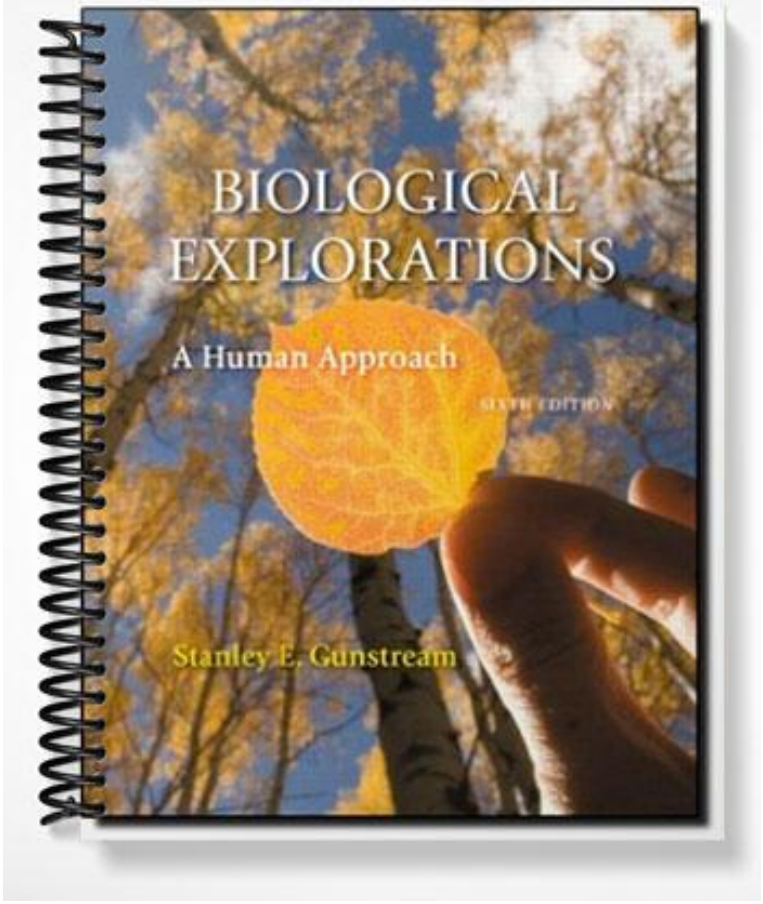
SOLUTIONS MANUAL



1 Orientation

Materials

In the lab

Triple-beam balances

Per student group

Beaker, 250 ml
Celsius thermometer
Graduated cylinders, 10 and 50 ml
Medicine dropper
Metric ruler, clear plastic
Penny
Pipettes, 1, 5, 10 ml
Test tube
Test tube rack
Wood blocks with 3 different densities; numbered 1, 2 and 3

OPERATIONAL SUGGESTIONS

General Comments

This initial exercise is designed to help students "get off on the right foot" in the laboratory. It emphasizes how students should prepare for a laboratory session and how they can work most effectively in the laboratory. Activities are designed to help students: (1) understand the construction of biological terms, (2) make simple measurements and calculations using the metric system, (3) collect and graph data, and (4) understand the scientific method.

The first laboratory session is the best time for you to emphasize your own preferences for (1) how students should prepare for the lab session, and (2) how they should function in the laboratory. Stressing these points now will save you time later in the course. You should emphasize what you expect from students and what they can expect from you.

One of the major hurdles in teaching an effective laboratory session is to train students to come to the lab prepared for each lab session. You will need an effective strategy to establish this behavior.

Assignment Tips

Assignment 3: Units of Measurement: Length

Some students may need help in making the metric system conversions, so you may wish to work an example or two on the board. Also, it may be helpful to demonstrate how to plot finger-length data on the graph.

Assignment 4: Units of Measurement: Mass

Explain how students are to use the balances in the lab to determine mass, especially if the balances are not triple-beam balances.

Assignment 7: Scientific Inquiry

An end-of-lab discussion of the nature of scientific inquiry, including both multi-observational and controlled-experimental methods, will be time well spent. It is especially important that students understand the thought processes and methodology of controlled experiments, because they must use this method of scientific inquiry throughout the course.

Student _____ Date _____

Lab Instructor _____

Orientation

1. Laboratory Procedures

a. Place an X by those activities that are to be completed before coming to the laboratory.

_____ Perform the experiments.
__X__ Learn the meaning and spelling of new terms.
__X__ Label diagrams.
__X__ Understand the objectives.
__X__ Color-code diagrams.
_____ Tear lab report out of lab manual.
__X__ Answer lab report questions on background information.

b. Place an X by those events in the laboratory that should be brought to the attention of your instructor.

__X__ Problems with equipment
__X__ Spillage of a liquid
__X__ Breakage of glassware
__X__ Minor injury
__X__ Directions not understood
__X__ Problems with supplies

2. Biological Terms

a. Use Appendix A to determine the literal meaning of these terms.

Biology **Study of life**
Cardiac **Pertaining to the heart**
Hypodermic **Pertaining to beneath the skin**
Erythrocyte **Red cell**
Dermatitis **Inflammation of the skin**

b. Use Appendix A to construct terms with these literal meanings.

Pertaining to something within a cell **Intracellular**
Study of the heart **Cardiology**
Nerve disease **Neuropathy**
Cancerous tumor **Carcinoma**
Pertaining to a single cell **Unicellular**

3. Measurements in Length

a. Indicate the name and value of these metric symbols.

