Mark scheme – What Happens in Cells (F)

Question			Answer/Indicative content	Marks	Guidance
1			B	1 (AO 2.1)	
			Total	**1**	
2			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**	
3			A ✓	**1** (**AO** 2.1)	
			Total	**1**	
4			C ✓	**1** (**AO** 1.1)	
			Total	**1**	
5			smallest: nucleotide allele largest: chromosome ✓	1 (AO1.1)	
			Total	**1**	
6		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
		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. *There is an attempt at a logical structure with a line of reasoning. The information is*	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

			in the most part relevant. **0 marks** *No response or no response worthy of credit.*		
			Total	**8**	
7	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
		iv	**Any two from:** as temperature increases enzyme activity increases ✓ optimum enzyme activity between 25^0C and	2 (AO3.1a)	**ALLOW** idea that as temperature increases/gets higher so does rate of (enzyme) reaction / gas release / ORA

			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 ✓		**ALLOW** higher temperature the faster the enzyme activity **ALLOW** enzyme starts to denature above 30^0C/between 30^0C and 35^0C
			Total	**10**	
8		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**	
9			**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**	
10	a		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

					Examiner's Comments 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".
	b	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)**	**Examiner's Comments** 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.
		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.
	c		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.
	d		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
			Total	**10**	
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	
		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**	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**

			(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.*		**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**	
12		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**	
13	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) 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**	
14			B	1	
			Total	**1**	
15			C	1	
			Total	**1**	
16			D	1	
			Total	**1**	
17		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**	
18			B	1	
			Total	**1**	
19			B	1	
			Total	**1**	
20			D	1	

			Total	**1**	