Photosynthesis: Reliable (!) experiments to try

Paul Beaumont, Kate Andrews, Kath Crawford & Trisha Geraghty

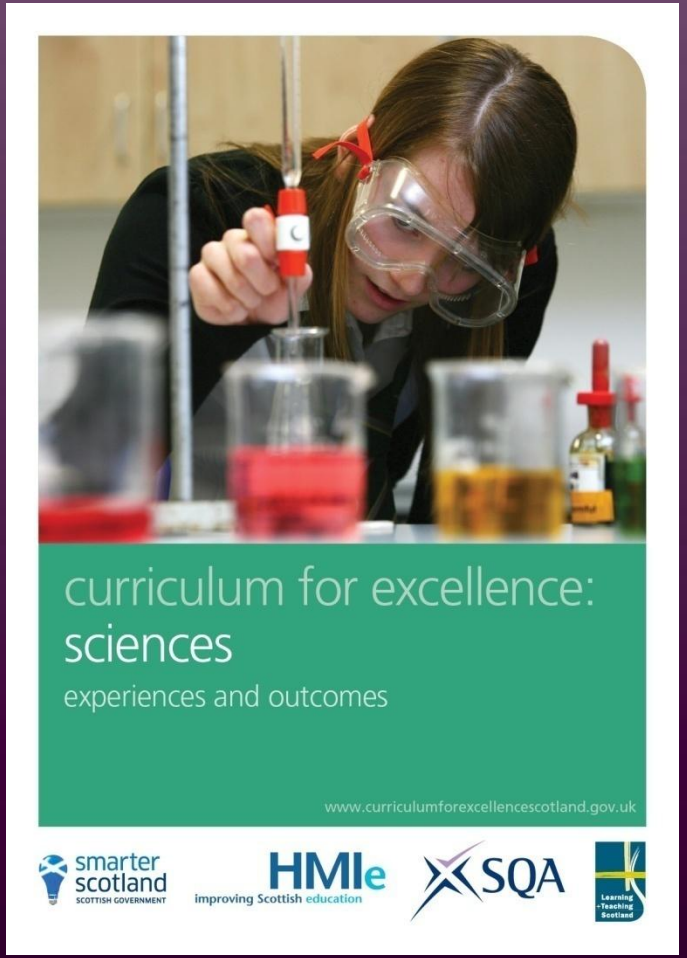
(Paul.Beaumont@sserc.org.uk)

Aims

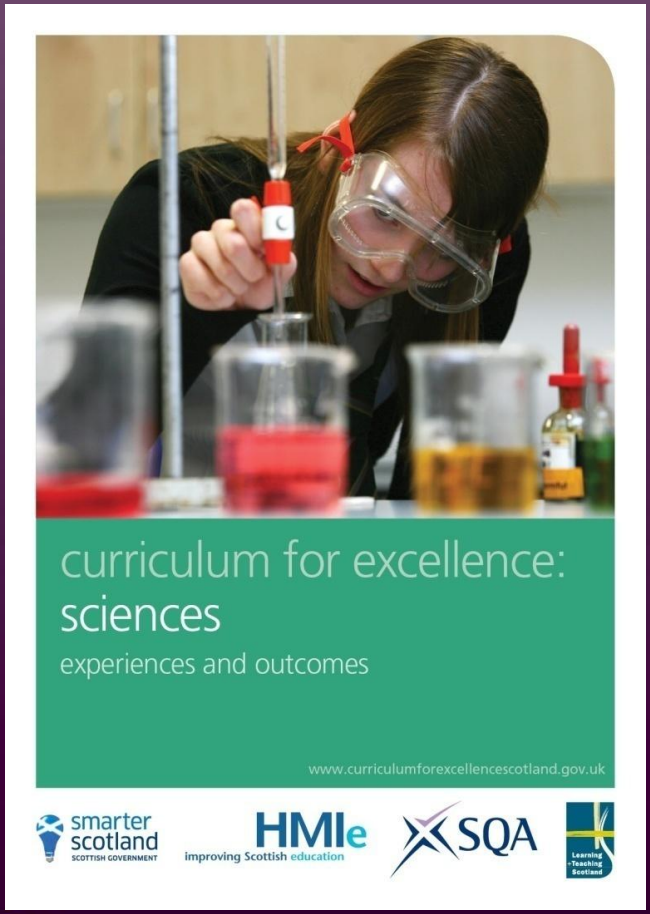
- *Offer hands-on experience of plant-based practical work to support CfE*
- *Consider experimental work which might support National 4 & 5*
- *Explore experimental work to show plant respiration*
- *Explore the effect of temperature on rates of respiration*

Curriculum for Excellence: Sciences Experiences and Outcomes

- *I have collaborated on investigations into the process of photosynthesis and I can demonstrate my understanding of why plants are vital to sustaining life on Earth [SCN 3-02A]*



Curriculum for Excellence: Sciences Experiences and Outcomes



- *Through exploring the carbon cycle, I can describe the processes involved in maintaining the balance of gases in the air, considering causes and implications of changes in the balance [SCN 4-05b]*
- *I can contribute to the design of an investigation to show the effects of different factors on the rate of aerobic respiration and explain my findings. [SCN 4-02b]*

CfE- National 4 & 5

curriculum for excellence

SQA

Overview of qualifications in the sciences curriculum area

July 2010

The information in this document covers the broad subject areas of Biology, Chemistry, Physics, Environmental Science, and Science.

