PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 6: MICROBIOLOGY AND PATHOGENS

ANTIBIOTIC RESISTANCE

SCORE	PERCENTAGE
/32	%

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Mark Scheme

Q1.

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)

Q2.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • antibiotics are only prescribed if the illness could be caused bybacteria / antibiotics not prescribed if the illness is caused by viruses only (1) • because antibiotics acts as a selection pressure for resistant bacteria (1)	**ACCEPT** reduces the {use of antibiotics / exposureof bacteria to antibiotics} **ACCEPT** a description e.g. presence of antibioticwont be a selective advantage **DO NOT ACCEPT** immune	(2)

Q3.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • HIV mutates (1) • resistance to one drug but not to {all / others} (1)		**(2)**

Q4.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • *Salmonella* food poisoning can spread easily (1) • therefore early identification means quicker treatment and containment of infection (1) • so that the correct antibiotic can be used to help prevent spread of infection and prevent antibiotic resistance if wrong antibiotic used (1)		**(3)**

Q5.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: <u>Evaluation</u> • judgment clearly stated and supported by an argument (1) AND at least one from each argument for 4 marks		

	For • antibiotic H is the most effective therefore spraying might help to reduce food poisoning (1) • which could prevent wider spread of infection or contamination of other products (1) Against • bacteria may be inside the chicken so unaffected by spraying (1) • possibility of promoting antibiotic resistance / effects on gut flora of consumers (1) • experimental results may not be {valid due to molecular size and diffusion / reliable due to lack of replicates} (1) • experiment used harmless strain of *Campylobacter* so results may not apply to { pathogenic strain / other bacteria that also cause food poisoning } (1)		**(5)**

Q6.

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.

Q7.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • there are more types of {penicillin / tetracycline / older antibiotic} (1) • because there has been more time for resistant strains to appear (1) • vancomycin has only one type (1) • because it has taken {a long time / 27 years} for the resistant strains to appear (1) • there is one type of {linezolid / daptomycin / younger antibiotic} (1) • because there has been less time for resistant strains to appear (1)	**Do not accept** immune	**(5)**