

How scientists make money

Activities in this pack

1. What scientists do
2. The purpose and success of a science-based business
3. Local science-based organisations
4. Investigating a science-based organisation
5. Science-based businesses: size, scope and moral science
6. Money and medicine: the pharmaceutical industry
7. Johnson Matthey: world leader in advanced material technology
8. BAE Systems: largest defence company in the world
9. GlaxoSmithKline: dissecting a multinational
10. BASF: the 'Verbund' philosophy

Consultation on 'How Scientists Make Money' activities

The draft activities are being sent to

- a number of teachers around the country
- education officers of relevant professional bodies
- some people in relevant industries
- other parties who have expressed an interest in the work

We will ask if

Level

The level of the content is suitable for the targeted award

The style and level of the language is suitable for the targeted learner

The activities and opportunities for assessment are useful and appropriate

Ease of use

The layout is helpful and logically structured to inform the learner

Instructions are clear

Delivery style ie graphics and interactions

Delivery style is appropriate to target learner

Delivery style does not interfere with effective communication of material

Resources

Accessible to learner

Appropriate for learner

Time allocation

Appropriate for learning activity

Relevance

To the curriculum and qualification specifications

Likelihood of usage

When, where, how materials likely to be used

If you would like to add your comments about these draft assignments using the above headings as guidance, please send them to:

Jean Scrase
4 SCIENCE
6 Deans Farm Buildings
Phillips Lane
Salisbury College
SP1 3NN

What scientists do

Introduction

Scientists may be found in all walks of life and all kinds of occupations. They are not confined to laboratories, working in isolation on esoteric research problems. Scientists are team players. They may be in a desert, by the side of a river, on the top of a mountain or deep beneath the sea. And they are working on everyday problems that affect all of us.

They work in public services such as the health service, environmental agencies, scientific consultants and analytical laboratories. Scientists have vital roles in the agricultural, biotechnology, engineering, manufacturing, chemical and pharmaceutical industries. They use science in a variety of ways, using specific working practices often dictated by safety regulations and commercial factors.

What you need to do

Summarise on one side of A4 what scientists do in the workplace.

You should allow about 1 hour for this activity

How to set about it

1. In pairs, brainstorm the questions:

- What jobs do scientists do?
- What types of tasks do scientists perform?
- What kinds of equipment and materials do scientists work with?

Take about 10 minutes to think about the questions and record your ideas on a sheet of A4 paper or on an overhead transparency.

Come together as a group with the other pairs and compare lists.

Add to your own list if you can.

2. The activities of scientists might be categorised as *characterising*, *obtaining* and *controlling*. Working in your group:

- Write down some other verbs that are closely related, in a science-context, to the three given above (e.g. for 'obtaining' you might write 'making', 'synthesising', 'culturing' etc).
- Choose ideas from your list of jobs and tasks that you think illustrate each of these things.

Try to define each term (*characterising*, *obtaining* and *controlling*) by writing a brief sentence to describe what it involves. Are there any activities that do not fit into one of these three categories? List them.

Finally, write your own individual definitions and examples to include in your file.

The purpose and success of a science-based business

Introduction

What's the purpose of science? When we learn about science we focus on biology, physics and chemistry - the reproduction of plants or the anatomy of snails, the speed of light or the principles of gravity, the structure of an atom or what happens when we split one. But science is also a business. Science makes money.

This activity will help you find out about science-based businesses. Like all businesses, they fall into three categories:

- Primary: extraction of raw materials or resources from the land, sea or air
- Secondary: using raw materials to produce or manufacture goods
- Tertiary: service providers who make sure goods reach the people who need them

All businesses exist for a reason - all aim to be successful. But what are the reasons? What's meant by 'successful'? What can be done to increase the chances of success? And how can success be measured?

What you need to do

- Write down the reasons for running a business and compare these with what science-based organisations themselves say.
- Produce a checklist of criteria for a 'successful' science-based business and suggest what steps could be taken to increase your confidence that a new business venture would be successful.

You should allow about 5 hours for this activity

How to set about it

1. In pairs, brainstorm the reasons for running a business (science-based or otherwise). Take about 15 minutes to think about the questions and record your ideas on a sheet of A4 paper or on an overhead transparency.

15 minutes
2. Working with two other pairs (the 'team'), share ideas and come up with an agreed purpose for running a business together with a brief explanation.

15 minutes
3. Each team will present its conclusions to the other members of the whole group. After the presentations spend some time discussing the ideas and issues that have been raised.

45 minutes
4. Look on company websites and other sources of information about science-based businesses and find out how they express their purpose and aims. One very useful resource is the Institute of Physics CD ROM 'Scientists in Business'. Here you can listen to scientists talking about their work and their companies. Write a brief commentary about how these compare with the ideas your team came up with.

3 hours
5. Working in your team, discuss what criteria could be used to judge whether or not a business is successful. Write a list of, say, 4-6 criteria.

15 minutes

6. Still working as a team, write down what actions a new company might take to increase its chances of being successful.

15 minutes

7. Finally, make sure that the records of work you carried out are organised clearly in your file.

15 minutes

Notes for teachers

Specification links

This activity may be used for:

- VGCSE Science Unit 3 (Science at work)
NB It will be presented in a modified form for this level
- AVCE Science Unit 1 (Investigating science at work)

While it does not meet specific requirements for GCE A/AS science specifications, it is hoped that some teachers may use it as an enrichment activity.

