Assessments and Scoring Rubrics for the CAPSI Study of Fifth Graders' Inquiry Science Abilities

TIMSS TEST

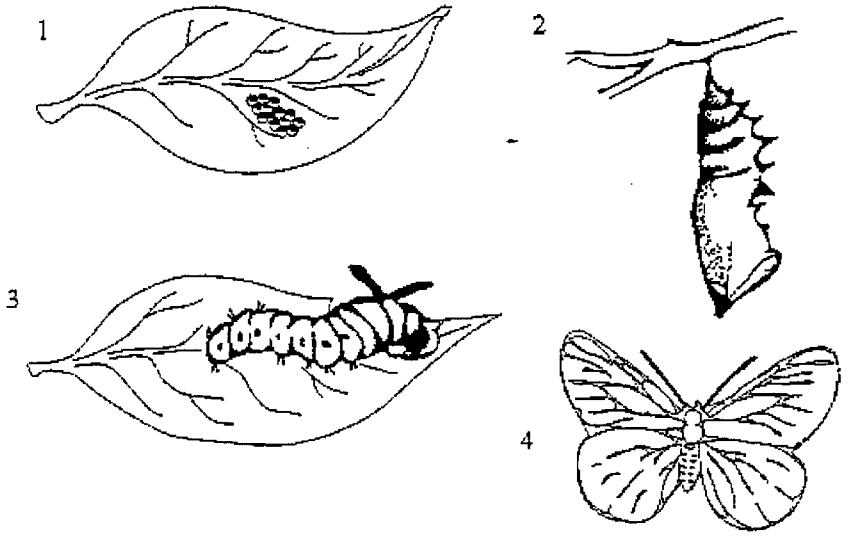
Science

DIRECTIONS (Questions 1-23): Circle the best answer to each question.

1. We can see the moon from the Earth because the moon

   A. is so hot that it glows like the sun
   B. has many volcanoes that give off glowing gas
   C. reflects light from the sun
   D. is made of rocks that give off their own light

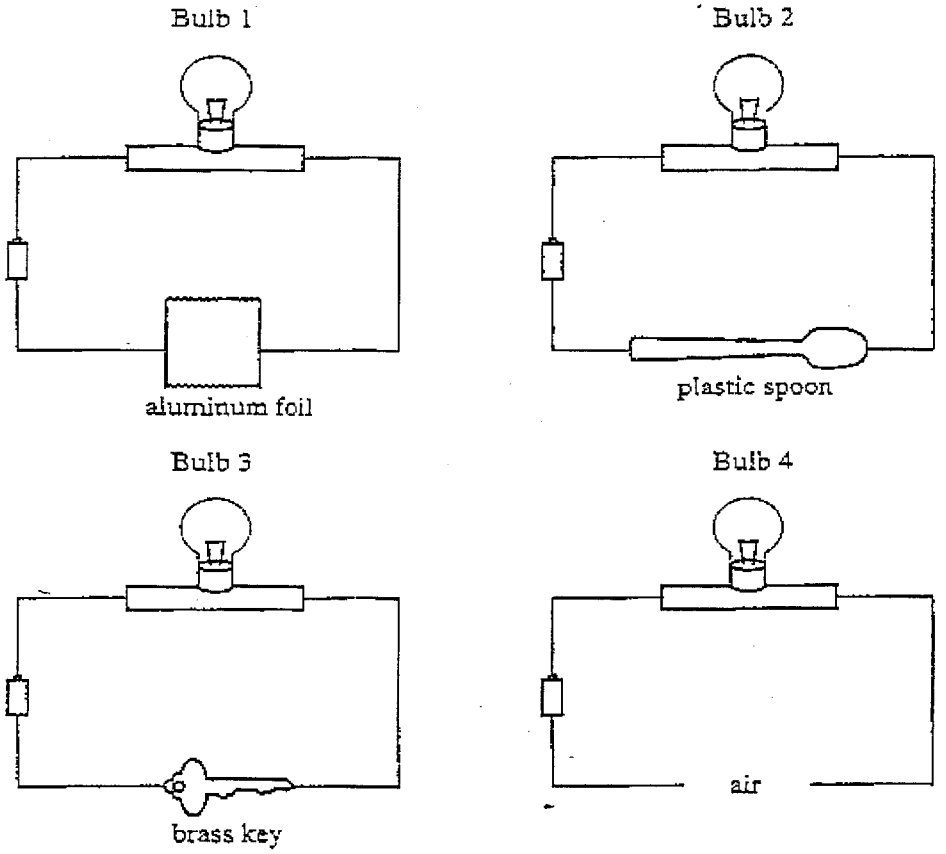
2. A butterfly sitting on a leaf laid some small eggs. The pictures show the changes that took place to the eggs.



In what order did the changes take place?

   A. 1,2,3,4
   B. 1,3,2,4
   C. 1,4,3,2
   D. 1,4,2,3

3. The following diagrams show a battery and a bulb connected by wires to various materials.



Which of the bulbs will light?

A. 1 only
B. 2 and 3 only
C. 1 and 3 only
D. 1,3, and 4 only
E. 1,2, and 3 only

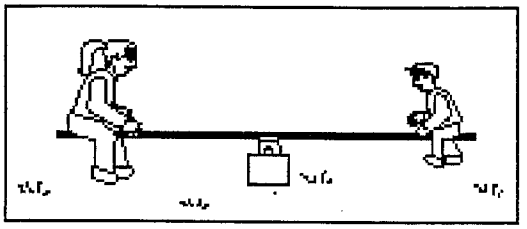
4. To find out whether seeds grow better in the light or dark, you could put some seeds on a piece of damp paper and

A. keep them in a warm dark place.
B. keep them in a warm light place.
C. put them in a light or dark place that is cool.
D. keep one group in a light place and the other in a dark place.

5. A girl wanted to play on a seesaw with her little brother.

Which picture shows the best way for the girl, who weighed 50 kg (kilograms) to balance her brother, who weighed 25 kg?

A.



