# Antibodies and vaccination

## Question Paper 5

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|---|---|
| **Level** | International A Level |
| **Subject** | Biology |
| **Exam Board** | CIE |
| **Topic** | Immunity |
| **Sub Topic** | Antibodies and vaccination |
| **Booklet** | Theory |
| **Paper Type** | Question Paper 5 |

**Time Allowed :** **71 minutes**

**Score :** **/ 59**

**Percentage :** **/100**

**Grade Boundaries:**

| A* | A | B | C | D | E | U |
|---|---|---|---|---|---|---|
| >85% | '77.5% | 70% | 62.5% | 57.5% | 45% | <45% |

CHEMISTRY ONLINE TUITION

**1** **(a)** White blood cells play an important role in defence.

State precisely the type of white blood cell that fits each of the descriptions given in **(i)** to **(iv)**.

**(i)** It is formed in the bone marrow and matures from a monocyte. It contains many lysosomes with hydrolytic enzymes.

.....[1]

**(ii)** It is formed, and matures in, the bone marrow. It contains a lobed nucleus and has the ability to ingest microorganisms by endocytosis.

.....[1]

**(iii)** When activated, it differentiates into a cell that secretes a chemical, which causes other cells to lyse (burst). It contains a large, spherical nucleus.

.....[1]

**(iv)** It is formed as a result of a primary immune response and remains in the body. On activation, it has the potential to produce antibodies during a secondary immune response.

.....[1]

**(b)** In 1980, it was announced that the highly infectious viral disease, smallpox, had been eradicated. This was mainly due to a worldwide vaccination programme planned by the World Health Organization (WHO).

Attempts have been made to control other diseases, such as measles, sickle cell anaemia and cholera, without the same success as smallpox.

**(i)** Define the term *disease*.

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.....[2]

CHEMISTRY ONLINE TUITION

**(ii)** Describe two features of the vaccine that contributed to the success of the smallpox eradication programme.

1. .....

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2. .....

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.....[2]

**(iii)** Discuss the reasons why vaccination has **not** eradicated cholera **and** sickle cell anaemia.

*cholera* .....

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*sickle cell anaemia* .....

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.....[5]

[Total: 13]

CHEMISTRY ONLINE TUITION

**2** Fig. 4.1 is an incomplete flow chart showing some of the events of the primary immune response that occur after a person has been given a vaccine.

