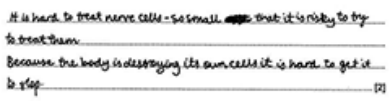
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1		i	**Any two from**: Longer heating/dark toast produces highest concentration/more acrylamide ✓ Toast made from potato has the most acrylamide ✓ The concentration of acrylamide in light coloured toast is very similar/same as untoasted bread ✓ Heating/as bread darkens wheat has the least increase in acrylamide ✓	2 (2 x AO 3.2b)	**AW** concentration for acrylamide **ALLOW** as toasting increases, acrylamide increases **ALLOW** untoasted and light rye make the least acrylamide **ALLOW** lightly toasted has no effect on acrylamide **ALLOW** any other correct conclusion between wheat and rye qualified **Examiner's Comments** This question was one of the most accessible with the majority of candidates scoring maximum marks. The most common marking points given were candidates correctly identifying the dark toast produces the highest amount of acrylamide and the longer you toast bread for the greater the concentrations of acrylamide. The main error was an incorrect comparison between wheat and rye bread.
		ii	**First check the answer on the answer line** **If answer = 6 award 3 marks** (Dark potato toast =) 600 (mg/kg) ✓ (One slice has) 30 (mg) ✓ Maximum = 6 slices ✓	3 (3 x AO 2.2)	Answer of 6.5 slices = 2 marks **Examiner's Comments** Candidates were able to apply their knowledge of scientific techniques, and most were given maximum marks for the correct calculation of number of pieces of bread without exceeding the maximum intake of acrylamide.
		iii	Idea that they would not be able to judge the colour of the toast in the same way / colours are subjective ✓	1 (AO 2.2)	**ALLOW** do not know how long to heat for to get the colours **IGNORE** do not know how long to heat the bread unqualified

					Examiner's Comments This challenged half of candidates on their ability to understand scientific techniques. Half of candidates identified that colour interpretation is subjective. The most common none scoring responses candidates stated were concentrations differed between bread, masses are different, were not given specific times.
			Total	**6**	
2	a		**First check the answer on the answer line** **If answer = 7920 award 2 marks** $\frac{66\,000\,000 \times 12}{100\,000}$ **OR** 66 000 000 / 100 000 x 12 ✓ = 7920 ✓	2 (AO 2.2) (AO 1.2)	**ALLOW** any correct calculating method **ALLOW** 660 **Examiner's Comments** This calculation was one of the higher scoring questions with most candidates given maximum marks for correctly calculating the number of cases of Huntington's in the UK. Where maximum marks were not given candidates made a power of ten error in their calculation.
	b		**Any two from**: Rejection (of cells) ✓ New cells would be damaged again by protein/not work ✓ Cells could mutate and become cancerous/form tumours ✓ Open to Infection/disease ✓	2 (2 x AO 1.1)	**AW** immune response **ALLOW** immunocompromised / immunosuppression / weakened immune system / transfer virus **IGNORE** unknown long-term effects / ethical issues **Examiner's Comments** Candidates demonstrated a lack of knowledge and understanding on the risks of using stem cells. Over half could identify that the cells could be rejected but very few could identify another risk factor. Many misinterpreted the question

					and spoke about ethical issues, which are not risk factors only negative arguments or stated vague effects such as side effects. Many candidates did not score on this question. **Assessment for learning** This has been identified as a knowledge gap. Candidates would benefit revisiting key knowledge throughout their GCSE course to embed key ideas. Candidates should be able to develop their scientific enquiry skills such as being able to differentiate risks with ethical issues in their evaluation skills.
			Total	**4**	
3		i	**Any two from**: Cause mutations/change DNA/genes ✓ Rapid/uncontrolled (cell) division ✓ Form tumours ✓	2 (2 x AO 1.1)	**AW** cell replication/multiplication/mitosis **IGNORE** reproduction/uncontrolled growth **IGNORE** spread to surrounding tissue **Examiner's Comments** Most candidates gained at least one marking point here. The most common given mark awarded candidates correctly identified that cancer causes raid uncontrolled cell division. A few candidates stated that cells reproduced faster which we did not accept. The candidates who scored maximum marks went on to qualify this by forming tumours.
		ii	Idea results in humans might be different / only tested on animals ✓	1 (AO 2.1)	**IGNORE** humans eat toast with no effects / humans have not been tested **Examiner's Comments** This was a high scoring question. The most common non-scoring response candidates wrote was that humans have eaten toast with no effects.

