National
Qualifications
2019

2019 Human Biology

Higher – Paper 1 – Multiple Choice

Finalised Marking Instructions

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Marking instructions for each question

Question	Answer	Mark
1.	D	**1**
2.	C	**1**
3.	A	**1**
4.	D	**1**
5.	C	**1**
6.	B	**1**
7.	B	**1**
8.	A	**1**
9.	C	**1**
10.	D	**1**
11.	A	**1**
12.	A	**1**
13.	B	**1**
14.	B	**1**
15.	C	**1**
16.	A	**1**
17.	C	**1**
18.	B	**1**
19.	D	**1**
20.	C	**1**
21.	B	**1**
22.	D	**1**
23.	D	**1**
24.	A	**1**
25.	B	**1**

[END OF MARKING INSTRUCTIONS]

National
Qualifications
2019

2019 Human Biology

Higher – Paper 2

Finalised Marking Instructions

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General marking principles for Higher Human Biology

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(c) Do not award half marks.

(d) Where a candidate makes an error in the first part of a question, award marks for subsequent answers that are correct with regard to this original error. Do not penalise candidates more than once for the same error.

(e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final answer (including units, if appropriate) on its own.

(f) Candidates should not use bulleted lists to answer extended-response questions. They must respond to the 'command' word as appropriate and provide extended answers to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.

(g) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.

(h) In the detailed marking instructions, words separated by/are **alternatives**.

(i) A correct response can be negated if the candidate includes:
- an extra, incorrect, response
- additional information that contradicts the correct response

(j) Where the candidate is instructed to choose one question to answer but instead answers two questions, mark both responses and award the higher mark.

(k) Unless otherwise required by the question, the use of abbreviations (for example DNA, ATP) or chemical formulae (for example CO_2, H_20) are acceptable alternatives to naming.

(l) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, do not penalise candidates repeatedly.

(m) If incorrect spelling is given, sound out the words.
- If the correct word is recognisable then award the mark.
- If the word can easily be confused with another biological term then **do not** award the mark, for example glucagon and glycogen.

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(n) Presentation of data:

- If a candidate provides two graphs, in response to one question, mark both and award the higher mark.
- If a question asks for a particular type of graph/chart and the candidate gives the wrong type, do not award full marks. Candidates cannot achieve the plot mark but **may** be able to achieve the mark for scale and label. If the x and y data are transposed, then do not award the scale and label mark.
- If the graph uses less than 50% of the axes then do not award the scale and label mark.
- If 0 is plotted when no data for this is given, then do not award the plot mark — candidates should only plot the data given.

(o) Only award marks for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify, name, give** or **state**, they need only answer or present in brief form
- **describe**, they must provide a statement as opposed to simply one word
- **explain**, they must provide a reason for the information given
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between topics being examined
- **calculate**, they must determine a number from given facts, figures or information
- **predict**, they must indicate what may happen based on available information
- **suggest**, they must apply their knowledge and understanding to a new situation

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Marking instructions for each question

Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	Pluripotent	**1**	
		(ii)	All genes are switched on/can be expressed/can be switched on **OR** No genes are switched off **OR** All proteins can be made by embryonic cells	**1**	Do not negate for all genes can be switched on or off. Do not accept all genes can be switched off on its own. Do not accept all genes <u>are</u> expressed.
	(b)		23	**1**	
	(c)		To study diseases/(genetic) disorders/drug testing. **OR** To study cell processes/cell growth/cell differentiation/gene regulation. **OR** As model cells.	**1**	Do not accept therapeutic uses such as for corneal repair or for growing skin.
	(d)		Embryos do not need to be used/ destroyed. **OR** It means a (potential) life does not need to be ended/destroyed.	**1**	

