Bacteria

Weight problems

Antibiotics

B1.1 Keeping Healthy

Diet and exercise

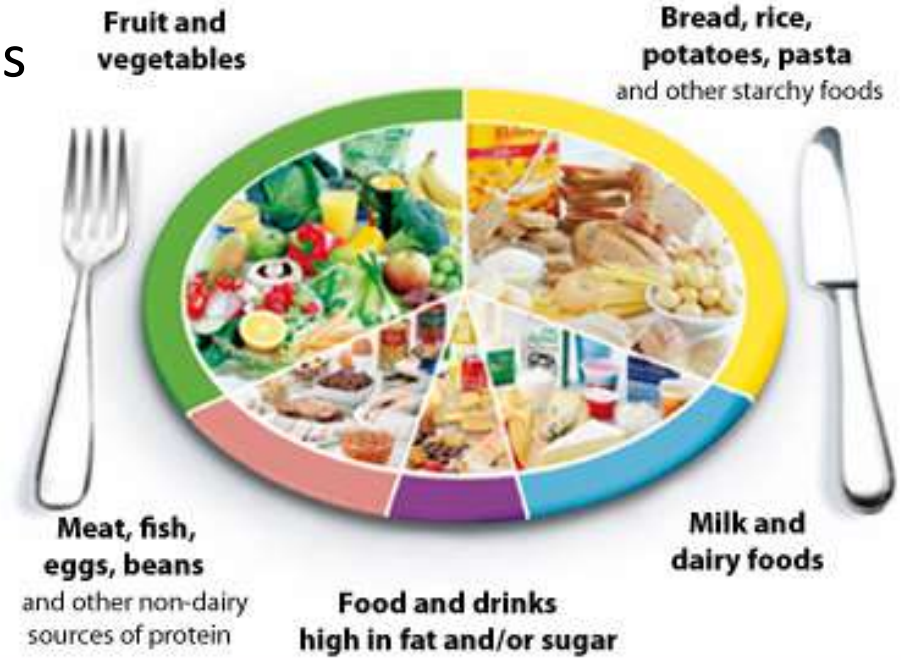
Immunity

Pathogens and disease

Defence mechanisms

Diet and exercise

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Water
- Fibre



Metabolic rate:
Rate of chemical reactions in your cells
Affected by...
Gender,
proportion of muscle to fat,
exercise /activity,
genetics

How much energy do you need?

- Males need more energy than females
- Growing teenagers need more energy than the elderly
- If you exercise you need to eat more
- Temperature has an effect – hotter then less energy spent warming up

Key words:
Deficiency diseases
Malnourished

Weight problems

Obesity

- Excess energy is stored as fat
- Some body fat is needed for cushioning and as an energy store
- Can lead to arthritis, diabetes, high blood pressure, heart disease

Inheritance:

Affect metabolic rate, risk of heart disease, muscle:fat, cholesterol

Cholesterol:

Needed for cell membranes and hormones eating high fat food means a higher level of harmful cholesterol and heart disease. This can also be inherited so levels will be high regardless of diet

Losing weight (mass)

Take in less energy than you use

- Reduce amount of food
- Increase exercise

Slimming groups provide support

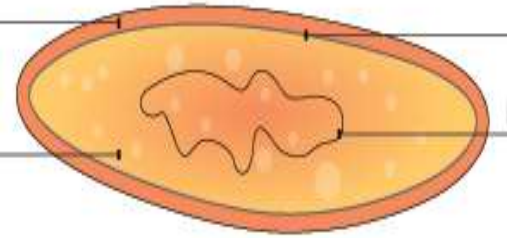
Pathogens and disease

Pathogens: Microorganisms that cause disease

Infectious: the microorganism can be passed on

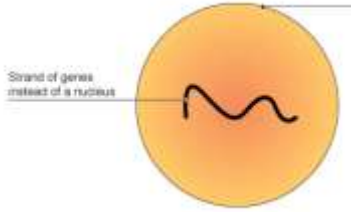
Semmelweis
Many women used to die after childbirth 'childbed fever'. He noticed doctors would go from dead body to baby delivery without washing hands. A doctor had a cut and died from the same symptoms. He told doctors to wash their hands but they were angry he was blaming them for deaths – they didn't know about viruses /bacteria and thought it was God's punishment to women

