



General Certificate of Secondary Education
June 2010 to June 2011

Science Centre Assessed Unit

4460/TN

4461 Science A
4462 Science B
4463 Additional Science
4411 Biology
4421 Chemistry
4451 Physics

TEACHERS' NOTES

SET FOUR

Investigative Skills Assignments (ISAs)

Valid for use until July 2011

Valid for Moderation in June 2010, June 2011 and June 2012

To be given immediately to the teacher(s) responsible for GCSE Sciences

All Centre Assessed Unit marks to be returned to AQA by 7 May in the year in which moderation is required.

4460/TN

1. The ISA papers for Set 4 will be available from the beginning of September 2009. The EO may print out **one** copy of the ISAs for the use of the Head of Science but this copy **must** be kept under secure conditions.
2. **The ISA papers should NOT be downloaded on to the centre's intranet. Neither should any electronic copies be made.**
3. Teachers' Notes are sent out in advance so that teachers can incorporate the ISAs into their schemes of work. The Teachers' Notes Set 4 can be found on our website:
<http://www.aqa.org.uk/qual/pdf/AQA-W-4460TN-TN4-08.PDF>
4. Full information about conducting the ISA can be found in the 'Teachers' Guide' and in the booklet 'Guidance and Standardising Material for ISA and PSA' distributed at the standardisation meetings.

These documents can be found on the website:
Teachers' Guide: <http://www.aqa.org.uk/qual/pdf/AQA-4461-62-63-11-21-51-W-TG.PDF>
Guidance and Standards Material: <http://www.aqa.org.uk/qual/pdf/AQA-4460-W-GS.PDF>
5. ISAs have a shelf life of **two** years. ISAs must be completed and marked within this validity period, but marks may be submitted for moderation for **one** further year. The work must be held under secure conditions for the entire period.
6. **Do not use the 'live' ISAs for practice purposes.** These Set 4 ISAs may not be used until September 2011 for practice.
7. Candidates should be entered in February for Centre Assessed Unit (CAU) moderation in the following June. Teachers should attach the CAU to a specific subject when making entries but amendments can be made in the light of March results.
A mark is not needed at the time of entry but should be submitted to AQA and the moderator by 7 May. The marks must be submitted on the Centre Mark Form (CMF). The Centre should also circle the highest and lowest non-zero mark for each subject on the CMFs.
8. Before filling in the CMF, the teacher should ensure that the PSA mark has been added to the ISA mark to make a total CAU mark.
9. The following table shows the codes needed for CAU entry and the ISAs that may be used.

Centres should be careful to ensure that candidates submit ISAs appropriate for the subject they are entering, as the inappropriate marks may be disallowed.

Subject and Cert Code	Code to Enter for CAU	ISAs to be used for CAU
Science A 4461	SCYC	B1.4 C1.5 P1.4
Science B 4462		B1.5 C1.6 P1.5
Additional Science 4463	ASCC	B2.3 C2.3 P2.3 B2.4 C2.4 P2.4
Biology 4411	BLYC	B1.4 B2.3 B3.3 B1.5 B2.4 B2.4
Chemistry 4421	CHYC	C1.5 C2.3 C3.3 C1.6 C2.4 C3.4
Physics 4451	PHYC	P1.4 P2.3 P3.3 P1.5 P2.4 P3.4

Centres may submit **marks** from Set 2 in May 2010 if the ISA was completed by the candidate before 31 July 2009.

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10. A separate entry is needed for each of the required units and for the overall subject before certification.
11. Please refer to the Teachers' Guide/Specification for further explanation of the choices that can be made about when to certificate for each subject.
- 12. Following an Ofqual Scrutiny of the New Science specifications, AQA must make an adjustment to the assessment of the ISA papers. New ISAs from September 2009 require candidates to use information from their own experiment to answer some of the questions in Section 2 of the ISA.**

Consequently:

- Centres should ensure that candidates complete the practical before attempting the ISA.
- As far as possible centres should use tasks **very similar** to the ones detailed in the Teachers' Notes.

Information Relevant to the completion of all ISAs

13. Risk Assessment

It is the responsibility of the centre that a risk assessment is carried out for each investigation.

14. The Practical Work

For this part of the investigation candidates may work individually or in groups.

For each different method used in an ISA undertaken by a class, the teacher **must** complete an ISA Explanation Sheet and attach it to each piece of work sent to the moderator. Instructions of a general nature may be given to the candidates, but these must not be so prescriptive as to preclude candidates from making their own decisions.