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Question			Expected response	Max mark	Additional guidance
2.	(a)		1. To separate/split the DNA/ strands. **OR** To break hydrogen bonds. **OR** To break bonds between the bases. **(1)** 3. Any temperature between 70 and 80. **(1)**	**2**	Accept to denature the DNA. Unzipping/unwinding the DNA negates.
	(b)		33	**1**	
	(c)		Stage 2 - (Primers) bind/attach to DNA/3'end/strands. **OR** Stage 2 – (Primers) bind/anneal/ attach to a complementary section/ target sequence/complementary nucleotides. **(1)** Stage 3 – (Primers) allow DNA/Taq polymerase to attach/start replicating/start copying/add nucleotides (to DNA). **(1)**	**2**	Answer must indicate link between the primer and DNA polymerase. Accept DNA/Taq polymerase adds nucleotides to primers.
	(d)		DNA can be amplified/copied/ replicated/multiplied.	**1**	

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Question			Expected response	Max mark	Additional guidance
3.	(a)		Acetyl group (is produced/present/ made). **(1)** Acetyl group combines with oxaloacetate to form citrate. **OR** Acetyl group enters the citric acid cycle. **OR** Acetyl group combines with coenzyme A to form acetyl coenzyme A. **(1)**	**2**	Acetyl coenzyme A entering the citric acid cycle/combining with oxaloacetate does not negate.
	(b)	(i)	It contains a different/wrong amino acid (in the enzyme). **OR** The shape of the enzyme/active site is changed.	**1**	Accept that the sequence of amino acids has changed/been altered. Do not accept that the sequence of amino acids after the mutation has changed/been altered. Do not accept the amino acids are altered.
		(ii)	Acetaldehyde/the toxic compound builds up/cannot be broken down (quickly). **OR** They are less efficient/slower at breaking down acetaldehyde/the toxic compound. **OR** They are less efficient/slower at forming/cannot form the non-toxic compounds.	**1**	Do not accept that they cannot fully break down alcohol on its own.
	(c)		It binds to/blocks/competes for the active site. **OR** It prevents the substrate/ acetaldehyde binding to the enzyme.	**1**	

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Question			Expected response	Max mark	Additional guidance
4.	(a)		1. Concentration/volume/mass/ dosage of supplement/placebo taken. 2. Time of day for exercise/taking the supplement/taking the placebo/testing. 3. Brand/type of supplement. 4. Other/additional (types of) exercise/training. 5. Number of times weight is lifted/ number of repetitions/time spent on training/intensity of training. 6. Food/fluid/other supplements/ medicines/drugs consumed. 7. Student health issues/smoking status/ethnicity **Any 2**	**2**	Only penalise the use of amount once. If candidate lists three or more variables and at least one is correct they can be awarded (**1 mark**). If all answers are correct award **(2 marks).**
	(b)	(i)	Axes have correct scales and labels. **(1)** Points correctly plotted and lines drawn. **(1)** Labels or key added to distinguish between group A/protein supplement and group B/placebo. **(1)**	**3**	Scales using one large box for 2 weeks on the X-axis and one large box for 10kgs on the Y axis are acceptable. Lines must go through all points. Only the X-axis scale must start at zero. If the axes are transposed the candidate loses the scale mark.

	Average maximum weight raised (kg)					
Time(weeks) / Group	0	2	4	6	8	10
A	52	57	64	72	86	95
B	50	55	60	68	74	80

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Question			Expected response	Max mark	Additional guidance
		(ii)	The protein supplement improved the ability (of leg muscles) to raise weights. **OR** The protein supplement allowed students to lift heavier weights/ more weight.	**1**	Do not accept the protein supplement improved performance. Answer must not simply describe the results.
		(iii)	Training/repeated use of apparatus/ use of weights.	**1**	Accept - the placebo effect/they believed they were taking the supplement.
	(c)		Group A/group taking the supplement had a greater increase in body mass compared to group B. **OR** Group A/group taking the supplement lost more fat compared to group B. **(1)** The change/increase in body mass must be due to muscle. **OR** The supplement/protein is used to synthesise/make muscle. **OR** This suggests body fat is being replaced by/converted to muscle. **(1)**	**2**	Accept group A/group taking the supplement gained 1·8kg/3% in body mass while group B gained 0·8kg/ 1·3% Accept group A/group taking the supplement lost 4·5% fat while group B lost 2·1%.

