

# A-level Biology: practical science endorsement

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# Overview of this session

- Common Practical Assessment Criteria (CPAC).
- Apparatus and techniques.
- Practical work in action –  
Biology: planning, assessing  
and tracking.
- Lab books.
- The CPAC experience  
for me and my students.
- Any questions?



# Common Practical Assessment Criteria (CPAC)

1. Follows written procedures.
2. Applies investigative approaches and methods when using instruments and equipment.
3. Safely uses a range of practical equipment and materials.
4. Makes and records observations.
5. Researches, references and reports.

## CPAC Pen portraits

A series of pen portraits have been written to clarify what is meant by 'not achieved', 'achieved' and 'achieved at a level of competence exceeding the CPAC standard'.

These exemplars have been developed in collaboration between the four Awarding Bodies: AQA, Eduqas, OCR and Pearson.

They are intended for guidance and training purposes, and to give an indication of the standard necessary for each CPAC statement.

Note that, although these pen portraits show (in the most part) CPAC skills in isolation, many practical exercises are likely to involve CPAC strands being assessed in combination.

# AQA practical endorsement online training



## What I am looking for when I am assessing each competency is .....

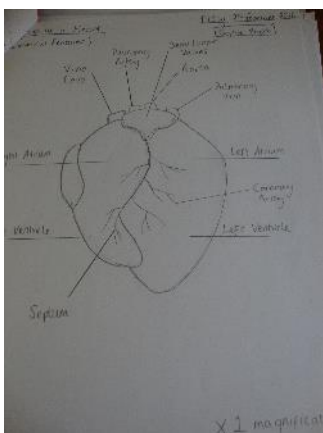
This aide memoire should **not** be used as a tick list. It is designed to help teachers (and advisers when carrying out monitoring visits) in thinking about what they will look for in their students' practical work. Blanks have been left in each section for teachers (and monitors) to add their own criteria. This document should be used **after** completing the endorsement training, available on the AQA website.

Common Practical Assessment Criteria (CPAC)	I am looking for my students to be able to ...
1. Follows written instructions	<ul style="list-style-type: none"><li>• follow a set of written instructions that are appropriate to the level of familiarity to equipment or techniques</li><li>• carry out steps in the correct order</li><li>• generate a set of data that is expected. This might be close to my own value or that expected from a data trend seen in a secondary source</li><li>• work independently, in pairs or small groups but they must carry out practical steps</li><li>• feel confident to seek clarification when carrying out method steps, when either using an unfamiliar set of apparatus or carrying out a new technique</li><li>• -----</li><li>• -----</li><li>• -----</li><li>• -----</li><li>• -----</li></ul>

