

# Antibodies and vaccination

## Question Paper 4

<b>Level</b>	International A Level
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Immunity
<b>Sub Topic</b>	Antibodies and vaccination
<b>Booklet</b>	Theory
<b>Paper Type</b>	Question Paper 4

**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%

1 (a) Define the term *disease*.

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..... [1]

Fig. 2.1 is a flow chart that shows the four different ways that a person can become immune to an infectious disease.

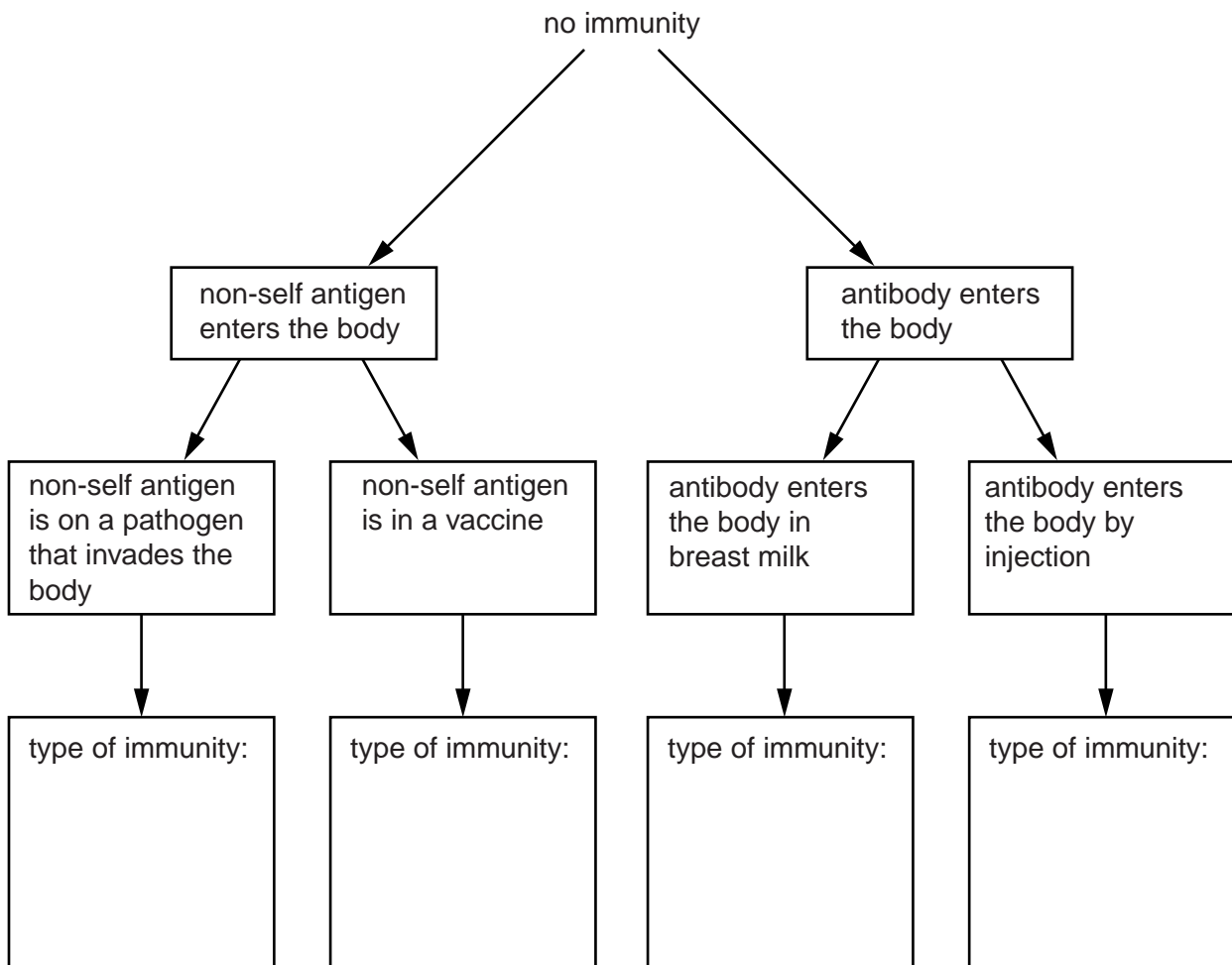


Fig. 2.1

(b) Complete Fig. 2.1 by writing in the boxes provided the four types of immunity described. [4]

Fig. 2.2 shows the number of cases of smallpox from 1950 to 1980:

- in all the countries of the world
- in India.

