

# GCSE

## Edexcel GCSE in Science Use, Misuse and Abuse

(Concept approach)

February 2006

advancing learning, changing lives

Support material

Edexcel Limited is one of the leading examining and awarding bodies in the UK and throughout the world. It incorporates all the qualifications previously awarded under the Edexcel and BTEC brands. We provide a wide range of qualifications including general (academic), vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, our centres receive the support they need to help them deliver their education and training programmes to learners.

For further information please call Customer Services on 0870 240 9800 (calls may be recorded for training purposes) or visit our website at [www.edexcel.org.uk](http://www.edexcel.org.uk)

Authorised by Jim Dobson

Prepared by John Crew

All the material in this publication is copyright

© Edexcel Limited 2006

# Contents

---

Scheme of work for Topic 4: Use, Misuse and Abuse	1
Activity 4.3: Multiplying microbes	12
Experiment 4.4: Microbe free surfaces	15
Demonstration 4.10: Effects of smoking	18



## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 1: Tuberculosis in London							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.12	8C Microbes and disease.	The human body has three lines of defence against invading micro-organisms.	<p><b>Starter</b></p> <p>News story about TB being found in a London primary school. TB in London — a growing problem. Extract key information from London Assembly document.</p> <p><b>Main</b></p> <p>Recall structure of respiratory system.</p> <p>What is TB? How big a problem is TB? What is its cause, how it is spread, its effects on the lungs and other organs.</p> <p>Glitter gel demo: Place a blob of glitter gel on one student's hand. The gel represents mucus, and the glitter represents a virus. They should pretend to sneeze into the hand then shake hands with other students. Observe and comment on how much virus spreads to other students.</p> <p><b>Plenary</b></p> <p>Summarise the reasons why TB has become a problem in London.</p>	<p>Web search: TB in primary schools. www.london.gov.uk</p> <p>Search for London Assembly report: Tuberculosis in London (2003)</p> <p>Video: The Human face of TB www.stoptb.org</p> <p>SGM: Tuberculosis — Can the spread of this killer disease be halted?</p> <p>Glitter gel.</p>	Explain what causes tuberculosis (TB) and how it is spread.	ICT 2.1 WO 2.2	
<b>Homework:</b> Where does TB and BCG feature in the British immunisation programme?							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 2: Controlling Tuberculosis							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.12 B1 b 4.13 B1 b 4.14 B1 b 4.16	8C Microbes and disease.	The human body has three lines of defence against invading micro-organisms.  Immunisation and antibiotics are used against diseases caused by micro-organisms.	<p><b>Starter</b></p> <p>Review immunisation homework.</p> <p><b>Main</b></p> <p>Discuss: Having a BCG vaccination.</p> <p>DOTS: how TB can be eradicated by international co-operation. The disease we thought was gone forever: what are the real trends over the years? Developing a new drug. How much time, effort and money is needed to produce a new drug?</p> <p>Use the websites listed to find the answers to the above questions.</p> <p><b>Plenary</b></p> <p>Review learning.</p>	<p>BCG leaflet: <a href="http://www.dhsspsni.gov.uk">www.dhsspsni.gov.uk</a></p> <p>DOTS: <a href="http://www.who.int">www.who.int</a></p> <p>Protection Agency Data: <a href="http://www.hpa.org.uk">www.hpa.org.uk</a></p> <p>Wellcome Institute: <a href="http://www.wellcome.ac.uk">www.wellcome.ac.uk</a></p>	<p>Explain what causes tuberculosis (TB) and how it is spread.</p> <p>Using secondary data, describe the prevention and control (drug therapy) of TB including the emergence of drug-resistant TB, financing, supply of drugs and treatment regimes.</p> <p>Interpret data on the number of cases of TB in the UK over a period of time.</p> <p>Use secondary data to explore the costs of developing new drugs.</p>	C 2.1	