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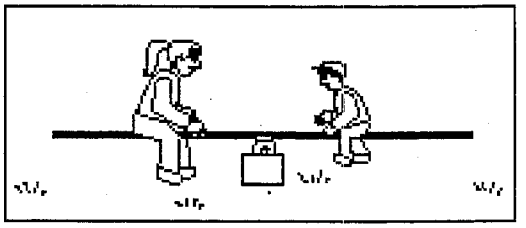

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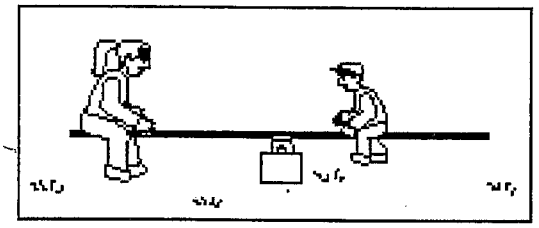

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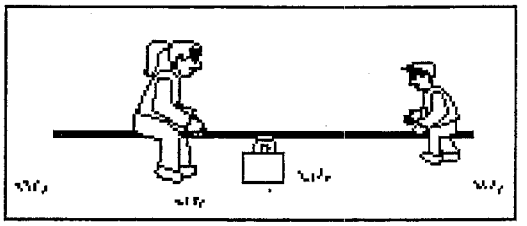


6. The walls of a building are to be painted to reflect as much light as possible. What color should they be painted?

A. Red
B. Black
C. White
D. Pink

7. Which group below contains three mammals?

A. Duck, eagle, robin
B. Cow, human, dog
C. Lizard, snake, turtle
D. Salamander, frog, toad

8. Rain and running water can wash away soil. From which area is soil most likely to be washed away?

A. A sloping area with bushes
B. A flat area with grass
C. A flat area that has no bushes
D. A sloping area that has no bushes

9. 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?

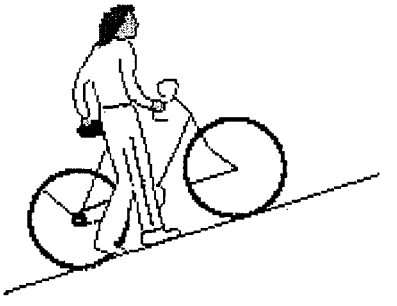
A. "It is flat at one end and round at the other."
B. "It smells like peppermint."
C. "It has a bump on it."
D. "I hope it is candy."

10. Ken put a thermometer in a glass filled with hot water. Why does the liquid inside the thermometer rise?

A. Gravity pushes it up.
B. Air bubbles are released
C. Heat from the water makes it expand
D. Air pressure above the water pulls it up

11. Keisha is pushing her bicycle up a hill. Where does Keisha get the energy to push her bicycle?

A. From the food she has eaten
B. From the exercise she did earlier
C. From the ground she is walking on
D. From the bicycle she is pushing



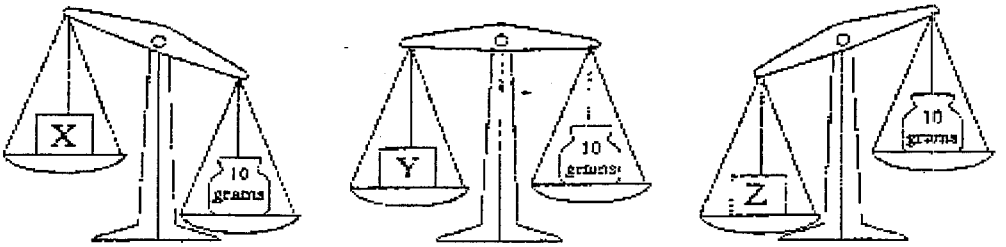
12. Which makes its own light?

A. A mirror
B. A candle flame
C. A diamond ring
D. A magnifying lens

13. A small animal called the duckbilled platypus lives in Australia. Which characteristic of this animal shows that it is a mammal?

A. It eats other animals
B. It feeds its young milk
C. It makes a nest and lays eggs
D. It has webbed feet

14. Which of the boxes X, Y, or Z has the LEAST mass?



A. X
B. Y
C. Z
D. All three boxes have the same mass.

15. Immediately before and after running a 50 meter race, your pulse and breathing rates are taken. What changes would you expect to find?

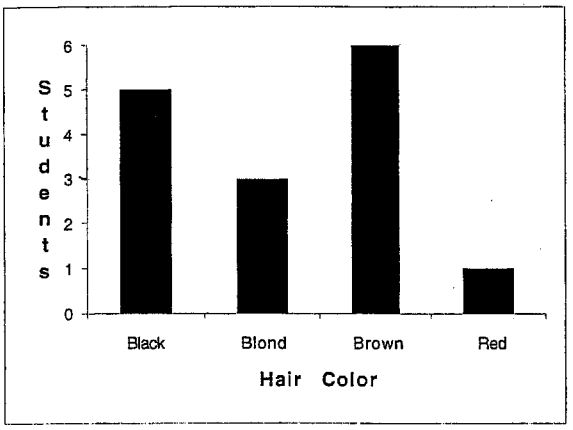
A. No change in pulse but a decrease in breathing rate
B. An increase in pulse but no change in breathing rate
C. A decrease in pulse and breathing rate
D. An increase in pulse and breathing rate
E. No change in either

16. Data about the hair color of fifteen students are shown in the table below.

Hair Color			
Red	Black	Brown	Blond
1	5	6	3

Which of the following bar graphs represents the data shown in the table?

A



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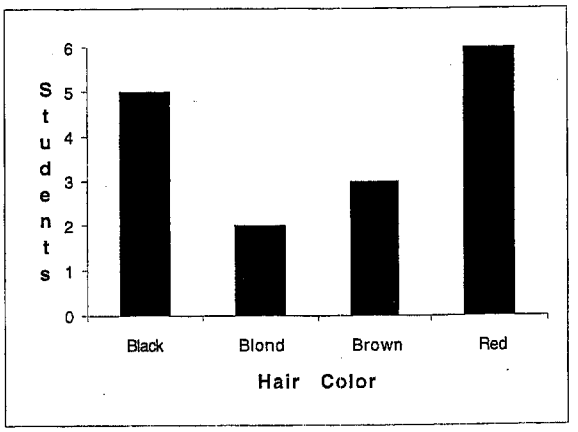

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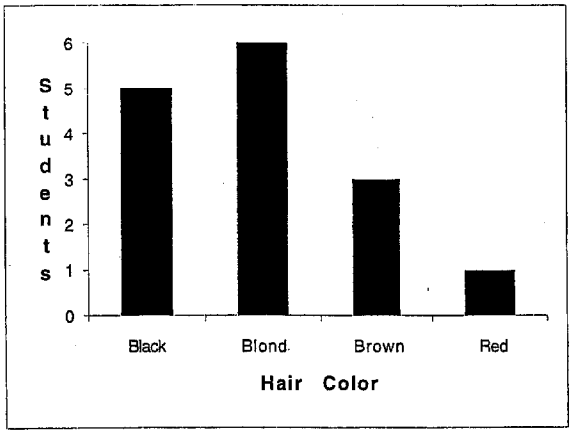

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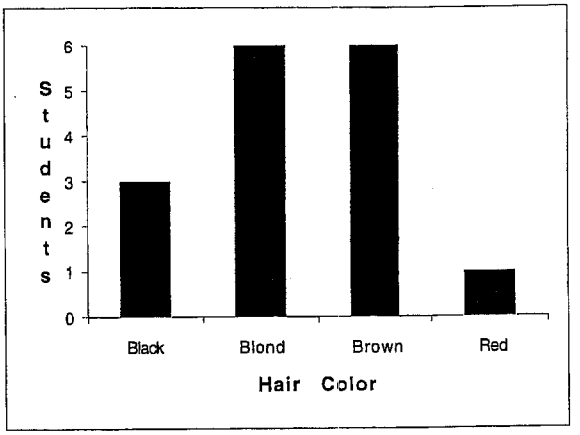


17. John kept some seeds on moist cotton in a dish. Mike put the same kind of seeds in a dish beside John's dish, and covered them with water. After two days, John's seeds sprouted, but Mike's did not. Which is the most likely reason?