<http://www.aqa.org.uk/resources/science/as-and-a-level/teach/practicals>

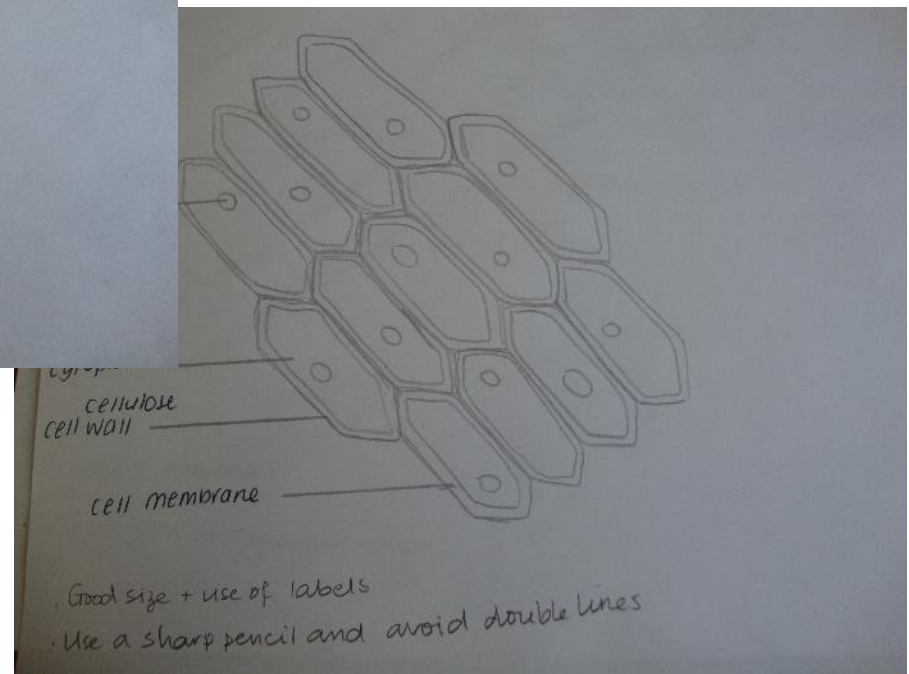
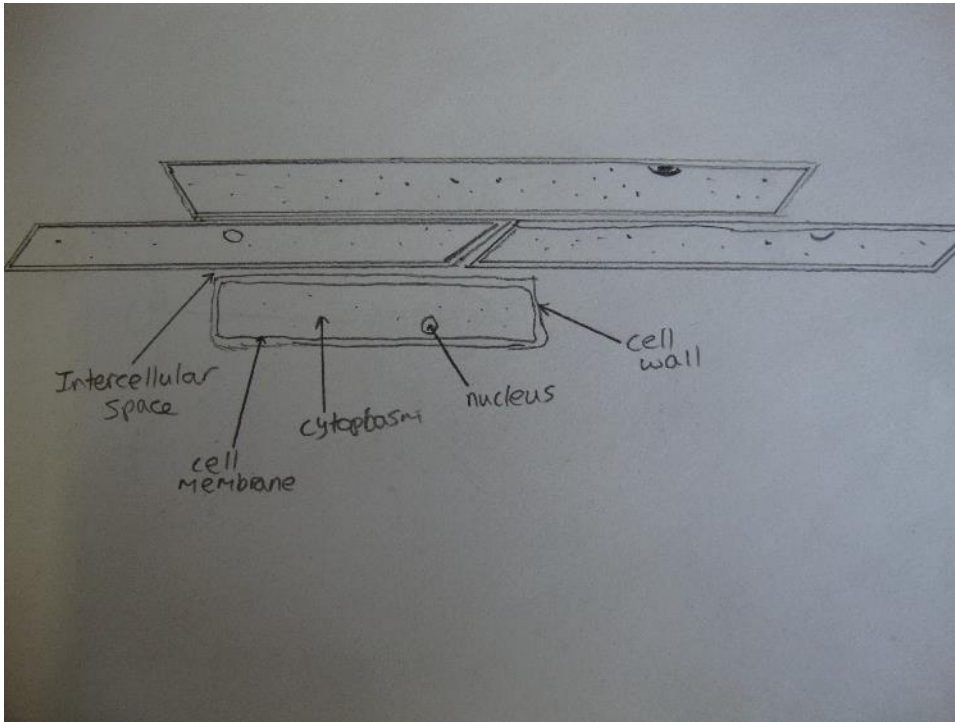
# 12 core practical activities

In addition to the five Common Practical Assessment Criteria (CPAC) there are a number of **apparatus and techniques** which must also be addressed.



	Apparatus and techniques
AT a	use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)
AT b	use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer
AT c	use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions
AT d	use of light microscope at high power and low power, including use of a graticule
AT e	produce scientific drawing from observation with annotations
AT f	use qualitative reagents to identify biological molecules
AT g	separate biological compounds using thin layer/paper chromatography or electrophoresis
AT h	safely and ethically use organisms to measure: <ul style="list-style-type: none"> <li>• plant or animal responses</li> <li>• physiological functions</li> </ul>
AT i	use microbiological aseptic techniques, including the use of agar plates and broth
AT j	safely use instruments for dissection of an animal organ, or plant organ

# Biological drawings (AT e) can be a challenge – practice is essential



# AT: students should take ownership of their progress

Apparatus and Techniques				
Letter	Apparatus and Techniques Covered	Practical	Date	Progress
AT a	Use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)	RP 9	23/09/16	
AT b	use appropriate instrumentation to record quantitative measurements, such as a colorimeter or potometer			
AT c	Use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions	RP 9	23/09/16	
AT d	Use of light microscope at high power and low power, including use of a graticule			
AT e	Produce scientific drawing from observation with annotations			
AT f	use qualitative reagents to identify biological molecules			
B	separate biological compounds using thin layer/paper chromatography or electrophoresis			
1	safel			

# CPAC 1: follows written procedures

Tick lists help the teacher during the practical.

