Antibiotics and painkillers

4.3.1.8 · Biology · revision notes

What antibiotics and painkillers can and cannot do, why antibiotics do not work on viruses, why it is hard to make drugs that kill viruses and why antibiotic-resistant bacteria are a concern. Questions are usually short 'explain why' items, sometimes with data.

Key facts

- Antibiotics kill bacteria inside the body, e.g. penicillin
- Use the specific antibiotic for the specific bacterium
- Resistant strain = bacteria that are not killed by an antibiotic
- Antibiotics do NOT kill viruses
- Painkillers treat symptoms but do not kill pathogens
- Drugs that kill viruses are hard to develop: viruses are inside cells, so the drugs may damage body tissues

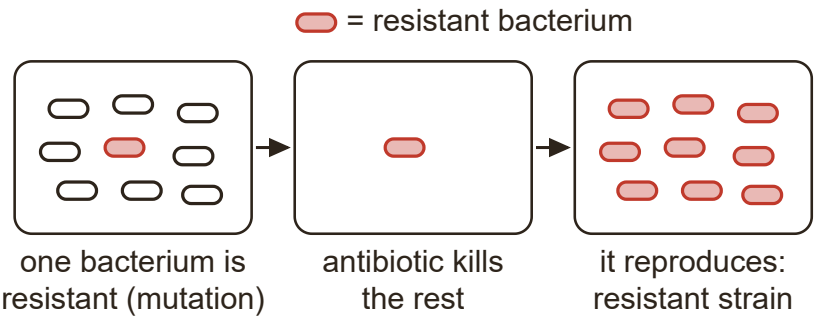
Notes

Antibiotics

- **Antibiotics**, such as **penicillin**, are medicines that cure bacterial diseases by **killing infective bacteria** inside the body.
- Specific bacteria should be treated with **specific antibiotics**: an antibiotic that kills one type of bacterium may not kill another.
- Antibiotics have greatly reduced deaths from infectious bacterial diseases.
- Antibiotics **cannot kill viruses**, so they do not help with viral diseases such as colds, flu or measles.

Antibiotic resistance

- Some strains of bacteria have become **resistant** to antibiotics: the antibiotic no longer kills them. This is of great concern.



The antibiotic kills the non-resistant bacteria, so the resistant ones survive and multiply.

- Infections caused by resistant strains are hard to treat and can spread, e.g. MRSA and some strains of the bacterium that causes gonorrhoea.
- To slow the development of resistance, doctors should not prescribe antibiotics for viral or minor infections, and patients should complete the course of antibiotics.

Painkillers and other medicines

- **Painkillers** (e.g. aspirin, paracetamol) and other medicines, such as cough medicines, treat the **symptoms** of a disease.
- They do **not kill pathogens**, so they do not cure the disease. The immune system still has to destroy the pathogen.

Why viral diseases are hard to treat

- Viruses live and reproduce **inside the body's cells**.
- It is difficult to develop drugs that kill viruses without also **damaging the body's tissues**.
- So most viral diseases are treated with painkillers and other medicines to ease the symptoms while the immune system destroys the virus. A few drugs can control viruses, e.g. antiretroviral drugs for HIV.

How to answer each type of question

Explain why antibiotics are not prescribed 2 marks **Grade 4**

1. Say what type of pathogen causes the disease.
2. Say that antibiotics do not kill that type of pathogen (viruses).

Example. A patient with a cold asks for antibiotics. The doctor refuses. Explain why.

Model answer. Colds are caused by a virus (1). Antibiotics do not kill viruses, so they would not help (1).

Compare painkillers and antibiotics

2 marks | Grade 4

1. Painkillers: relieve symptoms, do not kill pathogens.
2. Antibiotics: kill the bacteria, so they cure the disease.

Example. A person with a bacterial throat infection takes painkillers and a course of antibiotics. Describe the different effect of each type of medicine.

Model answer. Painkillers relieve the symptoms, such as pain, but do not kill the bacteria (1). Antibiotics kill the bacteria causing the infection, so they cure it (1).

Explain why drugs against viruses are hard to develop

2 marks | Grade 5

1. Say where viruses live and reproduce: inside body cells.
2. Say that drugs that kill them would also damage body cells or tissues.

Example. Explain why there are far fewer drugs to treat viral diseases than to treat bacterial diseases.

Model answer. Viruses live and reproduce inside the body's cells (1). So it is difficult to kill the viruses without also damaging the body's cells and tissues (1).

Data: resistant bacteria

3 to 4 marks | Grade 7

1. Percentage change = change ÷ original value × 100.
2. Explain the concern: the antibiotic does not kill resistant bacteria, so infections are hard to treat.
3. Add the consequence: serious illness or death, and the resistant bacteria can spread.

Example. In a hospital, infections caused by a strain of bacteria resistant to an antibiotic rose from 25 to 40 in one year.
(a) Calculate the percentage increase.
(b) Explain why the increase in resistant bacteria is a concern.

Model answer.

(a) 40 − 25 = 15 (1); 15 ÷ 25 × 100 = 60% (1)

(b) The antibiotic does not kill the resistant bacteria, so these infections are hard to treat (1). Patients may become seriously ill or die, and the resistant bacteria can spread to other patients (1).

Don’t lose marks

- Saying antibiotics kill viruses or cure colds and flu.
- Saying painkillers cure a disease or kill pathogens.
- Saying the person, or their body, becomes resistant to antibiotics. It is the bacteria that become resistant.
- Mixing up antibiotics (medicines) and antibodies (made by white blood cells).

Answering 'why are antiviral drugs hard to develop?' with 'antibiotics don't work on viruses'. The reason is that viruses are inside body cells, so drugs that kill them may damage body tissues.

More tips

Memory tricks

- AntiBiotics are anti-Bacteria. They do nothing to viruses.
- Painkillers kill pain, not pathogens.
- Three 'anti' words: antibiotic (medicine, kills bacteria), antibody (made by white blood cells, binds to antigens), antitoxin (neutralises toxins).

Exam technique

- Check which type of pathogen causes the disease in the question before you recommend a treatment.
- Use 'resistant' for bacteria and 'immune' for people. 'The bacteria become immune' does not get the mark.
- In percentage change calculations, divide by the original value and show your working.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **State what antibiotics do**
Antibiotics, such as penicillin, kill infective bacteria inside the body, curing bacterial diseases.

Grade 3 — **State what painkillers do**
Painkillers treat the symptoms of a disease but do not kill pathogens.

Grade 4 — **Explain why antibiotics don't treat viral diseases**
Antibiotics kill bacteria but cannot kill viruses.

Grade 5 — **Explain why specific antibiotics are needed**
Different antibiotics kill different bacteria, so the antibiotic must match the bacterium causing the disease.

Grade 5 — **Explain why antiviral drugs are hard to develop**
Viruses reproduce inside body cells, so drugs that kill them are likely to damage body tissues too.

Grade 5 — **Explain why antibiotic resistance is a concern**
Resistant strains are not killed by the antibiotic, so infections become hard to treat and the strains can spread.

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