Controlled Assessments: The ISA

This assessment is worth 34 marks in total and consists of three parts:

A practical investigation and 2 written test papers.

It is worth **25%** of the total marks for your GCSE

1. **Planning**
   - You will need to do some research outside of lessons to find different methods that could be used to do a practical.
   - You should also research how the results of the investigation could be used in the given every day context. (E.g. the practical might be related to how things cool down and how the experimental results may help to produce a container that will keep things hotter for longer.)
   - You have to fill in your research on a special form. Your teacher cannot tell you what to write. They can only tell you that you have too much information or too little.

**TOP TIPS FOR PLANNING**

- You must make sure you only write in **note form** on your planning sheet and use key words rather than full sentences.
- Only use the planning sheet that you are given and only write in the spaces provided.
- You might not need to find out about 2 methods. Your teacher will tell you.
- You need to find at least 4 different sources of information. Try and use a mixture of books and the internet. Your teacher might give you some to get started.
- Do your research in rough and then transfer the key points to your planning sheet.
- You MUST write down the full reference for any sources that you use on your planning sheet. So for websites, that is the FULL web address. (e.g. [http://store.aqa.org.uk/scienclab/AQA-GCSE-SCIENCE-COMMAND-WORDS.PDF](http://store.aqa.org.uk/scienclab/AQA-GCSE-SCIENCE-COMMAND-WORDS.PDF)) If it is a book, you need to include the title, author/s, publisher, edition, date published and the pages used. (e.g. AQA GCSE Science, Bone, Broadley, Gordon Hulme, Hocking, Mathews & Newall; Oxford University Press; 2011; pages 24 & 25)

2. **Section 1 test**
   - This is carried out under test conditions and will ask you questions about your research and your plan.
   - You will be allowed to take in your special planning form.
   - The questions will ask you about how to do the experiment, how you found out about the science and whether your sources are any good.
   - You will also be asked to draw a table for your results.

**TOP TIPS FOR SECTION 1 TEST PAPER**

- You must make sure that you answer in full sentences and that your writing is clear.
- Make sure that you have a pen, pencil, ruler and calculator.
- When you draw your table, use a ruler and make sure that the headings all have units in them. Your table is completed and marked before you do the experiment.

3. **Practical exam**
   - You will carry out the investigation. You will either use your method or you will be given one by your teacher.

**TOP TIPS FOR PRACTICAL EXAM**

- You must make sure that you are in school. EVERY student MUST contribute some results otherwise you will lose marks.
- You will work in small groups and each person in the group must take a turn at reading off some results from the experiment. Your teacher will be observing you during the practical and will note the marks that you will receive for the practical work.
- Each group will need to collect their own set of results. If you mess about and don’t get a full set of results you will lose marks. All results will be collected and shared amongst the class for section 4.
- **Processing results**
  - You will need to draw a graph of your results. You will do this by yourself under exam conditions.
  - You will need a pencil and a ruler and your results table (which you will get from your teacher).
  - You MUST hand this in at the end of the lesson for your teacher to mark and for you to have in the final exam.

- **Section 2 test paper**
  - This is carried out under test conditions and will ask you questions about your experiment and your results. You will also be asked to look at other peoples results from similar experiments.

<table>
<thead>
<tr>
<th>TOP TIPS FOR SECTION 2 PAPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ You must make sure that you understand the topic that is being covered. If after you have done the experiment, you aren’t sure, do some more research. You cannot bring any more information into this paper apart from what you have already done. (which your teacher will have.)</td>
</tr>
<tr>
<td>➔ Write clearly and read the questions carefully and remember to use all of the information that you will have access to.</td>
</tr>
</tbody>
</table>
PLANNING

Research

- You must write down the full details of any webpage/website you use.
- You must write down the title of any book and include the authors and publisher.
- You will be asked to compare 2 sources and say which source was better and why.

What should you cover on your planning sheet?

- Consider the variables (independent, dependent and control) that you will need to manage during the investigation.
- Consider the sources used for your research.
- Outline two possible methods from your research to investigate the hypothesis.
- Give reasons for why one method is preferable to the other.
  - Always include:
    - Independent and dependant Variables.
    - What are your controls and why are you controlling them.
    - Step by step method that a year 7 can follow.
    - Include how you will measure the results and units.
    - (Time) How long are you doing the investigation for.
    - Safety.
    - How many repeats will you have.