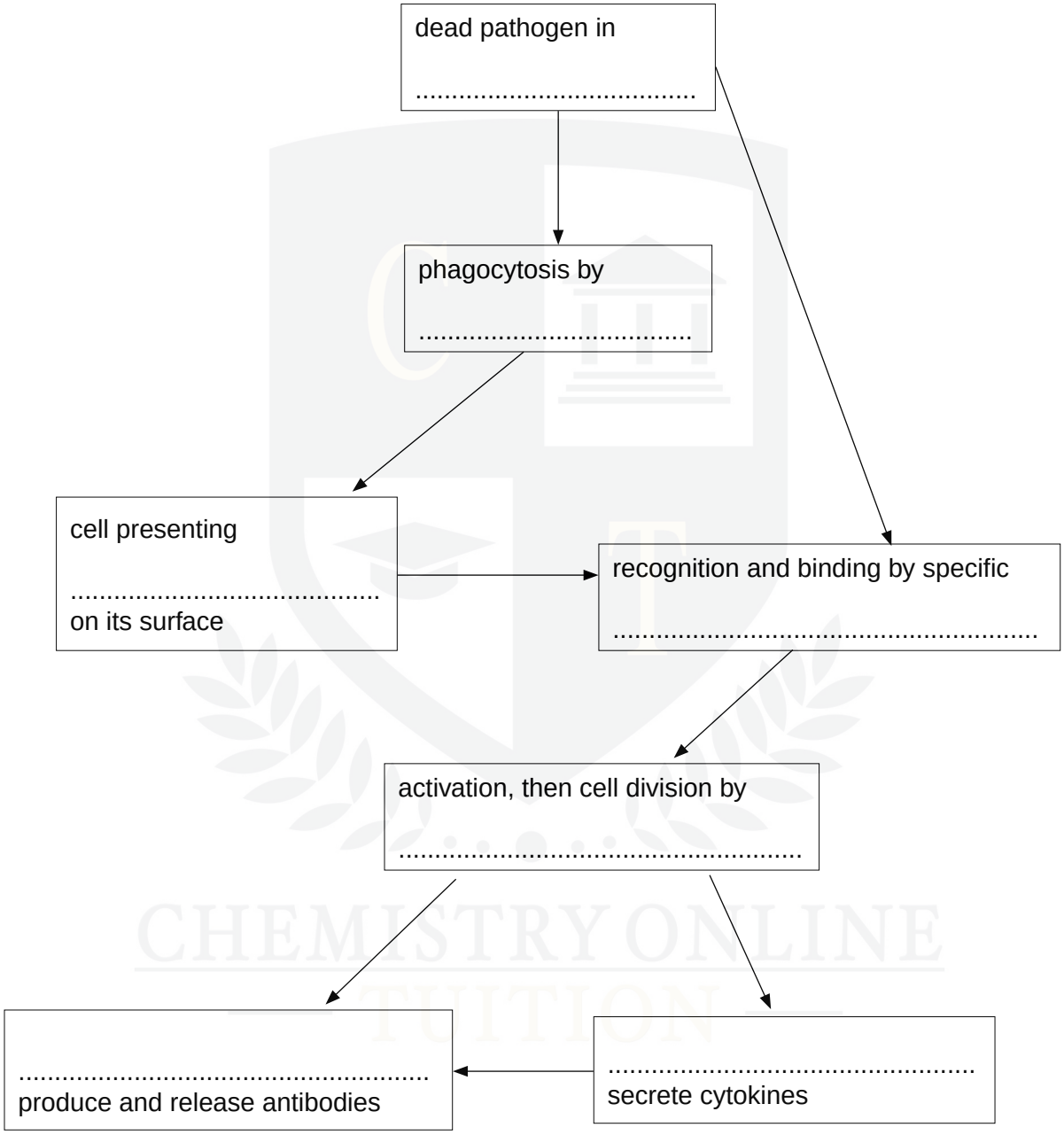


**Fig. 4.1**

**(a)** Choose the correct term from the list below to complete Fig. 4.1.

| | | | |
|---|---|---|---|
| **lymphocytes** | **antigens** | **mitosis** | **vaccine** |
| **$T_h$-lymphocytes** | **plasma cells** | **macrophages** | |

[3]

**(b)** Explain why the person is unlikely to become ill if they are infected by the same pathogen some months later.

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..... [3]

**(c)** Some parents decide that their children should not take part in a vaccination schedule.

Suggest how a country-wide vaccination schedule can give protection against infection to **unvaccinated** children.

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..... [2]

[Total: 8]

CHEMISTRY ONLINE TUITION

**3** Fig. 2.1 shows a world map shaded by country according to the incidence of tuberculosis (TB).


**Fig. 2.1**

**(a)** State the name of the pathogenic organism which causes TB and describe its mode of transmission from infected to uninfected people.

*name of organism* .....

*mode of transmission* .....

.....

.....[3]

**(b)** People suffering from TB are treated using antibiotics. Recently, multi-drug resistant TB (MDR-TB) has developed, making the disease more difficult to treat.
Suggest how this drug resistance may have arisen.

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.....[2]

CHEMISTRY ONLINE TUITION

**(c)** The World Health Organization (WHO) aims to eradicate TB worldwide by 2050. With reference to Fig. 2.1, discuss the problems to be faced in the eradication of TB.

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.....[5]

[Total: 10]