Required Practical 3 – Part 1 CPAC

CPAC1 – dilutions - table/ zeroing balance / potato pieces cut into discs/boiling tubes covered potatoes recorded before and after weighing

CPAC2 (a) - Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigations, experimental techniques and procedures with minimal assistance or prompting

Use of a balance/measuring cylinders placed on the bench when measuring solutions/cutting pieces/use of the same balance/removing skin

CPAC3 – Use of a scalpel and cutting tile/dealing with any accident appropriately

CPAC4 – Start and end mass recorded in grams/correct number of decimal places/suitable table

AS B

Name	Group	Competency					Notes
		1	2	3	4	5	
1. Annabel Ainscough	1						
2. Rebecca Bridge	2			✓			
3. Agate Faivelsone	8	Ⓟ					
Tom Frankish	2	Ⓟ		✓			GENERALLY DISORGANISED FILTER PAPER NOT LABELED
Elizabeth Harper	6			✓			MEASURING POTATO
asnaat Mahmood	7			✓			
becca Mar...							

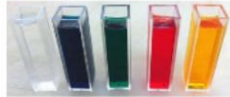




# CPAC 1: follows written procedures

## HOW TO USE THE COLORIMETER

1. Check the colorimeter is switched on
2. Select the correct filter – *this will usually be done for you already*
3. Place a cuvette containing distilled water in the holder in the colorimeter\* – the water should be approximately 5 mm from the top of the cuvette – this is your **Reference Cuvette**



\*Always ensure the cuvette is dry on the outside before placing it into the colorimeter

4. Press the 'zero' switch



5. The digital display should show 0.00 – *don't worry if the numbers flicker*
6. Remove the Reference Cuvette (keep it for future use) and place the first of your samples in a cuvette into the holder in the colorimeter – again the liquid in each cuvette should be about 5mm from the top



7. Record the number shown on the digital display – there are no units. This is an 'arbitrary' scale. The higher the number, the more light is absorbed



8. Replace the Reference Cuvette into the holder and press the button to zero – this resets the colorimeter.



Some of the cuvettes may have 2 frosted sides – as shown in the image. Place them in the holder in the colorimeter so that the light beam passes through the non-frosted sides of the cuvette (see image 1).

The light shines through the cuvette along the length of the colorimeter (see image 2).



Image 2: Direction of the light beam.

Image 1: Light beam passes through non-frosted sides of cuvette.

Required Practical 1 – Part 1 CPAC

Date: 18/10/16

CPAC 1 Minimal intervention - teacher/questioning - student – practical.  
 CPAC 3 Lab coats/glasses routine. Reporting of any concerns/breakages. Organised bench – practical.  
 CPAC 4 Tables - correct units/headings/IV in first column/no units in body of the table – lab book.

CPAC 1 Follows written instructions  
 CPAC 3 Safely uses a range of practical equipment and materials  
 CPAC 4 Makes and records observations

Name	Group	Competency					Notes
		1	2	3	4	5	
Blakemore							
agg	1						
unningham	1						
kes	2						
agan	10						
	4						

# CPAC 2: planning in advance is essential

What AQA is looking for	Use the equipment properly, without much prompting.  Work methodically and show ability to multi-task.	Have adapted method/equipment during the practical and have justified reasons for this.	Have listed the main variables and have explained how control variables will be kept the same.	Have selected the most appropriate equipment and explained reasons for choosing each piece in order to gather accurate results.
CPAC 2: make choices about appropriate element examples	Use equipment to measure volumes and time.	At least two adaptations to the method provided with justifications.	Independent and dependent identified and state how to control two variables.	Chosen equipment with fewest uncertainties and justified.

