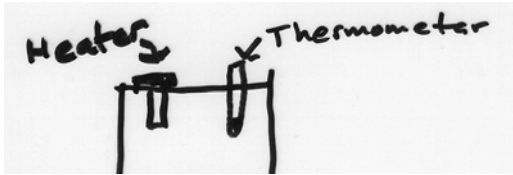


Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 1

| |
|--|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>As water temperature increases the amount of oxygen dissolved in water decreases because the goldfish had to breathe faster at higher water temperatures.</i> |
| Materials: <i>2 aquarium systems (with aquarium water) without goldfish or air pump labeled A and B, 2 tools to measure oxygen in water, 2 water heaters, 2 thermometers, stopwatch</i> |
|  |
| Procedure: <i>1. Set up aquariums labeled A and B as in diagram above. Make sure the tanks have the same amount of water and are in same room.</i> |
| <i>2. Use water heater to change temperature in tanks A and B to 20°C. Check using thermometer.</i> |
| <i>3. Use stopwatch to time 2 min. After 2 min. use tools to measure oxygen in tanks. Record measurements.</i> |
| <i>4. Use water heater to change temperature in tank B to 10°C. Check with thermometers.</i> |
| <i>5. Use stopwatch to time 2min. After 2 min use tools to measure oxygen in tanks. Record measurements.</i> |
| <i>6. Change temperature in tank B to 15°C, 20°C, 25°C, and 30°C. At each level check thermometer and repeat step 5.</i> |
| <i>7. Change temperature in both tanks back to 20°C. Check thermometers. Repeat step 5.</i> |
| <i>8. Repeat entire process under same conditions as trials 2 and 3.</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> </tr> </table> | | |
| | | | |

Published by the Science Learning Team of the Washington Office of the Superintendent of Public Instruction on September 9, 2006
 Copyright © 2006 by Washington Office of the Superintendent of Public Instruction (OSPI)
 All rights reserved. Educational institutions within the State of Washington have permission to reproduce this document. All other individuals wishing to reproduce this document must contact OSPI.



Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 2

| |
|--|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>If the tempature of the aquarium is higher the aquarium then the amount of oxygen in the water would become lower.</i> |
| Materials: <i>Two aquarium systems, thermometer, tool to measure oxygen in water, stopwatch</i> |
| Procedure: <i>1. Measure the oxygen in the water.</i> |
| <i>2. Do it at different tempatures.</i> |
| <i>controlled variable: fish and tank</i> |
| <i>manipulated variable: the tepature</i> |
| <i>responding variable: temperature</i> |
| <i>3. Record for 3 minutes.</i> |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 20px;"> </td> <td style="width: 30px; height: 20px;"> </td> </tr> </table> | | |
| | | | |

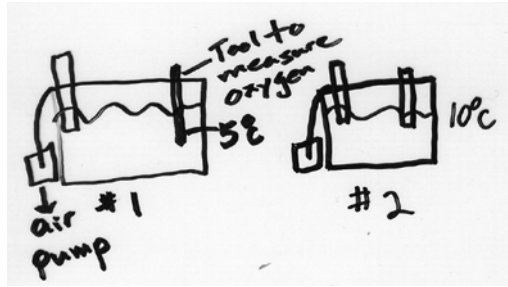


Student Response 3

Question: What is the effect of water temperature on the amount of oxygen dissolved in the water?

Hypothesis: *The warmer the water is, the more amount of oxygen to be dissolved because the water molecules are spread from each other when warm.*

Materials: *a tool to measure oxygen, stopwatch, 2 the same kind of aquariums marked #1 and 2, thermometer*



Procedure: *1. Pure in water in aquarium #1 with temperature 5°C and use the tool to measure the oxygen and record.*

2. Pure the same amount of water in aquarium #2, but the temperature should be 5°C.

3. Record how many oxygen observed in both

4. Raise the temperature of the water in aquarium # two to 15°C and repeat instruction numbe 3.

5. Raise to 20°C and repeat 3.

- Raise to 25°C and repeat 3.

