Understandings, Applications and Skills (This is what you maybe assessed on)

	Statement	Guidance
2.1.U1	Molecular biology explains living processes in terms of the chemical substances involved.	
2.1.U2	Carbon atoms can form four covalent bonds allowing a diversity of stable compounds to exist.	
2.1.U3	Life is based on carbon compounds including carbohydrates, lipids, proteins and nucleic acids.	Sugars include monosaccharides and disaccharides. Only one saturated fat is expected and its specific name is not necessary. The variable radical of amino acids can be shown as R. The structure of individual R-groups does not need to be memorized.
2.1.U4	Metabolism is the web of all the enzyme-catalysed reactions in a cell or organism.	
2.1.U5	Anabolism is the synthesis of complex molecules from simpler molecules including the formation of macromolecules from monomers by condensation reactions.	
2.1.U6	Catabolism is the breakdown of complex molecules into simpler molecules including the hydrolysis of macromolecules into monomers.	
2.1.A1	Urea as an example of a compound that is produced by living organisms but can also be artificially synthesized.	
2.1.S1	Drawing molecular diagrams of glucose, ribose, a saturated fatty acid and a generalized amino acid.	Only the ring forms of D-ribose, alpha–D-glucose and beta-D-glucose are expected in drawings.
2.1.S2	Identification of biochemicals such as sugars, lipids or amino acids from molecular diagrams.	Students should be able to recognize from molecular diagrams that triglycerides, phospholipids and steroids are lipids. Drawings of steroids are not expected. Proteins or parts of polypeptides should be recognized from molecular diagrams showing amino acids linked by peptide bonds.

Recommended resources:

http://bioknowledgy.weebly.com/21-molecules-to-metabolism.html

Allott, Andrew. *Biology: Course Companion.* S.l.: Oxford UP, 2014. Print.

2.1.U1 Molecular biology explains living processes in terms of the chemical substances involved.
2.1.U4 Metabolism is the web of all the enzyme-catalysed reactions in a cell or organism.

1. The structure of DNA was discovered in 1953, since then molecular Biology has transformed our understanding of living processes.
   a. Outline the relationship between genes (DNA) and polypeptides.

   b. Outline what the term metabolic pathway means.

   c. Referring to the term metabolic pathway describe what the term metabolism means to a molecular biologist.

   d. Describe the reductionist approach that a molecular biologist uses discover the working of a metabolic pathway.

   e. Explain why ultimately the reductionist approach used by molecular biologists might be a limited one.

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

2. Despite only being the 15th most abundant element on the planet carbon forms the backbone of every single organic molecule.
   a. What type of bonds can carbon molecules form? And how does the strength of these bonds compare with other types of bond?

   b. Explain why Carbon can form four bonds with up to four different atoms, and explain why.

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

3. Compare the key feature of the different groups of organic molecules by completing the table below.

	Key features	Examples
carbohydrates		
lipids		
proteins		
nucleic acids		

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

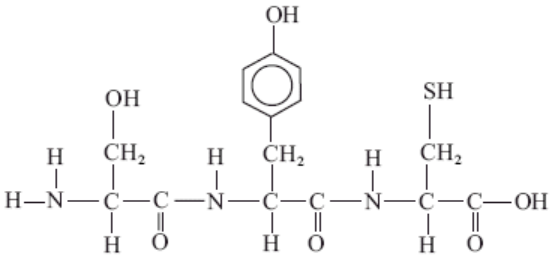
4. Draw the simplified (ring) structures of glucose and ribose. Number the carbon atoms correctly. Which sugar is a pentose? Which is a hexose? How are they named this way?

5. Octanoic acid is a fatty acid with the formula $CH_3(CH_2)_6COOH$. Draw the structure of molecule and explain why it is called a saturated fatty acid.

6. Draw the generalised structure of an amino acid. Label and annotate the diagram to show the different groups that comprise amino acids.

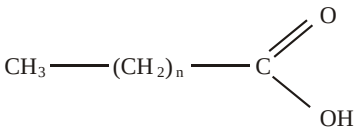
2.1.S2 Identification of biochemicals such as sugars, lipids or amino acids from molecular diagrams.

7. Which type of molecule is shown in the diagram to the right?

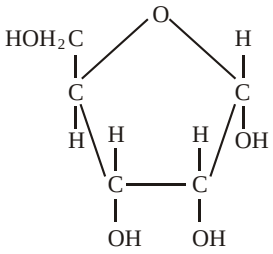


8. The diagrams below show various molecular structures.

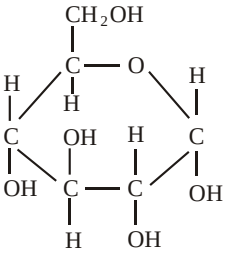
I.