<b>Homework:</b> Explain why the DOTS system has been so successful in treating TB.							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 3: Micro-organisms and disease							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.7 B1 b 4.8	8C Microbes and disease.	Be able to describe a pathogen as a disease-causing organism.  Be able to explain that microbes can be transmitted by direct contact, including vertical and horizontal, indirect contact, vehicle and vector-borne.	<b>Starter</b> Why do poverty and TB seem to go so closely together?  <b>Main</b> Illustrate pathogens and their transmission by showing selected slides from SGM 'Microbes and disease' pack.  Only a small number cause disease and many more are helpful, as in nutrient recycling, sewage treatment, production of food and medical products.  Explain the meaning of the words direct and indirect contact, vehicle and vector-borne transmission.  See Activity sheet 4.3.  <b>Plenary</b> Review issues from activity sheet.	Website: <a href="http://www.stoptb.org/tban">www.stoptb.org/tban</a> dpoverty  Microbes and disease pack from SGM.  Activity sheet 4.3	Describe a pathogen as a disease-causing organism.  Explain that microbes can be transmitted by direct contact, including vertical and horizontal, indirect contact, vehicle and vector-borne.	C 2.1	
<b>Homework:</b> Find out ways in which microbes can be useful to us in the biotechnology industry.							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 4: The first line of defence against infection							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.8 B1 b 4.9	8C Microbes and disease.	The human body has three lines of defence against invading micro-organisms.	<p><b>Starter</b></p> <p>The average adult has two square metres of skin which weighs 3.2kg and has approximately 300 million skin cells. How does this keep the microbes out?</p> <p><b>Main</b></p> <p>What is best surface to prevent microbes sticking? See experiment sheet 4.4.</p> <p>Discuss: Does crying really kill microbes?</p> <p>Students to map areas of the body where the first line of defence acts.</p> <p><b>Plenary</b></p> <p>Review issues from demonstration sheet.</p>	Experiment sheet 4.4.	<p>Explain that microbes can be transmitted by direct contact, including vertical and horizontal, indirect contact, vehicle and vector-borne.</p> <p>Describe the physical barriers as the body's first line of defence against micro-organisms, including the role of the skin, nasal hairs and cilia in the gaseous exchange tract and chemical barriers, namely lysozyme, found in tears.</p>	C 2.1 WO 1.2	See Experiment sheet 4.4
<b>Homework:</b> Produce a poster/presentation on the body's first line of defence.							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 5: The first and second lines of defence against infection							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.10	8C Microbes and disease.	The human body has three lines of defence against invading micro-organisms.	<p><b>Starter</b></p> <p>Recall composition and functions of the blood.</p> <p><b>Main</b></p> <p>Why can some people have the TB bacterium and not be ill?</p> <p>The TB bacterium overcomes the second line of defence:</p> <ul style="list-style-type: none"> <li>engulfed by white blood cells but 'hides'</li> <li>inactive (latent) infection</li> <li>may become active and infectious.</li> </ul> <p>What is the inflammatory response?</p> <p>How and why do white blood cells ingest bacteria?</p> <p><b>Plenary</b></p> <p>Summarise second line of defence.</p>	Free fact file 'Tuberculosis — Can the spread of this killer disease be halted?' and PowerPoint presentation from SGM.	Describe the second line of defence against infection as non-specific: <ul style="list-style-type: none"> <li>white blood cells ingest bacteria</li> <li>inflammatory response.</li> </ul>	C 2.1	
<p><b>Homework:</b> Research the link with HIV: TB and HIV form a deadly synergistic combination. Find out why latent TB becomes active. (Extension activity for more able pupils.)</p>							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 6: The third line of defence against infection: the specific immune system							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.11	8C Microbes and disease.	The human body has three lines of defence against invading micro-organisms.	<p><b>Starter</b></p> <p>List 10–20 diseases. Which of these can the body recover from without medication?</p> <p><b>Main</b></p> <p>The BCG vaccination: How does it work?</p> <p>BCG only works for about 75% of the population. What new vaccines are being developed?</p> <p>What is herd immunity?</p> <p>Include the meaning of antigen, lymphocytes and specific antibody production, how antibodies kill micro-organisms (in outline only), B lymphocytes, T lymphocytes and secondary immune response.</p> <p><b>Plenary</b></p> <p>Review learning with a quiz.</p>	<p>Video clips, photos, diagrams and text about the third line of defence (the specific immune system).</p> <p>Free fact file ‘Tuberculosis — Can the spread of this killer disease be halted?’ and PowerPoint presentation from SGM.</p>	Describe the third line of defence against infection as the specific immune system: when the immune system recognises a foreign body (antigen) and prepares a specific reaction to it (antibody production by the white blood cells).	C ☒1.1 ☒2.1 ☒3.1	