A. Mike's seeds needed more air.
B. Mike's seeds needed more light.
C. Mike did not put the dish in a warm enough place
D. Mike should have used a different kind of seed.

18. This table shows the temperature and precipitation (rain or snow) in four different towns on the same day.

	Town A	Town B	Town C	Town D
Lowest Temperature	13°C	-9°C	22°C	-12°C
Highest Temperature	25°C	-1°C	30°C	-4°C
Precipitation (rain or snow)	0 cm	2.5 cm	5 cm	0 cm

Where did it snow?

A. Town A
B. Town B
C. Town C
D. Town D

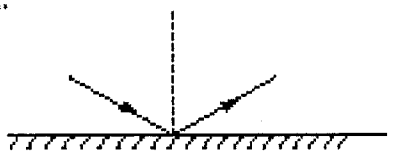
19. Seeds develop from which part of a plant?

A. Flower
B. Leaf
C. Root
D. Stem

20. A beam of light strikes a mirror as shown.

Which picture best shows what the reflected light would look like?

A.



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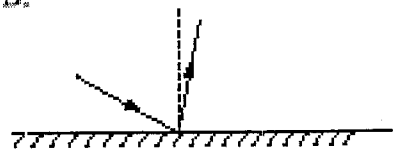

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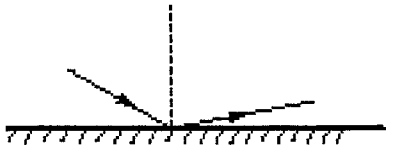

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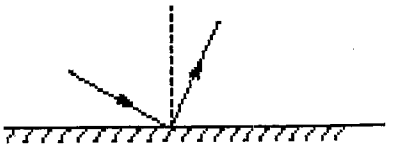
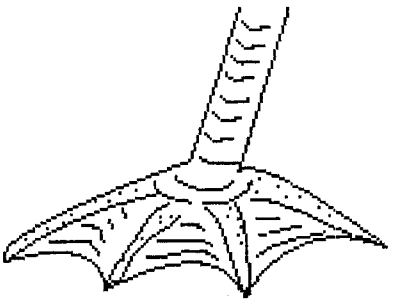


21. This is a drawing of a bird's foot. Where would you MOST likely find such a bird?

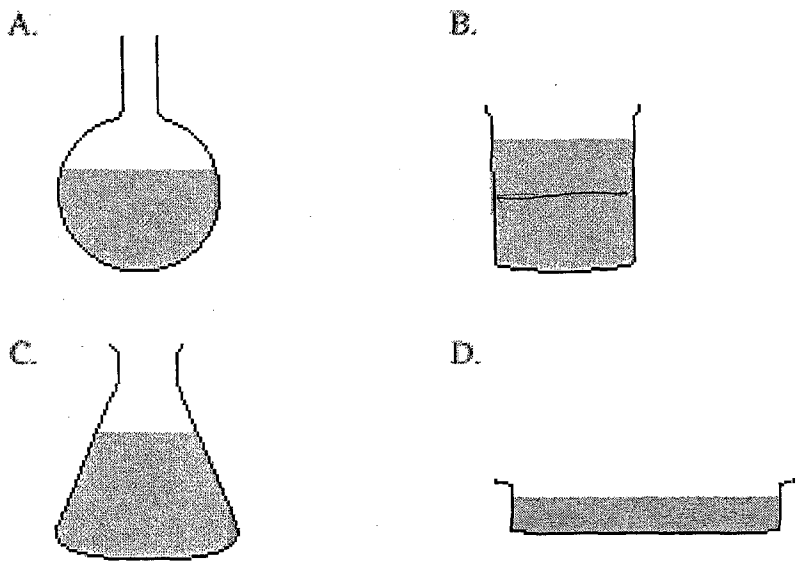
A. a forest
B. a meadow
C. a cornfield
D. a desert
E. a lake



22. Which is not used as an energy source?

A. Flowing water
B. Iron ore
C. Sun
D. Oil

23. A student put 100 ml (milliliters) of water in each of the open containers and let them stand in the sun for one day. Which container would probably lose the most water due to evaporation?



Directions (Questions 24-25): Answer the following questions in the space provided.

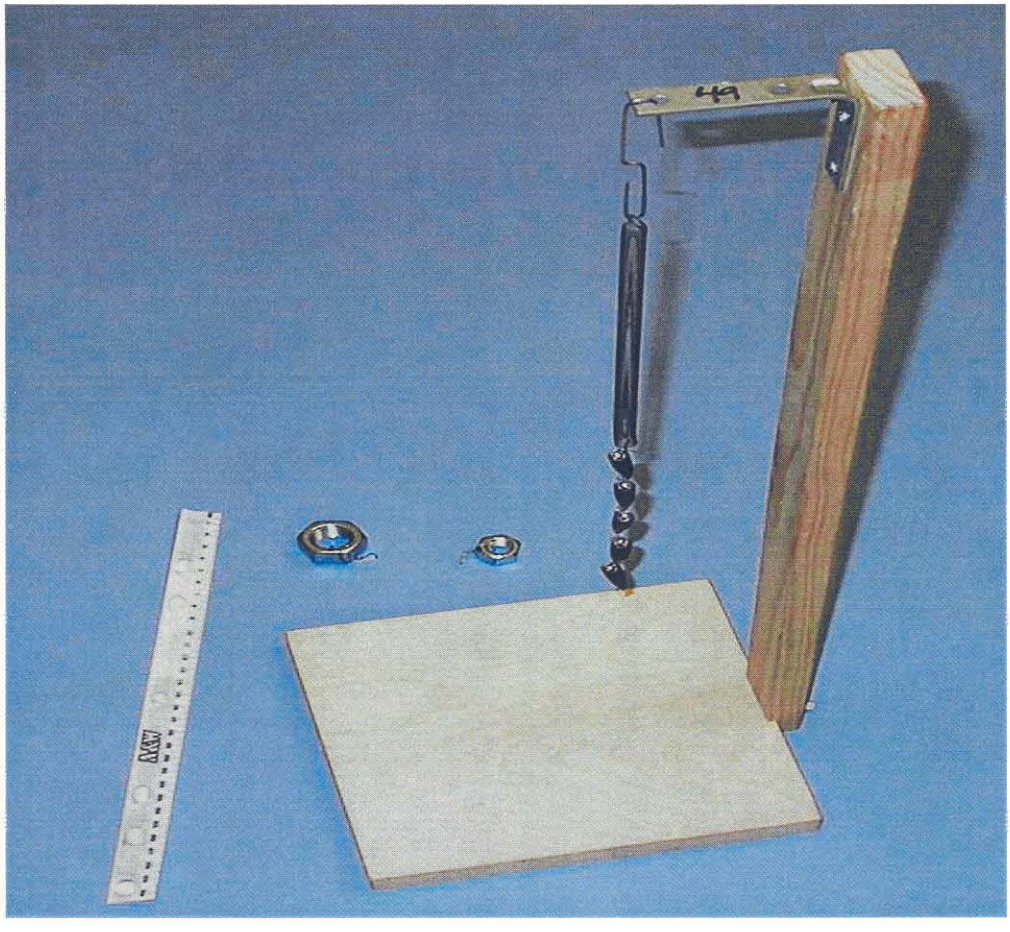
24. The Sun is bigger than the Moon but they appear to be about the same when you look at them from the Earth. Why is this?

