Scientist's IQ

Name:_____School:_____

Teacher:_____Class:_____

Group:_____Date:_____

Instructions: Answer the questions by choosing the option that you think is the most appropriate. In cases where a written response is required, please write in complete and clear sentences.

1. The data table below contains information about the sound intensity levels involved in a variety of situations and indicates the level of sound that can damage your hearing and cause pain.

Sound Intensity

Source	Intensity dB (Decibels)
Rustling leaves	20
Library	40
Busy traffic	70
Factory	80
Heavy truck	90
Subway	100
Construction	110
Jet engine	150
Rocket engine	180

90 dB—Endangers hearing
120 dB—Pain threshold

According to the information in the table, which workers have the greatest chance of experiencing significant hearing loss over time?

a. Traffic Police Officers
b. Shoe Factory Workers
c. Road Construction Crews
d. Library Desk Clerks

2. The data table below contains information about the most common elements (A - E) at the Earth's surface.

Most Common Elements at Earth's Surface

Element	Percent at Surface
A	46.6
B	27.7
C	8.13
D	5.00
E	3.63

After carefully examining the information in the table, which conclusion is *best* supported by the data in the table above?

a. Earth's surface is made of mostly B and E.
b. A is closer to Earth's surface than C.
c. There is more C than E at Earth's surface.
d. B is much heavier than D at Earth's surface.

3. The data table below shows environmental factors and soybean yields for three regions in Wisconsin over two years.

Wisconsin Soybean Production

Region*	Year	Annual Rainfall (centimeters)	Average Ozone Level (parts/thousand)	Average Crop Yield (bushels/acre)
1	1999	123	4	34
	2000	122	9	26
2	1999	120	8	28
	2000	117	7	29
3	1999	132	10	25
	2000	115	6	31

* soil types in all three regions are the same

Which of the following *best* explains the decrease in soybean yields in certain years across all three regions?

a. High levels of ozone damaged the soybean plants decreasing the average yield.
b. Low rainfall amounts failed to meet the plants' moisture needs and slowed growth.
c. Poor soil limited soybean growth and decreased the harvest.
d. Higher than normal rainfall increased pest activity, decreasing the average yield.

Use the following scenario to answer questions 4 and 5:

4. Antonio wanted to find out how the mass of a piece of clay affects the average distance the clay travels when launched from a spoon launcher. He wrote the following hypothesis before testing his ideas: "If the mass of the piece of clay is larger, then the average distance traveled will be greater."

4a. In order to test his hypothesis, the variable Antonio will need to manipulate (change) is the:

a. Distance the clay travels.
b. Spoon launcher he uses.
c. Mass of the clay.
d. Direction he launches the clay.

4b. In order to test his hypothesis, the variable Antonio will need to control (keep constant) is the:

a. Spoon launcher he uses.
b. Mass of the clay.
c. Distance the clay travels.
d. Number of trials he does.

Antonio collected the following data in order to test his hypothesis:

Distances Pieces of Clay Traveled (centimeters)

Clay Mass	Trial 1	Trial 2	Trial 3	Average Distance
Small	**76**	**80**	**84**	**80**
Medium	**50**	**42**	**46**	**46**
Large	**8**	**16**	**12**	**12**

5. Think about Antonio's hypothesis above.

5a. His hypothesis was:

a. Confirmed.
b. Not confirmed.

5b. Explain your answer to question 5a, using data from the results of the experiment above.

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6. Francine set up an experiment to compare how the amount of water affects the growth of a bean seed. For the experiment, she placed 4 bean seeds into separate containers of the same size filled with and covered by the same amount of soil. She also made sure the seeds received the same amount of light and a room temperature of 40 degrees Celsius.

She needed to create a data table to set up her experiment and record her results. Answer the following questions below and create a data table to accurately set up and collect data for this experiment.

6a. Francine will need to change the following test her idea: (Choose all options that you think apply.)

a. Temperature of the room.
b. Amount of water.
c. Size of the containers.
d. Amount of soil.
e. Height of the bean sprout.
f. Amount of light.

6b. Francine will need to keep the following the same to test her idea: (Choose all options that you think apply.)

a. Temperature of the room.
b. Amount of water.
c. Size of the containers.
d. Amount of soil.
e. Height of the bean sprout.
f. Amount of light.

6c. Francine will need to measure the following to test her idea: (Choose all options that you think apply.)

a. Temperature of the room.
b. Amount of water.
c. Size of the containers.
d. Amount of soil.
e. Height of the bean sprout.
f. Amount of light.

6d. Using an *if-then* statement, write a hypothesis to predict how one variable will affect another in Francine's experiment above.

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6e. Place the relevant variables that you identified above in the chart below. Be sure to:

- Organize the information in a systematic way
- Identify the increments of the manipulated variable to help Francine see patterns in her data

Please note: filling in variables for all of the rows and columns below is NOT required.

7a. In order to help scientists conduct research effectively, a scientific question must: (Choose all that you think apply.)

(a) Always begin with the words “how” or “why.”
(b) Be specific.
(c) Be open-ended.
(d) Lead to a “yes” or “no” answer.
(e) Be related to the goal at hand.
(f) Be testable.
(g) Be researchable using a variety of methods and sources.
(h) Have one correct answer.