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Question			Expected response	Max mark	Additional guidance
5.	(a)		ATP is produced/released/given out/gained (by the cell)/removed (from the pathway)/lost (from the pathway).	**1**	Do not accept that there is a net gain of ATP.
	(b)		They remove/release hydrogen (ions)/electrons. **OR** They pass hydrogen (ions)/electrons to NAD.	**1**	Do not accept collects hydrogen (ions)/electrons. Accept H^+ for hydrogen ions. Accept H/H_2 for hydrogen. Accept e^- for electrons.
	(c)		Glucagon	**1**	Accept - adrenaline/epinephrine
	(d)		(No/less intermediate Q so) no/less nucleic acids/nucleotides/lipids. **(1)** Nucleic acids/nucleotides are needed for cell division/making chromosomes/DNA replication/ protein synthesis. **OR** Lipids are needed for membrane formation. **(1)**	**2**	

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Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	Any interstitial cell between the seminiferous tubules labelled with a T.	**1**	If no line is drawn, the letter T must be near or on the interstitial cells.
		(ii)	1. It stimulates/promotes sperm/ gamete production. **(1)** 2. It activates/triggers the prostate gland/seminal vesicles (to produce secretions). **(1)** 3. It inhibits/stops the production of FSH/ICSH/the pituitary gland. **(1)** **Any 2 from 3**	**2**	Accept – it triggers the development of (secondary) sexual characteristics. Accept specific examples such as growth of facial hair and deepening of voice. Do not accept – it triggers puberty. Do not accept negative feedback of the pituitary on its own. Do not accept LH in place of ICSH but additional use does not negate.
		(iii)	(Low levels of) testosterone fails to inhibit the <u>pituitary</u> gland. **(1)** (An increased concentration of) <u>ICSH</u> is released (by the pituitary gland). **(1)** <u>Interstitial cells</u> produce testosterone. **(1)** **Any 2 from 3**	**2**	Accept low levels of testosterone stimulate the <u>pituitary</u> gland. Use of FSH in addition to ICSH does not negate. Do not accept LH in place of ICSH.
	(b)		AI - several samples of <u>semen</u> are collected (over a period of time). **OR** Sperm/semen is injected directly into the (female) reproductive tract/vagina/uterus/womb. **(1)** ICSI – The (head of the) sperm is injected directly into the egg (to achieve fertilisation). **(1)**	**2**	Answer must indicate insertion of sperm/semen by artificial means.

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Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Similarity Both increase up to 28 years. **OR** Both decrease from 28 years. **OR** Both peak at 28 years. **(1)** Difference The pregnancy rate is (always) higher (than the birth rate). **OR** The birth rate is (always) lower (than the pregnancy rate). **OR** The pregnancy rate increases faster than the birth rate up to 28 years. **OR** The birth rate decreases to zero (at 46 years) while the pregnancy rate does not. **(1)**	**2**	Answers must relate to trends and not single points. Accept same age for 28 years.
		(ii)	350	**1**	
	(b)	(i)	36	**1**	
		(ii)	The women who donated the eggs will be younger. **OR** The (donated) eggs/they will be younger.	**1**	Answer must indicate a comparison. Accept – their eggs are older. Do not accept their eggs are newer.

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Question			Expected response	Max mark	Additional guidance
	(c)		PGD identifies genetic disorders/ chromosome abnormalities. **OR** A parent/family member has a genetic disorder/chromosome abnormality. **OR** Biological tests indicate a genetic disorder/chromosome abnormality. **OR** To ensure that the embryo/fetus/ baby/child does not have the genetic disorder/chromosome abnormality.	**1**	Accept genetic diseases/inherited diseases/genetic mutations/ genetic conditions for genetic disorders. Accept gene mutations/ chromosome mutations/genetic abnormalities for chromosome abnormalities. Do not accept answers that suggest PGD identifies risk/likelihood of having the genetic disorder.