Bacteria:
Single-celled living organisms.
Used in yogurts, medicine



Reproduce asexually inside the body, produce toxins and damage cells
Symptoms are your body responding to this

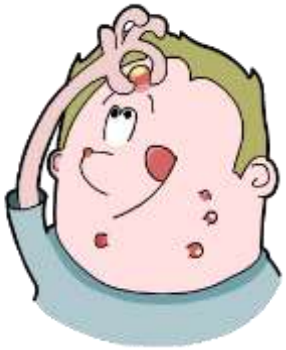
viruses:
Very small, cause diseases in every type of living organisms
They take over body cells, damage and destroy them



How are pathogens spread?

Different pathogens have different transmission routes:

food and water



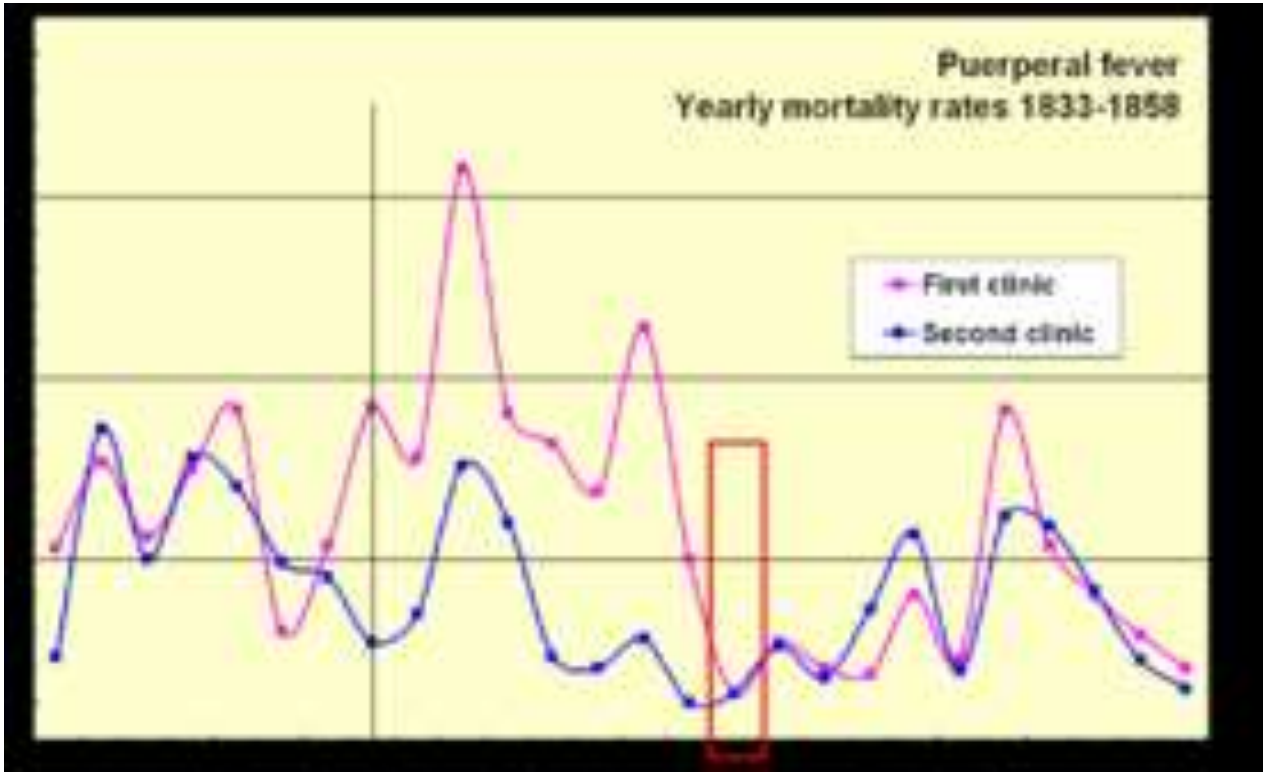
insect bites

airborne droplets

direct contact

indirect contact

Viruses and bacteria had never been seen before. It was hard to believe disease was spread by something that was invisible!



