

Standard One: Lab Design and Appendix A Lab Skills

Scientific explanations are built by combining evidence that can be observed with what people already know about the world.

What are some sources of information which should be researched before experimentation?

Learning about the historical development of scientific concepts or about individuals who have contributed to scientific knowledge provides a better understanding of scientific inquiry and the relationship between science and society.

Lamarck proposed a theory of evolution which stated that an organism could pass on acquired characteristics (like muscles to their children if a parent lifted weights). Even though this theory was wrong, how did it help the development of the scientific concept of evolution?

How have **values** entered into the fight over other groups or organizations having knowledge of a person's genetic profile?

List several sources of inquiry knowledge. _____

Inquiry involves making judgments about the reliability of the source and relevance of information.

Why is information from a scientific journal more reliable than that obtained from a TV advertisement?

Scientific explanations are accepted when they are consistent with experimental and observational evidence and when they make accurate predictions.

Why must the explanation of an experiment correlate with the data obtained in the experiment?

All scientific explanations are tentative and subject to change or improvement. Each new bit of evidence often creates more questions than it answers.

Why do most experiments in science lead to more questioning?

_____ : an explanation of natural events that is supported by strong evidence.

Well-accepted theories are ones that are supported by different kinds of scientific investigations often involving the contributions of individuals from different disciplines.

Why is the cell theory well accepted among most scientists today?

List two methods used to retrieve of electronic information.

List **five safety procedures** to be followed in experiments.

- a.)
- b.)
- c.)
- d.)
- e.)

_____ -- an intellectual prediction of the possible outcome of an experiment or a solution to the problem. This educated guess can only be made after a great deal of research.

A correctly worded hypothesis can be tested and supported as being correct or incorrect by using an _____.

The best way to write a correct hypothesis is as an "if-then" statement. (ex: If I give lettuce plants fertilizer, then they will grow better.)

The "if" part of the hypothesis is the _____ variable and the "then" part of the hypothesis is the _____ variable.

List the steps of a controlled experiment

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

What is **bias**?

How does the number of trials and the sample size influence the **validity** of an experiment?

Why is it fine if a hypothesis is incorrect? _____

More trials mean _____ validity.

Claims should be questioned if fact and opinion are intermingled, if adequate evidence is not cited, or if the conclusions do not follow logically from the evidence given.

Give an example of fact being intermingled with opinion in the results of an experiment.

The results of an experiment need to be _____ to be accepted.

Scientists use _____ review to evaluate the results of scientific investigations and the explanations proposed by other scientists. They analyze the experimental procedures, examine the evidence, identify faulty reasoning, point out statements that go beyond the evidence, and suggest alternative explanations for the same observations.

What are **indicator solutions**? _____

Give **three examples of indicator solutions** we have used in class this year and what they are used for.

- a.
- b.
- c.

Two things are needed for a controlled experiment:

1. The _____ contains all the parts of the experiment *EXCEPT* the one experimental factor being tested.
2. The _____ contains all the factors of the control group *PLUS* the one factor that is being tested.

The control group acts as the _____ with the variable group.

Good controlled experiments:

1. Can be _____ the same way and get the same results.
2. Have _____ sample size/many test subjects.
3. Are performed for _____ periods of time.
4. The experiment follows established ethical and legal standards.
5. *Have only _____ independent variable,*

_____ -- an inactive substitute for the variable often used in testing drugs

_____ variable is changed or manipulated by the experimenter

Ex: the amount of fertilizer given to a plant.

_____ variable -- depends upon the independent variable

Ex: the height the plant will grow is dependent upon the amount of fertilizer it is given. So the change in height would be the dependent variable.

Data Tables

Data tables are used to _____ data which will be plotted in a graph.