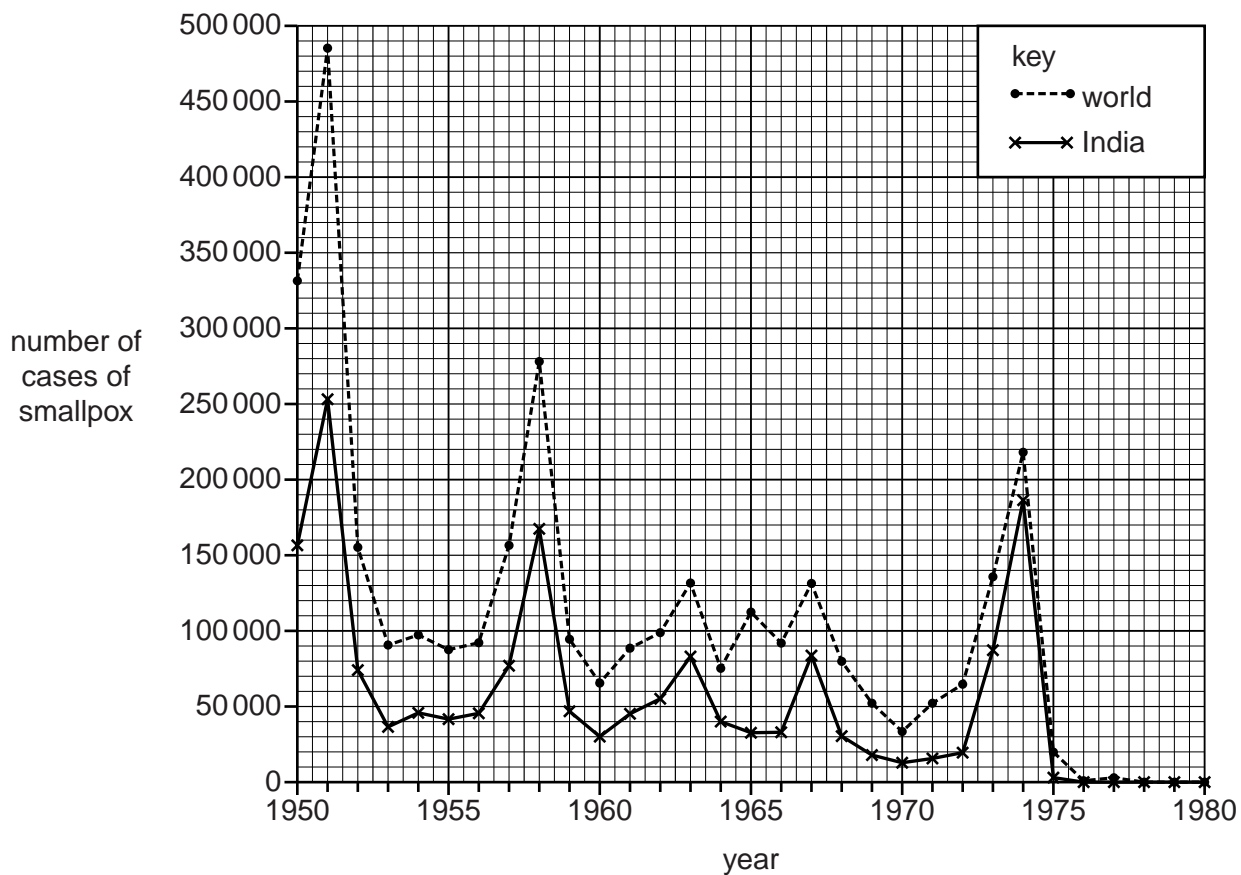


Fig. 2.2

(c) Describe the changes in number of cases of smallpox as shown in Fig. 2.2.

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The World Health Organization (WHO) declared the world to be free of smallpox in 1980.

**(d)** Outline some of the factors that led to the successful eradication of smallpox from the world population.

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..... [4]

[Total: 12]

- 2** Cholera is an infectious disease that can affect children and adults. Symptoms of the disease can occur very quickly, from a few hours to a few days.

Table 4.1 shows:

- the economic status of each of five countries
- the number of cases of cholera reported to the World Health Organization (WHO) over a five year period for each country
- the population in 2006 and in 2010 of each country.

**Table 4.1**

country	economic status	number of cholera cases reported			population / millions	
		2006	2008	2010	2006	2010
Zimbabwe	low	78	60055	951	12.5297	12.5715
Uganda	low	519	3726	2341	29.3703	33.4247
Angola	middle		10511	1484	17.0104	19.0819
Cameroon	middle		0	10759	17.9484	19.5989
Canada	high		1	2	32.6490	34.1088



(b) Vaccination helps to prevent the spread of infectious diseases by stimulating an immune response in individuals against specific pathogens, such as Morbillivirus, the virus that causes measles.

