**IB SEHS**

**Chapter 3**

**Self-Study Questions**

**Name**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Block** 1 2 3 4 **Day** A B

1. Identify C H O

2. State the smallest chemical unit of proteins and what it is made of.

3. Distinguish between as essential and non-essential amino acid.

4. Outline what is meant by the term glycogenolysis.

5. State the two main sites for glycogen storage in the human body.

6. Distinguish between saturated and unsaturated fatty acids.

7. State the functions of fat stored in adipose tissue.

8. Evaluate the amount of energy stored in dietary carbohydrates, fats and proteins.

9. Distinguish between dietary recommendation and dietary guidelines.

10. List the food groups most dietary guidelines refer to.

11. List the six forms of energy.

12. Outline the terms metabolism, anabolism and catabolism.

13. Discuss the role of insulin during exercise.

14. Discuss the role of muscle contraction and insulin I blood glucose uptake.

15. Explain the role of adrenaline in metabolism.

16. Define the term cell respiration.

17. Evaluate the relative contributions of the pathways of ATP production

A. In short duration, intense exercise (lifting heavy weights)

b. During a 20-minute steady state low intensity jog.

**IB SEHS**

**Chapter 3**

**Self-Study Questions**

**Name**:\_\_Answer Key\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Date:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Block** 1 2 3 4 **Day** A B

1. Identify C H O

Glucose

2. State the smallest chemical unit of proteins and what it is made of.

Amino acids…. which are compounds made of carbon atoms, nitrogen atoms, oxygen atoms and hydrogen atoms. Most amino acids are characterized by the same central structure and a side chain that distinguishes the physical and chemical properties. Each protein has a characteristic amino acid composition. They are linked in chains through peptide bonds.

3. Distinguish between as essential and non-essential amino acid.

Twenty amino acids have been identified as being required for the synthesis of proteins. Out of these 20, eight are considered “essential amino acids” and need to be provided by the diet. They are:

* 1. Isoleucine
  2. Leucine
  3. Lysine
  4. Methionine
  5. Phenylalanine
  6. Threonine
  7. Tryptophan
  8. Valine

4. Outline what is meant by the term glycogenolysis.

**Glycogenolysis**- The process that happens when the body needs more glucose than is ingested by the body glycogen is broken down and glucose (liver) and glucose -6-phosphate (muscle) can serve as metabolic fuel.

5. State the two main sites for glycogen storage in the human body.

a. Liver – supplies glucose to all organs

b. Muscles – supplies glucose to the muscles.

6. Distinguish between saturated and unsaturated fatty acids.

Saturated fats – has the maximal number of hydrogen atoms (four) on each carbon atom. It is solid at room temperature and should not exceed more than 10% of our daily diet.

Example: Crisco, bacon grease, solid butter sticks

Unsaturated fats – where two hydrogen atoms are missing forms double bonds between two carbon atoms and becomes unsaturated. These types of fats are liquid at room temperature.

Example: oils

7. State the functions of fat stored in adipose tissue.

Adipose fat is found under the skin and between the organs. Stored fat provides energy when energy supply is not immediately available from the diet or glycogen pools.

Lipolysis is the process of releasing triglycerides from the body’s stores. Triglycerides supported by enzymes are converted into glycerol and fatty acids. Fatty acids are then available for the energy generating B-oxidation.

8. Evaluate the amount of energy stored in dietary carbohydrates, fats and proteins.

Fats – 9 calories per 1 gram

CHO – 4 calories per 1 gram

Protein – 4 calories per 1 gram

9. Distinguish between dietary recommendation and dietary guidelines.

Dietary recommendations are set standards for what constitutes an adequate intake of essentials nutrients to promote health. They are developed by governments and health authorities based on scientific evidence to assess whether the diet of a population or a population subgroup meets the nutritional needs. The amount of nutrients varies based on age, gender, activity level, and changes during pregnancy and lactation.

Dietary guidelines target foods, food groups or meals and are set by a country to guide its people towards a healthy balanced diet. The development of dietary guidelines can be used on dietary recommendations – it can be a practical interpretation of nutrient intake recommendations. Dietary guidelines are influenced by:

Religious beliefs

Social norms

Preparation preferences

Food consumption patterns

Food availability

Food security

Income

Food prices

10. List the food groups most dietary guidelines refer to.

Fats, CHO, Proteins, Dietary fiber, and sodium

11. List the three forms of energy.

Proteins, Fats, CHO

12. Outline the terms metabolism, anabolism and catabolism.

**Metabolism** - The chemical process in living organisms required for the maintenance of life.

**Anabolism** - The constructive phase of metabolism where smaller molecules are converted to larger molecules.

**Catabolism** - The destructive phase of metabolism where larger molecules are converted into smaller molecules.

13. Discuss the role of insulin during exercise.

During a prolonged period with no food or excessive exercise, the blood glucose concentration decreases which causes the secretion of the hormone glucagon.

