

## GENERAL STUDIES

### science, technology and society - introduction

(“Benefits and risks of chemicals” theme)

These learning materials support General Studies at AS and A2 level.

They allow students to:

- Debate the moral, social and ethical use of chemicals.
- Examine the risks and benefits of chemicals in a modern society.
- Research, discuss and present a range of views that are not necessarily their own.

#### Lesson timing:

The bare minimum for the activities is shown for a single, 60 minute lesson. Spreading the activities over a longer period allows for more preparation, discussion and presentation time.

#### Activities in the lesson:

- Students look at and discuss critically a video programme (on DVD) and newspaper articles on the role of chemicals in our daily lives.
- Students research and present information on the risks and benefits of using chemicals.
- Students' opinions are gathered by a series of votes during the activity.

#### The pack contains:

- Learning outcomes and curriculum links.
- Teaching and learning resources:
  - *Without chemistry, what would we be left with?* video programme on DVD (running time 6 mins).
  - Newspaper articles and analysis cards: *Your body is full of toxins*, *Chemicals linked to asthma rise* and *Do clean houses cause asthma?*
  - Briefing cards for each of five different interest groups relating to the risks and benefits of chemicals.

**Note:** Video and support materials available at: <http://www.ciec.org.uk/molsmatter/molsmatter.htm>



Developed by the [Chemical Industry Education Centre](http://www.ciec.org.uk), University of York. Produced with the support of the Royal Society of Chemistry, the Society of Chemical Industry and the Chemical Industries Association Young Persons' Network



## GENERAL STUDIES: lesson plan and teacher's notes – “Benefits and risks of chemicals” theme

### Learning outcomes and curriculum links:

#### Edexcel AS/A2 level in General Studies

##### Knowledge and understanding

Science, Mathematics and Technology

- Moral responsibility: the social, ethical and environmental implications of scientific discoveries and technological development.

#### OCR AS/A2 level General Studies

##### The relationship between technology, science, culture (past and / or present) and ideology (A2)

Candidates should be given the opportunity to explore the relationships between technology, science, culture and ideology through such topics as:

- Resource exploitation.
- Sustainability and stewardship.
- Industry and ecology.
- Intermediate technology and development.
- Natural hazards and disasters.

### Total time:

60 minutes

### Resources:

*Without chemicals, what would we be left with?* video programme (running time approximately 6 minutes). Can be played on a domestic DVD player or a PC or Apple Mac computer with DVD drive. The computer and any data projector / beamer or interactive whiteboard to which it is connected must be sound-enabled.

*Your body is full of toxins* (based on an actual article from a national newspaper).

*Chemicals link to asthma rise* and *Do clean houses cause asthma?* - based on actual articles from national newspapers (also in Key Stages 3 & 4 lesson plan).

Interest group briefing cards – please copy one set of each per group.

Links to internet pages providing further information (download file from DVD).

Voting record sheet - please copy one for each student.

Voting pattern spreadsheet and presentation (download files from DVD - optional).

Access to computer to develop PowerPoint presentation, internet and Excel spreadsheet (optional)

Contents  
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## Lesson Plan and teacher's notes

Timing	Activity and teacher's notes	Resources
Start	<p><b>Introduction</b></p> <p>Lesson will be an informed debate on the place of chemicals in modern society.</p> <p>Looks at different points of view and puts them to the vote.</p> <p>Show of hands if you use chemical products.</p> <p>Show of hands if you do NOT use chemical products.</p>	
5 mins	<p><b>Two sides to the story</b></p> <p>Have students read the <i>Your body is full of toxins</i> article and view the <i>Without chemicals, what would we be left with?</i> video programme.</p> <p>Discuss the video and the article.</p> <p>What are the messages from each one?</p> <p>Did the students believe the messages?</p> <p>How do they think the messages are influenced by the organisations that produce them?</p> <p>Was the video credible or not? Why?</p> <p>Was the article credible or not? Why? [It was based on an actual article from a national newspaper].</p> <p>Vote on the question, "Are the benefits of chemicals greater than their risks?"</p> <p>Each student rates his or her vote on a scale of 1 to 5 using the voting record sheet. A vote scoring 1 shows strong agreement that the benefits of chemicals are greater than their risks and 5 shows strong disagreement.</p> <p>The voting record sheets can be used to track students' pattern of voting as the debate progresses. Initial responses can be entered into the voting pattern spreadsheet if desired.</p>	<p><i>Without chemistry, what would we be left with?</i> on DVD (running time approximately 6 minutes) Any data projector / beamer or interactive whiteboard connected to computer must be sound-enabled.</p> <p>Voting record sheets. Voting pattern spreadsheet (Excel) on computer linked to projector / whiteboard.</p>