			Total	**3**	
4			**C**	1 (AO 1.1)	**Examiner's Comments** The candidates also demonstrated good knowledge and understanding of the immune response and gaining immunity by identifying C as the correct response. The most common incorrect response was B that antibodies will destroy plasma cells.
			Total	**1**	
5			**A**	1 (AO 1.1)	
			Total	**1**	
6			**A**	1 (AO 1.1)	**Examiner's Comments** This question on monoclonal antibodies was the lowest scoring multiple choice question despite over half of candidates achieving this mark. The most common incorrect response was identified as C that the coloured marker combines with antigens and with antibodies on the test line instead of MCA carry the antigens along.
			Total	**1**	
7			**B**	1 (AO 1.1)	**Examiner's Comments** Candidates demonstrated good knowledge and understanding of plant defences, by the majority correctly identifying the cell wall is a physical defence.
			Total	**1**	
8	a		(Invading cells/pathogens) broken down/engulfed by phagocytes/white blood cells ✓ **AND** (White blood cells/lymphocytes) produce antibodies ✓	2 (2 xAO 1.1)	**ALLOW** phagocytosis **DO NOT ALLOW** antibodies/lymphocytes engulf (invading cells) **IGNORE** references to barriers to defence **IGNORE** antitoxins **DO NOT ALLOW** phagocytes produce antibodies **Examiner's Comments**

					This question discriminated between candidates at different grades well. The majority of responses gained a mark for correctly identifying the body produced antibodies in the immune system's response in destroying invading cells. The more successful responses could correctly describe or state phagocytosis. Some candidates confused the body's immune system with barriers to defence. **Misconception** Some candidates confused the body's immune response with barriers of defence such as stomach acid. Centres should make sure there is a clear distinction between these.
	b		**Any two from:** Idea treatment would attack/damage own immune system/white blood cells ✓ This would leave the body open to infections ✓ Cannot be treated with antibiotics/antivirals ✓	2 (2 xAO 2.1)	**ALLOW** stop/prevent immune system working **ALLOW** body will not attack/damage own immune system/white blood cells **ALLOW** will weaken the immune system / become immunocompromised/immunosuppressed **IGNORE** effects on nerves **<u>Examiner's Comments</u>** This question had the most unsuccessful responses, with many candidates stating difficulties of 'fixing' nerve cells due to their size and fragility and they weren't specific about how treatment would affect the immune system. Exemplar 1  It is hard to treat nerve cells - so small, that it is risky to try to treat them. Because the body is destroying its own cells it is hard to get it to stop. [2] Exemplar 1 states that it is difficult to treat nerve cells and that the body destroys its

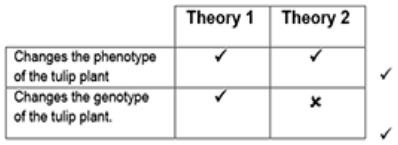
					own cells, which was unable to be given any marks.
			Total	**4**	
9			**C**	1 (AO 1.1)	
			Total	**1**	
10			(Slowing down the cell cycle) will slow down cell division/mitosis / less likely to divide uncontrollably **OR** Cancer is caused by rapidly dividing cells/mitosis ✓ **AND** Prevent tumours ✓	2 (2 xAO 1.1)	**AW** cell replication/multiplication for cell division **IGNORE** reproduction **IGNORE** stops/prevents cell division/mitosis/cells dividing uncontrollably **IGNORE** any process slowing down that occur during interphase **ALLOW** cancer cells carry out uncontrolled cell division/multiply quickly **IGNORE** tumour cells **IGNORE** cancer growing **IGNORE** tumours spread slowly **Examiner's Comments** This question required candidates to demonstrate their knowledge and understanding of mitosis and cancer. Most correct responses gained the marking point linking slowing down the cell cycle will protect the mole rat developing cancer. Fewer successful responses also identified that this would prevent tumours developing. The most common non-scoring response given was about cancer not spreading and chance of mutation would reduce during DNA replication.
			Total	**2**	
11			**A**	1 (AO 1.1)	
			Total	**1**	
12			**D**	1 (AO 1.1)	**Examiner's Comments** This was the least assessable multiple choice question with the most incorrect responses. The majority of candidates did

