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November 1, 16, 2014, 12:59 PM mlopez@guhsd.net a biochem basics.tiffView Download 25k v. 1 Nov 16, 2014, 1:00 PM mlopez@guhsd.net a Scan.tiffView Download 300k v. 1 Nov 16, 2014, 1:03 PM mlopez@guhsd.net Thank you for your participation! This preview shows pages 1 - 2 of 2 pages. Unformatted text preview: Biochemistry basics Which concepts from chemistry are useful for studying biology? Why? Usually chemistry is a necessary course for advanced biology courses. This is because everything in your body, all in one plant, all in a virus, etc. is made of atoms. The structures and properties of the molecules in an organism determine the characteristics and properties of the organism. Which molecules are polar, which are not polar? What molecules have acidic properties, which have basic properties? A quick review of these concepts at the beginning of your advanced biology course will help you understand the molecular basis of life. Model 1 - Molecular drawings Ball-and-stick model of 1-pentanol Lewis structure of 1-pentanol H H C H Line drawing of 1-pentanol OH H Ball-and-stick model of glucose O H Lewis structure of glucose H3C Line drawing of glucose H H H OH C OH C O H H C OH OH HO Ball-and-stick model of unsaturated fatty acid H C C H OH OH C OH Lewis structure of unsaturated fatty acid H H H C H OH HO OH C H H Line drawing of unsaturated fatty acid O H C C O OH H H CH3 OH 1. Name the three molecules illustrated in Model 1. Pentanol, glucose and unsaturated fatty acid 2. Name the three drawing types used to illustrate the molecules in Model 1. Lewis structure, line drawing and ball and ball-and-stick model. Biochemistry basics 1 3. How many bindings are usually formed by each of the following atoms: Carbon Hydrogen Oxygen 4 1 2 4. What types of drawings in model 1 provide more accurate images of the shape of a molecule? Justify your reasoning. Ball and stick model, because it all atoms, and it also shows the binding. 5. See Model 1. A. Symbols or atoms of which elements are missing from the line drawings? Hydrogen and carbon b. How do you know where the atoms of these elements are in the structure if they are missing from the drawing when reading a line drawing? Carbon atoms are at the vertex at each angle. hydrogen atoms would be attached to carbons so that each carbon has four bindings in total. 6. Find carbon and hydrogen atoms in the line drawing of the isoleucin shown below and draw H O H them in as if the drawing was a Lewis structure. H H CH3 O H3C OH H C NH2 Isoleucine H H H N H H 7. Isopropyl alcohol is a three-carbon molecule with an OH group attached to the middle carbon atom. Draw this molecule using all three types of drawings. H H H OH O H C C H LEWIS BALL AND STICK H3C CH3 LINE DRAWING 8. If you were asked to write the chemical formula for one of the compounds in Model 1, what type of drawing would be the easiest to use? Justify your reasoning. Lewis structure because each item is marked in the chart. 9. What is the advantage for a scientist in using a line drawing instead of a ball-and-stick model or Lewis structure? It saves time drawing, and allows the individual to look at it to focus on the important parts of the chart. 2 POGIL™ Activities for AP* Biology O H Model 2 – Properties of biological molecules Polar molecules (hydrophilic) acid nonpolar molecules (hydrophobic) Sure O H3C O OH H3C OH OH Lactic acid Neutral Fatty acid Neutral O CH3 H3C CH3 CH3 OH H3C NH2 CH3 CH3 Valine (amino acid) OH O H H OH H HO CHOLESTEROL H OH HO H OH GLUCOSE OH H HO O OH H OH H OH H OH Vitamin A H H H OH LACTOSE BASICS H OH HO CH3 N CH3 OH CH3 HO Adrenaline HO NH2 O Testosterone HO Dopamine NH2 N NH N N Adenine Biochemistry Basics 3 10. Consider the polar molecules in Model 2. A. In general, does the presence of atoms of which element(s) make a molecule polar? Nitrogen and oxygen b. What trait do atoms of these elements have that help make the molecules they are in polar? High electronegativity c. Can't polar molecules also have atoms of these elements? If so, what distinguishes a non-polar molecule from a polar molecule? Yes, non-polar molecules may also have oxygen and nitrogen atoms, but it is usually far fewer compared to the number of carbon atoms in the molecule. Also, some molecules with polar bonds are not polar due to the overall three-dimensional shape of the molecule. 