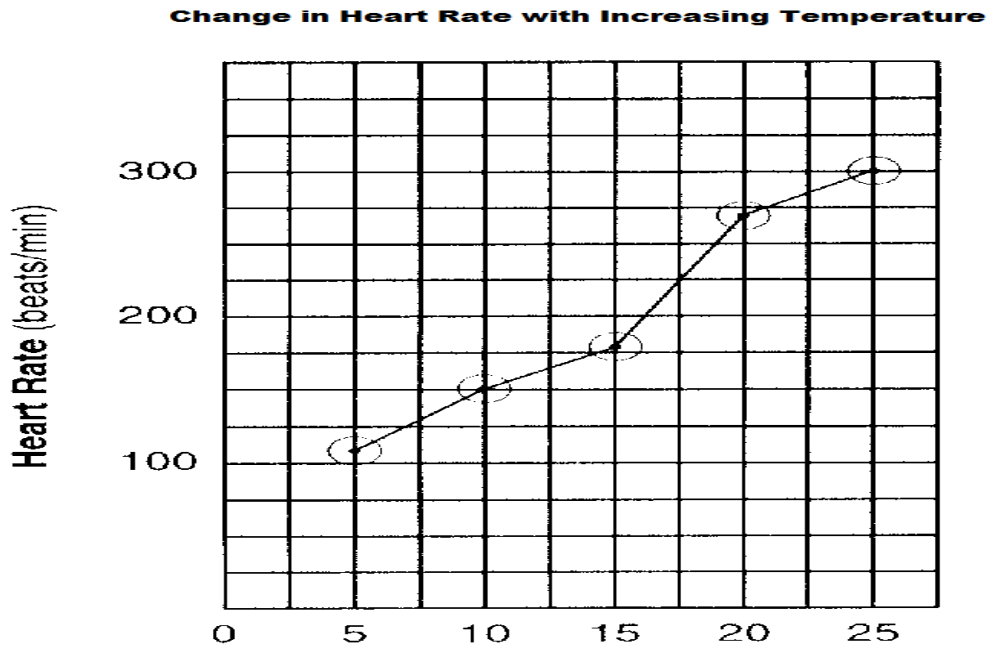
- First column in the table is for the _____ variable.
- Second column is another for the _____ variable.
- Each column should be titled, and include _____ of measurement.
- Data in the table must be arranged in ascending or descending order.

Temperature (°C)	Heart Rate (beats/min)
5	108
10	150
15	180
20	270
25	300

Graphing Key Points

1. Both the x and y axis of the graph must be labeled or titled. These labels are typically the same ones used in the data table. .
2. The _____ is always plotted on the **x-axis**.
3. The _____ always plotted on the **y-axis**.
4. The x and y axis must be numbered.
 - a. **These numbers must increase by a _____ increment** (that is you must count by 1's, 2's, 5's, 10's, etc).
 - b. **Your numerical scales should take up most of the axes.** Squeezing it all into the bottom corner makes the graph impossible to read and no credit will be given.
 - c. The **numbers must line up with the grid lines** of the graph, not with spaces between them.

d. You do not need to start numbering your axis with _____.



Most graphs drawn on the LE Regents have been **line graphs**. Make certain that you create the correct type of graph if asked to do so on the exam.

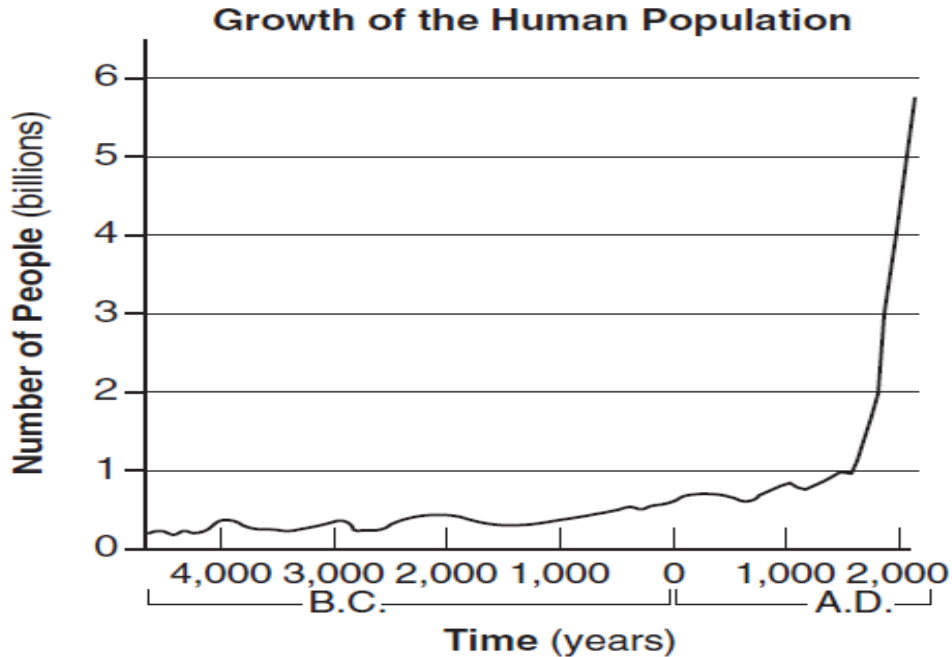
Other Terms:

Observation: What is seen or measured.