Glucagon is secreted by the cells of the pancreas and acts in the opposite way of insulin. It stimulates glycogenolysis and synthesis of glucose, which increases glucose levels in the blood – making energy available.

Glucagon also activates the lipolysis of triglycerides in fat stores, which contributes to the energy supply. Al low blood glucose concentration also stimulates adrenalin, which acts a glucagon in the process of glycogen breakdown and lipolysis

14. Discuss the role of muscle contraction and insulin in blood glucose uptake.

In order to maintain the energy supply by glucose the muscle increases the uptake of glucose from the blood. Muscle contraction stimulates the translocation of glucose transporters from the inner storage pool to the cell membrane, but in a different way to insulin (figure 3.10, page 65). The insulin induced transporter translocation takes place during phases of no exercise (rest). **Exercise lowers the concentration of insulin in the blood and reduces its function in glucose transport.**

15. Explain the role of adrenaline in metabolism.

In periods with no food intake (fasting) or exercise the blood glucose concentration decreases which causes the secretion of the hormone glucagon. A low blood glucose concentration also stimulates adrenaline which acts as glucagon in the processes of glycogen breakdown and lipolysis.

16. Define the term cell respiration.

Cell respiration – the controlled release of energy in the form of ATP.

17. Evaluate the relative contributions of the pathways of ATP production

A. In short duration, intense exercise (lifting heavy weights)

b. During a 20-minute steady state low intensity jog.

1. **Anaerobic System:**

**A. Creatine phosphate system:**

* Is another high -energy chemical compound.
* Although present in the muscle it cannot be used directly to drive muscle contraction.
* Creatine Phosphate (PCr) in combination with the two seconds of ATP already in the muscle, dominates the provision of energy for muscle contraction.
* This chemical reaction can occur quickly, so it is important during hard exercise.
  + Ex: Sprinting – ATP is needed at a fast rate.
* This chemical reaction can go both ways: At rest when we recover from exercise ATP can be used to refill our store PCr in muscle.
* PCr and ATP only make meaningful contributions to muscle contractions for the first twenty seconds. After this point, ATP is provided to the muscles by other ways.

**B. Lactic Acid**

* Glycolysis is a metabolic pathway present in the cytoplasm of all cells, which allows the cells to use carbohydrates.
* Glycolysis releases some of the energy in glucose as ATP and produces pyruvate…the way this occurs depends if oxygen is available.
* When the capacity for aerobic metabolism is limited (oxygen or mitochondria are limited in supply) pyruvate is converted to lactate (lactic acid).
* This yields only a small amount of ATP (2 molecules) this process occurs quickly; meaning this energy system is optimal to meet the high energy demands of hard exercise, especially when the input from PC r is beginning to fade.
* High intensity exercise can only be sustained for a short period of time due to the build up of lactic acid in the muscle. This lactic acid build up is so strong it reduces the pH in the muscle.
* This build up causes discomfort, but also reduces the ability of the muscle to contract and we begin to slow down.

**2. Aerobic System**

* The mitochondria of cells accommodate the biochemical processes of aerobic metabolism including the Krebs cycle and the electron transport chain.
* This aerobic energy system can produce ATP from the main food groups of our diet (CHO, Fats, proteins).
* CHO and fats are the principal energy substrates; proteins are also used and contribute around 15% of resting energy metabolism.

**Glucose Oxidation**

* + The final product of glycolysis (pyruvate) has a different fate depending upon metabolic conditions in cells.
  + During less demanding metabolic conditions pyruvate is converted to acetyl CoA.
  + Acetyl CoA enters the Krebs cycle in the mitochondria where chemical reactions that involve oxygen convert it to water and carbon dioxide.
  + During glycolysis and the Krebs cycle hydrogen ions are released.
  + Specific enzymes bind the hydrogen ions and carry them to the electron transport where energy is produced. This energy is needed to form ATP.

**Fat Oxidation**

* + Free fatty acid molecules enter the mitochondria and a process called B-oxidation removes two carbon units from the fatty acid chains.
  + The enzymes of the B-oxidation are in the matrix of the mitochondria and this process produces acetyl CoA.
  + Acetyl CoA has the same fate in oxidative metabolism as produced through glucose.
  + Fat cannot be used anaerobically.

**\*Be able to discuss different exercises and what energy systems they would use and why.**