5.1 Disease transmission and immune response

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS pathogen • antigen

Objective

Disease transmission and immune response. Original classroom practice for IB HL; not an official IB paper.

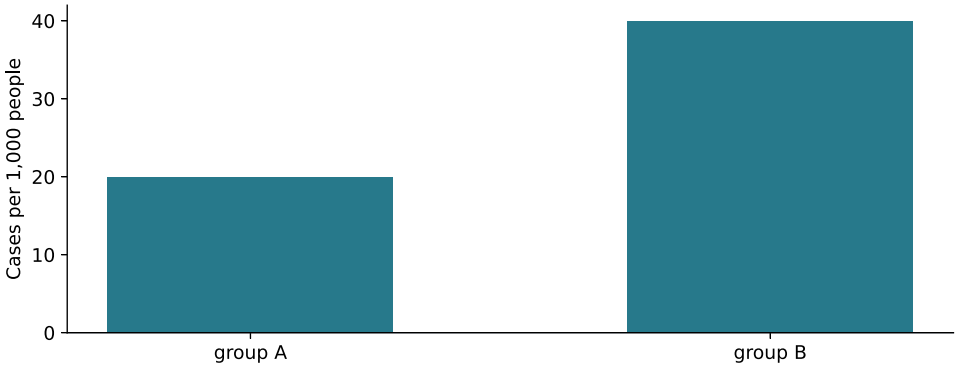
1 Key knowledge and worked examples

What would explain this observation?

- An antibiotic may help against a bacterial infection but fail against a viral illness. Treatment depends on the causal organism and the evidence supporting diagnosis.

Build the model

- **Pathogens** cause infectious disease.
- Physical barriers, phagocytosis and specific immune responses reduce infection.
- Antibodies bind particular **antigens** .
- Vaccination exposes the immune system to antigen safely enough to develop memory.
- pathogen: An agent that causes disease.
- antigen: A structure recognized by a specific immune response.



Choose evidence that can test it

- After vaccination, memory cells can support a faster secondary response.
- Antibiotic resistance arises through heritable variation and selection; an individual bacterium does not choose to become resistant because it needs to survive.

In the lab: Use published infection data to compare rates per equal population size. Distinguish prevalence at a time from new cases over a period. In school, use safe simulations or approved cultures rather than collecting unknown pathogens.

Work from known quantities

- Known: 18 cases occur in 900 people.
- Rate per 1,000 = cases / population × 1,000.
- Rate = 18/900 × 1,000 = 20 cases per 1,000.
- A second group with 10 cases in 250 people has 40 per 1,000, even though it has fewer cases.

Your turn: 12 cases occur among 600 people. Find cases per 1,000 people.

Check the conclusion and its limits

- Antibiotics do not act on viruses in the same way they act on bacteria.
- A vaccine is not an immediate cure for an established infection.

Not true: Every antibiotic is effective against every viral infection. Antibiotics act on bacterial structures and processes that viruses do not have, so they cannot cure a viral infection. Using them against viruses adds selection pressure for resistance without benefit.

Key:

- Pathogens cause infectious disease.
- After vaccination, memory cells can support a faster secondary response.
- Watch for: antibiotics do not act on viruses in the same way they act on bacteria.

Write from 16 cases per 1000

- 8 cases occur among 500 people.
- Find the rate per 1000. A smaller case count can still be a higher rate.

2 Practice

2.1 What explains the spread of antibiotic resistance? Choose one answer.

- **A** Resistant variants survive and reproduce more successfully
- **B** Bacteria deliberately change all their genes
- **C** Antibiotics turn viruses into bacteria [1]

2.2 12 cases occur among 600 people. Find cases per 1,000 people. Show the relation, substitution and units. [2]

2.3 Decide whether this claim is true and justify: Every antibiotic is effective against every viral infection. [2]

2.4 An agent that causes disease: write the technical term. [1]

3 Exam-style questions

3.1 Fictional samples report 12 cases in 600 people and 8 in 200. Compare rates and identify what else is needed before concluding one exposure caused disease. [4]