Resources

CD ROM

The Institute of Physics CD ROM, **Scientists in Business**, is an interactive multimedia programme for young scientists and engineers, showing how technical and business skills combine to build a successful career at the frontiers of industry. The structure of the CD ROM is:

What companies do

- Introduction
- Objectives
- Science and business
 - Science-based companies: purpose of business; success in business
 - Product and process development: introduction; R&D in companies; commercialization of science; R&D portfolios; patents and intellectual property
 - Science-based operations: introduction; managing complex systems; continuous improvement and technology transfer; testing and analysis
- Scientists in companies
 - Career paths: introduction; career patterns; trends in career patterns; employability
 - Working in industry: introduction; rewards of working in industry; increased individual responsibility; working in teams; new roles for specialists; broadening experience

How companies work

- Introduction
- Objectives
- How companies are organised
 - Functional areas: introduction; research and development; finance; commercial and marketing; manufacturing and production; human resources development; support functions; working together
 - Management structures: introduction; function based structures; product-based structures; matrix management structures
 - Current trends in management: introduction; Japanese influences; employee empowerment and flat management structures
- Money in companies
 - Finance and budgets: introduction; investment and return; budgets and budgetary control
 - Project appraisal: introduction; project appraisal procedures; project appraisal criteria; preparing a proposal

Personal development

- Introduction
- Objectives
- Acquiring new skills
 - Acquiring new skills – what? Introduction; technical skills and knowledge; general skills and knowledge
 - Acquiring new skills – when? Introduction; life-time learning; planning your learning
 - Acquiring new skills – how? Introduction; courses; open learning; experience; informal activities; networks
- Planning your development
 - Competences: introduction; what is meant by competence; levels of competence; assessing competence
 - Personal development plans: introduction; starting your plan; plan layout

Browse

- Introduction
- Objectives
- People route
 - Job type: company directors; scientist managers; scientists and engineers; other job types
 - Subject of first degree: physics; chemistry and materials science; mathematics; life sciences; engineering; other subjects
 - Company: company list
- Questions route
 - What companies do: science and business; scientists in companies
 - How companies work: how companies are organised; money in companies
 - Personal development: acquiring new skills; planning your development

Useful web addresses:

Akzo Nobel - Multinational Pharmaceuticals, Coatings and Chemicals Company

<http://www.akzonobel.com/>

AstraZeneca in the UK

<http://www.astrazeneca.co.uk/>

Welcome to BASF

<http://www.basf.com/>

BNFL.com

<http://www.bnfl.com/website.nsf/index.htm>

BP – A Leading Provider of Energy

<http://www.bp.com/>

Bristol-Myers Squibb Company

<http://www.bms.com/landing/data/index.html>

CBI - Confederation of British Industry - home

<http://www.cbi.org.uk/home.shtml>

Chemical Industries Association

<http://www.cia.org.uk/>

Esso

http://www.esso.com/index_flat.html

GlaxoSmithKline – Gateway

<http://www.gsk.com/>

Green Chemistry Network

<http://www.chemsoc.org/networks/gcn/>

Welcome to Hexcel – The Strength Within

<http://www.hexcel.com/>

Honeywell Home

<http://www.honeywell.com/>

Welcome to Johnson Matthey – World Leader in Advanced Material Technology

<http://www.matthey.com/>

Merck Sharp & Dohme – The Neuroscience Research Centre

<http://www.msd-nrc.co.uk/>

Novartis.com

<http://www.ciba.com/>

Pfizers Inc Innovation in Pharmaceuticals, Health Care, Medicines and Animal Health

<http://www.pfizer.com/main.html>

Pfizer Inc The Science of Medicine

<http://www.pfizer.com/science/science.html>

PowderJect Pharmaceuticals Plc Making medicines work better

http://www.powderject.com/flash_homepage.htm

Rolls Royce

<http://www.rollsroyce.com/>

Shell The Royal Dutch-Shell Group of Companies

<http://www.shell.com/royal-en/0,6091,,00.html>

Syngenta Home Page

<http://www.syngenta.com/>

The BioIndustry Association – Promoting UK Biotechnology

<http://www.bioindustry.org/>

The Chemical Industry

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Unilever international manufacturer of leading brands in foods, home care and personal hygiene products

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All businesses exist for a reason - all aim to be successful. But what are the reasons? What's meant by 'successful'? What can be done to increase the chances of success? And how can success be measured?

What you need to do

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Local science-based organisations

Introduction

Science is used in many businesses and organisations. Depending on where you live the type of local science-based organisations will vary. Broadly these organisations fall into three main categories:

- Primary businesses: those involved with the extraction of raw materials or resources from the land, sea or air
- Secondary businesses: those using raw materials to produce or manufacture goods
- Tertiary businesses: service providers who make sure goods reach the people who need them

It will probably be easy to identify big industrial organisations – they are often at the heart of a community. Similarly, hospitals are found in or near most towns and these places employ a large number of people who use science. However, sometimes the use of science by an organisation is less obvious. These places may be more difficult to locate, as perhaps will be the smaller businesses that use science in their work.

What you need to do

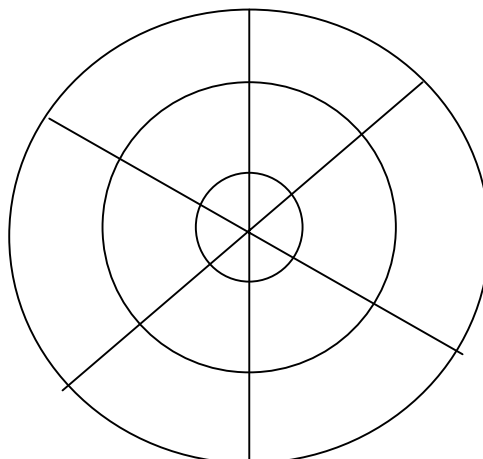
Produce a poster summarising the science-based businesses in the area where you live. The poster should contain the names of the companies, their locations, contact details (address, telephone, e-mail and website if they have one), what they manufacture or produce or the service they provide, and the nature of scientific work involved.

You may also consider making a PowerPoint presentation or building an electronic database.

You should allow about 6 hours for this activity (though it may take longer if you extend the activity and undertake a more ambitious investigation)

How to set about it

1. Decide with others in your group what geographical area you will investigate, e.g. county, town, city, a number of counties etc. One approach might be to get a map of the area and mark concentric circles of, say, 10, 25 and 50 miles radii from your school or college. The area might be sub-divided further by marking a number of segments, for example:



2. Try to find out what science-based employment there is in your chosen area. Work in a group and use the following questions to get you started:
 - Have you had a full or part-time job that has involved you in or brought you into contact with scientific work?
 - Do you have any relatives or friends who use science in their work?
 - Does anyone that you know, know somebody working as a scientist?
3. Now divide up the work between people in your group. Each segment might be assigned to a pair of students who work together to find out about the science-based organisations. Collectively the group can build up a picture of the distribution and type of science-based organisations.
Make sure each person understands their own responsibility and how it contributes to the group's work. Some ideas for where to look for information are given below.
4. Produce a poster to summarise the group's findings.

