Case 21 2nd Benchmark Study Guide

1st 9 weeks

Objective 1: Inquiry

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

Qualitative data is descriptive (color, size, texture) Quantitative 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

IV 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.

IV DV

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

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

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.

IV

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

He measured the diameter of the balloon periodically and observed the flask. His results are shown in the table.

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

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 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.

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.

IV

Sample Question: A pharmaceutical company developed a dietary supplement and wanted to determine if the product had any **(DV)** 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 Thompson 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.

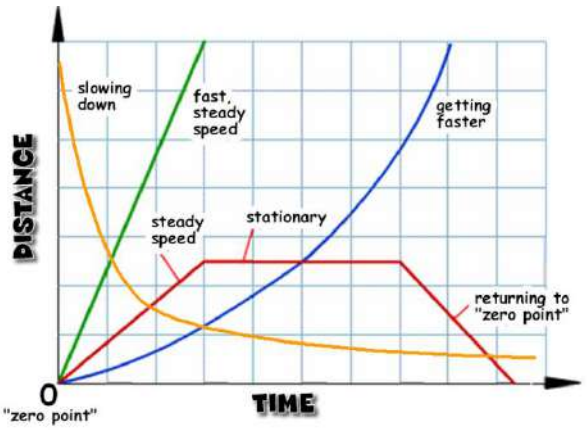
Household Water Usage	
Activity	**Average Water Used (L)**
Taking shower	50-77
Taking bath	96-116
Washing hands	4-8
Flushing toilet	19-27
Brushing teeth	19-39
Washing dishes by hand	20-77
Automatic dishwasher	27-58

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. *(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. *(observation)*

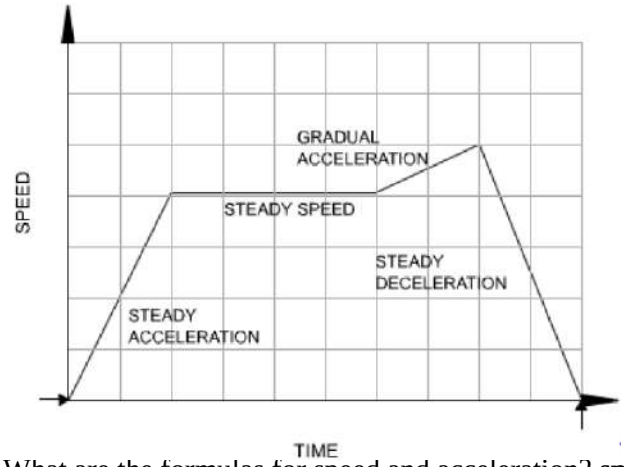
Motion & Newton's Laws

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



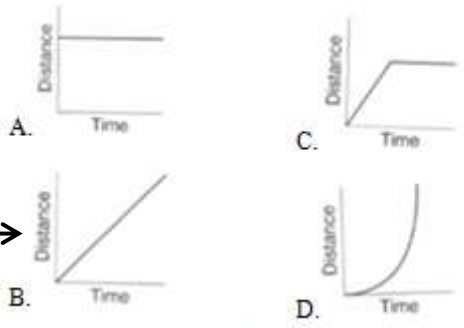
3. What are the formulas for speed and acceleration? **speed=distance/time, acceleration= (final speed-initial speed)/time**

4. What determines if an object is in motion? **Change in position**

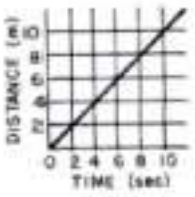
5. What are three ways an object can accelerate? **Speed up, slow down, change direction**

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?

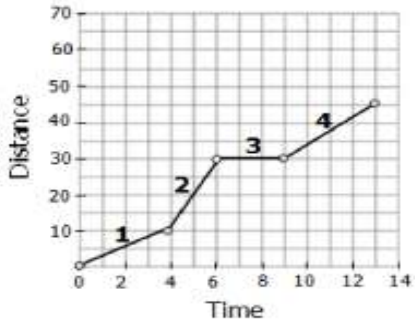
A. 0.5 m/s

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

B. 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. 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 2nd law : **F=ma force = mass X acceleration, or a=f/m**

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
B. K
C. L
D. M

Activity	Description
J	A student in a bus leaned back automatically when the bus started moving suddenly.
K	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.
M	Erika could throw a pencil farther than she could throw a heavy bowling ball.