15. Data Processing

For this part of the investigation candidates must work individually under direct supervision.

Each candidate must draw up his or her own table of results and should process the data in an appropriate way, eg charts, graphs, diagrams, line of best fit.

The candidates' work should be collected by the teacher at the end of this session and returned to the candidates only when they undertake the subsequent ISA.

Candidates need to produce a table for the results and draw a graph or bar chart to show their results. They will need to have collected sufficient data to display in such a format. (Refer to the Teachers' Guide for further clarification.)

Candidates' work must **not** be annotated with additional information, by either the teacher or the candidate, which would give them an unfair advantage during the ISA, eg the use of the terms independent/dependent variable.

16. The New Style ISA

A specimen paper of the new style of ISA can be found on our website at:
<http://www.aqa.org.uk/qual/pdf/AQA-4460-W-SPAM.PDF>

Please note that the previous style ISAs can still be used until they reach their final date.

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Biology 1 ISA 1.5 – Killing Microorganisms

Teachers' Notes

This ISA relates to Unit B1: Science A (4461), Science B (4462), Biology (4411) Section 11.4.

Area of investigation

This work should be carried out during the teaching of the section relating to:

What causes infectious diseases and how can our bodies defend themselves against them?

The Practical Work

Candidates should be given the opportunity to carry out an investigation concerning the effect of different dilutions of 'anti-bacterial' chemicals on the growth of microorganisms.

Candidates can add different numbers of drops of antiseptic or sanitiser to a culture suspension of a safe bacterium. A sample of each dilution could be streaked across a marked sector of an agar plate. After incubation the number of colonies of bacteria in each section should be counted. Alternatively candidates could use a turbidometric method to assess bacterial growth.

Candidates should either carry out repeats in order to find a mean or alternatively the class results could be pooled in order to find a mean.

It will be necessary for the teacher or technical support staff to carry out trial experiments before the practical sessions in order to determine appropriate concentrations of disinfectant to use.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

Biology 2 ISA 2.4 – Staying Cool

Teachers' Notes

This ISA relates to Unit B2: Additional Science (4463) Section 11.7, Biology (4411) Section 12.7.

Area of investigation

This work should be carried out during the teaching of the section relating to:

How do our bodies keep internal conditions constant?

The Practical Work

Candidates should be given the opportunity to carry out an investigation into how evaporation of sweat affects the loss of heat from the body.

One way would be to wrap newspaper round two boiling tubes. Fill each tube with hot water, and then wet the paper of one tube with more hot water. Record the temperature of the water in the two tubes at suitable intervals. It may be necessary to add further warm water to the paper of the one tube every few minutes (perhaps using a paint brush). Ten to fifteen minutes should be sufficient to observe clear differences between the temperatures of the water in the two tubes. Candidates can be encouraged to compare their results with others.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

Biology 3 ISA 3.4 – Yoghurt***Teachers' Notes***

This ISA relates to Unit B3: Biology (4411) Section 13.5.

Area of investigation

This work should be carried out during the teaching of the section relating to:

How are microorganisms used to make food and drink?

The Practical Work

Candidates should be given the opportunity to carry out an investigation concerning how temperature influences the production of yoghurt from milk.

Candidates can add a starter culture of suitable bacteria to a sample of milk.

Candidates could then record:

- the change of pH with time at different temperatures
- the time taken to reach a **certain** pH at different temperatures
- the pH reached after a certain **time** at different temperatures.

If pH meters are available, these could be used. Alternatively, candidates could use indicator paper or indicator solution to record the pH change.

If measuring or observing the pH change proves difficult, candidates could instead record the consistency of yoghurt, eg by adding a small marble to the yoghurt and recording the time taken for it to disappear.

It will be necessary for the teacher or technical support staff to carry out trial experiments before the practical sessions in order to determine an appropriate range of variable to use.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

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Chemistry 1 ISA 1.6 – *Investigating the Properties of Oils*

Teachers' Notes

This ISA relates to Unit C1: Science A (4461), Science B (4462) Section 12.3, Chemistry (4421) Section 11.3.

Area of investigation

This work should be carried out during the teaching of the section relating to:

How do we get fuels from crude oil?

Risk Assessment

The teacher's attention is drawn particularly to the flammable nature of oils. Suitable precautions must be taken to ensure the safe use of oils, particularly when investigating their viscosity at different temperatures.