Types of science-based organisations

When thinking about science-based organisations in your area, it might be worth using the following checklist to help you:

Science-based businesses obtain, manufacture or process products for sale, for example

- products from plants, animals or micro-organisms
- refining of materials used as energy resources
- chemical products, e.g. medicines, paints, dyes, fertilisers, plastics
- extraction of resources, e.g. water, gas, oil, gravel, clay, stone or minerals
- mechanical machine or electrical gadgets
- processing and packaging of products

Others use science to provide services, for example

- promoting the health of individuals
- communication
- working with the environment
- animal welfare
- education and training in science and technology
- distribution and sale of food and other products
- analysis of materials and substances
- distribution of energy resources

Where you might look

It will probably be easy to identify large businesses or places such as hospitals. Finding out about smaller businesses (often referred to as 'small or medium sized enterprises' or smes) may be more challenging. Similarly, some organisations will have a very clear science aspect to their work while for others the 'science' may be less obvious.

Here are some ideas for finding information.

Paper-based resources

Try libraries (you might look for The Directory of Small Businesses in you local public library), the careers service, Yellow Pages and any other relevant sources.

Local Councils publish annual reports in which you might find useful information.

The Directory of Independent Hospitals and the IHSM Health and Social Services Year Book might be helpful.

Past issues of local and national papers (usually available on CD-ROMs) often contain interesting articles about the successes and failures of local businesses.

Organisations

The local chamber of commerce (they publish business directories with contact details and brief descriptions of what each company does) may be able to help. Science and Technology Regional Organisations (SATROs) and education/business partnerships (EBPs) may be able to provide information.

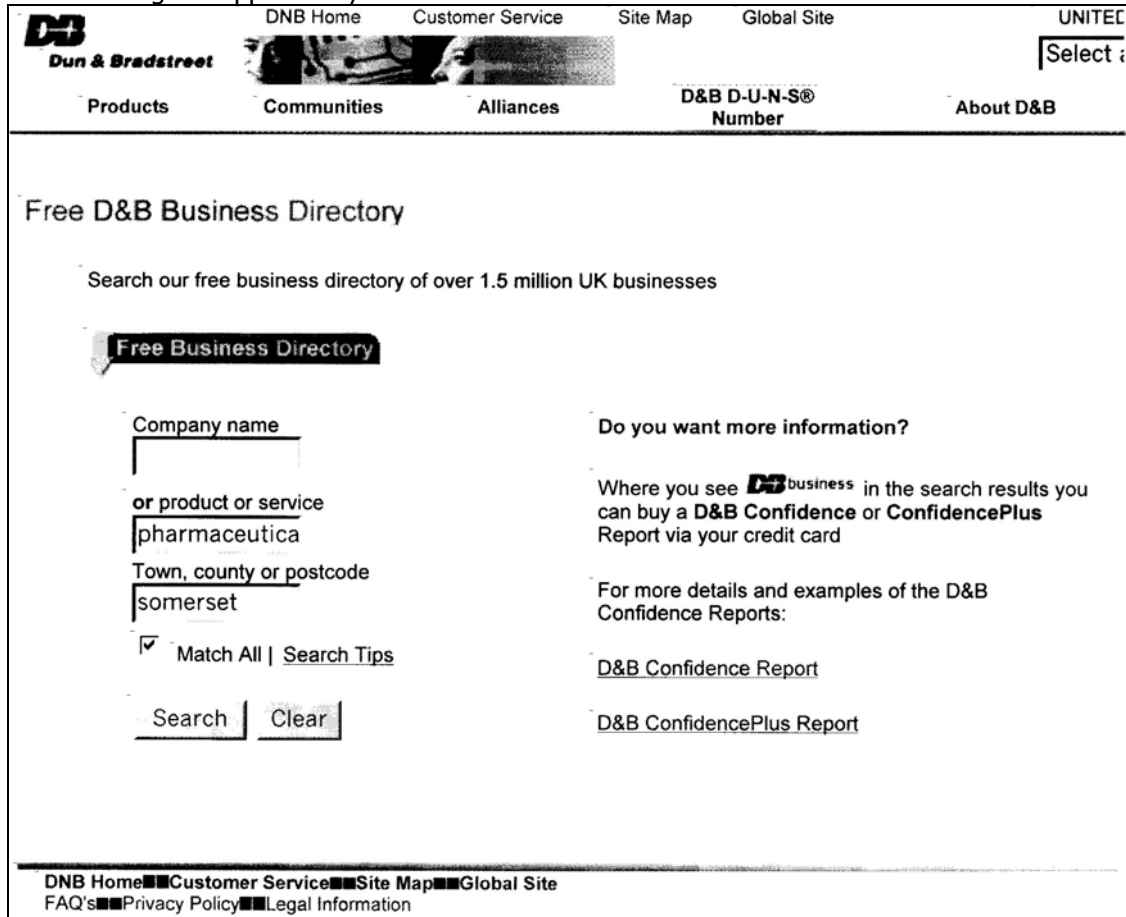
The internet

You should also try an internet search. There are many possibilities and you could try to search for them yourself.

However, here are some instructions to use the www.uk.dnb.com site. You can access the search facility directly using:

www.uk.dnb.com/AskAlex/searchscreen.htm

The following will appear on your screen:



- In the box 'product or service' type in whatever you are interested in (e.g. science, analysis, chemicals, pharmaceuticals, biotechnology, materials).
- In the box 'Town, county or postcode', type in the geographical area that you want to search.
- Click on 'Search' and you will be given a list of relevant companies.
- The names, telephone numbers and, in some cases web addresses, of organisations are listed; you may try visiting one or two of the websites.

