PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



MARK SCHEME

TOPIC 5: HEALTH, DISEASE AND THE DEVELOPMENT OF MEDICINES (PAPER 1, PACK 1)

SCORE	PERCENTAGE
/110	%

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	An explanation including **four** of the following: • by natural selection / evolution (1) • mutation in the bacterium /variation in the population (1) • only the resistant bacteria **survived treatment by antibiotics /** resistant bacteria survive when people **don't finish the course** (1) • the resistant bacteria {reproduce / divide} (1) • offspring inherit the resistance / resistance passed onto future generations / process repeats increasing level of resistance (1)	accept *Klebsiella* for bacteria accept they evolve accept some bacteria have a **{gene/allele}** for antibiotic resistance accept non-resistant bacteria killed **by antibiotics** ignore offspring are identical	**(4)** **A02 1**

Question number	Answer	Additional guidance	Mark
(ii)	people not completing their course of antibiotics/overuse of antibiotics	accept acted as a selection pressure accept being used to treat viruses/examples ignore misuse unqualified	**(1)** **AO1 1**

Question number	Answer	Mark
(iii)	B it does not have a nucleus **The only correct answer is B** ***A*** *is incorrect because prokaryotic cells do not have chloroplasts* ***C*** *is incorrect because prokaryotic cells have ribosomes* ***D*** *is incorrect because prokaryotic cells can reproduce without a host*	**(1)** **AO1 1**

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Q2.

Question number	Answer	Additional guidance	Mark
(i)	A comparison including **three** of the following: • the number of transplants needed increased rapidly but the number of donors {only increased slightly /remained low} (1) • from {2014 / 2015} the numbers of transplants required decreased (1) • the number of donors available was always lower than the number of transplants needed (1) • comparison of figures from the graph of the number of people needing an organ and donating an organ (1)	 accept peaked in {2014 / 2015} accept there are not enough donors for the transplants needed accept a comparative mathematical manipulation of the data	**(3)** **AO3 2ab**

Question number	Answer	Mark
(ii)	not enough donors are available / to increase the number of organs for donation / to meet the demand for organ transplants	**(1)** **AO3 2b**

Q3.

Question number	Answer	Mark
(i)	gonorrhoea	**(1)** **AO3 1a**

Question number	Answer	Additional guidance	Mark
(ii)	(66 000 000 ÷ 1000) = 66 000 (1) (66 000) x 3.7 =244 200 (people) or (3.7 ÷ 1000) = 0.0037 (1) (0.0037) x 66 000 000 = 244 200 (people) or (66 000 000 x 3.7) = 244 200 000 (1) (244 200 000 ÷ 1000) = 244200	award full marks for correct answer no working accept answers in standard form accept 244200 to any incorrect magnitude for one mark	**(2)** **AO2 1**

Question number	Answer	Additional guidance	Mark
(iii)	Any one from: • it is {**passed/spread**} from **person to person** (1) • caused by bacteria (1)	 accept **spread** by {sexual contact / body fluids} accept pathogen ignore caused by a virus	**(1)** **AO1 1**

Question number	Answer	Additional guidance	Mark
(iv)	Any one from: • avoid sexual contact (1) • use a {condom/femidom} (1) • screen people for an infection (1) • treat the infection/give antibiotics (1)	 accept use a barrier form of contraception ignore protection / contraception	**(1)** **AO2 1**

Question number	Answer	Additional guidance	Mark
(v)	An explanation including the following: • it is {killed/inhibited} by antibiotics (1) • because chlamydia is caused by bacteria (1)	 accept disrupt cell processes (in bacteria) /prevent (bacteria) reproducing accept antibiotics are used to kill bacteria for 2 marks	**(2)** **AO2 1**

Q4.

Question number	Answer	Additional guidance	Mark
	• 830 mm = 0.83 m (1) • 0.83/0.99 = 0.8383... = 0.84 to two d.p. (1) OR • 0.99 m = 990 mm (1) • 830/990 = 0.8383... = 0.84 to two d.p. (1) • Answer must be given to 2 decimal places	award full marks for correct numerical answer without working	**(2)**

Q5.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) $72 \div 1.81^2$ evaluation (1) = 21.977 / 21.98 / 22 3 s.f. (1) 22.0	accept $72 \div 3.2761$ award 2 marks for correct evaluation award full marks for correct numerical answer without working accept 21.9 for 2 marks	**(3)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	• the BMI shows male A is overweight but his waist:hip ratio {shows he is not abdominally obese / is below 0.9/is healthy} (1) • male A's weight distribution is not around the {vital organs/abdomen} (1)	 accept male A's weight is distributed evenly over the body accept more weight on the hips than the waist accept mass for weight	**(2)** AO 3 2a AO 3 2b

Q6.

