Question			Answer	Mark	Guidance
1	(a)		endocrine ; hormone ; cortex / cortical ; target / effector ;	4	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
1	(b)	(i)	**1** glucose , respired / phosphorylated / metabolised , to produce ATP ; **2** ATP , blocks / closes , potassium ion channel(s) **and** potassium ions / K^+ , build up (inside cell) / cannot leave ; **3** (voltage-gated) calcium ion / Ca^{2+} , channels open **and** calcium ions / Ca^{2+} , enter (cell by diffusion) ; **4** (more) calcium ions / Ca^{2+} , resulting in , movement of vesicles to membrane / exocytosis / described ;	4	**IGNORE** the numbered prompt lines, but the events **must** be in the correct sequence. 1 **IGNORE** 'glucose is broken down to form ATP' **2** ion must be indicated at least once If symbol used, must have correct charge **IGNORE** ref to 'depolarisation' (as not indicated on fig.) **3** ion must be indicated at least once If symbol used, must have correct charge **IGNORE** ref to polarisation **4** if ion had been mentioned in stage 3, then allow 'calcium' alone for this mp **ACCEPT** ecf ***for this mp*** if mp 3 not awarded because Na^+ stated instead of Ca^{2+} **IGNORE** 'secretion' as given in question

Question			Answer	Mark	Guidance
1	(b)	(ii)	**1** (continues to be secreted) as long as blood / plasma , glucose (concentration) , remains high / is higher than normal ; **2** (sufficient) ATP is still present and so K^+ channels remain closed ; **3** (exocytosis) still being triggered by , calcium ions / Ca^{2+};	**2 max**	**IGNORE** ref to what happens once the glucose level returns to normal and secretion stops (as Q asks about the continued secretion of insulin) **3** **CREDIT** Ca^{2+} , still present / remain high **CREDIT** exocytosis continues until Ca^{2+} can be removed from cell
			Total	**10**	

Question			Answer	Marks	Guidance
2	(a)	(i)	**1** (hormone) binds to <u>receptor</u> **;** **2** causing **,** cascade of events / enzyme reactions **;** **3** may involve switching **,** on / off, genes **;** **4** only **,** present / needed **,** in small **,** concentrations / quantities (to have an effect) **;** **5** may have effect on more than one **,** location / target tissue **;** **6** *idea that* effect may involve interaction of more than one hormone **;**	**2 max**	**IGNORE** prompt lines and mark as prose **1 ACCEPT (**hormone) complementary shape to <u>receptor</u> **1 ACCEPT** attach **1 IGNORE** fit **3 CREDIT** ref to changing gene expression
	(a)	(ii)	**1** (most) plant cells retain ability to differentiate / <u>totipotent</u> **;** **2** plants have **,** meristems / meristematic tissue **;** **3** *idea that* plant cells can de-differentiate and then differentiate into a different cell type; **4** (most) animal cells are **,** differentiated / not totipotent / not pluripotent / only able to differentiate into the same type(s) of cell / are multipotent;	**2 max**	**2 ACCEPT** named meristematic tissue e.g. shoot apex / root apex / cambium **4 ACCEPT** 'stem cells found in few (named) tissues' 'bone marrow cells only differentiate into blood cells'

Question			Answer	Marks	Guidance
	(a)	(iii)	**1** (inter-species / triploid) hybrids **,** are sterile / cannot reproduce sexually;		**1** **CREDIT** hybrid from named examples e.g. einkorn (wheat) x **,** wild / goat **,** grass emmer (wheat) x wild grass
			2 polyploidy (in the hybrid) provides duplicate of each chromosome **;**		**2** **IGNORE** ref to 'more than two sets of chromosomes' as this is given in Q
			3 (polyploidy) allows the hybrid to **,** carry out meiosis / form gametes **or** (polyploidy) restores fertility / overcomes sterility **;**		**3** **ACCEPT** 'chromosome number doubling restores fertility' **3** **ACCEPT** can reproduce sexually
			4 (hybrids are) <u>reproductively isolated</u> (from other species);		**4** **ACCEPT** gametes incompatible with other species
			5 increased, cell size / grain size, increases yield;		**5** **ACCEPT** seed size
			6 sterile hybrids expensive for farming (especially in developing countries);		
			7 (plants) stronger/more vigorous/ healthier;		**7** must be a comparative statement **7** **ACCEPT** less prone to disease / greater hybrid vigour **7** **IGNORE** pest resistance
				2 max	

