Case 21 1st Benchmark Study Guide

Objective 1: Inquiry

1. What is the difference between qualitative and quantitative data?

Oualitative data is descriptive (color, size, texture) Ouantitative data measures using numbers. (height, weight, mass)

- 2. Why is skepticism an important part of science? It allows for the formation of new theories by considering other explanations for the data. Ex. Police officers are skeptical with the evidence so they don't rule out any possible solutions to a crime (leads to new investigations)
- 3. What is an inference?

Inference is a conclusion based on prior knowledge. Observation is information gathered through the senses. Examples: The grass is wet. (Observation). It rained last night (Inference).

- 4. Explains what it means to analyze the data? Find patterns in the data & list them in order. (ie. Smallest to biggest) in relationship to the independent & dependent variable
- 5. When should a scientist revise their conclusion? When their data is not repeatable
- 6. How can technology affect scientific knowledge? Technology advances scientific knowledge. For example, improvements to the microscope have led to new discoveries

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)

IV- part you control as you are doing the experiment, DV- part being measured during the experiment, control groups- do not get independent variable & is used to make a comparison of the degree of the affect, constants- variable that stay the same

DV

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.

DV

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.

IV

- 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.

A student wants to observe the change in the temperature of water in containers of different colors. She follows the procedure listed.

- Label three identical containers container X, container Y, and container Z.

- Label three identical container's container's, container's, and container's 2 Paint container X white, container y green, and container Z black.
 Fill each container with 250 mL of water at 25°C.
 Keep the containers in direct sunlight for 20 minutes.
 Record the final temperatures of the water, and calulate the difference between the initial and final temperatures in each container.

What is the dependent variable of the experiment?

change in temperature of the water

- color of the containers
- Initial temperature of the water
- volume of the containers

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

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

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

IV

Jose performed an experiment where he combined <u>yeast</u>, <u>sugar</u>, <u>and water</u> in a flask <u>covered</u> with a <u>balloon</u>. **DV**

He <u>measured</u> the <u>diameter</u> of the <u>balloon</u> 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.

IV DV

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

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

Effect of Exercise on Pulse

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 <u>dietary supplement</u> and wanted to determine if the product had any **(DV)** <u>side effects</u>. The company <u>chose 5000</u> individuals to take the prescribed dosage of <u>one supplement</u> tablet <u>per day</u> for <u>six months</u>. Scientists from the company <u>surveyed</u> the <u>participants</u> to determine <u>whether they had experienced any side effects</u>. Using the survey results, the company decided that the <u>supplement was not ready</u> to go the FDA for approval to be sold in stores. Which argument <u>logically defends</u> this <u>conclusion</u>?

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.

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
120	Balloon is expanded; flask has foam and large bubbles	20 cm

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

Sample Question: Engineers developed a <u>new technology</u> to monitor brain activity during surgery. Which statement is a <u>logical argument</u> for <u>why</u> the <u>technology</u> is <u>not</u> a <u>perfect</u>, <u>permanent solution</u> 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 <u>atomic theory</u> in the <u>early 1800s</u>. <u>Later, experiments</u> by scientists like JJ Thompson and Ernest B. Rutherford <u>called for modifications</u> to Dalton's atomic theory. Based upon <u>scientific process</u>, <u>what should have happened next</u>?

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 <u>water consumption</u>. The table shows the range of averages for the class. The students discussed the data to reach <u>conclusions</u>.

Which statement from their discussion describes <u>skepticism</u> about <u>the data</u>?
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. (*true but not skepticism this is a conclusion*)

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.

A student reads that the Coriolis effect is a force caused by the rotation of Earth. This force causes moving objects on Earth's surface to be deflected slightly to the right in the Northern
 Hemisphere and to the left in the Southern Hemisphere. The student concludes that all wind movement in North America is deflected to the right. A classmate suggests that the force only applies to global winds on a larger scale and over long distances. For local areas, winds tend to flow from areas of high to low pressure.

How should the student respond to the classmate's suggestion?

- The student should ignore the original conclusion and replace it with the classmate's conclusion since a newer conclusion is always correct.
- The student should re-analyze the original conclusion based on the classmate's suggestion.
- The student should ignore the classmate's suggestion and rely on the original conclusion since a newer conclusion is always incorrect.
- The student should ignore both conclusions and perform an experiment to prove that both are incorrect.

	Household Water Usage	
	Activity	Average Water Used (L)
	Taking shower	50-77
	Taking bath	96-116
ľ	Washing hands	4-8
	Flushing toilet	19-27
ſ	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 acceleration graph that represents positive acceleration, constant motion, negative acceleration, then no motion



- 3. What are the formulas for speed and acceleration? speed=distance/time, acceleration= (final speedinitial speed)/time
- 1. What determines if an object is in motion? Change in position
- 2. What are three ways an object can accelerate? Speed up, slow down, change direction

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?



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. Inertia object at rest or in motion will stay at rest or in motion until an unbalanced force is applied

Ex. See J & L in the sample question chart

- 2) Def. Math law (F=ma) an object will accelerate in the direction the net force is applied Ex. See M in the sample question chart
- 3) Def. action/reaction, for every action there is an equal and opposite reaction Ex. See K in the sample question chart

2. What is inertia? Tendency of an object to resist a change in motion

3. What is the formula for newton's 2^{nd} law : F=ma force = mass X acceleration, or a=f/m

 $F(20N) = M \times a$ (Large Mass, Small Acceleration)

 $F(20) = m \times A$ (Small Mass, Large Acceleration)

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?