Question number	Indicative content	Additional guidance	Mark
(i)	Substitution (1) 21.00 x 11.18 Evaluation (1) 234.78 3 significant figures 235	award full marks for correct numerical answer without working award 2 marks for correct evaluation ecf for the incorrect calculation correctly rounded to 3 s.f.	**(3)** **AO3 1a 1b**

Question number	Indicative content	Additional guidance	Mark
(ii)	One from: • each country has a different size population (1) • allows comparisons to be made between countries (1)	 ignore it is easier to read/easier to analyse	(1) AO3 1a

Question number	Indicative content	Additional Guidance	Mark
(iii)	One from: • vaccination (1) • {reporting/diagnosis} systems (1) • {access to/quality of} healthcare (1) • environmental factors (1)	 accept examples of relevant environmental factors e.g. population density, proximity of country to others. (1) accept herd immunity (1)	(1) AO2 1

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	(8 x 4) = 32 (grams of alcohol) (1) 1.2 / 1.20 (x risk)	award full marks for the correct answer with no workings	(2) AO3

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer including two from: • mutations in DNA (1) • cell division is uncontrolled (1) • leading to the formation of a tumour / growth / mass of cells (1)	 accept change in the gene/cell mutates accept {rapid / continuous} cell division	**(2)** **AO2 1**

Q8.

Question Number	Answer	Additional guidance	Mark
(i)	An answer including **two** from: • (communicable) is passed from **person to person** (1) • (communicable) caused by {pathogens / example of pathogen} (1) • (communicable diseases) cannot be inherited (1)	 accept reverse arguments for non-communicable diseases	**(2)** **AO1 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation including: • {cough / sneeze} into a tissue / avoid close contact with infected people / avoid cramped living conditions (1) • because spread of TB is airborne droplets / TB is spread through the air (1) **OR** • vaccination / immunisation (1) • to provide immunity / reduces the chance of a person getting infected (1) **OR** • treat infected people with **antibiotics** (1) • reduces the number of infected people (1)	 accept regular hand washing / wear a mask / isolate an infected person accept spread by coughing / breathing it {in / out} accept reduces the chances of contact with an infected person	**(2)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(iii)	• suitable heading for each column, with country in the left column (1) • all data entered accurately (1)	accept country / region / number of people / people with TB countries can be entered in any order	**(2)** **AO2 1**

Q9.

Question number	Answer		Mark
(i)	An answer including three from: • (cells are triggered to divide) by mitosis (1) • this division is uncontrolled (1) • creates a mass/large number of cells /tumour (1)	accept cells won't stop dividing/faster cell division/increased cell division	(3) AO2 1

Question number	Answer	Mark
(ii)	C interphase **The only correct answer is C** ***A** is not correct because the DNA is not replicated in anaphase* ***B** is not correct because the DNA is not replicated in prophase* ***D** is not correct because the DNA is not replicated in telophase*	(1) AO1 1

Question number	Answer	Additional guidance	Mark
(iii)	An answer combining: • 1 in 20 is a rate of 5% (1) • obesity increases the risk of bowel cancer more (than other types of cancer) (1)	accept 13% is 1 in 8/1 in 7.7 accept other correct manipulation of figures accept obesity is less of a contributing factor to other types of cancer	(2) AO3 2a+ 2b

Q10.

Question number	Answer	Additional guidance	Mark
	An answer linking three from: • (pathogens have) antigens (1) • (that trigger) antibodies to be produced (1) • by lymphocytes (1) • (leads to the) destruction of the pathogen (1) • memory {cells/ lymphocytes} produced (1) • cause a secondary response (in the event of infection by the same pathogen) (1)	accept bacteria/virus for pathogen ignore WBC accept engulf pathogen accept description of a secondary response e.g. before symptoms/before the person gets ill/can react quickly	**(3)** **AO1 1**

Q11.

Question number	Answer	Additional guidance	Mark
	An answer including: • surgery to treat narrow or blocked arteries (1) • lifestyle changes including {healthy diet/more exercise} (1) • (life-long) medication to {prevent blood clots/reduce blood pressure/thin the blood} (1)	 accept by-pass surgery / stents / heart surgery / other relevant surgeries such as gastric bands accept examples of lifestyle changes e.g. stop smoking accept named medications used for cardiovascular disease	**(3)** **AO1 1**

Q12.

