University of BRISTOL

eBioLabs

Integrated tools for laboratory teaching

Gus Cameron. Department of Biochemistry.

Bristol BSc Honours Programmes in BioMedSci.

- BSc = 120 credits / year / 3 years.
- Students typically take three 40 credit point Units per year.
- BioMedSci First year is a selection of Units from:

    Microbiology, Biochemistry, Chemistry, Physiology, Pathology, Anatomy etc etc

Departmental Teaching: Biochemistry Dept

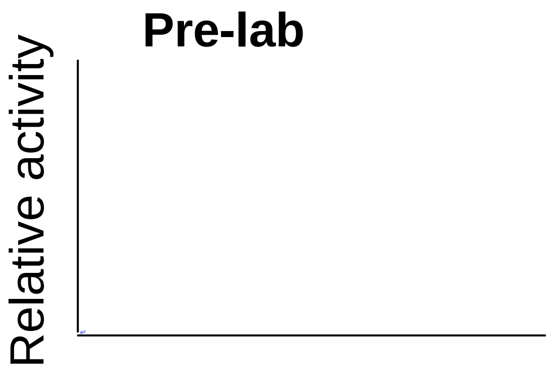
- BSc programme:
  - Single first year 40 credit-point unit (“1G Biochemistry”).
  - 245 students.
  - 45 “honours biochemists”
- Professional programmes:
  - Medics (250).
  - Vets (105).
  - Dentists (80).

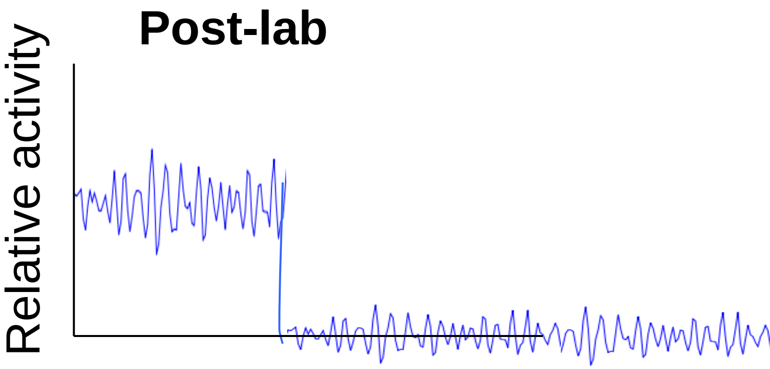
A typical Unit is composed of

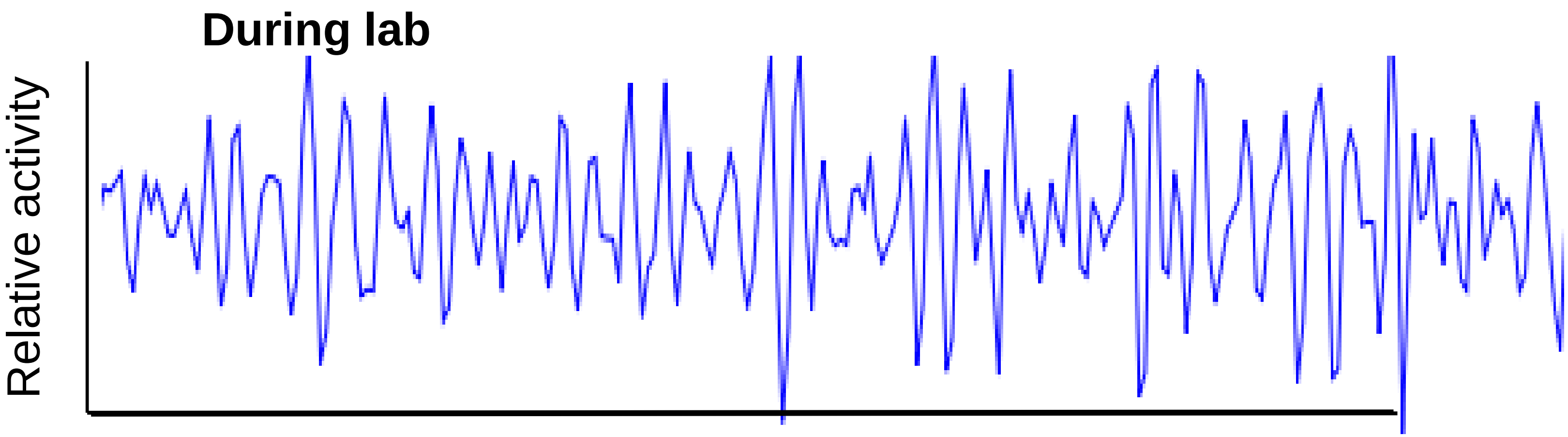
- 66 lectures (66 hrs)
- Twelve tutorials (12 hrs)
- Ten practicals (30 hrs)
- Assessment:
  - Progress exam (10 - 15 %)
  - Two three-hour papers (80-90 %)
  - Lab work and tutorials (0-10 %)

