

Week 13

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

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10. Diseases and immunity

Starter Quiz · 课前小测

IGCSE Biology

Name: _____ Score: _____

1. A pathogen is:

- ☐ a microbe that causes disease
- ☐ a type of white blood cell
- ☐ a vaccine
- ☐ a harmless gut bacterium

2. Phagocytes defend the body by:

- ☐ engulfing and digesting pathogens
- ☐ making antibodies
- ☐ carrying oxygen
- ☐ clotting blood

3. Which can be pathogens? (Select all that apply.)

- ☐ bacteria
- ☐ viruses
- ☐ fungi
- ☐ red blood cells

Tick every correct option.

4. Antibodies are made by:

- ☐ lymphocytes
- ☐ red blood cells
- ☐ platelets
- ☐ phagocytes

5. A pathogen spread by coughs and sneezes travels through the:

- ☐ air
- ☐ soil only
- ☐ bones
- ☐ nerves

6. A vaccine protects you by:

- ☐ triggering antibodies and memory cells ut causing the disease

- ☐ killing all bacteria in the body
- ☐ giving you the full disease
- ☐ replacing your blood

7. Memory cells let the body respond faster to a pathogen it has met before.

- ☐ True ☐ False

8. Swallowed pathogens are killed by the _____ in the stomach.

9. Antibodies recognise the markers on a pathogen called _____.

10. Which is a physical barrier to pathogens?

- ☐ the skin
- ☐ a vaccine
- ☐ an antibody
- ☐ a hormone

10. Diseases and immunity

IGCSE Biology

1. a microbe that causes disease

Pathogens are disease-causing microbes.

2. engulfing and digesting pathogens

Phagocytes engulf pathogens; lymphocytes make antibodies.

3. bacteria; viruses; fungi

Bacteria, viruses, fungi and protoctists can cause disease; red blood cells cannot.

4. lymphocytes

Lymphocytes produce antibodies.

5. air

Airborne droplets carry pathogens.

6. triggering antibodies and memory cells without causing the disease

It safely primes the immune system.

7. True

This is the basis of immunity.

8. acid

Stomach acid destroys many pathogens in food.

9. antigens

Each antibody fits a specific antigen.

10. the skin

The skin physically blocks pathogens.

10.1 Diseases and immunity

Name: _____ Class: _____ Date: _____

Total: 28 marks

KEY WORDS pathogen 病原体 • ions 离子 • antibodies 抗体 • disease 疾病
• active immunity 主动免疫

Objective

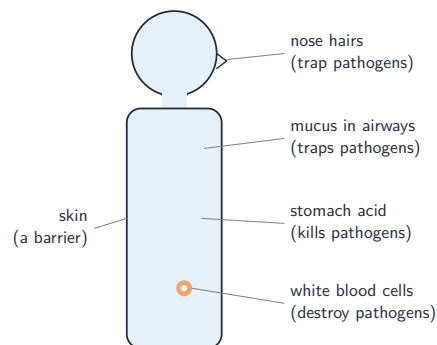
Build the skills to answer exam questions on **diseases and immunity** 疾病与免疫 — **pathogens** 病原体, the body's **defences** 防御, **antibodies** 抗体, **vaccination** 疫苗接种, and active vs passive immunity.

You must be able to:

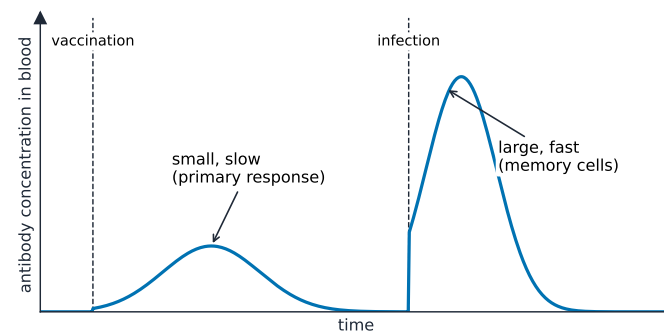
- define pathogen and transmissible disease; list the body's defences
- explain antigens/antibodies and how vaccination works
- compare active and passive immunity

1 Worked examples

■ Defences and vaccination



Defences: skin, nose hairs, mucus, stomach acid, white blood cells



vaccine: primary + memory · reinfection: rapid secondary

Vaccination makes memory cells → a fast, large response if the real pathogen arrives (active immunity)

- **passive immunity** (placenta, breast milk): short-term, no memory cells.