Question number	Answer	Additional Guidance	Mark
(i)	An answer including: • (statins) reduce the level of LDL cholesterol (1) • by 1.4 mmol per dm^3 / from 3.8 mmol per dm^3 to 2.4 mmol per dm^3	accept LDL cholesterol decreases accept idea that it decreases from 3.8 mmol per dm^3 to a lowest value of 2.3 mmol per dm^3 accept 1.5 mmol per dm^3	**(2)** AO3 (1a+1b)

Question number	Answer	Mark
(ii)	An explanation linking the following: • level of LDL increases after the medication is stopped (1) • Increases risk of {heart disease/heart attack/stroke/cardiovascular diseases/high blood pressure} (1)	**(2)** AO3 2a+2b

Q13.

Question number	Answer	Additional guidance	Mark
	A description including three of the following: • the antibiotic would go through a development phase (1) • pre-clinical (stage / trials) (1) • testing on animals / testing *in-vitro* / on cells (1) • clinical (stage / trials) (1) • testing on (healthy) volunteers / testing on patients (1) • double-blind trials (1)	accept examples of the development phase accept named animals accept a description of double-blind trials e.g. placebo and drug	**(3)** **AO2 1**

Q14.

Question Number	Answer	Mark
a(i)	**A** - bacterium	**(1)**

Question Number	Answer	Acceptable answers	Mark
a(ii)	A description to include two of the following points: Housefly carries a pathogen (1) housefly lands on (contaminated) faeces/animal waste (1) transfers dysentery /bacteria onto food (1) (infected) food eaten (1)	Ignore references to other types of disease transmission lands on food /infects the food	**(2)**

Question Number	Answer	Acceptable answers	Mark
a(iii)	An explanation to include the following points: Hydrochloric acid / HCl(1) in stomach (1) (acid) kills bacteria/ dysentry (1)	Both words needed for mark – stomach acid gets 1 mark for stomach. destroys/breaks down accept correct responses about antibodies/antitoxins for 1 mark	**(3)**

Question Number	Answer	Acceptable answers	Mark
(b)	an explanation to include two of the following points: mosquito is a vector (1) carries **protozoan/*Plasmodium*** (1) pierces skin (1) transfers (protozoan/*Plasmodium*) to blood (1)	Accept bites/injects/ sucks blood / feed on blood for pierces skin	**(2)**

Q15.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	the later that a person gives up smoking/the longer you smoke for the higher risk of lung cancer	ORA	**(1)**
(a)(ii)	9 (%)		**(1)**
(a)(iii)		2 marks for the correct bald answer	**(2)**

	500 000 x 9 (1) 100 = 45 000 (1)	if value other than 9 (2 – 14) inserted into correct equation ecf applies if calculation is correct	
(b)(i)	An explanation linking **two**of the following: • tobacco contains tar (1) • tobacco/tar contains carcinogens / causes mutations /is cancer forming (1) • nicotine in tobacco is addictive which makes it difficult to give up /causes people to smoke for longer (1)		**(2)**
(ii)	**A** ☒ carbon monoxide		**(1)**
(c)	An explanation including **three**of the following**:** • (stimulants) act at the synapse (1) • **more**neurotransmitters (1) • so speeds up neurotransmission(1)	Accept increases neurotransmitters Accept decreases reaction time/speeds up reactions/ speeds up brain activity	**(3)**

Q16.

Question Number	Answer	Additional guidance	Mark
	An explanation linking two of the following: • reduces the volume of the stomach (1) • so it reduces food intake (1) • so stored {fat/lipids} is used up (1)	 accept restricts the amount of food entering the stomach	**(2)** AO 2 1

Q17.

Question number	Answer	Mark
	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification - application of understanding (2 marks): • stent inserted into blood vessel and is expanded (1) • stent opens /widens blood vessel (1) • greater blood flow (through blood vessel) (1) • more oxygen delivered to body organ (1)	**(3)**

Q18.

Question Number	Answer	Additional guidance	Mark
	An answer linking three of the following: • exposure to the {toxin/antigen/ pathogen/bacteria} (1) • stimulates an **immune response** (1) • production of {(B)**lymphocytes** /antibodies} (1) • production of memory lymphocytes (1)	accept immunised /vaccinated accept antitoxins	**(3)** AO 2 1

Q19.