First-year students and attitudes to lab work

Early Work - Student Encephalography Traces







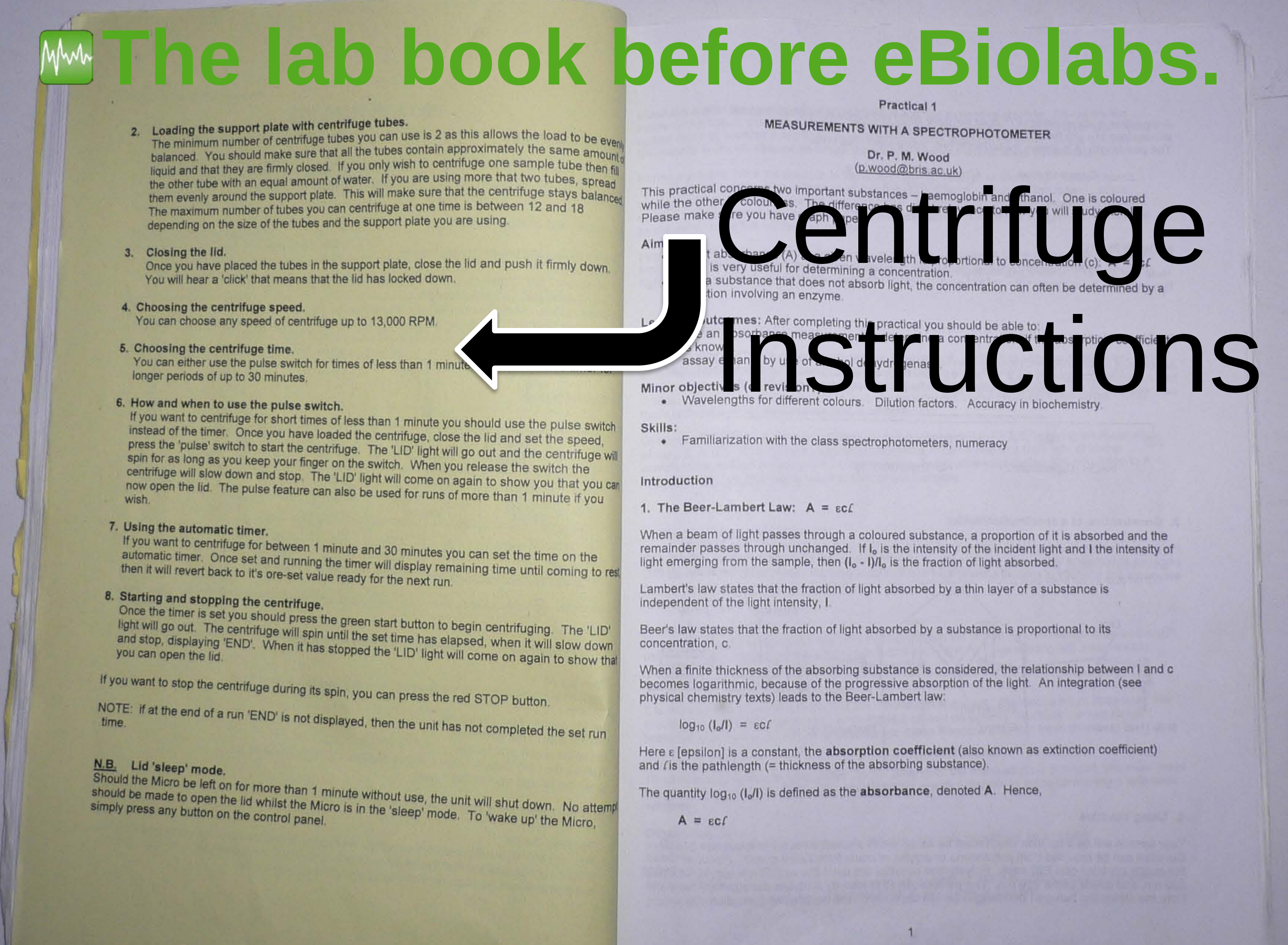
Biochemistry Teaching Labs

- Max 120 students (typically 80)
- Each experiment runs up to three times
- Two technicians
- One academic
- One full-time lead demonstrator
- Two to four postgraduate demonstrators

First-year students and attitudes to lab work

First-year students and attitudes to lab work

The lab book before eBiolabs.



2. **Loading the support plate with centrifuge tubes.**
The minimum number of centrifuge tubes you can use is 2 as this allows the load to be evenly balanced. You should make sure that all the tubes contain approximately the same amount of liquid and that they are firmly closed. If you only wish to centrifuge one sample tube then fill the other tube with an equal amount of water. If you are using more that two tubes, spread them evenly around the support plate. This will make sure that the centrifuge stays balanced. The maximum number of tubes you can centrifuge at one time is between 12 and 18 depending on the size of the tubes and the support plate you are using.

3. **Closing the lid.**
Once you have placed the tubes in the support plate, close the lid and push it firmly down. You will hear a 'click' that means that the lid has locked down.

4. **Choosing the centrifuge speed.**
You can choose any speed of centrifuge up to 13,000 RPM.

5. **Choosing the centrifuge time.**
You can either use the pulse switch for times of less than 1 minute ... longer periods of up to 30 minutes.

