Unit 2: Body Systems, Genetics, Microorganisms and Health

2.6 Health, disease, defence mechanisms and treatments

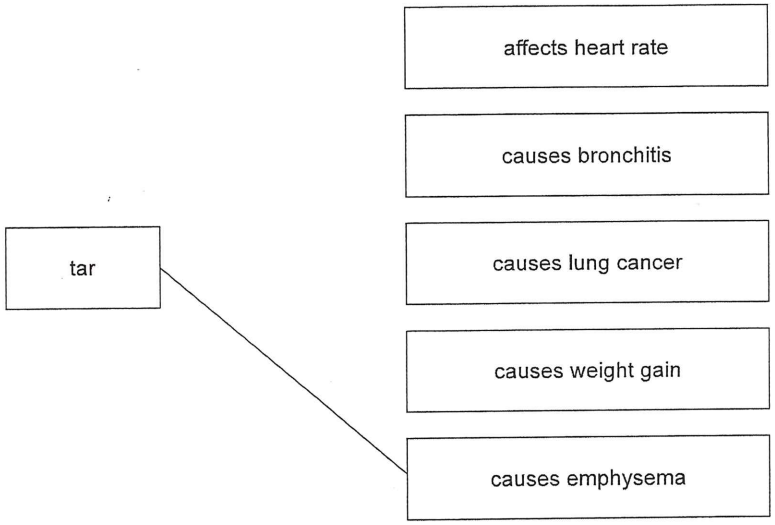
Content - CCEA Double Award Biology 2 – Fort Hill Integrated College HW Booklet Name: _____	Got it	Nearly	Haven't a clue
2.6 Health, disease, defence mechanisms and treatments			
Can you define health as being free from communicable and non-communicable disease;			
Can you explain the costs to society of communicable and non-communicable diseases, including the economic cost of treatment for the National Health Service;			
Communicable diseases			
Can you demonstrate knowledge and understanding of the types of communicable diseases caused by microorganisms, how they are spread, prevented and treated, including: • bacteria (chlamydia, salmonella and tuberculosis); • viruses (HIV leading to AIDS, cold and flu and human papilloma virus (HPV)); and • fungi (athlete's foot and potato blight); and			
Aseptic techniques			
Can you describe how to safely use aseptic techniques to grow uncontaminated colonies of bacteria in nutrient broth or on an agar plate, including: • sterilising Petri dishes, culture media, inoculating loops and culture bottles by autoclaving, flaming and alcohol to kill unwanted microorganisms; • needing to keep Petri dishes partially covered and to work near a Bunsen burner during inoculation to reduce the risk of contamination by microorganisms from the air; • incubating sealed Petri dishes at a maximum temperature of 25°C to avoid growth of pathogens; and • cleaning work surfaces and hands and safely disposing of bacterial cultures by autoclaving.			
The body's defence mechanisms			
Can you demonstrate knowledge and understanding of the body's defence mechanisms, including: • the skin, mucous membranes and blood clotting; • the production of antibodies by white blood cells (lymphocytes) in response to			

antigens; • the role of antibodies in defence – antibody-antigen reaction, clumping, reduced spread of disease microorganisms and symptoms; • the role of phagocytes in engulfing and digesting microorganisms; • the role of memory lymphocytes in a secondary response; and • immunity, in terms of active and passive;			
Antibiotics			
Can you demonstrate knowledge and understanding that antibiotics, for example penicillin, are chemicals produced by fungi that are used against bacterial diseases to kill bacteria or reduce their growth;			
Antibiotic resistant bacteria			
Can you demonstrate knowledge and understanding of the implications on the health of the population of: • **overuse of antibiotics leading to bacterial resistance, resulting in the development of superbugs such as MRSA; and** • **procedures to reduce the incidence of superbugs and why they are difficult to eradicate;** and			
Vaccinations			
Can you demonstrate knowledge and understanding of the role of vaccines, including: • the use of modified disease-causing organisms to produce raised antibody levels and memory lymphocyte levels in the blood; **and** • **the role of booster vaccinations and the interpretation of graphs of blood antibody levels.**			
Non-communicable diseases			
Can you recall that many non-communicable diseases may involve interactions between different types of disease and are caused by the interaction of these factors: • inherited – some people may carry a gene that predisposes them to some cancers; and • lifestyle, including: o poor diet: excess sugar and fat intake; o lack of exercise: energy used in exercise being lower than energy intake is the cause of obesity; o overexposure to the Sun: ultraviolet (UV) radiation causes mutations leading to skin cancer; o misuse of drugs: ▪ alcohol: binge drinking can cause liver disease and affect			