Question number	Indicative content	Mark
	AO1 • the gene that codes for human insulin is identified • in the human DNA • this is removed using a restriction enzyme • the plasmid of a bacterial cell is removed • using lysosomes/lysozyme • the plasmid is cut open • using (the same) restriction enzyme • leaving complementary sticky ends • the human gene is inserted into the bacterial plasmid • using the enzyme ligase • the plasmid is returned to the bacterial cell • the bacterial cell multiplies	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or underdeveloped. (AO1) • Presents and explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of scientific ideas is detailed and fully developed. (AO1) • Presents and explanation that has a well developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• A brief understanding of the removal of the human gene or how the bacterial cell is altered • The process described links to the next or a key aspect of the process
Level 2	3–4	• A brief understanding of both the removal of the human gene and the use of a plasmid / bacterial DNA / vector • Linked to the use of at least one correct enzyme
Level 3	5–6	• A clear understanding of the removal of the human gene, the use of the bacterial plasmid including one correct enzyme, and insertion of the (recombinant) plasmid into a bacterium • Linked to the correct enzymes for removal of the gene and the insertion into the plasmid AND the role of sticky ends

Level	Mark	Examples of answers
	0	No rewardable material.
Level 1	1–2	• The human insulin gene is inserted into the bacterial DNA - 1 • Cut the human insulin gene from a cell and insert it into the bacteria -2 • Cut the human insulin gene leaving sticky ends - 2
Level 2	3–4	• Cut the human insulin gene and cut a plasmid. Insert the gene into the plasmid DNA - 3 • Cut the human insulin gene and cut a plasmid with restriction enzymes. Insert the gene into the plasmid DNA - 4 • Remove the insulin gene using restriction enzymes and cut the plasmid with the same restriction enzyme, Use ligase to insert the gene into the plasmid - 4
Level 3	5–6	• Cut the insulin gene using a restriction enzyme that leaves sticky ends. Cut the plasmid DNA with the same restriction enzyme and insert the gene into the plasmid. Insert the recombinant plasmid back into the bacteria - 5 (no ligase) • Cut the insulin gene using a restriction enzyme. Cut the plasmid DNA with the same restriction enzyme and insert the gene into the plasmid. Insert the recombinant plasmid back into the bacteria – 5 (no sticky ends) • Cut the insulin gene using a restriction enzyme that leaves sticky ends. Cut the plasmid DNA with the same restriction enzyme to leave complementary sticky ends. Join the gene and the plasmid using ligase. Insert the recombinant plasmid back into the bacteria – 6

Q20.

Question number	Indicative content	Mark
	AO2 • gonorrhoea is spread by exchange of bodily fluids / sexual contact • from mother to child during childbirth • barrier contraception methods/condoms will reduce spread • abstinence prevents infection • screening for infections • contact tracing partners of infected individuals • education on the disease and ways to reduce its spread • treating infections with antibiotics **AO3** • number of cases in males higher than females • number of cases in males has increased since 2008 • number of cases in males has increased rapidly since 2010 • number of cases in females has increased since 2010 • rate of increases in cases is higher in men than women • comparative manipulation of data	**(6)** AO3/AO2

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information attempted but will be limited with focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3)
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3)
Level 3	5–6	• The explanation is supported through linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3)

Level	Mark	Additional Guidance
	0	No rewardable material.
Level 1	1–2	• A simple explanation that includes one aspect from the mechanism of spread, ways in which gonorrhoea can be prevented or how the number of people infected can be reduced by treatment (AO2) • A simple trend from the data (A03)

General additional guidance – the decision within levels The explanation of how Gonorrhoea is transmitted and infection rates reduced drives the level choice. The graph references decide the mark within the band
Level 1
<u>Possible candidate responses</u> • Gonorrhoea is spread by sexual contact/the exchange of body fluids • The spread of gonorrhoea can be prevented by using a condom/barrier contraception/abstinence • The number of people diagnosed with gonorrhoea has increased • More men are diagnosed with gonorrhoea than women • The number of cases in men and women are both rising • The number of cases in males is rising faster than the number of cases in females.

Level	Mark	Additional Guidance
Level 2	3–4	• An explanation that includes at least two aspects from the mechanism of spread, ways in which gonorrhoea infection can be prevented or how the number of people infected can be reduced by treatment (AO2) • The explanation makes reference to at least one trend in the graph including numerical values of relevant years or numbers of people diagnosed (AO3)

General additional guidance – the decision within levels The explanation of how Gonorrhoea is transmitted and infection rates reduced drives the level choice. The graph references decide the mark within the band
Level 2
<u>Possible candidate responses</u> • Gonorrhoea is spread by sexual contact/the exchange of body fluids and it's spread can be prevented by using a condom/barrier contraception/abstinence. The number of cases in males has increased since 2008 and rapidly since 2010 • Gonorrhoea is spread by sexual contact/the exchange of body fluids and because it is a bacterial infection it can be treated with antibiotics. The number of people diagnosed is increasing, for women 5000 people were diagnosed in 2010 and 8000 in 2014 • Gonorrhoea is spread by sexual contact and educating people about the disease and the use of condoms will prevent it spreading. The number of cases diagnosed is increasing. In 2014 26000 men were diagnosed and 8000 women

