OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

BIOLOGY B

B731/02

Unit B731: Biology Modules B1, B2, B3 (Higher Tier)

MARK SCHEME

Duration: 1 hour 15 minutes

MAXIMUM MARK 75

This document consists of 16 pages

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant - applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   words = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ora = or reverse argument

   eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

Question			Expected answer	Marks	Additional guidance
1	(a)		Deb's EAR is 34.8 (1) total protein intake is 32.4g which is less than EAR (1) **any one from:** not accurate because it is only an estimate for an 'average' person (1) not accurate because it will vary with age / Deb is a teenager/growing so will have a higher than average requirement (1)	3	
	(b)		contain essential amino acids / contain amino acids that cannot be made by the body (1)	1	**ignore** references to essential proteins
			Total	**4**	

Question			Expected answer	Marks	Additional guidance
2	(a)		they both bend light / refract (light) / focus light (1) idea that it is the lens that (fine) focuses the light on the retina (1)	2	**allow** lens helps to form an image on the retina
	(b)		increasing age decreases the size of the pupil for **both levels of brightness** (1) in dark conditions there is a greater difference between the old and the young (1) which means that for older people it is difficult for enough light to enter the eye in dark conditions which makes it difficult to see / read / AW (1) older people have smaller changes in pupil diameter in response to changes in light (1) which means that older people will not be able to see very well when going from bright to dark conditions (1)	4	**answers must link conclusions from graphs to implications in order to gain full credit** **allow** more variation for individuals of a given age in dark conditions (1) **allow** specific examples of going from light to dark conditions eg which means that older people will not be able to see very well when going from outside to inside on a sunny day (1)
			Total	**6**	

Question			Expected answer	Marks	Additional guidance
3	(a)		carbon monoxide makes the blood carry less oxygen so heart rate increases (1)	1	
	(b)		because smoking causes damage to cilia which means chemicals build up and cause cancer / emphysema (1) but giving up prevents further damage to cilia / less build-up of chemicals so reducing risk of cancer / emphysema (1)	2	**answers must link giving up cancer to limiting lung damage and subsequent risk of disease in order to gain full credit**
	(c)		causes more neurotransmitter to cross the synapse / increases the chance of nerve impulse being passed (1)	1	**allow** increases the rate at which a nerve impulse passes **allow** or mimic (neuro)transmitter **ignore** references to signals / messages
			Total	**4**	

Question			Expected answer	Marks	Additional guidance
4	(a)		probability = 0.25 / 25% / ¼ / 1 in 4 / 1 to 3 (1) genetic diagram showing two heterozygotes crossing to produce four correct offspring (1)	2	
	(b)		to prevent resistant strains spreading / being selected for / AW (1)	1	**allow** bacteria can develop resistance **not** reference to the person becoming resistant / the disease becoming resistant **not** to stop bacteria mutating
	(c)		no (no mark) because some patients have more than one type of bacteria since the percentages for the three types of bacteria add up to more than 100% / the data doesn't show if the 80% who had *Pseudomonas aeruginosa* also had *Staphylococcus aureus* / *Haemophilus influenzae* or if they were different patients (1) don't know how many patients have more than one type of bacteria because data doesn't show the percentage with no bacteria (1)	2	**allow** for each type of bacteria, the data shows the percentage of patients with that type of bacteria in their system but it does not show if these same patients have any of the other two types of bacteria in the system (1)
			Total	**5**	

Question			Expected answer	Marks	Additional guidance
5	✎		**Level 3** Answer comprehensively explains the effects of diabetes on Mary and applies understanding of diabetes to clearly explain why the monitor will help in the context of a very large meal. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5–6 marks) **Level 2** Answer explains some of the effects of diabetes on Mary and applies understanding of diabetes to explain the need to inject insulin but the importance of regulating the dose is not explained. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3–4 marks) **Level 1** Answer identifies the effects of diabetes in terms of being unable to regulate blood glucose. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1–2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include:** • Mary cannot produce enough insulin • she cannot therefore regulate her blood glucose level • idea of homeostasis • after the meal blood glucose level is too high • reference to problems caused by hyperglycaemia • alarm will sound to tell her so that she can inject herself with insulin • she needs this insulin injection to regulate blood glucose • important to match the dose to the blood glucose level • device measures very regularly so will give more frequent measurements so she knows almost immediately if the level is too high • she doesn't have to cut herself or use blood to detect her blood glucose level reducing risk of infection/improving quality of life • automatically tests without her having to remember • once she has injected insulin it will convert glucose to glycogen for storage in the liver • reducing blood glucose level **allow** blood sugar instead of blood glucose
			Total	6	