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CELL BIOLOGY (Nat 4)

- *Elodea / Cabomba experiments*
- *Immobilised algae and bicarbonate indicator to show carbon dioxide/light usage*

CELL BIOLOGY (Nat 5)

- *Immobilised algae*
- *Elodea / Cabomba experiments*

(Limiting factors – above can be used)

- *Experiments to investigate respiration.*

Photosynthesis

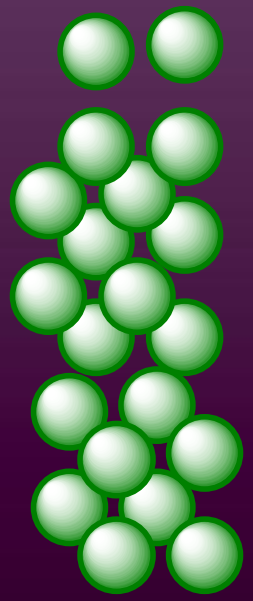
-

Debbie Eldridge

School Sci. Rev. (2004), ***85****, 37-45.*

Algae suspended in sodium alginate solution + *calcium chloride*

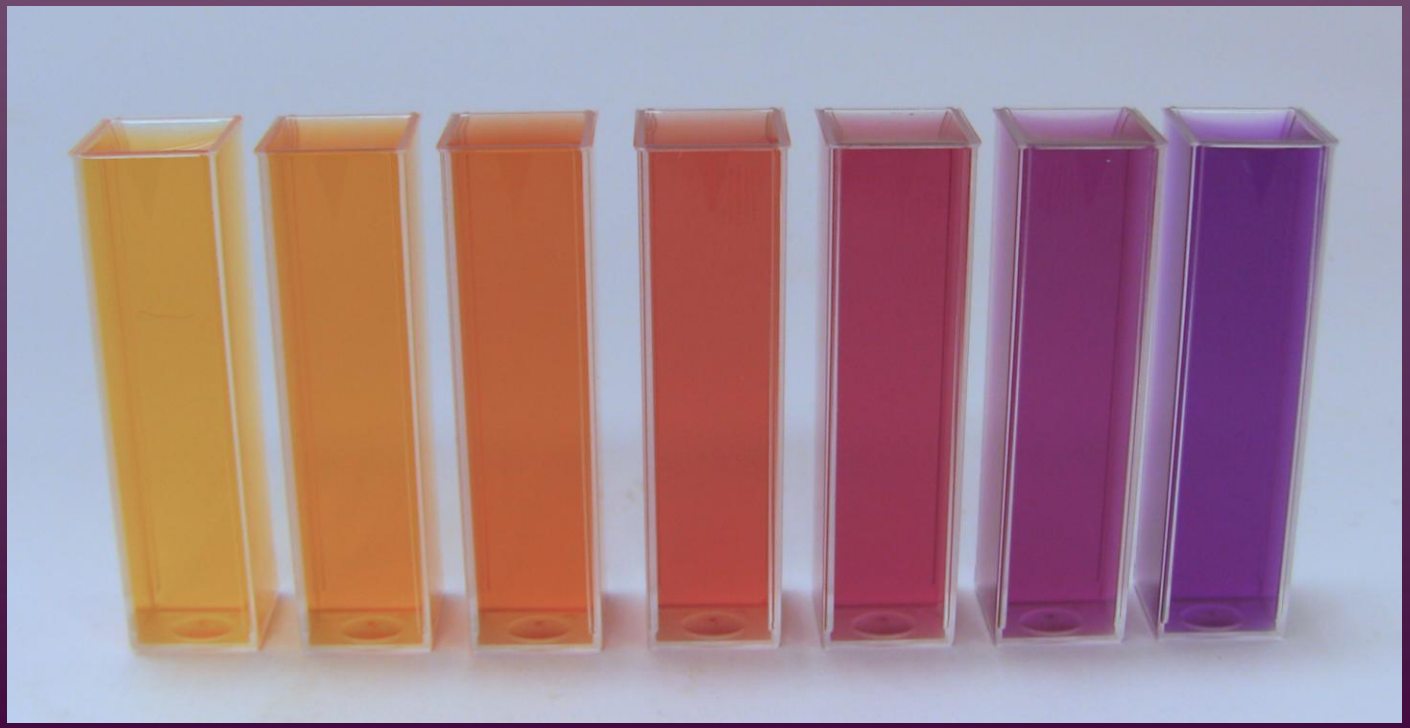
calcium alginate (insoluble)



Hydrogencarbonate indicator

- *Used to measure [CO_2]*
- *Orange/red in air*
- *Increasingly yellow as [CO_2] increases*
- *Orange → red → magenta → deep purple as [CO_2] decreases*