- Identify possible hazards and write down how the risks may be minimised.

---

AQA GCSE Science (4405) Additional Science (4468) Biology (4411) Chemistry (4402) Physics (4403)

<table>
<thead>
<tr>
<th>Centre Number</th>
<th>987665</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre Name</td>
<td>The New Academy</td>
</tr>
<tr>
<td>Candidate Name</td>
<td>John Smith</td>
</tr>
<tr>
<td>Candidate Number</td>
<td>1234</td>
</tr>
<tr>
<td>Investigation Title</td>
<td>SPECIFIC HEAT CAPACITY</td>
</tr>
<tr>
<td>ISA number</td>
<td>1234</td>
</tr>
</tbody>
</table>

The notes the candidate takes into the Controlled Assessment task are to be recorded in the space on this sheet. This sheet should be given to the teacher for checking before it is used in Section 1 of the ISA. When Section 1 of the ISA has been completed, the sheet should be retained by the teacher for subsequent use with Section 2. When Section 2 of the ISA has been completed, this sheet should be stapled to it.

Declaration

I confirm that these are the only preparation notes used in the Controlled Assessment task.

R Brown   J Smith

Date: 30/3/18

---

Hypothesis

There is a link between the mass of water being heated and the temperature rise.

Research Sources:


Method(s)

- Measure temp of water at start
- Heat for fixed time
- Measure temp at end

For test: Always give the same amount of heat. Try it for different masses - see what effect it has on the temp rise.

Equipment

- Bunsen & heating equipment
- Balance
- Thermometer
- Measuring cylinder or balance
- Timer

Risk assessment issues

- Hot water - could burn you
- Bunsen flame - could burn you
- Be careful, wear safety goggles, keep hands clear.

Relating the investigation to the context

What is the best size for a hot water tank in a house. Too big and it takes a long time to heat up, too small and it won't hold enough water.
Advice on tables

One of the most important parts of investigative science is recording measurements clearly and accurately. This nearly always means organising results in a neat and tidy table.

You are probably aware that in your ISA you need to prepare beforehand a blank table ready for use in the ISA practical. This table should be marked by your teacher before you fill in your data.

There is one simple rule for tables: they must have quantities and units in headings. Let's take a look at a simple table, with some results added:

<table>
<thead>
<tr>
<th>Mass (g)</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 mm</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>200</td>
<td>9</td>
</tr>
<tr>
<td>300</td>
<td>15</td>
</tr>
<tr>
<td>400</td>
<td>20</td>
</tr>
<tr>
<td>500</td>
<td>24</td>
</tr>
<tr>
<td>600</td>
<td>30</td>
</tr>
</tbody>
</table>

The above table has clear headings with the quantities measured neatly indicated. However, the units used are only indicated in the first row of table data. This is not accepted and is sloppy presentation.

This is much better:

<table>
<thead>
<tr>
<th>Mass (g)</th>
<th>Extension 1 (mm)</th>
<th>Extension 2 (mm)</th>
<th>Average Extension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>6</td>
<td>5.5</td>
</tr>
<tr>
<td>200</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>300</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>400</td>
<td>20</td>
<td>21</td>
<td>20.5</td>
</tr>
<tr>
<td>500</td>
<td>24</td>
<td>25</td>
<td>24.5</td>
</tr>
<tr>
<td>600</td>
<td>30</td>
<td>31</td>
<td>30.5</td>
</tr>
</tbody>
</table>

This second table is more than enough to get you full marks: the headings all have quantities and units indicated. Furthermore, the student has decided to repeat measurements of the extensions so he can take an average. Brilliant!
Section 1

Hypothesis: There is a link between the mass of water being heated and the temperature rise.

1 Think about the research that you did to find out how to test this hypothesis.

Name two sources that you used for your research.
AGA Physics - Nelson Thornes
Concise Twentieth Century Science (Archer)

Which of these sources was the more useful and why?
Concise Twentieth Century Science. It gave a full method and listed all the control variables that I needed to keep the same.

(3 marks)

2 In this investigation, you will need to control some of the variables.

Write down one variable that will need to be controlled.
The amount of energy supplied to the water.

Describe briefly how you would carry out a preliminary investigation to find a suitable value to use for this variable.
You should also explain how the results of this preliminary investigation will help you to decide on the best value for this variable.