Question			Expected answer	Marks	Additional guidance
6	(a)		birds feeding at two different trophic levels so not easy to allocate their biomass to a particular trophic level (1) **OR** dry mass of banana plants / insects / birds difficult to measure due to seasonal fluctuations / the need to kill the organism (1)	1	**allow** birds likely to also rely on other food webs (1)
	(b)		**Level 3** Answer correctly applies knowledge of energy transfers to give a well-reasoned explanation of which chain is more efficient and comprehensively explains the implications of efficiency. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5–6 marks) **Level 2** Answer applies knowledge of energy transfers to give a partial explanation of which chain is more efficient and shows understanding of some of the implications of efficiency. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3–4 marks) **Level 1** An incomplete answer, identifies B as more efficient, recognises that energy is lost at each stage. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1–2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include:** **B** more efficient • because it is the shorter chain / has fewer trophic levels • energy is lost at each trophic level • energy is lost by respiration, as heat, excretion, egestion and movement by consumers • not all parts of organism gets eaten / some parts of organisms not digested so not all passes to consumer • consumer loses up to 90% at each level • energy input gradually decreases up the chain • fewer levels result in a more efficient chain implications • food chain **B** will support more birds • shape of pyramid of biomass / biomass decreases at the top of the food chain/web • lower efficiency results in fewer organisms at the next stage • limited length of food chains as energy 'runs out' at the top
			Total	**7**	

Question			Expected answer	Marks	Additional guidance
7	(a)	(i)	14 2:3	1	
		(ii)	no mark for decision genetic diversity/variation (in region 2) reduced because of limited gene pool / genetic diversity/variation (in region 2) reduced because only 1 male in region 2 (1) because there is a limited gene pool species do not show a lot of variation therefore changes to the environment are likely to affect all of the population (1)	2	**marks for reasoning but must support decision** **allow** number of individuals below critical level (in region 2) / few organisms in large territories means difficult to find a mate (in region 1) / idea that animals isolated from each other so cannot interbreed to increase variation max (1)
	(b)		idea of conservation of useful genes (1) cultural aspects (1) medical products (1) do not know what will happen to food chains if they are allowed to die out (1)	1	
			Total	**4**	

Question			Expected answer	Marks	Additional guidance
8	(a)		because the number of prey goes up which makes more food available for lynx so more lynx reproduce and survive causing lynx population to increase (1) but it takes some time for the lynx population to reproduce and increase in numbers, creating a lag (1) OR because if the hare numbers are decreasing then there is less food for lynx and so fewer lynx survive (1) but it takes some time for the lynx to die due to lack of food and decrease in numbers (1)	2	**answers must link decrease/increase in prey to lifespan/ reproduction rate of lynx to gain full credit** **allow** reverse arguments in terms of hares eg hares increasing again before lynx because the lynx level is low enough to allow them to reproduce successfully, and they can rapidly reproduce (without death of offspring) because lynx numbers are low (2)
	(b)		no because they live in the same habitat but hares are prey and lynx are predators (1)	1	
	(c)		similar fluctuation in numbers / similar effect (as lynx) (1) but over a smaller range / but not so dramatic because wolves have other prey(1) OR no fluctuation / no effect (1) because wolves will replace hares with other prey (1)	2	**must link answer to wolves having other prey to gain full credit**
			Total	**5**	

Question			Expected answer	Marks	Additional guidance
9	(a)		amount of carbon dioxide given off in a certain period of time(1)	1	
	(b)		nitrifying bacteria (1) convert ammonia to nitrates (1) OR denitrifying bacteria (1) convert nitrates to nitrogen gas (1) OR nitrogen fixing bacteria (1) convert nitrogen gas into nitrates / nitrogen compounds (1)	2	**allow** word equations **allow** correctly named bacteria eg *Nitrobacter* is a nitrifying bacteria name of bacteria scores 1 in spite of incorrect description if no bacteria named score 0 **allow** returns nitrogen gas to atmosphere
			Total	**3**	

Question			Expected answer	Marks	Additional guidance
10	(a)		struggle for food could lead to the largest and strongest being more likely to survive and reproduce (1) and larger animals have smaller surface area to volume ratio and therefore lose less heat (1) **but** lack of food may mean that only smaller animals can eat enough to survive and reproduce (1) **in each case** alleles for smaller or larger size more likely to be passed on so over many generations size of animals changes (1)	4	**allow** references to genes rather than alleles
	(b)		they tried to insult his theory (1) they thought that Darwin suggested that we evolved from apes (1) they did not believe in evolution (1) his theory was against their religious beliefs / they thought that a god created man (1)	2	
			Total	**6**	