25. The weights of three blocks were compared.

Which one of the three blocks weighs the most? (A,B, or C): _____

Explain your answer.

Spring and Weights



Measure how the spring stretches with one to five ten-gram weights hanging from it.

Hang the small nut (25 gm) on the spring and use the data to determine its weight.

Hang the large nut (70 gm) on the spring and estimate its weight.

Name: _____
School: _____
Date: _____

Spring and Weights

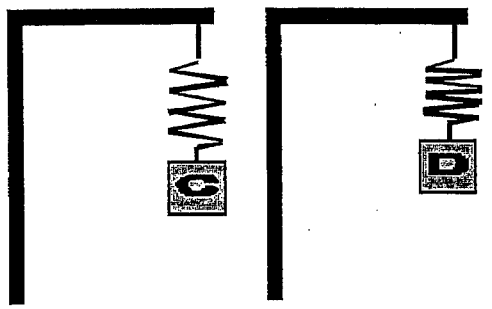
1. Measure the length of the spring as you hang the small weights on it. Record your data in the table below (only measure the length of the spring) Note: **one small weight = 10 grams**.

Number of small weights	Total weight in grams	Length of spring (centimeters)
0	**0**	

2. How much longer does the spring get as each weight is added?

   It gets approximately _____ centimeters longer each time a weight is added.

3. In the following picture, the two springs are the same but the weights are different.



4. Which weight is heavier, C or D? _____
5. Explain your answer:

4. You hung 30 grams (3 of the small weights) on the spring.

How long was the spring? _____ centimeters (check your table)

Now, suppose you hung a 35-gram weight on the spring.

How long would the spring be?_____ centimeters.

5. Remove the small weights and hang the **small nut** from the spring and measure the length of the spring.

The length of the spring for the small nut is _____ centimeters.

6. Find the weight of the small nut (be as accurate as possible)

I think the **small nut** weighs _____ grams.

Explain how you figured out the weight of the **small nut:**

7. Remove the small nut and hang the **large nut** from the spring and measure the length of the spring.

The length of the spring for the large nut is _____ centimeters.

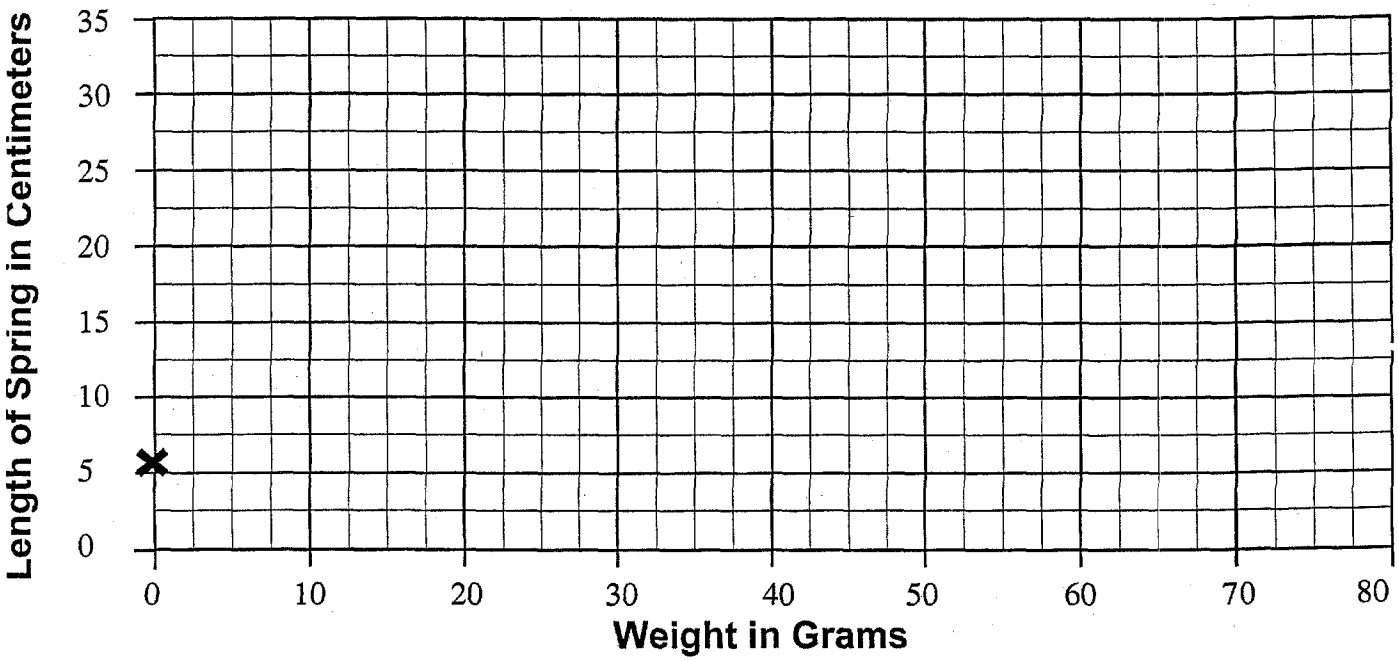
8. Find the weight of the large nut (be as accurate as possible).

I think the **large nut** weighs _____ grams.

Explain how you figured out the weight of the **large nut:**

9. Plot a graph using the data from your table.

X shows where the first point has been plotted for you.