11. In chemistry there is a saying that dissolves that, which means that things will mix with or dissolve into each other best when their polarities are equal. A. Is water polar or non-polar? Polar b. Is oil polar or non-polar? Non-polar c. Which of the substances in the Model 2 would dissolve well in water? Justify your reasoning. Some of the polar molecules Model 2 would dissolve well in water because their polarity is similar to water d. Which of the substances in the Model 2 is more likely to dissolve well in oil? Justify your reasoning. Most of the non-polar molecules from the Model 2 should be dissolved well in oil because their polarity is similar to oil. E. What class of substances in Model 2, polar or non-polar, are more likely to be found in high concentrations in the blood of a vertebrate? Justify your reasoning. The solvent for blood is water, so the polar molecules would be found in high concentrations in blood 12. See Model 2. A. What is another term for a polar molecule? hydrophilic b. What is another term for a non-polar molecule? hydrophobic c. Provide literal translation for the terms you gave in parts a and b above. 4 Hydrophile: water lover Hydrophobic: water-hater POGIL™ For AP* Biology 13. Functional groups are key groups of atoms in biological molecules. Describe the carboxy functional group that both acidic molecules in the Model 2 have in common. Both acidic molecules have COOH groups 14. Remember the definition of an acid that you learned in chemistry. Explain how the reaction below illustrates the acidic properties of lactic acid. O O H3C OH + H3C H2O O- + H3O+ OH Lactic acid Lactic acid Lactate ion An acid is any substance that produces hydronium ions in water. The hydrogen from the -COOH group lactic acid is donated to a water molecule to make a hydronium ion in this reaction 15. Describe the functional group, called an amine group, as the basic molecules in model 2 all have in common? They all have NH2 groups 16. Remember the definition of a base that you learned in chemistry. Explain how the reaction below illustrates the basic characteristics of adrenaline. OH H H N HO CH3 + N HO + H2O H HO CH3 + OH- HO Adrenaline A base is a hydrogenion acceptor, or a compound that produces hydroxide ions in water. A nitrogen atom or amine group from the adenine accepts a hydrogen ion from the water molecule that leaves hydroxide ion. 17. Predict approximate pH (pH = 7, pH >7, or pH <7) of= fairly= concentrated= aqueous= solutions= of= the following= compounds= from= model= 2.= lactic= acid=>7 <7 _____ dopamine= ph=>7 _____ Amino acid pH = 7 _____ Lactose _____ pH = 7 Biochemistry Basic 5 18. In chemistry, you learned that covalent bonds are a type of intramolecular bonding. They occur between non-metal atoms in a molecule. You may also have learned about a type of intermolecular bond called a hydrogen bond. Hydrogen bonds are weakly attractive forces between polar molecules that contain the highly polar bonds such as H-O, H-N or H-F. HYDROGEN BINDING KOVALENT BINDING KOVALENT BOND A. Note at least two covalent bindings in the diagram above. B. Mark at least one hydrogen bandage in the diagram above. 19. Which of the molecules in Model 2 would form hydrogen bonds with</7>(that is, other molecules of the same type) or with water molecules if in a solution? All polar molecules would form hydrogen bonds with water or other molecules of the same type 6 POGIL™ Activities for AP* Biology Extension Questions O 20. Although some are acidic in water solutions, some O amino acids have acid in theirNames, O basic,Hand others are neutral. Suggest an explanation of this observation based on structures 3C H3C OH and descriptions of the amino acids below. HO OH OH HO NH2 OO NH2 HH 3C3C Neutral amino acids NH2 OH OH HO HO NH 2 2 NH O HO Basic amino acid O HO O OH OH H2N H2N NH2 OO OO NH2 OH OH NH 2 NH Acidic amino acid O OH NH2 OO HO NH2 OH OH OH NH2 OO HH 2N 2N OH OH Neutral amino acids have both an amine (NH2) group and a carboxylic acid (COOH) Group. NH 2 2 NH NH 2 2 NH The two groups together cause the molecule to be neutral. Acidic amino acids have an additional carboxylic acid group in the molecule. Basic amino acids have an additional amine group in the molecule. 21. The structure shown below is a line drawing of non-cyclic AMP, an important messenger molNH2 eucle in molecular communication systems. A. Draw the missing carbon and hydrogen atoms on the molecule. N NH2 O N N O - P O - O N O N => HO P O H OH b. Write the chemical formula for a molecule of non-cyclic AMP. C H H C O OH O H O N C N C H C C O OH OH C10H12N5O6P C Biochemistry Basics 7 22. The phosphate functional group of the non-cyclic AMP molecule in question 21 contains acidic hydrogens. Explain what this phrase means. Hydrogen atoms attached to oxygen atoms by the phosphate group will be donated to water molecules when AMP is dissolved in water. NH2 b. Draw the non-cyclic AMP molecule after it is dissolved in water. N N O N -O P O N O -O OH OH 8 POGIL™ Activities for AP* Biology ... View full document document

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