OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



MARK SCHEME

B1.2 WHAT HAPPENS IN CELLS (AND WHAT DO CELLS NEED?)

SCORE	PERCENTAGE
/171	%

STEMUP

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Question			Answer/Indicative content	Marks	Guidance
1			B	1	
			Total	**1**	
2			D	1	
			Total	**1**	
3			B	1	
			Total	**1**	
4	a		Y axes correctly labelled, including units (1) Y axis even scales occupying more than half of the page (1) all points correctly plotted = 2 marks but at least 3 points correctly plotted = 1 mark line of best fit (1)	1 1 2 1	
	b		at 20 °C: slower reaction (1) particles moving more slowly (1) less frequent collisions (1)	1 1 1	**allow** reverse argument referring to 40 °C
	c		At 80 °C: slower reaction (1) enzyme denatured (1) shape of active site changed / cannot bind to substrate (1)	1 1 1	**allow** reverse argument referring to 40 °C
	d	i	(optimum) could be either side of 40 °C / could be anywhere between 40 °C and 60 °C (1)	1	
		ii ii	Do more repeats (1) Idea of narrower intervals around 40 °C (1)	2	 **allow** 30–50 °C

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Question			Answer/Indicative content	Marks	Guidance
	e		**any two from** use a colorimeter – so it's objective / AW (1) have the same student doing all observations – so there is a consistent judgement / AW (1) repeat the experiment at each temperature – can take mean / average (1)	2	**allow** light meter **allow** colour chart / serial dilution
			Total	16	

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Question			Answer/Indicative content	Marks	Guidance
5		i	the temperature of the heap was the same as the external temperature (1)	1	
		ii	Change in temperature ÷ time OR Tangent drawn from line and used to calculate rate	1	
			Total	**2**	
6			D	1	
			Total	**1**	
7			B	1	
			Total	**1**	
8			C	1	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
9	a		Y axes correctly labelled, including units (1)	1	
			Y axis even scales occupying more than half of the page (1)	1	
			all points correctly plotted = (2) but at least 3 points correctly plotted = (1)	2	
			line of best fit (1)	1	
	b		at 20 °C: slower reaction (1)	1	**allow** reverse argument referring to 40 °C
			particles moving more slowly (1)	1	
			less frequent collisions (1)	1	
	c		At 80 °C: slower reaction (1)	1	**allow** reverse argument referring to 40 °C
			enzyme denatured (1)	1	
			shape of active site changed / can not bind to substrate (1)	1	
	d	i	(optimum) could be either side of 40 °C / could be anywhere between 40 °C and 60 °C (1)	1	
		ii	do more repeats (1)	1	
		ii	idea of narrower intervals around 40 °C (1)	1	**allow** 30–50 °C
	e		**any two from** use a colorimeter – so it's objective / AW (1)	2	**allow** light meter **allow** colour chart / serial dilution
			have the same student doing all observations – so there is a consistent judgement / AW (1)		
			repeat the experiment at each temperature – can take mean / average (1)		
			Total	**16**	

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Question			Answer/Indicative content	Marks	Guidance
10		i	the temperature of the heap was the same as the external temperature (1)	1	
		ii	change in temperature ÷ time OR tangent drawn from line and used to calculate rate	1	
			Total	2	

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Question			Answer/Indicative content	Marks	Guidance
11	a	i	any higher and the bacteria might be killed / bacterial enzymes denatured (1)	1	**allow** optimum temperature for the bacteria / bacterial enzymes
		i	any lower and the erythromycin would diffuse slower / bacteria would reproduce more slowly so takes longer to get the results (1)	1	**allow** spread out slower
		ii	prevent contamination by other microbes (1)	1	**not** germs / bugs
	b	i	coat is digested (1)	1	
		i	by enzymes present in small intestine (1)	1	