(i) Suggest two reasons why measles vaccination programmes may fail to prevent epidemics.

- 1. ....
- .....
- 2. ....
- ..... [2]

(ii) Outline the response produced by **B-lymphocytes** on exposure to Morbillivirus in an individual **who already has immunity** to measles.

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- .....
- .....
- .....
- .....
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- .....
- ..... [3]

[Total: 12]





Fig. 3.1 shows the number of reported cases of measles and the percentage of the population vaccinated worldwide between 1980 and 2002.

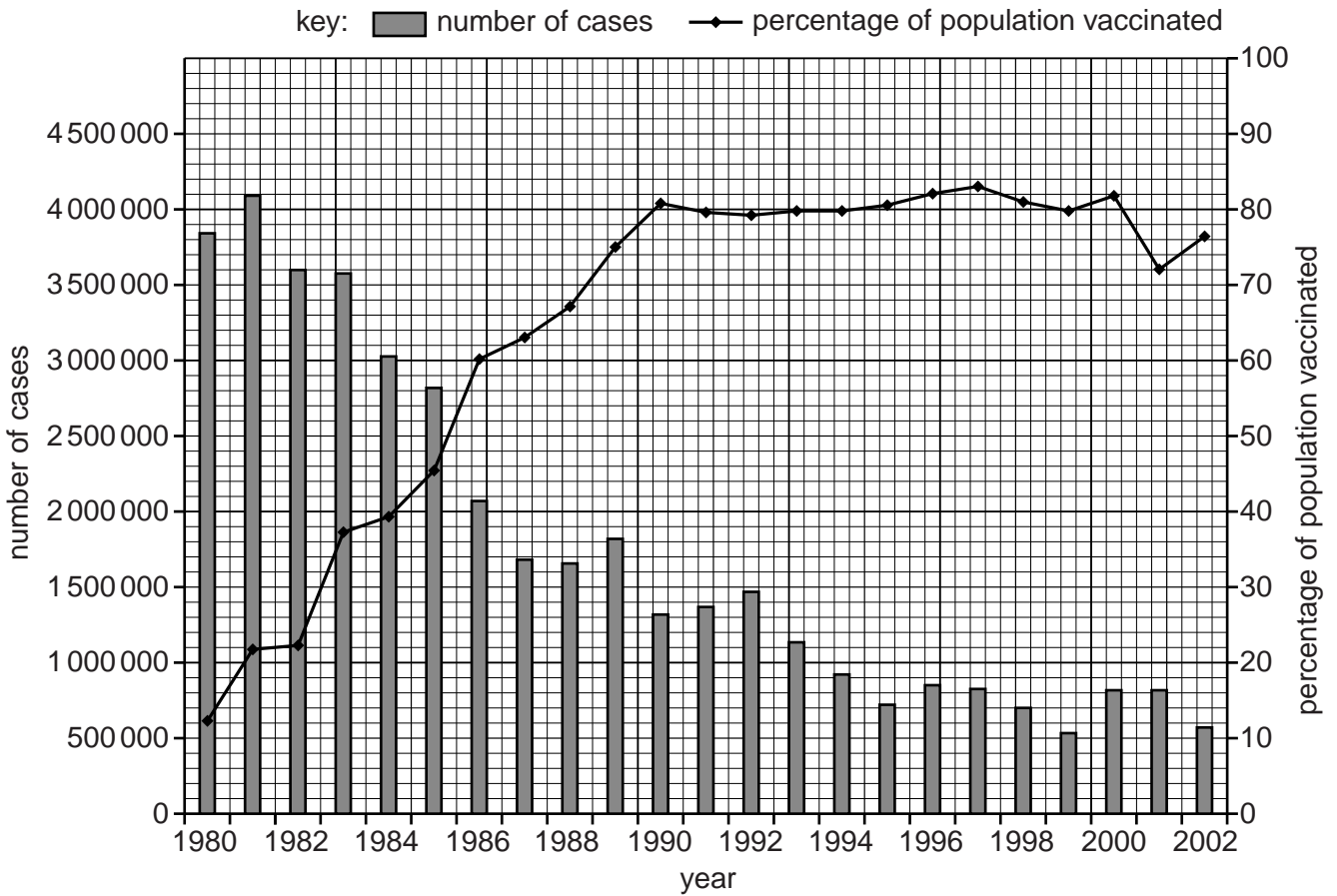


Fig. 3.1

(b) Describe the trends shown in Fig. 3.1:

between 1980 and 1990

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between 1990 and 2002.