Hydrogencarbonate indicator



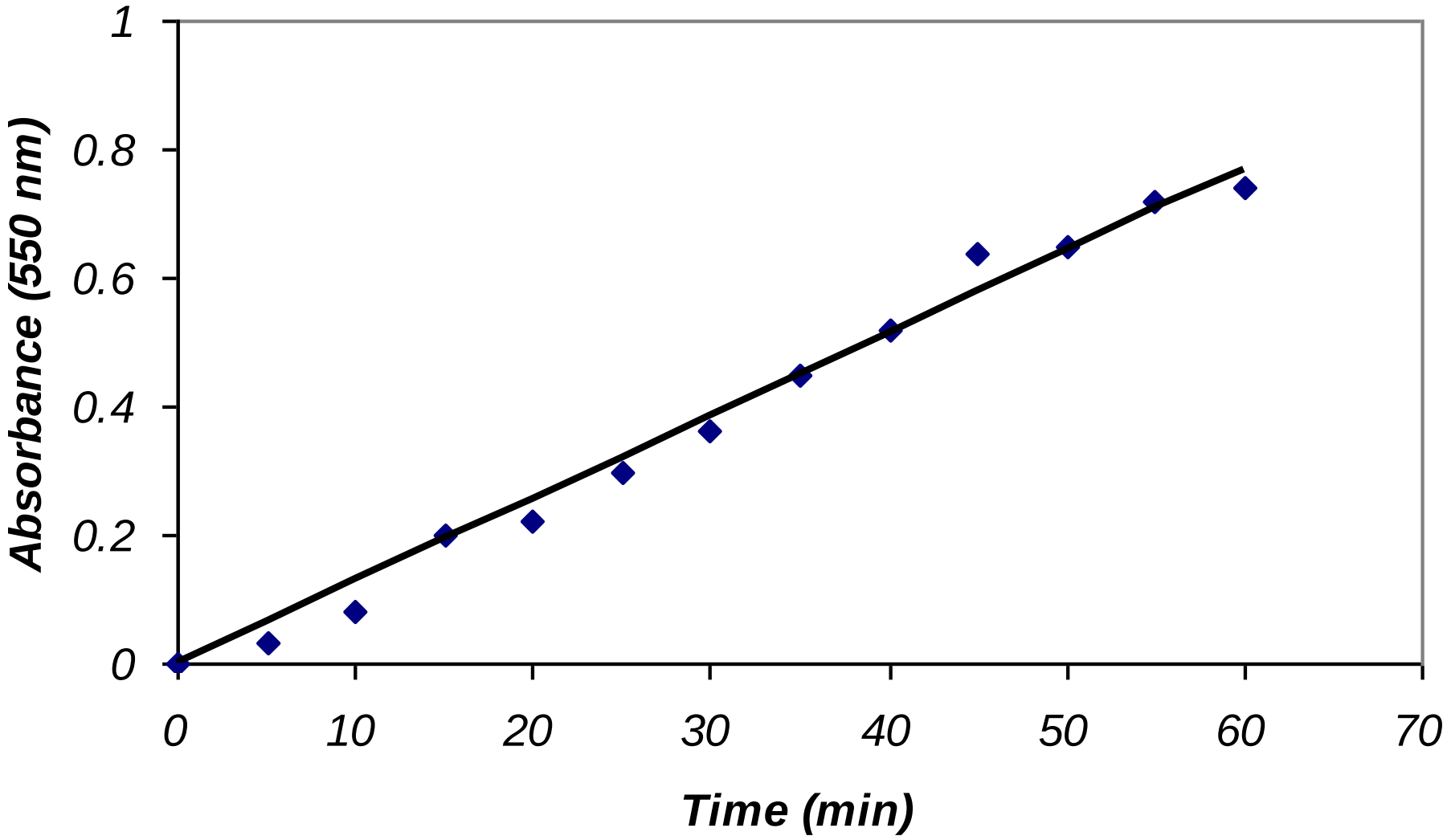
pH 6.8 ⟶ *9.2*

(in 0.4 increments)

Dark control

60-90 min irradiation

CO_2 loss as a function of time as measured by absorbance



1. *Set filter to 580 nm*
2. *HC indicator (pH 7.6) as blank*
3. *Zero colorimeter (R!)*
4. *Measure and record absorbance of sample (T!)*

R = Reference
T = Test

Algal Tube

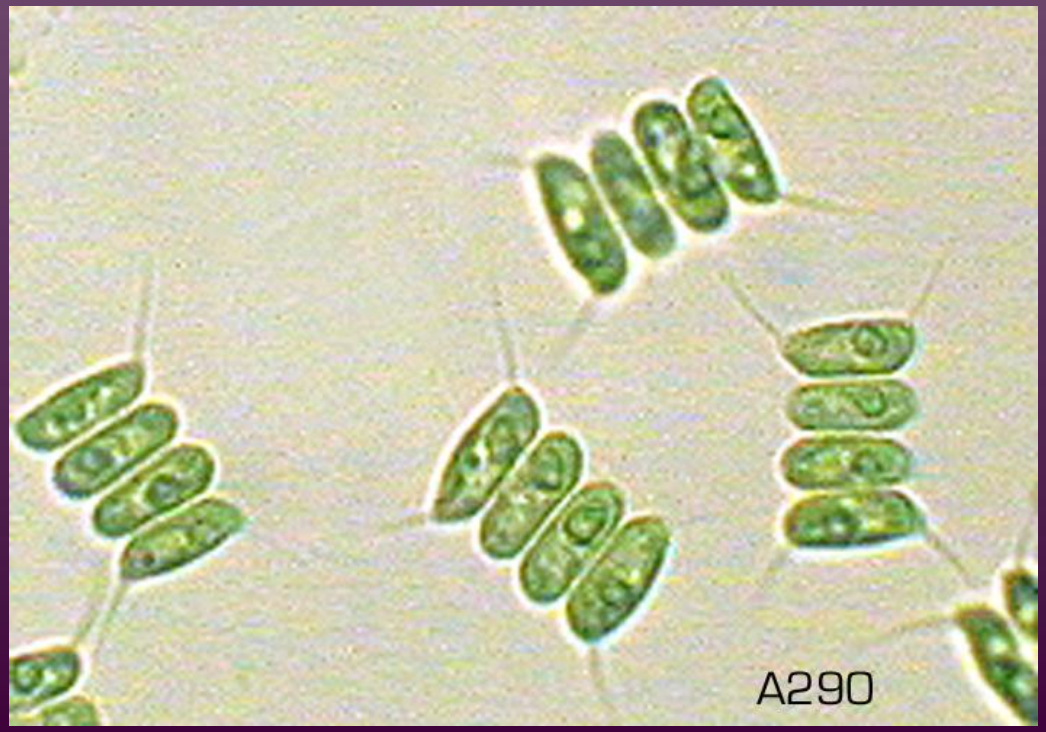
-

Tricia Geraghty

1. *Black card – cut to about 16 cm.*
2. *Coloured filter – cut to about 16 cm.*
3. *Stopper one end.*
4. *Mix algae and HCl in beaker – ca 50 cm^3 in total.*
5. *Add to tube.*
6. *Cylinders at either end.*
7. *Mix and place under lamps.*

What will you observe?