Doctors believed it was God punishing women.

Doctors didn't like being told that they might have been causing the deaths.

Defence mechanisms

- Droplet infection – *mucus*
- Direct contact – *skin barrier*
- Contaminated food and drink – *stomach acid*
- Break in the skin – *scabs*

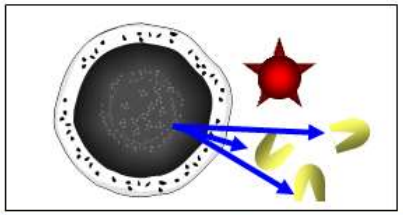
White blood cells of the immune system

❖Ingest microorganisms

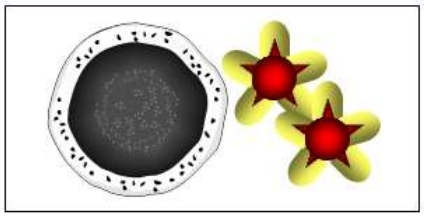
❖Produce specific antibodies

❖Produce antitoxins

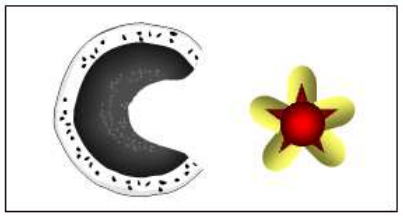
Step 1: The white blood cell "sees" the antigen (microbe)



Step 2: The cell produces antibodies to "fit" the antigen



Step 3: The antibodies fit onto the antigens and cause them to "clump"

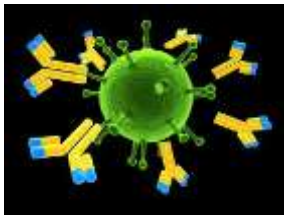


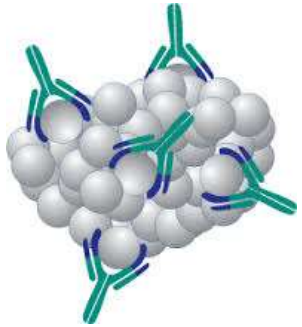
Step 4: The antigens are "eaten" by the white blood cells

White blood cells

- Engulf the pathogen

- Makes antibodies to attach themselves to the pathogen and kill it





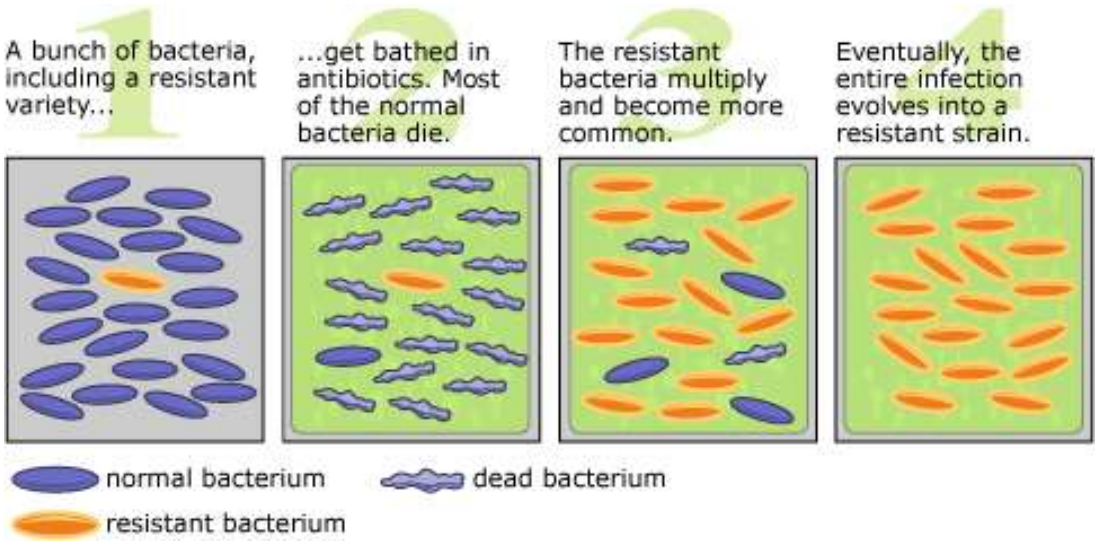
- Make antitoxins to destroy the toxins the pathogen makes