# CPAC 2: looking for specific examples

**Required Practical 3 – Part 1 CPAC**

CPAC1 – dilutions - table/ zeroing balance / potato pieces cut into discs  
potatoes recorded before and after weighing

CPAC2 (a) - Correctly uses appropriate instrumentation, apparatus and materials (activities, experimental techniques and procedures with minimal assistance or prompting  
Use of a balance/measuring cylinders placed on the bench when measuring pieces/use of the same balance/removing skin

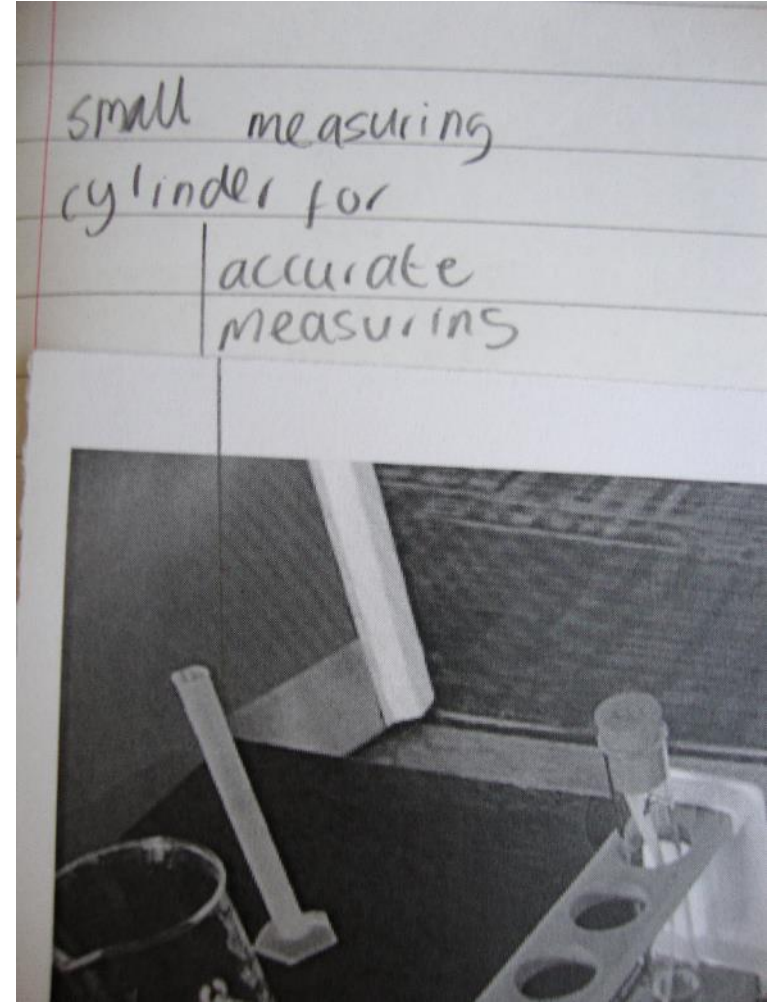
CPAC 3 – Use of a scalpel and cutting tile/dealing with any accident appropriately

CPAC4 – Start and end mass recorded in grams/correct number of decimal places

AS B

Name	Group	Competency				
		1	2	3	4	5
	1					

# CPAC 2: Students planning investigations



# CPAC 3: safe use of a range of practical equipment and materials

- It's not robust enough to say that students are reaching the pass standard because 'nothing went wrong'.
- Clear statements outline that students must:
  - identify main hazards and associated risks
  - use appropriate safety equipment and approaches with minimal prompting
  - make adjustments when issues are identified.