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**

4c & 4h Weather & hurricanes

1. How does air pressure relate to wind speed? **when air pressure decreases, wind speed increases**

2. What happens to the density of air when it cools? **it increases, which makes it sink**

3. Describe an air mass that forms over each of the following locations**: Canada, Gulf of Mexico, North Pacific Ocean. Canada: cold and dry, Gulf of Mexico: warm and humid, North Pacific Ocean: cold and humid**

4. What do each of the following measure: anemometer, barometer, hygrometer? **anemometer- wind speed, barometer- air pressure, hygrometer- humidity**

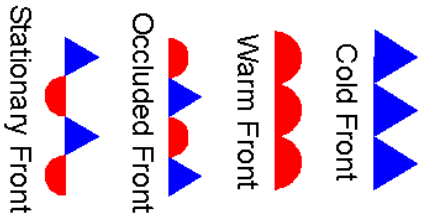
5. What type of weather is associated with a High (H) pressure system? Explain why. **Clear & sunny skies because moisture cannot rise to condense**

6. What type of weather is associated with a Low (L) pressure system? Explain why. **clouds, rain, maybe thunderstorms because moisture rises to condenses**

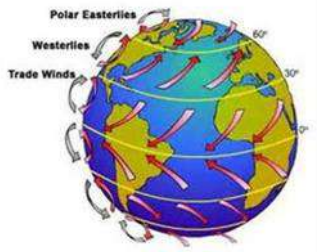
7. At what latitude line will a hurricane move back towards the east? **30 N**

8. What strengthens a hurricane? **Warm water, low pressure** What weakens a hurricane? **Land, cool water, & high pressure**

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
warm front- light precipitation, cold front- heavy rain and thunderstorms
Stationary- does not advance with steady precipitation, Occluded front – quick thunderstom



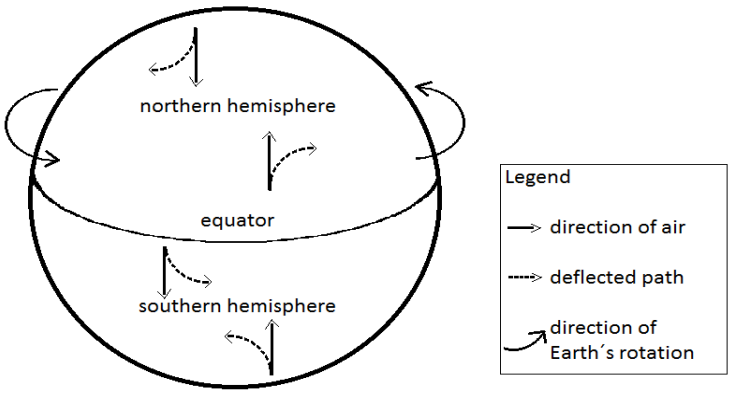
10. What is the difference between the easterlies & westerlies? **Westerlies blow from the west to east and cause hurricanes to turn away from United States. Trade winds blow hurricanes from east to west toward the US.**



11. What direction does weather generally move across the United States? **west to east**

12. How does air temperature relate to the amount of water vapor it can hold? **Warmer the air the more water vapor it can hold**

13. 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

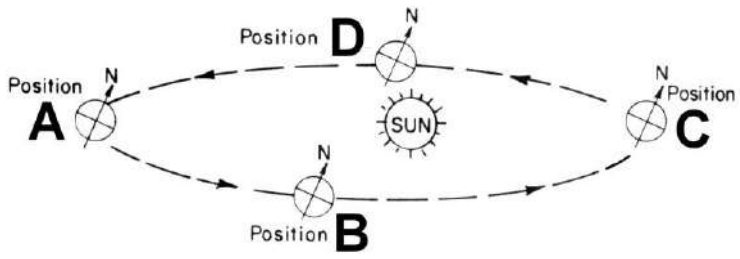


2nd 9 weeks

1. Explain how the Earth's rotation and revolution affects the length of days, years, and seasons.

Revolution is orbiting around the Sun. It takes one year. It causes the seasons to change along with the tilt. Rotation causes night and day and takes 24 hours. Earth rotates from east to west (counterclockwise)

2. Label the solstices and equinoxes on the diagram below.
A summer solstice in N hemisphere, C winter solstice in N hemisphere, B Autumn equinox, D Spring/vernal Equinox



3. Give the number of degrees latitude for each line and give the dates(s) in which the Sun is overhead.
Tropic of Cancer- 23.5 N
Tropic of Capricorn- 23.5 S
Equator- 0

4. Give the latitude lines for each climate zone and describe the climate.
Tropical- between 23.5 north & South of the equator- little seasonal variation, direct sunlight year round
Temperate – between 23.5 & 66.5 north & south, warm/hot summers, cool winters, greatest variation , moderate temperatures with distinct seasons
Polar – above 66.5 north arctic circle & below 66.5 south- short, cool summers, long, cold, dark winters, receive sunlight at very low angles

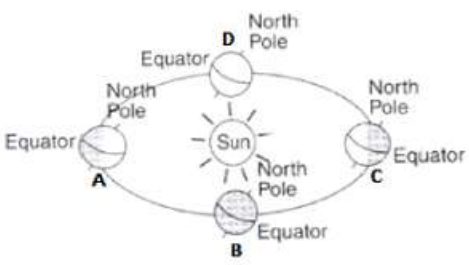
5. Explain how the seasons affect length of days and the Sun's angle in the sky.
Summer: sun is more direct because the angle is higher in the sky due to the earth's tilt towards the sun so earth has longer daylight hours & absorbs more energy & warms up

Winter: sun is less direct because the angle is lower in the sky due to the earth's tilt away from the sun so earth has shorter daylight hours & absorbs less energy & cools down

Spring & Fall: sun is most direct over the equator & the earth is neither tilted toward or away from the sun, so earth gets even amounts of daylight and darkness hours & absorbs equal amounts of energy for milder temperatures

Sample Question:

The diagram represents Earth at four different positions, A, B, C, and D in its orbit around the Sun.