Antibiotics

Painkillers relieve symptoms but do not affect the microorganism

Antibiotics work inside the body to kill bacteria that cause diseases by damaging the bacterial cells – they don't work on viruses as they live inside body cells

Some bacteria may **mutate** by natural selection
They are **antibiotic resistant**
The flu virus mutates very easily so the immune system wont recognise it



To reduce this we should... Only use antibiotics when necessary, treat with specific antibiotics, medical staff wash hands, isolate some patients, clean hospitals

***MRSA**: a result of natural selection in hospitals where many bacteria and antibiotics used to treat*

Antibiotics and Viruses...

How do viruses harm your cells?

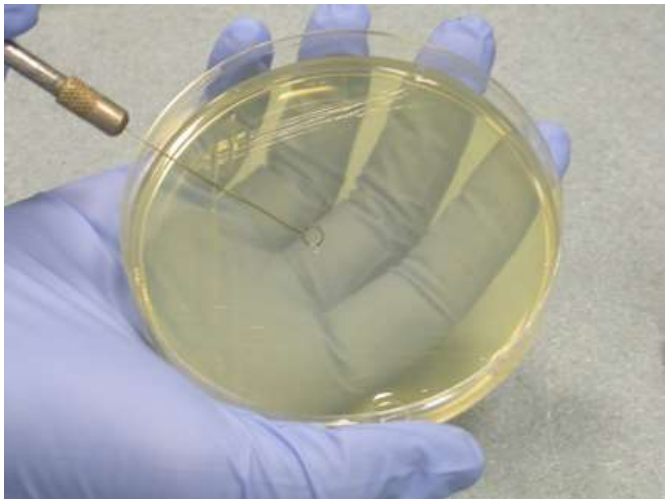
Viruses reproduce inside our body's cells and therefore antibiotics don't work. It is extremely difficult to create antiviral drugs as if they kill the virus, they'll be killing our body's cells too!

Fleming discovered Penicillin by noticing that bacteria were unable to grow around a patch of mould.

Growing bacteria

- Microorganisms can be cultured in the lab
- A ***culture medium (agar)*** is given containing an *energy* source (carbohydrate) and minerals. They are kept *warm* and allowed *oxygen* to grow

Safety:
Bacteria may mutate so contamination must be avoided – e.g. From skin, air, water..
Petri dishes and agar must be strilised from an autoclave or using gamma radiation / UV



Inoculate the plates – sterilise the loop, dip in suspension, zig-zag then incubate

Immunity

- ***Antigens*** – unique proteins on a cell surface
- White blood cells produce ***antibodies*** to join up with antigens on a pathogen
- White blood memory cells – ***immunity***

Vaccination – dead or weakened version of the pathogen introduced to body so white blood cells can develop antibodies – immune
e.g. MMR, tetanus, smallpox wiped out

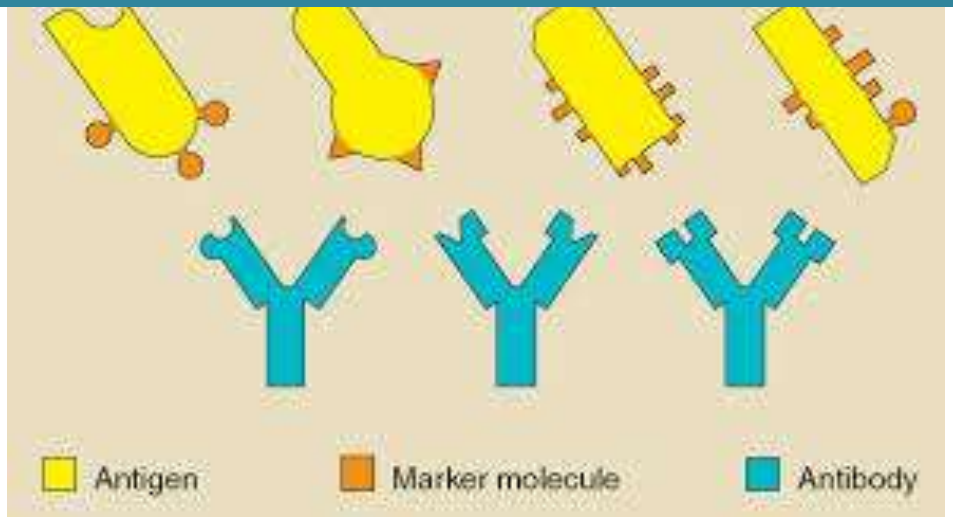
Vaccination debate: no medicine is risk free and some have rare side effects but it is important to vaccinate to protect the population from disease
e.g. MMR, Whooping cough – parents told could be dangerous but the disease itself poses more risk – brain damage etc