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Question			Answer/Indicative content	Marks	Guidance
		ii	* Please refer to the marking instructions on point 10 for guidance on how to mark this question. **Level 3** **(5–6 marks)** **Explains the shapes of the two graphs in the effectiveness / safety of the drugs delivery system.** *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)** **Explains the shapes of the two graphs the total dosage of the drugs.** *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)** **Simply describes the patterns in the graph.** *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*	6	**AO3.2a: Analyse the information and judge the relative effectiveness of the two delivery systems** • links this to the advantages / disadvantages of keeping a steady, intermediate level in the blood • with tablet high levels may be toxic • if reduce the dose, then when levels low it may not kill all bacteria • reference to allowing resistant strains to develop **AO2.2: Apply knowledge to demonstrate an understanding of how the capsules and tablets work in delivering the drug** • any statement regarding the total dosage for the two delivery methods • dosage rises rapidly because of rapid absorption into the blood stream • dosage falls fast because it is rapidly broken down • capsules allow staggered release of drug dosage • this is because walls are different thicknesses of the capsule • therefore different digestion time • conventional tablet releases drug all at once • tablet may not have a coating **AO2.1: Apply knowledge and understanding in reading the graphical information** • Simple description of the patterns of the two lines on the graph.
			Total	**11**	

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Question			Answer/Indicative content	Marks	Guidance
12			[Level 3] Answer includes a correct description of how protein synthesis is controlled and is able to link this to the change in shape of the cap Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Answer includes a correct description of how protein synthesis is controlled or links change in shape of the cap to the movement of the nucleus Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer includes a correct statement about how protein synthesis is controlled. or Links change in shape of the cap to production of different proteins / presence of different genes. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about protein synthesis may include: • Proteins are coded for by genes / DNA • Genes / DNA are kept in the nucleus (on chromosomes) • The genes contain a sequence of bases that code for the protein Indicative scientific points about the experiment include: • The cap changes shape because the cell starts to make different proteins • The different proteins are made because the nucleus has come from the cell with the crinkled cap • Therefore the cell's DNA / genes are now coding for proteins that make the cap crinkle Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
13	a		DNA is not a protein (1)	1	**ignore** just DNA
	b		**any two from:** egg cells do not supply all the chromosomes / genes (1) BUT (sperm and) eggs (each) supply half of the genetic material / genes / chromosomes (2)	2	egg cells are larger because they do not need to swim / contain food reserves (1)
	c		the substrate is like a key (not the enzyme) (1) the substrate fits into the enzyme's active site (not the other way round) (1)	2	**allow:** the enzyme is like a lock (not a key) (1) **allow:** the enzyme has an active site not the substrate (1) **allow**: 'enzyme and the substrate are the wrong way round' (2)
			Total	**5**	

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Question			Answer/Indicative content	Marks	Guidance
14			[Level 3] includes a correct description of protein synthesis AND describes where proteins are made AND correctly links this to the change in shape of the cap over a period of time. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] includes a correct description of protein synthesis AND describes where proteins are made OR correctly links this to the change in shape of the cap over a period of time. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] includes simple description of protein synthesis OR describes where proteins are made OR why it takes several weeks for the change in the cap. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade A* Indicative scientific points about protein synthesis at level 2/3 may include: • the order of bases codes for the order of amino acids • mRNA carries the code from the DNA • triplet base code read for amino acid Indicative scientific points about where proteins are made may include: • proteins are made on the ribosomes • in the cytoplasm Indicative scientific points about why it takes several weeks for the change in the cap: • time taken for the proteins in the cap to be replaced / make different proteins • mRNA from the old nucleus takes some time to be replaced by mRNA from new nucleus Indicative scientific points about protein synthesis at level 1 may include: • proteins are coded for by DNA / genes • sequence of bases that code for the protein Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
15	a		amino acids are not proteins (1) they make up proteins (1)	2	no marks if they haven't identified amino acids **not** incorrect statements about collagen and insulin **allow** amino acids make up proteins (2)
	b		the substrate is like a key (not the enzyme) (1) the substrate fits into the enzyme's active site (not the other way round) (1)	2	**allow** the enzyme is like a lock (not a key) (1) **allow** the enzyme has an active site not the substrate (1) **allow** 'enzyme and the substrate are the wrong way round' (2)
			Total	**4**	
16			C ✓	1 (AO 1.1)	
			Total	**1**	
17			A ✓	1 (AO 2.1)	
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
18	a		can control temperature (easier)/ can be set to a specific / constant temperature ✓ limited fire risk✓	2 (AO 2 x 2.2)	IGNORE reference to ease of measurement ALLOW less risk of burns ALLOW ORA Examiner's Comments This question assesses AO2.2. Candidates were able to identify that the electric water bath was much easier to control the temperature, but it was rare to see any link the limited fire risk compared to the Bunsen and beaker.
	b		for 60^0C / high temperatures: idea that (membranes break down) at 60^0C releasing more DNA / DNA is extracted easily ✓ against 60^0C / high temperatures: increased risk of DNA breaking down at 60^0C / more DNA destroyed at 60^0C / DNA not preserved at 60^0C ✓	2 (AO 2 x 2.2)	ALLOW idea that enzymes destroying DNA are denatured so less DNA destroyed Answers must make it clear which temperature they are referring to. ALLOW ORA

