

Antibodies and vaccination

Question Paper 6

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Immunity
Sub Topic	Antibodies and vaccination
Booklet	Theory
Paper Type	Question Paper 6

Time Allowed : 54 minutes

Score : / 45

Percentage : /100

Grade Boundaries:

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

1 (a) Outline the hybridoma method for the production of a monoclonal antibody.

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(b) Herceptin is a monoclonal antibody used in the treatment of some breast cancers. It binds strongly to molecules of a receptor protein, HER2, that is produced in abnormally large quantities in the plasma (cell surface) membranes of about 30% of human breast cancers.

Investigations have been made into the most effective way to use Herceptin to treat breast cancer.

One experiment investigated the ability of different treatments to induce cell death in breast cancer cells.

Herceptin and X-ray treatment were used both separately and together. The results are shown in Fig. 4.1.

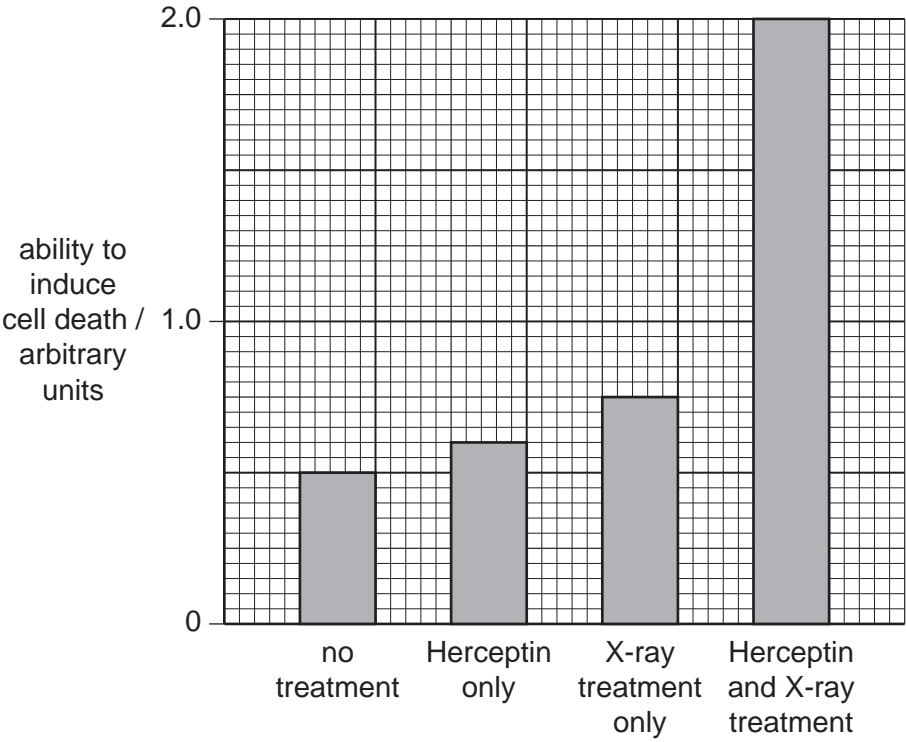


Fig. 4.1

With reference to Fig. 4.1,

- (i) compare the effects on breast cancer cells of the different treatments

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..... [3]

- (ii) calculate the percentage increase in the ability to induce cell death of using Herceptin **and** X-ray treatment compared with using Herceptin only.

Show your working.

..... [2]

- (c) A second experiment investigated the effect of increasing doses of X-rays on the survival of breast cancer cells in the presence and absence of Herceptin. The results are shown in Fig. 4.2.

