Version 1.1

General Certificate of Secondary Education
June 2007 and June 2008

SCIENCE CENTRE ASSESSED UNIT 4460/TN
4461 Science A
4462 Science B
4411 Biology
4421 Chemistry
4451 Physics

TEACHERS' NOTES

SET ONE

Valid for use until May 2008
Valid for Moderation in June 2007 and June 2008 and June 2009

For immediate release to teacher(s) responsible for GCSE Sciences

All Centre Assessed Unit marks to be returned to AQA by 5 May in the year in which moderation is required.

Administration

1. The CD with all the Investigative Skills Assignments (ISAs) will be sent to your centre's Examinations Officer in September. Please alert the Examinations Officer to the importance of this CD and the password that will be sent separately. The CD needs to be kept under secure conditions.

2. You will be taking at least two lesson slots to complete the ISA - one for the practical and one for the ISA itself. You need to get the candidates to produce a table of results before they conduct the practical.

3. Do not use the 'live' ISAs for practice purposes.

Carrying out the Investigation

4. The ISA should be linked to the work and units you are teaching the candidates. You will be teaching the content through How Science Works and will therefore be using the procedural content in Sections 10 and 17 of the Specification. You will be discussing with the candidates about how they should ensure that their investigations are fair, precise, reliable, unbiased etc.

5. You will need to fill in an explanation sheet for each ISA submitted for moderation. The moderator needs to know if you have deviated from the marking guidelines, and why it was necessary to do so. You may have carried out the practical work in a way other than that suggested in the Teachers' Notes. In each of these cases it is vital that this information is sent to the moderator. You may decide to carry out an investigation on a topic which is not the one referred to in the Teachers' Notes in this booklet. In this case you will need to let the moderator know when filling in the explanation sheet (an example of which is found on page 12 in this booklet).

6. You may give the candidates a student worksheet (an example referring to one of the ISAs is found on page 11). You must be careful not to be too detailed in what you tell them to do. Note that the candidates should prepare the table in which to record their results before starting the practical work. This should be done individually, under direct supervision, at the start of the practical session.

7. Complete the investigation with your class and collect in the tables of results and any graphs or charts.

Carrying out the ISA

8. When you need to complete an ISA, ask the Examinations Officer to get the appropriate ISA printed, and include the marking guideline.
   The candidates should not be allowed a preview of the ISA.

9. The ISA should be taken as soon as possible after completion of the practical work.
   (a) You give out the tables of results and any graphs or charts you collected to help them complete the ISA.
   (b) When they have completed the ISA collect the tables, graphs and ISA for each candidate.
   (c) If ALL the candidates finish earlier than 45 minutes, you can collect in all their work.

10. Any special arrangements that candidates are allowed for the written examinations can also be given to the candidates for ISAs.

11. If a candidate is absent, they may take the ISA as soon as they return – either with another class or on their own. If a candidate has missed the practical session, they may attempt Section 2 of the ISA. You may furnish them with a results table and graph in order to help them to respond to the questions in Section 2, but they may not submit the marks for Section 1. The work should be clearly marked 'Absent for practical session'. This strategy should only be used as a last resort - it is better to get the candidate to tackle a different ISA in its entirety if a practical session has been missed.

12. The teacher should mark the scripts and keep both the papers and the marks secure. Annotation should be made on each script at the time of marking. An ISA Explanation Sheet should be completed to help the moderator understand where changes to the marking guidelines have been used.

13. At no time are the candidates allowed to change their answers. Once the lesson in which the ISA is completed **there is no drafting and redrafting**. The candidates do **not** take their work away from the class and should be allowed no preview of the ISA.

Submission of Marks

14. Teachers will add the mark for the ISA (/34) to the mark for Practical Skills Assessment (PSA) /6 and use this for the total Centre Assessed Unit (CAU) mark. This should be filled in on the Candidate Record Form which **must** be signed by both candidate and teacher.

15. The PSA is a summative mark showing the level of skill in practical work that the candidate has reached after completing the whole course. It might be useful for the teacher to prepare a list which can be used when the skills have been observed over the year of the course.

16. All teachers marking ISAs should internally standardise their marking to ensure that the sample requested for moderation is a fair representation of the marks being submitted by the school.

Moderation

1. You need to enter your candidates in February for the CAU in June – you do not need to have a mark at this time, just register the intention to submit a CAU for a particular subject. Please refer to the Teachers' Guide for further explanation of the choices you can make about when you certificate for each subject. The codes you need for CAU entry are:
   - Science A and Science B = SCYC
   - Additional Science = ASCC
   - Biology = BLYC
   - Chemistry = CHYC
   - Physics = PHYC

2. If you wish to certificate for a particular subject you also need to register this intention in February also. The codes you need to enter the candidates for a **subject** are:
   - Science A = 4461
   - Science B = 4462
   - Additional Science = 4463
   - Biology = 4411
   - Chemistry = 4421
   - Physics = 4451

3. At Easter you will be sent the CMS and you need to send your marks to AQA and to your moderator by 5 May.

4. You will then be requested to send a sample of the work from each subject entered and these should be submitted by return of post.