Question			Expected answer	Marks	Additional guidance
11	(a)		tricuspid (valve) (1)	1	
	(b)		because valves prevent backflow (1) but pressure is always high enough in arteries to prevent backflow / push blood forwards (1)	2	**answer must link high pressure to no requirement for valves to gain full credit** **points may be in either order** **allow** pressure is higher in arteries than veins (1)
			Total	**3**	

Question			Expected answer	Marks	Additional guidance
12	✎		**Level 3** Answer describes in detail the nature of the genetic code and the possible impact on amino acid sequence of a change in base sequence. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5–6 marks) **Level 2** Answer describes correctly the importance of base sequence but the detailed knowledge of the triplet code is missing. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3–4 marks) **Level 1** Answer describes correctly the importance of DNA in protein coding but knowledge of base sequence is lacking. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1–2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**relevant points include:** • genes are sections of DNA • code for the amino acid sequence of a protein • consist of a string of organic bases • four different bases • A, T, G and C • the order of bases codes for the order of amino acids • triplet code • mutation may cause a change in the order of bases • different amino acids may be coded for • changes the amino acid sequence of the protein • protein functions differently or is not made
			Total	**6**	

Question			Expected answer	Marks	Additional guidance
13	(a)		chloroplast / vacuole / mitochondrion / nucleus (1)	1	
	(b)	(i)	beta-carotene genes not found in rice / AW (1) genetic engineering is quicker (1) more control over making sure the desired characteristic is present in the offspring (1) selective breeding can lead to reduction in genetic variation (1)	2	assume answer refers to genetic engineering unless stated
		(ii)	carry out controlled tests (1)	1	**allow** examples of controlled testing eg testing humans to see if it makes them ill compared to a control group / doing field trials to make sure that it does not impact plants growing around **ignore** reference to arguing / writing articles
			Total	**4**	

Question			Expected answer	Marks	Additional guidance
14	(a)		**B** (no mark) because the DNA / genes / chromosomes came from sheep **B** (1)	1	correct sheep and explanation for 1 mark **ignore** nucleus **ignore** codes / information with no reference to genes
	(b)		mass producing animals with desirable characteristics / producing animals that have been genetically engineered to provide human products / producing human embryos to supply stem cells for therapy (1)	1	
			Total	**2**	

Question			Expected answer	Marks	Additional guidance
15	(a)		respiration (1)	1	
	(b)	(i)	measurement of radius = 8mm (1) calculation = 2144 (micrometers^3) (1)	2	
		(ii)	correct calculation of ratio using answer from (ii) $\frac{2144}{50939} = 0.042$ (1) answer: poisoned as ratio is less than 0.05 (1)	2	**allow** not poisoned if ECF gives result above 0.05
			Total	**5**	

Question			Expected answer	Marks	Additional guidance
16	(a)		(getting older) reduces the BMR can tell this because the part of the formula involving age is given a negative value (1)	1	
	(b)	(i)	(6000 x 1.75) = 10500 OR (6000 x 1.20) = 7200 (1) (10500 – 7200) = 3300kJ (1) (3300 / 6.6) = 500 g (1)	3	evidence of calculation of a BMR worth 1 mark **allow** alternative calculation for 1st and 2nd marks (1.75-1.20) x 6000 = 3300kJ (2) final answer of 500g with no working shown can gain full credit
		(ii)	idea of some of the glucose will be used in anaerobic respiration which does not produce as much energy / some of the energy released will be from anaerobic respiration so less energy is made per gram (1)	1	
			Total	**5**	

Assessment Objectives (AO) Grid

(includes quality of written communication ✎)

Question	AO1	AO2	AO3	Total
1(a)	1	2		**3**
1(b)	1			**1**
2(a)	2			**2**
2(b)		2	2	**4**
3(a)	1			**1**
3(b)	1	1		**2**
3(c)	1			**1**
4(a)		1	1	**2**
4(b)	1			**1**
4(c)		2		**2**
5✎	4	2		**6**
6(a)		1		**1**
6(b)✎	4	2		**6**
7(a)(i)		1		**1**
7(a)(ii)		1	1	**2**
7(b)	1			**1**
8(a)	2			**2**
8(b)		1		**1**
8(c)		2		**2**
9(a)	1			**1**
9(b)	2			**2**
10(a)		4		**4**
10(b)	2			**2**
11(a)	1			**1**
11(b)	1	1		**2**
12✎	6			**6**
13(a)	1			**1**
13(b)(i)		2		**2**
13(b)(ii)		1		**1**
14(a)		1		**1**
14(b)	1			**1**
15(a)	1			**1**
15(b)(i)		2		**2**
15(b)(ii)		1	1	**2**
16(a)		1		**1**
16(b)(i)		2	1	**3**
16(b)(ii)		1		**1**
Totals	**35**	**34**	**6**	**75**