PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 6: MICROBIOLOGY AND PATHOGENS

ACTION OF ANTIBIOTICS

SCORE	PERCENTAGE
/40	%

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(i)	**The only correct answer is B** *A is incorrect because tetracycline targets the ribosomes* ***C** is incorrect because tetracycline targets the ribosomes and penicillintargets the cell wall* ***D** is incorrect because penicillin targets the cell wall*		(1)
(ii)	**The only correct answer is B** *A is incorrect because tetracycline is bacteriostatic* ***C** is incorrect because tetracycline is bacteriostatic and penicillin isbactericidal* ***D** is incorrect because penicillin is bactericidal*		(1)

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	• number of chicken and cattle with resistant *E.coli* (1) • ratio given (1) **OR** • mean percentage of resistant bacteria in chickens calculated (1) • ratio given (1)	Example of calculation: (43 + 25) 68 chickens and 3 cattle 22.67 : 1 / 22.7 : 1 / 23 : 1 / 1 : 0.04 (95.86 + 55.56) ÷ 2 = 75.71 (75.71 : 25.00 =) 3.03 : 1 / 3 : 1 **ACCEPT** 1 : 0.33 / 1 : 0.3 / 1 : 1 **NB** correct answer with no working gains two marks {6.06 : 1 / 6.1 : 1 / 6 : 1 / 1 : 0.17 / 1 : 0.2} = 1 mark	(2)

Question Number		Additional Guidance	Mark
(ii)	• mean number of resistant bacteria for cattle or rodents calculated (1) • answer (1)	Example of calculation: 8.33% of $2 \times 10^8 = 16.66 \times 10^6$ **OR** 14.58 % of $6 \times 10^9 = 87.48 \times 10^7$ 53 / 52.5 / 52.51 (times more) 8.6×10^8 / 8.58×10^8 / 858 140 000 etc (more bacteria) correct answer with no working gains two marks	(2)

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to four of the following: • (idea supported because) overall there are more resistant bacteriain the animals reared for food (1) • (idea not entirely supported because) the bacteria in wild animalsare more resistant to cephalothin (1) • the number of animals in each group is very small (1) • the number of different types of {animal / antibiotic} is limited (sodata may not be representative) (1) • no standard deviations shown so spread of data is unknown (1)	**ACCEPT** other quoted data to illustrate exception **ACCEPT** validity of data	(4)

Q3.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • there is a zone of inhibition around the penicillin disc / because penicillin only affects Gram positive bacteria (1) Plus two from the following points: • because it has a thick cell wall (1) • because penicillin interferes with formation of cross links (1) • during synthesis of new cell wall (1) • this results in bacteria being susceptible to osmotic shock (1)		**(3)**

Q4.

Question Number	Answer	Additional guidance	Mark
	A (inhibiting peptidoglycan cross-link formation in the cell wall)		**(1)**

Q5.

Question Number	Acceptable Answer	Additional Guidance	Mark
	A description that makes reference to the following: • inhibits formation of (new) crosslinks in peptidoglycan in cell wall (1) • causing lysis of cell due to osmotic pressure (1) • therefore penicillin is bactericidal (1)		**(3)**

Q6.

Question Number	Acceptable Answer	Additional guidance	Mark
	A description that makes reference to the following: • bactericidal kills by affecting structure of the cell membrane/cell wall (1) • bacteriostatic prevents reproduction by affecting DNA replication (1)		**(2)**

Q7.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of thefollowing: • an inhibitor of the bacterial enzyme may not affect thehuman one (1) • description of effect of treatment eg fatty acids not madeso {less respiration / bacteria die} (1) • so that there will be fewer side effects if used as atreatment for infections (1)	Allow enzymes are specific Allow is an effective antibiotic	**(2)**

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to two of the following: • Gram positive bacteria have more peptidoglycan than Gram negative bacteria (1) • Gram positive stains {purple / blue} (with Gram stain), but Gram negative do not stain {purple / blue} (with Gram stain) (1) • Gram positive contains {teichoic acid / lots of murein} but Gram negative do not (1) • Gram positive have no {periplasmic space /outer membrane} but Gram negative do (1)	Allow Gram positive have a thicker cell wall thanGram negative Allow Gram positive stains {purple / blue} (withGram stain), but Gram negative stain red (with Gram stain) Allow Gram positive have low {lipid / phospholipid} content but Gram negative havehigh {lipid / phospholipid} content	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • conversion of micrometres to mm (1) • calculation of speed (1)	Example calculation 1µm = 0.001 mm 0.001 x 100 = 0.1 (mm s^{-1}) Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to two of the following: • BvB can kill gram negative bacteria (1) • without side effects for humans (1) • therefore could be useful when treating resistant bacterialinfections (1)	Allow bacteria cannot become resistantto BvB	**(2)**

Q9.

Question Number	Correct Answer	Additional guidance	Mark
(a)	*Staphylococcus* spp.		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: • the number of living bacteria does not increase (1) • because cell division is prevented (1)	Accept more sophisticated answers that give details of how cell division is prevented	**(2)**

Question Number	Indicative content
***(c)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Candidates are expected to reach a decision/conclusion on whether the development of bacterial resistance is so serious and rapid that antibiotics will become ineffective in the treatment of the majority of bacterial infections. • Prior use of antibiotics increases the percentage of resistant bacteria, supported by quantitative data • Prior use of the named antibiotic has the greatest effect, supported by quantitative data • Increasing use of antibiotics increases selection pressures so more resistant strains • Shows understanding that resistance mechanisms are inherited by sexual means and lateral gene transfer, e.g. via plasmids and this means they can spread rapidly and in some cases across species • Bacteria have high reproduction rates and mutations more likely within a short time • Understands current methods used to limit increase in resistant strains such as strict controls on antibiotic prescribing, problems of ensuring patients complete course of treatment when symptoms disappear, limit use of antibiotics in animal husbandry etc. • Comments on difficulties of developing new drugs • Methods of preventing spread of resistant strains especially hospital infection • Movement of humans means that transfer of resistant strains will spread to

Level	Mark	Descriptor
	0	No rewardable material
Level 1	1-3	Provides little or no reference to a range of scientific ideas, processes, techniques and procedures. Scientific argument may be attempted, but fails to link biological concepts and/or ideas in order to support decision/conclusion. Limited attempt to address the question.
Level 2	4-6	Scientific reasoning occasionally supported through the linkage of a range of scientific ideas, processes, techniques and procedures. Scientific argument is partially developed. Attempts to synthesise and integrate relevant knowledge with linkages to biological concepts and/or ideas, leading to a notional scientific argument or decision/conclusion based on evidence.
Level 3	7-9	Scientific reasoning supported throughout by sustained linkage of a range of scientific ideas, processes, techniques or procedures. Scientific argument is well developed and logical. Demonstrating throughout the skills of synthesising and integrating relevant knowledge with consistent linkages to biological concepts and/or ideas, leading to nuanced and balanced scientific argument or decision/conclusion based on evidence.

Q10.

Question Number	Answer	Additional Guidance	Mark
	{kills / destroys} bacteria	**Do not accept** causes lysis / affects cell wall synthesis	**(1)**