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Question			Expected response	Max mark	Additional guidance
8.	(a)		An autosomal disorder/gene/allele/ mutation is not located on a sex chromosome while a sex-linked disorder/gene/allele/mutation is (located on a sex/X chromosome). **OR** An autosomal disorder/gene/allele/ mutation is located on autosomes/ chromosomes 1 to 22 while a sex-linked disorder/gene/allele/ mutation is located on the sex chromosomes/X chromosome. **OR** Autosomal disorders affect males and females (equally) while sex-linked disorders affect more males (than females).	**1**	Mention of the Y chromosome does not negate. Accept chromosome 23 for X chromosome.
	(b)	(i)	Aa	**1**	Only accept answers using 'a'.
		(ii)	You cannot tell the genotype (of Q and R). **OR** You cannot tell if they/Q and R are carriers/heterozygous/homozygous/ Aa/AA.	**1**	Accept – they can both have two dominant alleles or one recessive allele. Do not negate if the letters are wrong eg Tt
	(c)		Stem cells/bone marrow can start producing/produce/differentiate into lymphocytes/white blood cells.	**1**	Do not accept – bone marrow contains lymphocytes/white blood cells.
	(d)		Advantage – (amniocentesis has a) lower risk of miscarriage. **(1)** Disadvantage – (amniocentesis is carried out) later in the pregnancy. **(1)**	**2**	Answers must indicate a comparison. Accept – amniocentesis takes longer to get the results.

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Question			Expected response	Max mark	Additional guidance
9.	(a)		300	**1**	
	(b)		120	**1**	
	(c)		12 500	**1**	
	(d)	(i)	Cells are less sensitive to insulin/ resistant to insulin. **OR** Cells/they have fewer insulin receptors/have less sensitive insulin receptors/less effective insulin receptors. **(1)** They cannot convert/convert less glucose to glycogen. **OR** Less glucose is taken into the cells. **(1)**	**2**	Accept insulin receptors are desensitised. Answer must indicate the receptors are linked to insulin. Accept that it will take longer to convert glucose into glycogen.
		(ii)	Glucose/it is lost in urine/removed by the kidneys. **OR** Glucose/it is used in respiration/ in glycolysis/cell activities/to produce energy.	**1**	
	(e)		The man is able to produce insulin/ insulin is present. **OR** The (blood) insulin concentration increases/is high.	**1**	
	(f)		Exercise. **OR** Lose weight/fat.	**1**	Answers indicating insulin negate.

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Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	Men in England/English men	**1**	
		(ii)	Death rate is (always) higher in men/ lower in women. **OR** Death rate is (always) higher in Scotland/lower in England. **OR** English women have the lowest death rate/Scottish men have the highest death rate. **OR** Death rates decreased more in England/less in Scotland.	**1**	Answers must indicate a comparison and must refer to death rate. Do not accept answers that relate to chance/risk of death rather than death rate. Accept more die/more deaths in place of death rate is higher. Accept faster for more and slower for less.
		(iii)	9:11	**1**	
		(iv)	The death rate/it is <u>per 100 000</u>.	**1**	Answers that indicate the populations are the same size negate.
	(b)	(i)	Neither the participants/men nor the researchers/doctors know which group each man is placed into/who is getting the drug/placebo.	**1**	Candidate must indicate person giving drug and person receiving the drug don't know.
		(ii)	Large numbers/3000 men were used **OR** There were large numbers/1500 men in each group. **OR** A large sample size was used.	**1**	
		(iii)	Less cholesterol is deposited in arteries/the blood. **(1)** Less chance of atherosclerosis/the formation of an atheroma/the formation of plaque occurring (which causes CVD). **(1)**	**2**	Both answers must indicate less but answers that do not indicate less which are otherwise correct should be awarded (1 mark). eg LDL deposits cholesterol in the blood which leads to atheromas being formed (1 mark).