■ The defences, in the order the marks are given

Pathogen 病原体: an organism that causes disease. A **transmissible disease** passes from one host to another, directly (touch, body fluids) or indirectly (contaminated food or water, air, an insect vector).

The body's defences, in two layers.

- **Mechanical and chemical barriers, which act against every pathogen:** the skin as a physical barrier; hairs in the nose; **mucus** trapping pathogens in the airways, with cilia sweeping it up; stomach acid killing what is swallowed; tears containing enzymes.
- **The white blood cells, which act against a specific pathogen:** **phagocytes** 吞噬细胞 engulf and digest pathogens; **lymphocytes** 淋巴细胞 make **antibodies** 抗体 whose shape is complementary to the pathogen's **antigen** 抗原, so they bind to it and mark it for destruction or make the pathogens clump together.

Active and passive immunity. **Active** immunity comes from the body making its own antibodies, after an infection or a vaccination; it is slow to start but long-lasting, because memory cells remain. **Passive** immunity comes from receiving antibodies made elsewhere, such as through the placenta or breast milk; it is immediate but short-lived, because no memory cells are made.

Worked example (how a vaccine works). Describe how a vaccine gives long-term protection.

1. The vaccine puts a weakened, dead or partial pathogen, carrying its antigens, into the body.

2. Lymphocytes recognise the antigens and make specific antibodies against them.
3. **Memory cells** remain in the blood afterwards.
4. If the real pathogen enters later, the memory cells make antibodies faster and in larger amounts, so the person does not become ill.

Controlling the spread of a disease: clean water supplies, hygienic food preparation, waste disposal and sewage treatment, personal hygiene such as hand washing, and vaccination programmes. When enough people are vaccinated, **herd immunity** protects those who cannot be, because the pathogen cannot find enough hosts to spread through.

2 Practice

2.1 Define a pathogen. [1]

2.2 State two of the body's defences against pathogens. [2]

2.3 State two mechanical barriers that stop pathogens entering the body. [2]

2.4 Explain why an antibody against measles does not protect against influenza. [2]

2.5 Give two methods of controlling the spread of a disease carried in water. [2]

3 Exam-style questions

3.1 An antibody is able to bind to one pathogen because its shape is: [1]

- **A** the same as the antibody
- **B** complementary to the pathogen's antigen
- **C** larger than the pathogen
- **D** always changing

3.2 A child is vaccinated against measles.

(a) Describe how the vaccine gives long-term protection. [3]

(b) State the difference between active and passive immunity. [2]

3.3 A country runs a vaccination programme against a viral disease.

- (a) Describe how the vaccine produces long-term protection. [4]

- (b) Explain why the protection is described as active immunity. [2]

- (c) A newborn baby receives antibodies in its mother's breast milk. Name this type of immunity and explain why it lasts only a few months. [3]

- (d) Describe how a phagocyte destroys a pathogen that has entered the blood. [2]

- (e) When most of the population is vaccinated, unvaccinated people also become less likely to catch the disease. Explain why. [2]

Solutions

- 2.1** an organism that causes disease.

- 2.2** any two of: skin; nose hairs; mucus; stomach acid; white blood cells.

- 2.3** Any two of: the skin as a physical barrier; hairs in the nose; mucus in the airways trapping pathogens; cilia sweeping mucus away.

- 2.4** An antibody has a shape complementary to one particular antigen; the measles and influenza viruses carry different antigens, so the measles antibody cannot bind to the influenza virus.

- 2.5** Any two of: treating and chlorinating the water supply; treating sewage so it does not reach drinking water; boiling water before drinking; hand washing.

- 3.1 B.** An antibody's shape is complementary to the pathogen's antigen.

- 3.2** (a) the vaccine's antigens make lymphocytes produce antibodies; and memory cells form; if the real pathogen arrives, the memory cells make antibodies fast, so you don't become ill.

- (b) active immunity is made by your own body (long-term, memory cells); passive immunity comes from another body's antibodies (short-term, no memory cells).

- 3.3** (a) The vaccine introduces a weakened, dead or partial pathogen carrying its antigens; lymphocytes recognise the antigens and make specific antibodies against them; memory cells remain, so if the real pathogen enters later, antibodies are made faster and in larger quantities and the person does not become ill.

