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Biology Coursework
GCSE 2001/2002

Problem

A fish enthusiast wishes to increase the amount of fish possibly sustained in his fish tank.
However, he cannot afford to upgrade his filtration systems, buy a larger tank, buy more fish, buy a tank heating system or buy more pondweed.

Possible factors

Having been told that the financial restrictions on this problem are endless, we can only conclude that we must alter the level of oxygen in the water, allowing more fish to breath. To do this, we must increase the photosynthesis levels in the current pondweed.
So to find out the possible factors, we must look at what factors would affect the rate of photosynthesis:

1. *FOOD LEVELS IN THE PLANT*
2. *HEAT INTENSITY*
3. *LIGHT INTENSITY*
4. *WATER LEVELS*

We must now eliminate the water, heat and food factors as all three either need to be financed (food levels and heat intensity) or are immeasurable throughout the experiment (water levels). *T*his leaves us with light intensity.

Decided Factor

Having decided upon light intensity, we must take into consideration any secondary factors created by light. All artificial light creates heat, so we must use a water tank as a heat filter.

Statement

Using a desk lamp, I am trying to find out how differing l ight intensity affects the rate of photosynthesis in pondweed, therefore increasing the capacity for fish to live healthily in a tank.

Hypothesis

I predict that the higher the light intensity, the higher the rate of photosynthesis. This is due to the increase in one of the two necessary factors for photosynthesis to occur successfully; LIGHT and OXYGEN. However, as this is not an ideal environment for an experiment, there MAY be slight inaccuracies in the results, yet none too severe to sway from the generally straight line.

Method

Using the apparatus listed below (see list of apparatus) I set up the apparatus as shown below (see diagram of apparatus). Then, keeping all independent variables involved constant, I set about the experiment. Using the ruler to measure accurately the distance between the beaker and the lamp, I prepared the pondweed for the 1st reading by giving it a one minute acclimatisation period to adjust to the new light intensity. After that time, I started counting the bubbles released from the weed per minute. When that minute was up, I recorded the number of bubbles released, then immediately moved the lamp 10cm back to the next position for the 2nd reading. After giving the weed its one-minute acclimatization period, I started to count the bubbles again for a one-minute period, as before making sure there was a constant level of outside or interfering light.

List of apparatus

- 1 metre ruler (A)
- 1 branch of pondweed (B)
- 1 beaker of water (C)
- 1 boiling tube of water (D)
- 1 stand (E)
- 1 clamp (F)
- 1 spoon of catalyst (G)
- 1 table lamp (H)
- 1 stop watch (I)

