Case 21 2nd Benchmark Study Guide Objective 1: Inquiry

- 1. What is the difference between qualitative and quantitative data?
- 2. Why is skepticism an important part of science?
- 3. What is an inference?
- 4. Explains what it means to analyze the data?
- 5. When should a scientist revise their conclusion?
- 6. How can technology affect scientific knowledge?

Objective 1.a. Evaluate the design of an investigation, including the design's use of experimental controls and the design's effect on the conclusion.

-Identify the parts of experimental design. (independent variable, dependent variable, control groups, constants)

Sample Question: Two students plan to determine how temperature affects the solubility of salt in water. One student thinks more salt will dissolve when the temperature of water is highest, while the other student thinks more salt will dissolve at lower temperatures.

Which statement describes a scientific approach to their two predictions?

- A. Develop a compromise since the two students disagree.
- B. Measure the solubility of salt, sugar, and baking soda in water.
- C. Measure the solubility of salt in water at several different temperatures.
- D. Poll a group of students to determine which prediction is the most widely accepted.

Objective 1.b. Distinguish between qualitative and quantitative observations and make inferences based on observations.

Sample Question: Students tested the effect of caffeine on heart rate. The table shows data from two groups in the experiment.

Which inference can be made from the data in the experiment?

- A. Heart rate is not affected by caffeine.
- B. Caffeine causes heart rate to increase.
- C. Caffeine has different effects on heart rate based on gender.
- D. Both sugar and caffeine cause an increase in heart rate.

Objective 1.c. Summarize data to show the cause and effect relationship between qualitative and quantitative observations.

Sample Question: Jose performed an experiment where he combined yeast, sugar, and water in a flask covered with a balloon. He measured the diameter of the balloon periodically and observed the flask. His results are shown in the table.

What conclusion does the data support?

- A. The yeast consumed the sugar and released gas as a product.
- B. The yeast were poisoned by the sugar, resulting in death.
- C. Yeast are microscopic organisms that can be seen only with a microscope.
- D. Yeast and sugar can be dissolved in water.

Objective 1.d. Analyze evidence that is used to form explanations and draw conclusions.

Sample Question: Students tested the effect of exercise on pulse rate. They measured their pulse rates at rest, after walking, and after climbing stairs. The results are shown in the table.

Student	Resting heart rate (bpm)	Heart rate after consuming caffeine (bpm)
1	65	70
2	68	75
3	70	75
4	75	80

Student	Resting heart rate (bpm)	Heart rate after consuming water (bpm)
5	65	66
6	70	70
7	70	70
8	78	77

Minutes Passed	Observations	Diameter of Balloon
0	Deflated balloon; liquid in flask	14 cm
30	Balloon is upright above flask; liquid is foamy in flask	14 cm
60	Balloon is partially inflated; liquid has decreased & has large bubbles on top layer	15 cm
90 Balloon is larger; flask is full of foam and bubbles		18 cm
Balloon is expand 120 flask has foam a large bubbles		20 cm

Effect of Exercise on Pulse

Student	Resting pulse	Pulse after walking	Pulse after climbing stairs
1	59	66	112
2	71	81	115
3	83	96	120
4	72	89	118
5	68	77	114

Which conclusion is logical based on the students' data?

- A. Students who exercise regularly have a lower pulse than students who do not exercise.
- B. Some exercise will cause pulse to increase, while other types cause it to decrease.
- C. The type of exercise has an effect on how much the pulse increases after activity.
- D. There is no measurable relationship between different types of exercise and a student's pulse.

Objective 1.e. Justify whether an argument defending a conclusion is logical.

Sample Question: A pharmaceutical company developed a dietary supplement and wanted to determine if the product had any side effects. The company chose 5000 individuals to take the prescribed dosage of one supplement tablet per day for six months. Scientists from the company surveyed the participants to determine whether they had experienced any side effects. Using the survey results, the company decided that the supplement was not ready to go the FDA for approval to be sold in stores.

Which argument logically defends this conclusion?

- A. For the results to be valid, the researchers should have tested the supplement in mice rather than people.
- B. For the results to be valid, the researchers should have tested at least five other types of supplements.
- C. For the results to be valid, the researchers also should have given a placebo tablet to 5000 individuals as a control group for comparison.
- D. For the results to be valid, the researchers should have requested that each individual take two supplement tablets per day for the six-month period.

Objective 1.f. Develop a logical argument to explain why perfectly designed solutions do not exist.

Sample Question: Engineers developed a new technology to monitor brain activity during surgery. Which statement is a logical argument for why the technology is not a perfect, permanent solution for monitoring brain activity?

- A. Brain activity cannot always be monitored in all individuals because of disease.
- B. People must give their consent in order for brain activity to be monitored.
- C. Brain activity is only one body function that needs to be monitored during surgery.
- D. The technology may become outdated when a newer technology is developed.

