

National 5 Biology assignment packs

As you will be aware the SQA has made changes to the Course Specification for National 5 Biology [1]. One of the major changes which will come into effect at the start of the 2017/2018 academic session is that practical/experimental/fieldwork will become a mandatory feature of the assignment. The Biology Team at SSERC was commissioned by the SQA to produce 2 Resource Packs which could be used to support teachers and students with the implementation of this change.



Figure 1 - Resource pack 1 Limiting Factors in Photosynthesis.



Figure 2 - Resource pack 2 Fertiliser and the Growth of Algae.

These resource packs are available to download from the SSERC website [2]. We should point out that the packs are exemplars and that the suggested practical work is not mandatory. Many other practicals currently undertaken are equally appropriate and could be adapted to meet the new National 5 assignment guidelines. Over the coming months we will be looking to see how we might add to the SSERC pool of exemplars. Details

of these will be made available on the SSERC website and in future bulletins.

The activities suggested in the packs are not new - they have featured in previous bulletins [3], are on the SSERC website and have been shared at SSERC CPD events; but the protocols have been adapted to meet the SQA specifications for the National 5 Biology assignment.

Each resource pack consists of 3 elements:

- a Teacher/Technician Guide
- a Student Guide
- a generic risk assessment.

The Teacher/Technician Guide provides background information on the biology relating to the practical work together with notes on the methods suggested in the Student Guides. There is also detailed information relating to necessary equipment and suppliers. To meet the requirement for candidates to, "compare data/information from internet/literature research with the experimental/



Figure 3 - Scenedesmus grown in 0.25 cm³ concentration of Baby Bio™ for 10 days.

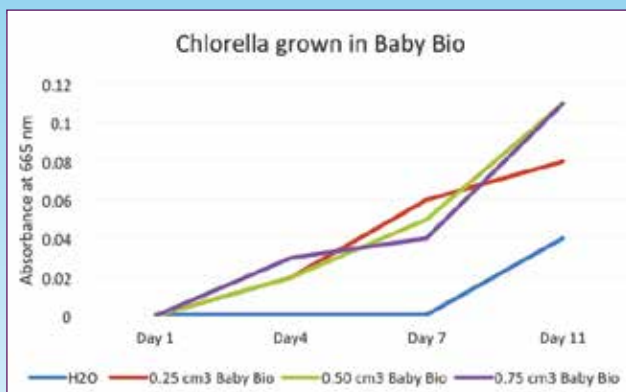


Figure 4 - Absorbance of Chlorella cultures grown in various concentrations of Baby Bio™.

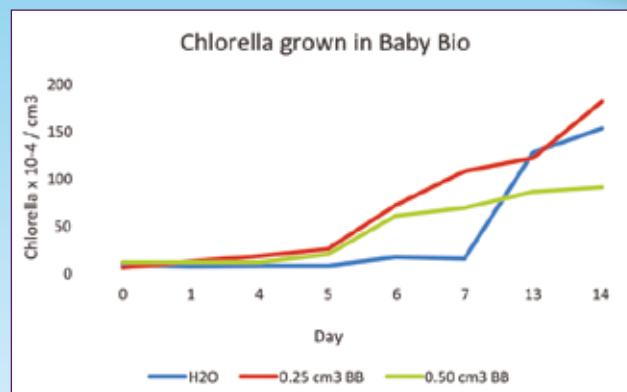


Figure 6 - Haemocytometer counts of Chlorella grown in Baby Bio™. Counts expressed as Chlorella numbers x 10⁴/cm³.



Figure 5 - Euglena grown in distilled water (top) and in Baby Bio™ (bottom) for 10 days observed at x 100 magnification.

Fertiliser and the growth of algae

The context for the activities described here is eutrophication - an increase in nutrient concentration in waterways that can lead to algal blooms. The practical activity is based on one described in *Algae a practical resource for secondary schools* (Society for General Microbiology, 2012).

The Student Guide provides protocols for setting up and carrying out investigations into the growth of populations of freshwater algae. Students can compare the size of the algal populations grown in fertiliser solutions over time by measuring absorbance of the algal cultures using a colorimeter. A suggested supplementary activity is to observe the cultures directly using a microscope. Some students might also compare algal growth over time by estimating population size by carrying out direct cell counts using a haemocytometer.

It is possible to use the basic method to investigate different variables: fertiliser concentration; fertiliser type. It would also be possible for different groups within the same class to carry out one of these investigations using different types of algae.

