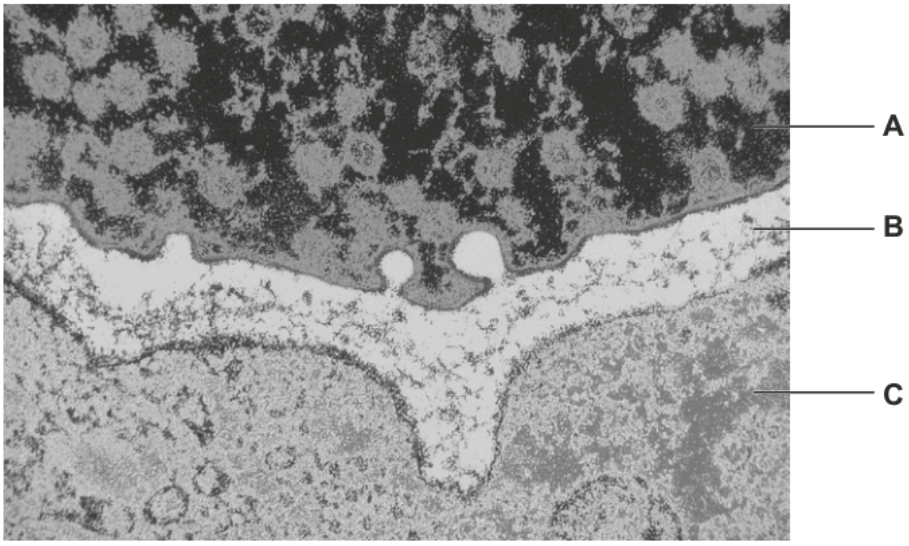
Neuronal and Hormonal Communication (5.1.3–5.1.4): OCR A Level Biolo

20 questions · 43 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 1 · June 2023 · Q18(a)(i) · 1 mark

18 (a) The electron micrograph shows the junction between two neurones.



(i) State the name given to the region labelled **B**.

..... **[1]**

Question 2 · A level Paper 1 · June 2023 · Q18(a)(ii) · 1 mark

(ii) Identify whether structure **A** or structure **C** is the first neurone in the pathway.

Use **one** piece of evidence visible in the electron micrograph to explain your choice.

.....

.....

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 3 · A level Paper 1 · June 2022 · Q21(a)(i) · 2 marks

21 (a) Glands can be either endocrine or exocrine.

(i) Describe what is meant by an endocrine gland.

.....

.....

.....

.....

..... **[2]**

Question 4 · A level Paper 1 · June 2022 · Q21(a)(ii) · 1 mark

(ii) The pancreas contains endocrine glands such as the Islets of Langerhans. It also contains cells that produce digestive enzymes.

Suggest why the cells that produce digestive enzymes are described as exocrine rather than endocrine.

.....

..... **[1]**

Question 5 · A level Paper 1 · June 2022 · Q21(b) · 2 marks

(b) Hormones can be classed as either steroid or non-steroid. Steroids are lipid soluble.

Suggest the location of the receptors for steroid hormones and state a reason for your suggestion.

.....

.....

.....

.....

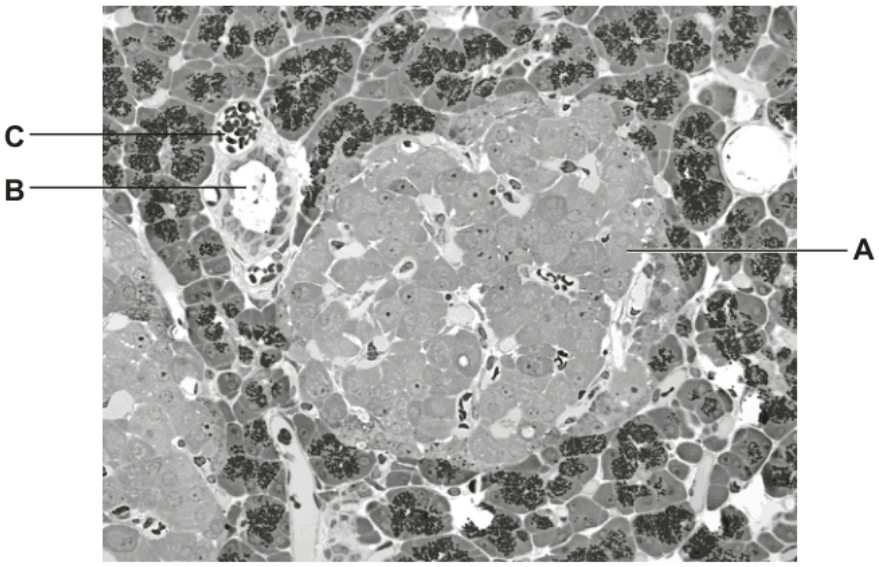
..... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 6 · A level Paper 3 · June 2024 · Q5(b) · 3 marks

(b) Insulin is secreted from cells in the pancreas.