The Practical Work

Candidates must be given the opportunity to carry out an investigation into the time it takes for a liquid to flow through different sized holes or how the viscosity of different oils varies.

This must be carried out by using a cup viscometer. This is a container with a small hole in the bottom. The time it takes for a known volume of a liquid to flow through is measured. The liquid does not necessarily need to be oil; a liquid such as shower gel, glycerol or washing-up liquid could be used, suitably diluted to provide different viscosities.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

Chemistry 2 ISA 2.4 – *Investigating Energy Changes*

Teachers' Notes

This ISA relates to Unit C2: Additional Science (4463), Chemistry (4411) Section 12.5.

Area of investigation

This work should be carried out during the teaching of the section relating to:

Do chemical reactions always release energy?

Risk Assessment

The teacher's attention is drawn particularly to the very exothermic nature of reactions involving magnesium that could result in hot solutions boiling out of a test tube.

The Practical Work

Candidates should be given the opportunity to carry out an investigation concerning the energy change during a displacement reaction.

Candidates should carry out a reaction involving a metal and a salt solution giving a colour change. Typically, different masses of iron or zinc are added to a copper sulfate solution and the temperature rise noted for each mass of metal added or for each different concentration of copper sulfate solution. Candidates should either carry out repeats in order to find a mean or alternatively the class results could be pooled in order to find a mean.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

Chemistry 3 ISA 3.4 – *Investigating Solubility*

Teachers' Notes

This ISA relates to Unit C3: Chemistry (4421) Section 13.3.

Area of investigation

This work should be carried out during the teaching of the section relating to:

What is in the water we drink?

Risk Assessment

The teacher's attention is drawn particularly to the oxidising nature of sodium and potassium chlorate. This is a particular problem if clothes get splashed and then left to dry without washing.

The Practical Work

Candidates should be given the opportunity to carry out an investigation into how the solubility of a substance depends on temperature.

One method would be for candidates to dissolve a known mass of a substance, eg potassium chlorate, in a known mass/volume of hot water.

The solution is then allowed to cool and the temperature at which the crystals of solute first appear is noted.

The experiment is then repeated after adding more water or more solute. Alternatively, samples can be taken from saturated solutions at different temperatures and evaporated to dryness. A solubility curve can be drawn from the results.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide.

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Physics 1 ISA 1.5 – *Solar Cells*

Teachers' Notes

This ISA relates to Unit P1: Science A (4461), Science B (4462) Section 13.4, Physics (4451) Section 11.4.

Area of investigation

This work should be carried out during the teaching of the section relating to:

How should we generate the electricity we need?

The Practical Work

Candidates should be given the opportunity to carry out an investigation concerning a solar cell. They should investigate how the light intensity affects the output.

Candidates could use a small square of solar cell with a voltmeter connected to the terminals. They can then alter the brightness of the incident light, eg by moving a bench lamp to different distances away from the solar cell, and find the effect on the output voltage.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide.

Physics 2 ISA 2.4 – *Thermistors*

Teachers' Notes

This ISA relates to Unit P2: Additional Science (4463) Section 13.6, Physics (4451) Section 12.6.

Area of investigation

This work should be carried out during the teaching of the section relating to:

What does the current through an electrical circuit depend on?

Risk Assessment

The teacher's attention is drawn particularly to the dangers associated with using hot water.

The Practical Work

Candidates should be given the opportunity to carry out an investigation concerning the resistance of a thermistor at different temperatures.

Candidates could use a rod thermistor or a small bead thermistor. The temperature could be changed by immersing the thermistor in water at different temperatures. A thermometer in the water can then be used to record the temperature.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide.

Physics 3 ISA 3.4 – Cantilevers***Teachers' Notes***

This ISA relates to Unit P3: Physics (4451) Section 13.1.

Area of investigation

This work should be carried out during the teaching of the section relating to:

How do forces have a turning effect?**The Practical Work**

Candidates should be given the opportunity to carry out an investigation concerning the deflection of a cantilever when a load is suspended from it. This can be done by clamping a metre rule to the edge of a bench and suspending a load from it. The deflection of the ruler from the horizontal can then be measured.

The independent variable may be, for example, the mass suspended from the cantilever or the position of the load on the cantilever.

Candidates will need to carry out repeats in order to calculate a mean.

Alternatively, results from within the class can be pooled in order to generate repeat data.

Please read notes 13–16 at the front of this booklet for more information about how the ISA is conducted. Full information about conducting the ISA can be found in the 'Teachers' Guide'.

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