foetal development (foetal alcohol syndrome); ▪ tobacco smoke: • tar can cause bronchitis (narrowing of bronchi and bronchioles), emphysema (damage to alveoli reducing the surface area for gas exchange) and lung cancer (abnormal cell division); • nicotine is addictive and affects heart rate; • carbon monoxide combines with red blood cells to reduce the oxygen-carrying capacity of the blood; and			
Can you describe the interactions between different types of disease: obesity causing cardiovascular diseases and Type 2 diabetes.			
Heart attacks and strokes			
Can you demonstrate knowledge and understanding of the cause and effect of a blockage in a blood vessel: • a blockage caused by a build-up of cholesterol deposits leads to clot formation; • restricted blood flow means less oxygen and glucose reaching cells, and the resulting reduced cell respiration leads to cell death; • a blockage in the coronary blood vessels restricts blood flow to the heart muscle and causes death of heart muscle cells (heart attack); and • a blockage in the blood vessels to the brain causes death of brain cells, resulting in reduced brain function (stroke);			
Can you explain these treatments for cardiovascular disease: • angioplasty and stents; and • statins and aspirin;			
Can you recall that certain lifestyle factors increase or reduce the risk of heart disease and strokes (excess dietary fats, smoking, stress and lack of exercise);			
Cancer			
Can you recall that uncontrolled cell division produces cancer cells, which can result in two types of tumour: benign (encapsulated and not spreading) and malignant (capable of spreading); and			
Can you appreciate how lifestyle choices can affect the risk of developing certain types of cancer, for example cervical (HPV vaccine), lung (smoking) and skin (UV radiation).			

1. (a) Tobacco smoke contains several substances that can cause damage to the body. Tar is one of these substances.

The diagram shows a line linking tar to one of its effects on the body.
Draw **two** more lines to link tar to its other effects on the body.



[2]

(b) (i) Name the substance in tobacco smoke that is addictive.

_____ [1]

(ii) Name the substance in tobacco smoke that reduces the amount of oxygen carried by the blood.

_____ [1]

2. Diseases can be caused by three types of microorganism; bacteria, fungi and viruses.

Examiner Only	
Marks	Remark

(a) Look at the lists below.

Draw lines to link each type of microorganism to the disease that it causes.

Type of microorganism	Disease
Bacteria	Athlete's foot
Virus	Mumps
Fungus	Salmonella

[2]

(b) Which one of the diseases, in the list above, could be caused by eating undercooked chicken?

_____ [1]

(c) Name the type of microorganism, in the list above, that can be treated by an antibiotic such as penicillin.

_____ [1]

(d) Suggest how the spread of athlete's foot can be prevented.

_____ [1]

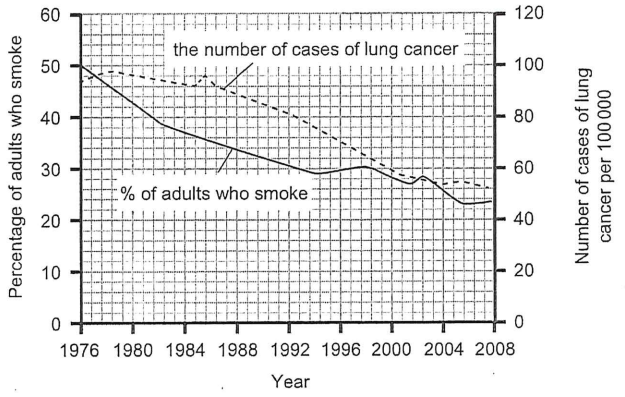
3. (a) Smoking causes harm to individuals and society. Using lines, link each substance in cigarette smoke to its effect on the body.

