PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



EXAM QUESTION PACK

TOPIC 6: MICROBIOLOGY AND PATHOGENS

ACTION OF ANTIBIOTICS

SCORE	PERCENTAGE
/40	%

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Q1.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Bacteria are becoming increasingly resistant to antibiotics.

Controlling the spread of antibiotic resistance is necessary.

Many types of bacteria are resistant to penicillin and tetracycline.

(i) Which row of the table shows the part of a bacterial cell affected by these antibiotics?

(1)

		Penicillin	Tetracycline
☐	**A**	cell wall	cell wall
☐	**B**	cell wall	ribosome
☐	**C**	ribosome	cell wall
☐	**D**	ribosome	ribosome

(ii) Which row of the table describes the action of penicillin and tetracycline?

(1)

		Penicillin	Tetracycline
☐	**A**	bactericidal	bactericidal
☐	**B**	bactericidal	bacteriostatic
☐	**C**	bacteriostatic	bactericidal
☐	**D**	bacteriostatic	bacteriostatic

(Total for question = 2 marks)

Q2.

Bacteria are becoming increasingly resistant to antibiotics.

Controlling the spread of antibiotic resistance is necessary.

In an investigation, *E.coli* bacteria were isolated from animals reared for food and from some wild animals.

The mean percentage of the *E.coli* isolated from each type of animal that were resistant to different types of antibiotics was determined.

The table shows the results of this investigation, where n is the number of each type of animal.

Antibiotic	Mean percentage of resistant *E.coli* isolated from animals reared for food (%)			Mean percentage of resistant *E.coli* isolated from wild animals (%)	
	Broiler chicken n = 45	Village chicken n = 45	Cattle n = 12	Bat n = 13	Rodent n = 35
Ampicillin	50.00	8.89	8.33	0.00	8.57
Cephalothin	14.29	8.89	8.33	20.00	14.58
Chloramphenicol	46.43	0.00	0.00	0.00	0.00
Neomycin	50.00	2.22	25.00	0.00	5.71
Tetracycline	95.86	55.56	25.00	0.00	2.86

(i) Calculate the ratio of tetracycline-resistant *E.coli* in all the chickens to tetracycline-resistant *E.coli* in cattle.

(2)

Answer .....

(ii) There was a total of 2×10^8 *E.coli* isolated from cattle and 6×10^9 *E.coli* isolated from rodents.

Calculate how many more *E.coli* are resistant to cephalothin in rodents than in cattle.

(2)

Answer .....

(iii) Antibiotics can be added to animal feed.

It is thought this use of antibiotics has contributed to the spread of antibiotic resistance.

Evaluate the extent to which the results of this investigation support this idea.

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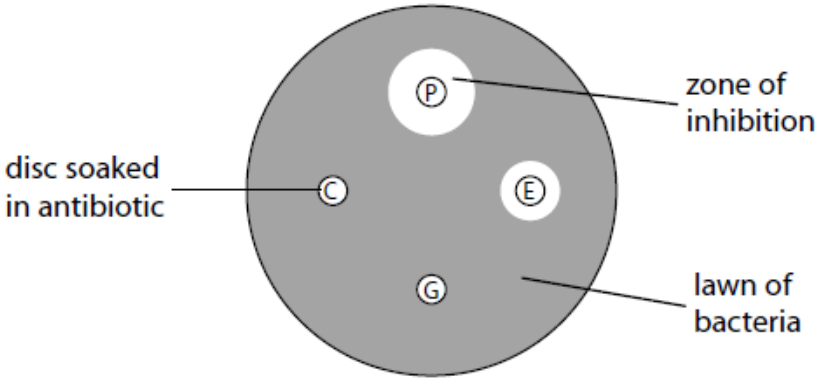
(Total for question = 8 marks)

Q3.

The resistance of one type of bacteria to a range of different antibiotics was investigated.

A lawn of bacteria was prepared by spreading a suspension of the bacteria over the surface of agar. Paper discs that had been soaked previously in different antibiotics were placed on top of the bacteria. The antibiotics were all the same concentration. The culture was incubated for 48 hours.

The diagram below shows the appearance of the culture after incubation.



Key:

C = chloramphenicol

E = erythromycin

G = gentamycin

P = penicillin

Explain why these results indicate that the bacteria must be Gram positive.