6. **How and when to use the pulse switch.**
If you want to centrifuge for short times of less than 1 minute you should use the pulse switch instead of the timer. Once you have loaded the centrifuge, close the lid and set the speed, press the 'pulse' switch to start the centrifuge. The 'LID' light will go out and the centrifuge will spin for as long as you keep your finger on the switch. When you release the switch the centrifuge will slow down and stop. The 'LID' light will come on again to show you that you can now open the lid. The pulse feature can also be used for runs of more than 1 minute if you wish.

7. **Using the automatic timer.**
If you want to centrifuge for between 1 minute and 30 minutes you can set the time on the automatic timer. Once set and running the timer will display remaining time until coming to rest then it will revert back to it's ore-set value ready for the next run.

8. **Starting and stopping the centrifuge.**
Once the timer is set you should press the green start button to begin centrifuging. The 'LID' light will go out. The centrifuge will spin until the set time has elapsed, when it will slow down and stop, displaying 'END'. When it has stopped the 'LID' light will come on again to show that you can open the lid.

If you want to stop the centrifuge during its spin, you can press the red STOP button.

NOTE: If at the end of a run 'END' is not displayed, then the unit has not completed the set run time.

__N.B.__ **Lid 'sleep' mode.**
Should the Micro be left on for more than 1 minute without use, the unit will shut down. No attempt should be made to open the lid whilst the Micro is in the 'sleep' mode. To 'wake up' the Micro, simply press any button on the control panel.

Practical 1

MEASUREMENTS WITH A SPECTROPHOTOMETER

Dr. P. M. Wood
(p.wood@bris.ac.uk)

This practical con... two important substances – haemoglobin and ...thanol. One is coloured while the other ... colour...ss. ... Please make s...re you have ...

Aim
- ...t absorbance (A) ... wavelength ... proportional to concentration (c): A = εcℓ ... is very useful for determining a concentration.
- ... a substance that does not absorb light, the concentration can often be determined by a ...tion involving an enzyme.

L... outcomes: After completing this practical you should be able to:
- ... an absorbance measurement ... a concentration if the absorption coefficient ... know...
- ... assay ethanol by ... alcohol dehydrogenase

Minor objectives (... revision)
- Wavelengths for different colours. Dilution factors. Accuracy in biochemistry.

Skills:
- Familiarization with the class spectrophotometers, numeracy

Introduction

1. The Beer-Lambert Law: A = εcℓ

When a beam of light passes through a coloured substance, a proportion of it is absorbed and the remainder passes through unchanged. If I_o is the intensity of the incident light and I the intensity of light emerging from the sample, then $(I_o - I)/I_o$ is the fraction of light absorbed.

Lambert's law states that the fraction of light absorbed by a thin layer of a substance is independent of the light intensity, I.

Beer's law states that the fraction of light absorbed by a substance is proportional to its concentration, c.

When a finite thickness of the absorbing substance is considered, the relationship between I and c becomes logarithmic, because of the progressive absorption of the light. An integration (see physical chemistry texts) leads to the Beer-Lambert law:

$$\log_{10}(I_o/I) = \varepsilon c \ell$$

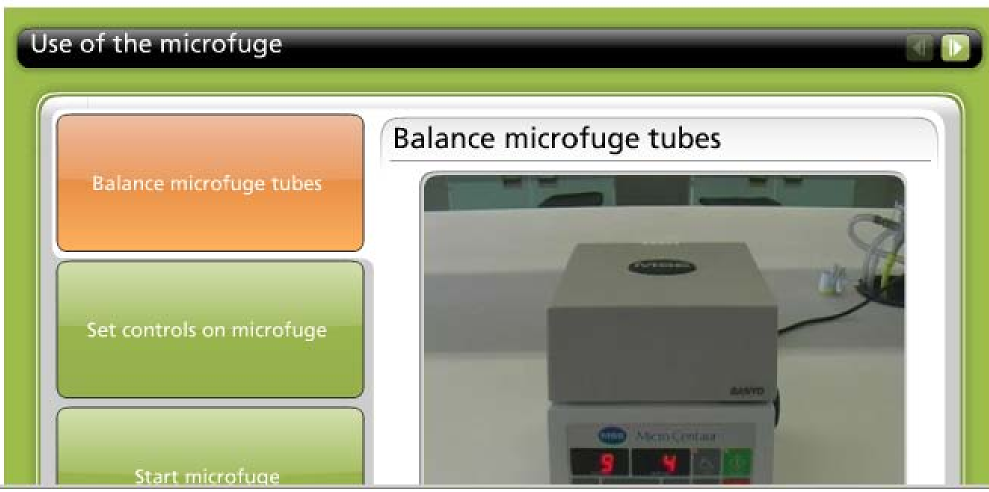
Here ε [epsilon] is a constant, the **absorption coefficient** (also known as extinction coefficient) and ℓ is the pathlength (= thickness of the absorbing substance).