Substance in cigarette smoke	Effect on the body
nicotine	causes narrowing of the bronchi
tar	reduces the amount of oxygen carried in the red blood cells
carbon monoxide	affects the heart rate

[2]

Examiner Only | Marks | Remark

(b) The graph shows how the percentage of adults who smoke and the number of cases of lung cancer in the UK have changed from 1976 to 2008.



(i) Describe two trends shown in the graph.

1. _____

2. _____ [2]

(ii) Suggest **one** change in legislation (the law) that has helped to bring about the change in the percentage of adults who smoke.

_____

_____ [1]

(iii) Which substance in cigarette smoke causes lung cancer?

_____ [1]

Examiner Only | Marks | Remark

(c) Doctors are becoming increasingly concerned about the amount of alcohol that young people drink.

Suggest one effect of excess drinking on

an individual's health. _____

society. _____ [2]

(d) Mary does not drink any alcohol on weekdays, but regularly drinks eight small bottles of alcopops on a Saturday night.

- A small bottle of alcopops contains 1.1 units of alcohol.
- The safe daily recommended intake of alcohol for a woman is 2–3 units.
- Mary does not drink more than the safe weekly recommended intake of alcohol for a woman (14–21 units).
- Mary is classified as a binge drinker.

(i) Use the information to explain why Mary is classified as a binge drinker.

_____

_____ [2]

(ii) Suggest two strategies that could be taken to encourage young people like Mary to reduce their alcohol intake.

1. _____

2. _____ [2]

Examiner Only | Marks | Remark

4. Tobacco smoke contains substances that cause harmful effects on the body.

Examiner Only	
Marks	Remark

(a) Name three of these substances.

1. _____

2. _____

3. _____ [3]

(b) Choose one of these substances and give **two** harmful effects it has on the body.

Substance _____

Harmful effects on the body _____

_____

_____

_____ [2]

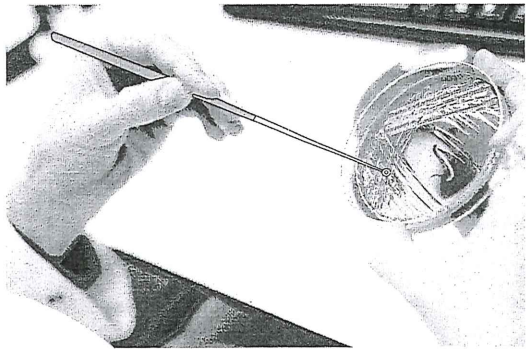
Cannabis is an illegal drug.

(c) Suggest **one** harmful effect on the individual and **one** harmful effect on society of using cannabis.

Individual _____

Society _____ [2]

5. Aseptic techniques are used when carrying out experiments with bacteria.
The photograph shows a loop being used to inoculate an agar plate.



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(a) Explain why the loop would be put into a Bunsen burner flame at the start of the experiment.

_____ [1]

(b) During inoculation the lid of the agar plate was completely removed.
Suggest what could happen as a result of this poor aseptic technique.

_____

_____

_____ [2]

(c) After inoculation the agar plate was sealed and then incubated at less than 25 °C.
Suggest a reason for each of these two steps.

1. Sealed _____

_____

2. Incubated at **less than 25 °C.** _____

_____ [2]

6. **(a)** Complete the table which gives information on some diseases caused by microorganisms.

