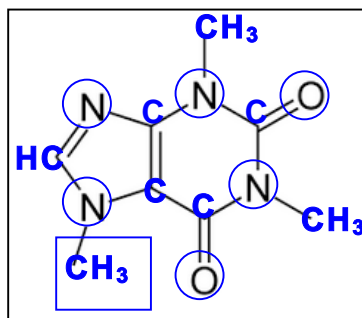


The key: 7.013 Recitation 2 – Spring 2018

1. The following is the “line-angle” drawing of caffeine. **Note:** *The carbon (C) and the hydrogen (H) atoms are not shown but implied.*

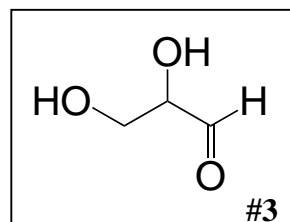
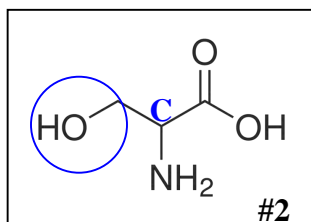
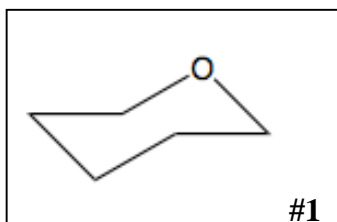


a) Clearly show the position of **ALL** C and H atoms on the drawing and give the **chemical formula** of caffeine: $C_8H_{10}O_2N_4$

b) On the line angle drawing, **box** a **nonpolar** group and **circle all electronegative elements**.

c) Give the **strongest non-covalent interaction** that allows caffeine to dissolve in aqueous environment. *Hydrogen bonding*

2. The following structures are shown as “line-angle” drawings of three chemical structures. For each structure, show the position of **all** of the carbon and hydrogen atoms as implied by the drawings.



a) Give the chemical formula of each structure based on the line angle drawings above.

#1: $C_5H_{10}O$

#2: $C_3H_5NO_2$

#3: $C_3H_6O_3$

b) **Circle** the structure that can serve as a building block of carbohydrates and **box** a functional group in this structure.

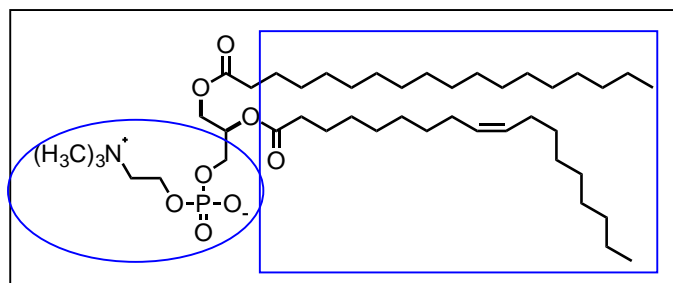
#3, its $-OH$ (hydroxyl group) or aldehyde group ($-CHO$)

c) **Box** the structure that can serve as a building block of proteins. **#2**

d) **Underline** the central carbon atom of the structure that you circled in part (c) and circle its side-chain. Based on its side-chain would you classify it as a polar or nonpolar amino acid?

It is polar due to the $-OH$ group in the side-chain.

3. The following is a line angle drawing of a biological molecule. Multiple copies of this molecule can arrange and form the plasma membrane of a cell.

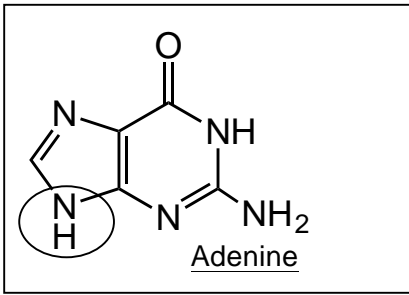


i. **Circle** the correct option. The above molecule belongs to the class of **carbohydrates/ lipids/ proteins/ nucleic acids**.

ii. **Circle** the part of the molecule that will be exposed to the aqueous (i.e. water filled) exterior or cytoplasm of the cell.

iv. **Box** the part of the molecule that will form the hydrophobic region of the plasma membrane.