(3)

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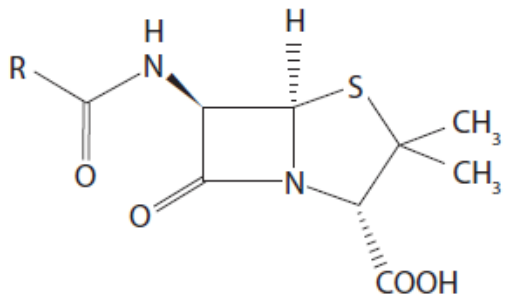
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(Total for question = 3 marks)

Q4.

Tetracycline and penicillin are two antibiotics that are commonly used to treat bacterial infections.

The diagram shows the structure of penicillin.



(a) Penicillin acts on bacterial cells by

(1)

☒ **A** inhibiting peptidoglycan cross-link formation in the cell wall

☒ **B** interfering with t-RNA carrying the amino acid methionine

☒ **C** preventing aerobic respiration by blocking the Krebs cycle

☒ **D** preventing t-RNA binding to ribosomes during protein synthesis

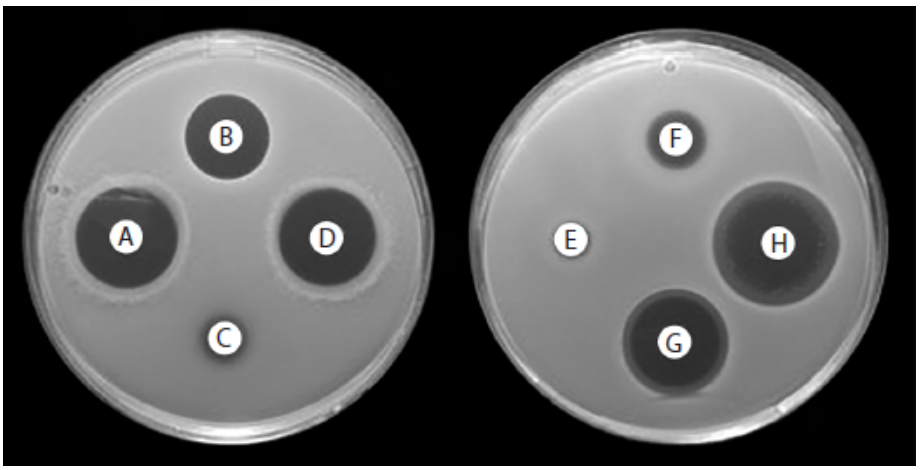
Q5.

A student read that more than half of raw chickens on sale in supermarkets are contaminated with bacteria from the genus *Campylobacter*.

Some species of *Campylobacter* cause food poisoning in humans.

The student carried out an experiment to test the effectiveness of various antibiotics against *Campylobacter*.

The photograph shows the student's agar plates at the end of the experiment.



The white circles labelled A–H are filter paper discs. These discs were soaked in different antibiotics then placed on the surface of the agar.

One of the antibiotics the student used was penicillin.
Describe the effect of penicillin on bacterial cells.

(3)

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Q6.

Describe the action of bactericidal and bacteriostatic antibiotics.

(2)

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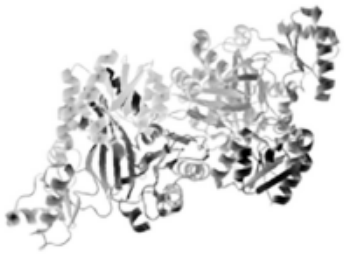
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(Total for question = 2 marks)

Q7.

Acetyl CoA is produced in the link reaction when pyruvate is broken down.

The photograph shows a molecule of the enzyme acetyl CoA carboxylase.



This enzyme is involved in the conversion of acetyl CoA into fatty acids.

The enzyme is activated by citrate.

Citrate does not bind at the active site.

Citrate is produced in the Krebs cycle.

The enzyme is inhibited by long chain fatty acyl CoA molecules.

Fatty acyl CoA molecules have a longer carbon chain than acetyl CoA.

The enzyme acetyl CoA carboxylase has a different structure in bacteria.

The enzyme in bacteria is made of several polypeptide subunits whereas in humans, the enzyme is one large polypeptide.

Inhibitors of the bacterial enzyme are being developed to treat bacterial infections.

Explain why inhibitors of the bacterial enzyme may be useful when treating bacterial infections.

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(Total for question = 2 marks)

Q8.

Cysteine proteases are enzymes found in fruits such as pineapples.

When a protease enzyme is added to fat-free skimmed milk, the milk turns from cloudy to clear.

Cysteine proteases are also found in the predatory bacterium *Bdellovibrio bacteriovorus* (BvB).