Pathogens

Pathogens has structures on their surface called antigens. Each type of pathogen has a

Once it's worked out the right antibody the white blood cells can remember it. So next time you get the disease you can fight it a lot quicker as your white blood cells already know which antibody to use.

The first time your body gets a pathogen, our white blood cells have to work out a new antibody to fit the antigen.



Did you get the 3 key steps?

1. Dead, weakened or inactive pathogen injected into bloodstream.
2. White blood cells create the right antibodies against the pathogen without you getting ill.
3. If the live pathogen enters the body the white blood cells already know which antibody to make and rapidly produced these antibodies to fight the disease.

Don't Wait... Vaccinate

You are protected!

Exam Questions

5 People may be immunised against diseases using vaccines.

5 (a) (i) Which part of the vaccine stimulates the body's defence system?

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(2 marks)

5 (a) (ii) A person has been vaccinated against measles. The person comes in contact with the measles pathogen. The person does **not** catch measles.

Explain why.

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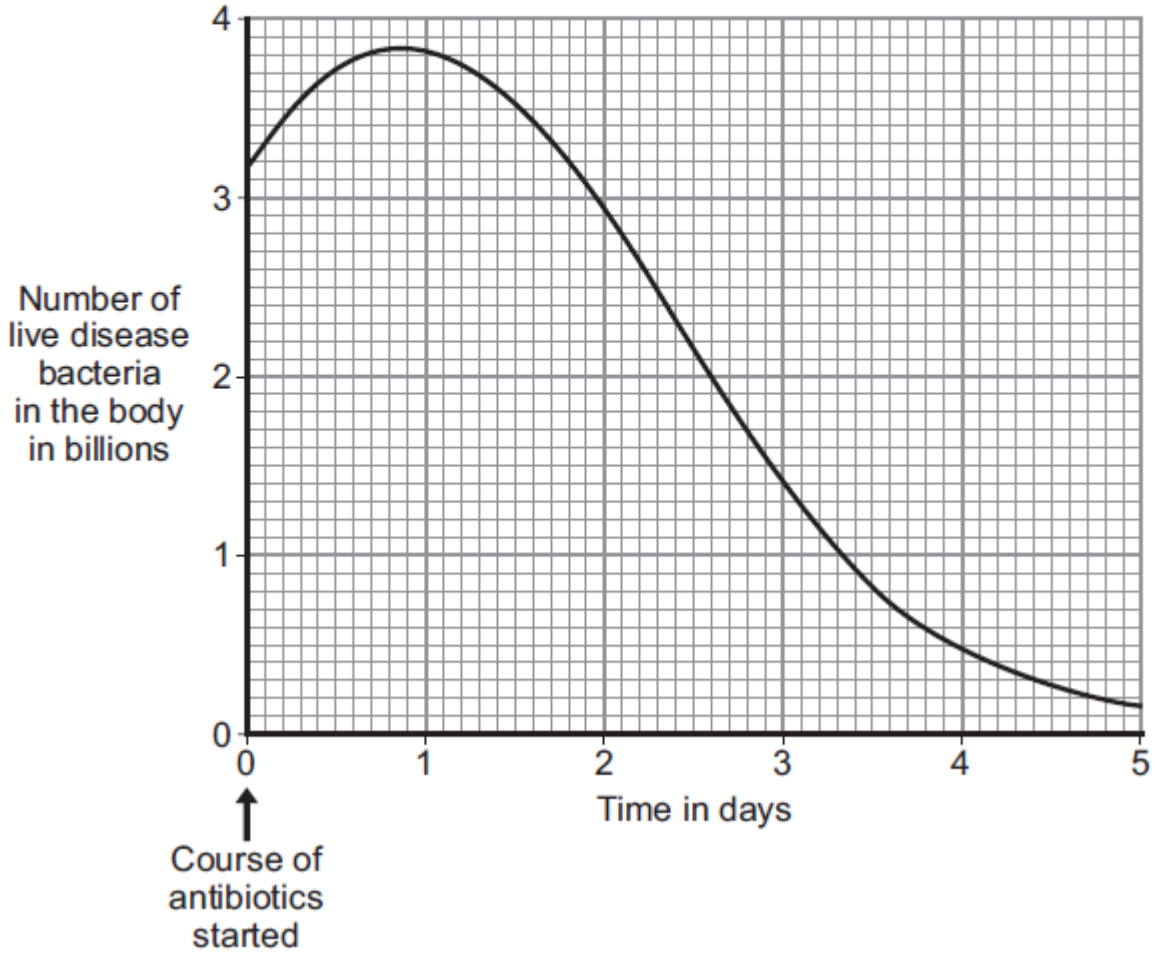
(3 marks)