Inference: A conclusion based on observation or evidence.

Sample question involving an inference:

The graph below shows how the human population has grown over the last several thousand years.

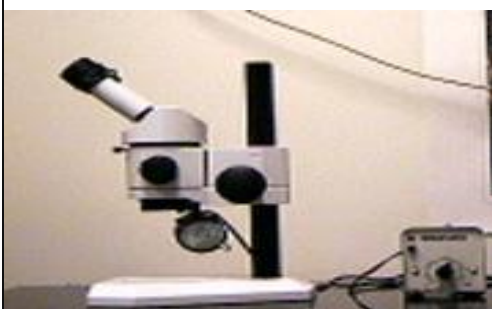


Which statement is a valid inference that can be made if the human population continues to grow at a rate similar to the rate shown between 1000 A.D. and 2000 A.D.?

- (1) Future ecosystems will be stressed and many animal habitats may be destroyed.
- (2) Global warming will decrease as a result of a lower demand for fossil fuels.
- (3) One hundred years after all resources are used up, the human population will level off.
- (4) All environmental problems can be solved without a reduction in the growth rate of the human population.

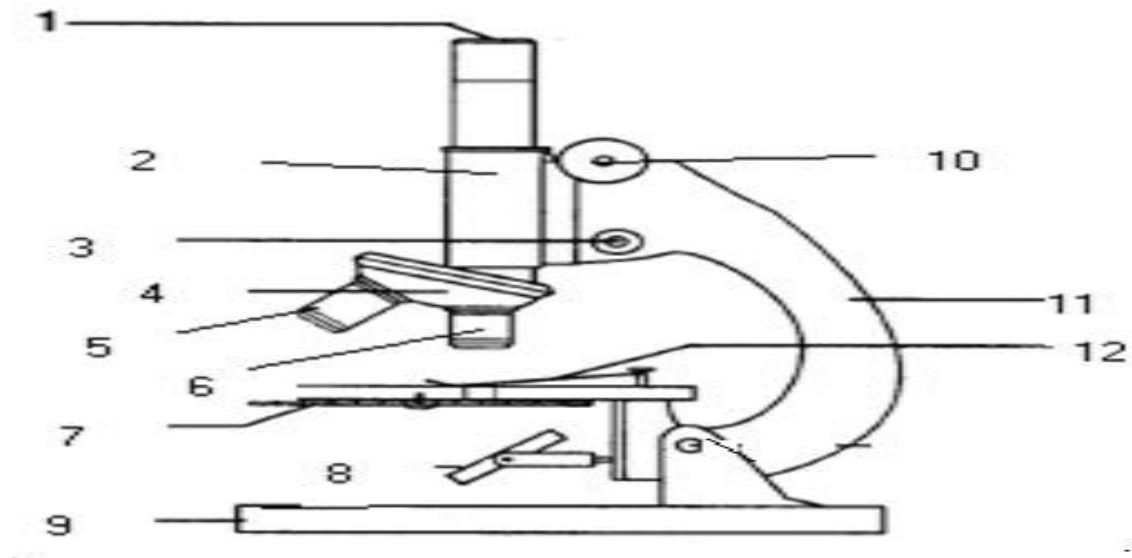
Review of Microscopy

Stereo Microscope



The image at the left is that of a **dissecting** or **stereo microscope**. The specimen to be observed is an **opaque** object (light does not pass through it). The observer sees the surface of the dissection specimen or other specimen being studied. This specimen is placed in a container on the stage of the microscope.

Light or Compound Microscope



Microscope Part	Function of Part
1.	
2.	
3.	
4.	
5.	
6.	
7.	

8.	
9.	
10.	
11.	
12.	

Other Points About the Compound Microscope

1. Always begin focusing on the _____ possible power. Remember to _____ the specimen you are observing in the field of view before switching to a higher power. Make certain that you move the objectives _____ from the specimen when focusing so there is no collision between the objective being used and the slide/cover slip..
2. As you switch from _____ to _____ power, the field of view becomes darker. To deal with this the _____ needs to be opened to allow in more light.
3. As you switch from low to high power the field of view becomes _____.