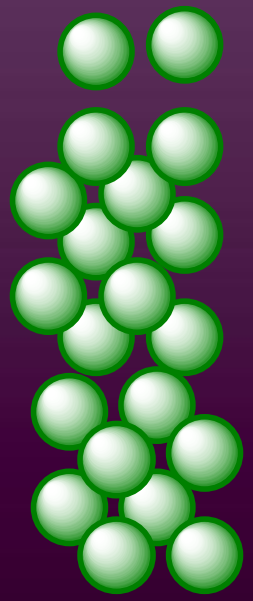
Algae



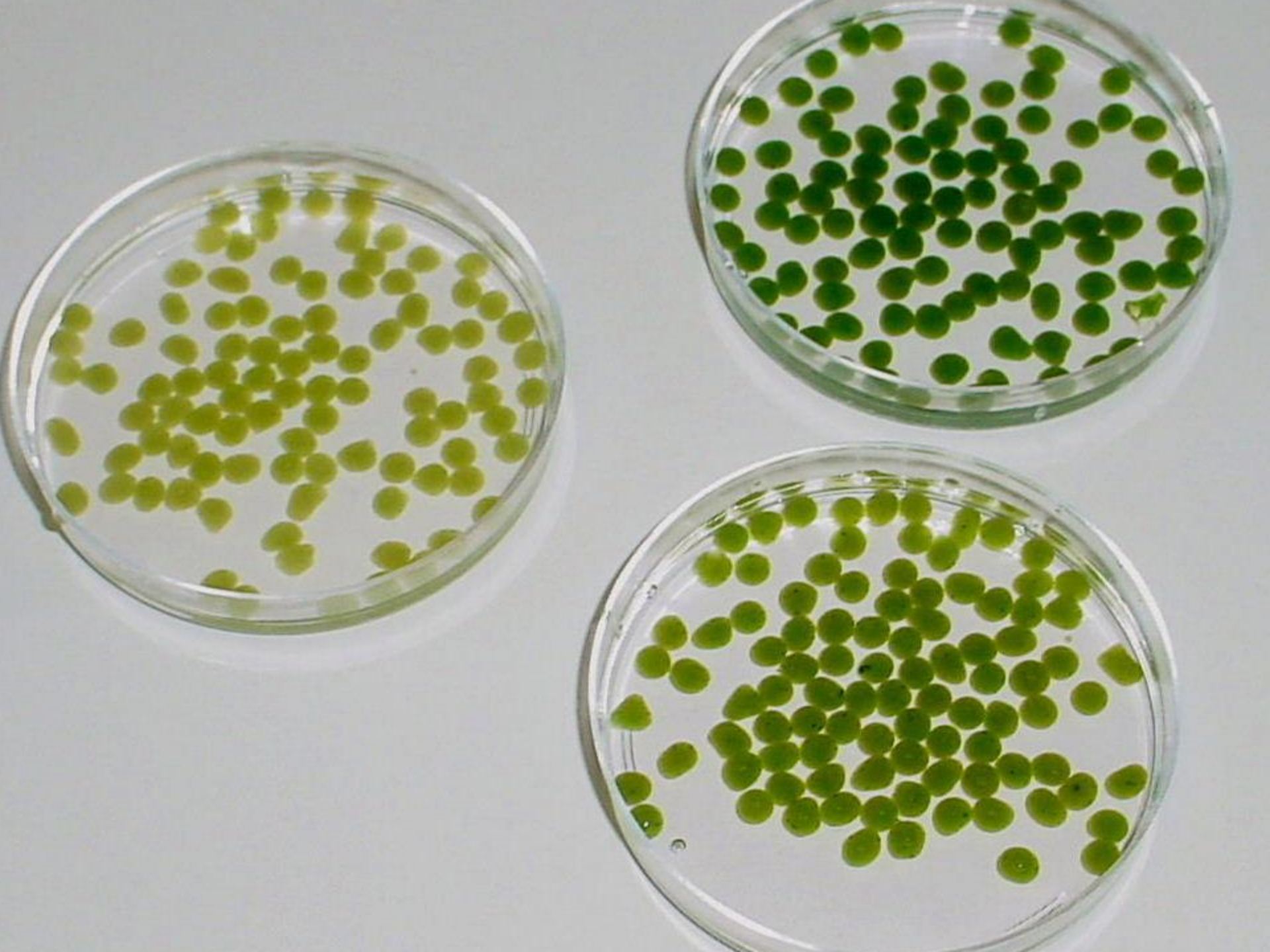
Scenedesmus quadricauda

Algae suspended in sodium alginate solution + *calcium chloride*

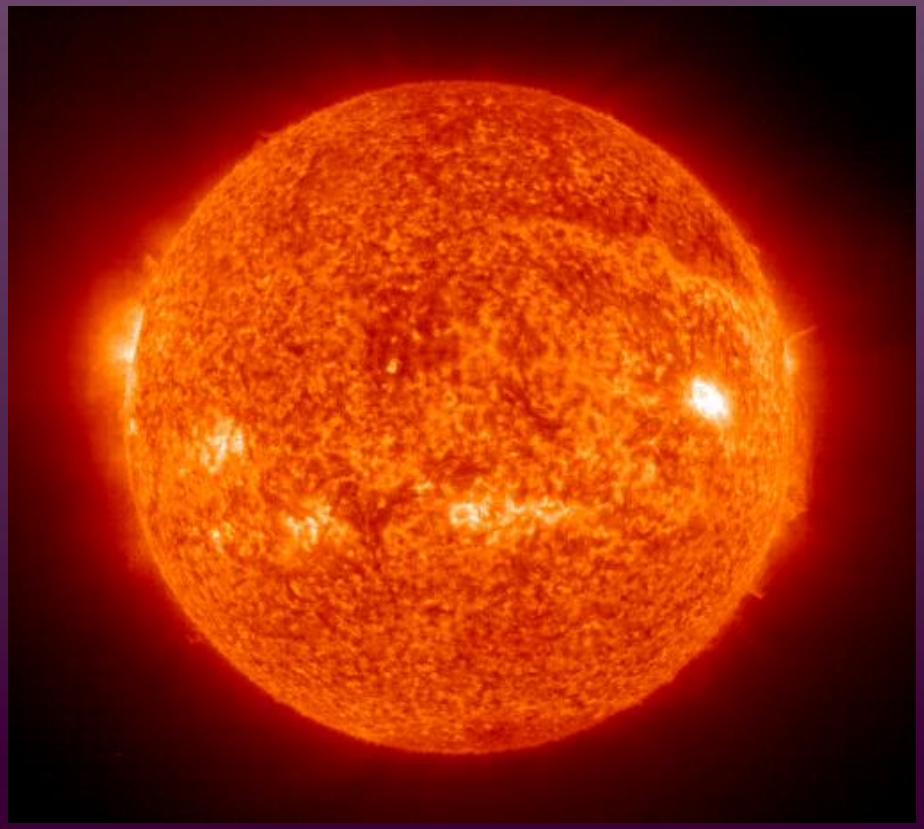
calcium alginate (insoluble)