Notes for teachers

Possible extensions

1. Instead of a poster, students could produce a database that allows them to sort the organisations according to certain criteria such as:
 - distance from school/college
 - type of scientific work undertaken
 - size (number of employees and turnover)
2. Students could try comparing the distribution of a particular type of organisation in different parts of the country, or the distribution of different types of organisations within a particular location.

Specifications links

Vocational A level

This activity may be used for AVCE Science Unit 1 (Investigating science at work). However, it is only an introduction and to meet the specification requirements students will need to tackle the activity **A science-based organisation**.

GCE A/AS

While it does not meet specific requirements for GCE A/AS science specifications, it is hoped that some teachers may use it as an enrichment activity.

Vocational GCSE

This activity could be modified and used to deliver part of the VGCSE Science Unit 3 requirements:

Science in the workplace

Vocational science is the science and skills used by people in a wide variety of jobs. Those with a major job role in science may classify things, obtain or make things, and monitor and control changes. The more scientists know about the materials and equipment they work with, the more effective they can be. Scientists tackle problems, sometimes straightforward, often complex. This requires employing scientific skills and knowledge, coupled with imagination and curiosity. However, there are many people who use science in their work that we do not think of as scientists. For some it is a significant part of their work (for example, nurses, engineers), for others it plays a smaller part (for example, photographers, chefs, gardeners).

You need to:

- *identify local, national and international businesses and service providers that use science*
- *put their employees into one of three classes: major; significant; and small users of science*
- *find out where the organisations are located and why*
- *identify the types of scientific activity that are carried out and the job titles and qualifications of the people who perform them*
- *find out what skills scientists need in addition to their qualifications*
- *find out what careers are available in science and science-related areas*

Investigating a science-based organisation

Introduction

We are a society that is dependent upon products and services. Clearly there is a need and a demand for medicines, electricity, transport and communications; but what about other everyday activities where the products of science and technology are used? What about leisure activities such as music and sport?

Organisations using science may carry out research and development, they may manufacture or process products or they may provide a service. Others are involved in education. In all areas where science is used, whether manufacturing, processing or providing a service, health and safety and quality assurance are vital.

There are many aspects to science-based businesses. For example, the type of work (and associated scientific processes) the organisations carry out, the roles and scientific qualifications of their staff, and legal and commercial constraints. Some are large organisations with many employees; others are much smaller. Businesses will use processes based on current scientific knowledge, and these processes will often have strict timescales.

There is a cost-benefit equation for all businesses, and this is in terms of social and environmental aspects as well as economics. There are ethical considerations when introducing new scientific and technological developments, such as cloning and genetically modified foods.

What you need to do

You need to write a report on an organisation that uses scientific knowledge in manufacturing or processing or to provide a service. If possible, choose an organisation that is local and where you can talk directly with someone working in that job. Your report should:

- Describe the type of scientific work, including the number and type of people who work in the organization.
- Discuss the costs and benefits relating to the organisation, and the impact they have on the local community.

The report should be word-processed report and you should use suitable ways to present your information. For example, tables, graphs, images.

You should allow about 30 hours for this activity

How to set about it

1. Choose an organisation to study in detail. It might be local, national or international. It could be a manufacturer or producer or be a service provider. Think about areas of science that particularly interest you, discuss the possibilities with your supervisor and choose the organisation.
2. Decide how you will gather information about the organisation you chose.

You might:

- Visit the organisation (discuss this with your supervisor before you approach anyone).
- Invite speakers from the organisation to come to your school or college.
- Look on company websites or at company annual reports and information literature.

- Read more generally about the area of activity in which the the organisation is involved.
3. Find out about work practices and the effects of commercial factors and safety regulations on them. Design data collection sheets to help you to cover this work.

You could:

- Design a questionnaire for use on a visit, with a visitor or for a telephone conversation.
 - Write a list of questions you need to answer.
 - Construct a checklist.
4. Make an action plan for any visits. Give yourself guidelines of what you need to look for or ask about. Add to or modify your sheets as you work your way through and develop the task. Remember - word processing gives you the flexibility to store and add to data whenever you like.
 5. Agree an outline programme of work, with a time frame, and arrange meetings with your supervisor to check your progress. The precise details of what you do and when you do it will probably change as the investigation develops. However, it is useful to have a broad plan with which to work.
 6. Once you have carried out the research, gathered and confirmed the information you need, produce a word-processed report about the organisation you studied. Use appropriate ways to present your information (e.g. tables, graphs, images).

Notes for teachers

If students have carried out the activity 'Local science-based organisations' they might choose an organisation from the list they produced.

Alternatively, they could use the same internet search facility to find an organisation further afield that does the kind of scientific work in which they are interested.

If students want to study a large national or multinational science-based business, here are some useful web addresses that might be explored:

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Pfizer Inc The Science of Medicine

<http://www.pfizer.com/science/science.html>

PowderJect Pharmaceuticals Plc Making medicines work better

http://www.powderject.com/flash_homepage.htm

Rolls Royce

<http://www.rollsroyce.com/>

Shell The Royal Dutch-Shell Group of Companies

<http://www.shell.com/royal-en/0,6091,,00.html>

Syngenta Home Page

<http://www.syngenta.com/>

The BioIndustry Association - Promoting UK Biotechnology

<http://www.bioindustry.org/>

The Chemical Industry

<http://www.chemical-industry.org.uk/>

Unilever international manufacturer of leading brands in foods, home care and personal hygiene products

<http://www.unilever.com/>

http://www.unilever.com/index_ie.html

Welcome to ICI Site

<http://www.ici.com/iciportal/index.asp>

Welcome to British Aerospace

<http://www.britishaerospace.com/>

Specifications links

Vocational A level

This activity may be used for **AVCE Science Unit 1** (Investigating science at work):

Organisations using science

Organisations that use science can be broadly grouped into those that obtain, manufacture or process products for sale, and those that provide a service.

