Name _____ Course/Section_____

Date _____ Professor/TA _____

## Activity 4/5.1 How can you identify organic macromolecules?

Refer to the figure (Some Simple Chemistry) on the next page when doing this activity.

**Part A. Answer the questions. Then use your answers to develop simple rules for identifying carbohydrates, lipids, proteins, and nucleic acids.**

1. What is the approximate C:H:O ratio in each of the following types of macromolecules?

| Carbohydrates | Lipids | Proteins | Nucleic acids |
|---|---|---|---|
| | | | |

2. Which of the compounds listed in question 1 can often be composed of C, H, and O alone?

3. Which of the compounds can be identified by looking at the C:H:O ratios alone?

4. What other elements are commonly associated with each of these four types of macromolecules?

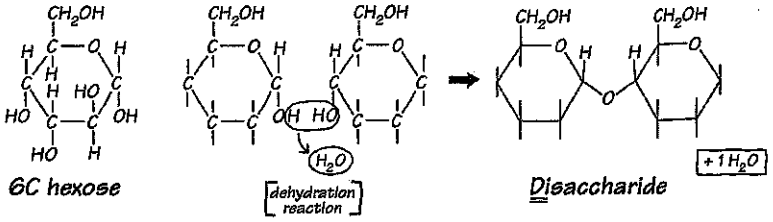
| | Carbohydrates | Lipids | Proteins | Nucleic acids |
|---|---|---|---|---|
| Always contain P | | | | |
| Generally contain no P | | | | |
| Always contain N | | | | |
| Generally contain no N | | | | |
| Frequently contain S | | | | |
| Generally contain no S | | | | |

# Some Simple Chemistry

| Compound | Basic components | ➡ Reaction ➡ | Product |
|---|---|---|---|

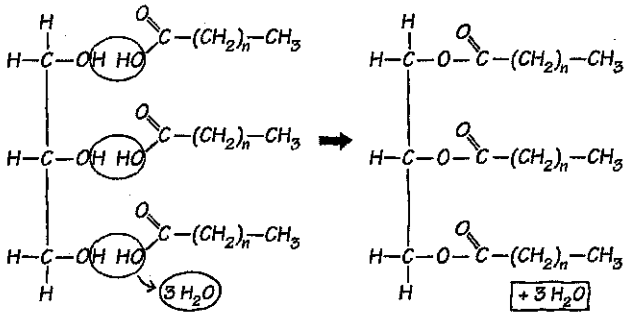
## Carbohydrates:

Sugars, starchee, glycogen, cellulose



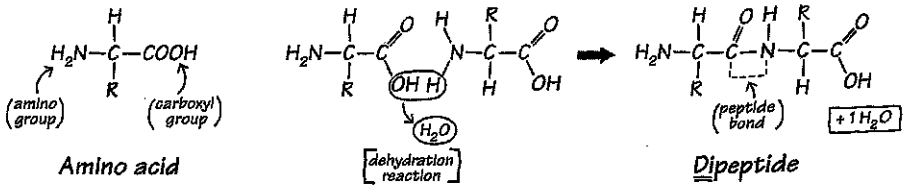

## Lipids:

Fats, oils, waxes, cholesterol



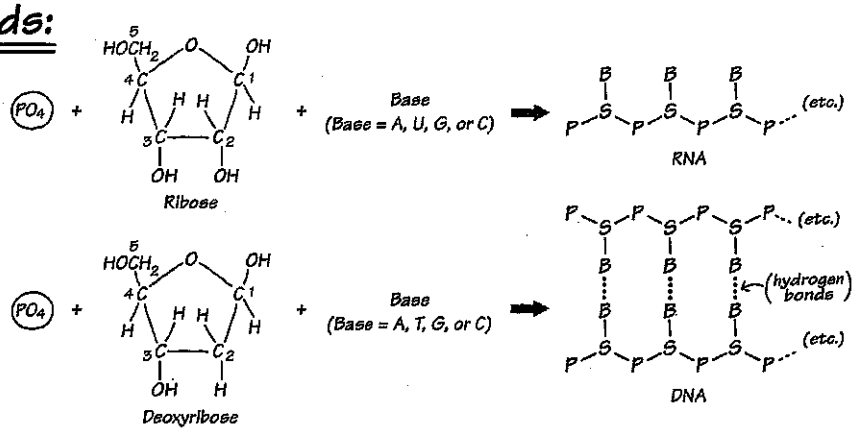

## Proteins:

Enzymes, structural proteins




## Nucleic acids:

DNA, RNA



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5. Functional groups can modify the properties of organic molecules. In the table below, indicate whether each functional group is polar or nonpolar and hydrophobic or hydrophilic. Which of these functional groups are found in proteins and lipids?

| Functional group | Polar or nonpolar | Hydrophobic or hydrophilic | Found in all proteins | Found in many proteins | Found in many lipids |
|---|---|---|---|---|---|
| —OH | | | | | |
| —$CH_2$ | | | | | |
| —COOH | | | | | |
| —$NH_2$ | | | | | |
| —SH | | | | | |
| —$PO_4$ | | | | | |

6. You want to use a radioactive tracer that will label only the protein in an RNA virus. Assume the virus is composed of only a protein coat and an RNA core. Which of the following would you use? Be sure to explain your answer.

a. Radioactive P b. Radioactive N c. Radioactive S d. Radioactive C

7. Closely related macromolecules often have many characteristics in common. For example, they share many of the same chemical elements and functional groups. Therefore, to separate or distinguish closely related macromolecules, you need to determine how they differ and then target or label that difference.

a. What makes RNA different from DNA?