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Question			Answer/Indicative content	Marks	Guidance
	c		wear face mask / goggles to prevent protease/ethanol/chemicals being inhaled / entering eyes✓ gloves / use tongs prevent ethanol/protease/chemicals being in contact with skin✓ turn Bunsen off as ethanol is flammable✓	2 (AO 2 x 2.2)	ALLOW use tongs as solution/ tube may be hot IGNORE reference to lab coats / glass breakages <u>Examiner's Comments</u> This AO2.2 question assessed application of knowledge an understanding to scientific enquiry. Candidates were good at recognising safety precautions. The most common were "gloves to prevent ethanol causing skin irritation" and "goggles to prevent chemicals getting in the eyes". Where candidates did not gain credit was for generalised explanations such as "goggles, so nothing gets on you".
	d	i	First check answer on answer line If answer = 33.1 (mg) award 2 marks $\frac{99.2}{3}$ OR 33.067 / 33.07✓ = 33.1 (mg) ✓	2 (AO 1.2) (AO 2.2)	<u>Examiner's Comments</u> This question assessed mathematical skills in a scientific enquiry context. Many candidates gained both marks. Occasionally rounding errors meant that they only gained 1 mark for correct working out. This is where showing working out can really benefit candidates, as those that didn't but made a rounding error, scored zero. This can be reinforced when candidates are developing their examination technique.

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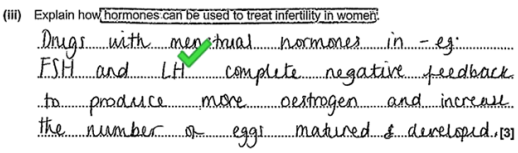
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Question			Answer/Indicative content	Marks	Guidance
		ii	(yes because) idea that there is a greater mean / yield / mass produced (of DNA)✓ there is less range/variation in results✓	2 (AO 2 x 3.1b)	ALLOW ECF ALLOW examples of data from table to indicate less range/variability Examiner's Comments AO3 interpretation and evaluation was assessed in this question. Many candidates identified the increased mass of DNA extracted as indicative that the electric water bath was better to use. Some candidates went on to identify that the range of results was narrower, indicating the variation in results was less and gained 2 marks.
			Total	10	
19			B ✓	1 (AO 2.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
20		i	First check answer on answer line If answer = 19.98 (mm) award 3 marks 20 - 0.025✓ but 19.975 (mm)✓ 19.98 (mm)✓	3 (AO 2 × 2.2) (AO 1.2)	<u>Examiner's Comments</u> The manipulation of standard form was often correct in this question.
		ii	lining is not repaired correctly✓	1 (AO 1.1)	ALLOW lining will not thicken / not build up IGNORE lining will not be maintained / will become thinner <u>Examiner's Comments</u> There was some confusion in the answers between the roles of progesterone and oestrogen. Common incorrect answers referred to the breaking down of the uterus lining.
		iii	Any three from: gonadotrophins used✓ FSH and LH used✓ FSH lead to ripening of follicle✓ and LH causes ovulation✓ human chorionic gonadotrophin✓ causes egg/ovum to mature inside follicle✓	3 (AO 3 × 1.1)	ALLOW stimulate egg production/development <u>Examiner's Comments</u> Candidates often gave the hormones that might be given to women to treat infertility, i.e. LH and FSH but did not specifically link them to their function. This is illustrated in exemplar 7, which would only gain one mark for naming the two hormones. Exemplar 7  (iii) Explain how hormones can be used to treat infertility in women. Drugs with menstrual hormones in - eg: FSH and LH complete negative feedback to produce more oestrogen and increase the number of eggs matured & developed. [3]

