

# Honors Biology

## August 20 – August 30, 2013

# BIOCHEMISTRY

Tuesday August 20	Introduction Materials <b>HOMEWORK:</b> Partnership Agreement Read Chapter 1 Sections 1-3 pages 4-19 Online Textbook Assignment
Wednesday August 21	Chapter 1 Section 3 Power Point Lecture and Notes Monty Python Teaches Science <b>HOMEWORK:</b> Chapter 1 Section 3 Directed Reading Worksheet Read Chapter 1 Section 4 pages 20-24
Thursday August 22	Chapter 1 Section 4 Power Point Lecture and Notes <b>LAB:</b> Microscope <b>HOMEWORK:</b> Review Lab Handout
Friday August 23	<b>LAB:</b> Microscope <b>HOMEWORK:</b> Finish Lab Handout Read Chapter 3 Section 2 pages 55-60
Monday August 26	Chapter 3 Section 1 Carbon Compounds Power Point Lecture and Notes Chapter 3 Section 2 Molecules of Life Power Point Lecture and Notes <b>HOMEWORK:</b> Molecules of Life Section 3-2 Review Worksheet
Tuesday August 27	<b>LAB:</b> Identifying Organic Compounds in Foods <b>HOMEWORK:</b> Chapter 3 Section 1 Review Questions 1-10 pg 54
Wednesday August 28	<b>LAB:</b> Identifying Organic Compounds in Foods <b>HOMEWORK:</b> Finish Lab Handout
Thursday August 29	Review for Chapter 1 and 3 Test Standardized Test Prep Questions <b>HOMEWORK:</b> Study for Chapter 1 and 3 Test
Friday August 30	Chapter 1 and 3 TEST <b>HOMEWORK:</b> Have a Great Weekend!!!



# Welcome to Honors Biology 2013-2014

I will strive to ensure that God's physical world is viewed, in all aspects, in light of spiritual truths. Because it is evident in the scripture that God calls us to honor Him with all aspects of our lives, I will challenge you to use this class opportunity to do 'All things as unto the Lord.' I look at our time together as a special gift from our heavenly Father and look forward to developing an authentic relationship with you.

From this basis, I want to give you a better picture of what I expect our time together to be like so that you can be as successful as you want to be. Remember, we both have a role in your success.

## Your Role

Take responsibility for creating your success in this class. Actively participate, come prepared, bring a positive God centered attitude, be a proactive learner, put your best effort into every assignment, seek out help when you need it, and treat yourself, your classmates, and your teacher with respect that God demands of you.

## My Role

Work for the success of every student. Make the class a positive experience for all students, make the class as interesting and relevant as possible, bring a positive God centered attitude to class, be a proactive educator, put my best effort into every class, give meaningful performance feedback, and treat all students with the respect that God demands of me.

The attached guidelines will answer your more specific questions. If they don't, please ask!

I am truly looking forward to working with you this year and cannot wait to see what wondrous things GOD has in store for us!!!!!!!

## Contact Information

Dr. David Haak  
Room 1121

Email: [dhaak@westminsterchristian.org](mailto:dhaak@westminsterchristian.org)

# Welcome to Honors Biology 2013-2014

**Grading** – I work hard to be a fair and consistent grader. If you honestly feel I have made an error in grading your work (it has been known to happen!), please come see me separately so we can have a mature discussion about it.

Grades are not curved and the following scale is used.

93 – 100% = A	87 - 89% = B+	77 – 79% = C+	67 – 69% = D+	0 – 59% = F
90 – 92% = A-	83 – 86% = B	73 – 76% = C	63 – 66% = D	
	80 – 82% = B-	70 -72% = C-	60 – 62% = D-	

Grading will be based on the following weighting.

**Tests / Quizzes = 50%**      **Labs / Projects = 25%**      **Homework = 25%**

**Late Work** – If work is not turned in on due date, students will receive a zero and parents will be emailed. This assignment will remain a zero until it is turned in. For each day the assignment is late, 20% will be taken off the grade. After five days, the assignment will no longer be accepted.

**Homework** – Homework assignments are designed primarily to help you practice and reinforce the concepts and skills learned in class. We will go over selected portions of homework assignments as needed. For additional help, I encourage you to first check with your classmates, and then, if you still need help, come see me.

**Make-up Tests** – If you miss a test day, you must be prepared to make up the test on your first day back at school. Extenuating circumstances can change that, but only after discussion and agreement with me.

**Days Absent** – While it is not a good idea to be absent from class, sometimes it is unavoidable. If you miss a day of class, you are responsible for finding out from me what you missed and working out a make-up schedule. Note that lab experiences cannot be made up, but on some labs I will allow you to get the data from a classmate and you will be allowed to complete the Analysis portion of the lab for credit. Work missed from an unauthorized absence will receive a grade of “0”.

**Extra Help** – My job (and calling from God) is to create an environment for you to have a successful learning experience. While I strongly encourage you to develop study partner relationships with your classmates, I also want you to feel free to come see me when you have any questions or concerns about the class. My “normal” office hours are attached. You can almost always find me in my room during these times, unless I am called away momentarily.

## Office Hours:

Before school

M,T,W,TH,F: 6:30am – 7:50am

During School

2<sup>nd</sup> and 5<sup>th</sup> period M,T,W,TH,F

# Classroom Partnership Agreement

Student:

By affixing my signature here I                     Your Name                    , state that I have read and understand the terms listed in the Welcome to Honors Biology handout. I understand that this class is a partnership between myself and my teacher and I agree to continuously work at that partnership.

\_\_\_\_\_  
Signature

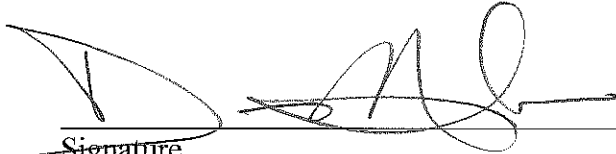
Parent:

By affixing my signature here, I                     Your Name                    , state that I have read and understand the terms listed in the Welcome to Honors Biology handout. I understand that this class is a partnership between my child and their teacher and I agree to support both of them in that partnership

\_\_\_\_\_  
Signature

Teacher:

By affixing my signature here, I Dr. David Haak, state that I have read and understand the terms listed in the Welcome to Honors Biology handout. I understand that this class is a partnership between myself and my students, and I agree to continuously work at that partnership.

  
\_\_\_\_\_  
Signature



# *Personal Profile*

Name: \_\_\_\_\_

Birthday: \_\_\_\_\_

Brothers/Sisters:

How many: \_\_\_\_\_

Names/Ages: \_\_\_\_\_

Pets: \_\_\_\_\_

Favorite:

Candy: \_\_\_\_\_

Band: \_\_\_\_\_

Song: \_\_\_\_\_

Favorite TV show: \_\_\_\_\_

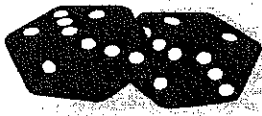
Movie of all time: \_\_\_\_\_

Tell me something about you that I would never have guessed on the first day of class.

