

# Temperature and respiration rate

## Background:

Water temperatures have an effect on the amount of dissolved oxygen (DO) available to fish. As water warms, it cannot hold as much dissolved oxygen. In contrast, air temperature has little effect on the amount of oxygen in the air we breathe.

A fish must pump water across its gills to meet its oxygen needs. If DO in the water is low, the gills must move faster to get enough oxygen for the fish to survive. We can count these gill movements to estimate the dissolved oxygen requirements of fish.

1. What happens to the dissolved oxygen when the temperature in the water goes up? What happens to the amount of times the fishes gills pump?
2. What happens to the amount of oxygen when the temperature in the water goes down? What happens to the amount of times the fishes gills pump?

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## Materials:

250 mL beaker  
600 mL beaker  
Thermometer  
Ice  
Goldfish

## Procedures:

Each team member will have a specific job as outlined below. Choose your job and write it on the top of your paper.

### 1. Gill beat counter

Count and record the number of gill beats/ minute every time the water changes by 1-2°C.

### 2. Time counter

Tell the gill plate counter when to start and end (one-minute counting intervals).

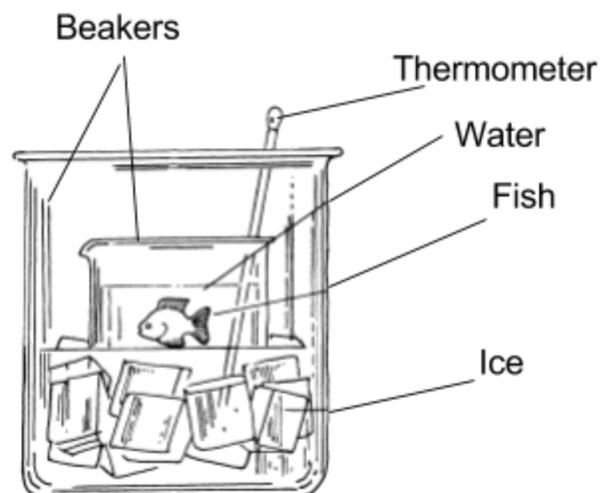
### 3. Temperature guardian

Announce the temperature changes by approximately 1-2°C intervals (but no more than 5°C intervals). It is not essential to be exact. Make sure the water changes happen slowly to avoid harming the fish.

### 4. Material Monitor:

Retrieves materials and makes sure that team is being responsible with lab specimen and supplies.

1. Measure 150 ml of water from the fish tank and place in the 250 ml beaker.
2. Use the net and carefully remove a fish place it in the 250ml beaker.
3. Place two ice cubes in the bottom of the 600ml beaker with 100 ml of water.
4. Measure the temperature of the large beaker. When the water temperature is colder than 23°C BUT no lower than 15°C, place the small container with the fish into the larger one (see drawing).



5. **Once the fish has calmed down**, measure the water temperature in the small beaker, record in table. Then count the number of gill beats per minute. DO NOT allow the temperature of the small container to drop below 15°C.
6. After the count has been completed, change the water temperature by adding 50 ml warm water into the 600ml beaker.
7. Once the temperature of the small beaker has gone up 1-2°C, signal the time and gill beat counters to do their counts.
8. For your third count, dump out the water in the large beaker and only add luke warm water. Place the fish inside the large beaker and put the thermometer in for 30 seconds.
9. The water in the small container should 1-2°C warmer than your previous measurement. Record the temperature and then count the gill pumps for one minute.
10. Repeat steps 8-9 slowly adding warmer water and raising the temperature 1-2°C.
11. Stop once you have taken 6 measurements.
12. Do not allow the temperature of the smaller container to exceed 27°C.
13. Create a line graph. The temperature will go on the x axis and the gill pumps will go on the y axis.

### Conclusion Questions

1. The amount of oxygen water can hold is directly related to the temperature of the water (the higher the temperature, the less oxygen it can hold). How might the effects of temperature affect the number of gill beats?
2. What could account for unexpected results in the data? For example, why would the number of gill cover beats be lower than expected at a certain temperature?
3. What will happen to an animal that is deprived of oxygen? How does this relate to cell respiration?
4. How does your answer in number three relate to what you saw in the lab?