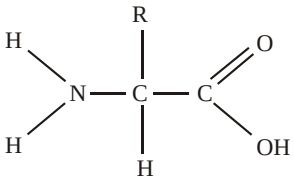
II.



III.



IV.



a. Identify which of the diagrams represent:
   i. the structure of glucose.
   ii. the structure of an amino acid.
   iii. the structure of fatty acids.

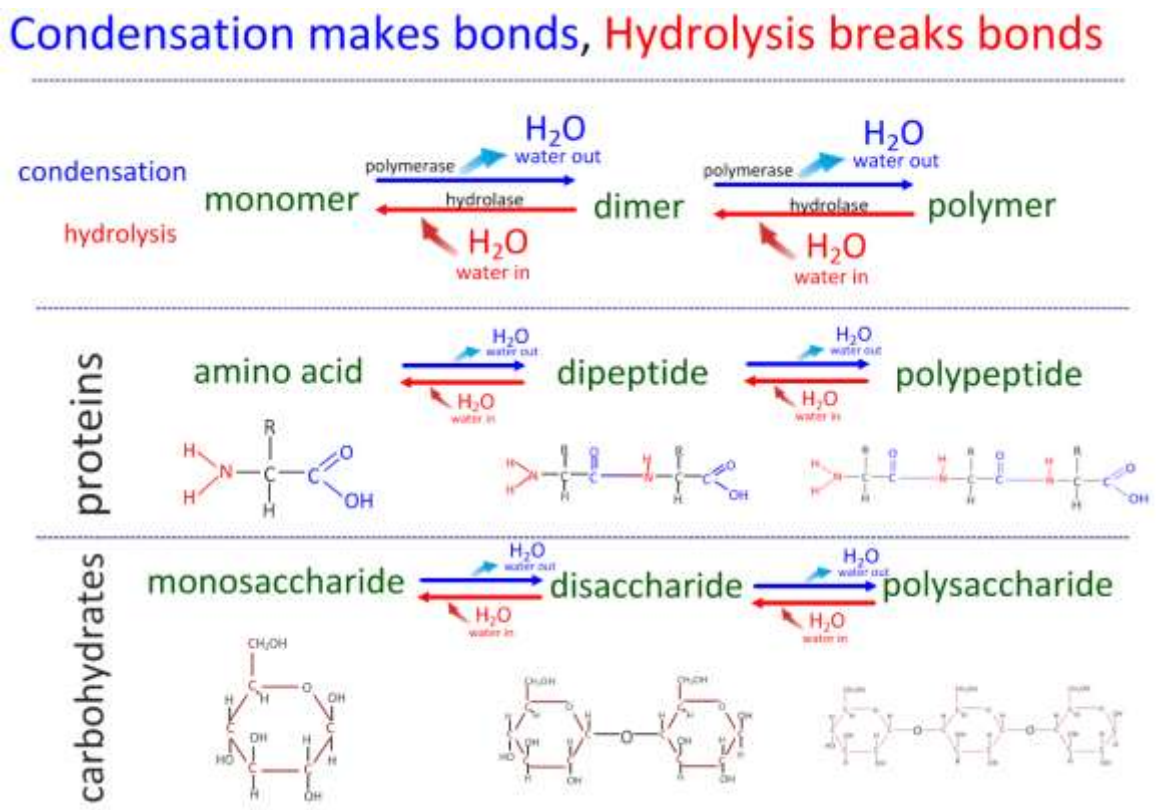
b. Discuss which of the molecules are most similar in structure.

2.1.U5 Anabolism is the synthesis of complex molecules from simpler molecules including the formation of macromolecules from monomers by condensation reactions.
2.1.U6 Catabolism is the breakdown of complex molecules into simpler molecules including the hydrolysis of macromolecules into monomers.

9. Distinguish between the terms anabolism and catabolism.

	anabolism	**catabolism**
synthesis or breakdown?		
type of reaction		
substrates		
products		
water produced or used?		
enzymes/agent involved		

10. Annotate the diagram below to complete your notes on anabolism and catabolism. In the carbohydrate section add a named example, include both the names of the molecules and enzymes.



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

11. Vitalism is a theory that nowadays has no credit.
    a. Describe the central tenant that Wöhler falsified.

    b. Wöhler accidentally artificially synthesised urea, hence falsifiying vitalism. What compound was he trying to produce?

    c. Accidental discoveries are a surprisingly common part of the development of scientific understanding. Referring to the IB guide identify which 'Nature of Science' points this example applies to.

Citations:

Allott, Andrew. *Biology: Course Companion.* S.l.: Oxford UP, 2014. Print.