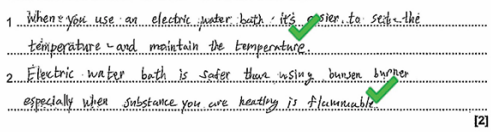
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Question			Answer/Indicative content	Marks	Guidance
		iv	order of bases is changed (in gene)✓ order of amino acids changed in protein / change in shape of the enzyme✓	2 (AO 1.1) (AO 2.1)	ALLOW nucleotides ALLOW mutation in base sequence ALLOW different amino acids in protein IGNORE codes for wrong amino acid to be made <u>Examiner's Comments</u> Many candidates correctly linked changes in the DNA base sequence to alterations in the amino acids in the protein or the shape of the protein molecule.
			Total	9	

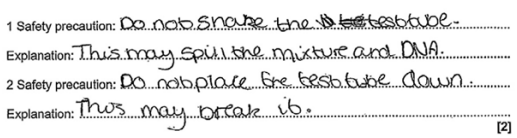
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Question			Answer/Indicative content	Marks	Guidance
21	a		can control temperature (easier)/ can be set to a specific / constant temperature ✓✓ limited fire risk✓	2 (AO 2 ×2.2)	IGNORE reference to ease of measurement ALLOW less risk of burns ALLOW ORA <u>Examiner's Comments</u> Many candidates correctly focussed on the fact that an electric water bath will maintain a constant temperature. Fewer candidates stated the need to prevent ethanol from being near a naked flame. Exemplar 1 contains both these points, therefore achieved both marks. Exemplar 1  1 When you use an electric water bath, it's easier to set the temperature and maintain the temperature. 2 Electric water bath is safer than using a bunsen burner especially when substance you are heating is flammable [2]
	b		for 60°C / high temperatures: idea that (membranes break down) at 60°C releasing more DNA / DNA is extracted easily ✓ against 60°C / high temperatures: increased risk of DNA breaking down at 60°C / more DNA destroyed at 60°C / DNA not preserved at 60°C✓	2 (AO 2 × 2.2)	ALLOW idea that enzymes destroying DNA are denatured so less DNA destroyed Answers must make it clear which temperature they are referring to. ALLOW ORA

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Question			Answer/Indicative content	Marks	Guidance
	c		wear face mask / goggles to prevent protease/ethanol/chemicals being inhaled / entering eyes gloves / use tongs prevent ethanol/protease/chemicals being in contact with skin ✓ turn Bunsen off as ethanol is flammable ✓	2 (AO 2 × 2.2)	**ALLOW** use tongs as solution/ tube may be hot **IGNORE** reference to lab coats / glass breakages Examiner's Comments Lower ability candidates did not gain marks in this question as they often gave vague answers such as references to being careful or not dropping equipment. An example of an answer that did not receive credit is seen in exemplar 2. Exemplar 2  1 Safety precaution: Do not shake the ~~test~~ testtube. Explanation: This may spill the mixture and DNA. 2 Safety precaution: Do not place the testtube down. Explanation: This may break it. [2]
	d	i	**First check answer on answer line** **If answer = 33.1 (mg) award 2 marks** $\frac{99.2}{3}$ **OR** 33.067 / 33.07✓	2 (AO 1.2) (AO 2.2)	Examiner's Comments The majority of candidates could correctly calculate the mean mass and give the answer to one decimal place. A small but significant number only gained one mark as they quoted too many decimal places.

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Question			Answer/Indicative content	Marks	Guidance
		ii	(yes because) idea that there is a greater mean / yield / mass produced (of DNA) ✓ there is less range/variation in results ✓	2 (AO 2 × 3.1b)	ALLOW ECF ALLOW examples of data from table to indicate less range/variability Examiner's Comments There were many correct references to the differences in the ranges of readings, although in some cases the range for the water bath was incorrectly calculated. Fewer candidates commented on the differences between the mean mass of DNA obtained.
			Total	10	
22			B	1 (AO 1.1)	Examiner's Comments AfL Although many candidates answered this correctly, several did so by writing the number in the answer box rather than the correct letter. Candidates who wrote 4 were credited but it is something they should be encouraged to avoid and to only use letters A, B, C or D.
			Total	1	
23			B	1 (AO 2.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
24		i	mRNA carries the code for proteins ✓ more protein will be made ✓	2 (AO 2 × 2.1)	ALLOW protein will be made faster Examiner's Comments This question assessed AO2.1. Many candidates were able to link mRNA to either more or faster protein synthesis, but very few referred to the term 'code' to link mRNA and protein synthesis.
		ii	First check answer on answer line If answer = 40 award 2 marks $\frac{20 \times 200}{100}$ ✓ = 40 ✓	2 (AO 2 × 2.2)	Examiner's Comments Candidates found this AO2.2 mathematics skills question quite challenging. 240 was a common incorrect response. Candidates need to have more practice at similar questions using percentages to develop their mathematical skills in this area.

