the Starch to simple sugars. If there is no colour change in the test tube containing the aspirin, the hypothesis that aspirin inhibits enzyme activity would be supported (1).

The experiment should be repeated a number of times to increase the reliability of the results.

3 marks

Total 4 marks

QUESTION 7

(a) Apoptosis is a term that describes programmed cell death, a normal cellular process and an essential feature of an organism's development.

1 mark

(b) During apoptosis, the cell is reduced to membrane-enclosed fragments that are engulfed by phagocytes.

1 mark

(c) Cytokines are the signals that a cell receives to keep them functioning. Withdrawal of these signals will trigger apoptosis or the signal initiates a signal transduction pathway that activates caspases.

1 mark

(d) Defects in the regulation of this signalling pathway are responsible for various diseases-too much apoptosis may cause degenerative conditions such as Alzheimer's disease while a lack of apoptosis allows cancer cells to multiply.

1 mark

Total 4 marks

QUESTION 8

(a) (i) B lymphocytes display antibodies on surface that identify particular antigens and then replicate to produce large numbers of plasma cells.

(ii) **Neotrophils**: Neutrophils are normally found in the blood stream. However, during the beginning of inflammation, particularly due to bacterial infections and some cancers, they migrate toward the site of inflammation, firstly through the blood vessels, then through interstitial tissue, following chemical signals (such as Interleukin-8) in a process called chemotaxis. They are the predominant cells in pus, accounting for its whitish/yellowish appearance.

Eosinophils: are responsible for combating multicellular parasites and certain infections. Along with mast cells, they also control mechanisms associated with allergy and asthma.

Basophils: store histamine, a chemical that is secreted by the cells when stimulated in certain ways (histamine causes some of the symptoms of an allergic reaction).

1+1=2 marks

(b) In CML, tyrosine kinase is stuck in the 'on' position. This new drug has a shape that is complementary to the active site so binds to the active site and prevents the substrate from binding with it, therefore preventing its activity.

1 mark

(c) **Targeted therapy** is a type of medication that blocks the growth of cancer cells by interfering with specific targeted molecules needed for carcinogenesis and tumor growth,[1] rather than by simply interfering with rapidly dividing cells (e.g. with traditional chemotherapy). Targeted cancer therapies may be more effective than current treatments and less harmful to normal cells.

1 mark

(d) **Rational Drug design** – involves the analysis of a disease to determine a strural aspect, usually the active site of a molecular component of the disease (1). A second molecule, the drug is then constructed to fit into that active site (1) to inhibit the activity of the first molecule (1).

3 marks

(e) Fewer adverse side effects of this drug

or

provide an extra binding site for another drug

or

enzyme or the drug can pass more readily into cancer cells

1 mark

Total 8 marks