<b>Homework:</b> Draw a series of cartoon-style diagrams to show how lymphocytes and antibodies respond to antigens on bacteria.							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 7: Types of drugs							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b4.3	9B Fit and healthy.	The use and misuse of substances can affect the normal functioning of the body systems, affecting mental as well as physical health.	<p><b>Starter</b></p> <p>Recall Daphnia experiment (topic 3).</p> <p><b>Main</b></p> <p>36% of athletes use caffeine supplements according to a survey. The figure rises to 50% for rugby union players. Why do they do this and is it cheating?</p> <p>Epilepsy: barbiturates may be used to control epilepsy. How does this work and what are the advantages and risks?</p> <p>I have a headache: how do the painkillers work? Recall structure of nerves and chemical transmission (Topic 3).</p> <p><b>Plenary</b></p> <p>Review issues from experiment sheet.</p>	<p>Science Upd8: wired is better than tired — reaction times and effect of caffeine experiment.</p> <p>Epilepsy action: <a href="http://www.epilepsy.org">www.epilepsy.org</a></p>	<p>Explain the effects on nerve transmission and reaction times of:</p> <ul style="list-style-type: none"> <li>stimulants including caffeine</li> <li>sedatives including barbiturates</li> <li>painkillers including paracetamol.</li> </ul>	<p>WO</p> <p>☑1.2</p> <p>☑1.3</p> <p>☑2.2</p>	
<p><b>Homework:</b> Caffeine was a banned substance for athletes for many years. Why was the ban lifted, and what has been the effect? Do caffeine-based drinks do what they say?</p>							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 8: Drugs: use and abuse							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.2 B1 b 4.5 B1 b 4.4 B1 b 4.6	9B Fit and healthy.	<p>The use and misuse of substances can affect the normal functioning of the body systems, affecting mental as well as physical health.</p> <p>Understand the difference between primary and secondary sources of data about the main physical and mental effects of the misuse of drugs and show an awareness that the data may be presented in different ways to different audiences using ICT.</p>	<p><b>Starter</b></p> <p>List some medically useful, and some abused drugs. Which abused drugs have been used in hospitals?</p> <p><b>Main</b></p> <p>Packets of paracetamol sold in supermarkets can now contain only 16 tablets, those from chemists a maximum of 32. The result has been a fall in the numbers of people overdosing on the drug and in the rate of liver transplants required as a result.</p> <p>Discuss: Why do people take drugs? I can take drugs and drive safely. Drugs don't affect my driving. The soldier's disease: during the 19th century opiates were widely used for pain relief for wounds received in the wars of that time. Soldiers who had become addicted were able to maintain their addiction at home, it was socially acceptable. Morphine is still used for some cancer patients.</p>	<p>BBC site web search: paracetamol.</p> <p>Mind, body and soul website: <a href="http://www.mindbodysoul.gov.uk">www.mindbodysoul.gov.uk</a></p> <p>Think! Website: <a href="http://www.thinkroadsafety.gov.uk">www.thinkroadsafety.gov.uk</a></p> <p>For information on specific drugs, use the DrugScope website <a href="http://www.drugscope.org.uk">www.drugscope.org.uk</a></p>	<p>Describe how the use of drugs may: affect activities such as driving; produce abnormal behaviour; create the risk of viral infections.</p> <p>Describe the uses of paracetamol and the dangers of overdose.</p> <p>Describe the use of opiates and cannabinoids in pain relief for terminally ill patients, and the dangers of addiction.</p> <p>Discuss why medical opinion on the use of cannabis for pain relief has fluctuated over the years.</p>	<p>C</p> <p>2.1</p> <p>2.2</p> <p>2.3</p>	