250
100
50



Light Sources




Available from
Focus DIY
(4’ and 5’)

What might you observe?

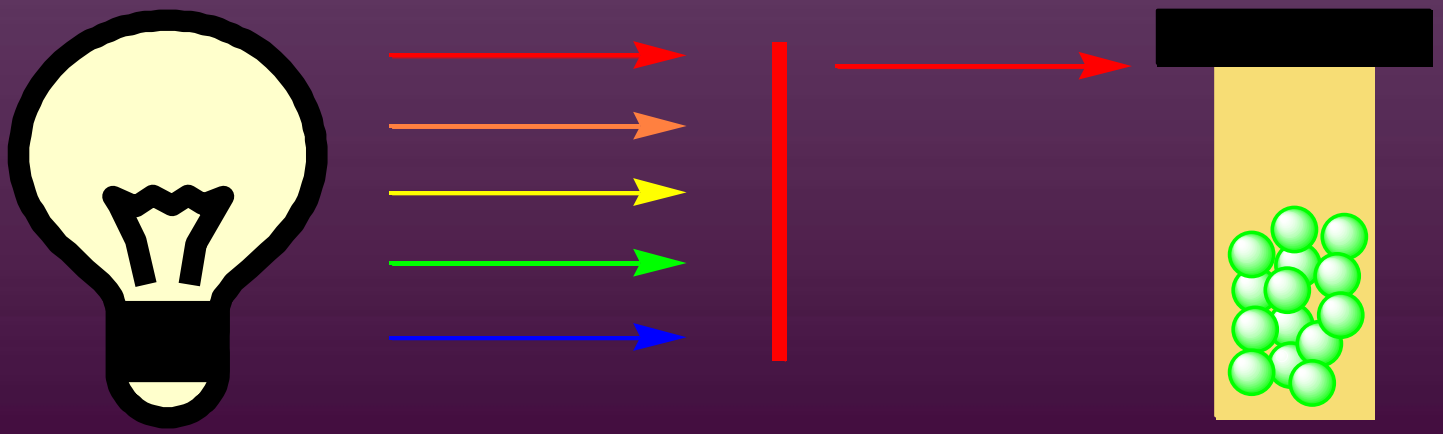
Dark control

60-90 min irradiation

Variables?

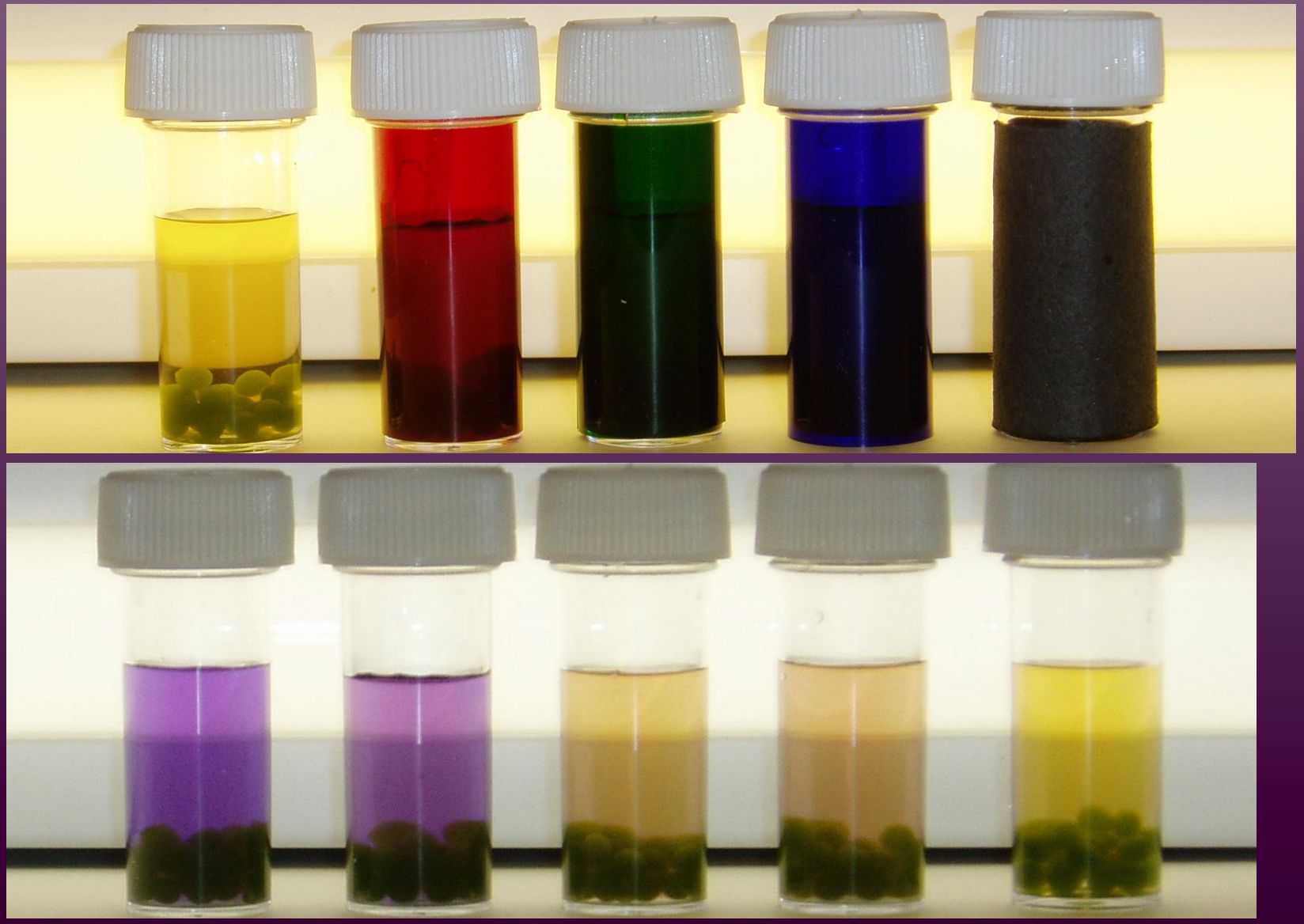
- *Colour of light*
- *Light Intensity*
  - *Distance from lamp*
  - *Neutral density experiment*
- *Number of balls*
- *Ball size*
- *Concentration of algae*
- *Temperature*

