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.

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**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.
### 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.

<table>
<thead>
<tr>
<th>Common Practical Assessment Criteria (CPAC)</th>
<th>I am looking for my students to be able to ...</th>
</tr>
</thead>
</table>
| 1. Follows written instructions            | - follow a set of written instructions that are appropriate to the level of familiarity to equipment or techniques  
- carry out steps in the correct order  
- 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  
- work independently, in pairs or small groups but they must carry out practical steps  
- feel confident to seek clarification when carrying out method steps, when either using an unfamiliar set of apparatus or carrying out a new technique |

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.

<table>
<thead>
<tr>
<th>Apparatus and techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT a</td>
</tr>
<tr>
<td>AT b</td>
</tr>
<tr>
<td>AT c</td>
</tr>
<tr>
<td>AT d</td>
</tr>
<tr>
<td>AT e</td>
</tr>
<tr>
<td>AT f</td>
</tr>
<tr>
<td>AT g</td>
</tr>
</tbody>
</table>
| AT h | safety and ethically use organisms to measure:
  - plant or animal responses
  - physiological functions |
| 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

<table>
<thead>
<tr>
<th>Letter</th>
<th>Apparatus and Techniques Covered</th>
<th>Practical</th>
<th>Date</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT a</td>
<td>Use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH)</td>
<td></td>
<td>RP Y</td>
<td></td>
</tr>
<tr>
<td>AT b</td>
<td>Use appropriate instrumentation to record quantitative measurements, such as a colormeter or potometer</td>
<td></td>
<td></td>
<td>23/09/16</td>
</tr>
<tr>
<td>AT c</td>
<td>Use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions</td>
<td>RP Y</td>
<td>23/09/16</td>
<td></td>
</tr>
<tr>
<td>AT d</td>
<td>Use of light microscope at high power and low power, including use of a graticule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT e</td>
<td>Produce scientific drawing from observation with annotations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF</td>
<td>Use qualitative reagents to identify biological molecules</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG</td>
<td>Separate biological compounds using thin layer/paper chromatography or electrophoresis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CPAC 1: follows written procedures

Tick lists help the teacher during the practical.
**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.
4. Always ensure the cuvette is dry on the outside before placing it into the colorimeter.
5. Press the 'zero' switch.
6. The digital display should show 0.00 – don’t worry if the numbers flicker.
7. 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 5 mm from the top.
8. 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.
9. Replace the Reference Cuvette into the holder and press the button to zero – this resets the colorimeter.

**Required Practical 1 – Part 1 CPAC**

<table>
<thead>
<tr>
<th>Name</th>
<th>Group</th>
<th>Competency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blakemore</td>
<td>1</td>
<td>2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Cunningham</td>
<td>1</td>
<td>2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Peters</td>
<td>2</td>
<td>2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Morgan</td>
<td>2</td>
<td>2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

Date: 18/10/16

CPAC 1 Follows written instructions
CPAC 3 Safely uses a range of practical equipment and materials
CPAC 4 Tables – correct units/heads/TV in first column/no units in body of the table – lab book.
CPAC 2: planning in advance is essential

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

Required Practical 3 – Part 1 CPAC

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

CPAC2 (a) - Correctly uses appropriate instrumentation, apparatus and materials (b) 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Group</th>
<th>Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
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.
### Risk Assessments

<table>
<thead>
<tr>
<th>Hazard (Procedure or equipment)</th>
<th>What could go wrong?</th>
<th>Who could be affected?</th>
<th>How the risk is minimised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounted needle</td>
<td>Improper use or needle could result in a person sustaining cuts</td>
<td>The person carrying out the dissection</td>
<td>Inform all the participants beforehand the proper technique for using the mounted needle.</td>
</tr>
<tr>
<td>Panic attack, fainting during dissection</td>
<td>A person could faint or experience a panic attack during a practical as they are afraid</td>
<td>The person carrying out the dissection</td>
<td>Have a space outside the lab where people can go if they feel unwell during a practical. Keep a first aid kit close by.</td>
</tr>
</tbody>
</table>

Date: 17/12/16

CPAC 3
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.
CPAC 4: makes records and observations

People also mention records could be different if I didn't homogenize the leaves enough.

4. 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 the color change.

An image showing the test tube containing the DEAP which had been coaled (on the right). There was a small rip in the tin foil covering the test tube which exposes the small, black
CPAC 4: makes records and observations

<table>
<thead>
<tr>
<th>TEMP/°C</th>
<th>ABSORPTION OF FINAL SOLUTION</th>
<th>ARBITRARY UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
</tr>
<tr>
<td>20</td>
<td>0.64</td>
<td>1.10</td>
</tr>
<tr>
<td>30</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>40</td>
<td>0.12</td>
<td>0.17</td>
</tr>
<tr>
<td>50</td>
<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>60</td>
<td>1.79</td>
<td>1.87</td>
</tr>
</tbody>
</table>

Investigation into the effect of a named enzyme on the rate of photosynthesis in chloroplasts.

Practical error: 8.19 = 8.6s 
blue@300 s

1. Suspension was with ice, it be due to a ice
2. Due into the solution
3. Lines now in the body of a

Colour of mixtures: A - light blue (turgor)
B - blue (dark)
CPAC 5: researches, references and reports

- 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.
Robin Hill and R. Scarisbrick first observed the Hill Reaction whilst carrying out experiments in the late 1930s, wherein ‘isolated chloroplasts’ produced and released oxygen when provided with an acceptor for the electrons that were being removed from water during the reaction.

To create this reaction in a school environment, students often use dichlorophenol indophenol (DCPIP) as the electron acceptor in order to carry out, and measure the rate of the reaction.

https://www.reference.com/science/hill-reaction-6a08390c8c91dbc#f

22/11/2016

The Hill reaction was discovered by Robert Hill in 1939. The reaction is the release of oxygen from isolated illuminated chloroplasts when suitable electron acceptors are added to the surrounding medium. The electron acceptors substitute for NADP+ in the natural acceptor for the light-dependent reactions of photosynthesis.

The student’s own records – lab books or folders

<table>
<thead>
<tr>
<th>Number</th>
<th>Competency</th>
<th>Practical</th>
<th>Date</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Follows written instructions</td>
<td>RPA</td>
<td>1/19</td>
<td>G</td>
</tr>
</tbody>
</table>
| 2a     | Applies investigative approaches and methods when using instruments and equipment  
Correctly uses appropriate instrumentation, apparatus and materials (incl. ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting | RPA       | 3/3/19| G        |
| 2b     | Applies investigative approaches and methods when using instruments and equipment  
Carries out techniques or procedures methodically in sequence and in combination identifying practical issues and making adjustments when necessary | RPA       | 3/3/19| G        |
| 2c     | Applies investigative approaches and methods when using instruments and equipment  
Identifies and controls significant quantitative variables where applicable and plans approaches to take account of variables that cannot readily be controlled | RPA       | 2/19 | G        |
| 2d     | Applies investigative approaches and methods when using instruments and equipment  
Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results | RPA       | 2/19 | G        |
| 3a     | Safely uses a range of practical equipment and materials  
Identifies hazards and assesses risks associated with these hazards, when making safety adjustments as necessary when | RPA       | 1/19 | G        |
Lab books – taking pride

Temperature is 40°C. Above 50°C, most of the enzymes were unable to discover results due to the fact that the enzyme more likely denatures. Label temperature.

Flow test: methylene blue

The methylene blue was added to the mixture and waited for the change to colourless. During this a
The CPAC experience for me and my students

- “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

For qualification information, resources and support, please visit

aqa.org.uk/science