10. Draw a line through the points on your graph.

11. Put an "**N**" on your graph to show the large nut and an "**n**" to show the small nut

Scoring Rubric for Spring Investigation

There are 11 items. Student performance on the three graphing questions was astonishingly bad, and it was decided not to try to score it. Questions 2,3, and 5 were meant to prompt thinking and were not awarded points.

A score of 1 is a good answer; 2 is acceptable; 3 is sometimes acceptable but not as good as 2.

Item, Score	Points	Description
1b,1 or 2	2	Accuracy of data in the table.
4b,1	3	Exactly halfway between 3 and 4 weights in the table
4b,2	2	Between 3 and 4, but not halfway.
6a,1 or 2	4	Weight of small nut between 20 and 30. Actual weight was 25
6b,1	3	Well articulated explanation.
6b, 2 or 3	2	Vague, or with a math mistake.
8a, 1 or 2	6	Weight of large nut between 65 and 85 gm. Or consistent with a systematic error in data table.
8a, 3	3	Weight of large nut greater than 50 gm
8b, 1	3	Well articulated explanation
8b, 2 or 3	2	Vague, or flawed but reasonable.
Max. total	21	

Paper Towels

Which of three paper towels can soak up the most water and which the least?

Develop your own method and use whatever equipment you need.

Name: _____
School: _____
Date: _____

Paper Towels

You should now have some equipment and 3 types of paper towels that we will call

- Pink
- Blue
- Plain White

Your task is to use the equipment to conduct a ***scientific experiment*** to answer these questions:

Which paper towel can soak up or absorb the MOST water?
Which paper towel can soak up or absorb the LEAST water?

YOU ARE NOT STUDYING WHICH ONE IS THE STRONGEST.

Think first before you start working. How can you find the answer with the equipment you have? You don't have to use all of the equipment. When you are finished you will be asked to write what you did so one of your friends can repeat the experiment exactly as you did it.

A. Use this space to take notes on what you did (so you can explain it later):

B. Results

1. Which paper towel soaked up or absorbed the **MOST** water? (circle one)

Pink **Blue** **Plain White**

How did you know?

2. Which paper towel soaked up or absorbed the **LEAST** water? (circle one)

Pink **Blue** **Plain White**

How did you know?

C. Steps in Experiment:
Write what you did so one of your friends can repeat the experiment exactly as you did it. (use the back of this page if you need to)

D. Questions

1. **Circle the letter for what you did.**
   a. wet a spot in the middle of each towel
   b. wet each towel completely
   c. cut pieces of the towels and wet each piece completely
   d. wet the three towels in different ways

2. **Check which of the following you used and describe how you used it.**

- ☐ Graduated plastic cup_____
  _____
- ☐ Measuring cup_____
  _____
- ☐ Weighing scale _____
  _____
- ☐ Ruler_____
  _____
- ☐ Dropper_____
  _____
- ☐ Plastic Box or Lid_____
  _____
- ☐ Anything else that helped_____
  _____

Scoring Rubric for Towels Investigation

There are six items, holistically scored from the all the information on the student's writeup:

A. Method for wetting the towel.
B. Saturation of towels
C. Appropriate measurement
D. Correctness of Result
E. Writeup of the experiment
F. Reporting of measurements

The numerical rating of the item in the table below is the quality of the response, 1 good, 2 acceptable, except for C, where there were four different good methods, any of which got full credit, and 1/3 credit was given for controlled use of a poor method.

Item, Score	Points	Description
A,1 or B,1	3	Method or saturation led to complete wetting of all the towels.
C,1-4	3	Appropriate Measurement. One of four conceptually correct ones.
C, 5	1	Consistent work with a poor method
D, 1	2	Correctness of results, most and least absorbent; but least could be either of two.
E, 1	2	Writing, with explicit description of all the steps
E, 2	1	Writing, with minor omissions
F, 1	1	Reporting, using numerical data
Max. Total	11	

Melting Ice Cubes

DAY 1:

Compare how fast ordinary ice cubes melt in fresh or salt water.

What might explain the difference?

Use colored ice cubes and observe the colored melt water.

Does this help explain the difference?

DAY 2:

Experiment with dropping colored fresh and salt water from eyedroppers into fresh and salt water. Observe the melting of colored ice cubes with stirring.

DAY 3:

Review all your data

Make a final hypothesis about the reason for the difference in melting time observed in Day 1.

Design a your own melting time experiment, do the experiment, and interpret the result.

Name: _____
Partner: _____

Melting Ice Cubes: Day 1

Part 1—What affects how fast an ice cube melts?

1. You know that when you put an ice cube in a cup of water it melts. But sometimes it melts faster and sometimes slower. For each of the following things, circle if you think it would make the ice cube melt **faster** or **slower**:

Warmer water	faster	slower
Larger ice cube	faster	slower
Bigger cup of water	faster	slower
Stirring the water	faster	slower
Blowing on the cube	faster	slower
Salt in the water	faster	slower

2. Explain your answer for the **salt water** – how would the salt affect the melting of the ice cube?

Part 2—Melting Ice Cubes in Regular Water and Salt Water

You will now compare ice cubes in regular water and salt water.

3. When the instructor places an ice cube in your cup, **immediately start your timer** (the ice cubes are made from regular water).

DO NOT STIR YOUR WATER OR MOVE YOUR CUP

4. While the ice cubes are melting, watch the shape of the cubes. Did the two ice cubes have the same shape as they melted?
   Describe the shape of the ice cubes here (write draw a picture):

5. Measure how long it takes for your cube to melt completely and record this melting time below. Also record your partner's melting time.

	REGULAR WATER	SALT WATER
MELTING TIME		

6. What did you find out from your measurements?

7. Why do you think this happened?

Part 3—Melting COLORED Ice Cubes

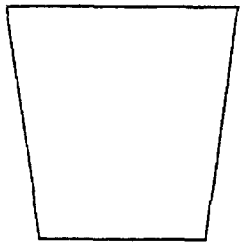
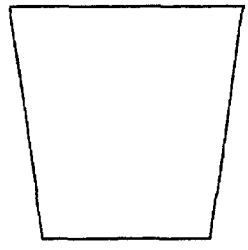
Food coloring in the ice cubes will help you understand what is happening.

8. Repeat the experiment exactly like you did in Part 2, this time with colored ice cubes.

DO NOT STIR YOUR WATER OR MOVE YOUR CUP

9. While the cubes are melting, look through the SIDES of the cups and notice the differences in how the cubes are melting.

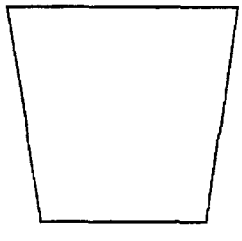
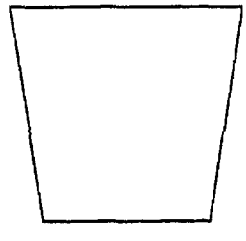
USE ARROWS TO SHOW THE DIRECTION THE COLORED WATER IS MOVING.