Diagram of apparatus

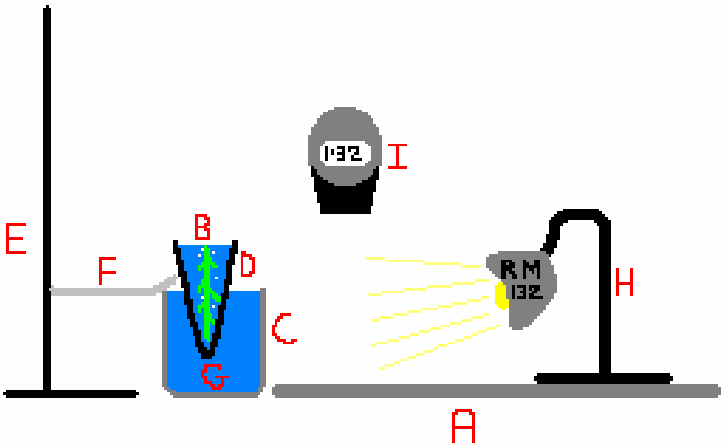
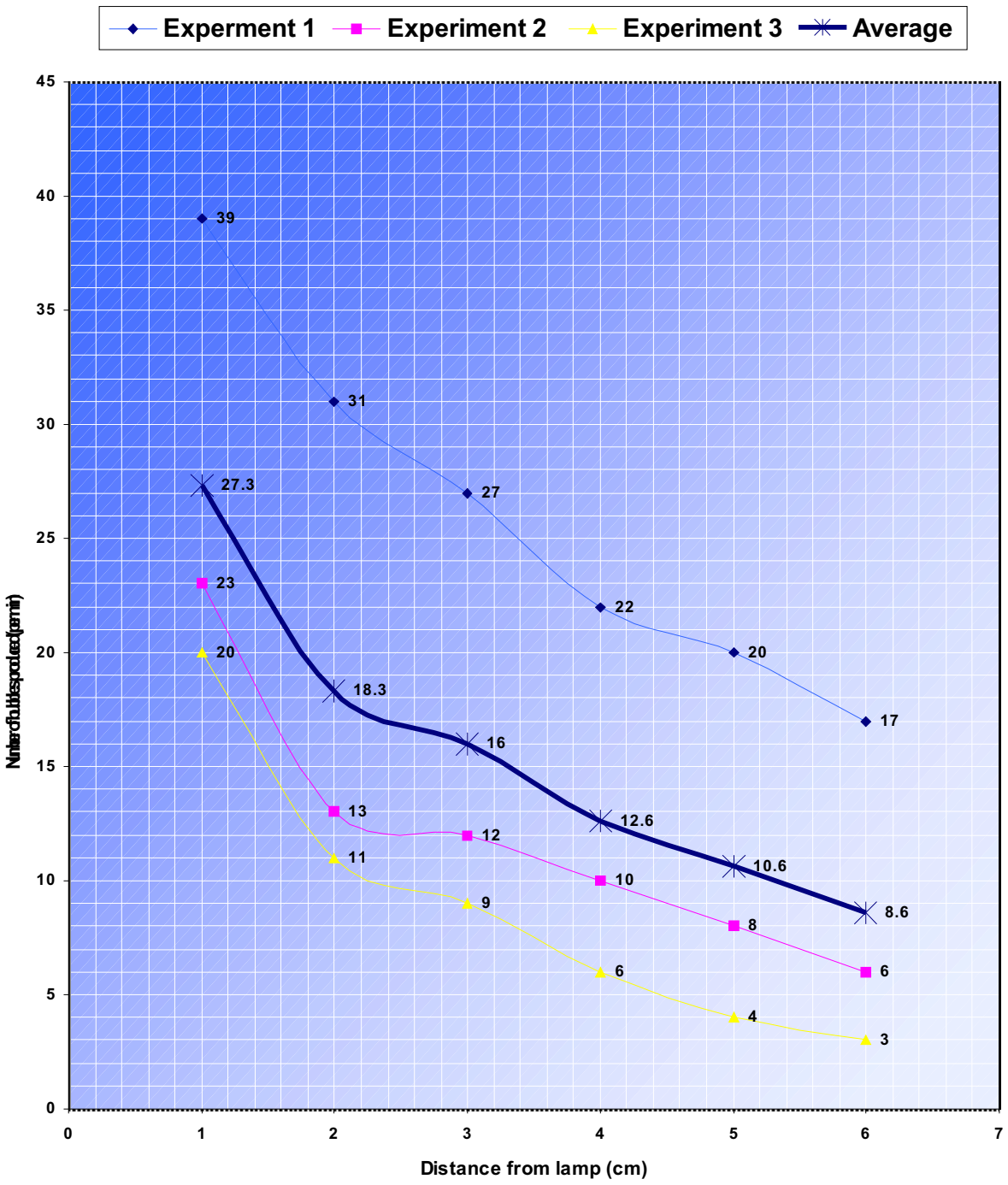


Table of results

Distance of lamp from pond weed (cm)	Number of bubbles released from weed (per min)			
	Experiment 1	Experiment 2	Experiment 3	*Average*
10	39	23	20	*27.3*
20	31	13	11	*18.3*
30	*27*	12	9	*16*
40	22	10	*6*	*12.6*
50	20	*8*	4	*10.6*
60	*17*	*6*	3	*8.6*

How light intensity affects photosynhthesis



Interpretation & evaluation

The results have proved my prediction was accurate, and that the higher the light intensity, the faster the rate of photosynthesis. This higher light intensity was forcing the pondweed to photosynthesise more, releasing more bubbles, and therefore increasing the oxygen levels in the water. This increased oxygen level then gives the potential for more fish to be added to the tank, solving the fish enthusiast's problem.

The only ways I can suggest for improving the results would be to…

- Use a bigger water shield instead of a beaker. The beaker didn't cover the entire weed, and because of the bending neck of the lamp, the exact positioning and therefore heat level from the lamp couldn't be kept constant.
- Carry out the experiment in a dark room as to totally cut out all interfering or outside light. As the results showed, after a certain point- the lamps light becomes almost irrelevant as the outside light levels are at the same level. In having a dark room, you can totally cut out all interfering light, allowing the experiment to be carried out as a FAIR TEST. This would tell us whether there is a point after which light intensity in any environment is irrelevant or not.
- More allocated time would allow for the experiment to be repeated providing indisputably accurate results and figures.
- Perhaps by bunging the test tube we could cut out all 'alien' influence by agents in the air. After deciding that light intensity was to be the independent variable, all other factors must be kept either neutral or constant. In bunging the tube this would be achieved.

Other than these above points, the experiment was planned and carried out as accurately as was practically possible, providing us with detailed results to form a conclusion to our problem.

Conclusion

In conclusion, I can now state that by sticking to the guidelines the only way to increase the capacity for fish in a tank is to increase the light intensity. This is because the higher the light intensity the faster photosynthesis occurs, thus the higher the oxygen levels in the tank. With this in mind, the answer to the fish enthusiast's problem is to move any current lighting closer to the fish tank.