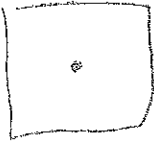




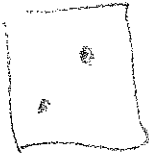
Your Name \_\_\_\_\_



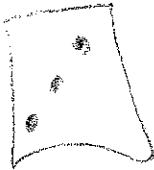
# Dice Game



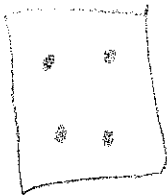
\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



# Interactive Online Edition

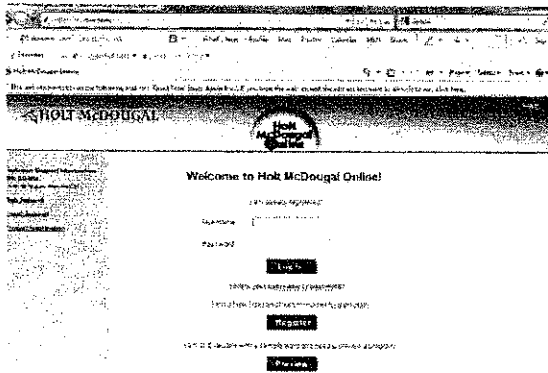
Username \_\_\_\_\_

# Login Instructions

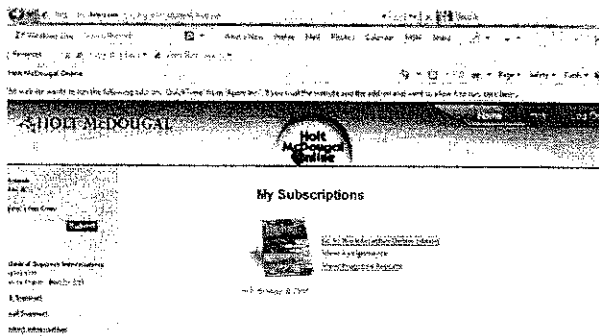
Password \_\_\_\_\_

Log in at <http://my.hrw.com>

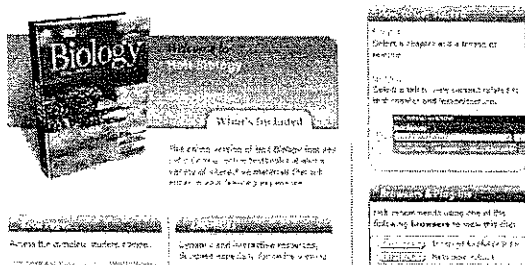
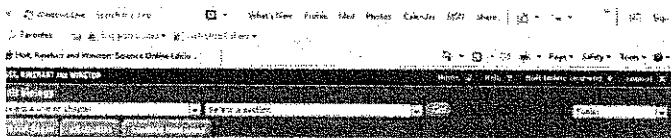
Once there you will see this screen. You will need to enter your Username, and Password then click LOGIN tab.



You will now need to select Go to the Interactive Online Edition tab. This will bring you to the next



page.



Once you are on Interactive Online Text page you can select

from any of the Orange/yellow tabs and follow the instructions that are on the page.

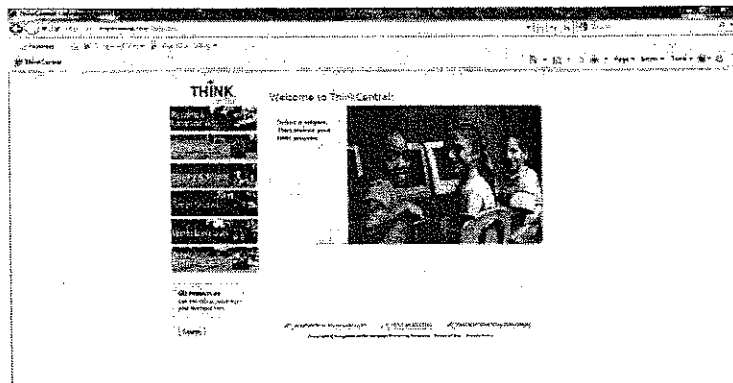
# Online Textbook

## Specific Assignment Instructions

In the address bar enter "**go.hrw.com**"

You need to make sure that you do not enter the www. It is not needed.

This should bring up this screen.



You will now need to enter the code that you have been given in the box at the bottom of the screen and press enter.


Click on the blue highlighted words and follow the instructions on the screen.

Section 3 The Study of Biology

## Chapter 1

### Objectives

- **Outline** the main steps in the scientific method.
- **Summarize** how observations are used to form hypotheses.
- **List** the elements of a controlled experiment.
- **Describe** how scientists use data to draw conclusions.
- **Compare** a scientific hypothesis and a scientific theory.
- **State** how communication in science helps prevent dishonesty and bias.




Section 3 The Study of Biology

## Chapter 1

### Science as a Process

- **Steps of the Scientific Method**
  - The **scientific method** involves making observations, asking questions, forming hypotheses, making predictions, designing experiments, analyzing data, and drawing conclusions.



Section 3 The Study of Biology

## Chapter 1

### Scientific Processes



- Collecting observations
- Asking questions
- Forming hypotheses and making predictions
- Confirming predictions (with experiments when needed)
- Drawing conclusions

Section 3 The Study of Biology

## Chapter 1

### Scientific Method

Click below to watch the Visual Concept.




Section 3 The Study of Biology

## Chapter 1

### Observing and Asking Questions

- The process of science begins with an observation.
- An **observation** is the act of perceiving a natural occurrence that causes someone to pose a question.




Section 3 The Study of Biology

## Chapter 1

### Forming a Hypothesis

- A **hypothesis** is a proposed explanation for the way a particular aspect of the natural world functions.



## Chapter 1

Section 3 The Study of Biology

### Forming a Hypothesis, *continued*

- **Predicting**
  - To test a hypothesis, scientists make a **prediction** that logically follows from the hypothesis.



## Chapter 1

Section 3 The Study of Biology

### Designing an Experiment

- **Performing the Experiment**
  - A *controlled experiment* compares an experimental group and a control group and only has one variable.



## Chapter 1

Section 3 The Study of Biology

### Controlled Experiment and Variable

Click below to watch the Visual Concept.



## Chapter 1

Section 3 The Study of Biology

### Designing an Experiment, *continued*

- **Performing the Experiment**
  - The **control group** provides a normal standard against which the biologist can compare results of the experimental group.
  - The **experimental group** is identical to the control group except for one factor.



