



General Certificate of Secondary Education
June 2011 to June 2012

Science Centre Assessed Unit

4460/TN

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

TEACHERS' NOTES

SET FIVE

Investigative Skills Assignments (ISAs)

Valid for use until May 2012

Valid for Moderation in 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

Introduction

1. The ISA papers for Set 5 will be available at the beginning of September 2010. 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 of the ISA CD so that teachers can incorporate the ISAs into their schemes of work. All the Teachers' Notes can be found on our website. Select a science then the Key Materials tab and then Support Material: eg Additional Science – web.aqa.org.uk/qual/newgcscs/science/new/add_materials.php?id=03&prev=03
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 also be found in the Support Material.
5. ISAs have a shelf life of **two** years. ISAs must be **completed** and **marked** within this validity period. The work must be held under secure conditions for the entire period.
6. **Do not use the 'live' ISAs for practice purposes.** These Set 5 ISAs may not be used as practice pieces.
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 must be submitted to AQA and the moderator by 7 May. 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 shows the codes needed for CAU entry and the ISAs that may be used with the candidates from **September 2010 to July 2011**.

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	B1.5	C1.6	P1.5
Science B	4462		B1.6	C1.7	P1.6
Additional Science	4463	ASCC	B2.4	C2.4	P2.4
			B2.5	C2.5	P2.5
Biology	4411	BLYC	B1.5	B2.4	B3.4
			B1.6	B2.5	B3.5
Chemistry	4421	CHYC	C1.6	C2.4	C3.4
			C1.7	C2.5	C3.5
Physics	4451	PHYC	P1.5	P2.4	P3.4
			P1.6	P2.5	P3.5

Centres may submit **marks** from Set 3 ISAs in May 2011 if the ISA was completed by the candidate before 31 July 2010.

10. A separate entry is needed for each of the required units and for the overall subject before certification. Entry for Centre Assessed Unit is not automatic:
eg for Biology GCSE (foundation level) you need to enter BLY1F, BLY2F, BLY3F and BLYC. Centres should also enter the certification code of 4411.
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. **From Set 4 onwards, the ISA requires candidates to use information from their own experiment to answer questions in Section 2.**
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 described in the Teachers' Notes.

Information Relevant to the completion of all ISAs

13. **Risk Assessment**

It is the responsibility of the centre to ensure 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.

It is advisable for teachers or technicians to carry out trial experiments.

For each different method used in an ISA undertaken by a class, the teacher **must** complete an ISA Explanation Sheet and attach it to work sent to the moderator. If more than one of the samples requires the same ISA Explanation Sheet, only one need be completed, but please make this clear when submitting the sample to the moderator. The Explanation Sheet can be found on the CD in the administration folder.

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. If a worksheet has been used please attach it to the ISA Explanation Sheet.

15. **Data Processing**

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

Candidates need to produce a table for the results. **This should be marked prior to the practical session.**

During the practical session, each candidate must complete his or her own table of results and should process the data in an appropriate way, eg charts, graphs, diagrams, line of best fit 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.)

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' 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 – (Set 4 and Set 5)**

A specimen paper of the new style of ISA can be found on our website in the Support Material, see note 3.

Please note that Set 3 ISAs can still be used until they reach their final date.

Biology 1 ISA 1.6 – *Distribution of Plants*

Teachers' Notes

This ISA relates to Unit B1: Science A (4461), Science B (4462), Biology (4411) Section 11.5.

Area of investigation

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

What determines where particular species live and how many of them there are?

- To suggest reasons for the distribution of plants in a particular habitat.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning the distribution (by percentage cover) of one plant species in a changing habitat, using a transect.

A simple method would be to extend a tape measure or string from the goal line of a football or hockey pitch to the edge of the goal area. Half metre quadrats could be placed on this at suitable intervals and the percentage cover of one species, eg grass, dandelions or plantain plants, in each quadrat should be estimated. It may be helpful to candidates to use quadrats that are internally divided into 100 squares. (Plastic fencing bought from a garden centre and cut into 50 cm × 50 cm squares makes a cheap alternative to commercially produced quadrats; there are one hundred 5 cm × 5 cm squares in this size quadrat.)

It is not necessary to measure the environmental factor that is changing, although it should be clear to candidates what that factor might be.

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 2.5 – Enzyme Action

Teachers' Notes

This ISA relates to Unit B2: Additional Science (4463) Section 11.6, Biology (4411) Section 12.6.