Timing	Activity and teacher's notes	Resources								
15 mins	<p><b>Group points of view</b></p> <p>Divide class into five groups.</p> <p>Read the two articles: <i>Chemicals linked to asthma rise</i> and <i>Do clean houses cause asthma?</i> These are based on actual newspaper articles but have been re-written to allow for use in the classroom.</p> <p>Each group is given a brief to represent a particular interest group:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;"><b>For chemicals</b></td> <td style="text-align: center;"><b>Against chemicals</b></td> </tr> <tr> <td style="text-align: center;">Chemical company</td> <td style="text-align: center;">Environmental group</td> </tr> <tr> <td style="text-align: center;">Hospital doctor</td> <td style="text-align: center;">Organic farmer</td> </tr> <tr> <td colspan="2" style="text-align: center;">Consumer</td> </tr> </table> <p>They are then given time to prepare a 5 minute (maximum) presentation to represent the point of view of their interest group.</p> <p>The time allowed to prepare for the presentations can be tailored to the group and time available. As a minimum, 20 minutes should be allowed.</p> <p>If appropriate, students can be given more time to prepare and utilise resources such as the internet and develop PowerPoint presentations (download templates from DVD).</p>	<b>For chemicals</b>	<b>Against chemicals</b>	Chemical company	Environmental group	Hospital doctor	Organic farmer	Consumer		<p>Interest group briefing cards</p> <p>One set of each per group.</p> <p>Internet access. Links to further information (Download file from DVD)</p> <p>Access to computer to develop PowerPoint presentation.</p>
<b>For chemicals</b>	<b>Against chemicals</b>									
Chemical company	Environmental group									
Hospital doctor	Organic farmer									
Consumer										

Timing	Activity and teacher's notes	Resources
35 mins	<p><b>Group presentations</b></p> <p>Each group presents its argument. This should be in the following sequence.</p> <ol style="list-style-type: none"><li>1. Hospital doctor</li><li>2. Environmental group</li><li>3. Chemical company</li><li>4. Organic farmer</li><li>5. Consumer (should look at both sides of the argument)</li></ol> <p>After each group, the students should vote using their voting record sheets. This allows the pattern of their views to be seen at the end of the debate.</p> <p>If desired, the voting results can be put into the voting pattern spreadsheet to show the pattern graphically.</p> <p>Final vote should indicate the group's overall opinion on whether the benefits of chemicals are greater than their risks.</p> <p>A score of 3 means the group is neutral to chemicals.</p> <p>Below 3 indicates the group feels that chemicals are useful and we should live with them.</p> <p>Above 3 shows that the group is against chemicals and we should try to live without them.</p>	<p>Access to computer for PowerPoint presentation.</p> <p>Voting record sheet</p> <p>Spreadsheet file on DVD (optional)</p>

Timing	Activity and teacher's notes	Resources
55 mins	<p><b>Summary</b></p> <p>Remind students of key messages from the lesson.</p> <p>Question and answer to gather things to consider when looking at the media or gathering information from other sources. For example:</p> <ul style="list-style-type: none"><li>Information can be gathered from many different sources and each may be produced with a particular view in mind.</li><li>Look for good and reliable information.</li><li>Is it balanced?</li><li>Is it based on facts or emotions? Is evidence presented and backed-up or are statements made with little effort to substantiate them?</li><li>Where has the information come from? What are the aims of the author?</li></ul>	
End	Look for both sides of the argument.	



## Your body is full of toxins

Research shows that people are accumulating deadly toxins day-by-day.

The *Daily Inquirer* is today calling on the Government to ban hundreds of dangerous chemicals that are widely used in this country.

Some kinds of cancer are on the increase. People are accumulating toxic chemicals such as DDT in their bodies. Environmental campaigners say that these chemicals are in the food we eat and the air we breathe.

The *Daily Inquirer* says that this has to stop. These deadly chemicals must be banned.

