Unit R073 – How scientists test their ideas

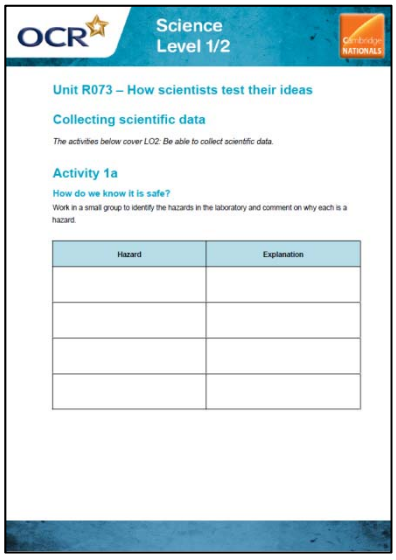
Collecting scientific data

Instructions and answers for teachers

The activities below cover LO2: Be able to collect scientific data.

The learner activities aim to develop the skills required to collect primary and secondary data and to carry out a risk assessment.

This task provides learners with the opportunity to identify hazards within a laboratory setting and the requirement to carry out a risk assessment before undertaking any practical activity. The use of hazard symbols and chemical data sheets links with industrial standards.



Associated Files:
Collecting scientific data

Expected Duration:
Activity 1 – 40 mins
Activity 2 – 1 hour
Activity 3 – 1 hour

Activity 1a

How do we know it is safe?

Work in a small group to identify the hazards in the laboratory and comment on why it is a hazard.

Hazard	Explanation

This is a fun activity which could be used as a starter to the lesson. Give out pictures of a hazardous laboratory for students to identify the hazards or use a video clip. Students are provided with posters with the hazard symbols on. They identify the symbols and comment on what that means if using something with that symbol on.

Resources

Video clip: The Adventures of Safety Steve http://www.youtube.com/watch?v=6YRmuk7SHpc

Photographs: mrcoles.edublogs.org

CLEAPSS Student Safety sheet 91a provides a suitable example. http://www.cleapss.org.uk/attachments/article/0/SSS91a.pdf?Secondary/Science/Student%20Safety%20Sheets/

Activity 1b

Hazard symbols

Work with a partner to identify the symbols and comment on what it means if using something with that symbol on. Complete the table.

Symbol	What it stands for	What should we do or not do
		
		
		
		
		
		

The table below includes a range of suitable symbols and explanations.

Symbol	What it stands for	What should we do or not do
	**FLAMMABLE**	Do not get near a naked flame or anything very hot.
	**OXIDISING**	Do not mix with anything that gives off oxygen.
	**CORROSIVE**	Burns the skin so don't spill on hands, or wear gloves when handling.
	**TOXIC**	Poisonous – wash hands after handling. Do not eat or drink.
	**MODERATE HAZARD** (eg, harmful if inhaled or in contact with skin, causes eye irritation)	Be careful not to breathe in any dust, wear gloves when handling, always wear safety glasses.
	**HEALTH HAZARD** (eg, sensitisers, carcinogens)	Could cause cancer or skin allergy. Do not handle without gloves.

Activity 1c

Hazard vs Risk

Your teacher will now pour out a glass of milk.

Work with your partner to identify any risks involved and how these risks could be minimised.

Fill in the table.

Risk	***How the risk can be minimised***

Explain the difference between a hazard and a risk.
Hazard – anything that has the potential to cause harm to you or to others
Risk – the chance of something happening that has the potential to cause harm. The level of risk depends on how likely it is that the event or situation will happen and how severe the harm could be.

For example: Scissors are a hazard. How likely are you to hurt yourself when using them? Unlikely if using them properly. If you did cut yourself, how severe would the harm be? For most people it is likely to be a small cut. So level of risk is low.

Hazards can be biological, chemical or physical.

Activity 2

Collecting experimental data

You have the method below for an experiment. Read it carefully.
Now carry out a risk assessment for this experiment and record your risk assessment in the table below.

Experiment: Investigate the effect of changing hydrochloric acid concentration on rate of reaction with magnesium ribbon.