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 8: Drugs: use and abuse (continued)							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
			<p>Use the DrugScope website to find primary and secondary sources of data about the main physical and mental effects of the misuse of drugs. Drug awareness leaflets may be produced for different audiences.</p> <p><b>Plenary</b></p> <p>Consolidate learning.</p>				
<p><b>Homework:</b> Some sufferers from multiple sclerosis smoke cannabis to help alleviate their symptoms. Find out about this. Is there any medical evidence that it does help?</p>							

## Scheme of work for Topic 4: Use, Misuse and Abuse

LESSON 9: Alcohol and solvents							
Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.1  B1 b 4.2  B1 b 4.15	9B Fit and healthy.	The use and misuse of substances can affect the normal functioning of the body systems, affecting mental as well as physical health.	<p><b>Starter</b></p> <p>What does the law say about the use and misuse of alcohol and solvents?</p> <p><b>Main</b></p> <p>Children as young as ten are playing ‘Russian roulette’ by sniffing glue, paint and other household solvents, a report from child welfare campaigners found.</p> <p>Crash! The effect of drink on driving.</p> <p>Using ICT half the class should produce a leaflet, showing the main physical and mental effects of the misuse of drugs, aimed at older teenagers. The other half of the class should aim theirs at year 6 and 7 students.</p> <p><b>Plenary</b></p> <p>Peer assessment opportunity: discuss the merits of both sets of leaflets produced.</p>	<p>Solvent abuse website: <a href="http://www.bbc.co.uk/crime/drugs/solventabuse.shtml">www.bbc.co.uk/crime/drugs/solventabuse.shtml</a></p> <p>Crash! Video from Think! Drink driving campaign <a href="http://www.thinkroadsafety.gov.uk">www.thinkroadsafety.gov.uk</a></p>	<p>Describe the main physical and mental effects of:</p> <ul style="list-style-type: none"> <li>solvents including lungs and neurones</li> <li>alcohol including reaction times, liver and brain.</li> </ul> <p>Describe how the use of drugs may:</p> <ul style="list-style-type: none"> <li>affect activities such as driving</li> <li>produce abnormal behaviour.</li> </ul> <p>Demonstrate how an understanding of the use of secondary sources of data about the main physical and mental effects of the misuse of drugs and show an awareness that the data may be presented in different ways to different audiences using ICT.</p>	C 1.1 2.1 3.1	
<p><b>Homework:</b> Research project on the recommended weekly intake of ‘unit’ of alcohol for men and women. Critical appraisal of anti drink driving TV adverts. Which are the most effective and why?</p>							

## Scheme of work for Topic 4: Use, Misuse and Abuse

### LESSON 10: Tobacco

Spec code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
B1 b 4.1	9B Fit and healthy.	The use and misuse of substances can affect the normal functioning of the body systems, affecting mental as well as physical health.	<p><b>Starter</b></p> <p>Recall the chemicals in tobacco, and their effects on the body from KS3.</p> <p><b>Main</b></p> <p>One in six smokers lights up within five minutes of waking up in the morning, half of all smokers within the first half an hour. So why do they need to do this?</p> <p>The meaning of addiction in relation to nicotine, and how nicotine addiction can produce abnormal behaviour, eg in producing withdrawal symptoms.</p> <p>The effects of smoking on the lungs and circulation. Include specific examples such as lung cancer, chronic bronchitis, emphysema, atherosclerosis, hypertension and strokes.</p> <p><b>Plenary</b></p> <p>The quiz on the mind, body and soul website is worth doing.</p>	<p>Mind, body and soul website: www.mindbodyand soul.gov.uk</p> <p>ASH website: www.ash.org.uk</p> <p>See demonstration sheet 4.10.</p>	Describe the main physical and mental effects of tobacco including gaseous exchange and circulatory systems.	<p>C</p> <p>2.1</p> <p>2.2</p> <p>2.3</p> <p>N</p> <p>2.1</p>	
<p><b>Homework:</b> Complete a case study on the history of a person who begins smoking aged 10, the problems associated with trying to give up, and the medical problems that it leads to.</p>							