Symbol	Name of Unit	Value of Unit
ml	**Milliliter**	**0.001 liter**
cm	**Centimeter**	**0.01 meter**
mm	**Millimeter**	**0.001 meter**
kg	**Kilogram**	**1,000 grams**

b. Measure the diameter of a penny in millimeters. __19__ mm
Convert your measurement to centimeters and meters. __1.9__ cm; __0.019__ m

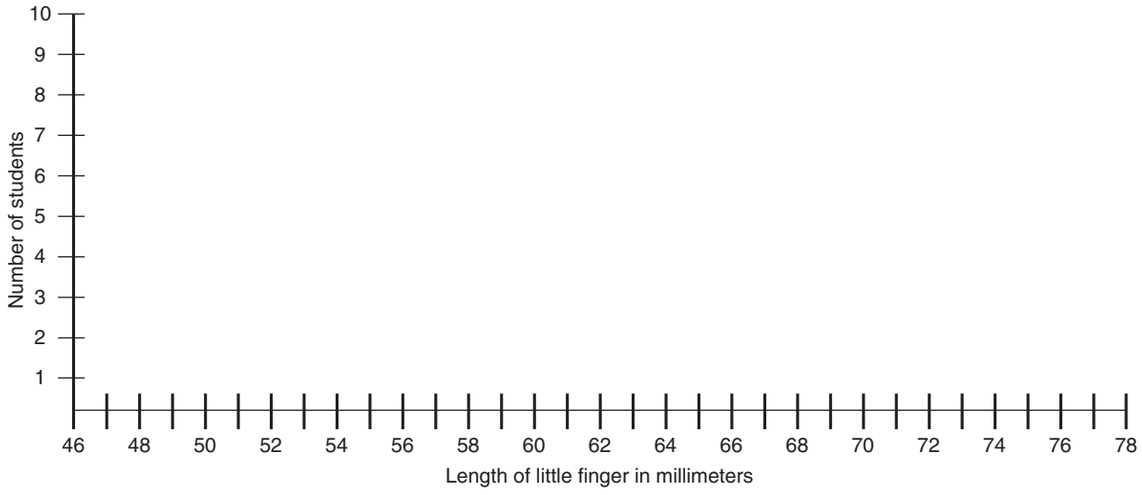
c. Measure the length of your little finger. _____ mm; _____ cm

d. Complete the chart showing the number of students with each finger length.

Length in mm	No. of Students	Length in mm	No. of Students	Length in mm	No. of Students	Length in mm	No. of Students
47	_____	55	_____	63	_____	71	_____
48	_____	56	_____	64	_____	72	_____
49	_____	57	_____	65	_____	73	_____
50	_____	58	_____	66	_____	74	_____
51	_____	59	_____	67	_____	75	_____
52	_____	60	_____	68	_____	76	_____
53	_____	61	_____	69	_____	77	_____
54	_____	62	_____	70	_____	78	_____

e. Using the data from the chart in item 3d, indicate:
The range of little finger lengths. _____ mm to _____ mm
The average of little finger lengths. _____ mm
(The average is calculated by dividing the sum of the finger lengths by the number of fingers measured.)

f. A graph presents data in a visual way. Plot the data from the chart in item 3d on the graph below by placing a dot where an imaginary vertical line from a particular finger length on the horizontal axis intersects with an imaginary horizontal line from the number of students with that finger length on the vertical axis. Draw a heavy vertical line from each dot to the horizontal axis, producing a bar graph. Another way of showing data in a graph is by drawing a curve that fits the dots. Try it.



g. Referring to the graph, what is the most frequent finger length? _____ mm
How many students have little finger lengths within 1 mm of the average finger length? _____
These students compose what percentage of the class? _____ %
(Percentage is calculated by dividing the number of students in this category by the number of students in the class and multiplying by 100.)

4. Measurements in Mass

a. Record the mass of the wood blocks. #1 _____ g; #2 _____ g; #3 _____ g

b. A physician directs a patient to take 1 g of vitamin C each day. How many 250-mg tablets must the patient take each day? **Four**

c. It is recommended that adults eat 0.8 g of protein per kilogram of body mass each day. What should be the minimum daily protein intake of a man with a weight of 185 pounds? (Hint: First convert 185 pounds to kilograms.) **67.3** g

5. Measurements in Volume

a. Record the dimensions of the wood blocks in centimeters.
#1 L _____; W _____; D _____ #2 L _____; W _____; D_____ #3 L _____; W_____; D _____

b. Calculate the volume of the three wood blocks in cubic centimeters.
#1 _____ cc #2 _____ cc #3 _____ cc

c. Calculate the density of each wood block.
#1 _____ #2 _____ #3 _____

d. What is the volume of the test tube? _____ ml

e. How many drops are in 1 ml of water? _____

f. Measure the mass of the 50-ml graduated cylinder. _____ g
Measure the mass of graduated cylinder +30 ml of water. _____ g
Calculate the mass of the water only. **30** g

6. Measurements in Temperature

a. Using a Celsius thermometer, measure the temperature of the following and convert the temperature to °F.

Air in the room _____ °C _____ °F

Cold tap water _____ °C _____ °F

b. Normal body temperature is 37°C (98.6°F). If a patient's temperature is 38°C, what is the temperature in °F? **100.4** °F

7. Scientific Inquiry

a. Did controlled experiments or multiple observations lead to the generalization that all organisms are composed of cells? **Observational science—repeated observations.**

b. Why is a control group important in an experiment? **It provides a point of reference, so you know that the results are due to the effect of the independent variable.**

c. Why is a prediction important? **It indicates the result that supports the hypothesis.**

d. State a new key question raised by the results and conclusion of the hypothetical example of the scientific method. _____

e. Using your key question, state a new hypothesis. _____

State a new prediction. _____

f. Describe a controlled experiment to test your new hypothesis. _____

g. What results would support your hypothesis? _____