7b. Which of the following questions do you think is the *best* example of a question that a scientist might ask in order to develop an experiment?

a. What effect does changing that have on it?
b. Which paper towel is best at absorbing water?
c. Does the sun affect plants?
d. How is air resistance measured?

8. Four children can feel and smell an object inside a bag. But, they cannot see it. Which of the following is NOT an observation about the object?

a. It is flat at one end and round at the other.
b. It smells like peppermint.
c. It has a bump on it.
d. It is candy.

9. Maria collected the gas given off by a heated piece of charcoal. The gas was then bubbled through a small amount of water. Part of Maria's report stated, "After the gas was put into the jar, the water gradually changed to a milky white color." This statement is:

a. An observation.
b. A conclusion.
c. A generalization.
d. A prediction.

10. Three high school students wanted to find out how far they could drive on one tank of gas. To do this, the students went to the same gas station to fill the tanks of their cars. They then drove their cars until the gas tanks were nearly empty.

The table below shows all the information the students collected during their investigation. Study the table, read their conclusion and then answer question 10a.

Student	**Type of Car**	**Gallons of Gasoline Tank Can Hold**	**Speed Driven (miles per hour)**	**Type of Road**	**Miles Driven by Different Cars**
1	Trans W	12	20	city streets	380
2	Mark 2002	15	40	country roads	310
3	Apex GXE	14	60	highway	420

Conclusion: Based on their investigation, the students concluded that they could drive farther on a full tank of gasoline in an Apex GXE than they could in the other cars.

10a. Think of reasons why their conclusion might be incorrect. Describe **two** specific changes the students could make to improve their experiment design.

1._____

2._____

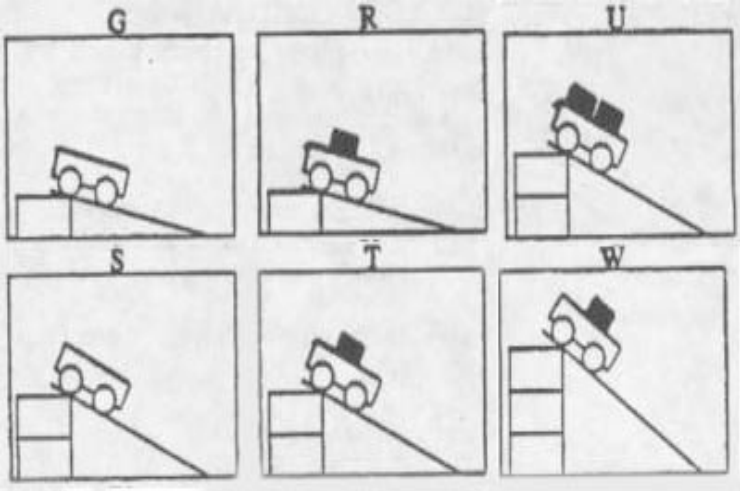
11. Scientists and engineers use many sources of information to understand phenomenon. For example, scientists and engineers who work to create more energy efficient cars use:

- Text-based materials that give them information about the physics of cars that has already been learned.
- Data from physical lab experiments.
- Data from simulation experiments.
- Other scientists' ideas as they work with each other to design the best car.

Using different sources of information helps the scientists to:

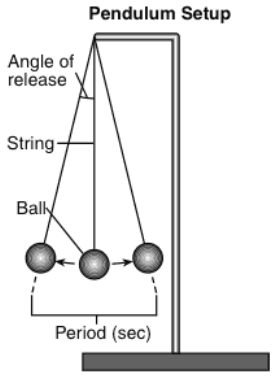
a. Get more confused about their ideas.
b. Use more evidence to confirm patterns and ideas.
c. Prove their ideas 100%.
d. Determine which sources of information are right or wrong.

12. The diagrams below show different trials Abdul carried out with carts. He started the carts from different heights and put blocks that were of equal mass in them. He wants to test this idea: The greater the mass of the cart, the greater its velocity at the bottom of the ramp. Which two trials should he compare?



a. R and U
b. T and W
c. S and T
d. G and T

13. The diagram below shows a ball hung on a string to create a pendulum. The pendulum's period and angle of release are shown. The period is the number of seconds in one complete swing of the pendulum.



Three different investigations were conducted to identify the variable that affects the period of a pendulum:

- Investigation 1: The pendulum was released at different angles. The length of the string and mass of the ball were the same for each angle.
- Investigation 2: Different lengths of string were used. The angle of release and mass of the ball were the same for each length
- Investigation 3: Balls of different masses were used. The angle of release and length of string were the same for each mass.

The data tables below show the results of all three investigations:

Data Tables

Investigation 1	
Angle of Release (°)	**Period** (sec)
20	1.3
17	1.3
15	1.3
13	1.3
10	1.3
5	1.3

Investigation 2	
Length of String (cm)	**Period** (sec)
135	2.4
104	2.1
98	2.0
69	1.7
34	1.3
29	1.2

Investigation 3	
Mass of Ball (kg)	**Period** (sec)
8.0	1.2
7.0	1.2
5.0	1.2
2.0	1.2
1.0	1.2
0.2	1.2

Carefully examine and use the information from all three data tables to identify which variable affects the period of a pendulum.

The variable that affects the length of the period of a pendulum is:

a. The angle of release.
b. The length of string.
c. The mass of ball.
d. All of the above

13a. Explain your answer to question 13 using data from the results of the investigations above.

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