At SSERC we have set up investigations using 3 types of freshwater algae, *Scenedesmus*, *Euglena*, and *Chlorella*. Figures 3, 4, 5 and 6 show some typical images and data sets.

Limiting factors in photosynthesis

Effect of Light Intensity

The context for this activity is to offer opportunities for students to investigate how light intensity or temperature affect the rate of photosynthesis. The activities are based on the well-established system using immobilised algae [5, 6]. For the effect of light intensity, 2 protocols are suggested one

fieldwork data" [4] each Teacher/ Technician Guide contains a list of links to websites and literature sources that provide relevant data or information easily accessible by National 5 students.

The Student Guide provides a very brief introduction to the practical activities followed by detailed protocols for the suggested methods. In each case a separate protocol for the investigation of two possible variables is provided.

The generic risk assessment should be used as the basis for a risk assessment appropriate to the circumstances which exist in your own school/college/class.

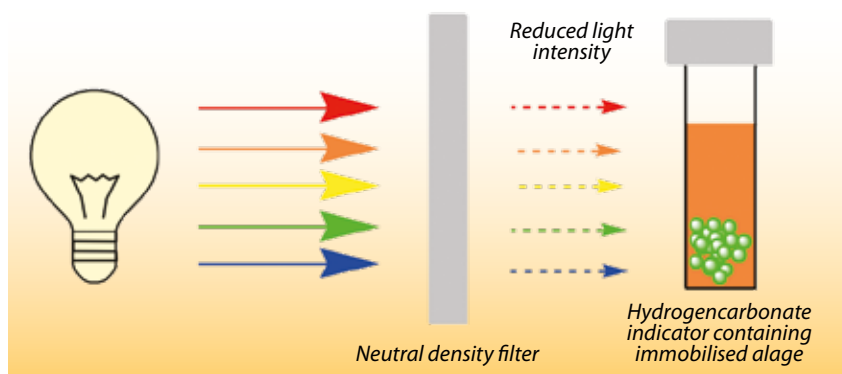


Figure 7 - Using a neutral density filter to reduce light intensity in photosynthesis experiments.

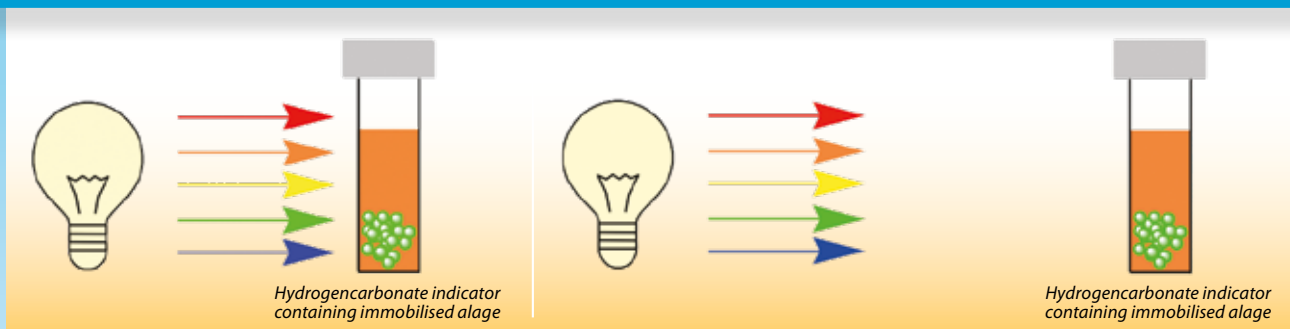


Figure 8 - Reducing the light intensity in photosynthesis experiments.

involving reduction of light intensity using neutral density filters and the other by altering distance of samples from the chosen light source (Figure 7 and 8).

The Student Guide sets out protocols for the experimental set-ups shown in Figures 7 and 8; absorbance changes can be conveniently measure using a colorimeter (580 nm). Figure 9 shows a sample data set.