Disease	Type of disease-causing microorganism	How the disease is spread	Prevention
AIDS	virus	exchange of infected body fluids	
	fungi	direct contact with microorganism e.g. often in swimming pool changing rooms	wear flip flops or keep changing rooms clean and dry
Salmonella		contaminated food	cook food thoroughly and do not mix raw and cooked food
Measles	virus		MMR vaccine

[4]

(b) The body has a number of natural defence systems. They help prevent us from getting disease caused by microorganisms. Complete the table by suggesting how each of the following defence mechanisms helps to prevent disease.

Defence mechanism	How it helps to prevent disease
Blood clotting	
Mucous membranes	
Production of phagocytes	

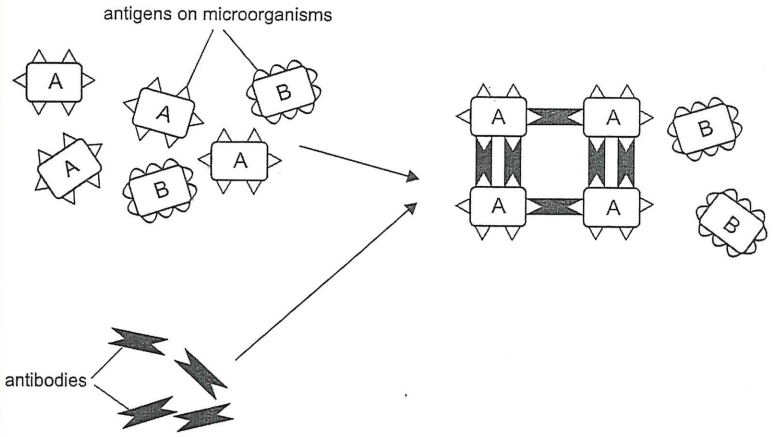
[1]

[1]

[2]

(c) One type of white blood cell produces antibodies to help fight disease caused by some microorganisms.

The diagram shows the effect of antibodies on some microorganisms.



Use the diagram to describe how the antibodies help the body defend against microorganism A.
Explain why these antibodies have no effect on microorganism B.

[4]

7. AIDS is a disease caused by the human immunodeficiency virus (HIV).
Table 1 shows worldwide data for HIV and AIDS for the years 2006 to 2013.

Table 1

	Number of people worldwide/millions							
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
People living with HIV	32.4	32.7	33.1	33.4	33.8	34.2	34.6	35.0
New HIV infections	2.8	2.7	2.6	2.5	2.5	2.4	2.2	2.1
AIDS related deaths	2.2	2.2	2.1	2.1	2.1	2.1	2.0	1.9
People receiving treatment				5.2	7.4	9.0	10.6	12.9

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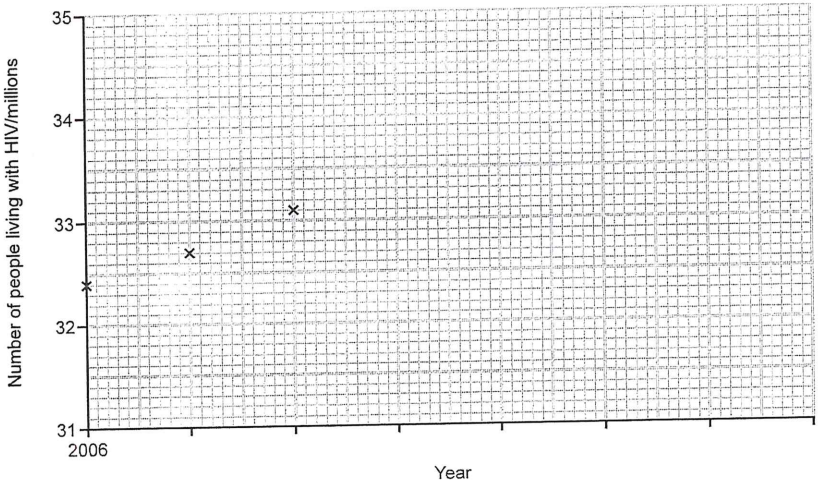
(a) (i) Use the data in **Table 1** to complete the line graph to show the number of **people living with HIV** for the years 2006 to 2013.
The first three points have been plotted for you.
Add the scale to the *x*-axis.