Area of investigation

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

What are enzymes and what are some of their functions?

- Different enzymes work best at different pH values.
- Protease enzymes catalyse the breakdown of proteins.
- Isomerase is used to convert glucose into fructose and therefore can be used in slimming foods.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning the effect of pH on the action of an enzyme. There should be sufficient range of pH to show its full effects on the action of the enzyme.

A simple method would be to add amylase to a range of pH buffers. Drops of each mixture could be added to small wells cut into starch-agar plates. After incubation, the plate should be flooded with iodine solution. The area of starch breakdown can be identified by the clear area around the well after allowing a few minutes for the iodine solution to be absorbed into the agar. After tipping out surplus solution the clear area can be easily seen by holding the plate to the light. The diameter of these areas can be used to compare the activity of the amylase at different pH values.

Candidates may be told how to deal with 'edge effects' if the above method is used or end-point of alternative methods, if necessary.

It is advisable for teachers or technicians to carry out trial experiments in order that a suitable pH range can be determined and that concentration, volume, incubation temperature and time are appropriate.

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 3.5 – *Breathing*

Teachers' Notes

This ISA relates to Unit B3: Biology (4411) Section 13.3 with links to Section 13.1.

Area of investigation

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

How does exercise affect the changes taking place within the body?

- During exercise a number of changes take place
 - the rate and depth of breathing increases.
- These changes increase the blood flow to the muscles and so increase the supply of oxygen.

How do dissolved materials get into and out of animals and plants?

- The breathing system takes air into and out of the body so that oxygen from the air can diffuse into the bloodstream...

RISK ASSESSMENT

The teacher's attention is drawn particularly to the toxic nature of pyrogallol.

Suitable eye protection should be worn with alkaline pyrogallol due to its caustic content.

Attention is drawn to CLEAPSS advice if using alkaline pyrogallol.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning the effect of exercise on the oxygen content of exhaled air.

A simple method would be to collect exhaled air (from half way through an exhalation) after exercise of several different intensities (including resting). Oxygen content of these can be analysed either by timing the burning of a candle in a fixed volume or by a J-tube method using alkaline pyrogallol to absorb the oxygen. Alternatively, if the equipment is available, a data logger and oxygen probe could be used.

Candidates should collect data for at least four values of the independent variable (including resting).

It may be necessary for teachers or technicians to carry out trial experiments.

Candidates should compare their results with those of others.

It is not necessary for candidates with specific medical conditions to take part in the exercise component of the work; however they should be involved in other parts of the practical aspect of the investigation.

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 1 ISA 1.7 – *Metal Ores*

Teachers' Notes

This ISA relates to Unit C1: Science A (4461), Science B (4462) Section 12.2, Chemistry (4421) Section 11.2.

Area of investigation

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

How do rocks provide metals and how are metals used?

- Ores contain enough metal to make it economical to extract the metal and this changes over time.

RISK ASSESSMENT

The teacher's attention is drawn particularly to the corrosive nature of acids and the generation of gases when acids and carbonates react together.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation to establish the relative amounts of copper carbonate present in several samples of prepared copper carbonate ores, by reacting sample ores with dilute hydrochloric acid.

Centres should prepare several (between 4 and 6) numbered metal ore samples by mixing small quantities of copper carbonate with varying amounts of acid washed sand. These should be tested to ensure that the samples provide a range of results.

Candidates should be allowed to choose their own dependent variable from:

- temperature rise
- time to stop producing carbon dioxide gas
- height of froth in boiling tube (or similar) after a set time. It may help to add a small amount of detergent.

Candidates should measure the dependent variables, allowing a rank order to be produced.

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 – 2.5 *Precipitates*

Teachers' Notes

This ISA relates to Unit C2: Additional Science (4463), Chemistry (4421) Sections 12.3 and 12.6.

Area of investigation

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

12.3 How much can we make and how much do we need to use?

- The amount of a product obtained is known as the yield.

12.6 How can we use ions in solutions?

- Insoluble salts can be made by mixing appropriate solutions of ions so that a precipitate is formed.

RISK ASSESSMENT

The teacher's attention is drawn particularly to the toxic nature of barium chloride.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation into the effect of varying the concentration of sodium sulfate on the amount of precipitate formed in the reaction between barium chloride solution and sodium sulfate solution.



The amount of precipitate can be determined by filtration, drying and weighing or by height in a test tube.