5. The marks will be validated by the moderator or an adjustment may be made.

6. The work of your sample candidates will be returned to you in July prior to the marks being graded.
   If you have decided to opt for certification for a particular subject, the mark of the CAU will be added to the total for certification. Otherwise it will remain on the system until such time as you decide to go for certification.

7. Remember that moderation of the CAU will only take place in May/June – so if you wish to certificate in January, you should have 'banked' a CAU mark the previous June.

8. Remember that each candidate must have a signed Candidate Record Form. They should receive a mark of 0 if you do not have the form signed.

Biology 1 ISA – *Reaction Times*

Teachers' Notes

This ISA relates to Unit B1, section 11.1

Area of investigation
This work should be carried out during the teaching of the section relating to:
How do human bodies respond to changes inside them and to their environment?

RISK ASSESSMENT
It is the responsibility of the centre to ensure that a risk assessment is carried out.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested method is described below, but this should not preclude centres from adapting this method to suit their own needs.

The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Suggested contexts:

- dropping and catching a ruler; (if this context is chosen students should be given a table to convert distance into time)
- timing of the pupil response to changing light intensity
- reaction timers, such as those available on a computer.

Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their **averaged** results.
(Refer to the Teachers' Guide for further clarification.)

Students must study reaction times in relation to an independent variable with at least two categories. For example, using right hand or left hand; girl or boy; sporty or non-sporty. The contexts necessarily include variables that are difficult to control. Consideration should be given to this aspect of data gathering.

Part 2: the Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate should 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 if appropriate.

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

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

Biology 1 ISA – *Fieldwork Investigation*

Teachers' Notes

This ISA relates to Unit B1 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?

RISK ASSESSMENT
It is the responsibility of the centre to ensure that a risk assessment is carried out.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested method is described below, but this should not preclude centres from adapting this method to suit their own needs.

The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Students should carry out a fieldwork investigation related to the distribution of a particular species. They may investigate any factor that may possibly influence the distribution. For example, they might investigate the height of grasses at different distances from a footpath.

The method should involve the use of a quadrat to sample a transect.

Thought will need to be given to:
- the number of measurements to be taken within each sample
- the number and location of samples to be taken.

It is important that, whatever the plan is, the candidates must be involved in taking some measurements. Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their **averaged** results.
(Refer to the Teachers' Guide for further clarification.)

Part 2: The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate should 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 if appropriate.

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

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

Chemistry 1 ISA – *Viscosity of Oils*

Teachers' Notes

This ISA relates to Unit C1 Section 12.3

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
It is the responsibility of the centre to ensure that a risk assessment is carried out. Your attention is particularly drawn to the flammable nature of oils. Suitable precautions must be taken to ensure their safe use particularly when investigating their viscosities at different temperatures.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested area for investigation is how the viscosity of an oil changes with temperature.

Some suggested methods are described below, but this should not preclude centres from adapting these methods to suit their own needs.

The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Viscosities of oils can be measured in a variety of ways:

- by using a cup viscometer. This is a container (eg a yoghourt pot) with a small hole in the bottom through which a known volume of oil flows
- by timing a ball-bearing falling through a narrow tube containing the oil
- by trapping a bubble of air in the oil within a narrow tube and timing the rise of the bubble upwards through the oil
- by putting drops of oil onto an inclined glazed tile and timing how long it takes for the oil to flow between two marks on the tile.

Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their **averaged** results.
(Refer to the Teachers' Guide for further clarification.)

Part 2: The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate should 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 if appropriate.

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

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

Chemistry 1 ISA *Unsaturation of Oils*

Teachers' Notes

This ISA relates to Unit C1 Section 12.5.

Area of investigation
This work should be carried out during the teaching of the section relating to:
How plant oils can be used

RISK ASSESSMENT
This investigation must be carried out in the fume cupboard when using bromine water.
It is the responsibility of the centre to ensure that a risk assessment is carried out.
Your attention is particularly drawn to the harmful and irritant nature of 0.02 mol dm–3 bromine water and the flammable nature of ethanol and oils.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.
A suggested area for investigation is how the unsaturation of oils can be measured and compared.
Candidates should be aware of how the reagent is used to find the degree of unsaturation of oils.
A suggested method is described below, but this should not preclude centres from safely adapting this method to suit their own needs or using a similar method involving different reagents.
The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.
Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.
Safety glasses must be worn and the experiment should be carried out in a fume cupboard.