## Chapter 1

Section 3 The Study of Biology

### Designing an Experiment, *continued*

- **Performing the Experiment**
  - The experimenter manipulates the **independent variable**.
  - The experimenter measures the **dependent variable** because it is affected by the independent variable.



## Chapter 1

Section 3 The Study of Biology

### Independent and Dependent Variables

Click below to watch the Visual Concept.




Section 3 The Study of Biology

**Chapter 1**

**Designing an Experiment, *continued***

- **Testing the Experiment**
  - Experiments should be conducted without bias and they should be repeated.




Section 3 The Study of Biology

**Chapter 1**

**Collecting and Analyzing Data**

- **Analyzing and Comparing Data**
  - Scientists analyze data to draw conclusions about the experiment performed.




Section 3 The Study of Biology

**Chapter 1**

**Drawing Conclusions**

- **Making Inferences**
  - An *inference* is a conclusion made on the basis of facts and previous knowledge rather than on direct observations.




Section 3 The Study of Biology

**Chapter 1**

**Drawing Conclusions, *continued***

- **Applying Results and Building Models**
  - Scientists often apply their findings about the natural world to solve practical problems.




Section 3 The Study of Biology

**Chapter 1**

**Constructing a Theory**

- A **theory** is a set of related hypotheses confirmed to be true many times, and it can explain a great amount of data.




Section 3 The Study of Biology

**Chapter 1**

**Communicating Ideas**

- **Publishing a Paper**
  - Scientists submit research papers to scientific journals for publication.
  - In *peer review*, the editors of a journal will send submitted papers out to experts in the field who anonymously read and critique the paper.



## Chapter 1

### Honesty and Bias

- Communication between scientists about their methods and results helps prevent dishonesty and bias in science.



## Chapter 1

### Honesty and Bias

- **Conflict of Interest**
  - The threat of a potential scandal based on misleading data or conclusions is a powerful force in science that helps keep scientists honest and fair.





SECTION 1-3 REVIEW

# THE STUDY OF BIOLOGY

**VOCABULARY REVIEW** Define the following terms.

1. prediction \_\_\_\_\_  
\_\_\_\_\_
2. control group \_\_\_\_\_  
\_\_\_\_\_
3. dependent variable \_\_\_\_\_  
\_\_\_\_\_
4. independent variable \_\_\_\_\_  
\_\_\_\_\_
5. theory \_\_\_\_\_  
\_\_\_\_\_

**MULTIPLE CHOICE** Write the correct letter in the blank.

- \_\_\_\_\_ 1. A field biologist who studies the behavior of birds in a rain forest most likely collects data through  
a. experimenting.    b. modeling.    c. observing.    d. inferring.
- \_\_\_\_\_ 2. Constructing a graph is an example of  
a. measuring.    b. organizing data.    c. observing.    d. predicting.
- \_\_\_\_\_ 3. Of the following steps in a scientific investigation, the last to be done is usually  
a. experimenting.    c. producing a model.  
b. observing.    d. hypothesizing.
- \_\_\_\_\_ 4. A statement that explains observations and can be tested is called  
a. a hypothesis.    b. an inference.    c. a theory.    d. a model.
- \_\_\_\_\_ 5. A visual, verbal, or mathematical explanation that is supported by data is called  
a. a hypothesis.    b. an inference.    c. a theory.    d. a model.

**SHORT ANSWER** Answer the questions in the space provided.

1. What are quantitative data? Give two examples of quantitative data. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. What is an advantage of a peer review of a scientific paper? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. How are a hypothesis, a prediction, and an experiment related? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. What are some of the things scientists might do to analyze data? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. **Critical Thinking** A scientist wanted to study the effect of a drug on the blood pressure of rats. She set up an experiment in which the experimental group consisted of rats that were injected with a salt solution containing the drug. What should the control group have consisted of?

\_\_\_\_\_

What were the dependent and independent variables in her experiment? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**STRUCTURES AND FUNCTIONS** Examine the drawing of the owl. In each space below, provide an observation that would support the inference given or provide an inference that could be derived from the observation given.



**Observations**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

The owl has wings.

Both of the owl's eyes face forward.

It is night.

**Inferences**

Owls live in trees.

Owls feed on mice.

Owls kill prey with their talons.

\_\_\_\_\_

\_\_\_\_\_


\_\_\_\_\_

Section 4 Tools and Techniques

## Chapter 1

### Objectives

- List the function of each of the major parts of a compound microscope.
- Compare two kinds of electron microscopes.
- Describe the importance of having the SI system of measurement.
- State some examples of good laboratory practice.




Section 4 Tools and Techniques

## Chapter 1

### Microscopes as Tools

- **Light Microscopes**
  - A **compound light microscope** is a microscope that shines light through a specimen and has two lenses to magnify an image.
  - Four major parts of a compound light microscope are the ocular lens, objective lens, stage, and light source.




Section 4 Tools and Techniques

## Chapter 1

### Microscopes as Tools

- **Light Microscopes**
  - The **eyepiece** magnifies the image.
  - The **objective lens** enlarges the specimen.
  - The **stage** is a platform that supports slides with specimens.
  - The **light source** is a light bulb that provides light for viewing images.




Section 4 Tools and Techniques

## Chapter 1

### Microscopes as Tools, *continued*

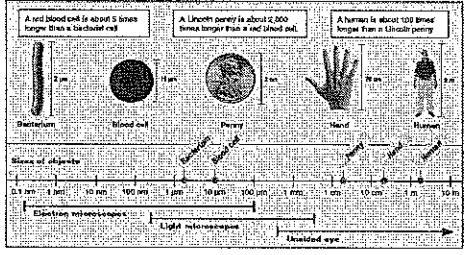
- **Magnification and Resolution**
  - **Magnification** is the increase of an object's apparent size.
  - **Resolution** is the power to show details clearly in an image.



Section 4 Tools and Techniques

## Chapter 1

### Object Size and Magnifying Power of Microscopes




Section 4 Tools and Techniques

## Chapter 1

### Microscopes as Tools, *continued*

- **Electron Microscopes**
  - In an *electron microscope*, a beam of electrons produces an enlarged image of the specimen.
  - Electron microscopes provide greater magnification and resolution than light microscopes.




Section 4 Tools and Techniques

**Chapter 1**

**Microscopes as Tools, *continued***

- **Electron Microscopes**
  - **Scanning electron microscopes** pass a beam of electrons over the specimen's surface for better viewing the external surface of a specimen.
  - **Transmission electron microscopes** transmit a beam of electrons through a thinly sliced specimen for better viewing the internal structures of a specimen.




Section 4 Tools and Techniques

**Chapter 1**

**Units of Measurement**

- **Base and Other Units**
  - Scientists use a single, standard system of measurement, called the **metric system**. The official name of the metric system is *Système International d'Unités* or *SI*.