The quantity $\log_{10}(I_o/I)$ is defined as the **absorbance**, denoted **A**. Hence,

$$A = \varepsilon c \ell$$

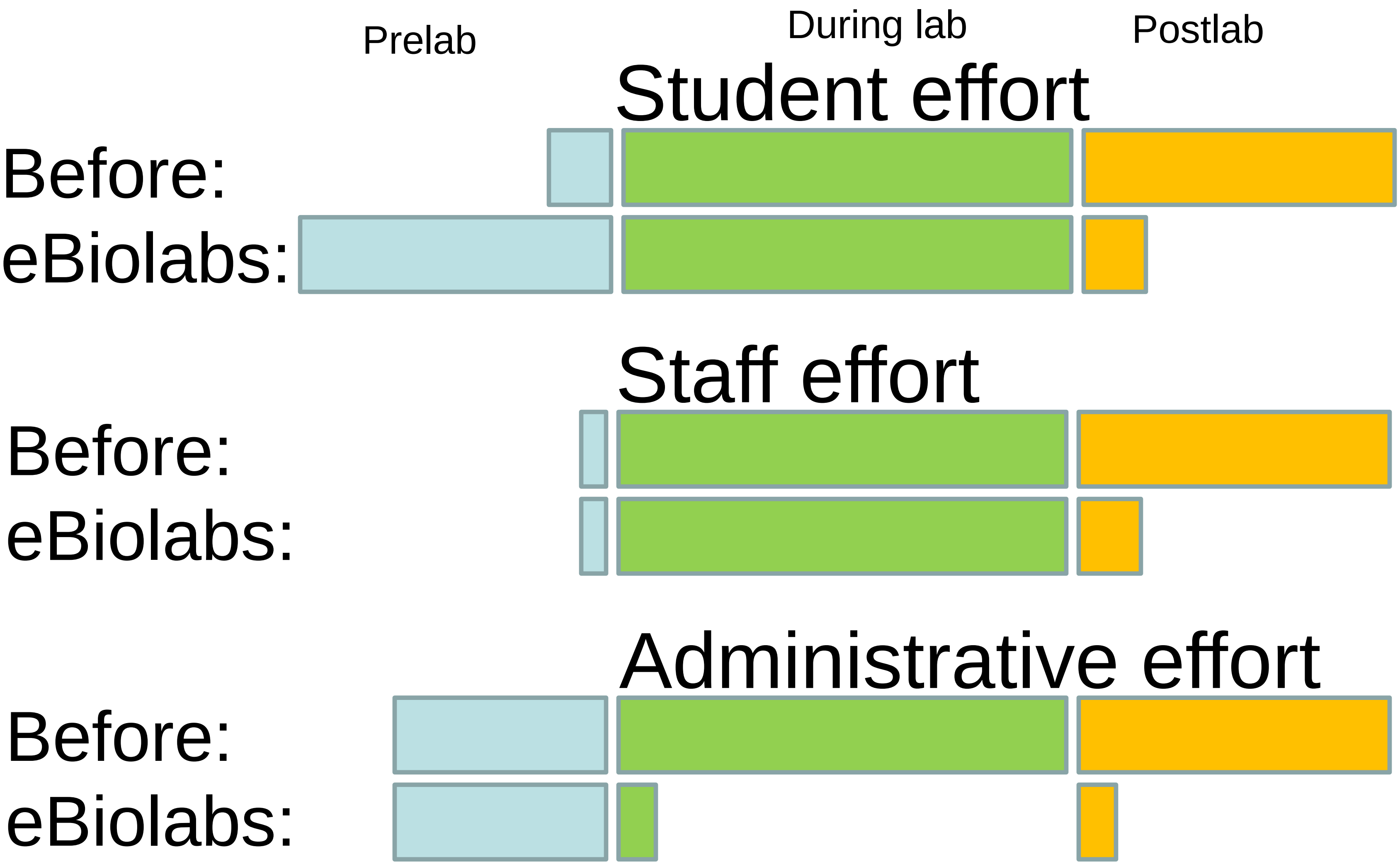
The “lab book” after eBiolabs.

Make sure you understand the steps involved in using a centrifuge safely.