- (b) The person's own lymphocytes make the antibodies, and memory cells remain afterwards, so the protection is long lasting.

- (c) Passive immunity; the antibodies were made by the mother, not the baby; the baby makes no memory cells, and the antibodies are gradually broken down, so the protection fades.

- (d) The phagocyte engulfs the pathogen, taking it inside the cell; enzymes then digest and destroy it.

- (e) There are too few people left who can catch and pass on the pathogen, so it cannot spread easily and the unvaccinated are unlikely to meet an infected person, which is herd immunity.

14 Which statements are correct descriptions of methods of preventing pathogens from entering the body?

- 1 Fibrin is converted to fibrinogen to form a mesh.
- 2 Phagocytes produce antibodies.
- 3 Platelets clot blood.
- 4 Lymphocytes engulf pathogens.

A 1, 3 and 4 B 1 and 3 only C 2 and 4 D 3 only

16 Three statements about immunity are listed.

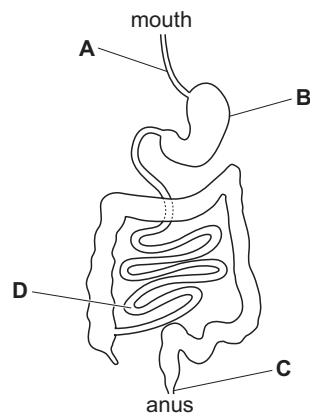
- 1 Specific antibodies are produced in response to specific antigens.
- 2 Pathogens have specific antigens.
- 3 A vaccination stimulates an immune response.

Which statements are correct?

A 1, 2 and 3 B 1 and 3 only C 1 only D 2 and 3 only

15 The diagram shows the human digestive system.

Where do cholera bacteria cause the secretion of chloride ions?



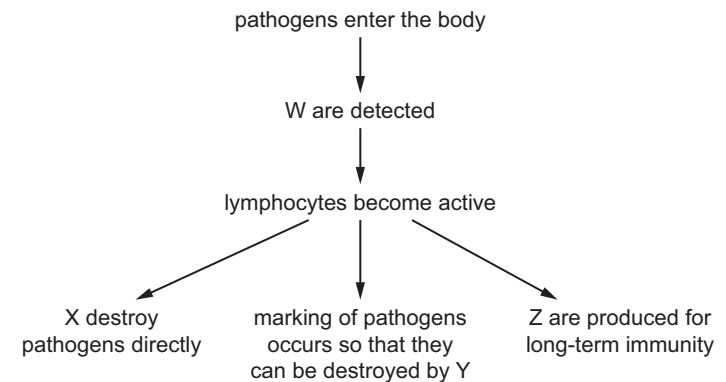
22 Which action would help to limit the development of antibiotic resistance in bacteria?

- A Use antibiotics frequently to prevent infection by antibiotic-resistant bacteria.
- B Use antibiotics only to treat bacterial infections.
- C Use antibiotics to treat all types of infections.
- D Use antibiotics to treat only viral infections.

17 What is an example of active immunity?

- A antibody production after infection
- B antibody transfer from mother to baby in breast milk
- C antibody transfer from mother to fetus across the placenta
- D an injection of antibodies that were produced by another individual

16 The diagram shows what happens in the body during active immunity.



Which structures or cells represent W, X, Y and Z?

	antibodies	antigens	memory cells	phagocytes
A	W	X	Y	Z
B	W	X	Z	Y
C	X	W	Y	Z
D	X	W	Z	Y

- 17 Cholera is a disease caused by a bacterium called *Vibrio cholerae* which produces a toxin in the infected person's gut.

What is the effect of this toxin?

- A The toxin causes loss of water from the gut into the blood.
- B The toxin causes loss of water from the gall bladder into the blood.
- C The toxin causes water to enter the gut from the blood.
- D The toxin causes water to enter the gall bladder from the blood.

- 19 Three statements about immunity are listed.

- 1 The transfer of antibodies from mother to baby in breast milk is an example of passive immunity.
- 2 Passive immunity results in long-term immunity because of the production of memory cells.
- 3 Active immunity is gained after vaccination with antigens.

Which statements are correct?

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only

- 5 Penicillin is an antibiotic.

- (a) (i) State the type of organism that antibiotics are used to kill.

..... [1]

- (ii) It is important to try and limit the development of antibiotic resistance.

Describe ways of limiting the development of antibiotic resistance.

.....