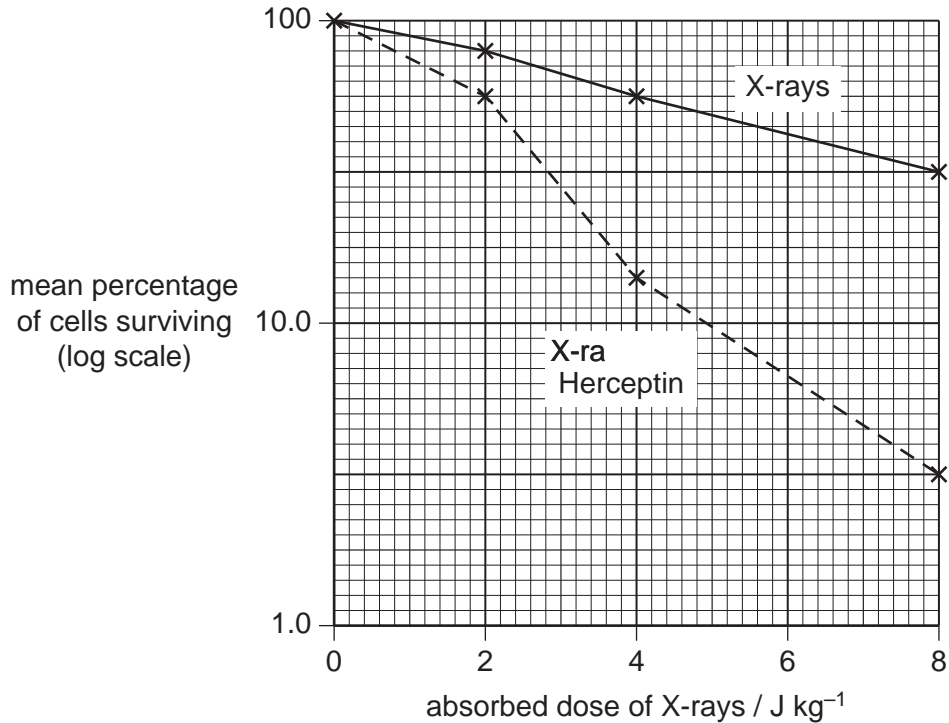


Fig. 4.2

With reference to Fig. 4.2,

- (i) compare the effects of increasing doses of X-rays on cells in the presence and absence of Herceptin

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- (ii) suggest an explanation for the effect of Herceptin.

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2 Fig. 4.1 is a diagram of a bacterium.