Put 500ml of cold water into a beaker and measure the temperature. Put a Bunsen underneath and heat it for 2 minutes. If you get a reasonable temperature rise of say 10°C, this should be OK. If the temperature rise is still too small, you would need to heat the water for longer.

(3 marks)
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you plan to do your investigation to test the hypothesis given.

You should include:
- the equipment that you plan to use
- how you will use the equipment
- the measurements that you are going to make
- how you will make it a fair test
- a risk assessment

**Equipment:** A large beaker (1 litre), Bunsen burner, tripod and gauze, stopwatch, thermometer, top pan balance.

**Method:**
1. Use the balance to measure 1 kg of water into the beaker, and use the thermometer to measure the temperature.
2. Switch on the gas and light the Bunsen, leave it on for 2 minutes. Don’t alter the setting on the Bunsen once started.
3. Record the temperature at the end of 2 mins and work out the temperature rise.
4. Do the same thing with four other masses of water. I shall use 200g, 400g, 600g and 800g. Keep the starting temperature and the setting on the Bunsen the same all the time to make it a fair test.

**Measurements**
- Mass of water in grams using balance
- Temperature of water at start and after 2 mins. using the thermometer

The list of equipment is complete and appropriate.
The method is clear and sufficiently detailed for another person to be able to follow this method and obtain valid results.

All the quantities that need to be measured during the experiment are clearly stated.

The candidate has mentioned two variables that should be kept the same in order to make it a fair test.

The risk assessment contains an identification of the main hazards (Bunsen flame and hot water), the associated risk and three control measures.

Even though the candidate has used bullet points in some places, the written account is well constructed and set out in a logical sequence. The spelling, punctuation, grammar and the correct use of technical terms is sufficient to meet all the relevant criteria.
Risk Assessment

The main hazards are:

- the Bunsen burner flame could set fire to something
- the hot water could burn you if spilled.

The risks are quite low if I am sensible and behave properly.

The control measures I am going to take to reduce the risks are:

- tie hair back when lighting the Bunsen.
- keep books etc away from the tripod in case they knock it over.
- don’t let the water get to boiling point.

(9 marks)
When you have completed your experimental work, you will be asked to share your results with others.

Explain the advantages of sharing your results with others.

*If all the class results are shared then we can calculate a mean and that would give us a more accurate result as it will reduce the effect of any random errors.*

(3 marks)

Make sure that you hand in your Candidate Research notes and your blank table for the results with this paper.

You will be awarded up to two marks for your table.

(2 marks)

The table is complete, as all the required headings and units are present.

END OF SECTION 1
DRAWING A GRAPH

There are some rules that you must follow when you are drawing a graph.

1) ALWAYS use as much of the graph paper as possible.
2) ALWAYS use a pencil to draw a graph, NEVER pen.
3) ALWAYS make sure that your axes have a consistent scale (e.g. the markings are equally spaced apart i.e. 5 small boxes each or 10 small boxes each etc and go up in 5s or 10s etc. You do not normally need to start your graphs at zero. So if your data runs from 102 to 104 don’t start at 0, most of your graph will be empty! Your scales will (almost always) be linear, so that each square represents the same change in value. Scales of three are a little awkward and should be avoided. ALWAYS label your axes. The independent variable will go on the horizontal axis, the dependent variable will go on the vertical axis.

4) Choose a line graph for continuous data (e.g. experiments that produce results that are a range of numbers like temperature, time etc.). Bar graphs are for data that is in categories e.g. dry, damp, hot, cold.
5) Use (X) to mark the points on a line graph NOT ●
6) Draw a line of best fit to show the pattern of the points, DO NOT connect the points together.
Use these words:

**Vertical axis**
(dependent variable – what you measure)

**Horizontal axis**
(dependent variable – what you test)

- Goes up steadily
- Stays the same
- Goes down steadily
- Goes up slowly at first then rapidly
- Reaches a maximum
- Reaches a minimum
- Goes up rapidly at first then slowly

**Results**

<table>
<thead>
<tr>
<th>Mass of water in grams</th>
<th>Temp at start °C</th>
<th>Temp at end °C</th>
<th>Temp rise °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>15</td>
<td>51</td>
<td>36</td>
</tr>
<tr>
<td>400</td>
<td>15</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>600</td>
<td>15</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>800</td>
<td>15</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>1000</td>
<td>15</td>
<td>19.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Both axes are appropriately scaled and labelled, the plotting is correct, and the line of best fit is suitable.
You will need to use your own results AND (where requested) the secondary results given to you for this task. You will need to discuss the pattern that you see with your results, using your graph.