A fat sample taken from Leila, a healthy 30 year old mother of two, was found to contain traces of hundreds of different chemicals. A sample from an Egyptian mummy contained virtually none of these. The explanation for the difference is simple, say experts: most of the chemicals are man-made and have been released into the environment over the last half century.

Leila, a writer for the *Inquirer*, was shocked by the results. "I'm appalled to find out that there are potentially toxic chemicals in my body", she said. "I eat a healthy diet, with fresh fruit and vegetables, but I never suspected them of being full of pesticides."

Leila's results are by no means unusual. Everyone in Britain probably has some level of toxic chemicals in their body.

Tony Harthill, director of AtomBuster Chemicals, dismissed the *Inquirer's* concerns out of hand. He said that "Modern analytical techniques can measure toxins in unbelievably small concentrations. At these tiny levels they are not harmful to human health."

Last month, Environment Minister, Malcolm Bleacher said that it was "clearly unacceptable" for people to have man-made chemicals in their bodies that were not tested for safety.

Doctors maintain that more people now get cancer because they live longer than their grand-parents and do not die of diseases such as polio and TB. But there are unexplained increases in some cancers and these could be linked to exposure to man-made chemicals.

The *Daily Inquirer* says that we must live without these harmful chemicals.



## Chemicals linked to asthma rise

Household chemicals, like cleaners and bleach, have been linked to an increase in childhood asthma rates. A study looked at 7,000 children in houses that used cleaners and found they were more than twice as likely to develop wheezing.

Britain is a world leader when it comes to asthma and wheezing. Over 1.4 million people suffer from the disease and there must be a cause.

A study has followed children over the last 15 years and found an alarming link with asthma and the use of household chemicals. Researchers point to the use of chemicals like paint strippers, carpet cleaners and air fresheners. The use of these products has increased by over 60 per cent in the last 10 years.

Dr. Sarah Harrison said, “The study asked mothers how often they used certain chemical products while they were pregnant. This allowed us to determine whether their houses were high or low in chemicals.” Children in the houses classified as “high chemicals” were more than twice as likely to suffer from wheezing before the age of three years.

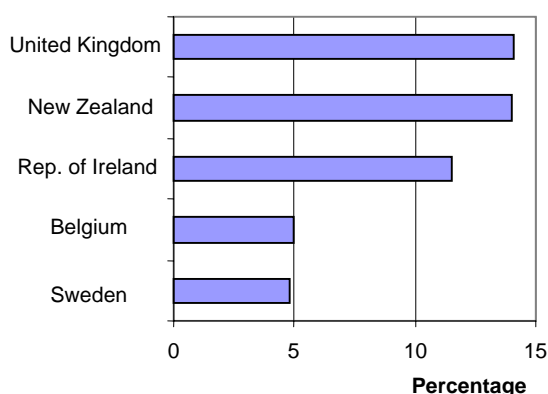
The researchers do not claim that these chemicals cause asthma but they say there is a connection. A particular chemical, formaldehyde, could be a common link.

Parent, Angela Philips said, “This

confirms my fears all along. I have always thought that my son's asthma was caused by chemicals. I don't use anything with chemicals in it.”

“I always buy organic foods because they don't have any chemicals in them. I don't use any chemical cleaners”, she said. “Jake should not be exposed to any chemicals. They are all dangerous and more research is needed.”

Severe wheeze in children aged 13-14 years old



The UK tops the league for severe wheeze in children. The latest study suggests that chemicals could be responsible.

## Do clean houses cause asthma?

Asthma rates in children are rising. Doubt is thrown on a recent report that links this rise with the use of chemicals.

A recent study suggested that the use of household cleaning products such as bleach and carpet cleaner was linked to a rise in childhood asthma. Dr. Samina Patel suggests there could be another reason. “Our research shows that children are exposed to less dirt than they were twenty years ago. Their immune systems do not develop in the same way. This could be the cause for the increase in asthma rates.”

“Advances in medicine and the use of chemicals to keep houses clean mean that people are living much longer”, she said. “These advances would have been impossible without the use of chemicals.”

An earlier report had suggested that the chemicals in household cleaning products were linked to the development of asthma in children.