You need to be able to identify local organisations that obtain, manufacture or process products for sale. (If they cannot be found locally you should identify regionally based organisations.) Examples of how organisations obtain, manufacture or process products might include:

- obtaining products from plants, animals or micro-organisms
- extracting resources, for example water, gas, oil, gravel, clay, stone or minerals
- producing chemicals or products derived from chemicals, for example paints, dyes, fertilisers, plastics
- producing pharmaceuticals, for example medicines
- producing mechanical or electrical devices
- refining materials used as energy resources
- processing and packaging products

You must also be able to identify local organisations that use science in providing services. Examples of services might include:

- promoting the health of individuals
- using and conserving the environment
- monitoring of environmental conditions
- animal welfare
- analysing materials and substances
- providing means of communication
- providing education in science and technology
- distributing and selling food and other products
- distributing energy resources

Using science in organisations

Scientific knowledge and skills may be applied in many different ways within an organisation. Sometimes the processes used require scientifically qualified people to carry them out (for example, analysing samples in a hospital laboratory). Sometimes scientists may have developed the processes or products, but the people who use them do not need to be scientists (for example, production workers in a bakery).

You need to study in depth at least one production organisation and one service provider to identify:

- *the areas of science represented in the organisations and the number of people employed*
- *the roles and responsibilities of the scientifically qualified staff and the types of scientific qualifications they have*
- *the nature of the work done. For example, research, production, quality control, safety, education*
- *the processes used by the organisation that are based on applying current scientific knowledge*
- *the timescales (hours/weeks/continuous) involved in the processes and the constraints within which the organisation operates. For example, commercial, legal, health and safety*

Science and the community

Science is involved in all aspects of our lives, and organisations that use science contribute to both the local and national economy.

You need to be able to *describe the ways in which organisations impact on the community in which they are situated. For example, their contributions to the economy, the way they manage their energy consumption, the demands they make on transport and communication systems, their management of waste materials, the numbers of people they employ and the skills they use.*

Applications of scientific knowledge can be detrimental as well as beneficial. You will need to be able to assess the implications of scientific developments. You need to be able to:

- *discuss the costs and benefits, including social, economic and environmental aspects of the use of science and technology in organisations*
- *identify a range of products and services on which we depend (for example 'hi-tech' consumer goods, medicines, electricity, transport and communications)*
- *make a reasoned judgement about constraints that should be imposed on the increasing use of scientific and technological developments*

GCE A/AS

While it does not meet specific requirements for GCE A/AS science specifications it is hoped that some teachers may use it as an enrichment activity.

Science Based Business: size, scope and moral science

Introduction

Some of the largest companies in the world are science-based businesses. They make and spend millions - sometimes billions - of pounds each year researching and developing products which, on numerous occasions, hit the supermarket shelves and are used by the 'everyday' consumer.

But how do these companies operate? They often have a large staff spread across many countries, they generally specialise in a number of areas, and, more often than not, they have to abide by their own ethical guidelines.

In this activity you will investigate a multinational, science-based business and gain an understanding of its size, scope and moral science.

What you need to do

Engage in discussions and write a report about a multinational organisation that uses scientific knowledge to research and develop, manufacture or process. You will search the websites of such companies to gain an understanding of their practice.

How to set about it

1. In pairs, or small groups, choose a multinational organisation to study. Consider the different types of company. For example, would you like to investigate an engineering specialist such as Rolls Royce, or a pharmaceutical giant like GlaxoSmithKline. Discuss the possibilities and suitability with your supervisor.
2. Find the website for that organisation and have a look around - get yourself acquainted. When you've got a feel for the site layout start taking some notes about the company focusing on these questions:
3. What does the company do? What, if anything, does it produce, and how many of the products have you seen or used yourselves?
4. How much money does the company make, and spend, each year? Discuss where you think most of the outgoings are spent. For example, staff wages or research?
5. What is the history of the company - how long has it been in existence? Has it undergone any mergers? If so, who has it merged with? Discuss how you think the company would have benefited and/or changed due to the mergers.
6. How many people does the organisation employ? In which areas do these people work?
7. Where is the company based, in which countries does it have subsidiaries, and what takes place in each of these countries? For example, you may like to consider factors such as where the board of directors is based, and where the manufacturing is done. Discuss why you think the company bases different departments in different countries.
8. Does the company have any policies or principles? These are often listed as codes of practice, or company values, and they offer an insight into the company's moral stance. For example, how do companies defend animal testing? Discuss the moral standpoint of the company you are investigating, taking into consideration the nature of their work. Could the company lose or save money if it didn't follow these principles?

9. When you have collected your information produce a word-processed report about the company. Cover all the issues raised in the previous questions and in your discussions. The report should be factual, but take a subjective view and express your opinions. Use appropriate ways to present your information (tables, graphs, images etc.).

Finding a suitable multi-national

You can choose from any number of science-based multinationals. If you're struggling, then these are good examples you may like to use:

Syngenta

<http://www.syngenta.com/>

GlaxoSmithKline

<http://www.gsk.com/>

Rolls Royce

<http://www.rollsroyce.com/>

Unilever

<http://unilever.com/>

Hexcel

<http://hexcel.com/>

Money and Medicine: The Pharmaceutical Industry

Introduction

The pharmaceutical Industry is huge. It has an enormous impact on the nation's health and economy. It makes and spends massive amounts of money, employs millions of people and is continually researching and developing new or improved products.

Here are some interesting – occasionally surprising – facts:

- The value of UK pharmaceutical exports in 1998 totalled nearly £6 billion – equivalent to nearly £100,000 per employee. On average, it takes around 10 to 12 years and £350 million to develop a new medicine. After North Sea oil, the pharmaceutical industry is Britain's most successful exporter, with a 1998 trade surplus of nearly £2.5 billion.
- An average prescription for medicine costs around £9.50. A day in hospital costs about £200.
- The annual cost of medicines prescribed by GPs in the UK is about £87 per person.
- The industry provides the nation's medicines to the NHS at a cost of around 25 pence per person per day.
- Research and development expenditure by the pharmaceutical industry in the UK amounts to more than £2.5 billion a year – over £7 million every day.
- Pharmaceutical companies carry out almost a fifth of all industrial research and development in Britain, spending more than 20 per cent of their gross output on advances in modern medicines.