[4]

(ii) Describe the trend shown in the graph.

_____

_____ [1]

Table 2 shows the amount of money spent on HIV and AIDS treatment and education for the same years.

Table 2

	Year							
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Money spent/ billions of dollars	8.8	10.5	14.6	15.5	15.6	17.1	18.9	19.1

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(b) The number of **AIDS related deaths** decreased from 2006 to 2013.

(i) Use the data in **Table 1 opposite**, to calculate the percentage decrease in **AIDS related deaths** from 2006 to 2013.

Show your working.

_____ % [2]

(ii) Use the data in the tables to give **two** reasons to explain this decrease in AIDS related deaths over this period.

1. _____

_____

2. _____

_____ [2]

(c) (i) Some other diseases caused by viruses can be prevented using vaccinations.
Name the scientist who developed the first vaccination.

JENNER [1]

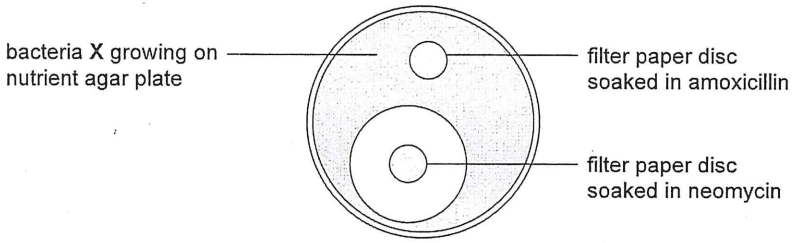
(ii) What disease was this vaccination used against?

SMALLPOX [1]

[Turn over

8.

Antibiotics are chemicals that are used to kill bacteria.
A nutrient agar plate had one type of bacteria (**X**) growing on the surface.
Two discs of filter paper, each soaked with a different antibiotic, were placed on the surface of the nutrient agar plate.
One disc of filter paper was soaked in amoxicillin and the other was soaked in neomycin.
The diagram shows the nutrient agar plate after it had been incubated for two days.



Use the diagram and your knowledge to describe and explain the effects of the antibiotics amoxicillin and neomycin on the growth of bacteria **X**.

Description _____

_____

_____

_____

Explanation _____

_____

_____

_____

_____

_____

_____ [4]

9.

Blood samples from three patients were analysed.
Table 1 gives the results for each patient.

Table 1

Blood samples were analysed for	Blood results for		
	Patient A	Patient B	Patient C
Blood alcohol level	high	not present	low
Level of cholesterol	high	normal	low
Carbon monoxide	normal	high	normal
Hormones:			
• Testosterone	present	absent	absent
• Oestrogen	absent	present	present
• Fertility hormones	absent	absent	present

Use the information in Table 1 and your knowledge to complete Table 2.
The first row has been completed for you.

Table 2

	Patient	Evidence
Most likely to have a heart attack	A	high cholesterol level
Is a male		
Most likely to be a smoker		
Most likely to be receiving IVF Treatment		
Most likely to be a binge drinker		

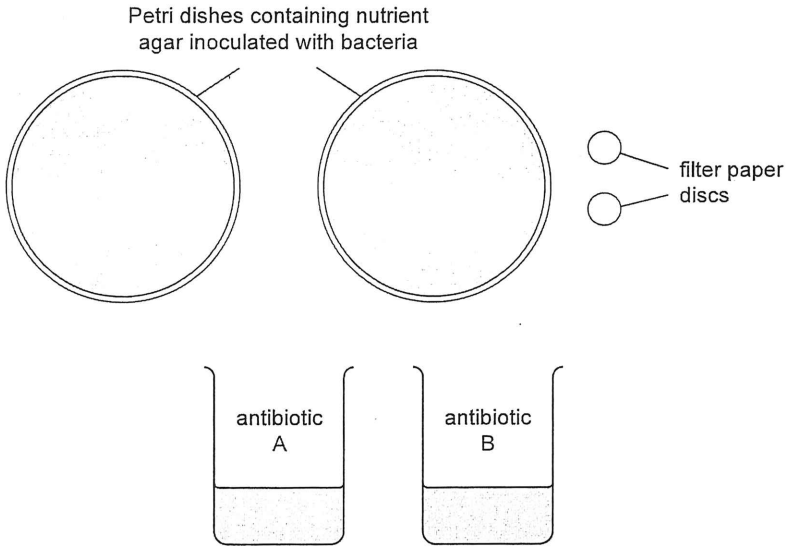
[8]