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Question			Answer/Indicative content	Marks	Guidance
		iii	new method uses the plants **own** genes ✓ concern that plants with the insecticide/gene might be harmful to humans / might impact on food chains / might kill useful insects ✓	2 (AO 2.2) (AO3.2a)	**ALLOW** might have side-effects **IGNORE** ideas about cultural or religious or ethical objections or that it is playing God <u>Examiner's Comments</u> This question assesses both AO2 and AO3. Candidates were most likely to score a mark for the AO3 marking point, but it was rare for them to gain the AO2 mark. Many candidates described the effect of the gene on the plant, not consumers, or did not pick up on the possible problems of the insecticide itself. There were several responses written about the concern about genetic modification not being a natural process. This is an idea that mark schemes are unlikely to credit, preferring instead to focus on the effects of GM food on all consumers. Candidates also frequently missed out writing about the plants own genes and just focused on the AO3 marking point of the bacterial gene so missed the AO2 marking point. It was common for candidates to write about general dangers of bacteria and infections and not specifically the gene.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
25			**Any two from:** drugs shape is same as substrate ✓ blocks the active site ✓ denature the enzyme ✓ change (shape of) active site ✓	2 (AO 2.1)	**ALLOW** drug is competitive/non-competitive inhibitor **ALLOW** competes with enzyme for active site **NOT** kill the enzyme **ALLOW** drug deforms enzyme/active site **ALLOW** substrate doesn't fit the active site/not complimentary **ALLOW** key doesn't fit the lock Examiner's Comments This AO2.1 question was answered well by higher ability candidates. Most candidates realised the enzyme could denature. Some went further to describe what this meant in terms of the shape of the enzyme.
			Total	2	
26			D	1 (AO 1.1)	Examiner's Comments Recalling their knowledge in this AO1.1 question was answered well by higher ability candidates, less so by others. Lower ability candidates were frequently distracted by A.
			Total	1	
27			A	1 (AO 1.1)	Examiner's Comments A very accessible question with the majority of candidates realising that DNA has a double helical structure.
			Total	1	
28			C	1 (AO 1.1)	Examiner's Comments Another very accessible question which was answered correctly by most candidates.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
29			C	1 (AO 1.1)	Examiner's Comments This question proved to be challenging with a number of candidates choosing distractor A as the answer.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
30	a	i	**Any two from:** transcription ✓ DNA (template) used to code for/make mRNA ✓ mRNA nucleotides/bases used to synthesis a mRNA molecule / mRNA nucleotides/bases pair with DNA nucleotides/bases ✓	2 (AO 1.1)	Examiner's Comments There were some correct references to transcription, but this question was intended as a high demand question and did prove to be quite challenging. Exemplar 8 shows an answer that does gain credit for referring to the pairing of DNA bases with mRNA bases. **Exemplar 8** The DNA is unzipped to be read by the mRNA. The mRNA then reads the DNA template, matching each base with its complimentary base pairing. [2]
		ii	**Any two from:** translation ✓ mRNA attaches to ribosome✓ tRNA is a carrier molecule for amino acids / tRNA/carrier molecule brings (correct) amino acids into place / tRNA reads the triplets on the mRNA✓	2 (AO 1.1)	**ALLOW** each triplet code on tRNA/carrier molecule is specific for an amino acid. **DO NOT ALLOW** amino acids are made Examiner's Comments Again, there were some correct references to translation, but many answers confused the roles of ribosomes, mRNA and tRNA. Another common error was to refer to the making of amino acids, rather than proteins.