Colour of light



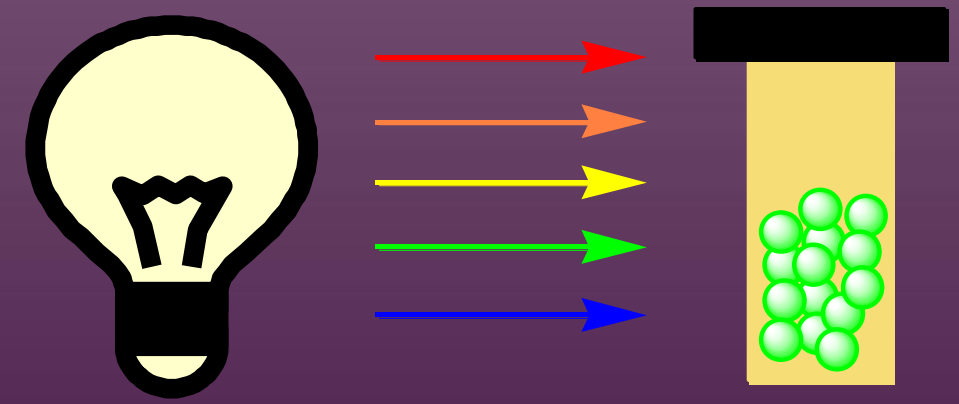
Lamp

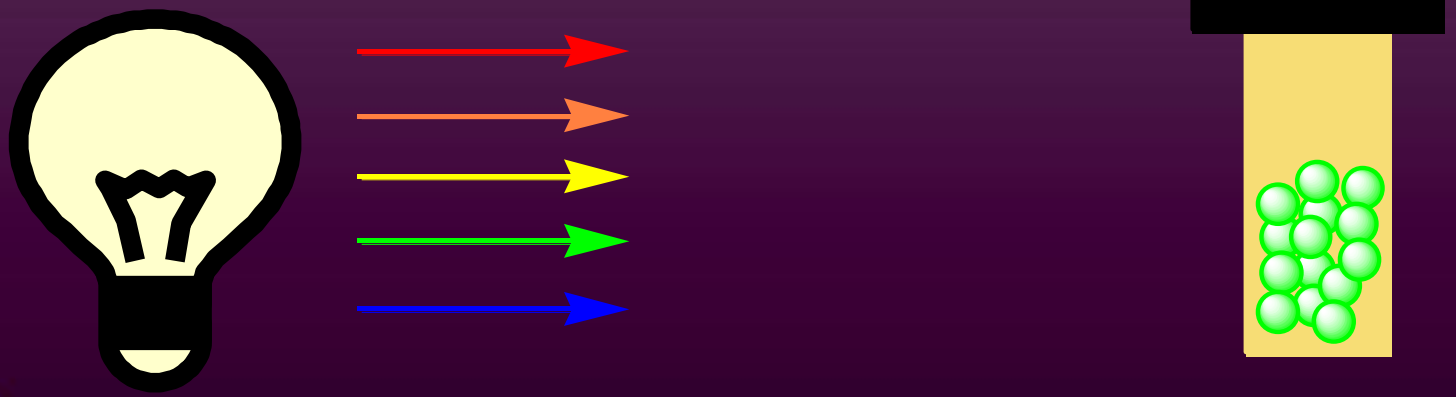
Hydrogencarbonate indicator containing algal balls