CHEMISTRY ONLINE
TUITION

**4** Fig. 3.1 shows a method of producing monoclonal antibodies.

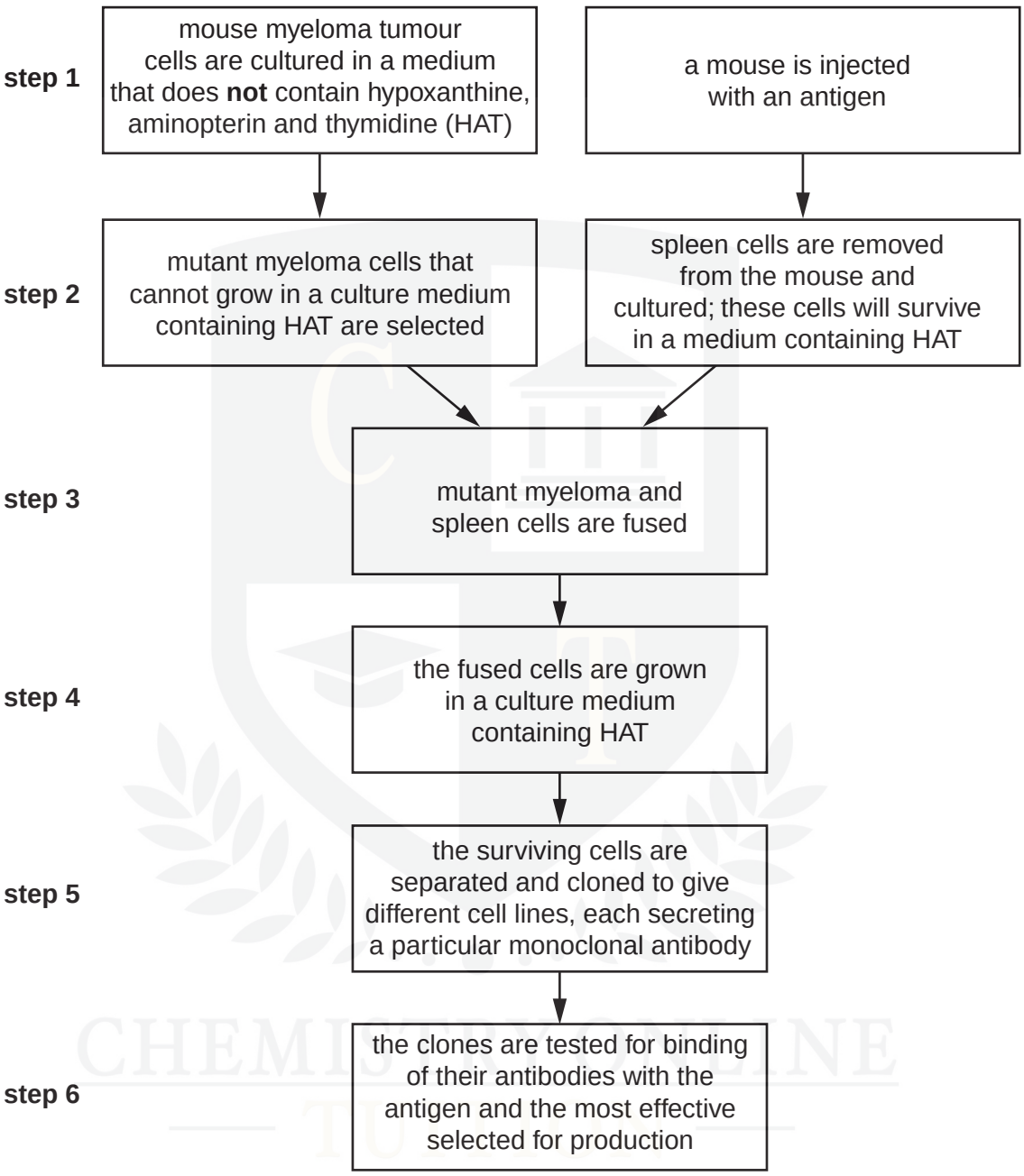


**Fig. 3.1**

**(a) (i)** Name this method of producing monoclonal antibodies.

..... [1]

**(ii)** Describe what is meant by the term *monoclonal antibody*.

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..... [2]

**(iii)** Describe, in detail, the molecular structure of one of the antibodies produced in **step 6**. You may wish to use an annotated diagram to answer the question.

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..... [3]

**(b)** The mutant myeloma cells used in **step 2** are myeloma cells with a gene mutation that prevents them from growing in a culture medium containing hypoxanthine, aminopterin and thymidine (HAT).

**(i)** Suggest why cells with this gene mutation **cannot** grow in a culture medium containing HAT.

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..... [2]

**(ii)** Explain why the mutant myeloma cells **can** grow in a culture medium containing HAT after they have been fused with mouse spleen cells (**steps 3** and **4**).

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..... [2]

**(iii)** Suggest why growing the fused cells in a culture medium containing HAT (**step 4**) is an important part of the procedure shown in Fig. 3.1.

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..... [2]

**(c)** Suggest advantages of using monoclonal antibodies for pregnancy testing.

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..... [4]

[Total: 16]

CHEMISTRY ONLINE TUITION

**5** During an immune response, plasma cells secrete antibody molecules. Fig.1.1 is a diagram of an antibody molecule. The diagram is **not** complete.

**Fig. 1.1**

**(a) (i)** Draw a circle around a variable region. [1]

**(ii)** Draw in and label the position of the disulfide bonds in the molecule. [1]

**(iii)** Explain the importance of disulfide bonds in protein molecules, such as antibodies.

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.....[3]

CHEMISTRY ONLINE TUITION

**(b)** Describe how antibodies provide protection against pathogens.

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..... [4]

**(c)** Other proteins are found in cell surface membranes.

Describe three roles of the proteins in cell surface membranes.

1 .....

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2 .....

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3 .....

..... [3]

[Total: 12]

CHEMISTRY ONLINE TUITION