Mixing 20 cm³ of 0.2 mol dm⁻³ of barium chloride solution when reacted with volumes ranging from 5 cm³ to 25 cm³ of 0.1 mol dm⁻³ of sodium sulfate solution will give meaningful results.

Filter paper should be oven-dried prior to the initial weighing.

Balances with a resolution of 0.01 g should be used.

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 3.5 – Neutralising Alkalis**Teachers' Notes**

This ISA relates to Unit C3: Chemistry (4421) Section 13.2.

Area of investigation

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

What are strong and weak acids and alkalis? How can we find the amounts of acids and alkalis in solution?

- The volumes of acid and alkali solutions that react with each other can be measured by titration using a suitable indicator.

RISK ASSESSMENT

Your attention is particularly drawn to the corrosive nature of acids, and alkalis.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation into the volume of dilute hydrochloric acid required to neutralise different concentrations of sodium hydroxide.

Candidates should investigate five or six different concentrations of alkali in the range of 0.1–0.5 mol dm⁻³ to find out the effect of changing the concentration of the alkali on the volume of acid needed to neutralise it.

Candidates should plot graphs of volume of acid needed to neutralise the alkali against concentration of alkali used.

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 1 ISA 1.6 – *Generating Electricity*

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 sections relating to:

How should we generate the electricity we need?

- Energy from renewable energy sources can be used to drive turbines directly.
- Renewable energy sources used in this way include wind.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning a wind turbine.

Candidates may use a simple 6 volt or 12 volt electric motor as a generator.

By fixing a cork onto the end of the axle or shaft, pieces of card can be cut and inserted as 'sails'. A hairdryer can then be used to generate the air stream and a voltmeter connected to monitor the output.

Candidates should investigate the link between output and the number of blades.

Candidates need to average their results and produce a graphical representation of their **averaged** 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'.

Physics 2 ISA 2.5 – Crumple Zones

Teachers' Notes

This ISA relates to Unit P2: Additional Science (4463), Physics (4451) Section 12.3.

Area of investigation

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

What happens to the movement energy when things speed up or slow down?

- When a force causes a body to move through a distance, energy is transferred and work is done.

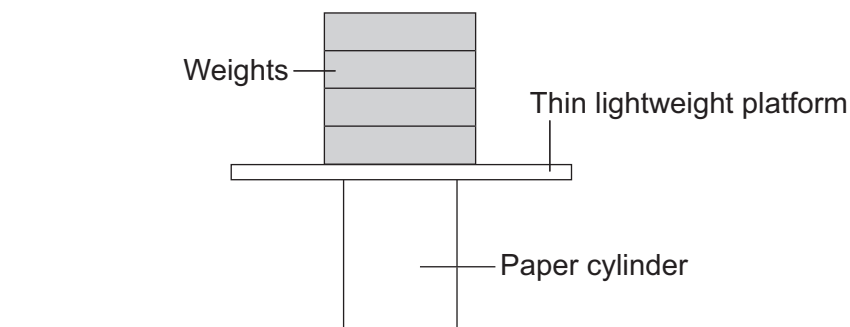
The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning crushing paper cylinders.

Candidates may make paper cylinders by cutting a small square out of paper, rolling it into a cylinder and then gluing or taping the two edges together. The minimum amount of tape should be used otherwise the cylinder will be given artificial strength. A small platform of, say, hardboard is then placed on top of the cylinder and weights added until the cylinder is crushed. A suitable size for the platform is about 10 cm by 10 cm.



Candidates may choose from a number of factors to investigate as the independent variable, eg

- diameter of cylinder
- height of cylinder
- thickness of paper.

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 3.5 – Refraction**Teachers' Notes**

This ISA relates to Unit P3: Physics (4451) Section 13.4.

Area of investigation

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

What do mirrors and lenses do to light?

- Refraction at an interface.

The Practical work

Candidates need to use information from their own experiment to answer questions in Section 2.

Therefore, as far as possible, the centre needs to use a task as close as possible to the one described below.

Candidates should be given the opportunity to carry out an investigation concerning refraction at an interface.

Candidates may use a glass or Perspex rectangular block. They may shine light from a ray box through the block and measure the angles of incidence and refraction for a range of angles. Alternatively they could use optical pins to plot the paths of the rays of light.

Candidates should investigate the link between the angle of incidence and the angle of refraction.

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'.