Draw a picture of what you see happening in the **REGULAR WATER** as the cube is melting.	Draw a picture of what you see happening in the **SALT WATER** as the cube is melting.
	

10. Record the melting times.

	REGULAR WATER	**SALT WATER**
MELTING TIME		

11. After the cubes have completely melted, look through the SIDES of the cups and notice the differences in the coloring of the water.

Draw a picture of what you see in the cup of **REGULAR WATER.**	Draw a picture of what you see in the cup of **SALT WATER.**
	

Questions about the colored ice cubes:

12. In the cup of REGULAR WATER, the colored regular water from the melting ice cube: (cirle one)

    A. mixed in. B. stayed on top. C. sank to the bottom.

13. In the cup of SALT WATER the colored water: (cirle one)

    A. mixed in. B. stayed on top. C. sank to the bottom.

14. Why did the ice cubes melt differently? Give your best explanation:

Name: _____
Partner: _____

Melting Ice Cubes: Day 2

Part 1—Drops of Water

You and your partner will be given a cup of regular water, a cup of salt water, a cup of colored regular water and a cup of colored salt water. You will be doing the observations together.

1. Fill a dropper with **colored regular water**. Carefully and gently squeeze a few drops into the **cup of salt water**.
   At eye level, LOOK THROUGH THE SIDE OF THE CUP and immediately observe what happens to the colored drops.
   - Describe what happens:

2. Fill a dropper with **colored salt water**. Carefully and gently squeeze a few drops into the **cup of regular water**.
   - Describe what happens:

(RAISE YOUR HAND TO GET FRESH WATER BEFORE YOU GO ON TO THE NEXT QUESTION)

3. Fill a dropper with **colored REGULAR water**. Carefully and gently squeeze a few drops into the **cup of REGULAR water**.
   - Describe what happens:

4. Fill a dropper with **colored SALT water**. Carefully and gently squeeze a few drops into the **cup of SALT water.**
   - Describe what happens:

Questions about the experiments you just did. Circle the best answer.

5. What did the DROPS OF COLORED **REGULAR** WATER do when you put them into the CUP OF **SALT** WATER?

   A. They sank to the bottom. B. They floated on top. C. They mixed in.

6. What did the DROPS OF COLORED **SALT** WATER do when you put them into the CUP OF **REGULAR** WATER?

   A. They sank to the bottom. B. They floated on top. C. They mixed in.

7. What did the DROPS OF COLORED **REGULAR** WATER do when you put them into the CUP OF **REGULAR** WATER?

   A. They sank to the bottom. B. They floated on top. C. They mixed in.

8. What did the the DROPS OF COLORED **SALT** WATER do when you put them into the CUP OF **SALT** WATER?

   A. They sank to the bottom. B. They floated on top. C. They mixed in.

9. Which statement is true?

   a. Regular water is heavier than salt water.

   b. Salt water is heavier than regular water.

   c. Regular water and salt water are equally heavy.

Part 2—Melting in Stirred Regular Water and Stirred Salt Water

You and your partner will now compare the melting of ice cubes in stirred regular water and stirred salt water. You and your partner should choose who will measure the cube in the **REGULAR WATER** and who will measure the cube in the **SALT WATER.**

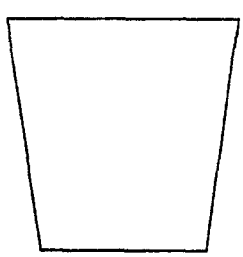
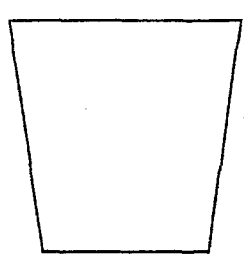
10. When the instructor places a colored ice cube in your cup, immediately start the timer.

    As you measure the time it takes for your cube to melt, **GENTLY STIR** your liquid until the ice cube melts completely and record your melting time below.

	REGULAR WATER	**SALT WATER**
MELTING TIME		

11. Does stirring make the ice cubes melt faster or slower? **Faster** **Slower**
    Why do you think this is?

12. **AFTER** the cubes have completely melted,

Draw a picture of what you see in the cup of **REGULAR WATER.**	Draw a picture of what you see in the cup of **SALT WATER.**
	

13. Are these the **SAME AS** or **DIFFERENT FROM** the pictures you drew on DAY 1?
    Why do you think this is?

Name_____

Melting Ice Cubes: Day 3

Part 1—Review and Explanation

You have studied ice cubes for 2 days. LOOK BACK OVER YOUR RESULTS!

1. Compare these situations: **circle** the case for which an ice cube melts **FASTER.**

A. Regular water **without** stirring (DAY 1)

B. Regular water **with** stirring (DAY 2)

C. ABOUT THE SAME

What is kept the same in this comparison?

What is changed in this comparison?

2. Compare these situations: circle the case for which an ice cube melts **FASTER.**

A. Salt water **without** stirring(DAY 1)

B. Salt water **with** stirring (DAY 2)

C. ABOUT THE SAME

What is kept the same in this comparison?

What is changed in this comparison?

3. Compare these situations: circle the case for which an ice cube melts **FASTER.**

A. Regular water **with** stirring (DAY 2)

B. Salt water **with** stirring (DAY 2)

C. ABOUT THE SAME

What is kept the same in this comparison?

What is changed in this comparison?

4. Compare these situations: circle the case for which an ice cube melts **FASTER**.

A. Regular water **without** stirring (DAY 1)

B. Salt water **without** stirring (DAY 1)

C. ABOUT THE SAME

What is kept the same in this comparison?

What is changed in this comparison?

5. Give an **explanation** for question #4 - the choice you made between regular water and salt water (without stirring). Why does **salt** change the melting time?

6. We have tried changing the kind of water, and we tried stirring the water. This is called changing a variable. What else (what other variables) could you change?

7. What do you think would happen if we melted an ice cube in sugar water? (would it take shorter or longer than regular water)

8. What do you think would happen if we used more water or less water to melt the ice cube?

Part 2—Design Your Own Experiment

Now that you and your partner have studied the melting of ice cubes in regular water and salt water, we want you to **think of an experiment** that will tell you more about the melting of ice cubes. We have provided the following:

- Ice cubes
- Three different containers (5 ounce cup, 16 ounce cup and 16 ounce bowl)
- Regular water
- Salt water
- Carbonated water
- Timers
- Stirrers

You must make up an experiment to measure the time it takes to melt two ice cubes.

