

## Water Regulation Task Information

**Subject:** Biology

**Content:**

- MST Framework - Standard 4 - The living environment
- Regents Biology Syllabus - Unit II - Maintenance in living things

**Format:** Paper/Pencil

**Purpose:** To interpret graphical data about cells in different solutions.

**Skills:**

**Primary:** Observing, Interpreting data

**Secondary:** Generalizing/Inferring, Predicting

**Time:** 20 - 30 Minutes

**Materials:** Task Sheet

**Preparation:** None

**Safety:** N/A

**Extensions/Modifications:** None

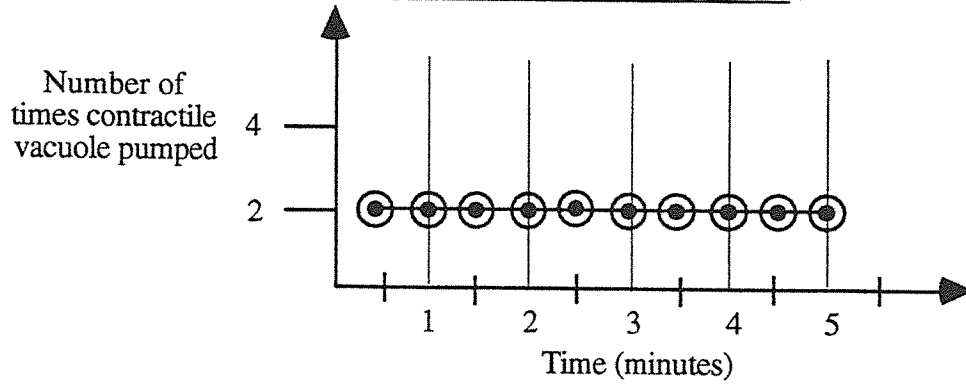
# Water Regulation

**Task:** At this station, you will be interpreting data presented in graphs.

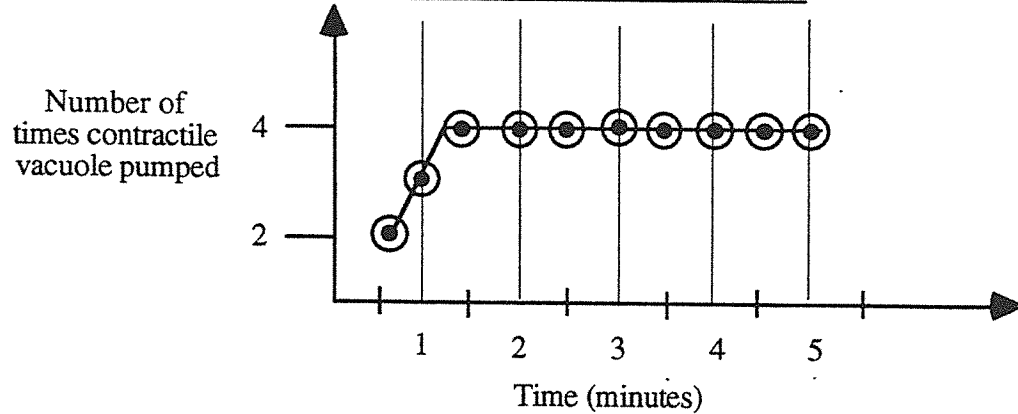
## Background

Paramecia are found in stagnant pond water. Excess water is regularly removed from these organisms by the pumping action of contractile vacuoles. Paramecia were placed in 3 different solutions: Pond water (containing 95% water and various dissolved materials), Solution A, and Solution B. While observing a contractile vacuole using the high power magnification (400x) of a microscope, a student counted, in 30 second intervals, the number of times the contractile vacuole pumped water out of the cell and repeated his counts in the three solutions. The results are presented in the graphs below:

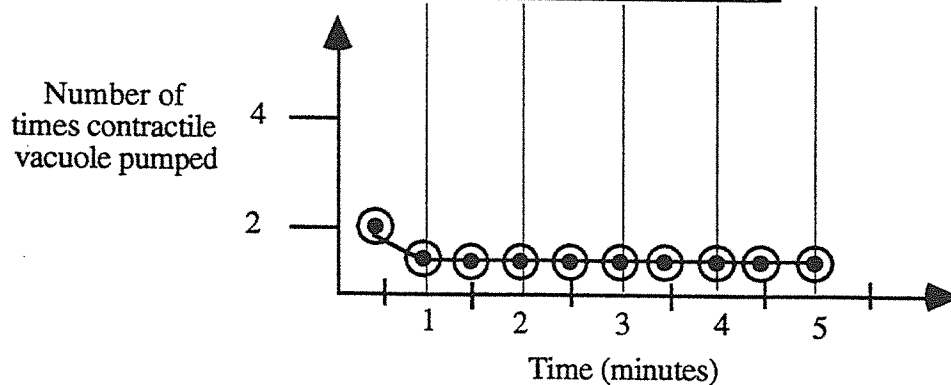
**Paramecium In Pond Water**



**Paramecium In Solution A**



**Paramecium In Solution B**



**Please Continue on the Next Page**

Base your answers to the following questions on these graphs.