Level	Mark	Additional Guidance
Level 3	5–6	• A detailed explanation that includes aspects from the mechanism of spread, ways in which gonorrhoea can be prevented and how the number of people infected can be reduced by treatment with antibiotics (AO2) • The explanation makes a comparison between data in the graph including either the difference in infection rates between men and women or indicates the rise in the numbers of people diagnosed (AO3)

General additional guidance – the decision within levels The explanation of how Gonorrhoea is transmitted and infection rates reduced drives the level choice. The graph references decide the mark within the band
Level 3
Possible candidate responses • Gonorrhoea is spread by sexual contact/the exchange of body fluids and it's spread can be prevented by using a condom/barrier contraception/abstinence. It is a bacterial infection, so it can be treated with antibiotics. The number of people diagnosed is increasing for men and women. For example, the number of cases in males has increased from 2008 to 2014 by 16 000. • Gonorrhoea is spread by sexual contact/the exchange of body fluids and educating people about the disease and the use of condoms will prevent it spreading. It is treated with antibiotics, but antibiotic resistance is becoming a problem. The number of people diagnosed is increasing for men and women. More men are diagnosed each year than women, for example, in 2014 8000 women were diagnosed and 26 000 men were diagnosed.

Q21.

Question number	Answer	Additional guidance	Mark
	An explanation linking the following: • HIV {destroys white blood cells / reduces the number of white blood cells} (1) • which compromises the immune system / making the person more susceptible to other {pathogens / infections / diseases} (1)	accept named white blood cells accept weakens the immune system ignore more susceptible to AIDS	**(2)** **AO2 1**

Q22.

Question number	Answer	Additional guidance	Mark
	An explanation linking four of the following: • people do not finish their course (of Colistin) (1) • natural selection /evolution (occurs) (1) • some bacteria have a mutation/ (genetic) variation (1) • (these) resistant bacteria survive /resistant bacteria reproduce (1)	accept overuse / repeated exposure (to the antibiotic) accept they have evolved accept some bacteria have a {**gene/allele**} for resistance accept the non-resistant bacteria die / the fittest bacteria survive ignore immune bacteria	**(4)** AO2 1

Q23.

Question number	Answer	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (2 marks): • penicillin prevents the bacteria from dividing as they cannot make a new cell wall (1) • because humans cells do not have a cell wall (1) • they are unaffected by penicillin (1)	**(3)**

Q24.

Question number	Answer	Mark
	cannot be transferred from one person to another	**(1)**

Q25.

Question Number	Answer	Additional guidance	Mark
	An explanation linking: • exercise {requires energy/ uses respiration} (1) • {obtain from/reducing} fat (1)	accept burns calories accept sweating causes water loss for 1 mark	**(2)** AO 1 1

Q26.

Question Number	Answer	Additional guidance	Mark
	An explanation linking the following: • HIV destroys white blood cells / HIV weakens the immune system (1) • so the body is unable to {destroy the TB pathogen / prevent the pathogen invading the body} (1)	accept people with AIDS have fewer white blood cells accept unable to produce antibodies to TB ignore fight off the disease	**(2)** **AO1 1**

Q27.

Question number	Answer	Additional Guidance	Mark
	An explanation linking three of the following: • they are immune (to *Clostridium tetani*) (1) • because the vaccination contained an antigen / bacteria have antigens (1) • **memory lymphocytes** (1) • leading to the production of antibodies (1) • leading to a **secondary** (immune) response (1)	accept idea of inactive/dead bacteria in the vaccine accept bacteria killed {faster/ quicker/quickly}	**(3)** AO2(1)

Q28.

Question number	Answer	Additional guidance	Mark
	An explanation linking: • BMI calculation takes into account height / divides mass by height^2 (1) • the obese man must be shorter / the normal man is taller (1)	ignore references to muscle mass accept BMI relies on measurements of height and weight/mass accept equation for BMI accept the men are different heights	**(2)** **AO2 1**

Q29.

Question Number	Answer	Mark
	World Health Organization / WHO	**(1)** **AO1 1**

Q30.

Question number	Answer	Mark
(i)	C	**(1)**

Question number	Answer	Mark
(ii)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via reasoning (2 marks): • male Q (1) • higher BMI / less exercise / higher fat intake (1) • so more risk of fatty deposits / plaques in arteries / atherosclerosis / restricted blood flow to heart (1)	**(3)**