Section 4 Tools and Techniques

**Chapter 1**

**Units of Measurement**

- **Base and Other Units**
  - The metric system has seven base units.

SI Base Units		
Base quantity	Name	Abbreviation
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd




Section 4 Tools and Techniques

**Chapter 1**

**Safety**

- **Good Laboratory Practice**
  - Lab safety involves safe and common-sense habits such as never working alone in a lab or without proper supervision by the teacher.



# Microscope Mania!

## I. Parts-o-the scope! And LENSES

a) The magnification of the ocular or eye piece is \_\_\_\_\_

b) Please identify the magnification on each of these lenses found on the revolving nosepiece:

Lens	Magnification	Use/purpose
Scanning power		
Low power		
HIGH POWER		

c) Please explain here how total magnification is calculated: \_\_\_\_\_

Lens	What is the TOTAL Magnification
Scanning power	
Low power	
HIGH POWER	

d) Locate the light source on your microscope. Turn it on.  
\_\_\_\_\_ (check when completed)

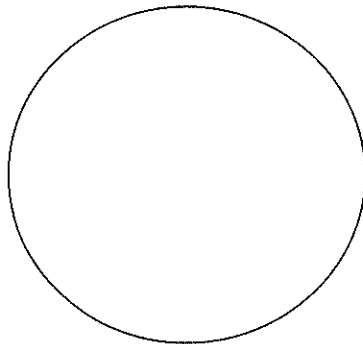
e) Locate the diaphragm. Look through the eyepiece and move the diaphragm.

Explain what happens:  
\_\_\_\_\_

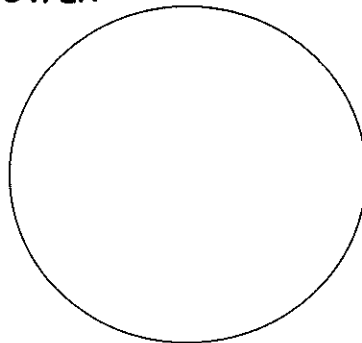
## II. Using the Scope How does it work?

a) Obtain the letter "e" slide. Place it on the **stage** over the hole. Use the **stage clips** to hold in place.

b) Draw how the letter "e" appears on the stage facing you **BEFORE** you look into the microscope:



Now draw the letter "e" as it appears once you look through the microscope on **LOW POWER**

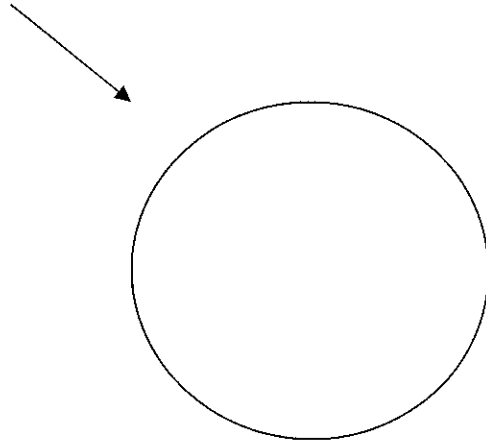


c) Explain what happened ( how does a microscope view an object?)

d) Have your partner push the slide to the left as you look through the lens. What happens?

e) Rotate to **HIGH POWER**. The lens is now very close to the slide. **DO NOT USE THE COURSE ADJUSTMENT KNOB, ONLY USE THE FINE FOCUS KNOB.**

Draw what you see now:



f) Slides will often crack because someone uses the coarse adjustment while on HIGH POWER.

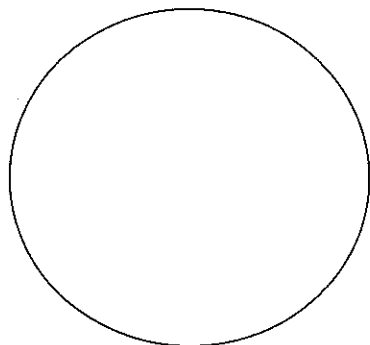
\_\_\_\_\_ I understand that I only use the coarse adjustment on LOW POWER and not on HIGH POWER because I will crack a slide!

Coarse adjustment=low power  
Fine adjustment=high power

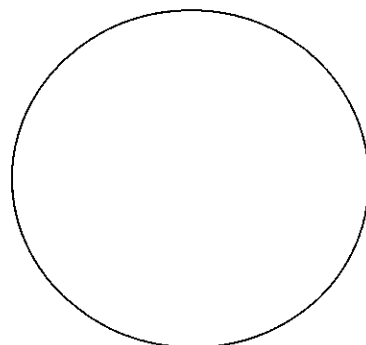
### III. More focusing Practice

a) Make a wet mount of a piece of your hair. Sketch under low power and under high power.

Low



High



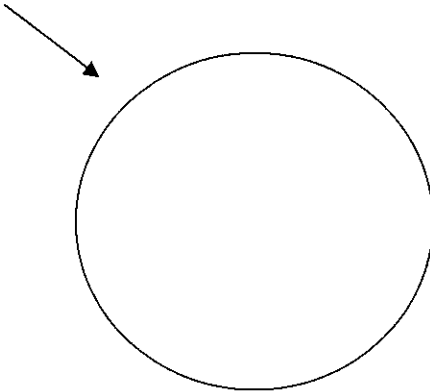
#### IV. Depth Perception

- a) Obtain a slide with the three colored threads. Focus under **LOW Power**

Sketch the threads on the slide

b)Indicate:

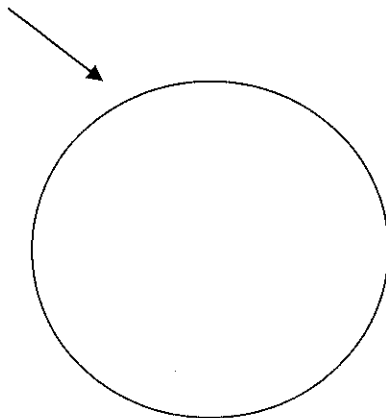
Top color \_\_\_\_\_  
Middle color \_\_\_\_\_  
Bottom Color \_\_\_\_\_



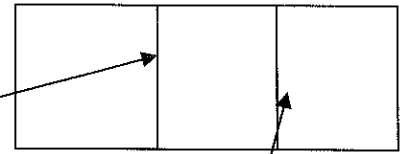
#### V. Staining and Low Power vs. High Power

unstained

1. With a razorblade, scrape the surface of a potato
2. place a drop of water on a slide
3. mix the potato with the water
4. add a coverslip
5. observe under low power
6. sketch the "unstained" starch grains