Centrifuge Instructions are now on-line and interactive

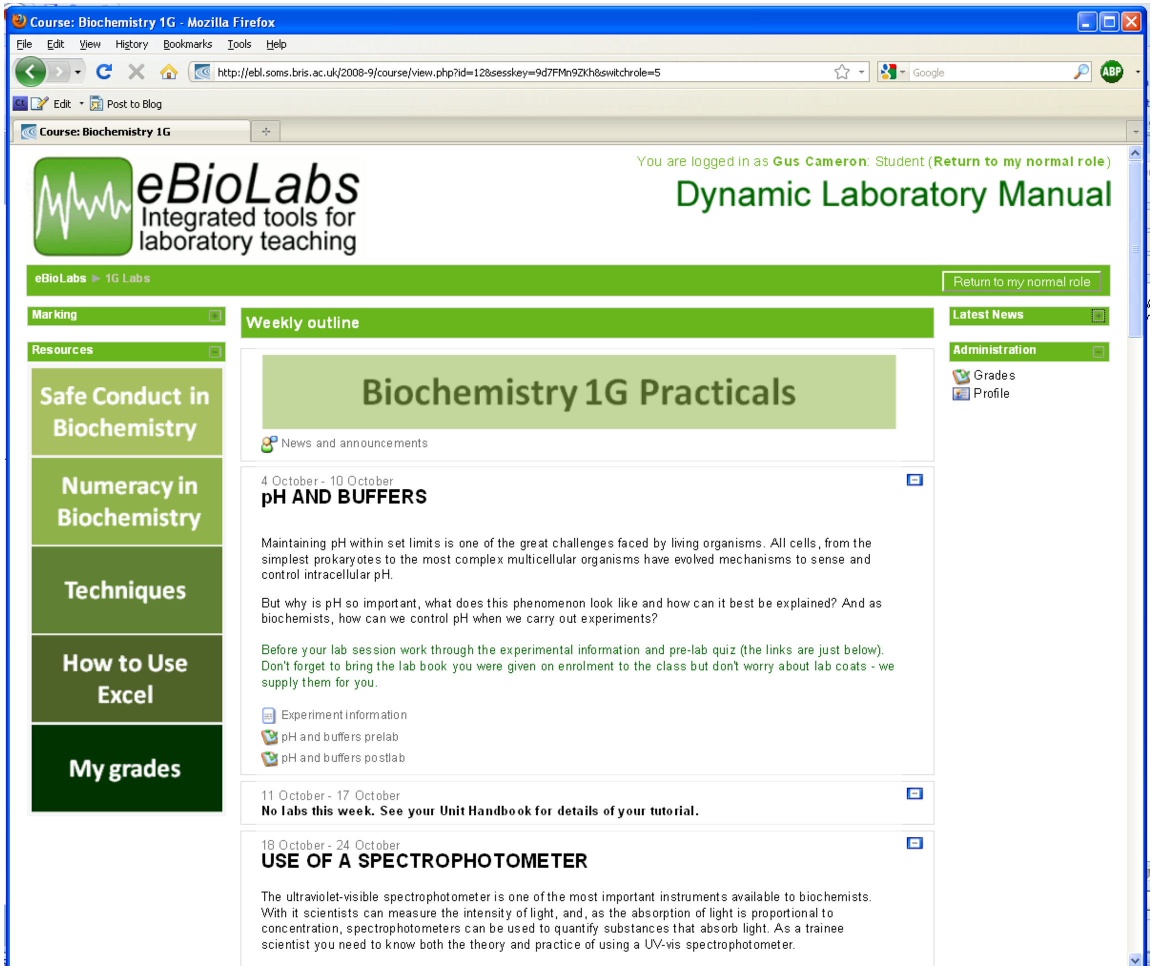
eBiolabs aims:



eBiolabs combines

- Lab instructions.
- Pre-lab tasks.
- On-line submission of work.
- On-line marking and feedback.
- Electronic registers.
- Electronic grade-books.
- Communication tools.