## Activity 4.3: Multiplying Microbes

### What you will learn from this activity

In this activity you will visualise large numbers of microbes and calculate microbe population growth.

### What you will know when you finish this activity

- How to calculate microbe growth rate.
- How long it takes for microbes to multiply.
- Why determining growth rate is important.
- How to visualise large numbers of microbes.

### How you may be assessed

You may be assessed on following instructions.

### What you do

- 1 Find the number of grains in a bag of rice from the supermarket. Do this by counting the number of grains needed to fill a spoon. Using spoonfuls, find the number of spoons of rice needed to fill a small beaker. Then calculate the number of grains of rice in the beaker. Finally, calculate the number of grains of rice from the bag by finding how many beakers of rice would fill the bag.
- 2 Approximately how many grains of rice are there in a bag of rice? How many bags of rice would you need to have a million grains of rice? How many for a billion?
- 3 Calculate how many cells are formed from a single cell in 20 generations. Do this by beginning with one cell and doubling it twenty times. Compare your numbers with those obtained by the others in your group. Correct any mistakes. If a single generation takes 30 minutes to reproduce draw a line graph of your results with time along the x-axis and population size up the y-axis. What conditions might affect the number of individuals in microbial populations?
- 4 What would happen if you were to calculate the number of individuals produced after 40 generations rather than 20? How could you graph this information to keep it on a single page? What would happen if the amount of time for a generation was changed? What would happen to the numbers in each generation if the length of time for the generation was doubled?

### Suggestions for further work/homework

Organism A has a generation time of 20 minutes and Organism B has a generation time of 30 minutes. 100 individuals of Organism A and 400 individuals of Organism B are placed in optimum conditions and begin to reproduce. Can you determine when, or if, both populations will ever be the same size?

Calculate how much money you would have at the end of a 30-day month if you had one penny on the first day and it doubled every day. How much would you have at the end of a 31-day month?

## Activity 4.3: Multiplying Microbes

### Notes for teachers and technicians

#### Aim

In this activity students will visualise large numbers and calculate microbe population growth.

#### Skills, knowledge and understanding

This activity will enable students to gain the following skills, and/or knowledge and understanding:

- how to calculate microbe growth rate
- how long it takes for microbes to multiply
- why determining growth rate is important
- how to visualise large numbers of microbes.

#### Previous skills, knowledge and understanding required

- 1 Graph drawing skills.
- 2 Multiplication and use of large numbers.

#### Materials required

Have the following for each team of four:

- 500 g package of rice or pinto beans
- graph paper
- bowl
- spoon
- 100 cm<sup>3</sup> beaker
- calculator.

#### Delivery strategies

Beans may be substituted for rice to simplify the counting process for the less able. Students may work independently or in groups.

It is easy to visualise numbers of familiar things. We can estimate how many people are in a room. We can estimate the distance between two classrooms. But visualising very large numbers is difficult. The number of microbes necessary to have an impact on humans in many cases is very large. Populations may increase from a single cell to millions of cells. They may increase to millions or billions in a single test tube.

A 500 g bag of medium grain rice contains approximately 20,000 grains. A 500 g bag of pinto beans contains approximately 1200 beans. After 20 generations, the new population would contain 1,048,580 microbes. After 40 generations, the new population would contain  $1.0995 \times 10^{12}$  microbes.

If students were given a penny on the first day of the month and doubled it each day, they would have £5,368,709 at the end of a month with 30 days and £10,737,418 at the end of a month with 31 days.