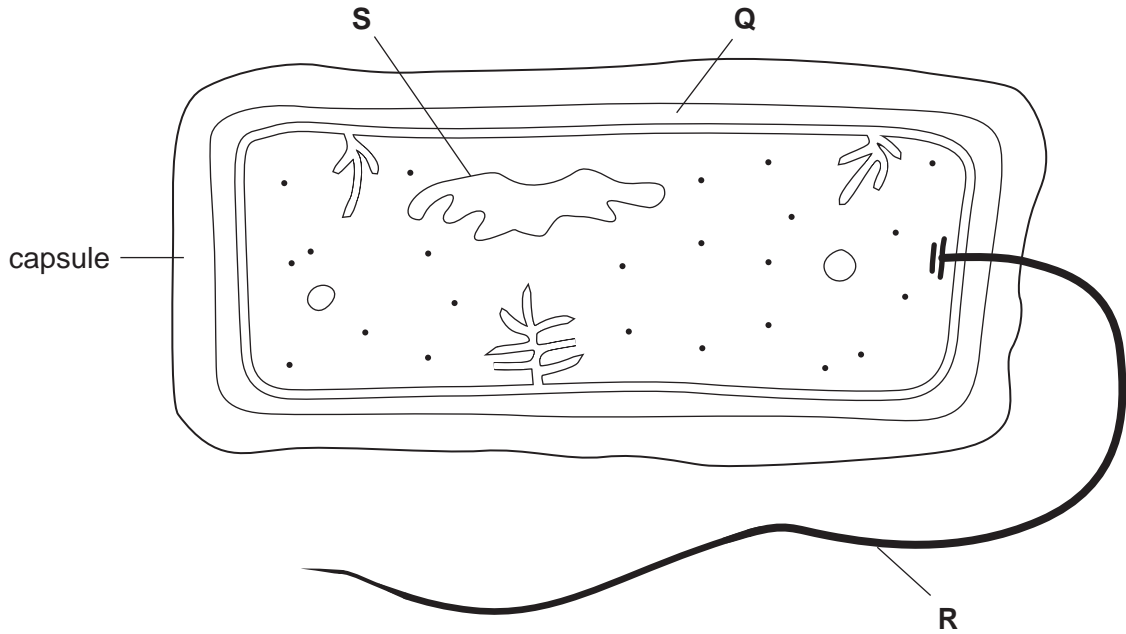


Fig. 4.1

(a) Name structures **P** to **S**.

Q

R

S[3]

(b) State the names of three structures that are present in a phagocyte from a mammal that are **not** present in bacteria.

1

2

3[3]

Tuberculosis (TB) is an infectious disease caused by a bacterium.

(c) (i) Name the bacterium that causes TB.

.....[1]

(ii) Describe how TB is transmitted from infected to uninfected people.

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Antibiotics are used in the treatment of people with TB. The usual procedure is for people with TB to take a mixture of three or four antibiotics for up to a year.

(d) Explain why it is necessary to give people with TB this type of treatment.

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[Total : 12]

- 3 Fig. 5.1 is a drawing of a section of a liver lobule that has been injected with ink. The Kupffer cells are clearly visible as a result of taking up carbon particles from the ink by phagocytosis.

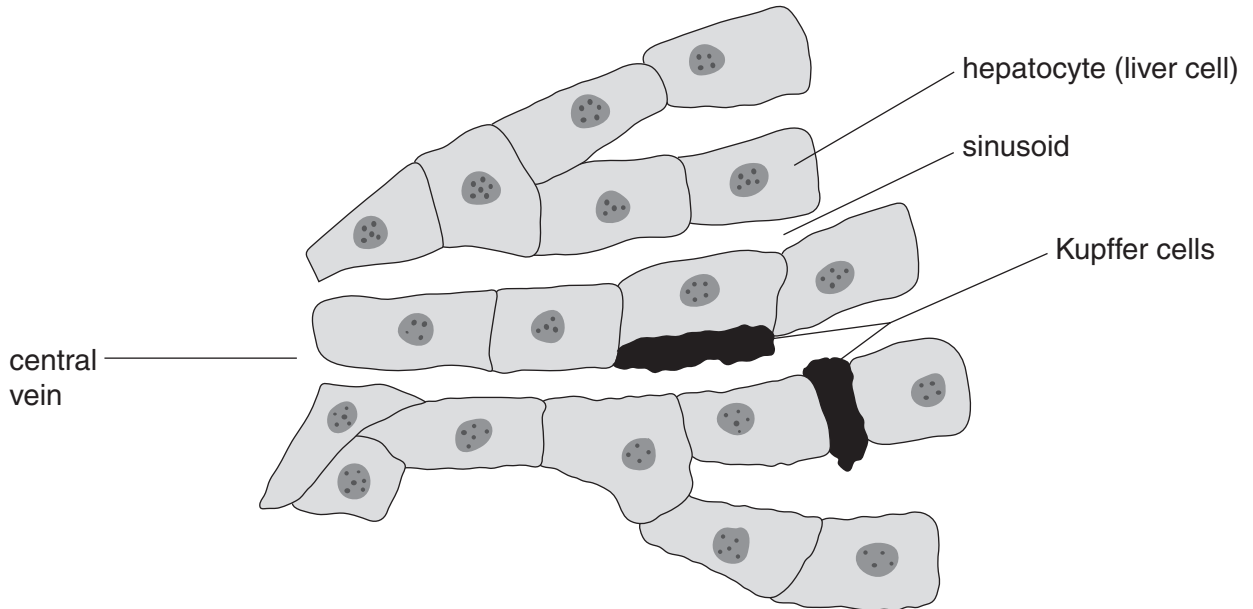


Fig. 5.1

- (a) The Kupffer cells remove damaged red blood cells from the blood in the sinusoids. Explain what happens to the haemoglobin.