This is a photomicrograph of pancreatic tissue.



Identify the structures labelled **A**, **B** and **C**.

A .....

B .....

C .....

[3]

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

Question 7 · A level Paper 1 · June 2018 · Q16(a)(i) · 2 marks

SECTION B

Answer **all** the questions.

16 (a) Gestational diabetes is a medical condition that affects pregnant women. It results in high levels of glucose in the blood, even though the woman produces normal levels of insulin.

(i) Gestational diabetes is most similar to which **other** type of diabetes?

Explain your answer.

.....

.....

.....

..... **[2]**

Question 8 · A level Paper 1 · June 2018 · Q16(a)(ii) · 2 marks

(ii) Suggest **two** ways a woman with gestational diabetes can manage her condition.

1 .....

.....

2 .....

.....

[2]

Question 9 · A level Paper 1 · June 2018 · Q16(b)(i) · 1 mark

(b) (i) Skeletal muscle is one of the main tissues where glucose is removed from the blood in response to insulin.

Name the other tissue.

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

(b) Another unusual characteristic of naked mole rats is their tolerance of pain.

Acid causes pain responses in most mammals. Naked mole rats are tolerant of the pain caused by acid.

This tolerance can be explained by the type of pain receptor found in naked mole rats.

Fig. 2.2 shows a representation of the ion channels present in the pain receptors of naked mole rats and other mammals.

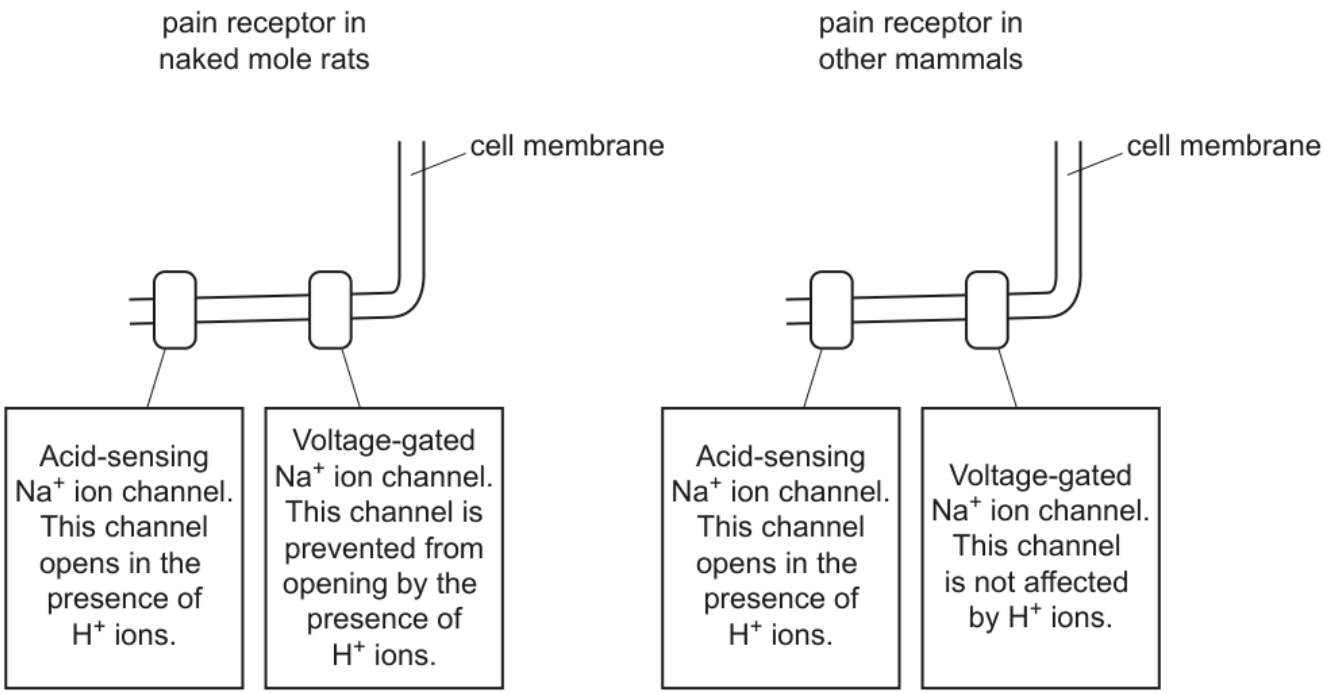


Fig. 2.2

(i) Use the information in Fig. 2.2 to suggest why naked mole rats do not feel pain when exposed to acid.

