

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

## **Speedy Species: Calculating the Average Rate of Speed of a GloFish®**

### **Objective**

The learner will calculate the average rate of speed of a GloFish® fluorescent fish and compare the rate of speed of a second species of fish.

### **Introduction**

Swimming quickly is an asset to any prey organism. In this activity, you will calculate the average rate of speed of a GloFish. Speed is the change in distance over time. Although the actual speed at which a fish is swimming may vary from one second to the next, the average rate of speed can be determined by dividing the total change in distance by the total time (average speed = change in distance/change in time). Following the same procedure you will then determine the average speed of a similar size fish of a different species.

### **National Standards Addressed**

Physical Science B – Motion and forces

### **Materials Per Group**

1 GloFish® fluorescent fish  
1 similar sized fish of a different species  
30 cm piece of 1" id (2.54 cm id) clear vinyl tubing  
2 tubing clamps  
200 mL aquarium water  
25 mL beaker  
1 sheet of transparency film cut in half  
Ruler  
Permanent marker  
Stop watch

### **Safety Precautions**

The proper procedure for transferring the fish from the beaker to the tubing should be demonstrated by the teacher to prevent injury to the fish.

Students should wash hands thoroughly after handling any living organisms.

## Procedures

### Part A: Measuring the Swimming Speed of a GloFish®

1. Obtain a 30 cm piece of clear vinyl tubing with an internal diameter of 1” (2.54 cm). Use the ruler and permanent marker to mark off one centimeter segments along the entire length of the tube.
2. Place a clamp on one end of the tubing. Tighten the clamp firmly enough to prevent water from leaking out.
3. Holding the tube perpendicular to the floor, fill approximately two-thirds of the length of the tube with aquarium water.
4. Place 12 to 15 mL of aquarium water in the 25 mL beaker.
5. Carefully transfer a single GloFish from the aquarium to the 25 mL beaker containing aquarium water.
6. Roll the half sheet of transparency film to form an adjustable funnel. Place the funnel into the open end of the water filled tube.
7. Gently pour the contents of the 25 mL beaker (including the fish) into the clear vinyl tube.
8. Seal the open end of the tube using a tubing clamp.
9. Place the tubing horizontally on the surface of your lab table.
10. Note the beginning location of the nose of the fish, wait 5 seconds and note the location of the nose of the fish. Determine the distance traveled in five seconds and record your data in Table 14.1.
11. Continue measuring the distance traveled in five second intervals for a total of ten trials.
12. Holding the tube upright, remove the clamp from the top end of the tube.
13. Gently pour the contents of the tube (including the GloFish) into the aquarium.
14. Calculate the average speed of your GloFish.

## Part B: Measuring the Swimming Speed of a Different Species of Fish

1. Obtain a fish of similar size but different species. Place the fish in 25 mL beaker contain 12 to 15 mL of aquarium water.
2. Place a clamp on one end of the tubing. Tighten the clamp firmly enough to prevent water from leaking out.
3. Holding the tube perpendicular to the floor, fill approximately two-thirds of the length of the tube with aquarium water.
4. Roll the half sheet of transparency film to form an adjustable funnel. Place the funnel into the open end of the water filled tube.
5. Gently pour the contents of the 25 mL beaker (including the fish) into the clear vinyl tube.
6. Seal the open end of the tube using a tubing clamp.
7. Place the tubing horizontally on the surface of your lab table.
8. Note the beginning location of the nose of the fish, wait 5 seconds and note the location of the nose of the fish. Determine the distance traveled in five seconds and record your data in Table 14.2.
9. Continue measuring the distance traveled in five second intervals for a total of ten trials.
10. Holding the tube upright, remove the clamp from the top end of the tube.
11. Gently pour the contents of the tube (including the fish) into the aquarium.
12. Calculate the average speed of the second species of fish.

## Data

Table 14.1 - GloFish® Data

Trial	Distance traveled in 5 seconds
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Average	

Table 14.2 - Second Species Data

Trial	Distance traveled in 5 seconds
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Average	

Table 14.3 - Class Average

Group	Average Speed of GloFish®
1	
2	
3	
4	
5	
6	
7	
8	
Class Average	

**Discussion Questions:**

1. In this activity, you determined the average speed of the fish in cm/sec. What is the speed of your fish in km/hour? Show your work.
2. Obtain the average speed of GloFish® data from the other groups in the class. Determine the class average speed of GloFish.
3. How does your data compare to the class average?
4. What factors could explain the difference between your data and the class average speed of GloFish?

5. How does the average speed of the GloFish® compare to the average speed of the second species of fish? Explain.
  
6. Using your text or other resources, explain the difference between the terms speed and velocity.
  
7. From the data collected in this activity, can you determine the velocity of the GloFish? Explain your answer.

### **Elaborations and Extensions**

Have students research to find the fastest known species of fish. Students compare the similarities and differences between GloFish and faster fish such as sailfish and/or shark.

# Speedy Species: Calculating the Average Rate of Speed of a GloFish® Answer Sheet

## Intended Grade Level

9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup>

## Teacher Information

Select a second species of fish that is similar in size to the GloFish® to prevent any difficulties swimming in the tubing. This activity could also be conducted in tall, clear plastic containers such as pasta containers; however, the volumes of water used will need to be adjusted in the protocol. Similarly, a 2.5 gallon zippered storage bag suspended upright could also be used.

1" clear vinyl tubing can be purchased at plumbing supply shops. Smaller internal diameter tubing could be used if your fish are small enough.

Any thin, flexible water-proof plastic can be substituted for transparency used to form a flexible funnel.

Demonstrate the proper procedure for transferring the fish from the beaker into the tube. You may want to have the students perform this transfer over the aquarium just in case there is a spill.

## Discussion Questions and Possible Answers

1. In this activity you determined the average speed of the fish in cm/sec. What is the speed of your fish in km/hour? Show your work.

*Sample Answer:  $5\text{cm}/5\text{ sec} = 1\text{ cm/sec} = .036\text{ km/hr}$*

2. Obtain the average speed of GloFish data from the other groups in the class. Determine the class average speed of GloFish.

*Students should add the average speeds and divide by the number of groups contributing.*

3. How does your data compare to the class average?

*Answers will vary with some lab groups above and some below the class average.*

4. What factors could explain the difference between your data and the class average speed of GloFish?

*Variations can be attributed to the use of different fish. Some of the fish may be more active than others at any given time. Some lab groups may have moved or talked more stimulating their fish to move more than those in a still, quiet environment.*

5. How does the average speed of the GloFish® compare to the average speed of the second species of fish? Explain.

*Answers will vary depending on the species of fish used.*

6. Using your text or other resources, explain the difference between the terms speed and velocity.

*Speed is a measure of the change in distance over time while velocity is a vector value reflecting direction. Velocity is calculated by dividing change in position over change in time.*

7. From the data collected in this activity, can you determine the velocity of the GloFish? Explain your answer.

*If the data were collected while the fish is traveling in the same direction, the velocity and average speed as determined in this activity are comparable.*