



Applied Science WebQuests

This workbook contains a range of web-based projects which prepare you for the type of assignments you will be completing for your BTEC Applied Science course.

Biology

- 2.5 Hip replacements
- 2.6 Microorganisms in the food industry

Chemistry

- 1.5 The value of the Periodic Table
- 2.6 Chromatography and crime

Physics

- 2.4 The science of music
- 3.5 Stage lighting

Hip replacements

Introduction

Some old people suffer from pain in their hip joints and have difficulty walking. To solve this problem they may be offered a hip replacement – the damaged hip is replaced with an artificial hip.

In this activity you will be using your research skills to find out about:

- the structure of a hip joint
- why a hip replacement may be needed
- what happens during hip-replacement surgery
- the benefits and risks of hip-replacement surgery

You will be using your literacy skills to produce a fact-sheet to be given out to patients who are thinking about having hip-replacement surgery.

Brief

You are going to produce a fact-sheet that doctors can hand out to patients who are thinking about having hip-replacement surgery.

Your factsheet should:

- contain a labelled diagram of the structure of the hip joint
- explain the job of each part of the hip joint
- include a short overview of what happens during hip-replacement surgery
- provide information on the benefits and risks of hip-replacement surgery
- fill one side of an A4 sheet
- use appropriate language that can be understood by people who have no medical or scientific knowledge.

Step 1

Research the following topics:

- the structure of a hip joint
- why a hip replacement may be needed
- what happens during hip-replacement surgery
- the benefits and risks of hip-replacement surgery.

Step 2

Find a diagram of the hip joint. Add labels to identify the different parts of the joint.

Step 3 (extension)

Find out what other options there are for patients with damaged hip joints, and how hip-replacement surgery is improving.

Step 4

Plan appropriate sub-headings to structure your fact-sheet and decide on the important information you want to include.

Step 5

Make your fact-sheet.

Sources**Basic structure of a joint**

This website contains information on the parts of a joint:

www.bbc.co.uk/bitesize/ks3/science/organisms_behaviour_health/life_processes/revision/7/

Structure of the hip joint

This website contains information on the structure of the hip joint:

<https://www.bbc.co.uk/bitesize/guides/zxc34j6/revision/5>

Hip-replacement surgery

This website contains information on why a hip replacement may be needed, what is involved in a hip-replacement operation, and risks of having the surgery:

www.bupa.co.uk/individuals/health-information/directory/h/hip-replacement

Hip-replacement surgery and alternatives/the future (extension)

This website contains information on why a hip replacement may be needed, what is involved in the operation, and risks of having the surgery. It also contains information on alternatives to hip-replacement surgery and improvements to the procedure:

www.nhs.uk/Conditions/Hip-replacement/Pages/Introduction.aspx

Writing frame

You are going to produce a fact-sheet that doctors can hand out to patients who are thinking about having hip-replacement surgery.

Summarise your research findings on the key areas below.

<p>Structure of a hip joint</p>	<p>Why a hip replacement may be required</p>	<p>What happens during hip-replacement surgery?</p>
<p>Benefits and risks of hip-replacement surgery</p>	<p>Alternatives and improvements to hip-replacement surgery (extension)</p>	<p>Plan for layout of fact-sheet</p>

Important points

- Make sure your fact-sheet fills only one side of an A4 sheet.
- Use appropriate language that can be understood by people who have no medical or scientific knowledge.
- Use bullet points to summarise your main findings.

Your work

You have now made a fact-sheet that doctors can hand out to patients who are thinking about having hip-replacement surgery.

Look at the questions below, and check that you have met the brief.

- Does your fact-sheet contain a labelled diagram of the structure of the hip joint?
- Have you explained the function of the different parts of the hip joint?
- Have you included an overview of what happens during surgery?
- Have you provided information on the benefits and risks of surgery?
- Have you included information on alternatives and improvements to hip-replacement surgery? (extension)
- Does your fact-sheet fit onto one side of an A4 sheet?

Have you used appropriate language that can be understood by people who have no medical or scientific knowledge?

Microorganisms in the food industry

Introduction

Many of the foods and drinks we consume have been made using microorganisms. For example, yeast is added to bread to make it rise, and bacteria are used to make yoghurt.

The production of both bread and yoghurt involves fermentation. Fermentation is a type of anaerobic respiration – the microorganisms respire without oxygen, breaking down sugars to transfer energy.