## **Activity 4.3: Multiplying Microbes**

### **Assessment strategies**

Students may be assessed on the following instructions.

### **Links with key stage 3 (KS3)**

8C Microbes and Disease.

### **Resources**

[www.microbeworld.org](http://www.microbeworld.org)

## Experiment 4.4: Microbe Free Surfaces

### What you will learn from this demonstration

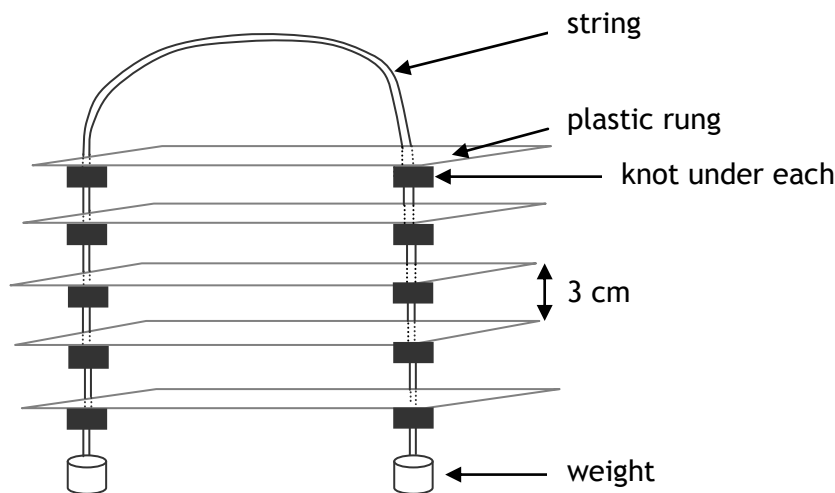
In this experiment you will design and test a surface that prevents harmless microbes from sticking to it.

### What you will know when you finish this demonstration

- Which types of surface encourage or discourage microbial growth.
- How slime growth can be prevented.
- Why slime doesn't grow on surfaces in swimming pools.
- Why slime grows only on the bottom of a boat.

### What you do

- 1 Build a ladder structure out of string and plastic strips, as shown below. The string should be threaded through the holes in the plastic and tied with knots approximately 3 cm apart to support each rung. Tie weights to the ends of the string.



- 2 Cover both sides of each rung with the different surface coating materials provided. Leave one of the rungs uncoated as a control. Make a note of which substances are used on which rungs.
- 3 Place a metal clamp stand rod across the top of the bucket containing your pond water. Hang the ladders from the clamp stand rod so they touch each other as little as possible. Leave the ladders undisturbed for two weeks.
- 4 After two weeks remove your ladder and examine the rungs for any signs of microbe growth with a magnifying glass. Give the amount of microbe growth on each rung a score from one to five with one being little or no growth, the control should have a score of three, and five for much more growth.
- 5 Present your results in a bar graph. Use your graph to obtain a conclusion from your experiment. Which type of surface encourages microbe growth? Which type of surface discourages microbe growth? How can slime growth be prevented? Why does slime not grow on surfaces in swimming pools? Why does slime grow only on the bottom of a boat? Should you change your tooth brushing habits as a result of your experiment?

### Suggestions for further work/homework

Design an experiment to show the effects of temperature on microbe adherence. What would you predict to be the effect of temperature on microbe adherence? How would you ensure it was a fair test?

## Experiment 4.4: Microbe Free Surfaces

### Notes for teachers and technicians

#### Aim

In this experiment the students will design and test a surface that prevents harmless microbes from sticking to it.

#### Previous skills, knowledge and understanding required

8C Microbes and Disease.

#### Skills, knowledge and understanding

- Which types of surface encourage or discourage microbial growth.
- How slime growth can be prevented.
- Why slime doesn't grow on surfaces in swimming pools.
- Why slime grows only on the bottom of a boat.