					not correctly identify that the use of genetic engineering to produce new medicines is not an example of genomic medicine. The most common incorrect response was A with changes in lifestyle advised for people with certain alleles.  **Assessment for learning** Centres could reinforce genomic medicine and treatments when teaching genetics. This has been identified as a knowledge gap.
			Total	**1**	
13			**B**	1 (AO 2.1)	**Examiner's Comments** This was one of the more challenging multiple choice questions and less than half of candidates were able to identify that beta blockers and nitrates would reduce blood pressure from the information provided.  **Assessment for learning** Centres could reinforce treatments of coronary heart disease as it has been identified as a knowledge gap.
			Total	**1**	
14			The (amyloid) protein is not made ✓ The allele/gene is not having an effect/ the allele/gene is not expressed ✓	2 (AO 2 × 2.1)	**ALLOW** the gene/allele/mRNA is not translated **DO NOT ALLOW** the DNA/mRNA is not transcribed **DO NOT ALLOW** the allele/gene is destroyed **DO NOT ALLOW** prevents the gene coding for the amyloid protein **Examiner's Comments** Again, this AO2.1 question was challenging for all candidates and only a very small number scored full marks. Many candidates thought that the gene or DNA code had been destroyed. Few

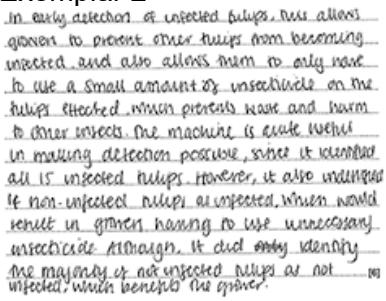
					candidates appreciated that since the mRNA had been destroyed, transcription had already taken place and that it was translation or the production of the protein that could not take place. **Misconception** There was a misconception that if a gene is silenced, the gene is destroyed.
			Total	**2**	
15		i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 69.23 award 2 marks** 9/13 × 100 ✓ 69.23 (%) ✓	2 (AO 1.2) (AO 2.2)	**ALLOW** 69.2307692308 or any correct rounding e.g. 69/69.2 **Examiner's Comments** Higher ability candidates scored full marks on this calculation question. A common error was to put the 9 over 22 instead of 13, giving a percentage change of 40.9. Some candidates misread the question and used the data for ginger or rosemary instead and not the control treatment as asked for in the question.
		ii	**Any one from:** Predators ✓ Parasites/other pathogens/diseases ✓ Weather conditions/change in temperature ✓ Lack of food ✓ More competition ✓	1 (AO 2.1)	**IGNORE** the oil from the pine trees **Examiner's Comments** This AO2.1 was generally well answered by most candidates. The larvae having predators on the pine trees was the most common correct answer. When candidates did not score it was usually because their answer was too vague, for example a less controlled environment, or unsuitable conditions on the pine tree.
		iii	**Any two from:** Ginger is more effective than rosemary (at killing larvae) / ORA ✓ Ginger/rosemary is more effective on the pine trees than in the lab / ORA ✓ Both are more effective than the control treatment ✓	3 (3 × AO 3.1b)	**ALLOW AW** throughout for more effective e.g. better Data mark can only be given if at least one correct evaluation mark awarded Data must involve some manipulation e.g. ginger kills 1586 and rosemary kills 1061 in total/ginger kills 525 more overall than rosemary

			AND Data used to back up argument ✓		e.g. ginger kills 412/41.2% more in the lab than rosemary e.g. ginger kills 113/11.3% more on the pine trees than rosemary e.g. ginger kills 16.2% more on the pine trees than in the lab **Examiner's Comments** The majority of candidates gained some marks on this AO3.1b question, with a minority gaining maximum marks. Most candidates were able to analyse the information and recognise that the ginger oil was the most effective at killing the larvae. Fewer commented on the ginger or rosemary oil being more effective on the pine tree and fewer still used data from the table and just quoted it instead. Some candidates only referred to one oil instead of evaluating the two oils as asked for in the question. **Assessment for learning** Candidates should be prepared to evaluate by processing information from the table provided, before attempting to answer the question. This will help them to construct a response that will cover the marks available in the question and make sure that the data is used to support their evaluation.
			Total	**6**	
16	a		Vaccine contains weakened/dead/inactive pathogen ✓ (formation of) memory cells ✓ Idea of infected with the real pathogen then antibodies are produced faster/in larger numbers ✓	3 (3 × AO 1.1)	**ALLOW** any type of pathogen **ALLOW** vaccine contains a pathogen's antigens **ALLOW** vaccine contains mRNA/genetic material **IGNORE** dead version of the disease/measles **DO NOT ALLOW** antibodies become memory cells/antibodies make memory cells **IGNORE** kills the pathogen quicker **Examiner's Comments**