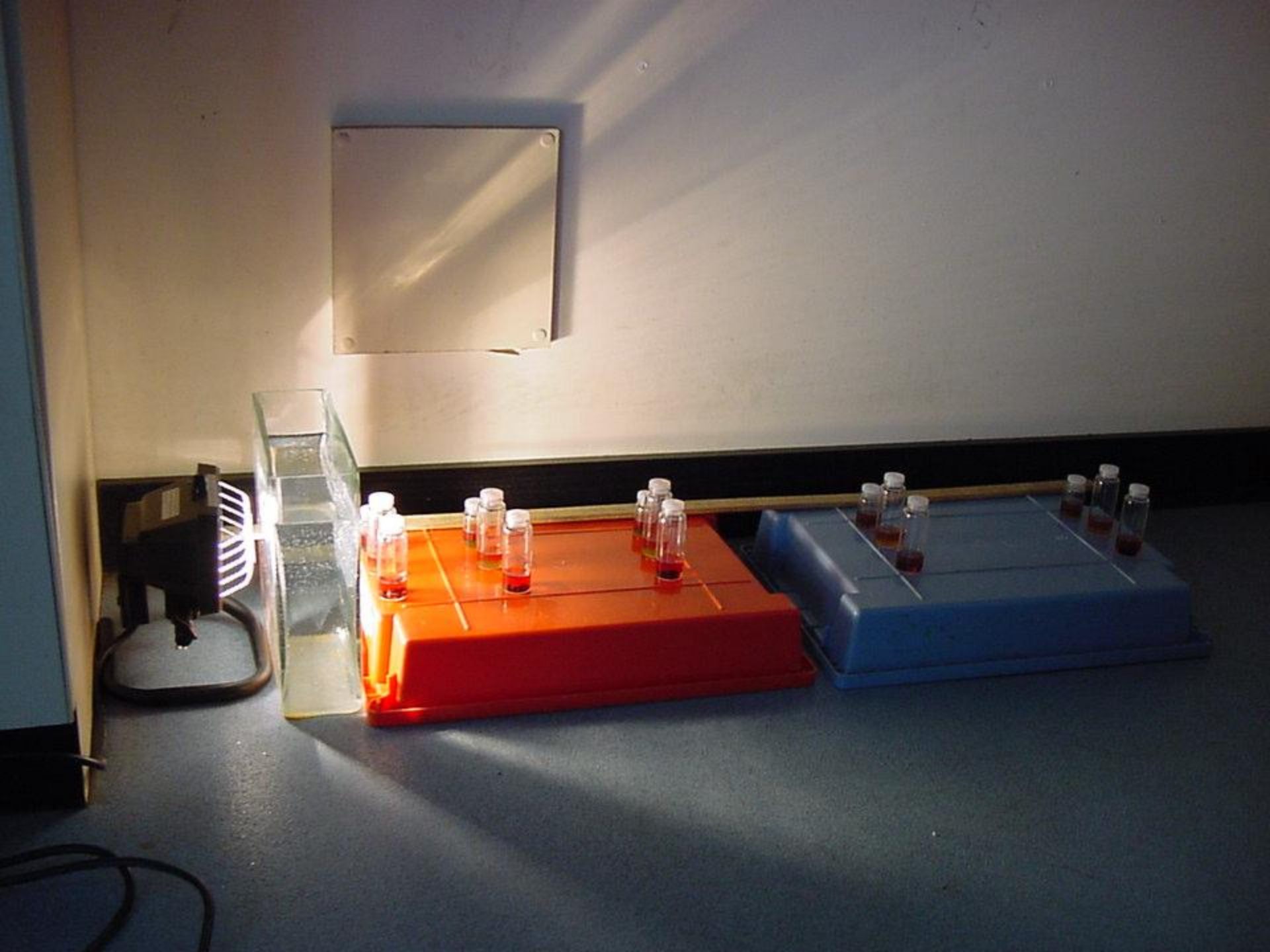


100% *Red* *Green* *Blue* *0%*

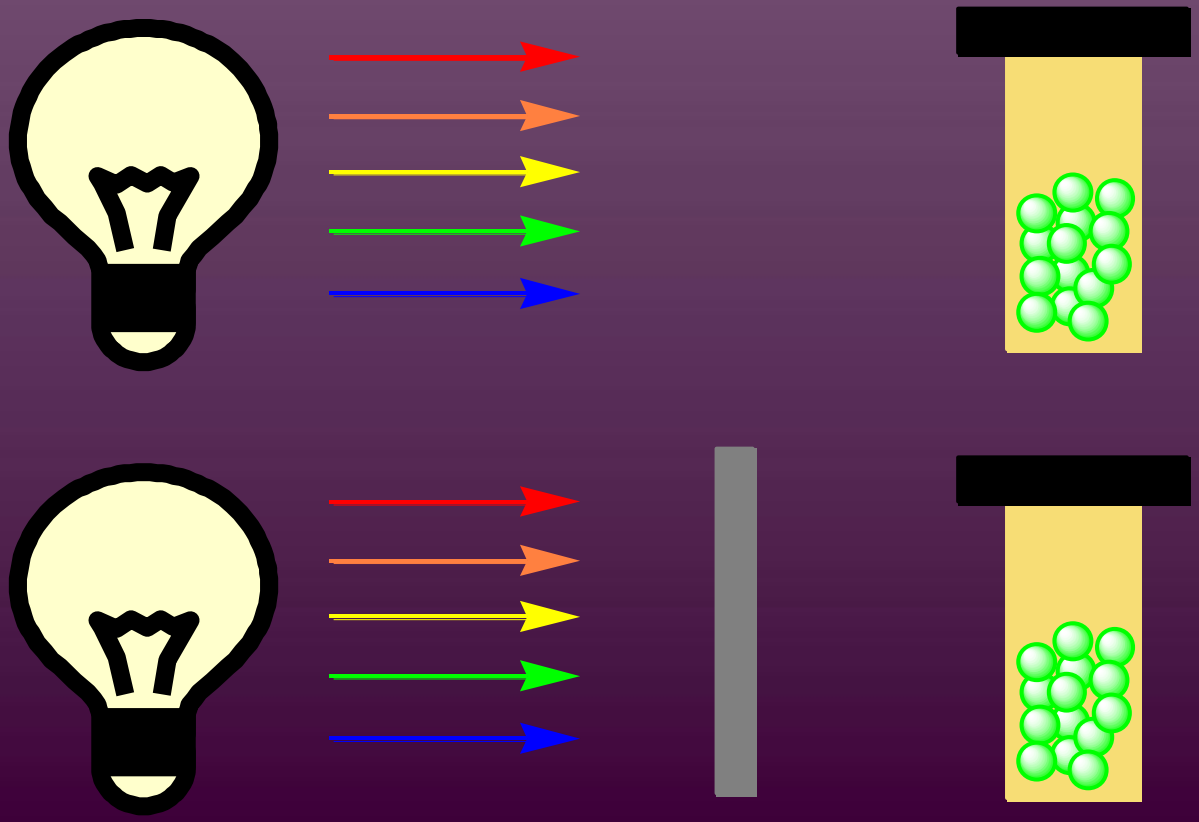
Light Intensity I







Light Intensity II



Neutral density filter

Filters

- *LEE Filters – range of filters*
- *Neutral density options*
- *LEE Filters, Central Way, Walworth Industrial Estate, Andover, Hants SP10 5AN.*