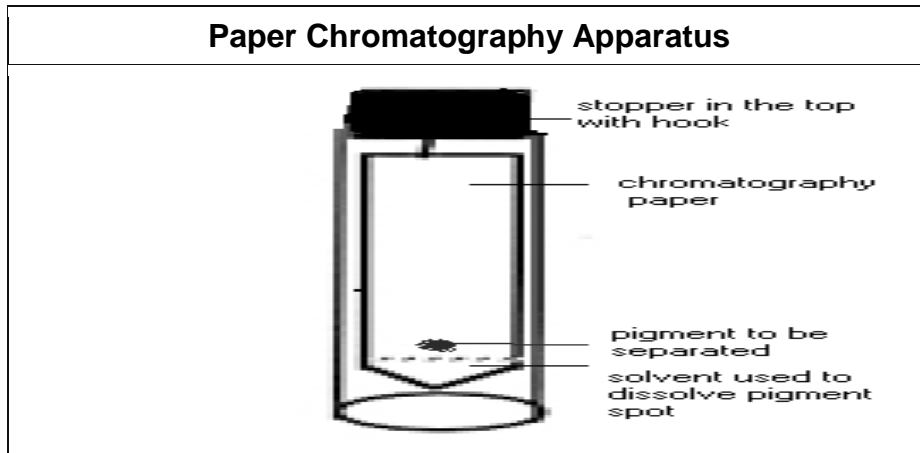


Images viewed under the light microscope are _____ (backward) and _____ (upside down). This is a compound light microscope view of the letter F placed on a slide in its normal position.

Chromatography

Paper chromatography is a procedure used to separate substances in a liquid mixture such as _____ pigments.

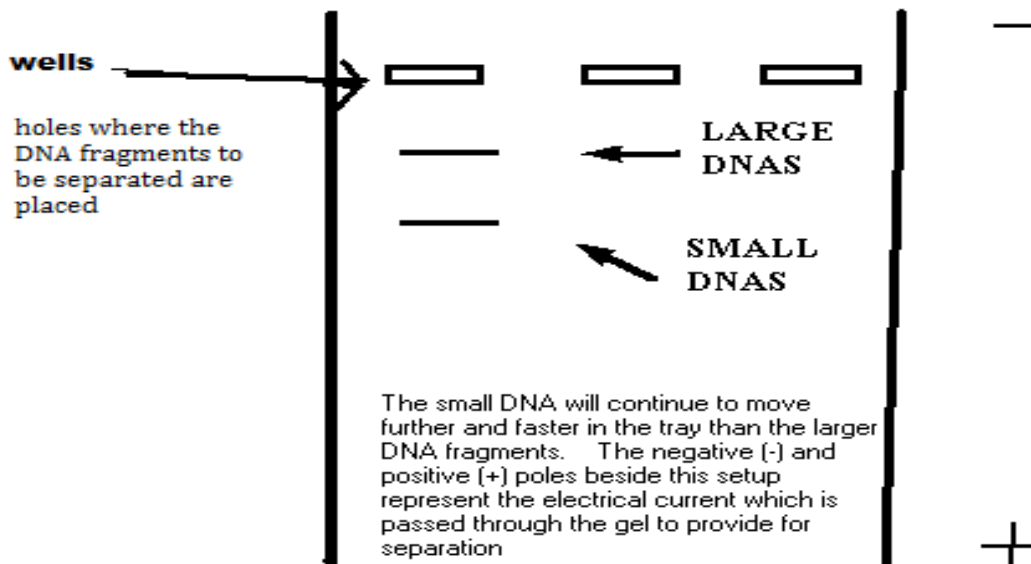
A small concentrated sample of a mixture is placed on the chromatography paper above the line of a solvent mixture. The paper is in contact with a solvent solution (water in our lab) at its bottom.



Identify two errors which can be made doing a chromatography of different plants, even when being provided with appropriate materials.

Electrophoresis

Gel electrophoresis is a procedure used to separate charged molecules of different sizes like _____ by passing them through a gel in an electrical field. The gel contains microscopic pores for the separation of the molecules of different sizes. The gel is usually composed of a jelly-like material called agarose which is made from seaweed.