9. What question will your experiment answer?

10. Tell us about your procedure by filling in the blanks for each cup. You choose which variables to change and which to keep the same.

My Experiment:

Cup A	Cup B
Kind of water:	Kind of water:
Container:	Container:
Stirred or non-stirred:	Stirred or non-stirred:

11. Predict which cup with take the longest to melt the ice cube.
(circle one)

CUP A **CUP B**

What is the main reason for your prediction?

12. Obtain your ice cubes and waters and do your experiment. As the ice cubes melt, record your observations here (draw a picture if it helps):

13. What were your melting times? Fill in the blanks.

The ice cube in **Cup A** melted in _____ minutes _____ seconds.

The ice cube in **Cup B** melted in _____ minutes _____ seconds.

14. How can you explain your results?

15. Explain how what you discovered today connects to what you learned the other two days.

Scoring Rubric for Ice Cubes Investigation

Many items during the three days were scored but not awarded points, if they were judged to be simply preparatory.

	Item , Score	Points	Description
Day 1	9 a and b, 1	1	For each of six good drawings.
	11a, 1 or 2	1	Good regular water drawing
	11b, 1	1	Good salt water drawing
	14, 1, 2, or 3	4	An explanation that mentions the segregation and/or temperatur differences. Or some other plausible effect of salt.
	Max. total 12, weight = 1		
Day 2	5-8	1	For each correct observation
	9	3	T-F, correct interpretation of density difference
	11b, 1 or 2	3	Effect is due to motion of liquid.
	Max. total	10, weight = 1.5	
Day 3			
	Q1-4, b and c	1	Correct variables the same and changed
	5,1	4	Answer that mentions segregation and temperature difference
	5,2	2	Measures segregation or temperature difference, or salt is heavier.
	9, 1 or 2	2	Articulate, and experiment is controlled (one variable changed)
	9, 3	1	Vague question
	10, 1	7	Experiment is controlled and matches the question
	10, 2	5	Experiment is controlled but does not match the question
	11b, 1	2	Mentions both cause and effect
	11b, 2	1	Cause only.
	14, 1 or 2	2	What happened and why.
	Max. total	25 , weight = 1.5	

Total score: The weighted day scores were added and normalized to a maximum of 10 pts for the maximum possible score of 64.5. Day 3 is weighted more than half.

Flatworms

DAY 1:

Observe the structure and behavior of the flatworms and make labeled drawings.

Perform and interpret an experiment to try to determine whether the worms prefer to be in the light or the dark.

DAY 2:

Observe and record eating behavior.

Design an experiment to try to find out which of three foods the worms prefer.

DAY 3:

Do your experiment, recording procedures and data, and interpret the results.

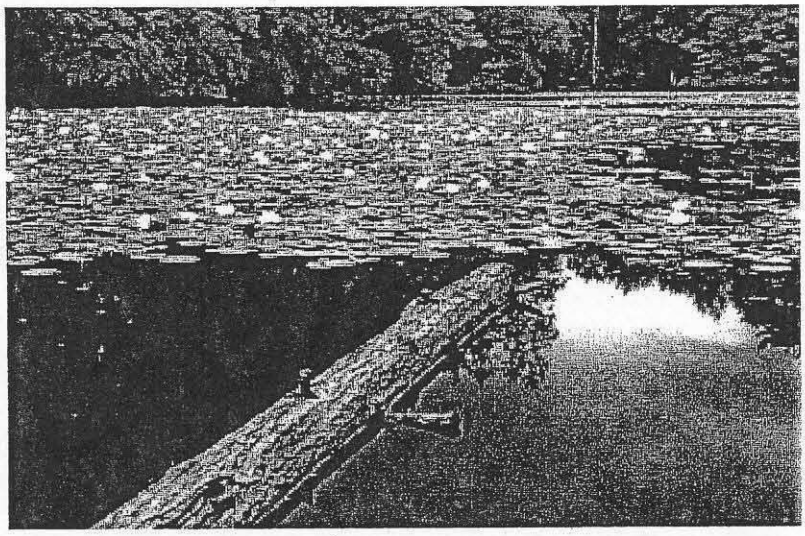
Name:_____

Partner:_____

Flatworms Activity

Day 1

There are many different kinds of worms in nature. Some worms live in the soil like the common earthworm, some have a sucker and feed on blood like the leech, and others are smooth and round like spaghetti but must live inside another animal.



Today you will be looking at a **FLATWORM**. Flatworms are found in freshwater lakes, streams or in ponds like this picture. By studying the behavior of the flatworm in the classroom, you may be able to better understand its habits out in the wild. Over the next three days you will observe the flatworm and do some experiments to find out more about this interesting worm. It is very important that you do careful observations and take detailed notes like a scientist.

1. Try to tell us at **least three things** that you know or have heard about worms:

2. Look at the worms in the magnifying box.
   a. Have you ever seen a worm like this before? (circle one)
      YES NO *(go to question 3)*

   b. If yes, where did you see it and what was it doing?

3. Watch your worms for one minute. See if you can get them to move.
   a. What kinds of shapes do you seen the flatworms take?

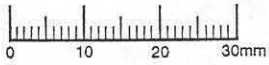
   b. Why would a flatworm change its shape?

   c. Describe the different types of movements you see. Try to describe how the flatworm moves – be as specific as you can:

4. a. Draw one or both of the worms in the space below. Make your drawing LARGE (much larger than real size) with LOTS OF DETAIL. Do not draw the magnifying box.

   b. Label any parts that you see.

5. Pick one worm to observe for one minute. Tap or shake it to get it to move or change shape. Use the ruler below to measure (as accurately as possible) how short and how long this worm can get?



a. The length of my flatworm is at its longest: _____ at its shortest: _____

b. Approximately how much bigger is your picture than the real flatworm?_____

6. Based on your observations, does the flatworm have a head? YES NO

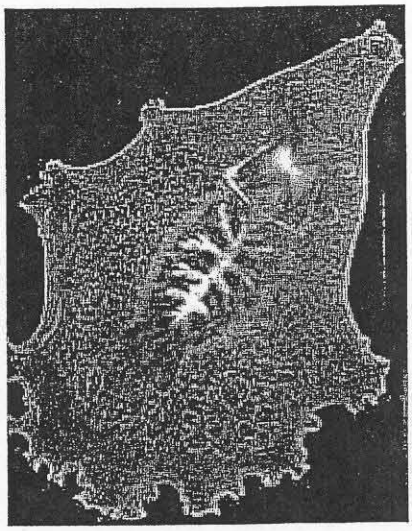
What evidence do you have for this?

7. Compare your flatworms to your partners.
   a. How are their flatworms LIKE yours?

   b. How are their flatworms DIFFERENT?

8. A group of scientists think they have discovered a new type of worm (picture) – but other scientists disagree saying it is just a flatworm.

