Infectious disease

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Infectious disease
Sub Topic	Infectious disease
Booklet	Theory
Paper Type	Question Paper 2

Time Allowed : **70 minutes**

Score : **/ 58**

Percentage : **/100**

Grade Boundaries:

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

1 **(a)** The summer squash plant produces fruit that are either white or yellow in colour and are either shaped like a disc or a sphere. The dominant phenotypes are white and disc-shaped fruit. Using the symbols **A** for white and **a** for yellow and **B** for disc and **b** for sphere, draw a genetic diagram to show what proportion of offspring will have yellow and sphere-shaped fruit if a white and disc-shaped fruit plant, heterozygous for both genes, is self-fertilised.

Sickle cell anaemia is a blood disease that is frequently fatal when homozygous. It is caused by an autosomal recessive allele. Heterozygotes have sickle cell trait and appear normal.

Malaria is a potentially fatal infectious disease of the blood caused by the protoctist, *Plasmodium*. In parts of the world where malaria is endemic the frequency of the sickle cell allele is high.

(b) Explain the possible health consequences, in such areas, for a person who is homozygous dominant and for a person who is homozygous recessive for the sickle cell allele.

(i) homozygous dominant for the sickle cell allele

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.....[1]

(ii) homozygous recessive for the sickle cell allele.

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(c) Explain why heterozygotes have a strong selective advantage in areas where malaria occurs.

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.....[3]

[Total: 11]

2 Complete the table below to show which of the five statements about disease apply to emphysema, tuberculosis, obesity, rickets and smallpox.

Fill in each box, using a tick (✔) to show that the statement applies or a cross (✘) if it does not.

statement	emphysema	tuberculosis	obesity	rickets	smallpox
eliminated by vaccination					
a worldwide infectious disease					
a form of malnutrition					
a deficiency disease					
involves degeneration of lung tissue					

[Total : 5]

3 Fig. 5.1 shows a section of lung tissue from a smoker. The image magnification is ×10.

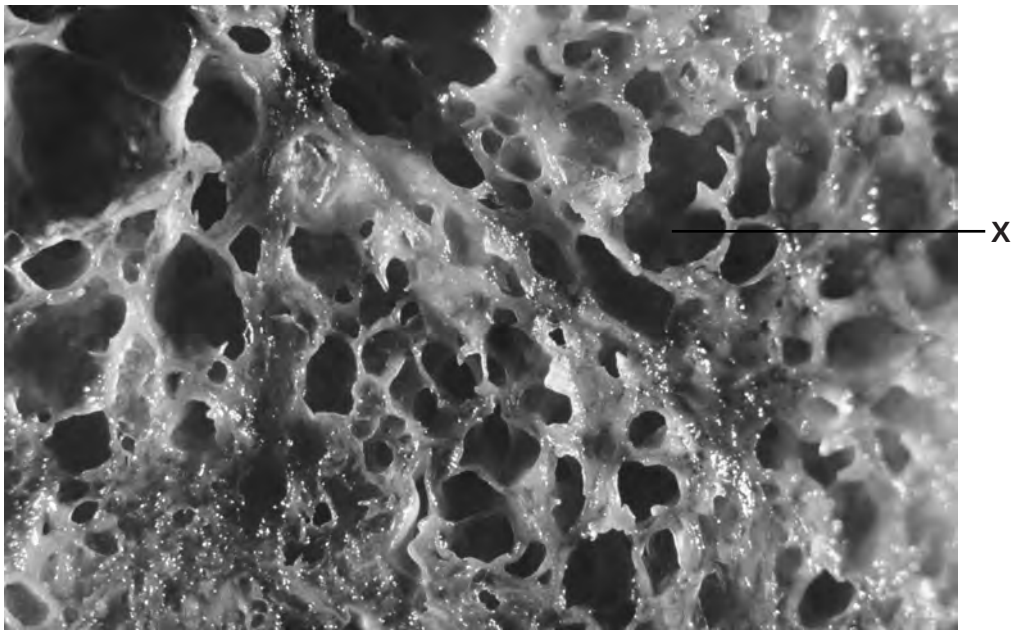

Fig. 5.1

In a smoker, the walls between the gas exchange structures in the lungs can break down, resulting in the damaged features visible in Fig. 5.1. One of these damaged features is labelled **X**.