					This question discriminated well. The higher ability candidates had a very good understanding of his AO1.1 question recalling knowledge of how vaccinations protect people against diseases. Answers were extremely thorough and detailed using the correct terminology. Most candidates described the action of the lymphocytes and antibodies before getting to the formation of memory cells and the faster production of antibodies. A common mistake for the first marking point was to give a more generic response about what the vaccine would contain, such as the disease or infection. Some candidates thought that the antibodies made the memory cells, which did not score a mark.
	b	i	1985 ✓ Because the number of cases has a steeper/the steepest decline/more people had the (MMR) vaccine ✓	2 (2 × AO 3.1a)	**ALLOW** 1984/1986 If year is incorrect 0 marks **Examiner's Comments** Most candidates that identified the correct date, also got the reason correct and scored full marks on this AO3.1a question. 1968 was the most common incorrect date given. This is the date that the vaccinations against measles started so the number of cases started to fall, but it was not the date of the MMR vaccine as asked for in the question.
		ii	2001 ✓ Idea of the number of cases increased as people were concerned about the risk (of autism)/the report/did not trust the vaccine **AND** Less people were vaccinated ✓	2 (AO 3.1a) (AO 3.2a)	**ALLOW** 2000/2002 If year is incorrect 0 marks **Examiner's Comments** This AO3 question was asking candidates to analyse the information given and make judgements. Most candidates could identify the correct year of 2001. The reasons for making this judgement were the concern about the risk or autism and the link to less vaccinations causing the increase in measles cases. Some candidates only gave one part of the reason and did not score this second marking point.
	c		People who have had measles have fewer different antibodies ✓	2 (2 × AO 3.2b)	**IGNORE** they have lots of antibodies for measles

			Idea that they are more likely to develop other diseases/more prone to other pathogens making them ill ✓		**ALLOW** less protection against other diseases **Examiner's Comments** Candidates were being asked to analyse the information and draw conclusions in this AO3.2b question. Many candidates did not recognise that the graph was showing the **different** antibodies remaining and gave answers suggesting it was the antibodies to measles that had decreased and therefore concluded that people would get ill with measles again. Higher ability candidates did recognise that the percentage of different antibodies had decreased and that this would give people less protection against other diseases.
			Total	**9**	
17	a		 ✓ ✓	2 (2 × AO 2.1)	1 mark for each correct row **Examiner's Comments** Candidates scored well on this AO2.2 question if they followed the instructions and put ticks or crosses in the table. Those that scored 1 mark got the first row correct with 2 ticks but omitted the cross in the second row. **Assessment for learning** Candidates should practice a variety of questions asking for just ticks or ticks and crosses. This would encourage candidates to read the question carefully and to follow the directions in the question.
	b	i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2112.68 award 2 marks** $\frac{2 \times 10^9}{14200} \times \frac{1.5}{100}$ ✓ 2112.68 ✓	2 (AO 1.2) (AO 2.2)	**ALLOW** any correct rounding of 2112.676056 **ALLOW** 2112/2113 for total number of infected tulips for 2 marks **ALLOW** correct answer in standard form **Examiner's Comments** Most candidates carried out this calculation well and scored full marks.

					Those that did not score often missed out the division by 14 200 hectares to convert their answer to the number of infected tulips in one hectare of land.
		ii	**Level 3 (5-6 marks)** Discusses the advantage of early detection and appreciates its consequences **AND** Discusses the usefulness of the machine including judgements based on the data *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** States an advantage of early detection **AND** Discusses the usefulness of the machine *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** State an advantage of early detection **OR** Discusses the usefulness of the machine *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit*	6 (2 × AO 2.1) (2 × AO 1.1) (2 × AO 3.2a)	**AO1.1 Demonstrates knowledge and understanding to state the advantages of early detection** • less insecticide/spray is needed • less chance that the virus is spread to other tulips (by the insects) **AO2.1 Apply knowledge and understanding to appreciate the consequences of early detection.** • less insecticide sprayed means less chance of pollution/less damage to the environment • less insecticide sprayed means less cost to grower • less insecticide sprayed means less risk to other insects **AO3.2a Analyse information to make judgements on the usefulness of the machine.** • machine can reduce the time needed to inspect tulips/the machine is faster • fairly accurate diagnosis/all/15 infected tulips are identified • only 14 diagnosed incorrectly • 14 diagnosed incorrectly can lead to more area being sprayed/loss of biodiversity • idea that although some non-infected are diagnosed, no infected tulips are missed **<u>Examiner's Comments</u>** * There were a lot of well-constructed answers to this Level of Response question covering the AO1.1 and AO3.2a components. Most candidates could state that early detection of the virus would stop the spread of infection and that the machine helped the farmer to quickly