Question			Answer	Marks	Guidance
	(b)		*cress seedlings* **C1** apical cells / apex/ tip(of shoot), produce **,** auxin / IAA **;** **C2** diffusion / active transport (down shoot / through parenchyma) **;** **C3** greater auxin (concentration) on shaded side of stem **;** **C4** auxin causes cell wall loosening **;** **C5** auxin causes cell **,** elongation / expansion **;** **C6** further detail of changes in cell **wall** ; *Human* **H1** retina / rods / receptors**,** detect light / AW **;** **H2** action potentials/ depolarisation/nervous impulse**,** along sensory neurone (membrane) **;** **H3** intermediate neurone (in brain) **/** (somatic) motor neurone / neuromuscular junction **;** **H4** correct ref to detail of synaptic transmission**;** **H5** depolarisation / contraction, of muscle fibre(s); **H6** correct ref to detail of muscle contraction;	**7 max**	**C1 ACCEPT** secretes /releases **C2 CREDIT** PIN (polar auxin transport) **C3 ACCEPT** auxin, moves to / collects on, shaded side **C3 IGNORE** found on shaded side **C4 ACCEPT** cell walls become,stretchy / less rigid **C4 IGNORE** weakened cell walls **C6** e.g. H^+ ions pumped into cell wall / low pH to allow enzymes to work / bonds broken within cellulose in wall **H1 IGNORE** ref to cones **H2 / H3 DO NOT CREDIT signals / messages** **H2 IGNORE** ref to optic nerve **H3 CREDIT** ref to relay neurone **H5 ACCEPT** muscle cell **H6** e.g. actin and myosin slide over each other
			Total	**13**	

Question			Answer	Mark	Guidance
3	(a)	(i)	diabetes (mellitus) **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** hyperglycaemia **IGNORE** Type 1 or Type 2 **DO NOT CREDIT** hypoglycaemia
3	(a)	(ii)	*idea that* time needed **,** to restore normal (blood) glucose concentration / for insulin to act (fully) **;**	1	
3	(a)	(iii)	18.6 **; ;**	2	**Correct answer = 2 marks**, even if no working shown. **If answer is incorrect**, then **ALLOW** 1 mark for seeing: 1.1 ÷ 5.9 **or** (7.0 – 5.9) ÷ 5.9 **or** 118.6 **or** 118.64 **If the answer is not correctly rounded to 1dp**, then **ALLOW** 1 mark for seeing a correct unrounded answer e.g. 18.64
3	(b)		**1** HbA1C / glycosylated Hb **,** contained within **,** red blood cell(s) / erythrocyte(s) **;** **2** red blood cells / erythrocyte(s) **,** have limited life span / live for 8 to 12 weeks **or** red blood cells / erythrocyte(s) **,** break down after **,** 12 weeks / 3 months **;** **3** HbA1C / glycosylated Hb **,** broken down **,** in liver / by hepatocytes / by Kupffer cells **;**	2 max	**CREDIT** RBC / rbc for 'red blood cell' throughout **3** **IGNORE** ref to recycling

