**Topic 2.1: Molecules to Metabolism**

**Essential Idea: Living Organisms control their composition by complex web of chemical reactions.**

**Statements & Objectives:**

**2.1.U1 Molecular biology explains living processes in terms of the chemical substances involved.**

Define “molecular biology.”

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Compare the benefits of a reductionist vs. systems approach to studying biology.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

Recognize common functional groups.

**(Identify:** Find an answer from a given number of possibilities)

Draw skeletal molecular structures from full structure diagrams

(**Draw**: Represent by means of pencil lines)

**2.1.U2 Carbon atoms can form four covalent bonds allowing a diversity of stable compounds to exist.**

Outline the number and type of bond carbon can form with other atoms.​

**(Outline**: Give a brief account or summary)

**2.1.U3 Life is based on carbon compounds including carbohydrates, lipids proteins and nucleic acids.**

List the four major classes of carbon compounds used by living organisms.

**(List**: Give a sequence of brief answers with no explanation.)

**2.1.U4 Metabolism is the web of all the enzyme-catalyzed reactions in a cell or organism.**

Define metabolism and catalysis.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

State the role of enzymes in metabolism.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**2.1.U5 Anabolism is the synthesis of complex molecules from simpler molecules including the formation of macromolecules from monomers by condensation reactions.**

Define anabolism, monomer and polymer.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Describe condensation (dehydration synthesis) reactions.

**(Describe**: Give a detailed account)

Using simple shapes to represent monomers, diagram a condensation reaction.​

(**Draw**: Represent by means of pencil lines)

**2.1.U6 Catabolism is the breakdown of complex molecules into simpler molecules including the hydrolysis of macromolecules into monomers.**

Define catabolism.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Contrast anabolism and catabolism.

**(Compare and Contrast:** Give an account of similarities and differences between two(or more) items or situations, referring to both(all) of them throughout.)

Describe hydrolysis reactions.

**(Describe**: Give a detailed account)

Using simple shapes to represent monomers, diagram a hydrolysis reaction.

(**Draw**: Represent by means of pencil lines)

**2.1.A1 Urea as an example of a compound that is produced by living organisms but can also be artificially synthesized.**

Draw the molecular structure of urea.

(**Draw**: Represent by means of pencil lines)

Describe how urea can be synthesized by living and artificial mechanisms.

**(Describe**: Give a detailed account)

**2.1.S1 Drawing molecular diagrams of glucose, ribose, a saturated fatty acid and a generalized amino acid.**

**\*for carbohydrates**

**\* for lipids**

Draw the molecular diagram of ribose.

(**Draw**: Represent by means of pencil lines)

Draw the molecular diagram of alpha-glucose.

(**Draw**: Represent by means of pencil lines)

Draw the molecular diagram of a saturated fatty acid.

(**Draw**: Represent by means of pencil lines)

Identify the carboxyl and methyl groups on a fatty acid.

**(Identify**: Find an answer from a given number of possibilities.)

Draw the generalized structure of an amino acid.

(**Draw**: Represent by means of pencil lines)

Label the amine group, carboxyl group, alpha carbon and R group on an amino acid.​

**(Label:** Add labels to a diagram)

**2.1.S2 Identification of biochemical such as sugars, lipids, or amino acids from molecular drawings.**

**​\*for carbs**

**​\*for lipids**

Identify the four major classes of carbon compounds used by living organisms from given diagrams (examples will include D-ribose, alpha glucose, beta glucose, triglycerides, phospholipids and steroids).

**(Identify**: Find an answer from a given number of possibilities.)

State the generalized chemical formula of the carbohydrates.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Identify the following carbohydrates from molecular drawings: D-ribose, alpha glucose, beta glucose, cellulose, glycogen, amylose starch and amylopectin starch.

**(Identify**: Find an answer from a given number of possibilities.)

Compare the relative amount of oxygen atoms in lipids to the amount in carbohydrates.

**(Compare and Contrast:** Give an account of similarities and differences between two (or more) items or situations, referring to both(all) of them throughout.)

Identify the following lipids from molecular drawings: triglycerides, phospholipids and steroids.​

**(Identify**: Find an answer from a given number of possibilities.)

**2.1.NOS Falsification of theories- the artificial synthesis of urea helped to falsify vitalism.**

Define vitalism.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Explain the role of urea in the falsification of vitalism.

(**Explain**: Give a detailed account including reasons or causes)

**Key Terms**

fatty acid

element

trace element

matter

proton

neutron

electron

metabolic reaction

coolant

vaporization

​catalyst

​steroids

beta glucose

covalent

polar

ionic

ion

cation

carbohydrate

lipid

polarity

thermal

​enzyme

carboxyl group

methyl groups

​cellulose

anion

hydrogen bond

organic

monomer

polymer

carbon

hydrogen

sodium

iron

functional groups

​amino acid

phospholipids

​glycogen

condensation

hydrolysis

hydrophobic

hydrophilic

adhesion

oxygen

nitrogen

phosphorous

anabolism

​dehydration

​R-group

triglycerides

amylose starch

density

nucleic acid

protein

sulfur

calcium

vitalism

reductionist approach

systems approach

​catabolism

​alpha-glucose

​D-ribose

carbohydrate

amylopectin starch