10. A student wanted to investigate how effective two antibiotics were against a particular type of bacteria.

The student was given the following apparatus:

- two Petri dishes containing nutrient agar inoculated with the bacteria;
- two filter paper discs;
- two different antibiotic solutions.

The diagram shows the apparatus the student was given.



Describe how the student carried out this investigation.

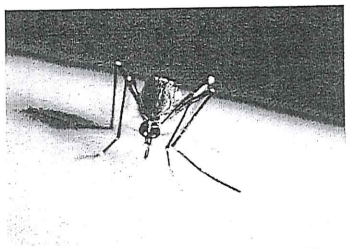
- Give **two** safety precautions.
- Describe and explain the results the student would obtain if antibiotic A was more effective than antibiotic B.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

[Turn over

11. **(a)** The photograph below shows the type of mosquito which can carry the virus that causes the disease yellow fever. When a person is bitten by this type of mosquito, the virus can be passed to that person. Approximately 7% of people who catch yellow fever die from it within three weeks.



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Paul is planning to visit Africa and has been advised to be vaccinated against yellow fever before he travels.

Suggest two reasons why Paul should be vaccinated before he travels.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

(b) The MMR vaccine gives immunity against measles, mumps and rubella.

The table below shows the percentage of the population who received the MMR vaccine in 2011, in the different regions of the United Kingdom.

Region of United Kingdom	Percentage of the population who received the MMR vaccine
England	89.1
Wales	91.5
Scotland	93.2
Northern Ireland	92.9

(i) Calculate the difference in the percentage of the population who received the MMR vaccine in Northern Ireland compared to England.

_____ % [1]

In 2011, there were fewer cases of measles in Northern Ireland than in England.

(ii) Suggest **one** reason why there were fewer cases of measles in Northern Ireland than in England, in 2011.

_____

_____ [1]

(iii) Name the scientist who developed the first vaccine.

JENNER [1]

Examiner Only	
Marks	Remark

12. MRSA is a 'superbug'. It is resistant to antibiotics and can spread quickly, particularly in hospitals.

(a) (i) What type of microorganism is MRSA?

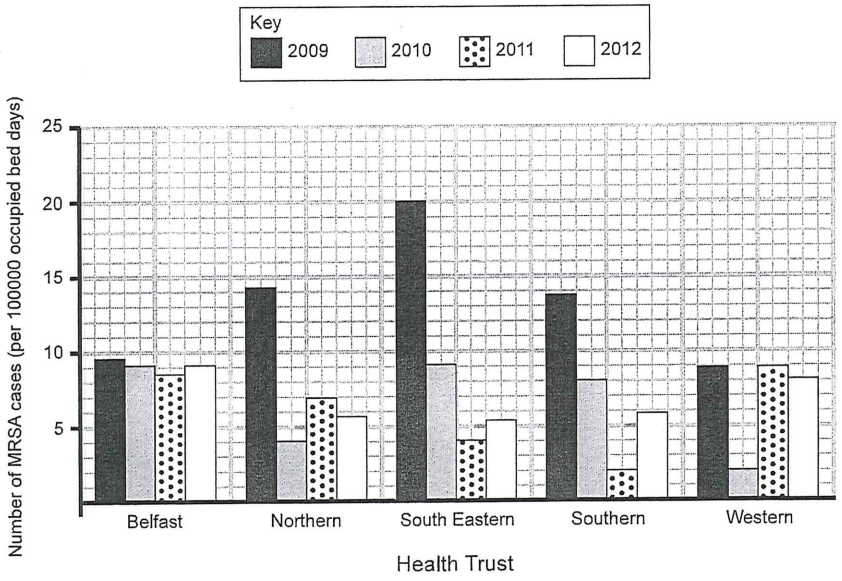
_____ [1]

(ii) Explain what is meant by the term 'resistant to antibiotics'.