# CPAC 3: risk assessments could be set for homework

17/2/16  
CPAC 3

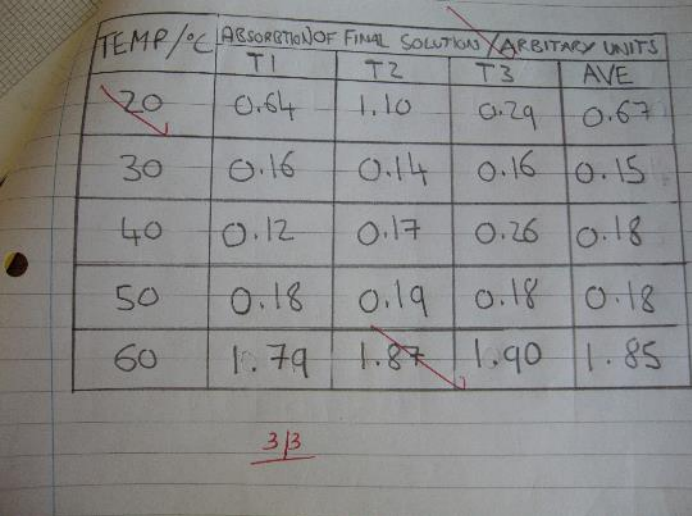
Risk Assessment

Hazard (Procedure or equipment)	What could go wrong?	Who could be affected?	How the risk is minimised
Mounted needle	Improper use of needle could result in a person sustaining cuts	The person carrying out the dissection	Instruct all the participants beforehand the proper technique for using the mounted needle.
Panic attack, fainting during dissection.	A person could faint or experience a panic attack during the practical as they are afraid	The person carrying out the dissection	Have a space outside the lab where people can go if they feel unwell during practical. Kap



# CPAC 4: makes records and observations

- Data can be qualitative or quantitative.
- Note that students must make accurate, relevant observations.
- They are also required to obtain accurate, precise and sufficient data before recording it methodically, using appropriate units and conventions.



A handwritten table on lined paper showing the absorption of final solutions at different temperatures. The table has five columns: TEMP/°C, T1, T2, T3, and AVE. The rows represent temperatures of 20, 30, 40, 50, and 60 degrees Celsius. The values for T1, T2, and T3 are recorded, and the average (AVE) is calculated for each temperature. A red checkmark is next to the 20°C row, and a red '3/3' is written below the table.

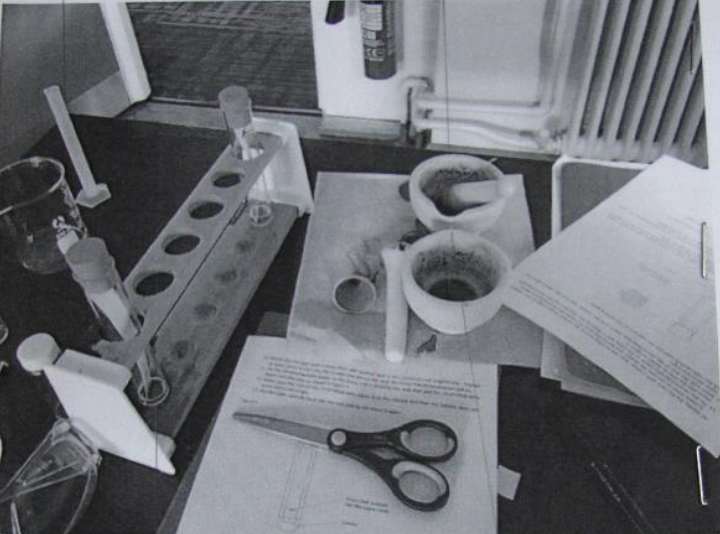
TEMP/°C	ABSORPTION OF FINAL SOLUTIONS			ARBITRARY UNITS
	T1	T2	T3	AVE
20	0.64	1.10	0.29	0.67
30	0.16	0.14	0.16	0.15
40	0.12	0.17	0.26	0.18
50	0.18	0.19	0.18	0.18
60	1.79	1.87	1.90	1.85

3/3

# CPAC 4: makes records and observations

small measuring cylinder for accurate measuring


Pestle & mortar - our results could be different if I didn't homogenise the leaves enough.



(3cm<sup>3</sup>) solvent in bottom of the boiling tube



capillary tubes, so I could get a small percize dot of homogenized leaf on the chromatography paper

Time taken (sec)



← To improve, use the same person to judge when the blue has disappeared each time.

There may be human error when starting/stopping the stopwatch. We need to decide at what point we begin the watch and understand that error may occur when reaching to no color change.

An image showing the test tube containing the DCP which had been covered (on the right). There was a small rip in the tin foil covering this test tube which explains the small, partial color change.



# CPAC 4: makes records and observations

TEMP/°C	ABSORPTION OF FINAL SOLUTION / ARBITRARY UNITS			AVE
	T1	T2	T3	
<del>20</del>	0.64	1.10	0.29	0.67
30	0.16	0.14	0.16	0.15
40	0.12	0.17	0.26	0.18
50	0.18	0.19	0.18	0.18
60	1.79	<del>1.87</del>	1.90	1.89

3/3

18/11/2015 Investigation into the effect of a named factor on the rate of dehydrogenase activity in chloroplasts.