5 (b) A man catches a disease. The man has **not** been immunised against this disease.
A doctor gives the man a course of antibiotics.

The graph shows how the number of live disease bacteria in the body changes when the man is taking the antibiotics.



5 (b) (i) Four days after starting the course of antibiotics the man feels well again.
It is important that the man does **not** stop taking the antibiotics.

Explain why.

Use information from the graph.

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(2 marks)

5 (b) (ii) Occasionally a new, resistant strain of a pathogen appears.

The new strain may spread rapidly.

Explain why.

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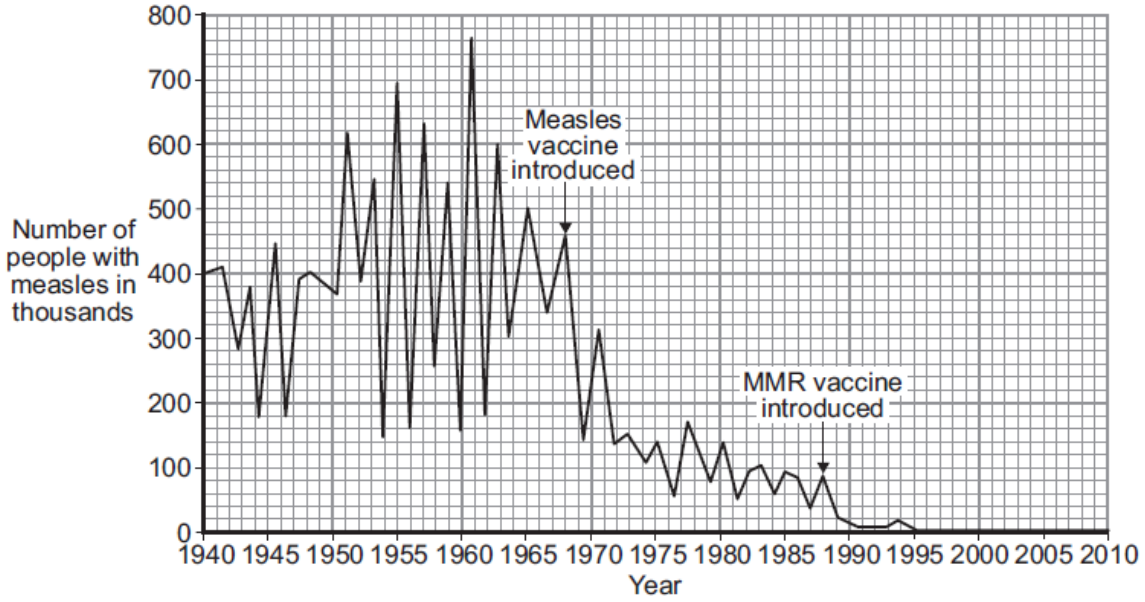
(3 marks)