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Question			Answer/Indicative content	Marks	Guidance
	b	i	small traces of DNA can now be replicated (using PCR) ✓ PCR makes enough DNA to profile / PCR makes enough DNA to match with suspects ✓	2 (AO 2.1)	IGNORE single copy of DNA Small traces of DNA can be replicated using PCR so that it can match to suspects = 2 marks DNA can be replicated using PCR so that there is enough to match to suspects = 2 marks Examiner's Comments A number of candidates thought that the PCR process actually matched the DNA samples. Often the ability to copy small amounts of DNA to make enough for testing was not appreciated.
		ii	S phase / DNA replication ✓	1 (AO 2.1)	ALLOW DNA duplication / IGNORE synthesis unless qualified Examiner's Comments S phase or DNA replication was stated by a number of candidates but more commonly there were references to mitosis or one of the stages of mitosis.
	c	i	Any two from: check on heredity ✓ look for genetic disorders /identify health risk factors ✓ idea of choosing correct medication / genomics ✓ to confirm a person's identity ✓	2 (AO 2.1)	ALLOW establish family tree / find relatives ALLOW specified health risk factor Examiner's Comments There were many correct references to genetic conditions, making ancestral links or the identification of individuals.

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Question			Answer/Indicative content	Marks	Guidance
		ii	avoid being identified for a crime / avoid high insurance costs / reluctance of employers to offer jobs / remain unaware of family history/genetic disorders / idea of dislike of sharing personal details / privacy (reasons) ✓	1 (AO 3.1a)	**ALLOW** do not want to be found by lost relatives **ALLOW** against the Human Rights Act Examiner's Comments A number of candidates seemed to think that the database actually stored physical samples of DNA that could be used for cloning. The most common creditable answers referred to protection of privacy.
			Total	10	
31		i	there are four different bases in DNA ✓	1 (AO1.1)	**ALLOW** nitrogenous bases **ALLOW** names of the four bases / represents ATCG
		ii	phosphate (groups) ✓ sugars ✓	2 (AO2 x 1.1)	**ALLOW** correct answers in either order **ALLOW** deoxyribose
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
32	a	i	electric heater ✓	1 (AO2.2)	**ALLOW** electric incubator / <u>electric</u> (water) bath
		ii	wear goggles / tie (long) hair back / secure loose clothing ✓	1 (AO1.2)	**ALLOW** wear gloves / use gauze under flask / use heatproof mat **IGNORE** face mask / do not touch hot equipment
		iii	**Any two from:** difficult to keep constant/regulate temperature ✓ uneven heating of flask creating hot/cold spots ✓ human error in reading thermometer ✓	2 (AO2.2)	**ALLOW** water may overheat **ALLOW** may become hot and denature enzyme **ALLOW** flask may have slightly raised temperature **ALLOW** temperature in water bath may not reflect temperature in the flask
	b	i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 32 award 2 marks** 34 + 29 + 33 = 96 ✓ 96 ÷ 3 = 32 ✓	2 (AO2.2)	**ALLOW** answer in the space under the table but answer on answer line in table takes preference **ALLOW** ECF for mean calculation
		ii	temperature ✓	1 (AO2.1)	
		iii	identifies variability in each point plot / gives an estimate of level of uncertainty ✓	1 (AO1.2)	**ALLOW** can plot range/error bars **ALLOW** large error bars variability is high/ORA **ALLOW** high variability then reliability is low/ORA **ALLOW** idea of the spread of data at each point and possibly identify/eliminate outlier/anomaly **ALLOW** ranges overlap the data at those 2 points isn't significantly different

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Question			Answer/Indicative content	Marks	Guidance
		iv	**Any two from:** as temperature increases enzyme activity increases ✓ optimum enzyme activity between 25^0C and 35^0C enzyme activity ✓ but somewhere between 30^0C and 35^0C enzyme activity starts to decrease ✓ idea decrease in rate (after 35^0C) due to denaturing ✓	2 (AO3.1a)	**ALLOW** idea that as temperature increases/gets higher so does rate of (enzyme) reaction / gas release / ORA **ALLOW** higher temperature the faster the enzyme activity **ALLOW** enzyme starts to denature above 30^0C/between 30^0C and 35^0C
			Total	10	

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Question			Answer/Indicative content	Marks	Guidance
33		i	**Any two from:** idea it affects enzymes (action/structure) ✓ high temperature causes active site to change shape / active site denatures ✓ stops them working ✓	2 (AO1.1)	**ALLOW** enzymes are heat sensitive/denature **ALLOW** enzymes cannot bind to substrate molecules **IGNORE** cells denature **ALLOW** enzymes no longer catalyse reaction