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Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	So water flea gets used to conditions/reacts to conditions/ becomes acclimatised. **OR** Allow the heart rate to stabilise/ adjust/settle/return to its resting rate. **OR** Allow time for caffeine to take effect/enter the flea.	**1**	Do not accept to allow the reaction to take place. Incorrect use of accuracy or reliability does not negate an otherwise correct answer.
		(ii)	So you can play it back. **OR** To slow it down. **OR** To get a more accurate reading. **OR** To minimise counting error/make it easier to count.	**1**	Use of reliable negates. Accept – as it is difficult to count (the heart beats).
		(iii)	As the caffeine concentration increases from 0 to 0·8 g/l the heart rate increases and then it levels off/ remains constant from 0·8 g/l to 1 g/l. **(1)** It increases from 135 to 270 bpm/by 135 bpm. **OR** It levels off/remains constant at 270 bpm. **(1)**	**2**	Accept it increases to 0·8 g/l then it levels off/remains constant. Answer must indicate g/l for at least one figure. Answer must indicate bpm for at least one figure.
		(iv)	Repeat the investigation/experiment at each (caffeine) concentration. **OR** Repeat the investigation/experiment with more water fleas. **OR** Repeat the investigation/experiment and take an average.	**1**	Do not accept use additional (caffeine) concentrations. Accept with another water flea. Do not accept using different model organisms.

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Question			Expected response	Max mark	Additional guidance
	(b)		1. The medulla controls the autonomic nervous system/ sympathetic nervous system/the sympathetic nerve/sino-atrial node/SAN. 2. The sino-atrial node/SAN sends impulses/signals through the heart/across the atria/to the atrio-ventricular node/AVN. **OR** The sino-atrial node/SAN is located in the wall of the right atrium (of the heart). 3. A sympathetic neuron/nerve/ nervous system releases noradrenaline/norepinephrine. 4. Noradrenaline/norepinephrine/ the sympathetic nervous system/ increases the heart rate. **Any 3 from 4**	**3**	

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Question			Expected response	Max mark	Additional guidance
12.	(a)	(i)	(Prolonged) exercise/eating/sex/ laughter.	**1**	Do not accept stress/injury but these do not negate a correct answer. Accept any named sporting activity for exercise. Accept eating any named food. Accept taking (recreational) drugs or named drug eg cocaine, alcohol, nicotine.
		(ii)	They reduce (the intensity of) pain **OR** They induce feelings of pleasure/ euphoria/happiness.	**1**	Accept act as natural painkillers. Accept that they inhibit pain receptors/signals. Activating the reward pathway negates.
	(b)		Acts as a dopamine agonist/mimics the action of dopamine. **OR** Prevents/slows the breakdown of dopamine. **OR** Prevents/slows the reuptake of dopamine.	**1**	Do not accept – take synthetic dopamine/L-dopa unless qualified with a correct mode of action. All answers must relate to a drug treatment.
	(c)	(i)	It has reduced the number of/there are less receptors.	**1**	Mention of sensitivity of receptors does not negate. Do not accept amount of receptors. Use of antagonist does not negate.
		(ii)	The individual must take more of the drug (to get an effect).	**1**	Do not accept it leads to increased tolerance of the drug but this does not negate. Use of addiction does not negate.

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Question			Expected response	Max mark	Additional guidance
13.	(a)	(i)	They form a (physical) barrier **OR** They are closely packed.	**1**	Accept that they produce a waterproof barrier. Accept that they produce sweat/ sebum/chemical secretions. Do not accept stomach acid, saliva, mucus and tears. Do not accept that they form a chemical barrier.
		(ii)	(Blood) capillary	**1**	
	(b)	(i)	Mast (cells)	**1**	
		(ii)	Vasodilation/increased blood flow **OR** Increased permeability of capillaries.	**1**	Accept from a buildup of tissue fluid. Do not accept vasodilation of capillaries but this does not negate if answer includes correct reference to capillary permeability. Accept more porous for increased permeability.
	(c)	(i)	It recognises an antigen **OR** Antigens on the pathogen. **OR** It has specific/antigen receptors/ binding sites (to the pathogen).	**1**	Do not accept the word antigen on its own.
		(ii)	They cause the cells to produce self-destructive enzymes **OR** They induce/cause apoptosis/ (programmed) cell death.	**1**	Do not accept T-lymphocytes inject self-destructive proteins/enzymes into infected cells. Accept cell suicide for cell death. Answer must indicate the role of T-lymphocytes so apoptosis on its own is incorrect.
	(d)	(i)	The immune response/lymphocytes/ T cells have destroyed most of the viruses/HIV/infected cells.	**1**	Accept the immune response/ lymphocytes/T cells are attacking/ removing the virus/HIV/the infection. Do not accept the immune response/lymphocytes/T cells are fighting/combating the virus/HIV/ the infection.
		(ii)	The HIV virus is attacking/ destroying T lymphocytes/T cells/ them.	**1**	Accept that the HIV virus kills T lymphocytes.