Question			Answer	Mark	Guidance
3	(c)		patient might have had a drink containing sugar ; AVP ;	1 max	**DO NOT CREDIT** ref to having eaten (as patient had confirmed that he had not eaten) **CREDIT** ref to a specific sugar-containing drink e.g. ● patient was nervous and secreted adrenaline ● other medication interferes with glucose levels ● patient's haemoglobin does not bind effectively with glucose (e.g. anaemia / sickle cell)
3	(d)	(i)	**1** if blood glucose falls , extremely / dangerously / too / very , low ; **2** if patient , cannot produce (enough) glucagon / produces little glucagon ; **3** *idea that* glucose source cannot be taken by mouth ;	1 max	**1** **CREDIT** hypoglycaemic / hypoglycaemia **IGNORE** 'below normal' alone **2** **CREDIT** ref to dysfunctional , α cells / glucagon receptors **3** **CREDIT** a suitable reason (e.g. fitting or in a coma)

Question			Answer	Mark	Guidance
3	(d)	(ii)	*when blood glucose concentration decreases* **1** (glucagon) released by the **,** **alpha** / α **,** cells in **,** **islet**s of Langerhans / **pancreas** **;** **2** promotes / AW **,** conversion of **glycogen** to glucose / **glycogenolysis** **,** in **,** liver / muscle / **effector** **,** cells **;** **3** ref **gluconeogenesis** / described **;** **4** ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration **;** **5** **negative feedback** **,** reduces / inhibits **,** the secretion of glucagon **;** **6** glucagon **,** reduces / inhibits **,** insulin secretion **;**	4 max	**IGNORE** ref to insulin or events following an increase in blood glucose concentration **1** **DO NOT CREDIT** 'alpha cells are produced' **2** **Any description must** correspond correctly to term **DO NOT CREDIT** if glucagon *converts* glycogen directly **3** **Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **4** **Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **5** **DO NOT CREDIT** stopping glucagon secretion **6** **DO NOT CREDIT** stopping insulin secretion
			QWC – technical terms used appropriately and spelled correctly **;**	1	Use of **three** terms from: **alpha**, **islet**, **pancreas** , **glycogen**, **glycogenolysis**, **effector**, **gluconeogenesis**, **negative feedback** **Please insert a QWC symbol next to the pencil icon, followed by** **a tick (✓) if QWC has been awarded** **or a cross (×) if QWC has not been awarded** **You should use the green dot to identify the QWC terms that you are crediting.**
			Total	**13**	

Question			Answer	Marks	Guidance
4	(a)	(i)	islet(s) of Langerhans ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** α and β cells
4	(a)	(ii)	beta / β ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** b **IGNORE** islets (of Langerhans) **DO NOT CREDIT** B (confusion with immune system)

Question			Answer	Marks	Guidance
4	(b)		*in gap order* **1** increases **;** **2** glycolytic / glycolysis **;** **3** depolarised **;** **4** calcium **;** **5** exocytosis **;**	5	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** ***1*** **CREDIT** rises / gets higher **ACCEPT** 'is high' ***2*** **IGNORE** metabolic / respiratory ***3*** **ACCEPT** **'**less negative / more positive **,** on the inside (than previously)' **or** 'less positive / more negative **,** on the outside (than previously)' **IGNORE** figures (as Q has asked for words) **DO NOT CREDIT** ionised / polarised ***4*** **IGNORE** Ca or Ca^{2+} (as Q has asked for words) **DO NOT CREDIT** if incorrect symbols given (e.g. Ca^{+} , CA^{2+})
4	(c)	(i)	ribosome / <u>rough</u> endoplasmic reticulum / <u>R</u>ER **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** rRNA (as this is not *where* proteins are made)

Question			Answer	Marks	Guidance
4	(c)	(ii)	**1** transported to Golgi ; **2** modified / processed , in Golgi ; **3** packaged into / stored in , (Golgi) vesicle(s) ; **4** vesicles transported towards , plasma / cell surface , membrane ; **5** AVP ;	3 max	**IGNORE** ref. to mechanism of insulin secretion **IGNORE** ref. to negative feedback control of insulin secretion ***2*** **DO NOT CREDIT** if ref. to carbohydrate ***4*** **IGNORE** 'fuses with membrane' ***5*** eg • detail of modification (splitting / recombining, polypeptide) • role of cytoskeleton • use of ATP (in context of, modification / movement)
			Total	**11**	