What you need to do

Use appropriate data to demonstrate the size of the pharmaceutical industry and its influence on the nation's health and the time, money and effort it takes to develop a new medicine.

You should allow about 2 hours for this activity

How to set about it

1. Using the data given in table one complete the following tasks:
 - Plot a suitable graph to demonstrate the growth in NHS sales from 1989 to 1999. Has there been a steady growth?
 - In 1999 exports reached a record level (£6,332 million). Construct a suitable diagram (a pie chart, for example) to represent the industry's major markets in 1999.
 - What proportion of home sales went to (i) The National Health Service, (ii) Over the counter (OTC) medicines in 1999?
 - On the same labelled graph plot (i) exports against year, (ii) imports against year.
 - What contribution did the pharmaceutical industry make to the nation's trade balance in 1999 (that's the difference between money gained by exporting and money spent on importing goods)?
 - Estimate the contribution that the pharmaceutical industry might be expected to make to the nation's balance in 2005.

- These statistics show that in 1999 the average person in the UK spent £25.92 on OTC medicines (including non-prescription medicines, lotions, surgical goods, dressings and appliances). Do you think you spend this much on OTC medicines per year?
- Plot a graph showing the OTC Home Market per Head (£) and NHS Home Market per Head (£) from 1989 to 1999. Have they both risen at the same rate? Comment, in a short paragraph, on the trends you see.

Year	Home Market				UK Pharmaceutical Trade	
	Sales to NHS (£million)	OTC Sales (£million)	NHS Home Market per Head (£)	OTC Home Market per Head (£)	Exports (£million)	Imports (£million)
1985	1627	451	28.74	7.97	1426	590
1986	1706	529	30.05	9.32	1533	679
1987	1849	590	32.48	10.36	1621	786
1988	2074	722	36.35	12.65	1735	876
1989	2316	810	40.47	14.15	2016	1062
1990	2533	855	47.55	16.05	2258	1158
1991	2755	884	52.37	16.80	2556	1371
1992	3189	950	59.28	17.66	2993	1663
1993	3893	1091	66.90	18.75	3710	2019
1994	4227	1186	72.39	20.31	4005	2304
1995	4583	1256	78.22	21.44	4939	2812
1996	5078	1276	86.39	21.71	5386	3107
1997	5551	1350	94.07	22.87	5455	3192
1998	6081	1425	102.67	24.06	5860	3418
1999	6782	1542	113.98	25.92	6332	4273

SOURCE: Association of the British Pharmaceutical Industry

2. Clearly the pharmaceutical industry has huge economic importance – drugs are a big business. But what impact do British scientists have on the industry and the discovery of drugs?
- Try to find names of British scientists who, in the last ten years, have won the Nobel Prize for their contribution to chemistry, physiology or medicine.
 - Table two lists the 20 ten best-selling medicines for 1999. Try to find out what the top three drugs are used for. You might like to look at the companies' websites for this:
<http://www.astrazeneca.co.uk/>
<http://www.pfizer.com/main.html>
<http://www.merck.com/>
 - What percentage of the 1999 sales for the top ten drugs did British companies command?

Rank	Product	Company	Country	£million
1	Losec	Astrazeneca	UK	6078
2	Lipitor	Pfizer	USA	5380
3	Zocor	Merck	USA	4364
4	Norvasc	Pfizer	USA	3349
5	Ogastro	Abbott	USA	3067
6	Prozac	Lilly	USA	2875
7	Seroxat	GSK	UK	2416
8	Zyprexa	Lilly	USA	2391
9	Celebrex	Pharmacia	USA	2373
10	Zoloft	Pfizer	USA	2248
11	Erypo	J&J	USA	2168

12	Claritine	S-P	USA	2165
13	Epogen	Amgen	USA	1966
14	Augmentin	GSK	UK	1919
15	Glucophag	BMS	USA	1867
16	Vioxx	Merck	USA	1808
17	Pravachol	BMS	USA	1734
18	Risperdal	J&J	USA	1707
19	Ciproxin	Bayer	Germany	1578
20	Zithromax	Pfizer	USA	1443
SOURCE: Association of the British Pharmaceutical Industry				

3. Imagine you have to go into hospital for a fairly major operation. What pharmaceutical products do you think will be used to ensure your stay in hospital is more comfortable before, during and after the operation?

Have a look at the data in table three. Which three diseases do you think have been most effectively impacted by medicine between 1952 and 1982? Which three diseases have been least impacted?

TABLE THREE		
Average In-Patient Beds Used Daily in NHS Hospitals, England and Wales		
	1952	1982
All infective diseases	4996	1761
Tuberculosis	21450	291
Acute poliomyelitis	709	2
Pneumonia	5347	5725
Bronchitis	3458	2115
Peptic Ulcers	4264	1041
Asthma	1080	810
Diabetes	2324	2697
Epilepsy	1370	675
Glaucoma	408	243
Rheumatoid arthritis	2230	1997
SOURCE: Association of the British Pharmaceutical Industry		

Johnson Matthey: world leader in advanced material technology

Introduction

Johnson Matthey (JM) is a massive company. It's described as the "World Leader in Advanced Material Technology". Split into four main divisions – Catalysts and Chemicals, Pharmaceutical Materials, Precious Metals and Colour & Coatings – JM turns over massive profits and operates across the globe.

What you need to do

You will be guided around the Johnson Matthey website, collating information for a PowerPoint presentation. You should imagine you have to perform the presentation at a trade fair in China. You will have to speak for about 20 minutes. That's roughly 6-8 PowerPoint slides with accompanying notes to tell the world about your company.

You should allow about 3 hours for this activity

How to set about it

You can find the JM website at <http://www.matthey.com/>

1. The home page lists seven categories to explore. To find out about the company you should, quite logically, click the link [About JM](#). This will take you to a screen with four further categories:

[Overview](#): Believe it or not, this will provide you with a useful overview of JM, its global operations and general ethics – perhaps a good intro for your presentation.