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..... [4]

(c) The measles virus has a unique protein on its surface called MV-H which can bind to a protein called CD-46 on the surface of human cells. This allows the measles virus to infect these cells.

Suggest how the two proteins, MV-H and CD-46, can bind to each other.

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..... [2]

[Total: 11]

- 4 Many tumours release a protein growth factor called VEGF. This is a chemical signal that causes nearby blood vessels to grow new branches into the tumour.

The monoclonal antibody, bevacizumab (Avastin<sup>®</sup>), specifically binds to VEGF.

- (a) Suggest how Avastin<sup>®</sup> can prevent the growth and spread of a tumour.

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- (b) Avastin<sup>®</sup> is made by the hybridoma method.

State:

- (i) the antigen that is injected into a mouse to produce this monoclonal antibody

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- (ii) what is meant by a *hybridoma*.

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.....[1]

- (c) The monoclonal antibody made by the hybridoma method is modified to obtain humanised mouse antibody. This type of antibody molecule resembles those produced by humans.

Suggest advantages of using humanised mouse antibody rather than mouse antibody.

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.....[3]

- (d) A second monoclonal antibody, ranibizumab (Lucentis<sup>®</sup>) is used to treat eye diseases. Lucentis<sup>®</sup> is a fragment of Avastin<sup>®</sup> and is shown in Fig. 2.1.

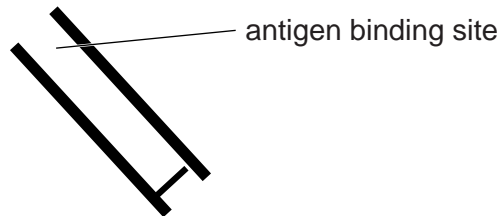


Fig. 2.1

Complete Fig. 2.1 to show a molecule of Avastin<sup>®</sup>.

Labels are **not** required.

[2]

[Total: 9]

- 5 (a) Nicotine, in cigarette smoke, is highly addictive. A nicotine vaccine has been developed to try and reduce the effects of addiction. The vaccine stimulates an immune response to produce antibodies that bind to the nicotine molecule. Fig. 6.1 is a diagram of an antibody molecule.

On Fig. 6.1:

- label **three** structural features that enable an antibody molecule to carry out its function.
- next to each label, state the function of the feature.

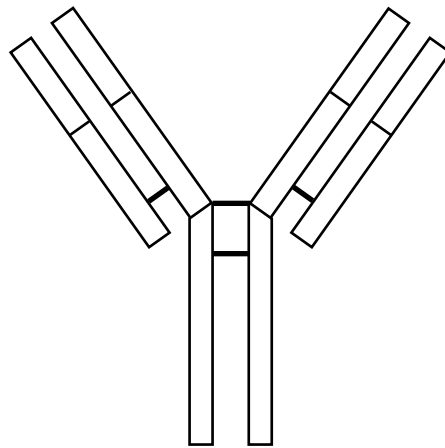


Fig. 6.1

[3]

- (b) Nicotine has an effect on the cardiovascular system, such as making platelets sticky, so causing blood to clot. This increases the risk of thrombosis and reduces blood flow.

Outline **other** effects of nicotine on the cardiovascular system.

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..... [3]

[Total: 6]

6 Fig. 1.1 is a diagram of an antibody molecule.

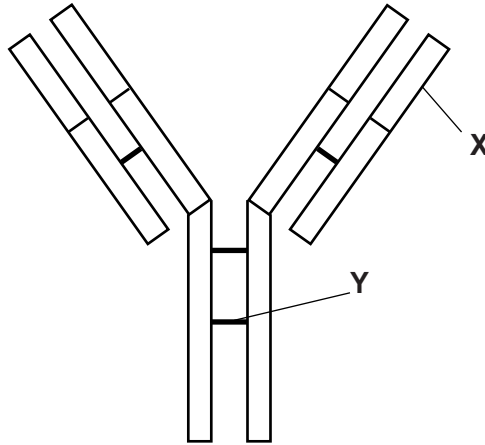


Fig. 1.1

(a) (i) Name the part labelled X.

..... [1]

(ii) Name the bond labelled Y.

..... [1]

(iii) The antibody molecule in Fig. 1.1 has quaternary structure.

Explain the meaning of the term *quaternary structure* as applied to proteins.

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