  Tel 01264 366245; www.leefilters.com

Transmission data

Filter Nº	%T
298	71
209	50
210	25
211	12.5
299	6.25

Background

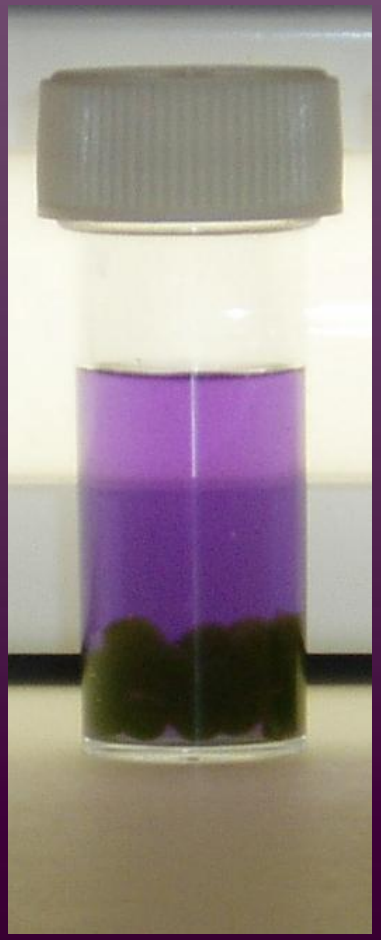
Rodger McAndrew

Investigating the compensation point of algae - (A new use for old balls!)

SSERC Bulletin 225 (Summer 2008)

100% *71%* *50%* *25%* *12.5%* *6.25%*

Dark control



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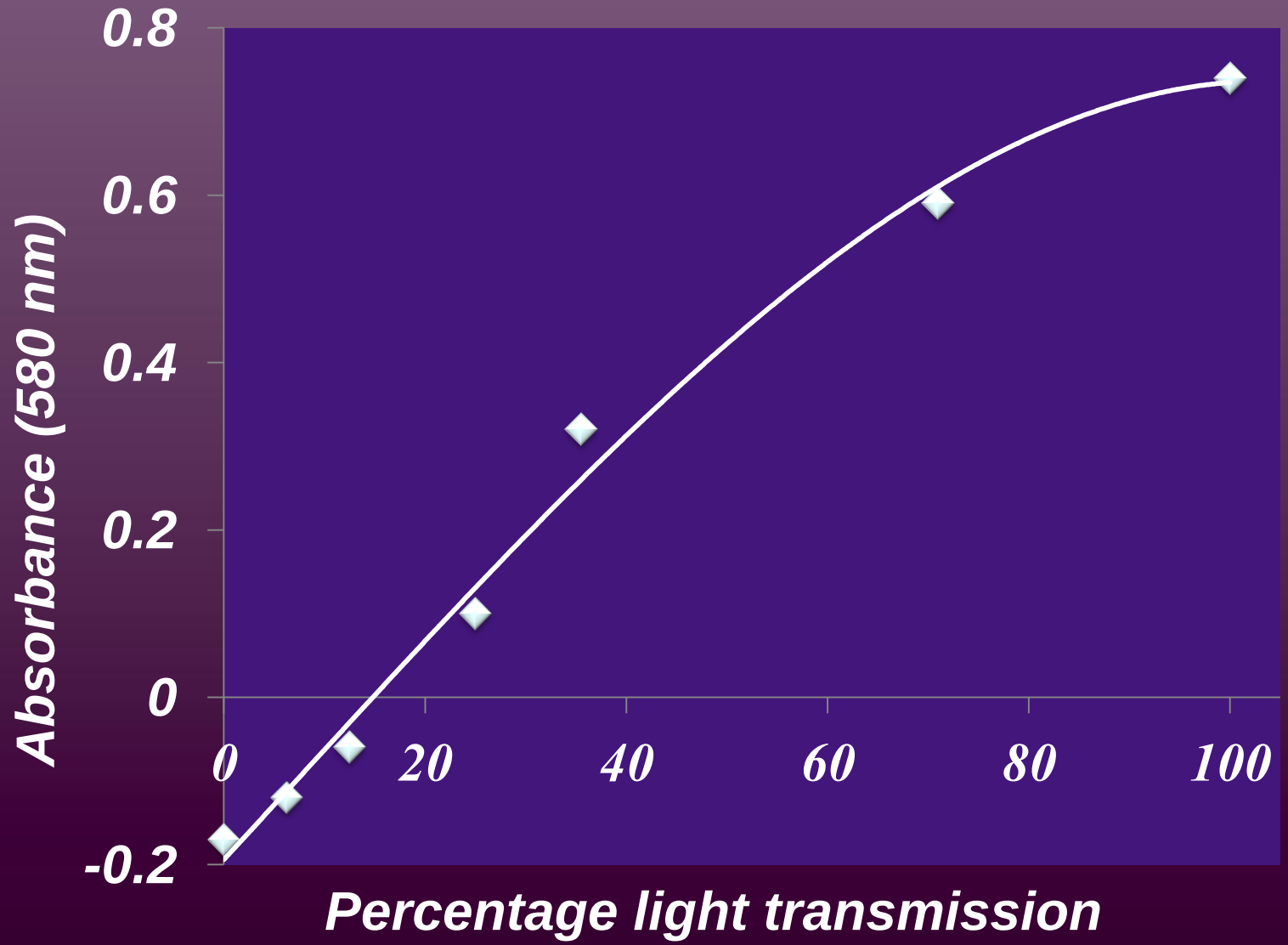
0.8
0.6
0.4
0.2
0
-0.2
Absorbance (580 nm)
0
20
40
60
80
100
Percentage light transmission

CO_2 appearance as a function of time