   What other information would you need to decide?



10. **Light and Dark Experiment.** Now get the RED TIMER, and practice using it for the next activity. When you know how to use the timer, take a look at the long tube that has two flatworms in it.

- Move the flatworms to the black line in the middle of the tube as best you can, by moving the bubble up and down.
- WHEN the flatworms are near the black line, place the tin foil around half of the tube to make it dark.

PLACE THE TUBE ON YOUR WHITE TRAY

Do not touch it - just observe the worm.

- Begin your timer. Do not stop your timer for the next 10 minutes.
- While you are timing, complete the data table below.

DATA TABLE

TIME PASSED	LOCATION OF FLATWORM #1. Circle your answer.		LOCATION OF FLATWORM #2. Circle your answer.	
1 minute	Dark	Light	Dark	Light
2 minutes	Dark	Light	Dark	Light
3 minutes	Dark	Light	Dark	Light
4 minutes	Dark	Light	Dark	Light
5 minutes	Dark	Light	Dark	Light
6 minutes	Dark	Light	Dark	Light
7 minutes	Dark	Light	Dark	Light
8 minutes	Dark	Light	Dark	Light
9 minutes	Dark	Light	Dark	Light
10 minutes	Dark	Light	Dark	Light

11. Why did you have to wait until the flatworms were near the black line on the tube before adding the tin foil?

12. How many total minutes did the flatworms spend in the **dark**? What percentage of the total time is this?

    Flatworm 1 _____**minutes** which is _____ % of the total time

    Flatworm 2 _____**minutes** which is _____ % of the total time

13. If you left the flatworms overnight, which side would you expect to find them in in the morning?

    LIGHT side DARK side

    Explain your reasoning:

14. If you were hunting for flatworms in a pond, where would you look?

    Explain your reasoning:

Name:_____

Partner:_____

Flatworms – Day 2

Today you are going to examine how a flatworm eats. Flatworms eat in a very unusual way. You will have to make careful observations to figure out how they eat. In the wild, flatworms feed on algae and rotting plants and animals, but they will eat other foods too. First we will experiment with **egg yolk.**

1. Do you think that flatworms will eat the egg yolk? YES NO
   Explain your reasoning:

2. Get a magnifying box with two flatworms. Add a very small piece of egg yolk. Observe how the flatworms 'eat' with the hand lens. Describe what you see in the space below. USE AS MUCH DETAIL AS YOU CAN.

   HINT: here are some things to notice:
   - The color of the flatworms before and after eating
   - How long it takes for the worms to realize there is food
   - How much time the flatworms spend eating
   - How they eat

   Enter your observations here:

3. Did your flatworms eat the egg yolk? YES NO COULDN'T TELL

4. How long did it take the flatworms to discover their food?_____

5. How do you think a flatworm knows that there is food?

6. What else would you want to find out about the flatworms?

7. What other types of food do you think a flatworm would eat? (give reasons for your answers)

Name:_____

Flatworms – Experimental Design

Now we want you to **design an experiment** to find out what types of food a flatworm will eat. We have several different types of food for you to test: egg yolk, cheese, tomato, lettuce, chicken, and liverwurst. **Choose three types of food to test.** You will have at least four worms, and a large flat dish to conduct your experiment in.

1. Describe the steps in your experiment and what you will look for:

2. What things will you measure in the experiment?

3. Write the experimental question that you are trying to answer:

Name:_____

Flatworms – Day 3

Now we want you to conduct the experiment that you designed yesterday. Get the food that you need.

1. Write the names of the food you are testing: _____
   _____
   _____

2. Which type of food do you **predict** the worms will like best?_____
   Explain your reasoning:

3. Now conduct your experiment as scientifically as possible.
Use this space to **take notes** and **record your measurements**:

4. Write the steps in your experiment:

   Write what you did so one of your friends can repeat the experiment exactly as you did it.

5. Which food do the flatworms seem to prefer (or like the best)?

6. What evidence (reasons or facts) do you have that the flatworms prefer the food you named in question (5) above?

7. Did you measure anything during your experiment? YES NO
   If "yes," describe what you measured.

8. Did you learn anything else about flatworms during your experiment?

9. Describe any problems you might have had conducting your experiment.

10. How would you improve your experiment if you could do it over again?

11. Describe another experiment you might like to do with the flatworms.

Scoring Rubric for Worms Investigation

Many items over the three days were not awarded points, and were judged to be simply preparatory.

	Item, Score	Points	Description
Day 1			
	3a, 1-3	1	One or two shapes, or that worm didn't move.
	3b, 1,2	1	Reasonable and plausible answer
	4a, 1 or 2	2	At least two features correctly drawn
	4a, 3	1	One feature correctly drawn
	4b, 1 or 2	2	Two or more appropriate labels
	4b, 3	1	One appropriate label
	5a, 1	4	Two good measurements
	5a, 2	2	One good measurement
	5b, 1 or 2	2	A reasonable ratio or size difference
	6b, 1	2	A good reason
	7ab, 1	2	A similarity and a difference
	7ab, 2,3	1	One similarity or difference, or confused
	10,1	2	At least 7 minutes of data
	11, 1	4	For a fair test.
	11, 2	2	Somewhat reasonable for a comparison
	12, 1 or 2	4	Both minutes and one or two per cents correct
	12, 3 or 4	1	Only one minute and %, or both minutes
	13a,1	1	Correct based on data
	13b,1	3	Refer to the experimental data
	13b,2	1	" "
	14a, 1 or 2	2	A dark place.
	14b, 1	3	Refers to data
	Max. total	35	
Day 2			
	2, 1-3	2	Good observations
	5, 1 or 2	1	Explanation with evidence, or a sensory hypothesis
	Expt Des 1, 1	4	Clear plan with at least three steps
	Expt Des 1, 2	2	Vague plan, two steps
	Expt Des 2, 1	4	One or more feasible measurements
	Expt Des 2, 2	2	One or more hypothetical measurements

	Expt Des3,1,2	2	Valid experimental question
	Max total	13	
Day 3			
	3, 1	4	At least one reference per food, and a time measurement or other support for what they say
	3, 2	2	Vague and incomplete
	3, 3	1	Reference to one food and one measure
	4, 1	4	Three clearly stated steps: setup, measurement/observation, and recording
	4, 2	2	Not complete
	4, 3 or 4	1	One step or vague
	6, 1	4	Clear evidence
	6, 2	2	Reference to data
	7, 1 or 2	2	Measured time
	9, 1	2	Reasonable problem and a plausible improvement
	9, 2 or 3	1	Reasonable problem and no improvement, or an improvement alone
	Max total	16	

Total Score: Weight each day equally to give 3.33 maximum points and add to get total score with a maximum of 10.