#### Equipment and chemicals required

Each group of three or four students should have:

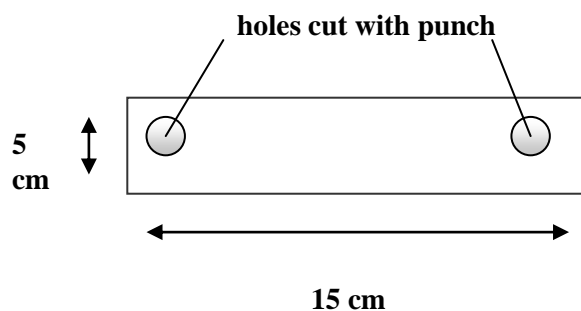
- 1 four different surface coating materials such as petroleum jelly, nail polish, hot pepper sauce
- 2 two small weights
- 3 magnifying glass
- 4 two x 1 m lengths of string
- 5 five pieces cut from lemonade bottles.

#### Health and safety issues

Wash hands before and after the activity. Make sure that all materials collected for surface coating are safe to handle. Food and drinks are not allowed.

#### Delivery strategies

Two weeks before the experiment an artificial pond should be created. Buckets should be filled with pond water and soil placed in the bottom to a depth of about 2 cm. If tap water is used it should be left at room temperature for 24 hours before adding the soil. Before the activity begins five ladder rungs per group should be cut. Cut lemonade bottles into 5 cm x 15 cm strips. Punch a hole in each end of the strips with a hole punch as shown below.



## Experiment 4.4: Microbe Free Surfaces

Present the students with the following questions. When you sneeze or cough into your hand, why don't the microbes just fall off? Run your tongue over your teeth. What do you feel? Are there microbes on your teeth? If you look into a pool, you may see a green coating on the sides and bottom. Do microbes stick better to some surfaces than others? Can you coat a surface with something to prevent microbes from sticking to it? Can you coat a surface to encourage microbes to stick to it?

A jar of water from a pond or ditch may be used to demonstrate the presence of tiny swimming organisms. Students should suggest what kind of surface would be suitable for microbes to live on, and what substances might prevent the adherence of microbes.

### Links with key stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- 8C Microbes and Disease.

### Resources

[www.microbeworld.org](http://www.microbeworld.org)

## Demonstration 4.10: Effects of smoking

### What you will learn from this experiment

In this demonstration you will find out about some effects of tobacco smoke on the body.

### What you will know after you see this demonstration

After this demonstration you will know the relative pH of tobacco smoke, the relative quantity of carbon dioxide it produces, and you will see how much tar is collected.

### What you do

Your teacher will set up some smoking apparatus – this will include a cigarette.

- 1 Note down your observations as the cigarette burns.
- 2 What happens to the indicator?
- 3 What does this show?
- 4 What happens to the limewater?
- 5 What does this show?
- 6 What happens to the cotton wool?
- 7 What did you notice about the smell of the cotton wool?

### Suggestions for further work/homework

Find out what other chemicals are contained in tobacco smoke, and their effects on the body.

## Demonstration 4.10: Effects of smoking

### Notes for teachers and technicians

#### Aim

In this demonstration the students will find out some of the effects of tobacco smoke on the body.

#### Skills, knowledge and understanding

After this demonstration the students will know the relative pH of tobacco smoke, the relative quantity of carbon dioxide it produces, and will see how much tar is collected.