[Introducing JM](#): This category, again, provides an overview, but with a little more detail. Make notes under each of the five sub-headings (Expertise; Customers; People; Investment In Growth; Global).

[Innovation](#): This describes the importance of innovation in big business. Make notes – this could be a particularly good theme to use throughout your presentation.

[Locations Worldwide](#): This link is a search engine. Pick a country and a division and you can find where that particular office is. This will be good to gain an idea of the company's reach, size and scope.

[JM Links](#): This provides numerous links to other JM sites. Again, this gives you a good idea of scope and, if you wish, you can follow a few of the links for further information.

2. Back to the home page and the second link, [Our Divisions](#). This is where you really find out what JM actually do. The company is split into four divisions, as described earlier. The overview will tell you about each of these in brief terms – take notes. Next, pick one area that most interests you. This can now be your speciality! So, follow the relevant link and discover more.
3. Home again. Link three: [Information for Investors](#). This is where you find out about the money. This shows you just how big JM is. The link is split into six categories. The best one to follow is [Annual Report 2001](#). As the name would suggest, this tells you how much money was made in 2001. The whole report can be downloaded as a pdf. file, or you can use further links to explore bits of it yourselves.

4. Home. And onto [News and Media](#). Here you'll find all the latest (and archived) news stories involving JM. If you have a look through you can pick out a few that you feel are most relevant and use extracts in your presentation. You may like to search the archives if you need to add strength to anything you've previously mentioned.
5. The fifth link, [Your Career With JM](#), can be visited if you wish. It may provide useful information about why people would want to work at JM and how employees are treated.
6. Finally, you should follow the link Commitment to the Environment. This link explains: "The health, safety and welfare of its employees and the company's responsibilities to the environment and the community are a high priority for Johnson Matthey." Such information could be extremely important if you are trying to 'win' customers, and would certainly need to be touched upon in your presentation.
7. You should now have enough information. However, there's one final link, [JM Worldwide](#), which takes you to various other JM sites for even more information, if you think it's needed.

BAE Systems: largest defence company in the world

Scientists make money working for all manner of companies. The aerospace industry is no exception.

This assignment will give you an idea of the size and scope of a major company – BAE Systems, “a truly global systems defence and aerospace company with reach into international markets as a prime contractor and systems integrator in the air, land, sea and space defence market sectors”. You will be led through some of the features of the company website. You will find out about the company’s history, its global reach and its huge cashflow.

What you need to do

For this assignment you should imagine that recent events have brought bad press to the aerospace industry – particularly companies dealing with defence. The industry is also said to be fading slightly. You work for BAE Systems’ Public Relations department, and have to produce a series – probably three or four – press releases about your company, informing people of what you do and calming fears of job losses and/or decreasing profits. When you use any data and statistics you should provide the source material at the back of the press release (journalist aren’t just going to take your word for it!).

You should allow about 3 hours for this activity

How to set about it

1. The home page, <http://www.baesystems.co.uk> (which seems to take an age to download) has a useful index on the left hand side. To gain the best overview of BAE and its practices scroll over the – believe it or not – Overview link. This provides a new drop down menu with seven categories: Introduction; Key Points; Our organisation; Organisation chart; Leaders/Biographies; Our Identity; Our Evolution.

[Introduction](#) and [Key Points](#) provide the best starting point to gain an idea of what the company do. [Our Identity](#) explains what the company’s name represents. The [Organisation Chart](#) gives you a decent idea of the structure of the company’s hierarchy.

Perhaps most useful, though, is the link [Our Evolution](#). This tells of BAE’s history – from April 1977 to May 2001 – which will give you excellent insight into how BAE have grown. What event/s do you think was/were most influential?

2. Go back to the Home Page. Follow the link to [BAE Systems Facts](#). On the new left hand panel, follow the links [Customer](#) and [Location](#) to get an idea of where BAE operate and what activities take place.
3. Go back to the Home Page. Click the link to take you to the [Site Map](#). Click the link [Global Footprint](#). Look at the Global Map and BAE’s “unrivalled global capacity”. Note how many employees the company has and how many countries it operates in.

But how much money do they make?

4. From the home page click the link [Investor Relations](#). On the new page click [Visit Investor Relations](#) and then [Financial Data](#). This takes you to a page with four links: Consolidated profit and loss; Balance sheets; Cash flow Statement; Divisional.

These links each give you an idea of the profits and cashflow of BAE Systems.

5. Go back to [Investor Relations](#). Click [5 year summary](#). This will give you lots of information about BAE's finances over the last five years – essential if you're going to persuade people that the industry's still growing.

So what good news can you promote...

6. From the home page go to the [Virtual News Room](#). Click on [Breaking News](#). This will give you all the latest news stories about BAE Systems. These could come in very useful as examples within your press releases. The page also has an option to access all the archive stories.

And there's more...

7. This assignment has only touched on a few of the site's pages. Take any time you have left to wander around, unguided, and pick out any other bits of information you think could be of use. A good starting point might be to go to the Home Page and click on [Site Map](#).

GlaxoSmithKline: dissecting a multinational

Introduction

GlaxoSmithKline, the pharmaceutical giant, is one of the largest science-based companies in the world. It is one of the leading research companies producing numerous products, many of which you would have bought and used, or been prescribed.

But what do we know about GlaxoSmithKline? How much money does it make? Just how 'multinational' is it? And does it conduct tests on animals?

In this activity you will investigate a multinational, science-based business and gain an understanding of its size, scope and moral science.

What you need to do

You will act as the Public Relations (PR) machine for the science-based multinational GlaxoSmithKline and write a two page 'advertorial' for a supplement in a Sunday broadsheet about the company, including its structure and ethics. You will gather the information while being guided through the GlaxoSmithKline Website.

You should allow about 3 hours for this activity

Note An 'advertorial' is a cross between an advertisement and an editorial. They are written in the style of a newspaper article, but they clearly promote the product/company concerned. Local newspapers, which rely on advertising revenue, are particularly good places to find examples of these.