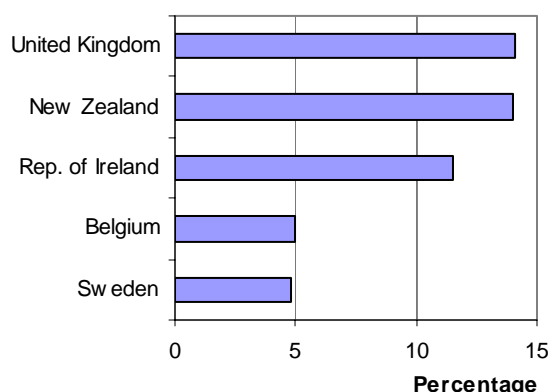
But the improvement in hygiene means that children are not exposed to dirt and dust as their immune system develops. This could make them more likely to develop asthma. The reality is that there are probably many things that make a person more or less likely to develop asthma. “If asthma was caused by just one thing, it is likely that scientists would have found that cause already”, said Dr. Patel.

The United Kingdom tops the league



in wheezing children but Ireland is lower and Belgium and Sweden are much lower. If all countries use cleaning products, the rates of asthma should be the same.

Severe wheeze in children aged 13-14 years old



Frank Carter, a spokesman for AtomBusters Chemicals, said, “This type of stuff happens because people just don't understand about chemicals. Even a potato makes pesticides to stop it being eaten by worms.”

“Chemicals have helped to improve everyone's lives. It really annoys me when people knock the industry without knowing their facts.”

Research continues to find the true cause of asthma.

## Group briefing card

### Hospital doctor

#### Messages you want to promote:

- Chemicals are vital to keeping people healthy and for treating disease. Medicines have helped to increase people's average life expectancy, from 48 years in 1900 to 78 years today.
- All medicines have side-effects (risks) and it is the job of the doctor to assess these risks and advise the patient.
- Research is vital to develop new medicines, for example, to cure diseases like HIV / AIDS and malaria that kill millions each year, especially in Africa and Asia.
- By law, medicines have to be tested for safety and effectiveness before they are used. Most alternative remedies have not been tested to the same rigorous standards.
- Even the tragedy of Thalidomide had a silver lining, enabling us to test all future drugs for the "Thalidomide"-type risk.
- Think about how difficult modern life would be without medicines. How could surgical operations be performed without anaesthetics? Would they be more or less risky without antibiotics and antiseptics?
- There is no alternative to the responsible use of chemicals. The benefits of chemicals are much greater than their risks.

*Turn over for internet resources*

## Internet resources

Consumer Health Information Centre: <http://www.chic.org.uk>  
Health Supplements Information Service: <http://www.hsis.org/>  
Medicine Chest Online: <http://www.medicinechestonline.com>  
National Institute for Health and Clinical Excellence: <http://www.nice.org.uk>  
Health Canada: <http://www.hc-sc.gc.ca/english/>  
Greenpeace: <http://www.greenpeace.org>  
The Soil Association: <http://www.soilassociation.org>  
WWF-UK: <http://www.wwf.org.uk>  
Sustainable development: <http://www.sustainability-ed.org>  
Chemistry in your Daily Life: <http://www.cefic.be>  
Risk education: <http://www.risk-ed.org>  
Science scare stories: <http://www.junkscience.com>

*Turn over for briefing card – hospital doctor*

## Group briefing card

### Environmental group

#### Messages you want to promote:

- Protecting the environment and health is the highest priority. Without man-made chemicals the environment would be much better for people to live in
- Many chemicals are harmful to people or wildlife and many more are not tested to modern standards. Manufacturers cannot be trusted to police their own activities. They should have to prove their products are safe before putting them on sale.
- Any chemical that accumulates in the human body, wildlife or the environment should be banned.
- Many household chemicals are not necessary and are sold just to make more money.
- There are natural products that can take the place of synthetic chemicals. For example, herbal remedies can replace medicines.
- Producing and using chemicals causes lots of avoidable pollution and uses up limited resources of energy and raw materials.
- We should change our lifestyle so as to manage without chemicals. The benefits of chemicals are not worth their risks.