					identify the infected tulips. Many candidates discussed the diagnosis rates of the machine and although it did identify some non-infected tulips as infected, they recognised that it did not miss out any infected tulips. The most common score was Level 2, 4 marks. The discussion of the advantage for AO2.1 was rarely seen to score at Level 3, as many candidates mentioned that there would be a disadvantage to using the machine if it detected noninfected tulips as infected. Exemplar 2  In early detection of infected tulips, this allows grower to prevent other tulips from becoming infected and also allows them to only have to use a small amount of insecticide on the tulips effected, which prevents waste and harm to other insects. The machine is quite useful in making detection possible, since it identified all 15 infected tulips. However, it also identified 4 non-infected tulips as infected, which would result in grower having to use unnecessary insecticide. Although, it did identify the majority of not infected tulips as not infected, which benefits the grower. [6] This response represents an excellent example of how to gain maximum marks. The candidate has clearly stated the advantage of early detection by 'preventing other tulips from being infected' for AO1.1. They also discuss the advantage of the early detection as 'the use of a small amount of insecticide on the tulips effected, preventing waste and harm to other insects' for AO2.1. The candidate then discusses how useful the machine is, 'since it identified all 15 infected tulips' for AO3.2a. The communication is clear, concise and all aspects of the question have been covered so it scores Level 3, 6 marks. **OCR support** This 'how to answer 6 mark Level of Response questions' set of activities will be useful to share with candidates https:/www.ocr.org.uk/Images/561672-how-to-answer-6-mark-lor- activities.zip. It will allow them to practice identifying key parts of questions, as well as familiarise themselves with different levels of answer.

			Total	**10**	
18	a		Sugar/glucose (level)✓ Insulin and glucagon ✓ Metabolic ✓ Thyroxine ✓	4 (AO 4 × 1.1)	**ALLOW** either order **DO NOT ALLOW** glycagon/glycogen **IGNORE** TSH **Examiner's Comments** This question discriminated well as only higher ability candidates scored full marks. The most common correct answer was sugar for the first marking point and thyroxine for the fourth marking point. Insulin was often given but the second hormone was not correct for marking point 2, with answers such as glycogen, thyroxine, and adrenaline. Some candidates missed the link to the thyroid gland in the question and thought that the third marking point was referring to heart rate and so put adrenaline as the hormone that was lacking. **Assessment for learning** Candidates should be encouraged to read and highlight or underline key parts of the question which provide relevant information. This would highlight the pancreas and thyroid as the two glands that were being affected and would help the candidate to make the link to the symptoms and hormones that would be lacking.
	b		Killing the plasma cells stops production of amyloid/ Protein/killing the plasma cells stops blood vessels being blocked (from the pancreas and thyroid gland) ✓ Stem cells can differentiate into new plasma cells/stem cells can be used to replace the plasma cells ✓	2 (AO 2 × 2.1)	**IGNORE** stops amyloidosis **IGNORE** the new plasma cells cannot make the amyloid/protein **Examiner's Comments** Many candidates, even higher ability candidates found this AO2.1 question challenging. Candidates had not recognised the two bullet points as a direction on how to structure their answer. Many answers referred to killing amyloid, forming new blood plasma, and making new cells. Candidates that scored 1 mark were able to link killing plasma

					cells to the stopping of the production of the amyloid protein. Many candidates appreciated that stem cells could differentiate into new cells, but it was rare to see 'differentiate into plasma cells' for the second marking point.
			Total	**6**	
19			C ✓	1 (AO 1.1)	**Examiner's Comments** In this AO1.1 question many candidates incorrectly put A, indicating that they did not know that HIV is a pathogen and AIDS is a set of infections, choice C. **Misconception** Many candidates are unaware of the distinction between HIV, the virus and AIDS, the set of infections.
			Total	**1**	
20			C ✓	1 (AO 1.1)	
			Total	**1**	
21			D ✓	1 (AO 1.2)	**Examiner's Comments** Candidates found recalling their knowledge of a scientific technique in the AO1.2 question challenging. Some candidates were distracted by A.
			Total	**1**	
22			A ✓	1 (AO 1.1)	
			Total	**1**	
23			A ✓	1 (AO 1.1)	**Examiner's Comments** Recalling their knowledge in this AO1.1 was answered well by the higher ability candidates. They could successfully describe an antigen, choosing A. The most common incorrect answer was D, as an antigen can be a protein molecule but it is not made by white blood cells.
			Total	**1**	