

# Antibodies and vaccination

## Question Paper 1

<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 1

**Time Allowed :** 65 minutes

**Score :** / 54

**Percentage :** /100

**Grade Boundaries:**

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



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A series of horizontal dotted lines for writing.

- 2 B-lymphocytes have antibodies located on their external surface. When B-lymphocytes become plasma cells they then secrete antibodies.

Fig. 5.1 shows how the enzyme papain digests an antibody to obtain three fragments.

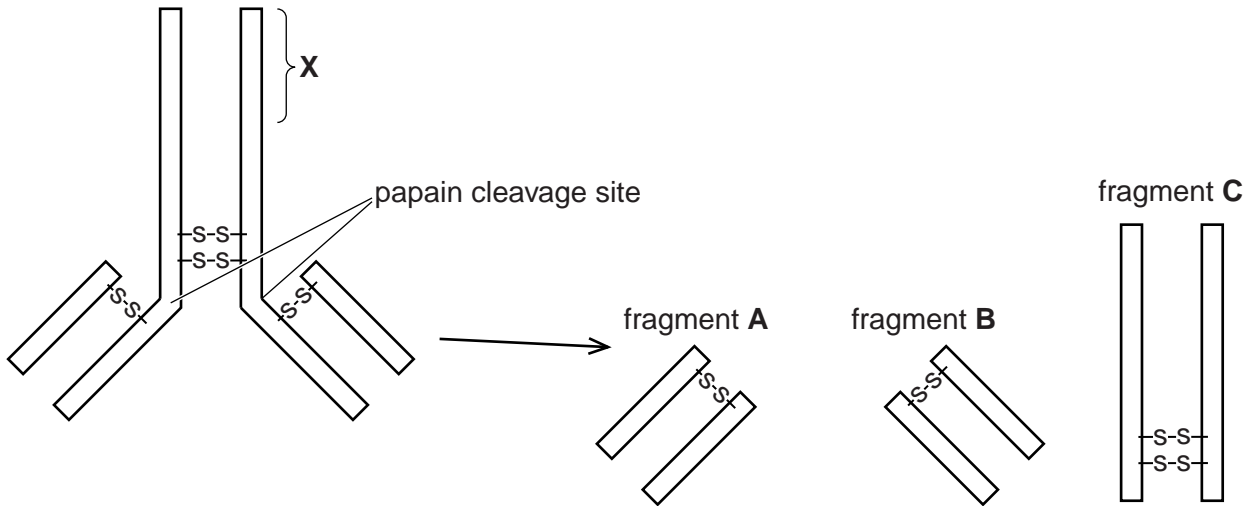


Fig. 5.1

- (a) Fig. 5.1 shows the location of the region where papain acts.

State **one** role of this region in the intact antibody molecule.

.....  
 .....  
 ..... [1]

- (b) The three fragments, **A**, **B** and **C** still retain their ability to function.

State the function of:

- (i) fragments **A** and **B**

.....  
 ..... [1]

- (ii) fragment **C**.

.....  
 ..... [1]

- (c) The region labelled X in Fig. 5.1 is hydrophilic in antibodies that are secreted by plasma cells, whereas in antibodies located on the surface of B-lymphocytes, region X is hydrophobic.

Suggest reasons for this difference.

.....  
.....  
.....  
.....  
.....  
.....  
..... [2]

- (d) Papain is a globular protein with a tertiary structure but no quaternary structure.

(i) State how many polypeptides there are in a molecule of papain.

..... [1]

(ii) Explain how the tertiary structure of the protein results in papain being globular.

.....  
.....  
.....  
..... [2]

[Total: 8]

3 (a) Explain how the virus that causes measles is transmitted.

.....  
 .....  
 .....  
 ..... [2]

(b) Antibodies against measles are produced by plasma cells during an immune response.

Fig. 2.1 shows a diagram of an antibody molecule.

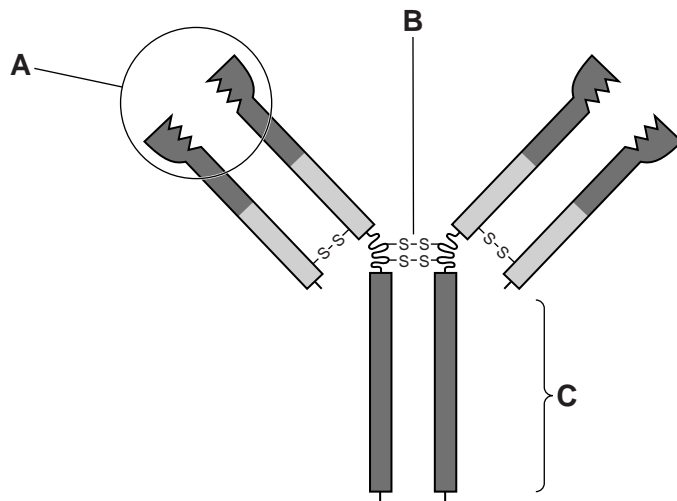


Fig. 2.1

Explain the functions of the parts labelled A, B and C.