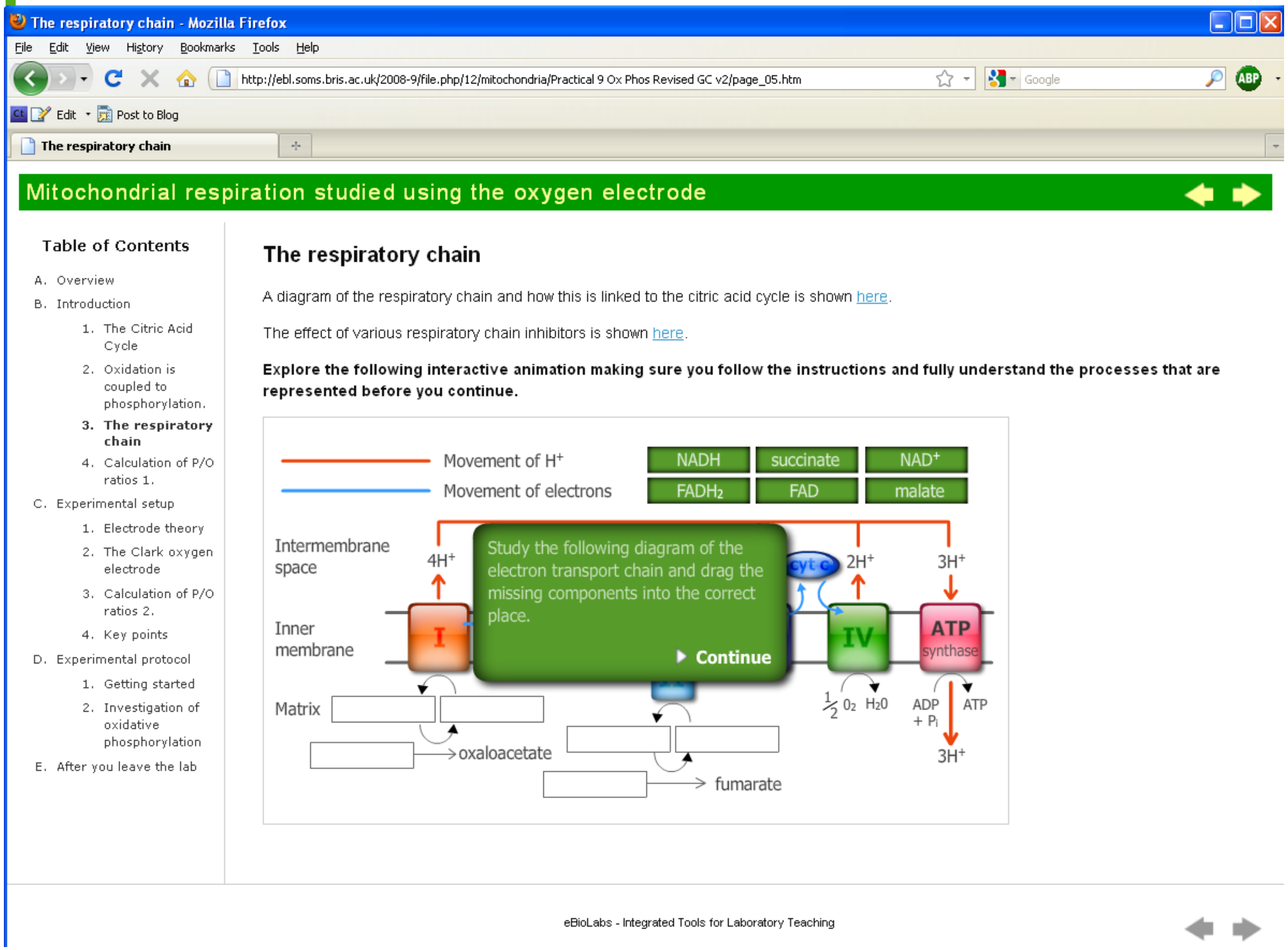
eBiolabs website



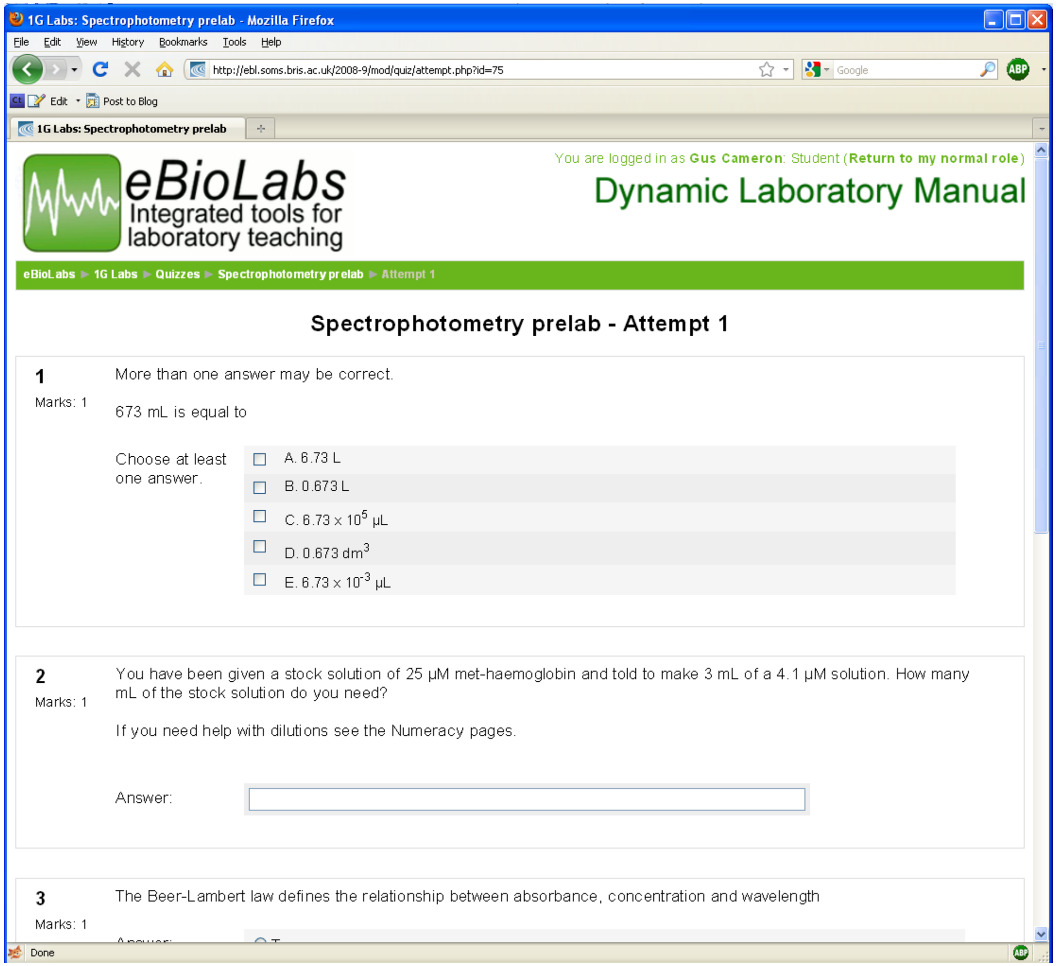
Student workflow

1. Log in via Single Sign On.
2. Study experimental information.
3. Check understanding with pre-lab test.
4. Attend practical and record results.
5. Log in and submit post lab assignment.
6. Await feedback and marks.

Experimental Information



Testing understanding



Gradebook

1G Labs: Grades: View - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://ebl.soms.bris.ac.uk/2008-9/grade/report/grader/index.php?id=12&perpage=10&page=0&sortitemid=78

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1G Labs: Grades: View

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Jump to...