These bacteria are harmless to humans but prey on Gram negative bacteria.

(i) Give two differences between Gram negative and Gram positive bacteria.

(2)

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(ii) The cell of the predatory BvB is 1µm in length and can swim 100 times its length per second.

Calculate the swimming speed of this bacterial cell in mm s^{-1}.

(2)

Answer .....

(iii) The BvB bacteria have been described as 'living antibiotics'.

Explain why the BvB bacteria might be useful in the future for treating bacterial infections.

(2)

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(Total for question = 6 marks)

Q9.

Antibiotics have been developed to control bacterial infections.

(a) Name **one** bacterium which causes symptoms of infection by producing exotoxins.

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(b) Explain how an antibiotic has a bacteriostatic effect on bacteria.

(2)

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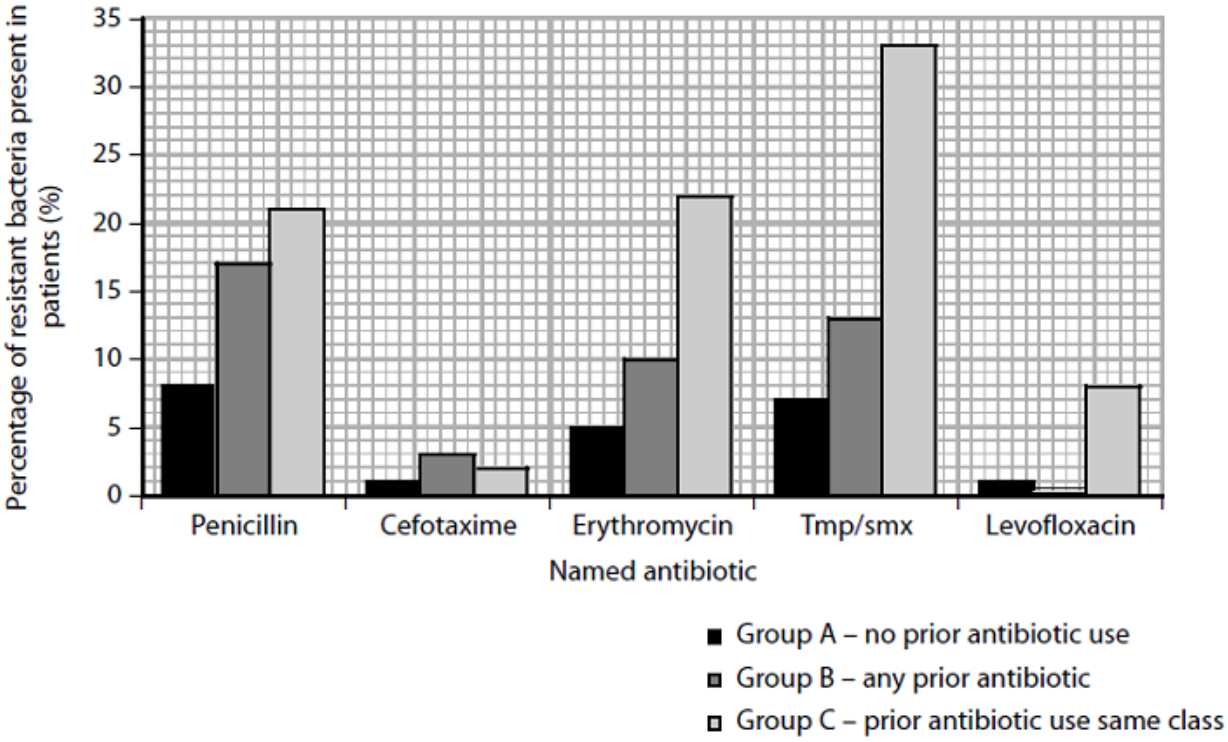
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*(c) Bacterial resistance to common antibiotics is an increasingly serious problem facing doctors treating a wide range of infections.

The graph below shows the percentage of resistant bacteria in patients being treated with antibiotics for *Streptococcus pneumoniae* infections.

Group A had never been given antibiotics.
Group B had been previously treated with other antibiotics.
Group C had been previously treated with the named antibiotic.



Analyse the data and use your knowledge of antibiotic resistance to evaluate the claim that soon doctors will be unable to treat most common bacterial infections with antibiotics.

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(Total for question = 12 marks)

Q10.

Antibiotics are widely used to treat infections.

Some antibiotics are bactericidal.

State what is meant by the term bactericidal.

(1)

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(Total for question = 1 mark)