11.2 Antibodies and vaccination

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

KEY WORDS monoclonal antibodies • vaccine • immunity • hybridoma • active immunity

Objective

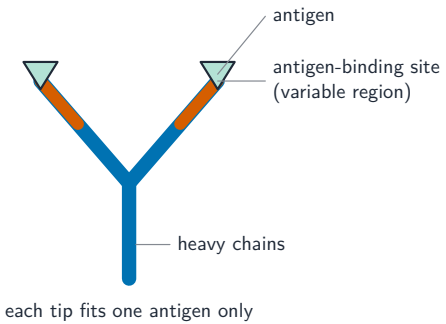
Build the skills to answer exam questions on **antibodies and vaccination** – antibody structure, **monoclonal antibodies** , types of **immunity** , and **vaccination** .

You must be able to:

- relate antibody structure to function and outline the hybridoma method
- distinguish active/passive and natural/artificial immunity
- explain how vaccines and vaccination programmes give long-term immunity

1 Key knowledge and worked examples

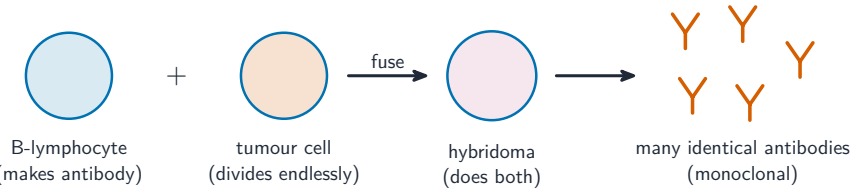
■ Antibody structure and function



The two tips are variable regions that bind one specific antigen

An antibody is a Y-shaped protein; its two **variable regions** bind one antigen only. Antibodies clump pathogens together, mark them for phagocytes, and block toxins.

■ Monoclonal antibodies



A hybridoma pours out one identical (monoclonal) antibody

A **hybridoma** = a B-lymphocyte (makes the wanted antibody) fused with a tumour cell (divides endlessly). Uses: **diagnosis** (e.g. pregnancy test) and treatment (carry drugs to target cells).

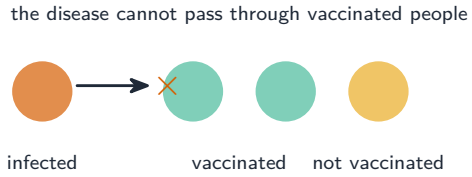
■ Types of immunity

	natural	artificial
active	after an infection (your body responds)	vaccination (safe dose of antigen)
passive	antibodies passed from mother to baby	injection of ready-made antibodies

active = your body makes its own antibodies (slow, long-lasting);
passive = ready-made antibodies given (fast, short-lived)

Active immunity lasts (your body responds); passive is fast but short (ready-made antibodies)

■ Vaccination and herd immunity



When enough people are vaccinated, the pathogen cannot reach the few who are not

A **vaccine** contains antigens that trigger a primary response and make memory cells – long-term immunity without illness. If enough people are vaccinated, **herd immunity** protects the rest.

2 Practice

2.1 State the part of an antibody that binds the antigen, and explain why it binds only one antigen. [2]

2.2 State one difference between active and passive immunity. [1]

3 Exam-style questions

3.1 Which is an example of **passive natural** immunity? [1]

- **A** recovering from chickenpox
- **B** being given a vaccine
- **C** antibodies passing from a mother to her baby in breast milk
- **D** being injected with ready-made antibodies

3.2 Why does passive immunity not last long? [1]

- **A** the antibodies are the wrong shape
- **B** no memory cells are produced
- **C** the antigens are destroyed
- **D** phagocytes remove the antibodies

3.3 (a) Outline how monoclonal antibodies are produced by the hybridoma method. [3]

(b) State **one** use of monoclonal antibodies in medicine and explain how their specificity is important. [2]

3.4 Explain how a vaccination programme can protect even people who have not been vaccinated. [3]