(a) **(i)** Name the gas exchange structures which are damaged in Fig. 5.1.

.....[1]

(ii) Name the smoking-related disease resulting in the damaged feature labelled **X** in Fig. 5.1.

.....[1]

(b) Smoking-related diseases may increase the risk of infectious diseases of the gas exchange system.

Describe **and** explain how smoking can increase the risk of these infections.

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(c) From one cigarette, a smoker will inhale between 14 and 20 mg of carbon monoxide.

Describe the effects of carbon monoxide on haemoglobin.

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..... [2]

[Total: 7]

4 *Staphylococcus aureus* is a bacterium that is the cause of many different infectious diseases.

(a) Fig. 4.1 is a diagram of *S. aureus*.

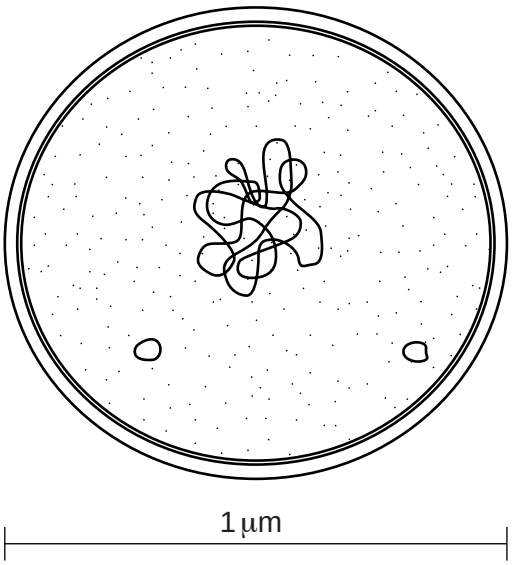

Fig. 4.1

(i) Cell structures, such as mitochondria, endoplasmic reticula (ER), Golgi apparatus, lysosomes and chloroplasts are found only in eukaryotic cells. These are not present in Fig. 4.1.

With reference to Fig. 4.1, describe **other features** that support the fact that *S. aureus* is a prokaryote.

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.....[3]

(ii) State the main difference in the composition of the plant cell wall compared to the bacterial cell wall.

plant cell wall .....

bacterial cell wall .....[2]

(b) Bacterial cells behave in a similar way to plant cells when immersed in solutions of different water potential.

Suggest **and** explain what would happen to bacteria placed in a solution with a water potential more negative than their cell contents.

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.....[3]

(c) Some strains of *S. aureus* have become resistant to one or more of the antibiotics used to treat infections.

The mechanisms of antibiotic resistance involve proteins, for example:

- enzymes to breakdown antibiotics
- membrane proteins that inactivate antibiotics
- membrane proteins that pump out antibiotics.

Explain why antibiotic resistance arises as a result of mutation.

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.....[2]

[Total: 10]

5 Diseases are either infectious or non-infectious.

(a) Complete Table 4.1 to produce a summary of four important infectious diseases.

Table 4.1

name of disease	type of causative organism	name of causative organism
cholera	bacterium	*Vibrio cholerae*
HIV/AIDS	virus	
malaria		
tuberculosis (TB)		*Mycobacterium tuberculosis*

[4]

(b) Typhoid is an example of an infectious disease.

Some features of typhoid include:

- caused by a bacterium that can only infect humans
- caused by the ingestion of contaminated food and water
- can be treated with drugs
- can be prevented by a vaccine.

(i) State which of the diseases named in Table 4.1 is transmitted in the same way as typhoid.

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(ii) State which type of drug can be used in the treatment of typhoid. Give a reason for your answer.

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..... [1]

(iii) Child vaccination programmes against typhoid in some countries have had considerable success. The numbers contracting the disease have decreased, not only in the vaccinated children, but also in other age groups that were not part of the programme.

Suggest explanations for this observation.

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..... [2]

(c) After infection, the ingested typhoid bacteria are engulfed by phagocytes.

(i) Explain why the phagocytes act only against the bacteria and not against human cells.