4. The following is adenine base, which can covalently bond, through condensation reaction with ribose sugar to form a nucleotide (ATP).

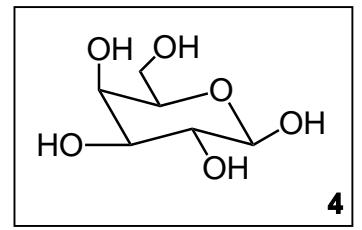
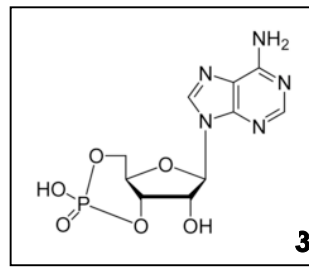
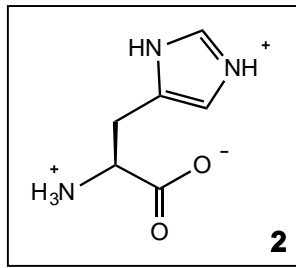
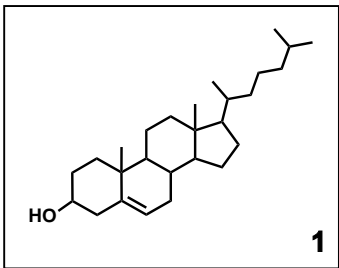


i. Which Carbon atom of the ribose sugar (choose from **C1'/ C2'/ C3'/ C4'/ C5'**) would covalently bond with the circled region of adenine to form Adenosine triphosphate (ATP)?

ii. Would you classify this base as **purine** or pyrimidine? **Explain** why you selected this option.

It has two rings unlike pyrimidines, which have only one hexagonal ring and no pentagonal ring

5. Four different structures are shown below.



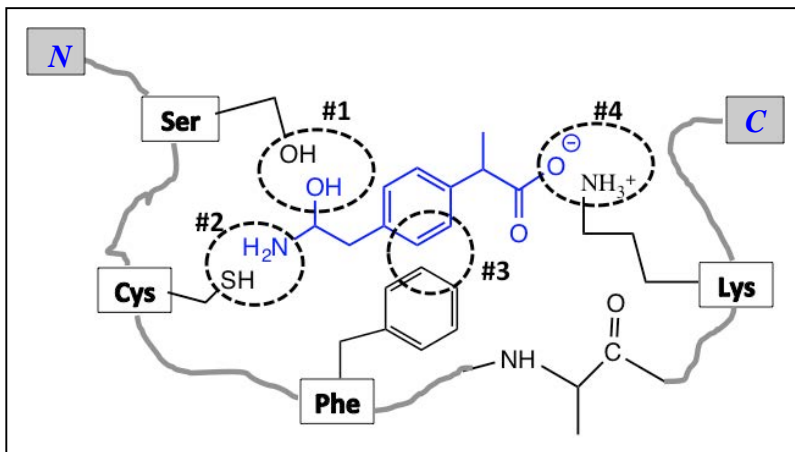
i. Which molecule (**1/ 2/ 3/ 4**) serves as a building block of proteins? **#2**

ii. Which molecule (**1/ 2/ 3/ 4**) is an example of steroids that may be found within the non-aqueous interior of the cell membrane? **#1**

iii. Which molecule (**1/ 2/ 3/ 4**) serves as a building block of polysaccharides (sugar polymers)? **#4**

iv. Which structure (**1/ 2/ 3/ 4**) is an example of a nucleotide? **#3**

6. This schematic shows the interaction between **Molecule 1** and **Enzyme X (dotted circles)**. For simplicity, only the side-chains of the amino acids of Enzyme X that interact with the Molecule 1 are shown.



Give the **STRONGEST** interaction (**hydrogen/ ionic/ hydrophobic/VDW**) at...

Position #1: **Hydrogen**

Position #2: **VDW**

Position #3: **Hydrophobic**

Position #4: **Ionic**

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7.013 Introductory Biology
Spring 2018

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