In this experiment we are going to investigate one of the limiting factors in photosynthesis - light intensity.

We will need:

4 universal bottles.

Hydrogencarbonate indicator, also known as bicarbonate indicator.

Immobilised algal balls.

A lamp as a light source.

A light grey filter and a dark grey filter.

These will allow different amounts of incident light to pass through.

One black piece of paper, which will exclude all light.

A colorimeter, set to 580 nanometres.

Cuvettes and a pipette.

First, transfer 15 algal balls into each of the four universal bottles.

Using a syringe add 4 cubic centimetres of hydrogencarbonate indicator to all four universal bottles.

Hydrogencarbonate indicator measures carbon dioxide levels in aquatic systems.

Now place the light grey, dark grey and black filters around 3 of the universal bottles, and leave one bottle without a filter.

This sample will receive one hundred percent of the incident light.

Record on each bottle lid which filter is in place on each bottle.

No filter, light grey filter, dark grey filter and black paper.

Place all 4 bottles in front of the lamp, make sure that all samples are close to and equidistant from, the lamp.

Leave the samples in front of the lamp for around 90 minutes.

After 90 minutes thoroughly mix the contents of each universal bottle.

Switch on the colorimeter and set the filter to 580 nanometres.

Rinse out a cuvette with distilled water and then add about 3 cubic centimetres of distilled water to it.

Use this cuvette to zero the colorimeter.

Take the universal bottle with no filter, which received one hundred percent of the incident light, and remove the indicator from the bottle using a pipette.

Then put the indicator into a cuvette.

Using the colorimeter, measure and record the absorbance.

Repeat this for the bottles with the light grey filter, the dark grey filter and the bottle with black paper which received zero percent of the incident light.

Visually the results can be described as colours.

Hydrogencarbonate indicator becomes more orange or yellow with increased carbon dioxide levels, and changes from red through magenta to deep purple as carbon dioxide is removed.

If algae are photosynthesizing more than respiring, we would expect the indicator to change towards deep purple, indicating decreased carbon dioxide.

We can see this most in the bottle with no filter.

The bottle with the light grey filter shows a colour of red, and the bottle with the dark grey filter shows a colour change to orange, indicating increasing carbon dioxide due to less photosynthesis occurring.

Carbon dioxide is increasing because of respiration happening at a faster rate than photosynthesis.

The bottle with the black paper shows a colour of yellow.

CO_2 has increased the most due to no light being available for photosynthesis.

Using the colorimeter we can record our result for each filter.

In conclusion, this experiment tells us that as we increase the density of the filter and reduce the light intensity, the algae could not photosynthesize as effectively.

Light intensity is a limiting factor for photosynthesis.