Needs a title / Framing - more space

repeats	X (time)	Y (time)	
1	8:19 = 90s	blue @ 300 seconds	Practical error; suspension was with ice, it broke due to an ice cube into the solution
2	6m:26s	"	
3	6m:51s	"	
4	8m:10s	"	
	6m:41s	"	

Writes notes in the body of the report

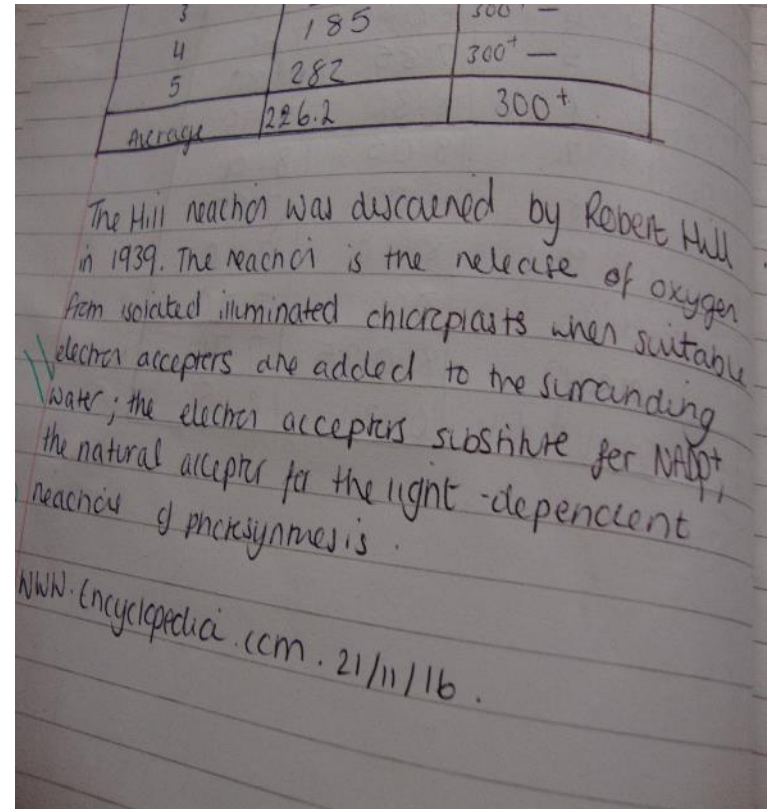
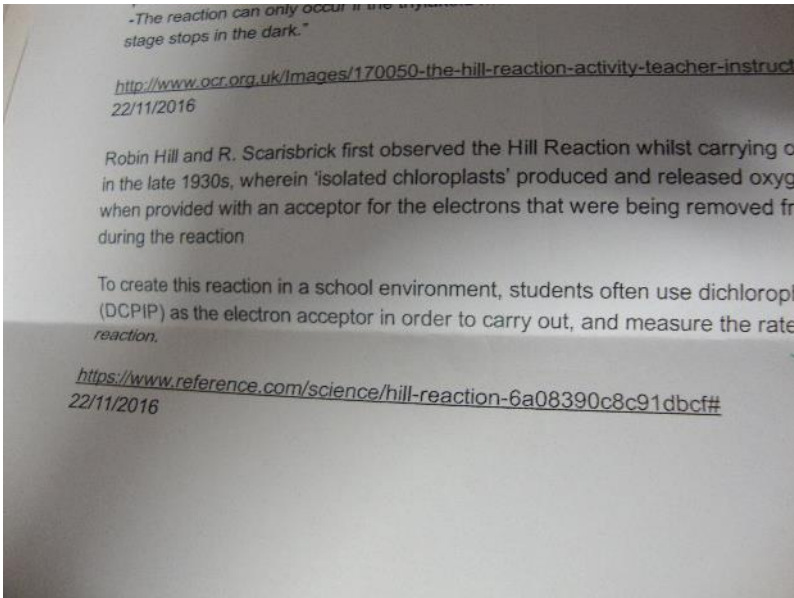
Colour of mixtures = A - light blue (turquoise)  
B - blue (dark)

# CPAC 5: researches, references and reports

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- CPAC 5 is being evidenced as soon as students begin to process their raw data.
- Research must be used to inform further practical work or to support a conclusion being made.
- It may also be used well to evaluate a practical method, to inform adjustments for next time.

