PEARSON EDEXCEL GCSE BIOLOGY (HIGHER) · 1BI0

BIOLOGY



MARK SCHEME

TOPIC 5: HEALTH, DISEASE AND THE DEVELOPMENT OF MEDICINES (PACK 3)

SCORE	PERCENTAGE
/90	%

STEMUP

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Mark Scheme

Q1.

Question Number	Indicative content	Mark
	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 therefore not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **Lytic lifecycle** • viruses cannot replicate outside a host • virus binds to host cells • inserts genetic material into the host cell • use the cells machinery to produce viral proteins • use the cells machinery to produce nucleic acids • components assemble into new viral particles • viruses exit the cell through the host cell membrane • or causes lysis of the host cell • allows production of many virus particles **Spread of infection** • virus particles leave the host • virus released into body fluids • spread through airborne droplets/contact • allowing spread to another host	**(6)** AO 1 1

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 elements of biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an 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 the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Q2.

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**

Q3.

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**

Q4.

Question number	Answer	Additional guidance	Mark
	Any one from: • mammals may be harmed • drugs may affect other mammals in a different way(1)	other mammals systems work in a different way from humans	(1)

Q5.

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 <u>vector</u> (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)**

Q6.

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: <u>Hydrochloric</u> acid / <u>HCl</u>(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)**

Q7.

	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)	$\frac{500\,000 \times 9}{100}$ (1) = 45 000 (1)	2 marks for the correct bald answer if value other than 9 (2 – 14) inserted into correct equation ecf applies if calculation is correct	**(2)**
(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	Accept increases neurotransmitters Accept decreases reaction time/speeds up reactions/ speeds up brain activity	**(3)**

	neurotransmission(1)		

Q8.

	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)	$\frac{500\,000 \times 9}{100}$ (1) = 45 000 (1)	2 marks for the correct bald answer if value other than 9 (2 – 14) inserted into correct equation ecf applies if calculation is correct	**(2)**
(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)**

Q9.

Question Number	Answer	Acceptable answers	Mark
(i)	**D** ☒ nicotine		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	A explanation linking two of the following: cigarettes / tobacco / smoke contains tar (1) (tar) is **carcinogenic** / a **carcinogen** (1) leads to mutations in DNA (1)	 Ignore references to causes cancer / tumours accept: mutations in cells /rapid cell division	**(2)**

Question Number	Answer	Acceptable answers	Mark
(iii)	A explanation linking two of the following points: cigarette smoke contains carbon monoxide / carbon monoxide attaches to {red blood cells / haemoglobin}(1) which reduces the oxygen carrying capacity of {red blood cells/haemoglobin} (1) less oxygen to the muscles /reduced respiration in muscles / reduced muscle contraction (1) OR tar reduces the surface area of the lungs (1) so decreased gas exchange / less oxygen absorbed into the bloodstream (1) less oxygen to the muscles /reduced respiration in muscles / reduced muscle contraction (1)	 Accept {red blood cells / haemoglobin} carry less oxygen / forms carboxyhaemoglobin Accept: smoke particles for tar accept causing emphysema (1)	**(2)**

Q10.

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

Q11.

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

Q12.

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)**

Q13.

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

Q14.

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

Q15.

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

Q16.

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)

Q17.

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

Possible candidate responses

- 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

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. 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.

Q18.

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**

Q19.

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**

Q20.

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	**(4)** AO2 1

		/ the fittest bacteria survive ignore immune bacteria	

Q21.

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

Q22.

Question number	Answer	Mark
	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the Bunsen burner flame kills all microorganisms on the loop (1) • so only the desired bacteria are transferred to the loop/no unwanted microorganisms spread on the agar plate (1)	**(2)**

Q23.

Question Number	Answer	Additional Guidance	Mark
	An explanation linking: • the toothpastes were not harmful to the cells (1) • because the % of healthy cells after 2 hours was similar to saliva (1)	 accept toothpaste has the same effect as saliva accept toothpaste 2 is less harmful to cells accept a description of the data values to illustrate a similar effect	**(2)** **AO3 2a + 2b**

Q24.

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)**

Q25.

Question number	Answer	Mark
	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the CD4+ count is significantly below the normal range because the HIV has destroyed the {white blood cells/CD4+ cells} (1) • so the person is more susceptible to opportunistic infections and classified as having AIDS (1)	**(2)**

Q26.

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

Q27.

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

Q28.

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

Q29.

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**

Q30.

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**