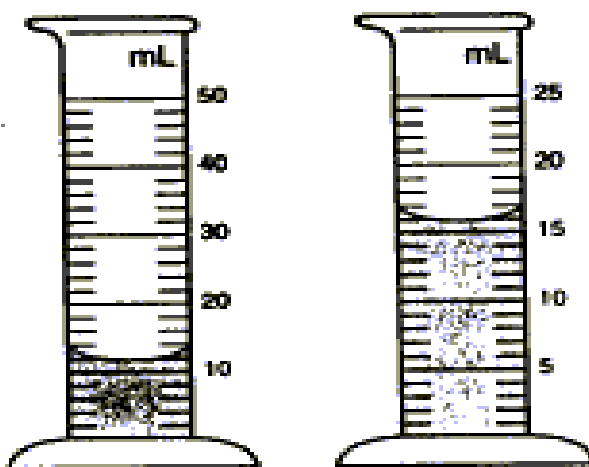
_____ -- used to cut DNA is cut into pieces so it can fit through the gel to be separated in an electrophoresis

Some Uses for the Gel Electrophoresis DNA Separation

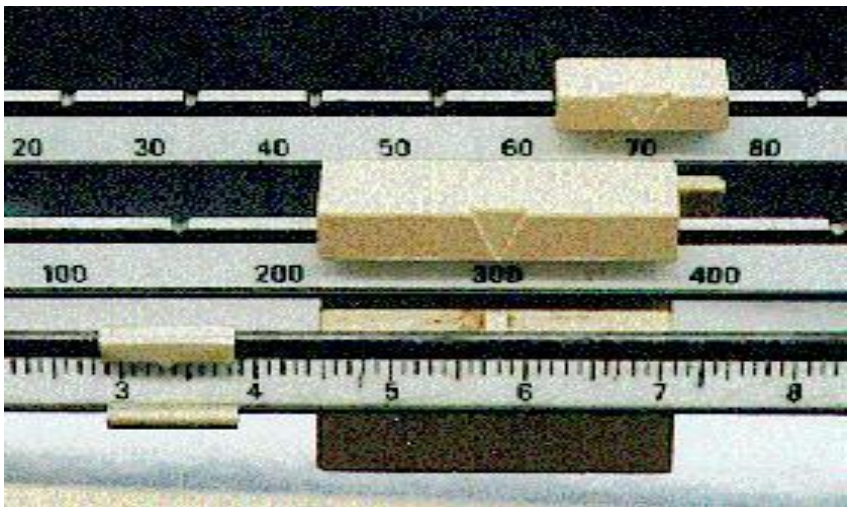
1. It may be used to determine an individual's genetic relationship to his or her ancestors, as the _____ closely matched the banding pattern between two individuals, the more closely they will be genetically related. In theory, no two individuals will form the same DNA banding pattern when the electrophoresis is completed.
2. It may be used to identify an individual that have committed _____ based on the ability to match the suspects _____ to evidence which has been collected at a crime scene.
3. It may be used to determine evolutionary relationships between organisms, as organisms with a _____ genetic relationship will form more similar banding patterns.

Volume Measurement


A commonly used instrument to measure liquid _____ is the graduated cylinder. This instrument usually measures liquid volume in milliliters (ml).

Using a Graduated Cylinder	
	<p>It is important to remember to read to the _____ of the curved line or meniscus when measuring solutions involving water or most liquids. What is the volume in each of these graduated cylinders?</p> <p>_____</p>


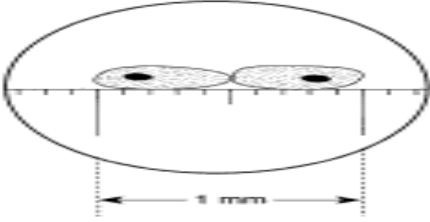

Mass Measurement

Using the Triple Beam Balance	
	<p>What is the mass of this object?</p> <hr/>

Length Measurement

Using a Ruler to Measure Length
<p>Problem: How long is leaf A?</p>  <p>Leaf A</p> <hr/>

Microscopic Measurement

Formula for Total Microscope Magnification	
Total magnification =	Power of the _____ x Power of the _____ _____
Finding the Size of a Microscope Field of View	
	<p>In the pictured field of view at the left, it can be observed that there are approximately 3 1/2 divisions equal to a length of _____ mm. or _____ micrometers.</p>
Finding the Size of Multiple Cells in a Field of View	
	<p>The two cells in this field take up a field of view of one millimeter. Therefore, the size of the specimen is equal to 1 mm/2 cells or _____ mm per cell. Since 1 mm = 1,000 micrometers. The average size of each cell is _____ micrometers.</p>
Estimating Cell Size When the Field of View is Known	
	
<p>This amoeba considered lengthwise appears to occupy approximately _____ of the field of view. The field of view in the left image is 3 mm. Its approximate length is 3 mm X 1/3 = _____ mm or _____ micrometers for the approximate length of this amoeba.</p>	
<p>The student is viewing the same amoeba in the field of view at the right on a higher power. The field of view gets _____ which makes the amoeba appear _____.</p>	