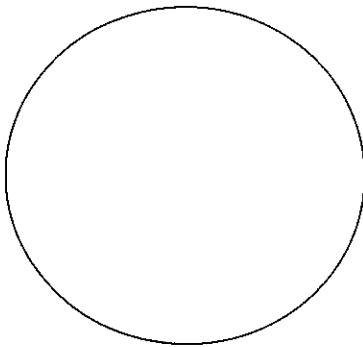




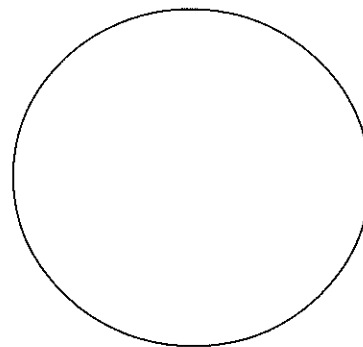
stained

7. Add a small drop of iodine on on any **edge** of the coverslip
8. take a small piece of paper towel and put across the coverslip on the other side of the drop of iodine
9. watch the iodine stain be draw across the slide! **AMAZING**
10. View the stained grains under low power and sketch them.
11. View the stained grains under **HIGH** power and sketch them

Low power



High Power



- a) What is the purpose of using stains?
- b) Which power allowed you to see **LESS** starch grains in your field of view?
- c) Which power allowed you to see **MORE** starch grains in your field of view?



SECTION 1-4 REVIEW

# TOOLS AND TECHNIQUES

**VOCABULARY REVIEW** Circle the term that does not belong in each of the following groups, and briefly explain why it does not belong.

1. compound light, transmission electron, light electron, scanning electron \_\_\_\_\_  
\_\_\_\_\_
2. base unit, stage, nosepiece, objective lens \_\_\_\_\_  
\_\_\_\_\_
3. magnification, power of magnification, resolution, mass density \_\_\_\_\_  
\_\_\_\_\_
4. second, minute, meter, kilogram \_\_\_\_\_  
\_\_\_\_\_
5. meter, square meter, cubic meter, kilogram per cubic meter \_\_\_\_\_  
\_\_\_\_\_

**MULTIPLE CHOICE** Write the correct letter in the blank.

- \_\_\_\_\_ 1. The ability of a microscope to show details clearly is called  
a. enlargement.    b. magnification.    c. reduction.    d. resolution.
- \_\_\_\_\_ 2. One limitation of the scanning electron microscope is that it cannot be used to  
a. examine specimens smaller than cells.  
b. view living specimens.  
c. produce an enlarged image of a specimen.  
d. produce an image of the surface of a specimen.
- \_\_\_\_\_ 3. A microscope with a 10× ocular lens and a 25× objective lens has a total power of magnification equal to  
a. 2.5×.            b. 35×.            c. 250×.            d. 2,500×.
- \_\_\_\_\_ 4. The SI base unit for time is the  
a. second.            b. minute.            c. hour.            d. day.
- \_\_\_\_\_ 5. The SI prefix that represents 1,000 times the base unit is  
a. deci.            b. centi.            c. kilo.            d. micro.

**SHORT ANSWER** Answer the questions in the space provided.

1. Arrange the following parts in the order that matches the light path through a light microscope: specimen, ocular lens, objective lens, light source. \_\_\_\_\_

\_\_\_\_\_

2. What are the maximum magnifications of the LM, TEM, and SEM? \_\_\_\_\_

\_\_\_\_\_

3. Write the abbreviation for each of the following units: meter, kilometer, centimeter, millimeter, micrometer. What is the mathematical relationship between these units? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

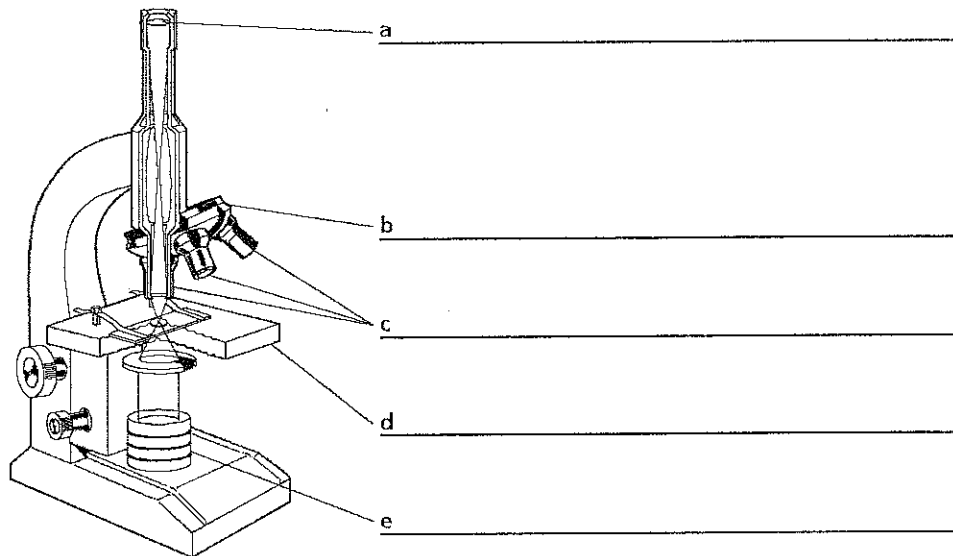
4. **Critical Thinking** A group of scientists want to determine whether the bacteria they are studying have viruses inside them. Which type of microscope should they use? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**STRUCTURES AND FUNCTIONS** Label each part of the figure in the spaces provide.



## Chapter 3 Biochemistry

### Table of Contents

#### Section 1 Carbon Compounds

#### Section 2 Molecules of Life



## Section 1 Carbon Compounds

### Chapter 3

#### Objectives

- **Distinguish** between organic and inorganic compounds.
- **Explain** the importance of carbon bonding in biological molecules.
- **Identify** functional groups in biological molecules.
- **Summarize** how large carbon molecules are synthesized and broken down.
- **Describe** how the breaking down of ATP supplies energy to drive chemical reactions.



## Chapter 3 Section 1 Carbon Compounds

### Carbon Bonding

- **Organic compounds** contain carbon atoms and are found in living things.
- Most *inorganic compounds* do not contain carbon atoms.



## Section 1 Carbon Compounds

### Chapter 3

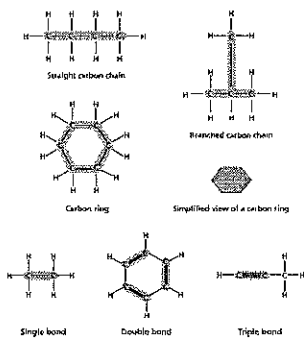
#### Carbon Bonding, *continued*

- Carbon atoms can readily form four covalent bonds with other atoms including other carbon atoms. The carbon bonds allow the carbon atoms to form a wide variety of simple and complex organic compounds.