1. Using complete sentences describe your observations of the behavior of the contractile vacuole in each solution:

A. Pond water: \_\_\_\_\_

\_\_\_\_\_

B. Solution A: \_\_\_\_\_

\_\_\_\_\_

C. Solution B: \_\_\_\_\_

\_\_\_\_\_

2. Think about the relationship between the concentration of dissolved materials in the two solutions and pond water. Use the following terms to complete the two statements below.

Same as OR Greater than OR Less than

A. The concentration of solution A was \_\_\_\_\_ the concentration of pond water.

B. The concentration of solution B was \_\_\_\_\_ the concentration of pond water.

3. What would you add to Solution A to restore the vacuole contraction to the same rate as in pond water?

\_\_\_\_\_

4. Using complete sentences suggest an explanation to your answer to question 3:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. Using complete sentences what would you add to Solution B to restore the vacuole contraction to the same rate as in pond water.

\_\_\_\_\_

6. Using complete sentences suggest an explanation to your answer to question 5.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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7. What will happen to a paramecium if the contractile vacuole failed to remove the excess water.

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8. Using complete sentences explain how you have reached your prediction in question 7.

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9. Name two (2) biological processes which take place in this investigation.

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# Water Regulation - Scoring Rubric

Maximum score - 24 points

## 1. Observations 9 points total

Allow 1 point for each of the following components

- Correct rate of contraction
- Indication of no change over time
- answer is correct and in a complete sentence

### 1A. Pond Water 3 points total

Sample of acceptable answer for 1A

~ The contractile vacuole pumped twice per 30 second interval the whole time.

### 1B. Solution A 3 points total

Sample of acceptable answer for 1B

~ The contractile vacuole initially pumped 2 times per 30 second interval. This rate increased to 4 times per 30 second interval and then remained constant.

### 1C. Solution B 3 points total

Sample of acceptable answer for 1C

~ The contractile vacuole initially pumped 2 per 30 second interval. This rate decreased to 1 time per 30 second interval and then remained constant.

## 2. Relationship between water concentration 2 points total

Allow 1 point for part A and 1 point for part B.

2A. The concentration of material in Solution A was **less than** pond water.

2B. The concentration of material in Solution B was **greater than** pond water.

## 3. What would you add to Solution A? 1 point total

- Allow 1 point if the student states that a solute, such as salt, could be added to solution A to restore the vacuole contraction to the same rate as in the pond water.

## 4. Explanation of answer to question #3 3 points total

Allow 1 point for each of the following;

- States or implies correct relationships between water and amount of solute.
- States or implies correct relationships between concentration of solute and activity of contractile vacuole.
- Answer is correct and in complete sentences

Sample of Acceptable answer:

~ would add solute to the solution in order to increase the concentration of solute. This would decrease the concentration of water and the paramecium wouldn't have to pump as often.

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**5. What would you add to Solution B? 1 point total**

- Allow 1 point if the student states that a solvent, such as water, could be added to solution B.
- 

**6. Explanation of what would add to Solution B 3 points total**

- Allow 1 point for each of the following;
    - states or implies the correct relationship between concentration of water and the amount of solute in a solution.
    - States or implies the correct relationship between concentration and the activity of the contractile vacuole.
    - Answer is correct and in complete sentences
- 

**7. Prediction if the contractile vacuole failed 1 point total**

- Allow 1 point if the student states or implies that the paramecium becomes non functional;. ( i.e. Dies or bursts)
- 

**8. Explain your prediction in question #7 2 points total**

- Allow 1 point if the student includes the following components;
    - States or implies the correct relationship between function of the vacuole and the well being of the paramecium.
- OR**
- States or implies the correct relationship between too much water and the death of the organism
  - Answer is correct and in complete sentences
- 

**9. Two Biological processes 2 points total**

- Allow 1 point for each of the biological processes named
    - osmosis
    - Homeostasis
    - other processes may be appropriate
- 

**Highest possible score 24 points**

Student ID \_\_\_\_\_  
Male / Female (circle one)

Scoring Form - Water Regulation

Circle the student's score for each part of the exercise. Add the points for each part and write the total score at the bottom of the scoring form.