How to set about it



Access the website at www.gsk.com, and go to Corporate Home:

Global Sites



Read about GlaxoSmithKline, and note what the company does – this could be a decent quote for the advertorial.

Next you need to learn about GlaxoSmithKline in more detail, using the menu at the side of the screen:

Main Menu

[About GSK](#)

[Media Room](#)

[Investor Information](#)

[Careers](#)

[Products](#)

[Research & Development](#)

[Business Development](#)

[The Community](#)
[Contact Us](#)

The link 'About GSK' is clearly going to be the best bet for information. Follow the link and note down the nature of the business (including some of the household products GlaxoSmithKline make), the history of the business (you'll know you're on the right track if, for example, you read about Beecham's factory in 1859) and any mergers. You might also want to gather a little information about the Board of Directors.

Go back to Corporate Home using the link at the top of the page. Using the links find the company's financial information to gain an understanding of the size of its annual turnover and profits.

Again, from Corporate Home, follow the 'Research & Development' link. Here you'll find the company's ethics. Its policy on animal testing is particularly controversial, and you'll need to follow their arguments if you're going to be a successful PR person (even if you don't agree!).

The Research & Development page will also give you valuable insight into the time scales and the actual processes that GlaxoSmithKline have to go through before marketing a product.

Once you've got all the relevant information, start writing the advertorial. For the purposes of this assignment you can assume that, despite the size of GlaxoSmithKline, nobody has heard of them. It's your job to tell the science world – in no more than 1,500 words – all about your company.

BASF: the “Verbund” philosophy

Introduction

How Scientists Make Money is firmly rooted in the idea that science-based business generates massive profit – how else do you get people to invest in the company? It's here that scientists are employed to use their skills, forming the backbone of such companies. The chemical industry is no exception.

This assignment will guide you through the website of BASF – a German-based ‘transnational chemical company’ – enabling you to form an understanding of the work they do, the money they generate and the all important “Verbund” philosophy.

What you need to do

You will be guided through various pages of the BASF website, collecting and collating information as you go. You should imagine you're a BASF employee and write and give a presentation aimed at school and college leavers. The presentation will tell the students (aged about 18-20) about the company and why they might like to work there. You will find lots of information – it's up to you to decide which bits are most relevant, and if visuals (for example, over-head projections of graphs and statistics) will help your presentation.

You should allow about 3 hours for this activity

How to set about it

1. From the BASF home page - <http://www.basf.com/> - click on the 'About Us' icon at the top of the page. From the drop down menu select 'Overview'.

What do they actually do? Write a couple of paragraphs, taking note of the subheadings: Innovations, Verbund and Environment (although, at this stage, don't follow any other links). Note things such as how many employees they have, how much money they invest in research and development and a summary of the Verbund philosophy.

2. On the same page, follow the link '[product line](#)'. List the five areas that BASF specialise in, writing a brief note about each one. Have a think about an area you'd like to investigate further. When you've decided, click on the relevant '[more...](#)' link.
3. When you've read a bit more about your chosen area, you can begin to investigate even further! On the drop down menu pick another subject (for example, if you chose Agricultural Products and Nutrition, you might want to look at Specialty Polymers) and click on the tick...



Warning: Some of these links are in German. Only tackle these if you 'Sprechen Sie Deutsche'!

When you've clicked the tick, and worked out your language capabilities, have a wander through the site and collate more information for your final presentation. Do this for as many, or as few, subjects as you wish.

Innovations: Research and Development and the science around us...

4. Go back to the 'About Us', 'Overview' page. Click the link '[Innovations](#)'. Here you'll learn more about BASF's research activities. Follow the link to 'Research Facts', noting how much money is spent and in which areas. NB: The page has a couple of diagrams you may like to use/adapt for your presentation. The 'Innovations' page also provides links to 'History of Research' and 'R&D collaborations'. Here you can gather information about various research milestones. Which of these do you think has had most, or any, impact on your life? Also, take note of the numerous other companies BASF work alongside (feel free to enter any of their website for additional information).
5. On the Innovations home page there's a box titled 'current topic' (at the time of writing, this topic was hairsprays). Click the '[more...](#)' link taking you to a new page 'SCIENCE AROUND US'. As the text explains:

Innovations explained: Whether color care in a laundry detergent or waterproof leather - there is a lot of innovative chemistry at the heart of many everyday things. Here you will find answers to the question: How does it actually work?

Pick an interesting 'innovation explained' and, if you think it will add value, use the example in your presentation.

And what about the vital ingredient in any business – money...

6. Go back to the BASF home page. On the top menu bar, scroll over 'Investor Relations'. On the drop down menu click 'Publications and Presentations'. From this page follow the links '[First quarter 2001](#)' and '[Financial Report 2000](#)'. This should open a 'pdf' file (provided your PC has Acrobat Reader or equivalent). Unfortunately, these reports are somewhat tedious. Don't feel you have to read the whole thing. Skim through and pick out the most interesting and/or surprising facts and figures. You may like to do the same with other reports. For example, the interim reports throughout 2001 may indicate any growth, or otherwise.

History, employees, values and principles, environment, health and safety...

7. If you're presenting to prospective employees they're going to want to know about their prospective employer's principles and, perhaps, what opportunities they have to travel. Make your way back to the 'About Us', 'Overview' page. Using the links '[Sites](#)' and '[Employees](#)' note where BASF operate and how many people are employed in each region. Think about what each region might specialise in.
8. Go back to the 'Overview' page and follow the links '[values and principles](#)' and '[Safety, Health, Environmental Responsibility](#)'. Note the company's values. Can you find out what "Responsible Care[®]" is? The 'Values and principles' page offers numerous links for you to follow. Don't be daunted – each one provides a succinct overview.
9. One final link from the 'Overview' page is '[History](#)'. You may find this useful for providing an introduction to your presentation.

So what is this "Verbund" philosophy...

10. You may have noticed throughout the website that BASF refer to "Verbund". Fortunately for you, they've devoted a section of their website to explain what it is! Follow the link and use the information, together with the references to Verbund that you've encountered already, write a couple of paragraphs explaining it.