## Chapter 3 Section 1 Carbon Compounds

### Carbon Bonding



## Chapter 3 Section 1 Carbon Compounds

### Chapter 3

#### Functional Groups

- **Functional groups** are groups of atoms that influence the properties of molecules and the chemical reactions in which the molecules participate.




Section 1 Carbon Compounds

### Chapter 3

#### Large Carbon Molecules

- **Condensation reactions** join **monomers** (small simple molecules) to form **polymers**. A condensation reaction releases water as a by-product.
- In a **hydrolysis reaction**, water is used to split polymers into monomers.




Section 1 Carbon Compounds


### Chapter 3

#### Energy Currency

- **Adenosine triphosphate (ATP)** stores and releases energy during cell processes, enabling organisms to function.



Adenosine triphosphate (ATP)                      Adenosine diphosphate (ADP) and inorganic phosphate




Section 2 Molecules of Life

### Chapter 3

#### Objectives

- **Distinguish** between monosaccharides, disaccharides, and polysaccharides.
- **Explain** the relationship between amino acids and protein structure.
- **Describe** the induced fit model of enzyme action.
- **Compare** the structure and function of each of the different types of lipids.
- **Compare** the nucleic acids DNA and RNA.




Section 2 Molecules of Life

### Chapter 3

#### Carbohydrates

- **Carbohydrates** are organic compounds composed of carbon, hydrogen, and oxygen in a ratio of about one carbon to two hydrogen atoms to one oxygen atom.
- Carbohydrates are a source of energy and are used as structural materials in organisms.





Section 2 Molecules of Life

### Chapter 3

#### Carbohydrates

Click below to watch the Visual Concept.





Section 2 Molecules of Life

### Chapter 3

#### Carbohydrates, *continued*

- **Monosaccharides**
  - Carbohydrates are made up of monomers called monosaccharides.



## Chapter 3

Section 2 Molecules of Life

### Carbohydrates, *continued*

- **Disaccharides and Polysaccharides**
  - Two monosaccharides join to form a double sugar called a **disaccharide**.
  - A complex sugar, or **polysaccharide**, is made of three or more monosaccharides.



## Chapter 3

Section 2 Molecules of Life

### Disaccharides

Click below to watch the Visual Concept.

Visual Concept



## Chapter 3

Section 2 Molecules of Life

### Proteins

- **Proteins** are organic compounds composed mainly of carbon, hydrogen, oxygen, and nitrogen.
- Proteins have many functions including structural, defensive, and catalytic roles.



## Chapter 3

Section 2 Molecules of Life

### Proteins, *continued*

- **Amino Acids**
  - Proteins are made up of monomers called **amino acids**. The sequence of amino acids determines a protein's shape and function.



## Chapter 3

Section 2 Molecules of Life

### Amino Acids

Click below to watch the Visual Concept.

Visual Concept



## Chapter 3

Section 2 Molecules of Life

### Proteins, *continued*

- **Dipeptides and Polypeptides**
  - Two amino acids are joined by **peptide bonds** to form a **dipeptide**.
  - A long chain of amino acids is called a **polypeptide**.



Chapter 3 Section 2 Molecules of Life

### Structure of Proteins

Proteins are chains of amino acids folded into compact shapes.

The diagram illustrates the structure of a protein. On the left, a large, complex, spherical cluster of small spheres represents a "Globular protein". On the right, a vertical chain of small spheres is labeled "Linked amino acids".

End of Slide

Chapter 3 Section 2 Molecules of Life

### Proteins, *continued*

- **Enzymes**
  - Enzymes speed up chemical reactions and bind to specific substrates.
  - The binding of a substrate with an enzyme causes a change in the enzyme's shape and reduces the activation energy of the reaction.

End of Slide

Chapter 3 Section 2 Molecules of Life

### Enzyme Activity

**BIO graphic** **Enzyme Action**  
Enzymes speed biochemical reactions by bringing key molecules together.

- 1 A substrate attaches to an enzyme's active site.
- 2 The enzyme lowers the activation energy of the reaction.
- 3 The enzyme is not changed by the reaction.

The diagram shows an enzyme with a specific "Active site" (a notch). A "Substrate" (a shape that fits into the notch) binds to the enzyme. This process is shown in three stages: 1. The substrate approaches the active site. 2. The substrate is bound to the active site. 3. The substrate is broken down into "Products".

End of Slide

Chapter 3 Section 2 Molecules of Life

### Lipids

- Lipids are nonpolar molecules that store energy and are an important part of cell membranes.

End of Slide

Chapter 3 Section 2 Molecules of Life

### Lipids, *continued*

- **Fatty Acids**
  - Most lipids contain **fatty acids**, unbranched carbon molecules that have a hydrophilic end and a hydrophobic end.

The diagram shows a phospholipid bilayer, which is a double layer of phospholipids. Each phospholipid has a hydrophilic head and a hydrophobic tail. Below the bilayer, a single fatty acid molecule is shown, consisting of a hydrophilic head and a long hydrophobic tail.

End of Slide

Chapter 3 Section 2 Molecules of Life

### Fatty Acids

Click below to watch the Visual Concept.

**Visual Concept**


End of Slide



Chapter 3 Section 2 Molecules of Life

Lipids, *continued*


- **Triglycerides**
  - Triglycerides consist of three fatty acids and one molecule of glycerol.



Chapter 3 Section 2 Molecules of Life

Lipids, *continued*


- **Phospholipids**
  - Phospholipids, which make up cell membranes, consist of two fatty acids and one glycerol molecule.



Chapter 3 Section 2 Molecules of Life

Lipids, *continued*


- **Waxes**
  - A wax is made of one long fatty acid chain joined to one long alcohol.
- **Steroids**
  - A steroid is composed of four fused carbon rings.



Chapter 3 Section 2 Molecules of Life

**Nucleic Acids**

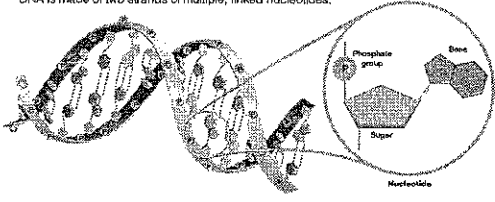
- A nucleic acid is a large and complex organic molecule that stores and transports information.



Chapter 3 Section 2 Molecules of Life

**Structure of Nucleic Acids**



DNA is made of two strands of multiple, linked nucleotides.



Chapter 3 Section 2 Molecules of Life

**Nucleic Acids**

Click below to watch the Visual Concept.



### Chapter 3

#### Nucleic Acids, *continued*

- The nucleic acid **deoxyribonucleic acid (DNA)** contains genetic information for cell activities.
- **Ribonucleic acid (RNA)** molecules play many key roles in building of proteins and can act as enzymes.