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(ii) Unlike other bacteria, the typhoid bacteria are able to survive and multiply within the phagocytes.

Suggest an explanation for this observation.

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(iii) Explain why people with HIV/AIDS are more susceptible to infections, such as typhoid.

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[Total: 14]

6 Fig. 4.1 shows a graph of the number of people, worldwide, estimated to be newly infected with the human immunodeficiency virus (HIV) in the years 1990 to 2008.

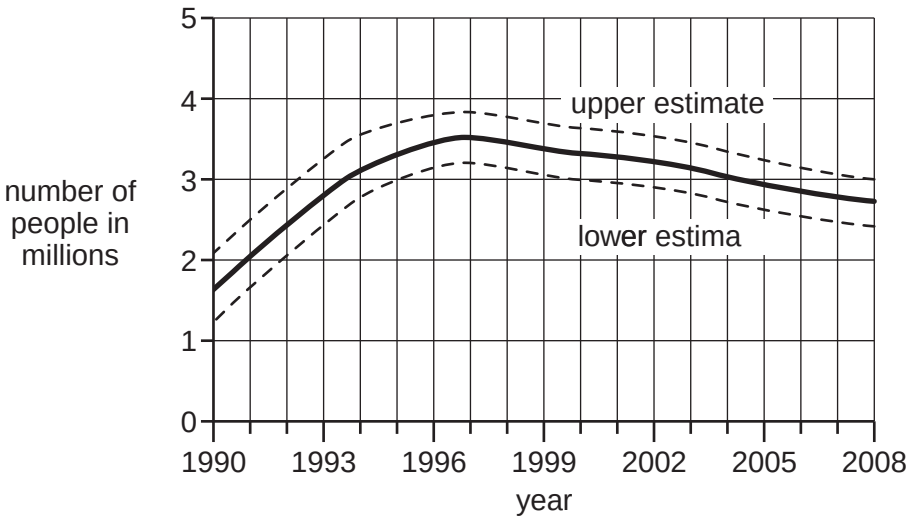

Fig. 4.1

(a) (i) Use the information in Fig. 4.1 to describe the changes in the number of people newly infected with HIV.

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(ii) Suggest possible explanations for the decrease in the number of people newly infected with HIV.

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..... [3]

(b) Explain why it was necessary to include the upper and lower estimates on the graph in Fig. 4.1.

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..... [1]

Fig. 4.2 shows a graph of the total number of estimated deaths due to HIV/AIDS over the same time period as the graph in Fig. 4.1.

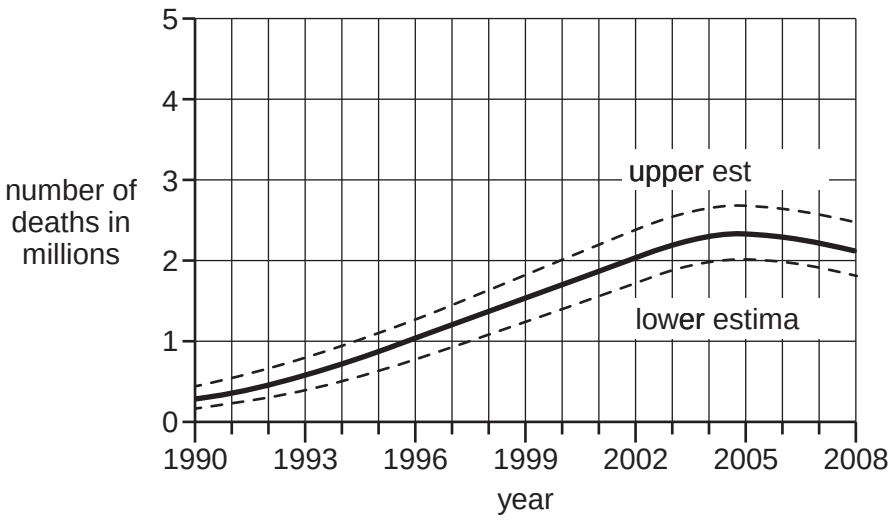

Fig. 4.2

(c) Use the information given in Fig. 4.1 **and** Fig. 4.2 to explain the relationship between new HIV infections and deaths due to HIV/AIDS.

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[Total: 11]