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Question			Expected response	Max mark	Additional guidance
14.	A		**Encoding** 1. Encoding is transferring information into memory/short-term memory (STM)/ long-term memory (LTM). 2. Transfer occurs from sensory memory to STM to LTM. 3. Only selected images/sounds are encoded/transferred into STM/transferred from sensory memory. 4. Information is transferred from STM to long-term memory (LTM) by rehearsal/ organisation/elaboration. **Any 2 for the mark** 5. Rehearsal is the repeating of information/organisation involves putting information into related groups/ elaboration involves adding meaning to information. 6. Rehearsal is a shallow form of encoding/elaboration is a deeper form of encoding (information into LTM). **Storage** 7. Sensory memory retains/holds information for a few seconds. 8. STM has a limited (storage) capacity/ holds information for a short time. 9. The number of items held in STM can be increased by <u>chunking</u>. 10. Information is retained in STM by rehearsal. 11. Information is lost from STM by displacement/decay. 12. LTM has an unlimited (storage) capacity/holds information for a long time. **Retrieval** a. Retrieval of information (from LTM) is aided/helped by the use of <u>contextual cues</u>. b. Contextual cues relate to the time/ place where the information was (firstly) encoded/memory was created.	**9**	5. Candidates cannot explain rehearsal/organisation and elaboration by only using the terms as their explanation. 8. Accept any number between 5 to 9 items for limited STM capacity. 8. Accept 30 seconds or less for short time. 9. Accept an example that illustrates <u>chunking</u> increases the number of items held in STM. 9. The use of increased memory span does not negate answers relating to <u>chunking</u>. a. trigger a memory from LTM is the same as retrieval of information from LTM.

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Question			Expected response	Max mark	Additional guidance
14.	B		**Vaccination** 1. Vaccination develops/provides immunity against a pathogen/disease. **OR** Vaccination produces memory cells against a pathogen. 2. Antigens from pathogens are used to create memory cells/immunological memory. 3. If a vaccinated individual becomes infected/exposed again, antibody production/the immune/the secondary response is greater/more rapid/ prevents symptoms developing. 4. Vaccines can contain inactivated (pathogen) toxins/dead pathogens/parts of pathogens/weakened pathogens. 5. Antigens are usually mixed with an adjuvant **OR** Vaccines usually contain/are mixed with an adjuvant. 6. An adjuvant makes the vaccine more effective/enhances the immune response. **Herd Immunity** a. Mass vaccination programmes are designed to establish herd immunity (to a disease). b. Herd immunity occurs when a large percentage/high numbers of a population are immune/immunised/ vaccinated. c. Herd immunity reduces the spread of diseases. d. Herd immunity protects non-immune individuals as they have a lower probability/less chance of coming into contact with infected individuals. e. Diseases have a threshold for herd immunity. f. The threshold depends on the type of disease/the effectiveness of the vaccine/the density of the population. **Any 2 for the mark** g. Herd immunity/vaccination may not be possible due to poverty. h. Herd immunity/vaccination may not occur due to vaccine rejection.	**9**	Accept viruses or bacteria for pathogens The terms vaccine/ vaccination/immunisation are interchangeable. d. Answer must indicate coming into contact with an individual who has the disease. g. Accept lack of access to medical facilities/doctors as poverty. h. Accept beliefs/allergy as rejection.

[END OF MARKING INSTRUCTIONS]

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