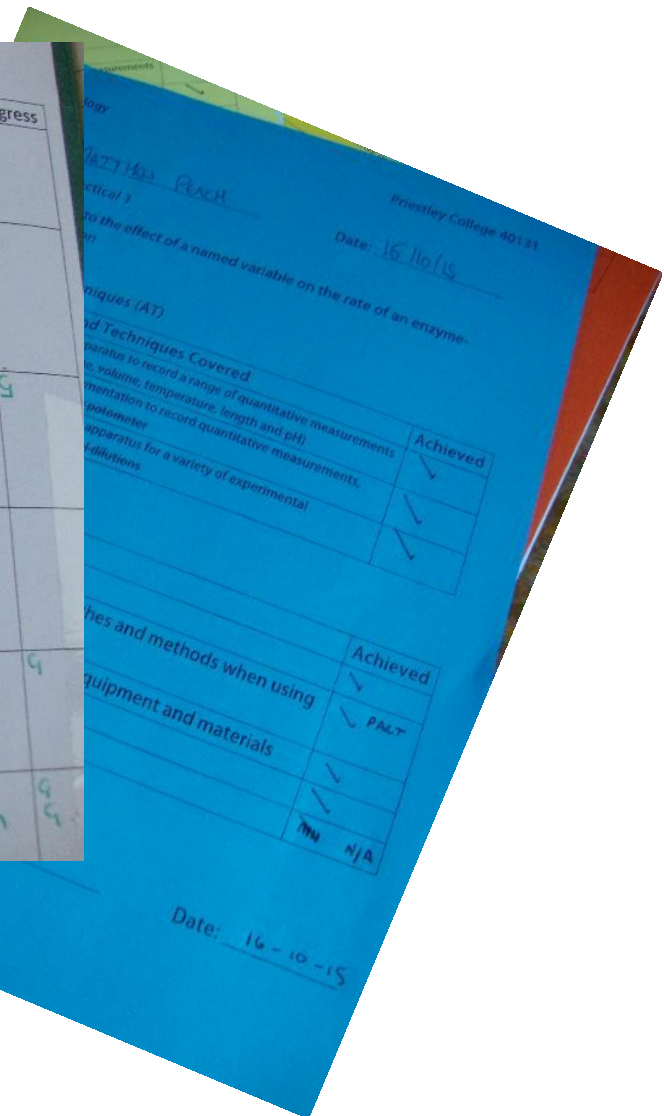
# CPAC 5: researches, references and reports