#### Equipment and chemicals required

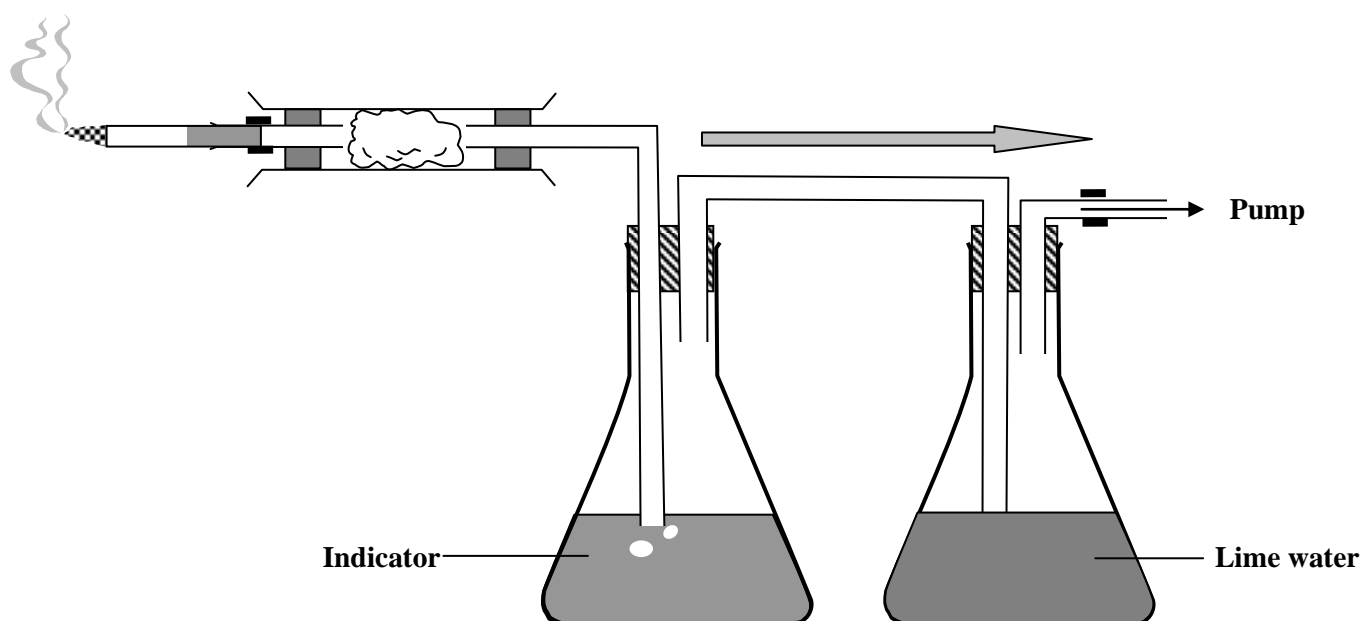
- 1 Cigarette.
- 2 Cotton wool.
- 3 Glassware, bungs and tubing as shown in the diagram.
- 4 250 cm<sup>3</sup> limewater solution.
- 5 250 cm<sup>3</sup> universal indicator solution (optional).
- 6 Beaker.
- 7 Tongs.
- 8 Pump.

#### Health and safety issues

Do not allow the tarry residues to be handled. They stain skin and are harmful. Place a beaker underneath the cigarette to catch the ash.

#### Delivery strategies

This is a teacher demonstration using the smoking apparatus as shown in the diagram. Light the cigarette. Let the cigarette burn completely and ask the students to note down their observations as it burns. They should note what happens to the indicator and cotton wool.



## Demonstration 4.10: Effects of smoking

The cotton wool should turn a yellow colour from the tar. Take this out with a pair of tongs and pass it around the class for the pupils to smell. Smokers and non-smokers alike are usually disgusted by the smell! A few open windows will help get rid of the smell.

Students should observe that an acidic gas and tar are given off by the burning cigarette. The gas should turn limewater milky.

### Links with other GCSE Science topics

This demonstration is related to:

- C1 a 6.7 know how to test for carbon dioxide
- C1 b 7.21 recall that carbon monoxide is a toxic gas and explain that it lowers the ability of blood to carry oxygen.

### Links with key stage 3 (KS3)

This demonstration builds on the following skills, knowledge and understanding from KS3:

- 9B Fit and Healthy.

February 2006

For more information on Edexcel and BTEC qualifications please contact our  
Customer Services on 0870 240 9800  
or <http://enquiries.edexcel.org.uk>  
or visit our website: [www.edexcel.org.uk](http://www.edexcel.org.uk)

Edexcel Limited. Registered in England and Wales No. 4496750  
Registered Office: One90 High Holborn, London WC1V 7BH