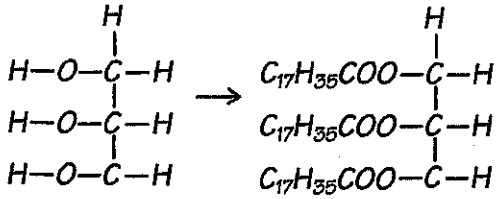
b. If you wanted to use a radioactive or fluorescent tag to label only the RNA in a cell and not the DNA, what compound(s) could you label that is/are specific for RNA?

c. If you wanted to label only the DNA, what compound(s) could you label?

8. Based on your answers to questions 1–7, what simple rule(s) can you use to identify the following macromolecules?

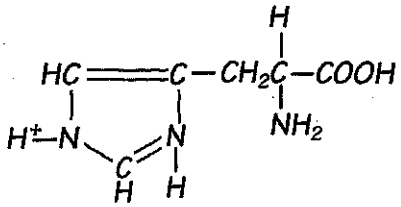
| | |
|---|---|
| Carbohydrates | |
| Lipids | |
| Proteins | |
| Nucleic acids | |
| DNA versus RNA | |

**Part B. Carbohydrate, lipid, protein, or nucleic acid? Name that structure!**
Based on the rules you developed in Part A, identify the compounds below (and on the following page) as carbohydrates, lipids, amino acids, polypeptides, or nucleic acids. In addition, indicate whether each is likely to be polar or nonpolar, hydrophilic or hydrophobic.

1) $C_{17}H_{35}COOH$ +  →



2)



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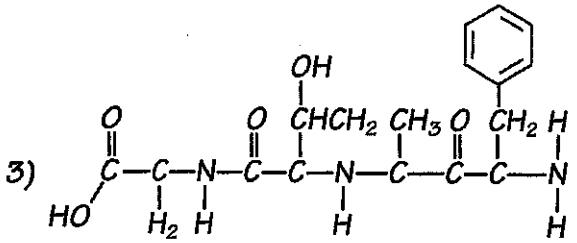

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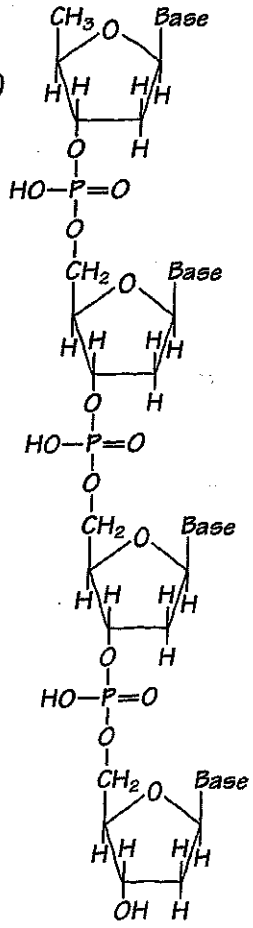
**Part B.** *Continued*

4)



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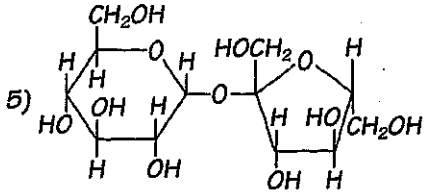

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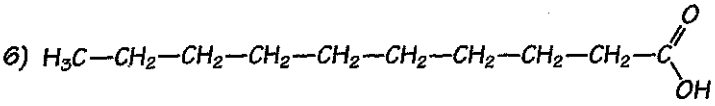

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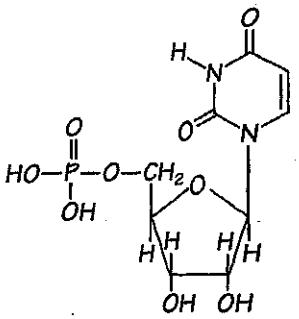

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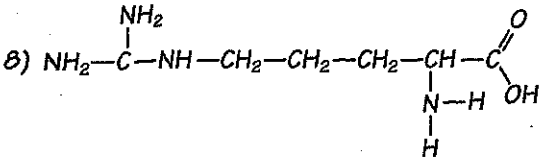

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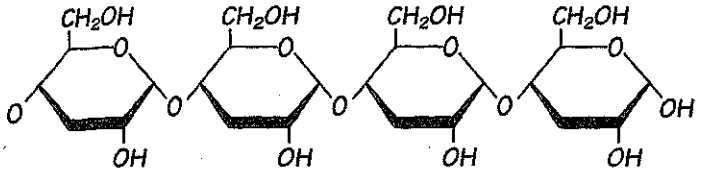

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