*Turn over for internet resources*

## Internet resources

Greenpeace: <http://www.greenpeace.org>  
The Soil Association: <http://www.soilassociation.org>  
WWF-UK: <http://www.wwf.org.uk>  
Sustainable development: <http://www.sustainability-ed.org>  
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National Institute for Health and Clinical Excellence: <http://www.nice.org.uk>  
Health Canada: <http://www.hc-sc.gc.ca/english/>

*Turn over for briefing card – environmental group*

## Group briefing card

### Chemical company

#### Messages you want to promote:

- The chemical industry brings jobs and increased prosperity.
- The industry is highly regulated and wastes are re-used or disposed of responsibly. Pollution is being reduced steadily. We support sensible regulations, but excessive regulation will damage the chemical industry and those who depend on it for jobs.
- Chemicals are needed to protect hygiene, improve nutrition, purify drinking water and cure disease. They are also needed to make many other beneficial products, eg: contact lenses, sports equipment, heart bypass valves, footwear, clothing and insulation.
- Think of how impossible modern life would be without chemicals in plastics, electronics, cosmetics, building materials and fuel for transport systems. This lesson is made possible by chemical technology.
- Fresh fruit and vegetables are a proven defence against cancer. Fertilisers and pesticides allow increased production of these, so that they are plentiful and affordable.
- There is not enough land or farmyard manure to grow all the food we need organically. Even if we had the cows, it would take nearly 300 lorry-loads of manure to produce the same benefit as 1 lorry-load of synthetic fertiliser. That would mean up to 500,000 extra lorry journeys on our roads each year.
- There is no alternative to the responsible use of chemicals. The benefits of chemicals are much greater than their risks.

*Turn over for internet resources*

## Internet resources

Chemistry in your Daily Life: <http://www.cefic.be>  
Risk education: <http://www.risk-ed.org>  
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Greenpeace: <http://www.greenpeace.org>  
The Soil Association: <http://www.soilassociation.org>  
WWF-UK: <http://www.wwf.org.uk>

*Turn over for briefing card – chemical company*

## Group briefing card

### Organic farmer

#### Messages you want to promote:

- Chemical fertilisers and pesticides are harmful to the environment in general and wildlife in particular. We only use natural fertilisers like farmyard manure and permitted minerals such as rock phosphate, which supplies crops with sulfur and potassium.
- There are alternatives to chemical pesticides, such as biological control and crop rotation.
- Organic crops are good for our business because they can be sold for a higher price than crops grown conventionally. We also believe they taste much better and do not contain pesticides. No system of farming is better for the environment than organic.
- We are against genetically-modified crops because they are not natural and force farmers to depend on multi-national companies for supplies of seeds.
- Organic farming is good for local jobs because it needs more people than modern farming methods.
- Good food can be produced without synthetic chemicals. The benefits of chemicals are not worth the risks.

*Turn over for internet resources*

## Internet resources

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Health Canada: <http://www.hc-sc.gc.ca/english/>

*Turn over for briefing card – organic farmer*

## Group briefing card

### Consumer

#### Messages you want to promote:

- You are concerned about pollution but, to be honest, your local environment is pretty clean.
- You are worried about some things you read in the press about toxic chemicals and it does not seem right that many have not been tested for safety. But you do not know of anyone who has been directly harmed by them. You don't know how you would manage without your washing machine, bleach or disinfectant.
- You don't have much money and could not afford to buy as much fresh fruit and vegetables at the prices charged for organic produce. You sometimes change your buying habits but the most important influence is cost.
- You like the convenience of plentiful and affordable food that is hygienically packaged so that it can be sold in your local supermarket.
- You feel guilty about vehicle emissions but value mobility, convenience and choice. You wouldn't want to give up your car.
- We do seem to need chemicals to make most of the things we have come to depend on, like TVs, building materials, clothing and cleaning products. But this puts enormous power into the hands of business. You sometimes wonder whether we are being manipulated by the chemical companies and should try to do without their products.

*Turn over for internet resources*

## Internet resources

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Consumer Health Information Centre: <http://www.chic.org.uk>

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*Turn over for briefing card – consumer*

## Are the benefits of chemicals greater than the risks?

### Voting record sheet

Rate your feelings on the statement, "The benefits of chemicals are greater than the risks" on a scale of 1 to 5. Vote at the start of the session and then after each of the presentations.

- 1 - I strongly agree that the benefits are greater than the risks.
- 2 - I agree a little bit that the benefits are greater than the risks.
- 3 - I don't really agree or disagree that the benefits are greater than the risks.
- 4 - I disagree a little bit that the benefits are greater than the risks.
- 5 - I strongly disagree that the benefits are greater than the risks.

	Start	After presentations by:				
		Hospital doctor	Environmental group	Chemical company	Organic farmer	Consumer
Score						