A.	J
-	

- В. Κ
- С. L D. Μ

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

Study the distance-time graph in the

10 12 14

8

diagram.

70 60 50

> 0 2 4 6 Time

2d.

1. Identify the parts of a circuit and draw an example of a simple circuit **Energy source (battery), load/device (bulb), wires, switch (open/close).**



- What type of current does the power grid use? Explain why.
 AC current because the voltage can be increased and decreased to travel long distances & move in both directions.
- 3. Explain the functions of each of the following parts of the power grid: substation, transformer, generator, turbine, power lines substation- step up voltage for long distances, transformer- decrease voltage before entering home, generator- produce electricity, turbine- spins the generator, power linescarry electricity long distances
- 4. Make a sequence map to show how electricity flows through the grid using the following terms: power plant, outlet, junction box, large substation, transformer, small substation
- 5. What are the products for cellular respiration? carbon dioxide and water
- 6. Identify four most common renewable resources and one most common nonrenewable resource used to generate electricity. renewable- solar, wind, hydroelectric, geothermal. Nonrenewable- fossil fuels (coal, oil, natural gas)

The Electrical Power Products Division of Howard Industries in Laurel, Mississippi manufactures 7. transformer products used in power grid systems like the one shown.



What are the products of combustion? Carbon

The Excelsior Power Plant has broken its production of electricity into four parts. Part A shows the arrival coal to the power plant, part B shows the burning of coal to heat water and produce steam, part C shows the steam entering the turbine generator, and part D shows the transfer of

The figure shows how electrical energy is transferred to a house from a power station.



Which statement describes the role of the transmission grid?

- It stores the electrical energy for future use.
- It generates electrical energy.
- It conducts high-voltage current over long distances.
- It converts electrical energy to other forms of energy.

Which labeled parts step up or step down the voltage during transmission?

	1 and 6
to conve	2 and 4
to create	3 and 5
to transr	1 and 5
to increas	e or decrease the voltage coming through the wires

dioxide & water vapor

4d.

- 1. Name three gases that contribute to the greenhouse effect. **carbon dioxide, methane, water vapor**
- 2. Of these 3, which one seems to have the biggest impact on temperature increases in our atmosphere? **carbon dioxide**
- 3. What 2 activities have caused the largest increase of greenhouse gases in the atmosphere over the last 100 years? **burning fossil fuels**
- 4. Describe the importance of the Carbon/oxygen cycle. Photosynthesis and respiration cycle oxygen/carbon through the atmosphere.
- 5. What type of energy sources can generate electricity without burning a fuel source? Wind, Solar & hydroelectric (renewable)
- 6. What can we do to reduce the effects of global warming? drive less, turn off lights, use less electricity, recycle, decrease dependency on fossil fuels, plant more trees



2.a.

- 1. State the law of conservation of mass.
- 2. Write the name of each compound: NaCl, CO₂, H₂O, C₆H₁₂O₆, O₂
- 3. Label the products & the reactants in the following equation:

 $2H_2 + O_2 \rightarrow 2H_2O$

4. Hydrogen reacts with oxygen to produce water as represented by this chemical equation.

 $2H_2 + O_2 \rightarrow 2H_2O$

8 grams of hydrogen react completely with some oxygen to produce 72 grams of water. How many grams of oxygen are involved in the given reaction?

5. Which equation shows a balanced chemical reaction where energy is used to produce sugar and oxygen from carbon dioxide and water?

- A. $6 \text{ CO}_2 + 6 \text{ H}_2\text{O} \xrightarrow{\text{sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$
- B. $2 O_2 + 6 H_2O \xrightarrow{sunlight} C_6H_{12}O_6 + 2 CO_2$
- $C C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2 + energy$
- D. $CO_2 + 6O_2 \longrightarrow H_2O + C_6H_{12}O_6 + energy$

2b.

- 1. What type of elements form ionic bonds? Covalent bonds?
- 2. In group 17, which elements form the strongest, most stable bonds?
- 3. Which elements don't bond? Why?
- 4. Which group(s) are the most active non-metals?
- 5. Which group(s) are the most active metals?
- 6. What is the pH of an acid? Of a base?
- 7. What are some properties of acids & bases?

A student draws a concept diagram to represent four different chemical reactions. Which concept diagram represents a balanced reaction?



$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

What is indicated by the balanced equation for this chemical reaction?

- There are half as many hydrogen atoms on the reactant side of the equation as on the product side.
- There are more carbon atoms on the product side of the equation than on the reactant side.
- There are more oxygen atoms on the product side of the equation than on the reactant side.
- There are the same number of hydrogen atoms on both the reactant and product sides of the equation.



A student places 1 g of baking soda, a white solid, inside a balloon and attaches the balloon to the mouth of a flask that has some vinegar in it. He then slowly lifts the balloon so that the soda falls into the vinegar in the flask. The image shows the experimental arrangement before and after the reaction and a list of observations.



The baking soda fall into the solution.
 Bubbles formed in the solution.
 The balloon grew in size.
 The flask became cold.
 The solution turned white.

Which observations best provide evidence of a chemical change?

- 2 and 4
- 2 and 5
- 1, 3, and 4
- 1.3, and 5