In this activity you need to choose one food or drink product made using microorganisms. You will then use your research skills to find out about:

- the microorganism used
- how fermentation is involved in the production of the food
- how the product is manufactured.

You will be using your literacy skills to produce a leaflet explaining how your chosen product is manufactured on a large scale.

Brief

You are going to produce a leaflet explaining how your chosen food or drink product is manufactured on a large scale.

Your leaflet should:

- describe the type of microorganism involved in the production of the food or drink
- describe the importance of the fermentation reaction
- include a step-by-step description of how the product is manufactured on a large scale
- include pictures of any equipment used during production
- be made from one folded piece of A4 paper
- use appropriate scientific terminology, with any key words defined.

Step 1

Find a food or drink that is made using microorganisms, then research the following topics:

- what microorganism is involved in the manufacture of your chosen product
- how fermentation is used in the production process
- how the product is manufactured on a large scale.

Step 2

Organise the manufacturing process into a step-by-step sequence. Find pictures to illustrate the process.

Step 3

Plan appropriate sub-headings to structure your leaflet and the important information you want to include.

Step 4 (extension)

Probiotic yoghurts are yoghurts that have had additional species of bacteria added to them. The manufacturers claim that these bacteria aid digestion. Carry out some further research to find out whether probiotic yoghurts are more beneficial to health than normal yogurts.

Step 5

Make your leaflet.

Sources**Fermentation, beer, and wine**

This website contains information on fermentation using yeast and the production of beer and wine.

www.bbc.co.uk/schools/gcsebitesize/science/triple_ocr_gateway/beyond_the_microscope/useful_microorganisms/revision/2/

Making beer

This website contains information on how beer is manufactured.

resources.schoolscience.co.uk/sgm/sgmfoods10.html

Making cheese and yoghurt: an introduction

This website contains information on fermentation using bacteria and the production of cheese and yoghurt.

www.bbc.co.uk/bitesize/standard/biology/biotechnology/living_factories/revision/6/

Making cheese

This website contains a step-by-step guide on how cheese is manufactured.

<https://www.greatbritishchefs.com/features/how-cheese-is-made>

Making yoghurt

This website contains information on how yoghurt is made and a brief introduction to probiotics.

www.animalsmart.org/kids-zone/jr-animal-scientist-e-news/how-is-yogurt-made-

Probiotics

This website contains information on probiotics and studies into their uses.

<https://www.saga.co.uk/magazine/health-wellbeing/treatments/supplements/probiotics>

Writing frame

You are going to produce a leaflet explaining how your chosen food or drink product is manufactured on a large scale.

Summarise your research findings on the key areas below.

Product:

Microorganism used:

Other ingredients
needed:

Fermentation reaction:

How product is manufactured (step-by-step)

Probiotics (extension)

Plan for layout of
factsheet

Important points

- Make sure your leaflet fits on one folded piece of A4 paper.
- Include pictures of any equipment used during the manufacturing process.
- Use bullet points to summarise your main findings.
- Use scientific language, where appropriate, but make sure you explain any key terms.

Your work

You have now made a leaflet that explains how a food or drink product, created using microorganisms, can be manufactured on a large scale.

Look at the questions below and check if you have met all the criteria given in the brief.

- Have you described the type of microorganism involved in the manufacture of the product?
- Have you described the importance of the fermentation reaction?
- Have you included a step-by-step description of how the product is manufactured on a large scale?
- Have you included pictures of any equipment used in the manufacture of your chosen product?
- Is your leaflet made of one folded piece of A4 paper?
- Have you used appropriate scientific terminology and defined any key words?

The value of the Periodic Table

Introduction

The Periodic Table is a wonderful tool for chemists, but non-scientists who don't understand it often see it as dull and boring.

In this activity you will be using your research skills to find out about:

- the real value of the Periodic Table
- how the Periodic Table reveals patterns
- how the Periodic Table makes chemistry simpler to understand.

You will be using your literacy skills to produce a persuasive presentation to convince non-scientists of the value of the Periodic Table.

Brief

You are going to make a presentation that will convince non-scientists that the Periodic Table really is useful.