Equipment

Hydrochloric acid – range of concentrations 2M, 1.5M, 1M, 0.5M, 0.1M

Magnesium ribbon – cut into 2cm lengths

Measuring cylinders – 100cm3

Beakers 250cm3

safety glasses

stop watch

Method

1. *Use a measuring cylinder to measure out 25 cm3 of 2 M hydrochloric acid.*
2. *Put it in a beaker.*
3. *Drop in 2cm of magnesium ribbon and quickly start the stop watch.*
4. *Time how long it takes for the reaction to finish.*
5. *Record your results in a suitable table.*
6. *Empty the beaker and rinse it out and dry it.*
7. *Now repeat the experiment using 1.5M hydrochloric acid.*
8. *Now repeat the experiment again using the other concentrations of hydrochloric acid.*

Risk assessment

What is the hazard?	What is the risk?	What can you do to control the risk?
Acid	Burns on hands	Be careful when pouring out and wear gloves
Acid	Splashes in the eye	Wear safety glasses
Glass	Breakage and cuts	Make sure outside is dry so doesn't slip. Carry carefully. Clean up and breakages.
Water on floor	Slip	Clean up at once
Hydrogen gas	Explosion risk	Ventilate the room well. No naked flames.

Suitable results table:

Concentration of hydrochloric acid in M	Time taken for reaction to finish in seconds	Rate of reaction 1/time in seconds

Activity 3

Collecting data from secondary sources

The aim of this task is to provide students with the opportunity to identify the best sources for information. It will also give them the opportunity to collect secondary information and create a bibliography.

How can you find out information about what are healthy foods?
Work in a buzz group to suggest where you could find out information about healthy foods.

Your teacher will now summarise all the sources on the white board.

You are now going to do some research to find out information about a topic.

Research topic: ***Should junk foods be banned?***

Work with a partner to find information for and against banning junk food.

You will need to plan where you can find out this information so that you can produce a balanced argument.

You could use IT, books, magazines, health leaflets or people. You should make a list of all the sources you have used.

Notes about doing research are given on the next page.

When you have completed your research make a summary of your findings for and against banning junk food.

You should display your findings on poster paper so other people in the class can read them.

Make sure you answer the question: Should junk foods be banned?

Introduce the activity: How can you find out information about what are healthy foods?

Students work in buzz groups to suggest sources.

Summarise on white board.

Discuss with the class: How do we know which method would give information which could be trusted?

Introduce research activity for the lesson: Should junk foods be banned?

This is a good opportunity for pair work. Students will need to research information to produce a balanced argument, plan where they could source information and then carry out research using IT/texts/literature sources. They will need to be able to print out items/photocopy from books etc.

A library box of materials both useful and non-useful could be made available.

Following the research, students should prepare a summary of their findings as a poster which can be displayed for the rest of the class to read. They should have an answer to the research question.

Notes about research tips are included in the student activity sheet – copy below.

Top tips for carrying out research

1. Make sure before you start that you really know what you are trying to find out.
2. Think about the best way to collect information.
3. You will need to keep a bibliography or list of sources from which you found out information.
   - Books: give author, title, date of publication
   - Newspapers/magazines: title of article, title of publication, date of publication
   - Website: full URL
4. You have decided to use the Internet: where do you start?
   a) Use a search engine like Google.
   b) Identify the key words in your question or title.
   For example: You want to find out about Nokia mobile phones - there are three key words:
   - Nokia
   - Mobile
   - Phone

If you type just one of them then the search will give millions of hits.

Even if you type in all three – Nokia mobile phones - there will still be too many hits to sort out because the search engine will look for each word separately.
You need to type them in like this: “Nokia mobile phones” - the search engine now looks for these three words linked together.

c) Check the first few sites listed. Ignore the advertisements at the sides of the page.
d) Open a site and quickly scan the contents. Look for the key words in your research topic. Can you understand the first two or three sentences? If you can’t understand them – then it isn’t a good site for you to use. Check it is what you really are looking for. If it is then carry on. If not close and open another site.
e) Highlight the web address bar, copy and paste into a Word document – your source list. Number the source. Quickly add a note about that site – e.g. is it for or against the topic. If you are unable to copy and paste the web address then you will need to write out the full URL.
f) Print out the web page if it is really one you are going to use. Make sure you number this page with the same number you used in your source list.
g) Now repeat for more resources.

5. You have decided to use a book or newspaper/magazine: where do you start?

a) Use the index to look for the topic.
b) Quickly scan the page(s). Do they provide the information you are looking for?
c) Write down in your source list the full details of the book/article. Number the source list.

6. Now select information from your source. With web pages it is a good idea to use a highlighter pen to mark the bits you need.

7. For sources you have found you need to decide:
   - do they provide an answer to the research topic
   - are all sources just giving you one side of the argument or one view
   - where has the source obtained the information from, is there any bias e.g. if you were looking for information on whaling then Greenpeace would be biased
   - have you collected balanced points of view e.g. a comment for and against the argument

8. You should now write down on file paper a summary of the information you have found out. Don't copy it word for word.

9. If you want to use a quote, copy it exactly using "……." to show it is a quote. Make sure you have a reference for the quote.