 [2]

- (b) Penicillin is produced by an organism called *Penicillium chrysogenum*.

Fig. 5.1 is a diagram of *Penicillium chrysogenum*.

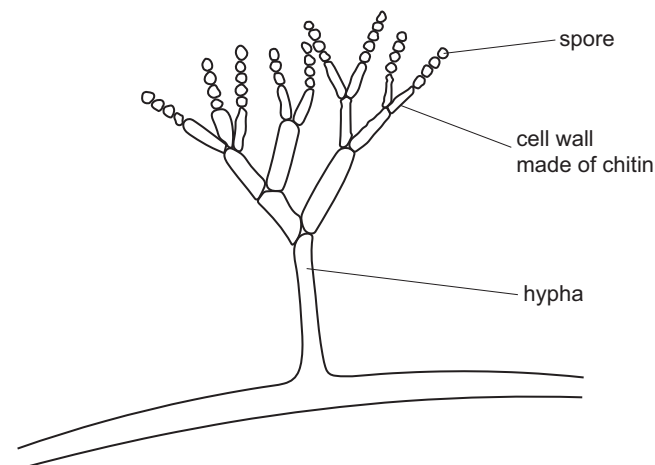


Fig. 5.1

- (i) State what *Penicillium* in the scientific name of *Penicillium chrysogenum* represents in the binomial system.

..... [1]

- (ii) Using the information in Fig. 5.1, identify the kingdom that contains *Penicillium chrysogenum*.

..... [1]

(c) Penicillin can be made in a fermenter.

(i) State the name of **one other** product made in a fermenter.

..... [1]

Fig. 5.2 shows a fermenter.

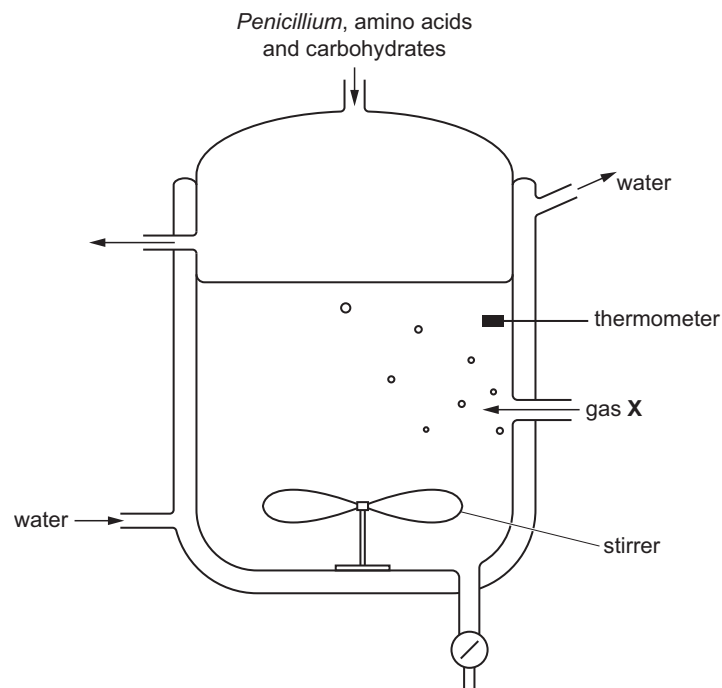


Fig. 5.2

(ii) Gas X in Fig. 5.2 is needed for the production of penicillin.

State the name of gas X.

..... [1]

(iii) The concentration of gas X is one of the conditions that must be controlled to ensure that penicillin is produced.

State the **other** conditions required to produce penicillin **and** describe how they are controlled in the fermenter.

.....

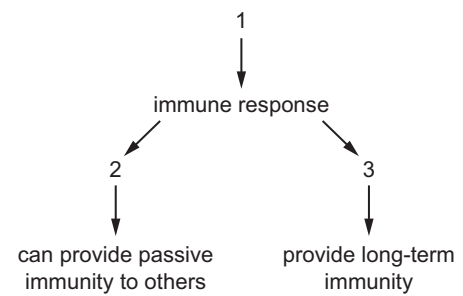
 [5]

(d) State the name of the organism that is used in bread-making **and** in biofuel production.

..... [1]

[Total: 13]

- 17 The diagram shows the effect of vaccination on the human body. Three components in the diagram are represented by numbers.



Which components are memory cells?

- A** 1 only **B** 2 and 3 **C** 2 only **D** 3 only