



**General Certificate of Secondary Education  
June 2012**

**Science B  
(Specification 4500)**

**SCB4P**

**Unit 4: Using Practical and Investigative Skills**

***Report on the Examination***

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Set and published by the Assessment and Qualifications Alliance.

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## **GCSE Science B**

### ***SCB4P***

#### **General Comments**

There was a balance between the three options – Investigating the Concentration of Vinegar, Percentage of Copper in Rock Samples and The Absorption of Light by Paper – although the higher marks tended to be achieved in the vinegar and copper carbonate work.

Some schools / colleges gave more guidance than is actually allowed since there was a lot of similarity in the work of their students. Providing leading questions in conclusions and evaluations, for example, is deemed to be too much guidance and will limit students to Level 1. Some plans were very similar, if not identical, yet students had been credited as working independently. Teachers should check on the levels of control for each section in order to ensure that they are adhering to the requirements of the controlled assessment.

It is important that teachers review the Quality of Written Communication in strands 4, 6 and 7. In many cases, especially in work credited at Level 3, students had not used scientific terminology or their explanations included spelling and grammatical errors. In these cases, the student cannot be awarded the maximum mark for the level even if all of the criteria have been met.

#### **Notes on Administration**

Generally schools / colleges met the AQA deadlines for sending in marks and responding to the request for samples by the moderator. However, a significant number had not completed the Candidate Record Forms in sufficient detail to aid the moderation process: candidate numbers were missing and in some cases the marks had not been filled in on the reverse of the form.

Annotation is absolutely essential. In some sections, for example 5c, annotation is required to indicate the level of guidance given to students when completing their graph or chart. Teachers who did not annotate the work seriously disadvantaged their students since in the absence of any annotation the moderator had to assume Level 1. Teachers should annotate in red pen rather than in pencil.

The best examples included a tick sheet at the front of each student's work to summarise the marks awarded and annotation throughout next to where the evidence could be found. It is helpful if the codes from guidance material are used.

Some pieces of work were not well organised and the moderator had to go backwards and forwards within the work to find evidence. It helps the moderator if work is organised in the order set out on the Candidate Record Form (Research, Planning, Assessing and managing risk, Collecting data, Processing data, Analysing data, Evaluating the practical activity). The best examples saw teachers providing a writing frame with expandable section headings to help students order their work.

## Section 1: Research

A number of schools / colleges had awarded marks in this section where no source had been quoted: even at Level 1 a source of research **must** be cited. The applications were not always clear and students did not fully use their research. For example:

- in the vinegar work, students could have related their investigation to the Food Standards Agency and how they would test the acid levels to check for safety, quality and value for money
- in the radiation work, students could have discussed how the lead and paper was a model for gamma radiation and lead shielding, which is used in hospitals to protect radiographers.

It would be helpful if students included sources used in this section (some included a bibliography at the end of the work). At Level 1 a general source such as 'text book' can be mentioned; however, at levels 2 and 3 the name of a text book (preferably with authors) or web addresses are required. 'Google' or similar is a search engine, not a source and therefore can only be credited at Level 1. Students should be encouraged to list their sources in a bibliography.

## Section 2: Planning

Generally, plans were completed well, and most students had clearly been encouraged to write their plans in the future tense, as required. Some similarity was seen in the plans, suggesting guidance had been given. Annotation can be used here to explain how much guidance had been given. It would be helpful, if students had found a plan from their research, that they clearly noted this in their bibliography.

Occasionally, marks were awarded for a plan where a student had not included an aim for their experiment. Most schools / colleges had effectively asked their students to identify the variables involved and the best examples asked students to write a prediction to help them give the possible relationship between the variables (such as 'I think that when more paper is added between the lamp and the photocell, the lower the voltage reading' or 'I think that the more expensive vinegar will be more concentrated and will not need as much to neutralise the sodium hydroxide'). Quite a large number of centres incorrectly awarded 2.3b for statements such as those above rather than for a **quantitative** relationship. For this mark point, students could, for example, suggest that 'if a sample of copper carbonate gives off two times more carbon dioxide than another then it will contain twice as much copper' or 'if a vinegar is twice the price of another then it will be twice as concentrated and will only require half the volume to neutralise the sodium hydroxide'.

## Section 3: Assessing and managing risks

Most schools / colleges completed levels 1 and 2 well. For 3.2ai 'most' of the relevant hazards should include the major ones. For example, in the vinegar work, if a student has not included the vinegar and sodium hydroxide, they have not included two of the major risks and therefore this mark point has not been satisfied.

At Level 3, students must identify the chemicals by name: 'acid' or 'alkali', for example, are not sufficiently detailed. Students should be encouraged to include the molarity of any chemicals to help the teacher and moderator assess whether the risks described are appropriate. A number of students, for example, described vinegar and sodium hydroxide as 'corrosive', which would be incorrect at the molarities used.