_____

_____ [1]

(b) The graph below compares the number of MRSA cases in hospitals for the first three months of each year from 2009–2012 for each of the five Health Trusts in Northern Ireland.



© Adapted from HSC Public Health Agency '5 areas bacteramia surveillance quarterly report Jan-Mar 2012'.

(i) The table compares the number of MRSA cases in the first three months of 2010 to 2012 compared to the same period the previous year for different Health Trusts.

Use the information in the graph opposite to complete the table for the Western Trust.

	Number of MRSA cases in the first three months of each year compared to the previous year		
Health Trust	**2010**	**2011**	**2012**
Belfast	decreased	decreased	increased
Northern	decreased	increased	decreased
South Eastern	decreased	decreased	increased
Southern	decreased	decreased	increased
Western			

[1]

(ii) Use the information in the table to give the Health Trust that shows the same trend as the Western Trust.

_____ [1]

(iii) Use the information in the graph opposite to calculate the percentage decrease in MRSA cases between **2009 and 2011** for the **South Eastern Trust**.

Show your working

_____ % [2]

(iv) Suggest **two** ways that staff in the hospitals in this Health Trust could have brought about this decrease in MRSA cases.

1. _____

_____

2. _____

_____ [2]

13. The human body has a number of mechanisms to deal with disease-causing microorganisms.
The first line of defence is to prevent the microorganisms from entering the body.

(a) Describe **two** ways microorganisms are prevented from entering the body.

1. _____

_____

2. _____

_____ [2]

(b) If microorganisms such as bacteria do get into the body, the body responds by producing antibodies.

Describe how the presence of a specific microorganism results in the production of antibodies.

_____

_____

_____

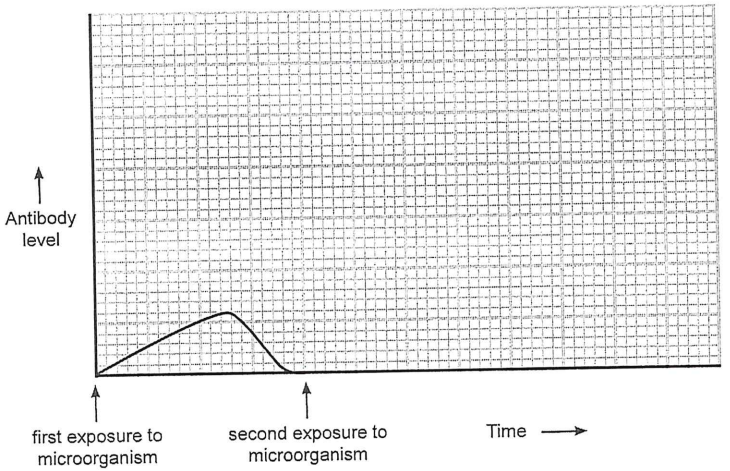
_____

_____

_____ [2]

(c) A person was exposed to the same type of microorganism on a second occasion.

On the graph, draw a line for the time period given to show the antibody level that you would expect.