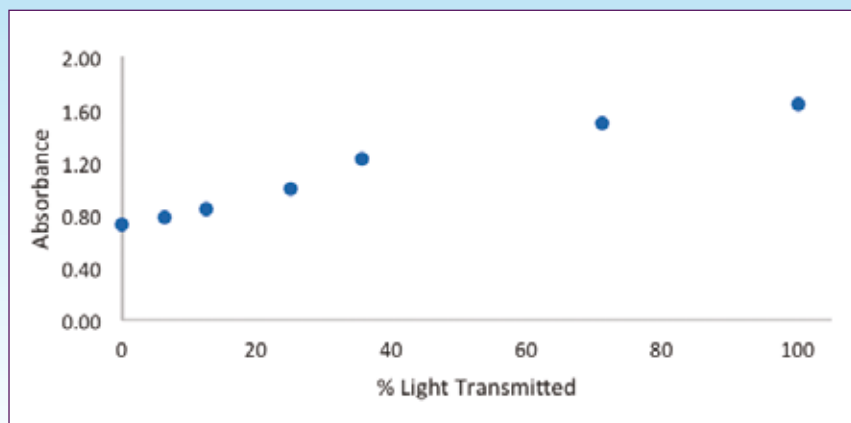


Figure 9 - Change in absorbance (580 nm) after 90 min illumination for samples as per the experimental set-up in Figure 7 on page 11.

Effect of temperature

The effect of temperature on the rate of photosynthesis can also be measured using immobilised algae although in our experience this is a slightly more challenging experimental set-up to put in place. A sample set of data is shown in Figure 10. The raw data for Figures 9 and 10 will be available on the SSERC website shortly.

The full National 5 Biology Assignment packs can be accessed on the SSERC website: <http://www.sserc.org.uk/biology/biology-national-4/4239-test>. Associated data sets can also be accessed from this page.

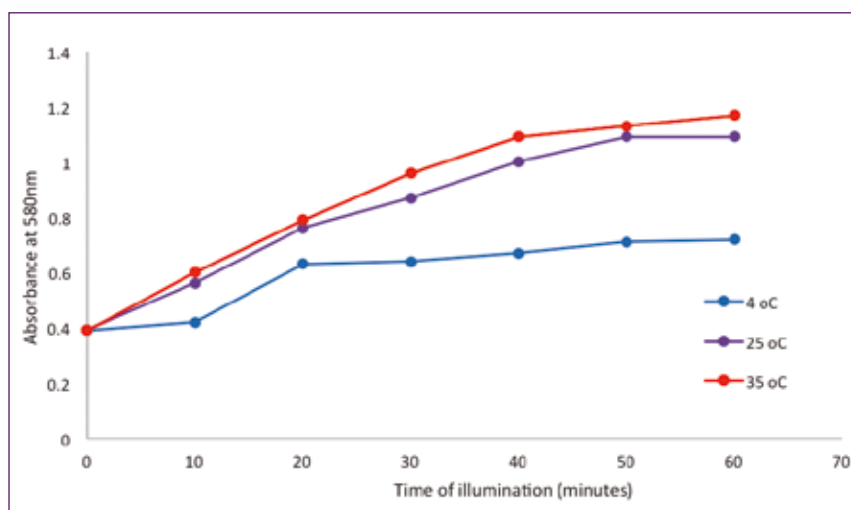


Figure 10 - Effect of temperature on the rate of photosynthesis in *Scenedesmus quadricauda*.

References

- [1] National 5 Course Specification 2017-2018 session, June 2018 at https://www.sqa.org.uk/files_ccc/BiologyCourseSpecN5.pdf (accessed September 2017).
- [2] SSERC website at <http://www.sserc.org.uk/biology/biology-national-4/4239-test>.
- [3] Investigating the effects of fertilisers on an algal population at http://www.sserc.org.uk/images/Bulletins/245/SSERC_bulletin245_p4-7.pdf, <http://www.sserc.org.uk/bulletins226/2006/219-winter-2006/1249-saps-photosynthesis-kit-use-of-algal-balls-to-investigate-photosynthesis261>. SAPPs photosynthesis kit at <http://www.sserc.org.uk/bulletins226/2006/219-winter-2006/1249-saps-photosynthesis-kit-use-of-algal-balls-to-investigate-photosynthesis261>. Limiting factors in photosynthesis at http://www.sserc.org.uk/images/Bulletins/246/SSERC_bulletin_246_p2-5.pdf.
- [4] National 5 Course Specification 2017-2018 session, June 2018 at https://www.sqa.org.uk/files_ccc/BiologyCourseSpecN5.pdf (accessed September 2017).
- [5] Eldridge, D. (2004) A novel approach to photosynthesis practicals. *School Science Review*, **85** (312), 37–45.
- [6] Andrews, K., Beaumont, P.C. and Crawford, K. (2015), Measurement of limiting factors in photosynthesis. *School Science Review*, **96** (356) 31-35.