1. Observations

1A	0	1	2	3
1B	0	1	2	3
1C	0	1	2	3
2. Relationship between water concentration	0	1	2	
3. What would add to solution A?	0	1		
4. Explanation of answer to #3	0	1	2	3
5. What would you add to solution B	0	1		
6. Explanation for answer to #5	0	1	2	3
7. Prediction if contractile vacuole failed	0	1		
8. Explain your prediction in #7	0	1	2	
9. Two biological process	0	1	2	

**Total Score** \_\_\_\_\_

Total possible score - 24 points

Student ID BIO - WR - 1

Scoring Form - Water Regulation

Male / Female (circle one)

Circle the student's score for each part of the exercise. Add the points for each part and write the total score at the bottom of the scoring form.

1. Observations

1A	0	1	2	3
1B	0	1	2	3
1C	0	1	2	3
2. Relationship between water concentration	0	1	2	3
3. What would add to solution A?	0	1	2	3
4. Explanation of answer to #3	0	1	2	3
5. What would you add to solution B	0	1	2	3
6. Explanation for answer to #5	0	1	2	3
7. Prediction if contractile vacuole failed	0	1	2	3
8. Explain your prediction in #7	0	1	2	3
9. Two biological process	0	1	2	3

Total Score

24 pts

Total possible score - 24 points



Base your answers to the following questions on these graphs.

1. Using complete sentences describe your observations of the behavior of the contractile vacuole in each solution:

- A. Pond water: The number of times the contractile vacuole pumped stayed the same for all 5 minutes at 2 x's
- B. Solution A: The number of times went up after the first 1/2 from 2 to 4 pumps per ~~in 30~~ 30 sec.
- C. Solution B: The number of times went down in the first 1/2 min. from 2 to 1 times per 30 sec

2. Think about the relationship between the concentration of dissolved materials in the two solutions and pond water. Use the following terms to complete the two statements below.

Same as OR Greater than OR Less than

- A. The concentration of solution A was Less than the concentration of pond water.
- B. The concentration of solution B was Greater than the concentration of pond water.
3. What would you add to Solution A to restore the vacuole contraction to the same rate as in pond water?

Some salt-but not too much.

4. Using complete sentences suggest an explanation to your answer to question 3:

The salt would change the water concentration to make it more like the pond water.  
The contractile vacuole would slow down to normal

5. Using complete sentences what would you add to Solution B to restore the vacuole contraction to the same rate as in pond water.

More water would need to be added to B.

6. Using complete sentences suggest an explanation to your answer to question 5.

Adding more water would dilute the solution to make it more like the pond water so the contractile vacuole acts normal

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7. What will happen to a paramecium if the contractile vacuole failed to remove the excess water.

It would explode because too much  
water would come in.

8. Using complete sentences explain how you have reached your prediction in question 7.

Too much water would diffuse in to  
The cell causing pressure.

9. Name two (2) biological processes which take place in this investigation.

diffusion, Active Transport.

Student ID BIO - WR - 2  
Male / Female (circle one)

Scoring Form - Water Regulation

Circle the student's score for each part of the exercise. Add the points for each part and write the total score at the bottom of the scoring form.

1. Observations

1A	0	1	2	3
1B	0	1	2	3
1C	0	1	2	3
2. Relationship between water concentration	0	1	2	
3. What would add to solution A?	0	1		
4. Explanation of answer to #3	0	1	2	3
5. What would you add to solution B	0	1		
6. Explanation for answer to #5	0	1	2	3
7. Prediction if contractile vacuole failed	0	1		
8. Explain your prediction in #7	0	1	2	
9. Two biological process	0	1	2	

Total Score 20  
Total possible score - 24 points

13  
24

Base your answers to the following questions on these graphs.

1. Using complete sentences describe your observations of the behavior of the contractile vacuole in each solution:

- A. Pond water: It stays the same through out the 5 minutes while in the pond water
- B. Solution A: It pumps more in the same amount of time that it take to pump in pond water
- C. Solution B: The number of times the vacuole pumps drops in solution B.

2. Think about the relationship between the concentration of dissolved materials in the two solutions and pond water. Use the following terms to complete the two statements below.

Same as OR Greater than OR Less than

- A. The concentration of solution A was Less than the concentration of pond water.
- B. The concentration of solution B was Greater than the concentration of pond water.
- 3. What would you add to Solution A to restore the vacuole contraction to the same rate as in pond water?

pond water

4. Using complete sentences suggest an explanation to your answer to question 3:

This would change the composition of solution A, and change the way that the Paramecium reacts. If there is more pond water, they will react with more normal pumping of the contractile vacuole

5. Using complete sentences what would you add to Solution B to restore the vacuole contraction to the same rate as in pond water.

I would add some of what was in solution.

6. Using complete sentences suggest an explanation to your answer to question 5.

Since the beating was low in B and high in A, adding A to B would probably bring the number of times towards the middle.

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7. What will happen to a paramecium if the contractile vacuole failed to remove the excess water.

The paramecium would leak water.

8. Using complete sentences explain how you have reached your prediction in question 7.

If it was gone there would be a hole.

9. Name two (2) biological processes which take place in this investigation.

Excretion, Cyclosis.