SECTION 3-2 REVIEW

**MOLECULES OF LIFE**

**VOCABULARY REVIEW Distinguish between the terms in each of the following pairs of terms.**

1. monosaccharide, polysaccharide \_\_\_\_\_  
\_\_\_\_\_
2. amino acid, protein \_\_\_\_\_  
\_\_\_\_\_
3. nucleotide, nucleic acid \_\_\_\_\_  
\_\_\_\_\_

**MULTIPLE CHOICE Write the correct letter in the blank.**

- \_\_\_\_\_ 1. Glycogen, starch, and cellulose are  
a. monosaccharides. b. disaccharides. c. polysaccharides. d. simple sugars.
- \_\_\_\_\_ 2. The different shapes and functions of different proteins are determined by  
a. the R groups of the amino acids they contain. c. the carboxyl groups of the amino acids they contain.  
b. the amino groups of the amino acids they contain. d. whether or not they contain any amino acids.
- \_\_\_\_\_ 3. Most enzymes  
a. are changed by the reactions they catalyze. c. strengthen the chemical bonds in their substrate.  
b. increase the activation energy of the reactions they catalyze. d. are sensitive to changes in temperature or pH.
- \_\_\_\_\_ 4. The large numbers of carbon-hydrogen bonds in lipids  
a. make lipids polar. c. allow lipids to dissolve in water.  
a. store more energy than the carbon-oxygen bonds in other organic compounds. d. are found in the carboxyl group at the end of the lipid.
- \_\_\_\_\_ 5. The most important function of nucleic acids is  
a. catalyzing chemical reactions. c. storing energy.  
b. forming a barrier between the inside and outside of a cell. d. storing information related to heredity and protein synthesis.

**SHORT ANSWER** Answer the questions in the space provided.

1. What are the storage and quick-energy forms of carbohydrates found in animals, and how are these forms structurally related to each other? \_\_\_\_\_

\_\_\_\_\_

2. How many different kinds of monomers are there in starch? \_\_\_\_\_  
 How many different kinds of monomers are there in proteins? \_\_\_\_\_

3. What compound composes most of the cell membrane? \_\_\_\_\_  
 How is this compound suited to the function of the membrane? \_\_\_\_\_

\_\_\_\_\_

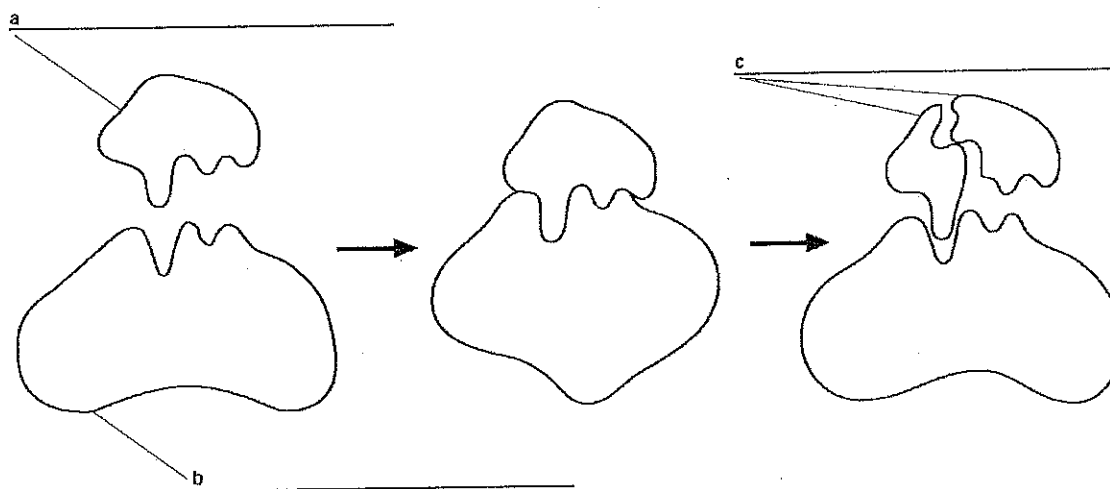
4. Steroids are made up of what type of molecule? \_\_\_\_\_  
 Give two examples of steroids. \_\_\_\_\_

5. **Critical Thinking** Insects that live on land have a coating of wax on the outer surface of their body. What function might the wax serve for these animals? \_\_\_\_\_

\_\_\_\_\_

**STRUCTURES AND FUNCTIONS** Label each part of the figure in the spaces provided.

The diagram below shows the interaction of an enzyme and its substrate during a chemical reaction.



## Inquiry Lab

# Identifying Organic Compounds in Foods

## OBJECTIVES

Determine whether specific nutrients are present in a solution of unknown composition.

Perform chemical tests using substances called *indicators*.

## PROCESS SKILLS

- experimenting
- identifying
- observing
- measuring

## MATERIALS

- lab apron
- safety goggles
- disposable gloves
- 500 mL beaker
- hot plate
- 9 test tubes
- labeling tape
- marker
- 10 mL graduated cylinder
- Benedict's solution
- 9 dropping pipets
- glucose solution
- unknown solution
- distilled water
- 9 glass stirring rods
- tongs or test-tube holder
- test-tube rack
- albumin solution
- sodium hydroxide solution
- copper sulfate solution
- vegetable oil
- Sudan III solution





## Background

1. Carbohydrates, proteins, and lipids are nutrients that make up all living things. Some foods, such as table sugar, contain only one of these nutrients. Most foods, however, contain mixtures of proteins, carbohydrates, and lipids. You can confirm this fact by reading the information in the Nutrition Facts box found on any food label.
2. In this investigation, you will use chemical substances, called *indicators*, to identify the presence of specific nutrients in an unknown solution. By comparing the color change an indicator produces in the unknown food sample with the change it produces in a sample of known composition, you can determine whether specific organic compounds are present in the unknown sample.





**Identifying Organic Compounds in Foods** *continued*

3. Benedict's solution is used to determine the presence of monosaccharides, such as glucose. A mixture of sodium hydroxide and copper sulfate determines the presence of some proteins. This procedure is called the biuret test. Sudan III is used to determine the presence of lipids.

**Procedure**

    **CAUTION** Put on a lab apron, safety goggles, and gloves. In this lab, you will be working with chemicals that can harm your skin and eyes or stain your skin and clothing. If you get a chemical on your skin or clothing, wash it off at the sink while calling to your teacher. If you get a chemical in your eyes, immediately flush it out at the eyewash station while calling to your teacher. As you perform each test, record your data in the data table on the next page.