5 (a)(i)	dead / inactive / weakened	allow antigen / protein ignore ref to other components ignore small amount	1
	pathogen / bacterium / virus / microorganism	ignore germs / disease	1
5 (a)(ii)		antigen / antibiotic instead of antibody = max 2	
	white blood cells produce / release antibodies	accept lymphocytes / leucocytes / memory cells produce antibodies do **not** accept phagocytes	1
	antibodies produced quickly		1
	(these) antibodies destroy the pathogen	allow kill do **not** accept antibodies engulf pathogens	1
5 (b)(i)	(live) bacteria still in body	ignore numbers	1
	would reproduce	ignore mutation / growth	1
5 (b)(ii)	antibiotics / treatment ineffective or resistant pathogens survive	accept resistant out compete non-resistant	1
	these reproduce		1
	population of resistant pathogens increases	allow (resistant pathogens reproduce) rapidly	1

2 The graph shows the number of people with measles in the UK between 1940 and 2010.



2 (a) Compare how effective introducing the measles vaccine was with introducing the MMR vaccine.

Use data from the graph.

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(3 marks)

2 (b) The MMR vaccine was introduced in 1988.

Other than measles, which **two** diseases does the MMR vaccine protect against?

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(2 marks)

2 (c) To immunise someone against measles, a small quantity of the inactive measles pathogen is injected into the body.

Describe what happens in the body after immunisation to stop a person catching measles in the future.

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(3 marks)

2(a)	both lead to reduction / fall (in measles cases) measles vaccine caused a big drop or correct use of figures MMR wipes out measles or drops to (almost) zero or doesn't fall as much as measles vaccine or correct use of figures.	can be implied	1 1 1
2(b)	mump(s) rubella / german measles	either order allow phonetic spelling	1 1
2(c)	white blood cells (wbc) produce antibodies in future / if re-infected antibody production rapid / fast(er) / quick(er)	allow lymphocytes / leucocytes ignore memory cells ignore antitoxins / antigens / antibiotics / engulfing allow ecf from antitoxins / antigens / antibiotics ignore engulfing ignore reference to specificity	1 1 1

3 A student is given a tube containing a liquid nutrient medium. The medium contains one type of bacterium.

3 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student is told to grow some of the bacteria on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

You should explain the reasons for each of the steps you describe.

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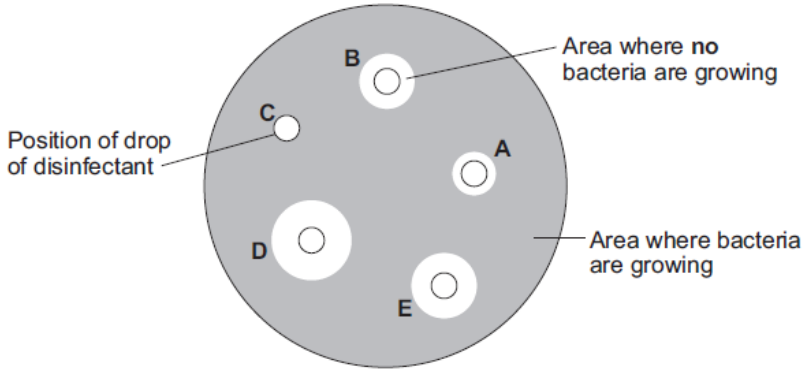
[6 marks]

3 (b) After the culture had been prepared, the student added one drop of each of five disinfectants, **A**, **B**, **C**, **D** and **E**, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



3 (b) (i) There are areas on the agar jelly where **no** bacteria are growing.

Why?

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(1 mark)

3 (b) (ii) The student concluded that disinfectant **D** would be the best for using around the home.

Give **one** reason why the student might be correct.

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Give **one** reason why the student might **not** be correct.