Your presentation should:

- be persuasive, showing how the Periodic Table is useful in helping people make sense of over 100 elements
- include some information about the history of the Periodic Table
- illustrate some differences between elements in the Periodic Table
- include information about the elements of Groups 1, 7, and 0
- explain how the Periodic Table can be used to make predictions
- contain six slides
- include pictures.

Step 1

Research the following topics:

- a brief history of the Periodic Table, including who developed it and why
- a few interesting elements that show how different elements can be from one another
- the Group 1 elements (similarities and trends)
- the Group 7 elements (similarities and trends)
- the Group 0 elements (similarities and trends)
- how the Periodic Table can be used to make predictions.

Step 2

Find some appropriate pictures to use in your presentation.

Step 3 (extension)

Choose one trend that you have researched and find some data to illustrate the trend. Think about the best way to display the data.

Step 4

Choose the key points that you have found out about and decide how they can be used to convince your audience that the Periodic Table really is useful.

Step 5

Make your presentation.

Sources**Purpose and development of the Periodic Table**

An introduction about the development of the Periodic Table and why it is so important:

<https://www.bbc.co.uk/bitesize/guides/z36cfcw/revision/1>

Group 1

The chemistry of the Group 1 elements (alkali metals):

www.ducksters.com/science/chemistry/alkali_metals.php

Group 7

The chemistry of the Group 7 elements (halogens):

www.ducksters.com/science/chemistry/halogens.php

Group 0

The chemistry of the Group 0 elements (noble gases):

https://www.ducksters.com/science/chemistry/noble_gases.php

Element data (extension)

An interactive Periodic Table with data for each element:

www.chemicalelements.com/

Making predictions

One of Mendeleev's greatest achievements was to predict the existence of germanium and what it would be like. This story really highlights the power of the Periodic Table:

www.chemistryexplained.com/elements/C-K/Germanium.html#b

Writing frames

You are going to make a presentation that will convince non-scientists that the Periodic Table really is useful.

Summarise your research findings on the key areas below.

The history of the Periodic Table (who developed it and why?)

Examples of elements with very different properties

Element 1:

Element 2:

Element 3:

Group 1 elements (similarities and trends)

Group 7 elements (similarities and trends)

Group 0 elements (similarities and trends)

Trend data (extension)

Making predictions using the Periodic Table

Important points

- Make sure your presentation includes 6 slides.
- Your presentation should be persuasive.
- Use appropriate pictures to help make your points.

Your work

You have made a presentation to convince non-scientists that the Periodic Table really is useful.

Look at the questions below and check if you have met all the criteria given in the brief.

- Is your presentation persuasive?
- Does your presentation include some information about the history of the Periodic Table?
- Have you illustrated some differences between elements in the Periodic Table?
- Does your presentation include information about the elements of Groups 1, 7, and 0?
- Have you explained how the Periodic Table can be used to make predictions?
- Do you have a final summary slide that illustrates how powerful the Periodic Table is?
- Does your presentation contain six slides and include pictures?

Chromatography and crime

Introduction

Chromatography is a technique that is used a lot by forensic scientists. In this activity you will look at one case in which chromatography has been, or could be, used to help solve a crime.

In this activity you will be using your research skills to find out about:

- the use of chromatography in forensic science
- a particular case where chromatography can help solve a crime.

You will be using your literacy skills to prepare a report from an 'expert witness' about the use of chromatography in your chosen investigation.

Brief

Sometimes, when a case is tried in court, an expert witness might be needed to explain complicated or technical evidence. You are going to take the role of an expert witness. You will write a report that will be presented at a courtroom trial to explain chromatography evidence in a case.

Your report should:

- give a brief overview of the case you have chosen
- explain how paper chromatography works in general
- explain how chromatography provides evidence in your chosen case
- explain any key terms so that a jury with no scientific knowledge can understand the evidence.

Step 1

Look at the sources provided to get an idea of the types of cases in which evidence from chromatography might be presented in court. One example is a real case, while the others are made-up based on the type of cases that will have come to court. Choose one case that you would like to work on, and summarise what happened (the story). If it is a made-up case you will have to use your imagination to help create the story.

Step 2

Use your existing knowledge and the sources to write down key points describing, in general terms, how paper chromatography works. Find some pictures that you can use to help the jury understand paper chromatography.

Step 3 (extension)

Thin layer chromatography (TLC) is similar to paper chromatography and is also often used in forensic investigations. The court you are writing a report for often comes across cases involving the use of TLC and they have asked you to include a brief description of the differences between paper chromatography and TLC. Find out how TLC is different to paper chromatography, and what advantages it has.