Dynamic Laboratory Manual

eBioLabs ▶ 1G Labs ▶ Grades ▶ View ▶ Grader report

Turn editing on

Choose an action ...

Grader report

Visible groups: All participants

Page: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ...26 (Next)

	Biochemistry 1G					
		pH and buffers Full view		Spectrophotometry		
First name / Surname	Aggregation Course total	pH and buffers prelab	pH and buffers postlab	Experiment 1	Spectrophotometry prelab	Spec
Olivia Lambert	741	20	69	93	16	
Jenny Sharpe	854	20	74	97	17	
Emma Still	760	20	70	87	17	
Eleanor Bird	529	20	70	87	14	
Luke Dickerson	496	20	60	79	17	
Velislava Petrova	768	20	71	99	19	
Paul Lissowski	685	20	71	81	18	
Nicholas Hough	779	20	75	90	13	
Sarah Cumming	740	20	64	91	18	

Done

Lab book

You may need to adjust the **Cal** control during the practical to maintain full scale deflection (with fresh buffer and NO mitochondria – see 1), but **do not** touch the zero control.

B. Effect of various inhibitors - *note these are toxic, but the amounts that you are using pose no health risk. If you do get any on your skin, wash with methanol and then water.*

Perform the following experiments:

(i) Set up the electrode with medium + phosphate in the cell. Add glutamate + malate + mitochondria before lowering the electrode. Then add two additions of ADP and while respiration is proceeding rapidly, add **oligomycin**. Add more ADP and observe the effect. Finally add **dinitrophenol** and note what happens.

(ii) Set up the electrode with medium + malate + glutamate + phosphate in the cell. Add mitochondria then add DNP After the rapid rate has been obtained, add **rotenone**, then succinate, then **antimycin**, then ascorbate, allowing time for any effect to be observed in each case