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- (b) Describe how excess amino acids are deaminated by the hepatocytes.

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(c) Outline the function of the hepatocytes in detoxification of a **named** toxic compound.

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[Total : 10]

4 Fig. 3.1 is an electron micrograph of a type of B-lymphocyte called a plasma cell.

Plasma cells secrete antibody molecules.

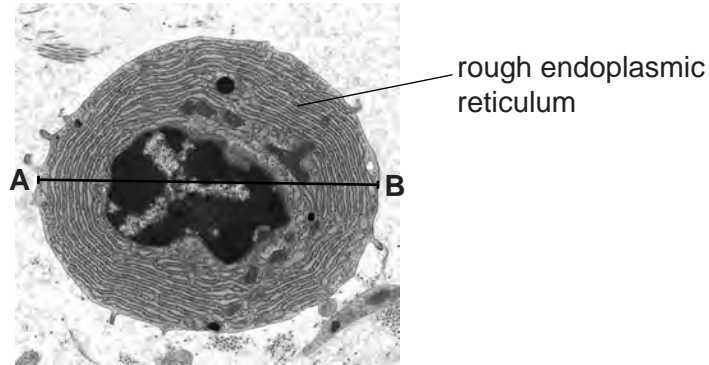


Fig. 3.1

(a) Suggest why plasma cells contain a large quantity of rough endoplasmic reticulum.

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.....[2]

(b) The diameter **A – B** of the plasma cell in Fig. 3.1 is 15 μm .

Calculate the magnification of Fig. 3.1.

Show your working.

magnification \times [2]

(c) Smallpox was the first disease to be eradicated by vaccination. The vaccine was effective for up to 10 years after one dose and did not require boosters within this time.

Name the causative organism (pathogen) of smallpox.

.....[1]

- (d) When a person received the smallpox vaccine, the numbers of plasma cells specific for the smallpox pathogen were measured from blood samples taken over a period of 35 days.

Fig. 3.2 shows how the numbers of smallpox-specific plasma cells changed during 35 days after vaccination.

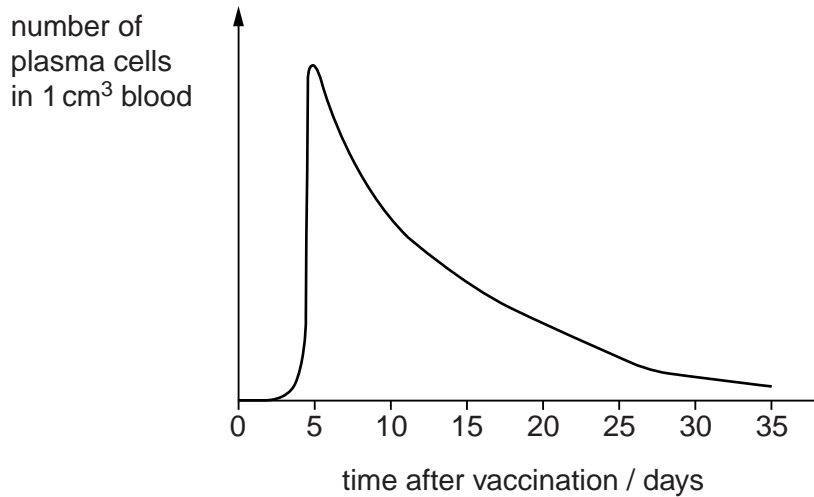


Fig. 3.2

Fig. 3.2 shows that the number of smallpox-specific plasma cells increases and then decreases within 35 days of vaccination.

Explain how a single dose of this vaccine can provide immunity for up to 10 years when the plasma cells are short-lived.

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.....[3]

- (e) State two reasons why the vaccination programme was successful in eradicating smallpox.

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.....[2]

- (f) State the type of immunity provided by the smallpox vaccine.

.....[1]