Step 4

Research your chosen case in detail, and write down the key points explaining the use of chromatography to provide evidence.

Step 5

Now write your report and prepare for your day in court!

Sources**Chromatography and crime – identifying ink**

A fun introduction to the use of chromatography for identifying ink:

<https://www.bbc.co.uk/bitesize/guides/ztkdd2p/revision/1>

Ransom note chromatography

A fun case about a ransom note:

www.webinnate.co.uk/science/week4.htm

Bank robbery

The use of chromatography to match dyes:

<https://www.reference.com/science/chromatography-used-solve-crime-fc53072f9871394f>

Thin layer chromatography (TLC) (extension)

What TLC is and where it is used in forensics:

www.the-gist.org/2011/07/tlc-the-forensic-way/

Advantages of TLC:

<https://www.bbc.co.uk/bitesize/guides/ztkdd2p/revision/2>

Writing frame

You are going to take the role of an expert witness. You will write a report that explains chromatography evidence in a case. It will be presented at a courtroom trial.

Summarise your research findings on the key areas below.

The case

Case title:

Case summary (What happened? What crime was committed?):

How paper chromatography works

How chromatography provides evidence
in the case

Thin-layer chromatography (TLC) (extension)

Important points

- Remember you are the expert witness in court. Your report will be read out, and then you could be cross-examined on it. You must be able to explain everything you have written.
- Explain any key terms so that a jury with no scientific knowledge can understand the evidence.

Your work

You have written a report that will be presented at a courtroom trial to explain chromatography evidence in a case. Remember that you might be cross-examined on your report so you must understand it all clearly.

Look at the questions below and think about whether you have met the brief.

- Have you selected one case?
- Does your report summarise the possible crime that has been committed?
- Does your report explain how paper chromatography works in general?
- Have you explained how chromatography provides evidence in your chosen case?
- Have you explained any key terms so that a jury with no scientific knowledge can understand the evidence?

The science of music

Introduction

Many people enjoy music and going to concerts, but most know very little about the science of music and how to protect their hearing at concerts.

In this activity you will use your research skills to find out:

- how to compare different sounds
- how different instruments produce notes
- how we can hear music
- how to protect your hearing.

You will be using your literacy skills to produce a leaflet for concert organisers to give to members of the public who want to know more about the science of music.

Brief

Produce a leaflet for a concert organiser to give to concert-goers who want to learn about the science of music.

Your leaflet should:

- explain what sound waves are and how to compare the loudness and pitch of different sounds
- describe how some different instruments produce vibrations to create sound
- explain how we hear
- explain why people should protect their hearing
- provide tips on how people can protect their hearing at a concert
- fit on one A4 sheet of paper
- use clear language that can be understood by the general public.

Step 1

Before starting, decide what type of concert you are going to write about (e.g. classical, rock, pop).

Step 2

Choose some instruments relevant to the type of concert you are writing about, and find out how these instruments produce vibrations to create sound.

Find out why people should protect their hearing and how they can do it.

Step 3 (extension)

Many people buy recorded music instead of going to concerts. Include information about what happens in a music-recording-studio in your leaflet.

Step 4

Plan the layout of your leaflet and the information you want to include. Most concert-goers want to enjoy themselves, so include images and small chunks of information rather than lots of text in your design.

Step 5

Create your leaflet.

Sources**What is sound?**

This website describes how sound is produced, what sound waves are, and how the ear works. Choose the 'What is Sound' option.

www.acoustics.salford.ac.uk/schools/index1.htm

How do instruments produce sounds?

This site describes how different musical instruments produce vibrations which produce sounds:

www.method-behind-the-music.com/mechanics/instruments

How do we hear things?

This website describes the structure of the ear and how we hear:

www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p=335&np=152&id=1463

How loud noises affect our ears and how to prevent harm

These sites explain how loud noises affect hearing, how to compare loudness, and some ways to prevent hearing damage:

www.dangerousdecibels.org/education/information-center/

www.actiononhearingloss.org.uk/your-hearing/about-deafness-and-hearing-loss/types-and-cause-of-hearing-loss/noise.aspx

How is music recorded? (extension)

Choose the Recording Studio option to find out what happens when music is recorded:

www.acoustics.salford.ac.uk/schools/index1.htm

Writing frame

Produce a leaflet for a concert organiser to give to concert-goers who want to learn about the science of music. Summarise your research findings on the key areas below.