Results

1. Calculation of P/O ratios:

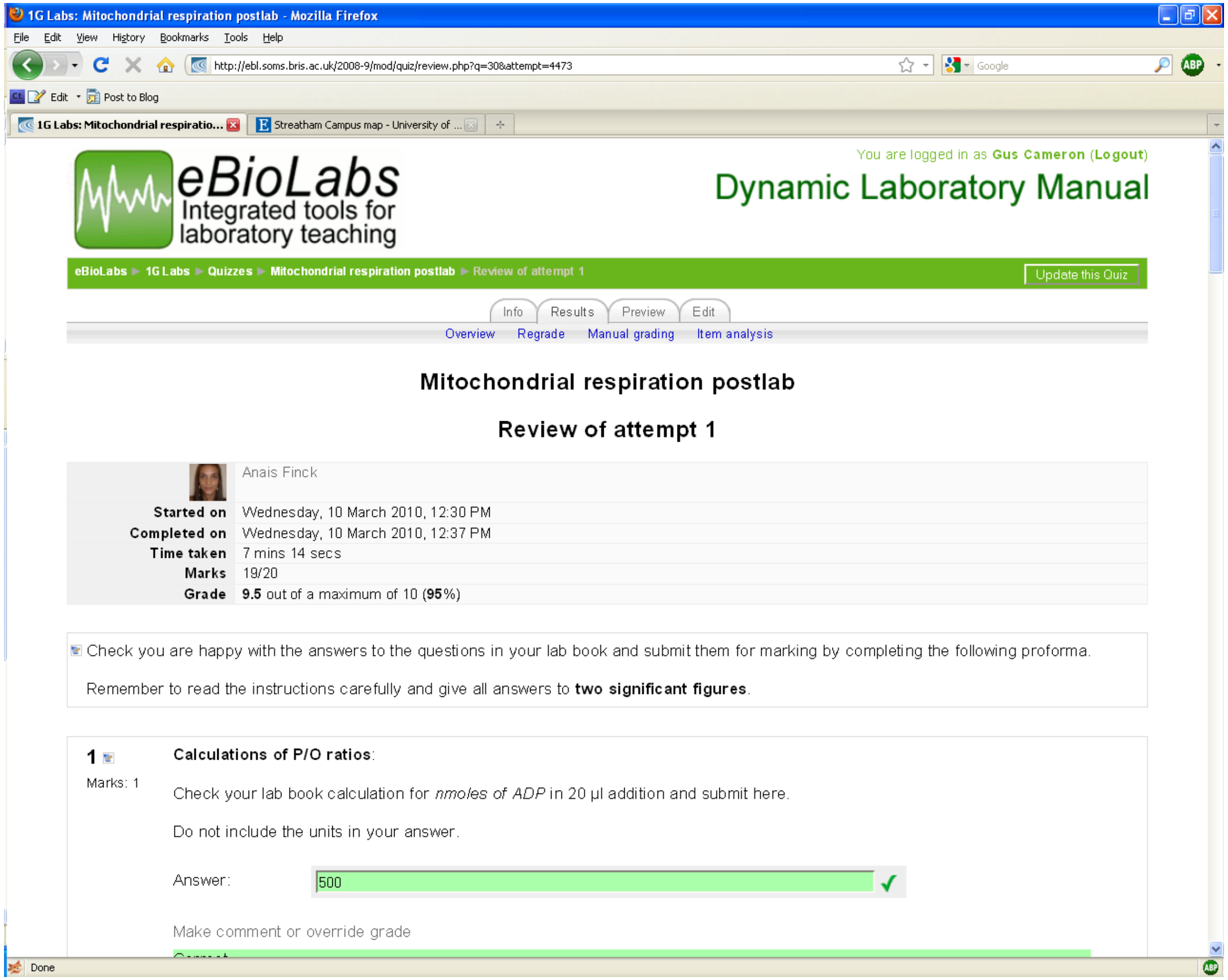
i) nmols of ADP in 20μl addition =

ii) nmols O atoms in 3.0 ml air saturated medium =

iii) nmols O atoms represented by each small division on the chart recorder =

		Substrate		
		Glutamate + malate	Succinate	Ascorbate + TMPD
Number of chart recorder divisions	ADP addition 1			
	ADP addition 2			
	ADP addition 3			
	Mean value			
	Mean P/O			
	Expected P/O			

Post-lab tasks. *Integrated.*



Post-lab tasks. *Excel.*

Kate_Binley_marked_RBC_kb9213_1_.xlsx [Read-Only] - Microsoft Excel

eBiolabs Session 6: Membrane Permeability

This spreadsheet is automatically marked. Do not add additional rows, columns or formatting of any kind.

You MUST save this spreadsheet in **Excel format** on your computer before to uploading it to eBiolabs.

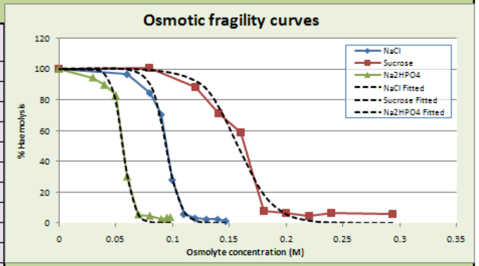
Enter your name here:	Kate Binley	**Your lab partners name:**	Cherie Leung
Enter your Bristol Username here:	kb9213	Did you do experiment A or B?	A

A1. Osmotic fragility curve with NaCl (5 marks)

Tube	Final [NaCl] (M)	A_{420}	% Haemolysis	% Haemolysis Best Fit	Square of Error
1	0.147	0.016	1.39	0.029	1.854
2	0.14	0.027	2.34	0.085	5.087
3	0.13	0.028	2.43	0.398	4.130
4	0.12	0.036	3.13	1.849	1.642
5	0.11	0.067	5.82	8.161	5.478
6	0.0999	0.326	28.3	29.861	2.435
7	0.09	0.817	70.9	66.414	20.123
8	0.08	0.972	84.4	90.318	35.023
9	0.06	1.112	96.5	99.521	9.124
10	0	1.152	100	100.000	0.000
				Sum Squares	2.914
				EC50_A1	0.094
				Slope_A1	-67.37

A2. Osmotic fragility curve with Sucrose (5 marks)

Tube	Final [Sucrose] (M)	A_{420}	% Haemolysis	% Haemolysis Best Fit	Square of Error
1	0.294	0.064	6.15	0.013	37.664
2	0.24	0.068	6.54	0.452	37.060
3	0.22	0.045	4.33	1.670	7.074
4	0.2	0.065	6.25	5.971	0.078
5	0.18	0.078	7.5	19.186	136.557
6	0.16	0.614	59	47.021	143.498
7	0.14	0.743	71.4	76.841	29.609
8	0.12	0.917	88.2	92.540	18.834
9	0.0789	1.05	101	99.466	2.352
10	0	1.04	100	99.997	0.000
				Sum Squares	6.424
				EC50_A2	0.158
				Slope_A2	-28.63



The osmolarity required to obtain 50 % lysis (the EC50) is the same for all three compounds. Thus when concentration is measured in molarity the EC50 of sucrose (one species) will be three times the EC50 of Na_2HPO_4 (three species) and 1.5 times that of NaCl (two species). The EC50 of NaCl should be twice that of Na_2HPO_4. We have calculated the EC50 from the data you presented and used that to assign marks.

EC50 for the compounds	EC50_A1	0.094	M NaCl
	EC50_A2	0.158	M Sucrose
	EC50_B1	0.056	M Na_2HPO_4
Ratios of the EC50s	EC50_A2 / EC50_A1	EC50_A2 / EC50_B1	EC50_A1 / EC50_B1
	1.68	2.80	1.67
Expected ratio	1.5	3	2
% Error	% Error	% Error	% Error
	11.7	6.5	16.3
	Marks / 5	Marks / 5	Marks / 5

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eBiolabs year one. Results.

- ~7000 student contact hours supported.
- ~5000 student assignments managed.
- Significant differences between eBiolabs students and non-eBiolabs students.
- Reflects way students want to learn.
- Staff report higher level conversations.
- ~ 40 staff days saved.

eBiolabs. Next.

- Physiology first year.
- Pharmacology first year.
- Biochemistry second year.
- Cellular and Molecular Medicine / Microbiology pending.