6. Let the temperature to cool to 10°C and repeat number two.

| Investigation Attributes | Value Pts. |
|----------------------------|------------|
| Prediction | |
| Prediction Reason | |
| Materials | |
| Two Controlled Variables | |
| Manipulated Variable | |
| Responding Variable | |
| Record Measurements | |
| Trials are Repeated | |
| Exper. Control Condition | |
| Extra Validity Measures | |
| Logical Steps | |
| Total Value & Score Points | |

Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 4

| |
|---|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>If the temperature is higher than the amount of oxygen dissolved in water will be less.</i> |
| Materials: <i>2 identical aquarium sets, thermometer, oxygen measuring tool</i> |
| Procedure: |
| <i>1. In both tanks have a normal tank set at 20°C and one at high of 30°C.</i> |
| <i>2. Check temperature before starting.</i> |
| <i>3. After a break of 5 min check temp.</i> |
| <i>4. Repeat the 5 min break at least 6 times to get an average.</i> |
| <i>5. Record data.</i> |
| <i>6. Compare w/A and B.</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> </tr> </table> | | |
| | | | |



Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 5

| |
|--|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>As the temperature increases more air will be lost, but it will be opposite with cold water.</i> |
| Materials: <i>Two aquarium systems one with an A another with a B, thermometer, tool to measure oxygen percentage</i> |
| Procedure: |
| - <i>Check the oxygen levels at 20° for “A”, “B”.</i> |
| - <i>Drop the temperature in “A” to 10°C and raise “B” to 30°.</i> |
| - <i>Then check the oxygen levels in each.</i> |
| - <i>Raise “A” 5° to 15°, and lower “B” to 25° and record oxygen levels.</i> |
| - <i>Continue raising and lowering temps to 20° and record the oxygen levels.</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table> | | |
| | | | |

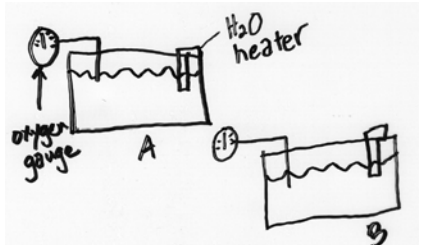


Student Response 6

Question: What is the effect of water temperature on the amount of oxygen dissolved in the water?

Hypothesis: *The temperature decreases the O₂ level in the H₂O.*

Materials: O₂ gauge, aquariums, H₂O heaters



Procedure:

1. Label one tank "A". this is the control and stays at 20°C.
2. Label the other tank "B".
3. Increase the temperature of tank B, starting at 10°C and ending at 30°C, by increments of 5.
4. For each increment of 5, record the reading in the oxygen gauge.

| Investigation Attributes | Value Pts. |
|----------------------------|------------|
| Prediction | |
| Prediction Reason | |
| Materials | |
| Two Controlled Variables | |
| Manipulated Variable | |
| Responding Variable | |
| Record Measurements | |
| Trials are Repeated | |
| Exper. Control Condition | |
| Extra Validity Measures | |
| Logical Steps | |
| Total Value & Score Points | |

Student Response 7

| |
|--|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>If the temperature increases then the amount of oxygen will go down because the oxygen will begin to evaporate.</i> |
| Materials: <i>Two identical fish tanks with a water heater, water, two thermometers, two tools to measure the oxygen in water, stopwatch.</i> |
| <i>controlled variables: Fish tank, light in the room.</i> |
| <i>manipulated variable: temperature of the water</i> |
| <i>responding “ ”: Amount of oxygen.</i> |
| <i>experimental control condition: Fish tank where oxygen isn't increased</i> |
| Procedure: <i>1. Label the tanks A and B</i> |
| <i>2. take an initial temp. and the amount of oxygen in both tanks. Record in a table.</i> |
| <i>3. While keeping tank A's temperature the same increase tank B's temperature by 5°C. Wait 5 minutes.</i> |
| <i>Record the temperature and amount of oxygen.</i> |
| <i>4. Repeat step 3, and increase tank B's temperature by 5° again.</i> |
| <i>5. Repeat Step 3 and increase B's temperature 5° again.</i> |
| <i>6. Record all your results.</i> |
| <i>7. Repeat if necessary.</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table> | | |
| | | | |



Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 8

| |
|--|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>The higher the temperature the less oxygen will dissolve because the heat applies less pressure to the oxygen.</i> |
| Materials: <i>2 identical aquarium systems one marked A and another marked B, thermometer, stopwatch.</i> |
| Procedure: |
| <i>1) Heat aquarium A to 30°C and aquarium B to 10°</i> |
| <i>2) Over a one minute period count and record how many bubbles rise to the top of each aquarium</i> |
| <i>3) Record the average for each tank</i> |
| <i>4) Repeat experiment to validate</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> </tr> </table> | | |
| | | | |



Student Response 9

| |
|---|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>The higher the water temperature the lower the amount of oxygen dissolved in the water.</i> |
| Materials: <i>1) tank, 2) tool to measure oxygen in the water, 3) thermometer</i> |
| Procedure: |
| <i>1) Get the water in the tank to 20°C</i> |
| <i>2) Measure and record the amount of oxygen in the water</i> |
| <i>3) Heat the water to 25°C. Repeat step 2</i> |
| <i>4) Heat water to 30°C, Repeat step 2</i> |
| <i>5) Cool water to 15°C, Repeat step 2</i> |
| <i>6) Cool water to 10°C, Repeat step 2</i> |

| Investigation Attributes | Value Pts. | |
|----------------------------|------------|--|
| Prediction | | |
| Prediction Reason | | |
| Materials | | |
| Two Controlled Variables | | |
| Manipulated Variable | | |
| Responding Variable | | |
| Record Measurements | | |
| Trials are Repeated | | |
| Exper. Control Condition | | |
| Extra Validity Measures | | |
| Logical Steps | | |
| Total Value & Score Points | | |



Aquarium Systems PCA Student Responses for Item 10: Plan an Investigation

Student Response 10

| |
|---|
| Question: What is the effect of water temperature on the amount of oxygen dissolved in the water? |
| Hypothesis: <i>If the water temperature is raised, then the oxygen level will raise. Because fish need more oxygen to breathe so it must be their.</i> |
| Materials: <i>2 identical aquarium systems marked A and B, thermometer, stopwatch, oxygen measuring tool</i> |
| Procedure: <i>1 Set up the two aquarium systems.</i> |
| <i>2. Measure initial temperature and oxygen count.</i> |
| <i>3. Change water temp. to 10°C and record amount of oxygen.</i> |
| <i>4. Change water temp. to 15°C and record amount of oxygen.</i> |
| <i>5. Increase temp. to 25°C and Record data.</i> |
| <i>6. Increase to 30°C and Record data.</i> |
| <i>7. Repeat.</i> |
| <u>variables</u> |
| <u>manipulated</u> – <i>change in water temp</i> |
| <u>controlled</u> – <i>same amount of fish, same type of aquarium, same amount of water</i> |
| <u>responding</u> – <i>amount of oxygen</i> |

| Investigation Attributes | Value Pts. | | |
|----------------------------|--|--|--|
| Prediction | | | |
| Prediction Reason | | | |
| Materials | | | |
| Two Controlled Variables | | | |
| Manipulated Variable | | | |
| Responding Variable | | | |
| Record Measurements | | | |
| Trials are Repeated | | | |
| Exper. Control Condition | | | |
| Extra Validity Measures | | | |
| Logical Steps | | | |
| Total Value & Score Points | <table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 20px;"></td> <td style="width: 30px; height: 20px;"></td> </tr> </table> | | |
| | | | |