What to say about your conclusions:

**Causal Link**
If you change a variable and it has an effect on another variable then there is a causal link between them. The independent variable causes the dependent variable to change.
*For example: When the voltage across a resistor is increased the current through the resistor increases too. More voltage causes the current to increase.*

**Association**
If two variables change because of a third variable; it is associated to both variables.
*For example: It can be seen that when it is rainy it is usually windy, but both are driven by a third variable; changes in atmospheric pressure.*

**Chance**
When two variables change but there is no link between them.

**Directly Proportional** When the dependent variable is doubled the dependent doubles too. *(Straight line graph that goes through the origin.)*

**Linear** When the dependent variable increases at a constant rate. *(Straight line graph.)*

**Predictable** When a clear relationship is established reading outside the range tested can be predicted.

**Complex** A pattern or trend is clear but it is not directly proportional or linear. *(A curved line on a graph.)*
These questions are about the investigation that you were given to test the hypothesis.

Hypothesis: There is a link between the mass of water being heated and the temperature rise.

(a) What were the variables in the investigation you did?

   The independent variable was: The mass of water
   The dependent variable was: The temperature rise after 2 minutes
   One control variable was: The length of time the water was heated for.

(b) Think about the way in which you took your measurements.

   Resolution means the smallest scale division on the measuring instrument that you were using.

   What was the resolution of your measurement of the dependent variable?

   °C

   Do you think that this resolution was appropriate for this investigation?

   Explain your answer.

   No, it would have been better if I had a thermometer that measured to 1/10th degree, because then it would have been more accurate.

(c) The hypothesis that you were given before you started your investigation is printed above.

   Do your results support this hypothesis? Explain your answer.

   Yes, because the more water I used the lower the temperature rise. There was a pattern.
1 (d) You have been given the results obtained by other people in your class or by your teacher.
Do these other results show that this investigation is reproducible?
Explain your answer using data.
   We all got the same pattern - more water meant a smaller temperature rise, but they weren't exactly the same as mine because some of them started at different temperatures.
   (3 marks)

1 (e) If you were to repeat your experiment, would you make any changes to your method?
Tick the box beside your answer.
Yes, I would make changes to my method  ✔ 
No, I would not make changes to my method.

Explain why you would or would not make any changes.
   I would insulate the beaker and put a lid on it.
   This would stop any heat escaping through the walls of the beaker or any heat being lost by the water evaporating.
   (3 marks)
2 You have been given a Data Sheet which provides data from similar investigations.

2 (a) Draw a sketch graph of the results in Case Study 1.

The graph should show how the mean temperature rise varies with the mass of water being heated.

![Graph](image)

2 (b) Does the data on the Data Sheet support the hypothesis you were given at the start of your investigation?

To gain full marks you should use all of the appropriate data from Case Studies 1, 2, and 3 to explain the extent to which the data supports or contradicts the hypothesis.

Case study 1 does it give the same shape graph as mine.

Case study 2 gives the same pattern as well.

Case study 3 doesn’t help cos they heated the water for different times.

Overall, using a “best fit” approach, this answer is just worth 2 marks.
2 (c) Use Case Study 4 to answer this question.

What is the relationship between the specific heat capacity of a substance and the mean temperature rise of that substance?

Explain how well the data supports your answer.

Light oil has the highest specific heat but the smallest temp. rise.

Brick has the lowest specific heat and the highest temp. rise.

So the bigger the specific heat, the smaller the temperature rise.

(3 marks)

3

Think about the context that you were given for this investigation.

How could the results of your investigation be useful in this context?

You may use information from your A4 sheet of research notes to help you to answer this question.

In a domestic hot water tank, the bigger the volume or mass of water you have, the smaller the temperature rise you will get when you heat it up. When you fill the kettle for a cup of tea you shouldn’t put too much water in or it will take too long to boil.

(3 marks)

4

Make sure that you hand in your A4 sheet of notes, results tables, and charts or graphs with this paper.

You will be awarded up to four marks for your chart or graph.

(4 marks)

END OF QUESTIONS