- The students should use a burette in the fume cupboard that has been pre-filled with 0.02 mol dm-3 bromine water by a teacher or technician. Any refilling of the burette must be carried out in the fume cupboard by a teacher or technician.
- 1cm3 of ethanol is put into a boiling tube and five drops of the oil being tested.
- 5cm3 of the bromine water is added from the burette. The boiling tube is stoppered and carefully shaken.
- If the bromine water is decolourised, the stopper is carefully removed and another 5cm3 of bromine water added and shaken.
- This is repeated until the bromine water is no longer decolourised.
- The residues should be disposed of in the fume cupboard and not poured down the sink.

Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their averaged results.
(Refer to the Teachers' Guide for further clarification.)

Part 2: The Data Processing
For this part of the investigation candidates must work individually under direct supervision.
Each candidate should 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 if appropriate.
The candidates' work should be collected by the teacher at the end of this session and only returned to the candidates when they undertake the subsequent ISA.
Candidates' work must not be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA – eg the use of the terms independent/dependent variable.

Physics 1 ISA – *Thermal Insulation*

Teachers' Notes

This ISA relates to Unit P1, section 13.1:

Area of investigation
This work should be carried out during the teaching of the section relating to:
How is heat (thermal energy) transferred and what factors affect the rate at which heat is transferred?

RISK ASSESSMENT
It is the responsibility of the centre to ensure that a risk assessment is carried out. Your attention is particularly drawn to the dangers associated with using hot water.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested method is described below, but this should not preclude centres from adapting this method to suit their own needs.

The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Candidates should be given the opportunity to carry out an investigation concerning the rate of loss of heat from a container.

- The simplest method would be to fill a container with hot water and record the temperature at the start and at suitable intervals for, say, 10 minutes.
- Any variable may be investigated, eg shape or colour of container, surface area, lagging, initial temperature, volume.

Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their **averaged** results.
(Refer to the Teachers' Guide for further clarification.)

Part 2: The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate should 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 if appropriate.

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

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

Physics 1 ISA – *Wind Turbines*

Teachers' Notes

This ISA relates to Unit P1, section 13.4

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?

RISK ASSESSMENT
It is the responsibility of the centre to ensure that a risk assessment is carried out.

Part 1: The Practical Work
For this part of the investigation candidates may work individually or in groups.

A suggested method is described below, but this should not preclude centres from adapting this method to suit their own needs.

The teacher should complete the Explanation sheet. This should be included with the sample of candidates' work which will be sent to the moderator.

Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

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

- 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 may investigate any aspect of wind turbines, eg the link between output and the wind speed or the number or angle of the blades.

Candidates need to fill in the table they have produced prior to the practical, average their results and produce a graphical representation of their **averaged** results.
(Refer to the Teachers' Guide for further clarification.)

Part 2: The Data Processing
For this part of the investigation candidates must work individually under direct supervision.

Each candidate should 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 if appropriate.

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

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

Thermal Insulation

Student instructions

Your task is to investigate how the rate of loss of heat depends on the number of layers of insulation.

You will be using a beaker of hot water, a thermometer and some sheets of newspaper.

Method:

1. Using scissors cut a circle of cardboard slightly bigger than the top of the beaker. This will form a lid for the beaker.
   Use the point of the scissors to make a hole in the middle of the lid for the thermometer to fit through.

2. Cut pieces of newspaper of the right size to wrap around the sides of the beaker. These can be held in place using a rubber band.

3. Use hot water from the kettle to put into the beaker, and place the lid on the beaker.
   Put the thermometer through the hole in the lid.

4. Record the temperature of the water every minute for 10 minutes.

5. Repeat the experiment using different numbers of layers of newspaper.

Remember:

You must decide:

1. How you will make this a fair test.

2. How many different layers of newspaper you should use.

3. How many repeats you should carry out.

Before you start the practical work you must draw up a table ready to record your results

When you have finished your investigation:

1. Make sure that you have produced a clear table of results.

2. Process your results to produce what you think is the most appropriate **graph or chart**.

ASSESSMENT and QUALIFICATIONS ALLIANCE

ISA Explanation Sheet

to accompany each ISA
(You will need to fill in more than one of these sheets if different students have carried out different methods)

Centre Number						Date Practical Carried Out	
ISA Code						ISA Title	
Name of Teacher							
Independent variable						Dependent variable	

Did you make any changes to the suggested Method?

YES / NO

If Yes - give details of any changes you made to the suggested method, the equipment, chemicals etc. for this investigation.

Any other Information:

Teacher Signature:

Please attach any experimental worksheet or outline used by the candidates to carry out the investigation if available.