[3]

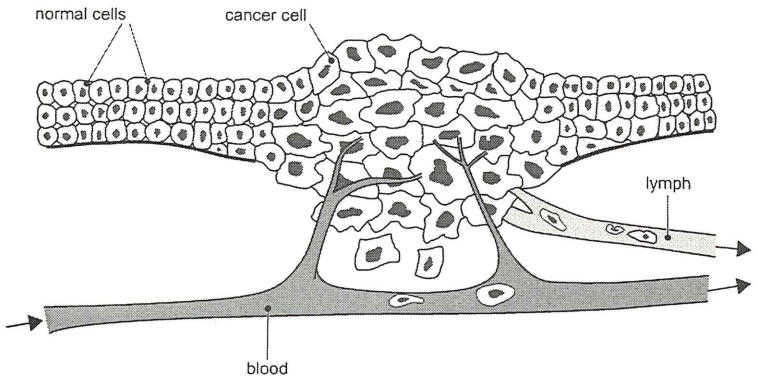
14. **(a)** What is cancer?

Examiner Only	
Marks	Remark

_____

_____ [1]

The diagram shows a developing cancer tumour.



Look at the diagram.

(b) Use evidence from the diagram to

- describe **two** differences between a normal cell and a cancer cell.
- give **two** reasons why these cancer cells are malignant.
- suggest why this tumour can continue to grow.

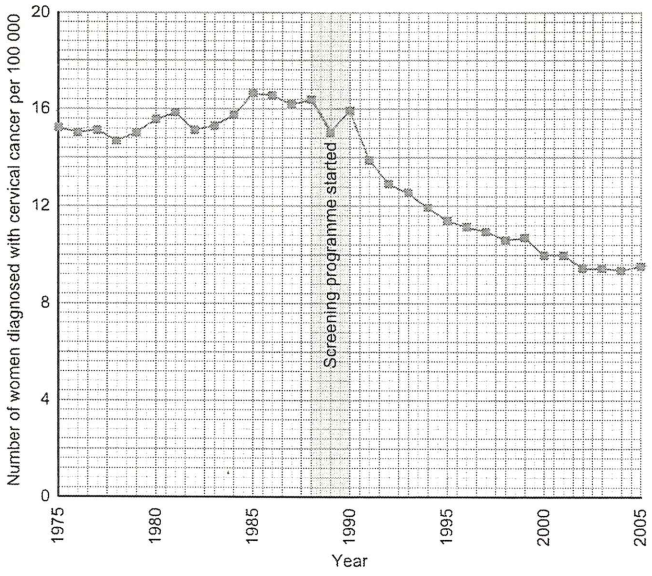
In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

Examiner Only	
Marks	Remark

_____ [6]

(c) The graph shows the number of women per 100 000 diagnosed with cervical cancer between 1975 and 2005 in the United Kingdom.

Examiner Only | Marks | Remark



Cervical screening programmes were started by the National Health Service in 1988.

Look at the graph.

(i) Describe the trend in the graph **after** the screening programme started.

_____

_____ [1]

(ii) Explain why screening programmes are successful.

_____

_____

_____ [2]

Examiner Only | Marks | Remark

(iii) Give **three** ways cervical cancer can be treated.

1. _____

2. _____

3. _____ [3]

HPV (Human Papillomavirus) can cause cervical cancer.

This virus can be passed from one person to another during sexual intercourse.

An HPV vaccination programme has been introduced into schools.

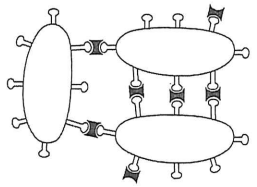
The vaccine is given to 12-year-old girls.

(d) Suggest two reasons why.

1. _____ [1]

2. _____ [1]

15. **(a)** The body has a number of defence mechanisms against disease-causing microorganisms. One of these mechanisms is the clumping of microorganisms. The diagram shows a clump of three microorganisms.



Source: Principal Examiner

(i) On the diagram, label an antigen. [1]

(ii) Describe the stages that have occurred to produce this clump.

_____

_____

_____

_____

_____

_____ [3]

(iii) Microorganisms in a clump cannot easily move.
Suggest how this helps in the defence against disease.

_____ [1]

(b) After the clump has been formed it is then destroyed by another process.
Name and describe this process.

Name _____

Description _____

_____

_____

_____ [3]

Turn over