**TEST 1: MONOSACCHARIDES**

1.    **CAUTION** Do not touch the hot plate. Use tongs to move heated objects. Turn off the hot plate when not in use. Do not plug in or unplug the hot plate with wet hands. Make a water bath by filling a 500 mL beaker half full with water. Then, put the beaker on a hot plate, and bring the water to a boil.
2. While you wait for the water to boil, label one test tube "1-glucose," label the second test tube "1-unknown," and label the third test tube "1-water." Using the graduated cylinder, measure 5 mL of Benedict's solution, and add it to the "1-glucose" test tube. Repeat the procedure, adding 5 mL of Benedict's solution each to the "1-unknown" test tube and "1-water" test tube.
3. Using a dropping pipet or eyedropper, add 10 drops of glucose solution to the "1-glucose" test tube. Using a second dropping pipet, add 10 drops of the unknown solution to the "1-unknown" test tube.
- Using a third dropping pipet, add 10 drops of distilled water to the "1-water" test tube. Mix the contents of each test tube with a clean stirring rod. (It is important not to contaminate test solutions by using the same dropping pipet or stirring rod in more than one solution. Use a different dropping pipet and stirring rod for each of the test solutions.)
4. When the water boils, use tongs to place the test tubes in the water bath. Boil the test tubes for 1 to 2 minutes.
5.  **CAUTION** Do not touch the test tubes with your hands. They will be very hot. Use tongs to remove the test tubes from the water bath and place them in the test-tube rack. As the test tubes cool, an orange or red precipitate will form if large amounts of glucose are present. If small amounts of glucose are present, a yellow or green precipitate will form. Record your results in your data table.




**Identifying Organic Compounds in Foods** *continued*

Identification of Specific Nutrients by Chemical Indicators					
Test	Nutrient in test solution	Nutrient category (protein, lipid, etc.)	Result for known sample	Result for unknown sample	Result for distilled water
1					
2					
3					

**TEST 2: PROTEINS**

6.  Label one clean test tube "2-albumin," label a second test tube "2-unknown," and label a third test tube "2-water." Using a dropping pipet, add 40 drops of albumin solution to the "2-albumin" test tube. Using a second dropping pipet, add 40 drops of unknown solution to the "2-unknown" test tube. Using a third dropping pipet, add 40 drops of water to the "2-water" test tube.
7. Add 40 drops of sodium hydroxide solution to each of the three test tubes. Mix the contents of each test tube with a clean stirring rod.
8. Add a few drops of copper sulfate solution, one drop at a time, to the "2-albumin" test tube. Stir the solution with a clean stirring rod after each drop. Note the number of drops required to cause the color of the solution in the test tube to change. Then, add the same number of drops of copper sulfate solution to the "2-unknown" and "2-water" test tubes.
9. Record your results in the data table.

**TEST 3: LIPIDS**

10. Label one clean test tube "3-vegetable oil," label a second test tube "3-unknown," and label a third test tube "3-water." Using a dropping pipet, add 5 drops of vegetable oil to the "3-vegetable oil" test tube. Using a second dropping pipet, add 5 drops of the unknown solution to the "3-unknown" test tube. Using a third dropping pipet, add 5 drops of water to the "3-water" test tube.
11.  **CAUTION** Sudan III solution will stain your skin and clothing. Promptly wash off spills to minimize staining. Do not use Sudan III solution in the same room with an open flame. Using a clean dropping pipet, add 3 drops of Sudan III solution to each test tube. Mix the contents of each test tube with a clean stirring rod.
12. Record your results in the data table.
13.   Clean up your materials, and wash your hands before leaving the lab.

**Identifying Organic Compounds in Foods** *continued*

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**Analysis and Conclusions**

1. Based on the results you recorded in your data table, identify the nutrient or nutrients in the unknown solution.

\_\_\_\_\_

2. What are the experimental controls in this investigation?

\_\_\_\_\_

\_\_\_\_\_

3. Explain how you were able to use the color changes of different indicators to determine the presence of specific nutrients in the unknown substance.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. List four potential sources of error in this investigation.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Further Inquiry**

Is there a kind of macromolecule that the tests in this lab did not test for? If so, list the kinds of macromolecules not tested for, and give one reason why they were not tested for.



### Chapter 3

Image Bank

### Preview

Carbon Bonding

Energy Currency

Structure of Proteins

Enzyme Activity

Lipids

Structure of Nucleic Acids

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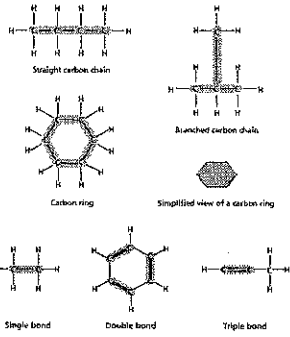
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### Chapter 3

Section 1 Carbon Compounds

### Carbon Bonding



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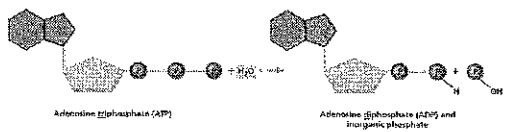
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### Chapter 3

Section 1 Carbon Compounds

### Energy Currency



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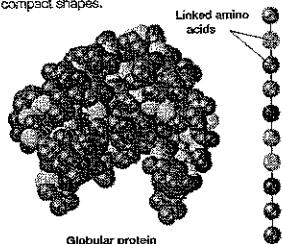
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### Chapter 3

### Section 2 Molecules of Life

#### Structure of Proteins

Proteins are chains of amino acids folded into compact shapes.



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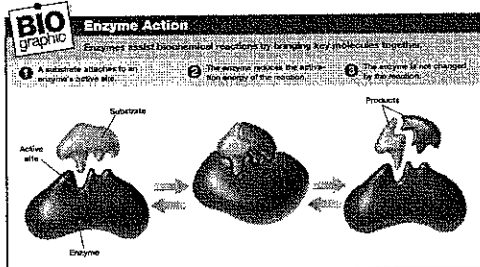
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### Chapter 3

### Section 2 Molecules of Life

#### Enzyme Activity



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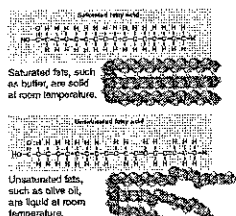
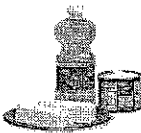
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### Chapter 3

### Section 2 Molecules of Life

#### Lipids

Fatty acids can be saturated or unsaturated.



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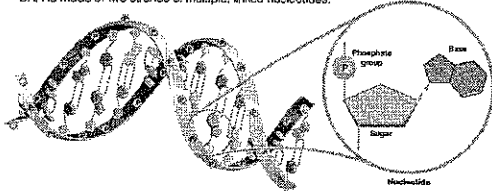
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## Chapter 3

### Section 2 Molecules of Life

#### Structure of Nucleic Acids

DNA is made of two strands of multiple, linked nucleotides.



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