Concert type: (e.g. classical, rock, pop)

What are sound waves, and how do they travel?

How can we compare loudness and pitch of different sounds?

How are sound waves produced by different instruments?

How do we hear, and how is hearing damaged by loud sounds?

How can you prevent hearing damage?

Plan for layout of leaflet

Important points

- Use interesting images and language that can be understood by people going to a concert.
- Make your leaflet useful and easy to read; you will need to summarise the information.

Your work

You have made a leaflet for concert-goers who want to learn about the science of music.

Look at the questions below and think about whether you have met the brief.

- Is your leaflet about a particular type of concert?
- Have you explained what sound waves are?
- Have you explained how to compare the loudness and pitch of different sounds?
- Have you described how some different instruments create sound?
- Have you explained how we hear?
- Does your leaflet help to convince people that they should protect their hearing?
- Have you provided tips on how people can protect their hearing at a concert?
- Does your leaflet fit on one A4 sheet of paper?
- Have you used clear language that can be understood by the general public?
- Is your leaflet interesting for people who are out having a good time?
- Does it contain some pictures?

Stage lighting

Introduction

At concerts and theatres stage lighting is used to create different effects.

In this activity you will use your research skills to find out:

- how different colours are created by mixing light
- how coloured light affects what we see
- how stage lights are used to create different effects
- how to combine lights to create special effects.

You will use your literacy skills to produce a fact-sheet to give to amateur-theatre groups to help them plan their lighting schemes.

Brief

You will produce a fact-sheet for people who are planning lighting effects for a concert or production.

Your fact-sheet should:

- state the primary and secondary colours of light
- describe how to create different colours of light
- explain how the appearance of objects changes under different coloured lights
- be made from one folded piece of A4 paper
- be suitable for people with no scientific knowledge.

Step 1

Research the following topics:

- primary and secondary colours of light and what happens when they are mixed
- how different colours of light are produced
- how coloured light affects the appearance of objects.

Step 2 (extension)

Find out how stage lighting is used to create other special effects. For example, research the difference between spot-lights, flood-lighting, and back-lighting.

Step 3

Plan appropriate sub-headings to structure your fact-sheet and decide what important information you want to include.

Step 4

Make your fact-sheet.

Sources

Primary and secondary colours

This website explains how coloured light mixes to make secondary colours:

<http://www.funscience.in/study-zone/Physics/RefractionOfLight/PrimaryColorsAndSecondaryColors.php#sthash.3JkNhB7w.dpbs>

Coloured light and filters

This website contains a lot of detail so look at the pictures. It explains what primary and secondary colours of light are. It explains what filters do to light and there is a table showing the colour of objects seen in different lights. You will need to follow the different links to get to all of the useful information:

www.cyberphysics.co.uk/topics/light/color.htm#addition

Mixing colours

This website allows you to see the effect of mixing different colours:

<https://trycolors.com/>

Stage lighting (extension)

This website explains the difference between different types of stage light and how effects can be created:

www.stagelightingguide.co.uk/

Writing frame

Produce a fact-sheet to give to amateur-theatre groups to help them plan their lighting schemes.

Summarise your research findings on the key areas below.

What are the primary and secondary colours of light?

What colours are produced when coloured light is mixed?

How are different colours of light produced?
e.g. filters

How and why do objects appear different in coloured light?

How are other stage-lighting effects created?
(extension)

Plan for layout of fact-sheet

Important points

- Make sure your leaflet fits on one folded piece of A4 paper.
- Use interesting images and language that people who are not scientists can understand.
- Labelled diagrams and bullet points are better than a lot of text. Summarise the points.

Your work

You have now made a fact-sheet to give to amateur-theatre groups to help them plan their lighting schemes.

Look at the questions below and check whether you have met the brief.

- Have you stated the primary and secondary colours of light?
- Have you stated the combinations of coloured light that are used to create other colours?
- Have you described how filters affect the colour of light passing through them?
- Have you described how colours of objects appear to change when you see them in coloured light?
- Is your fact-sheet made of one folded piece of A4 paper?
- Have you used language which can be understood by people with no scientific knowledge?