Between which positions would the United States be experiencing winter?

A. positions A and B

B. positions B and C

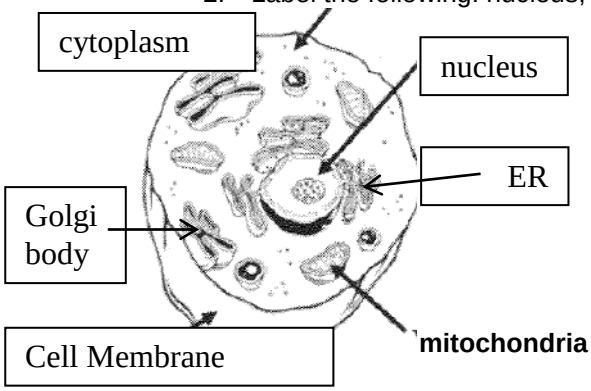
C. positions C and D

D. positions D and A

3b. Compare and contrast the major components and functions of different types of cells.

1. Explain how plant and animal cells are different :**plants have chloroplasts, larger vacuole, & cell wall**

2. Label the following: nucleus, mitochondria, ER, Golgi Body, cell membrane, cytoplasm



Complete the data chart & be able to identify all parts on a diagram of a cell.

Organelles	Function
cytoplasm	Gel-like material that fills the cell & surrounds the organelles
cell membrane	Allows material to enter or exit the cell & protects the contents of the cell
nucleus	Control center of the cell
endoplasmic reticulum	Transport materials & proteins around the cell
ribosome	Builds proteins in the cell
mitochondria	Provides energy for the cell by breaking down sugar molecules in cellular respiration
chloroplast	Provides food for a plant cell by collecting energy from the sun during photosynthesis
cell wall	Rigid material that surrounds a plant cell that gives it shape, support, & protection
vacuole	Stores food, water, & other materials in the cell
Golgi body(apparatus)	Packages & distributes proteins and other material in the cell
lysosome	Break down larger particles to smaller particles for recycling in the cell

Specialized Cell	Function
blood	Carry oxygen and other material throughout the body
bone	Structure and movement
muscle	Attaches to bone and allows for movement
nerve (neurons)	Detects stimuli from the environment and transmits information between cells
epithelial	Covers the surface of the body and the lining of internal organs

3c. Describe how viruses, bacteria, fungi, and parasites may infect the human body and interfere with normal body functions. (DOK 1)

Pathogen	Add Another Example	Most used treatment	Brief Description
virus	Influenza, HIV, polio, smallpox, chicken pox, rabies	antiviral medicines, fluid replacement	Tiny particle with nucleic acid surrounded by a protein coat that can only reproduce inside a living cell

bacteria	Strep throat, staph, pneumonia, tetanus	antibiotics	Prokaryotic cell with a cell wall that interferes with the normal function of a cell & reproduces by binary fission
fungus	Athlete's foot, ringworm	antifungal cream or spray	Most are unicellular organisms that reproduce by spores
protist	Malaria, sleeping sickness	anti-malarial drugs	An organism that requires a host to obtain nutrients to survive

1. What type of pathogen are antibiotics mostly used to treat? **bacteria**
2. How are the following pathogens spread from organism to organism?
   Virus: body fluids, coughing, sneezing
   Fungus: direct contact, inhaling spores
   Bacteria: direct contact, inhaling contaminated air or touching a contaminated object
   Protist: vectors, contaminated food or water

3. Which pathogen from above is most like a parasite? **Protist**

4. What is a vector & give an example? **Organism that transfers a disease to a human. Ex. Mosquito with malaria**

5. List ways you can prevent an infection from a pathogen.

Wash hands, exercise, get rest, eat healthy, get check-ups, stay away from contaminated people

6. Describe how a virus infects the body.
   Attaches to a cell membrane, injects genetic material, duplicates until the cell burst & dies, newly replicated virus attack other cells

7. Describe how a virus & bacteria are different
   Bacteria make poisons that kill or slow cells down, viruses replicate inside of a cell until it burst, viruses are smaller that bacteria, bacteria can be treated with antibiotics & viruses cannot, viruses are non-living & require a host cell to reproduce, bacteria reproduce through binary fission