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Question			Answer/Indicative content	Marks	Guidance
		ii	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Demonstrates knowledge of homeostasis. **AND** Applies knowledge of a skin mechanism for maintaining body temperature in different environments. **AND** Analyses information to comment on the effect of exposing skin. *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)** Demonstrates knowledge of homeostasis **and** applies knowledge of a skin mechanism for maintaining body temperature in different environments. **OR** Demonstrates knowledge of homeostasis **and** analyses information to comment on the effect of exposing the skin. **OR** Applies knowledge of a skin mechanism for maintaining body temperature in different environments **and** analyses information to comment on the effect of exposing skin. *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)** Demonstrates knowledge of homeostasis. **OR** Applies knowledge of a skin mechanism for maintaining body temperature in different environments. **OR** Analyses information to comment on the effect of exposing skin.	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)	**AO1.1 Demonstrate knowledge and understanding of skin and homeostasis** • need to keep constant internal temperature, despite the different external temperatures • person A needs to lose heat to the environment / person B needs to reduce heat lost to the environment • person A gains heat from the environment / person B loses heat to the environment • person A will be in danger of overheating / person B will be in danger of becoming too cold. **AO2.1 Apply knowledge and understanding of the mechanisms in skin for maintaining body temperature in different environments** • cold environment reduces sweating /decreases blood flow to the skin (vasoconstriction) / shivering / body hairs rise • warm environment increases sweating / increases blood flow to the skin (vasodilation) / body hairs on skin lie flat **AO3.1a Analyse information and ideas to interpret the effect of exposing / covering skin in different environments** • person A body less covered/more exposed skin in warmer conditions increases heat loss/allows sweat to evaporate • person B body covered/less exposed skin in colder conditions reduces heat loss/stops sweat evaporating

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Question			Answer/Indicative content	Marks	Guidance
			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.*		
			Total	8	
34			smallest: nucleotide / allele / chromosome :largest ✓	1 (AO1.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
35	a		more accurate/precise measurement (of volume/amount of gas) ✓	1 (AO3.3b)	ALLOW gas could dissolve in water / less gas can escape IGNORE gives exact measurement of gas release
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.3 (cm^3 / min) award 3 marks $\frac{25+23+22}{3} = 23.3333333$ ✓ $\frac{23.3^{\cdot}}{10} = 2.3333333$ ✓ = 2.3 (cm^3 / min) ✓	3 (AO1 x 1.2) (AO2 x 2.2)	ALLOW one mark for clear evidence of rounding incorrect answer correctly to one dp.
		ii	increased movement of molecules / increased kinetic energy ✓ therefore, more chance of substrate colliding with enzymes/active sites ✓ more chance of substrate entering active site ✓	3 (AO2 x2.1)	increased KE of enzymes and substrates leads to more collisions = 2 marks ALLOW more enzyme-substrate complexes forming
	c		(phenols) alter the shape of the active site/enzyme / block active site/enzyme ✓ so substrate no longer fits/binds with active site/enzyme ✓	2 (AO2.1)	IGNORE reference to denaturing need reference to active site once only for 2 marks
			Total	9	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>36</td><td></td><td></td><td>Any four from:
DNA unwinds/unzips ✓

during transcription mRNA is made ✓

mRNA moves from the nucleus to the cytoplasm/ribosomes ✓

translation on the ribosomes ✓

carrier molecules/tRNA bring specific amino acids ✓

amino acids joined to form a protein ✓</td><td>4
(AO4 x 1.1)</td><td>

DO NOT ALLOW amino acids are produced</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>37</td><td>a</td><td></td><td>smallest

largest

nucleotide
allele
chromosome
genome</td><td>1
(AO1.1)</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>66000000 ÷ 500 = 132 000 ✓</td><td>1
(AO2.2)</td><td>ALLOW 0.132 million or 132 thousand</td></tr>
<tr><td></td><td>c</td><td></td><td>man
D d
woman
d Dd dd
d Dd dd

✓

0.5 / 50(%)✓</td><td>2
(AO2.2)
(AO3.1a)</td><td>ALLOW appropriate use of other lower/upper case letters

ALLOW ECF
ALLOW 1 in 2 / ½ / 1:1 ✓
DO NOT ALLOW 1:2</td></tr>
<tr><td></td><td>d</td><td></td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 839 award 2 marks

2517/3 ✓

= 839 ✓</td><td>2
(AO2 x 1.2)</td><td>

ALLOW 840 or 2521/3 ✓</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

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