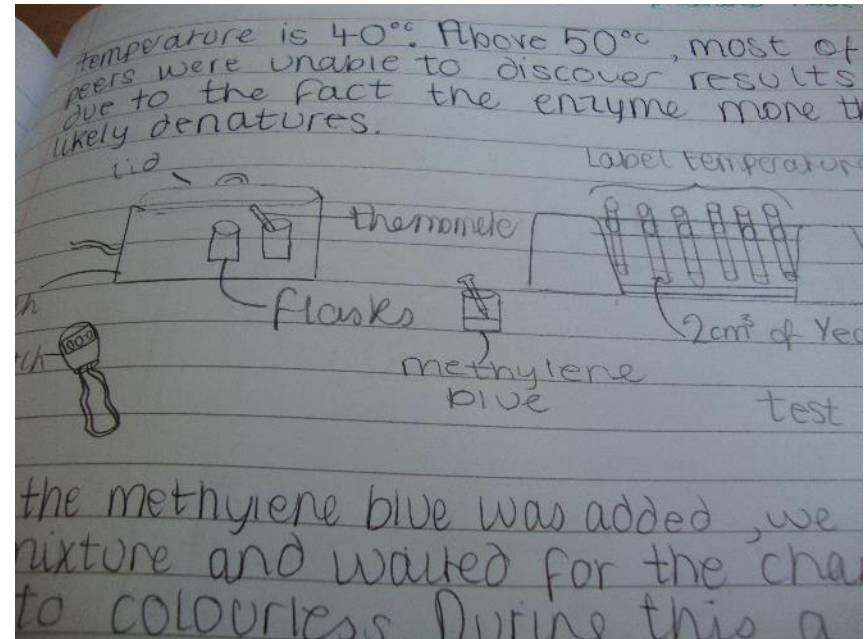
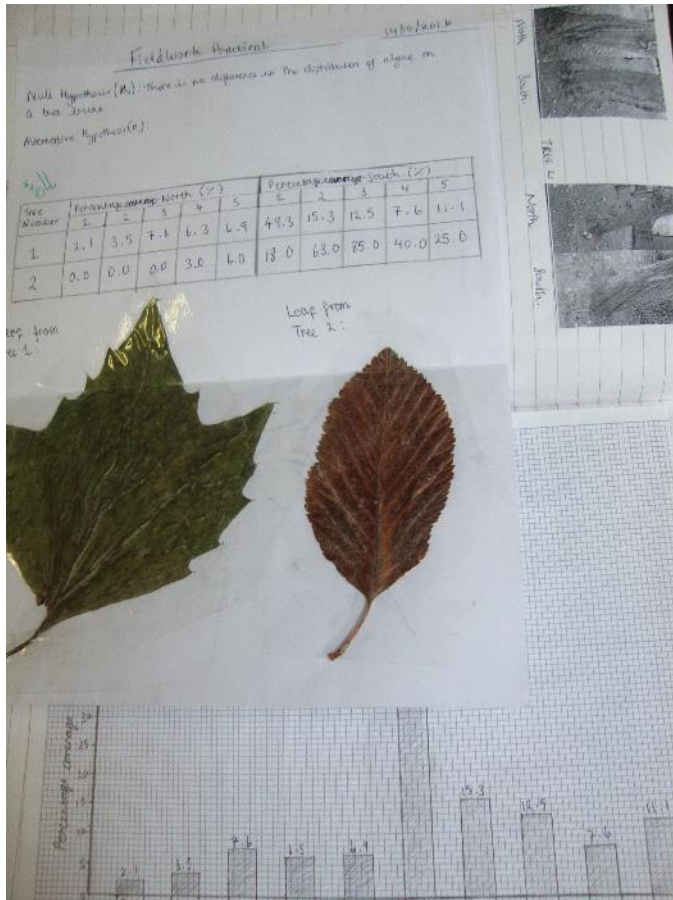
# The student's own records – lab books or folders

Name: \_\_\_\_\_

Competencies /CPAC		Practical	Date	Progress
Number	Competency			
1	Follows written instructions	Budgets RP9	16/9 23/9	4 4
2a	<b>Applies investigative approaches and methods when using instruments and equipment</b> Correctly uses appropriate instrumentation, apparatus and materials (incl. ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting	RP9	23/9	4
2b	<b>Applies investigative approaches and methods when using instruments and equipment</b> Carries out techniques or procedures methodically in sequence and in combination identifying practical issues and making adjustments when necessary	RP9	23/9	4
2c	<b>Applies investigative approaches and methods when using instruments and equipment</b> Identifies and controls significant quantitative variables where applicable and plans approaches to take account of variables that cannot readily be controlled			
2d	<b>Applies investigative approaches and methods when using instruments and equipment</b> Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results	RP9	23/9	4
3a	<b>Safely uses a range of practical equipment and materials</b> Identifies hazards and assesses risks associated with these hazards, when making safety adjustments as necessary when	Budgets RP9	16/9 23/9	4 4



# Lab books – taking pride



# The CPAC experience for me and my students

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- “Students are taking more pride in their practical work – especially their lab books.”
- “As a teacher I have more freedom and flexibility.”
- “Increased demands on my technician and budget.”
- “Students are more serious about their practical work – there is less ‘sitting back’ and letting someone else do it.”
- “Practical work is recognised as being at the heart of good science teaching.”
- “Students are encouraged to think for themselves.”
- “Students see the relevance of their practical work.”

How can I help?

Your turn to ask the questions...



Thank you

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For qualification information, resources and support, please visit

**[aqa.org.uk/science](https://www.aqa.org.uk/science)**

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