A small number of schools / colleges awarded 3.2b for dealing with accidents (such as wiping up spills) rather than for prevention of accidents. At Level 3, the control measures must be firmly based on scientific reasoning. Students can reference hazcards, for example, but must also use them and show good understanding of how they can reduce risks. Very occasionally, students had confused hazards and risks or had simply identified risks as 'high', 'medium' or 'low' without further explanation.

## **Section 4: Collecting data**

It was in this section that some centres gave too much guidance by providing tables for their students, which limited them to Level 1. The use of class data by pooling students' results is perfectly acceptable: however, students should draw their own results table first. To be awarded Level 2 and Level 3 marks, these tables should have three or more columns and include headings and units. On a number of occasions, level and 3 marks were being awarded when units in particular were missing.

For 4.3b, the results must be recorded consistently. In some cases, decimal places varied down a column yet the mark point had been awarded.

It is preferable for students to make a comment about repeating for 4.2c but this is vital if there are definite anomalies. For 4.3c students must make a comment and also explain **why** it is necessary to repeat. It would help the moderator if the student made their comment in this section or (if this is recorded elsewhere) if the teacher annotates in the results section where in the work the evidence can be found – for example '4.3c comment in evaluation'.

For 4.2a and 4.3a 'accurate' includes recording the results to an appropriate number of decimal places. A small number of students recorded titration results in the vinegar work as whole numbers rather than to at least one decimal place, which would be appropriate for a burette.

## **Section 5: Processing data**

To achieve 5.2a, the student must refer to actual numerical data rather than to general patterns; these can only be credited at level 1. At level 3, the patterns should be quantitative or complex and should be described in detail. Simply stating for example that the pattern was 'directly proportional' is insufficient without further explanation.

At Level 1 and Level 2, 'simple calculations' are ones such as calculating a mean from three results: very simple subtractions are insufficient. To achieve Level 2 students should record their answers consistently and to an appropriate number of significant figures. Some students had been awarded 5.3b for calculating means, which are not deemed to be 'complex' and therefore should not gain credit at this level. 'Complex calculations' included:

- calculating the percentage of copper in the different ores
- calculating the molarity of the vinegar samples tested
- calculating the thickness of lead required to stop 95% of the radiation.

In the radiation example, an answer to several significant figures was expected (rather than simply 'between x and y cm'), reflecting that this is a Level 3 criterion.

If a student's graph or chart has not been annotated with the level of guidance given, then the moderator must assume Level 1 – making it vital that teachers annotate the work clearly. At Level 2 and Level 3, students are expected to include axis labels and units and (particularly at Level 3) graphs should be accurately plotted.

## Section 6: Analysing data

Most students managed to gain 2 marks in this section but were often limited to Level 2. At Level 1, students simply needed to give a statement about their findings but to gain a mark point for 6.2a, they needed **to refer directly to the data**, which means that they need to use actual numerical data in their conclusion.

A good majority of students managed to achieve 6.2bi either by comparing their results with those of their classmates or with results provided by the teacher or technician or by referring to the secondary data provided in the Candidates' Notes. Unfortunately, 6.2bii was not completed well even though the mark point was often awarded. Students needed to suggest, for example, comparison with other groups in their class rather than simply suggesting further repeats. Few students successfully completed Level 3. At this level, when comparing their data to secondary data, students should refer to the secondary data in the Candidates' Notes, and it would be beneficial to refer to some class data as well. In addition, to gain the mark point for 6.3i, students needed to discuss the limitations of the data, something that was often omitted. To achieve 6.3ii, students needed to use scientific reasoning to explain their findings, but in some cases this lacked the detail expected at the highest level. If the conclusions were not well structured, clear and logical, even though both mark points had been satisfied, the Quality of Written Communication was not appropriate and a mark of 6 could not be awarded.

## Section 7: Evaluating the practical activity

A good majority of students achieved 2–4 marks in this section. Level 1 was often completed quite well. At times, students were awarded Level 2 marks for discussing how well they performed in the experiment rather than for evaluating the effectiveness of the working methods. Students could, for example, comment on the appropriateness of the equipment used, the accuracy and precision, any difficulties posed by using particular methods. Improvements needed to be fully justified in order to gain 7.2ii.

To be awarded Level 3, students were expected to give a reasoned and logical evaluation of the strengths and weaknesses of the working methods. The level of detail required reflects that this is the highest stage: improvements needed to be fully justified and students needed to describe how the results could be both more reliable and valid. The mark awarded in this section also needed to reflect the Quality of Written Communication.

Some schools / colleges provided a table for their students to complete for this section. Whilst such tables could help lower ability students or help students order their thoughts, they do not encourage students to use the necessary detail and good communication needed to achieve good Level 2 or Level 3 marks. Students should be encouraged to write in prose in order to show their communication skills to the full.

## Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA Website.

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