Objective 1.g. Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations.

Sample Question: John Dalton was a scientist who developed the atomic theory in the early 1800s. Later, experiments by scientists like JJ Thomson and Ernest B. Rutherford called for modifications to Dalton's atomic theory. Based upon scientific process, what should have happened next?

- A. Scientists found that Dalton's experiments were faulty, so they completely ignored his conclusions and developed their own theories.
- B. Despite new evidence, scientists did not modify Dalton's original atomic theory because it was already universally accepted.
- C. Thompson and Rutherford repeated their experiments until they could replicate Dalton's results so they would not have to modify the theory.
- D. The scientists' experiments provided new evidence that did not support Dalton's theory, so modifications were made to the original theory.

Objective 1.h. Analyze different ideas and recognize the skepticism of others as part of the scientific process in considering alternative conclusion.

Sample Question: Students gathered data to analyze their water consumption. The table shows the range of averages for the class. The students discussed the data to reach conclusions.

Which statement from their discussion describes skepticism about the data?

- A. Kendall agrees with the data because it supports the data she collected.
- B. Faith concludes that taking showers conserves more water than taking baths.
- C. Neelly wonders if the dishwashing data is accurate since the range is so large
- D. Hope recognizes that washing hands uses the least amount of water.

Household Water Usage		
Activity	Average Water Used (L)	
Taking shower	50-77	
Taking bath	96-116	
Washing hands	4-8	
Flushing toilet	19-27	
Brushing teeth	19-39	
Washing dishes by hand	20-77	
Automatic dishwasher	27-58	

Motion & Newton's Laws

Objective 2.c. Distinguish the motion of an object by its position, direction of motion, speed, and acceleration and represent resulting data in graphic form in order to make a prediction.

- 1. Draw a displacement/time (speed graph) graph that represents each of the following motions: positive acceleration, constant motion going away, negative acceleration, no motion, constant motion coming back (label each of them)
- 2. Draw one speed/time (acceleration) graph that represents positive acceleration, constant motion, negative acceleration, then no motion.
- 3. What are the formulas for speed and acceleration?
- 4. What determines if an object is in motion?
- 5. What are three ways an object can accelerate?

Sample Questions:

Which graph represents a body moving at a constant speed?



The graph shows the distance traveled by an object plotted against time.



What is the average speed of the object?

- A. 0.5 m/s
- B. 1 m/s

C. 1.5 m/s

D. 2 m/s

Study the distance-time graph in the diagram.



According to the diagram, where does the object have no motion?

- A. 1
- в. 2
- C. 3
- D 4

Objective 2.f. Recognize Newton's Three Laws of Motion and identify situations that illustrate each law (e.g., inertia, acceleration, action, reaction forces).

1. Give a short definition for each of Newton's Laws of Motion and give one example of each.

- 1) Def. Ex.
- 2) Def. Ex.
- 3) Def. Ex.

2. What is inertia?

3. What is the formula for newton's 2nd law

Sample Question: Tom is learning about Newton's Laws of Motion. He and his classmates experienced four different activities, as described in the chart.

Which activity illustrates Newton's Third Law of Motion?

- Α. J
- Β. Κ C. L
- D.
- Μ

Activity	Description	
J	A student in a bus leaned back automatically when the bus started moving suddenly.	
к	Tom's paddle pushed the water backward to move his kayak forward.	
L	Students in a moving bus leaned forward when the bus quickly applied the brakes, Erika could throw a pencil farther than she could throw heavy bowling ball.	
м		

4.c. Examine weather forecasting and describe how meteorologists use atmospheric features and technology to predict the weather.

4.h. Justify why an imaginary hurricane might or might not hit a particular area, using important technological resources.

- How does air pressure relate to wind speed? 1.
- 2. What happens to the density of air when it cools?
- Describe an air mass that forms over each of the following locations: Canada, Gulf of Mexico, North Pacific Ocean. 3.
- What do each of the following measure: anemometer, barometer, hygrometer? 4.
- What type of weather is associated with a High (H) pressure system? Explain why. 5.
- What type of weather is associated with a Low (L) pressure system? Explain why. 6.
- 7. At what latitude line will a hurricane move back towards the east?
- 8. What strengthens a hurricane? What weakens a hurricane?
- 9. Draw the symbol for each of the following & tell what weather is associated with each type: warm front, cold front, occluded front, stationary front
- 10. What are isobars?
- 11. What is the difference between the easterlies & westerlies?
- 11. How does air temperature relate to the amount of water vapor it can hold?

12. What is the Coriolis Effect? Draw arrows on the globe to show the direction of the air flow from the north pole to the equator.



Sample Questions:

When air pressure rapidly falls, what weather change usually occurs?

- A. clearing skies
- B. decreasing humidity
- C. approaching storm
- D. decreasing temperature



What will happen to the temperature in Amarillo when the front passes through?