(i) A .....  
 .....  
 .....  
 ..... [2]

(ii) B .....  
 .....  
 ..... [1]

(iii) C .....  
 .....  
 ..... [1]

4 Measles is an infectious disease, while lung cancer is not.

(a) Explain why lung cancer is sometimes referred to as a 'lifestyle disease'.

.....  
.....  
.....  
..... [2]

(b) State the type of pathogen that causes measles and state its mode of transmission.

*pathogen* .....

*transmission* .....

..... [2]

(c) Between January and April 2011, 118 measles cases were reported in the USA, where measles was previously thought to be virtually eradicated.

Suggest a reason for this rise in measles cases.

.....  
.....  
.....  
..... [1]

[Total: 5]

5 (a) State the name of the organism that causes cholera.

..... [1]

(b) NQR is an important respiratory enzyme located in the cell surface membrane of the bacterium that causes cholera.

A student suggested that an inhibitor of the enzyme NQR could be used as a drug in the prevention and control of cholera.

Suggest and explain how this inhibitor would function.

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



(c) Table 5.1 shows the statistics for cholera reported to the World Health Organization (WHO) in four regions of the world in 2008.

**Table 5.1**

region	number of cases	number of deaths	fatality rate/%
Africa	179 323	5 074	2.83
Asia	10 778	69	0.64
Europe	22	0	0.00
North America	7	0	0.00
Total	190 130	5 143	

(i) Calculate the total cholera fatality rate for 2008.

Show your working.

answer ..... % [2]

(ii) Apart from differences in total population size in each of the regions, suggest explanations for the differences shown in Table 5.1.

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.....

..... [4]

[Total: 10]

- 6 Cholera is a disease caused by the bacterium *Vibrio cholerae*. The disease symptoms are caused by a toxin, produced by the bacterium, interacting with proteins in the cell surface membranes of epithelial cells in the human intestine.

The cholera toxin is a protein and is composed of two subunits, **A** and **B**. Subunit **A** is made from one polypeptide and subunit **B** is made from five identical polypeptides.

Fig. 3.1 shows the structure of the cholera toxin.

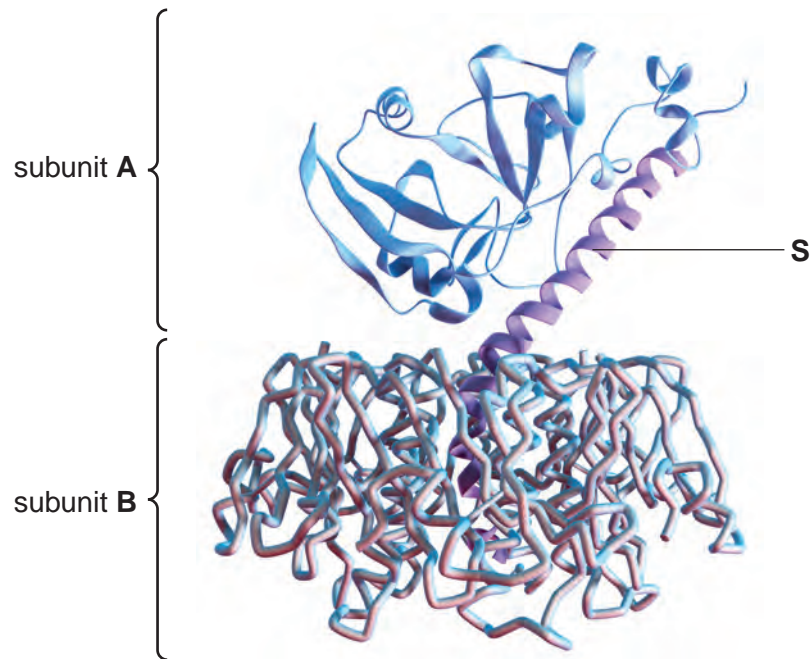


Fig. 3.1

(a) Name:

- (i) the level of structure that is only shown by a protein that has more than one polypeptide chain

.....[1]

- (ii) the part labelled **S**.

.....[1]

The cholera toxin interacts with ion channels in the epithelial membranes, resulting in watery diarrhoea.

These channels open, allowing ions to move from the epithelial cells into the lumen of the intestine.

**(b) (i)** Name the process by which the ions move in this case.

..... [1]

**(ii)** Due to the movement of ions into the lumen, water moves from the epithelial cells into the lumen.

Name the process by which water moves and explain why it moves into the lumen.

*name* .....

*explanation* .....

.....

.....

..... [3]

Large outbreaks of cholera are often associated with natural disasters. For example, following an earthquake in Pakistan in 2005, an estimated 20 000 cholera cases were reported in the vicinity, compared to approximately 1000 cases in the rest of the country.

**(c) (i)** Describe the mode of transmission of cholera.

.....

.....

.....

.....

..... [2]

**(ii)** Explain how natural disasters can sometimes result in transmission to more individuals.

.....

.....

.....

..... [2]