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(2 marks)

3(a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.		6
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).	There is a simple description of at least two stages and an explanation of at least one of them.	There is a clear description of all three stages and an explanation of at least two of them.

examples of biology points made in the response:

Pre-inoculation

- Petri dish and agar sterilised before use
- to kill unwanted bacteria
- inoculating loop passed through flame / sterile swab
- to sterilise / kill (other) bacteria

Inoculation

- loop/swab used to spread/streak bacterium onto agar

allow other correct methods, eg bacterial lawns

- lid of Petri dish opened as little as possible
- to prevent microbes from air entering

Post-inoculation

- sealed with tape
- to prevent microbes from air entering
- incubate
- to allow growth of bacteria

3(b)(i)	bacteria killed / destroyed	ignore fights / attacks / stops growth / got rid of	1
3(b)(ii)	*Might be correct* largest area / space where no bacteria are growing	allow most bacteria killed	1
	Might not be correct (need more evidence as) D may be harmful to people / animals / surfaces **or** may work differently with different bacteria	ignore ref to cost / dangerous or harmful unqualified	1
	or disinfectants may be different concentrations	ignore different amounts of disinfectant unless reference to different drop size	
	or may not last as long	ignore take longer to work allow reference to anomalous result or not repeated	

6 White blood cells protect the body against pathogens such as bacteria and viruses.

6 (a) (i) Pathogens make us feel ill.

Give **one** reason why.

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(1 mark)

6 (a) (ii) White blood cells produce antibodies. This is one way white blood cells protect us against pathogens.

Give **two** other ways that white blood cells protect us against pathogens.

1 .....

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2 .....

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(2 marks)

6 (b) Vaccination can protect us from the diseases pathogens cause.

6 (b) (i) One type of virus causes measles.

A doctor vaccinates a child against measles.

What does the doctor inject into the child to make the child immune to measles?

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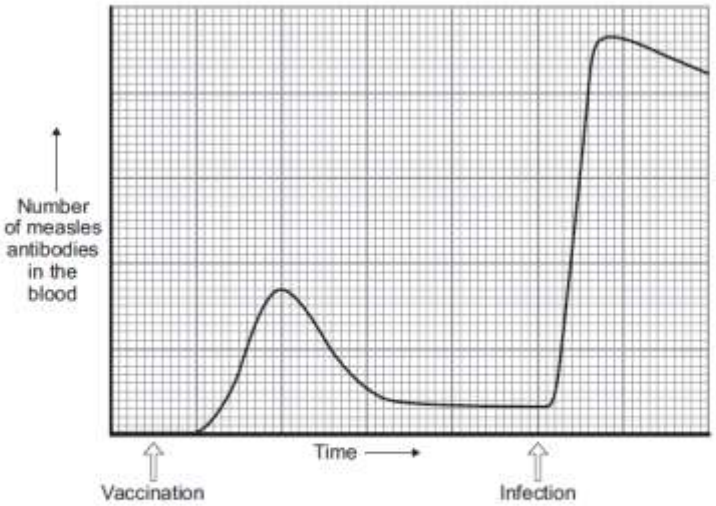
(2 marks)

6 (b) (ii) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection.



More measles antibodies are produced after the infection than after the vaccination.

Describe other differences in antibody production after infection compared with after vaccination.

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(3 marks)

6 (b) (iii) Vaccination against the measles virus will **not** protect the child against the rubella virus.

Why?

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(1 mark)

6 (c) What is the advantage of vaccinating a large proportion of the population against measles?

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(1 mark)

6(a)(i)	any **one** from: • (produce) toxins / poisons • (cause) damage to cells	 kill / destroy cells allow kills white blood cells	1
6(a)(ii)	produce antitoxins engulf / ingest / digest pathogens / viruses / bacteria / microorganisms	 accept phagocytosis or description ignore eat / consume / absorb for engulf ignore references to memory cells	1 1
6(b)(i)	dead / inactive / weakened (measles) pathogen / virus	accept idea of antigen / protein ignore bacteria	1 1
6(b)(ii)	(after infection) rise begins sooner / less lag time steeper / faster rise (in number) longer lasting **or** doesn't drop so quickly	accept converse if clearly referring to before vaccination idea of staying high for longer ignore reference to higher starting point	 1 1 1
6(b)(iii)	antibodies are specific or needs different antibodies	accept antigens are different **or** white blood cells do not recognise virus	1
6(c)	reduces spread of infection / less likely to get an epidemic	 accept idea of eradicating measles	1