.....

.....

.....

.....

..... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 11 · A level Paper 3 · June 2019 · Q2(b)(ii) · 1 mark

(ii) Explain how a pain receptor is an example of a transducer.

.....

.....

..... **[1]**

Turn over

Question 12 · A level Paper 1 · June 2018 · Q21(a)(i) · 4 marks

21 (a) The greater blue-ringed octopus, *Hapalochlaena lunulata*, is one of the most venomous of all animals.

Its bite contains tetrodotoxin (TTX), a neurotoxin that can cause paralysis and death within minutes.

(i) The following information has been discovered about the effects of TTX on nerve cells:

- TTX binds to the external surface of the voltage-gated sodium ion channels in the axon membrane.
- Binding of TTX changes the tertiary structure of the channel.
- This means the channel cannot open.

Using the information provided, explain how TTX affects the activity of neurones.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 13 · A level Paper 1 · June 2018 · Q21(b) · 1 mark

(b) Molluscs such as *H. lunulata* have unmyelinated neurones. Saltatory conduction cannot occur in these neurones.

Why is transmission of action potentials along the axon slower in the absence of saltatory conduction?

.....

..... **[1]**

Turn over

Question 14 · A level Paper 1 · June 2022 · Q21(c)(i) · 2 marks

(c) The Society for Endocrinology has produced a booklet about adrenal failure to help patients understand their illness.

The following statements are adapted from this booklet.

- Adrenal failure is caused by inability of the adrenal glands to produce sufficient amounts of cortisol and aldosterone.
- In healthy people, the hormone ACTH is produced by the pituitary gland and causes the adrenal cortex to release more cortisol and aldosterone.
- A pituitary tumour can stop ACTH production by the pituitary. This leads to adrenal failure.
- Symptoms of adrenal failure include severe fatigue and weakness, weight loss, low blood pressure and salt craving.

(i) Explain the symptoms of adrenal failure.

.....

.....

.....

.....

..... **[2]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 15 · A level Paper 1 · June 2022 · Q21(c)(ii) · 3 marks

(ii) Explain why patients with a pituitary tumour have adrenal failure but still respond normally to situations of danger or excitement.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

Turn over

Question 16 · A level Paper 1 · November 2021 · Q17(b)(i) · 1 mark

(b) Scientists investigated the effect of the drug nifedipine on the secretion of insulin from pancreas cells in culture.

Pancreas cells were first incubated with glucose at a concentration of $3\,mmol\,dm^{-3}$. The concentration of glucose was then increased to $20\,mmol\,dm^{-3}$ in the presence or absence of nifedipine.

The scientists then measured the amount of insulin secreted by the cells. They recorded their results as a percentage of the total insulin content of the cells. Each experiment was repeated seven times.

The results are shown in the table.

Condition	Mean insulin secreted (%)
Without nifedipine	7.8 ± 0.78
With nifedipine	0.8 ± 0.15

(i) Name the cells that secrete insulin.

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 17 · A level Paper 1 · November 2021 · Q17(b)(ii) · 2 marks

(ii) Explain why it was necessary to increase the concentration of glucose surrounding the cells before they measured insulin secretion.

.....

.....

.....

.....

..... **[2]**

Question 18 · A level Paper 1 · November 2021 · Q17(b)(v) · 2 marks

(v) Nifedipine blocks Ca^{2+}-channels.

Explain how blocking calcium channels could inhibit insulin secretion.

.....

.....

.....

.....

..... **[2]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

(ii) The sensory neurone was stimulated electrically and the FURA-2 fluorescence in the synaptic bulb was measured. At the same time, an electrode recorded the membrane potential in a postsynaptic neurone.

The results of this study are shown in the table.

Strength of electrical stimulation	FURA-2 fluorescence in synaptic bulb	Highest membrane potential in postsynaptic neurone (mV)
Low	Low	–60
Medium	Medium	+40
High	High	+40

The intensity of FURA-2 fluorescence is proportional to the concentration of Ca^{2+} ions.

The scientists concluded that changes in the concentration of Ca^{2+} ions in the presynaptic neurone caused an action potential in the postsynaptic neurone.

Evaluate and explain the scientists' conclusion.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 20 · A level Paper 1 · November 2021 · Q17(c) · 6 marks

(c)* Type 1 diabetes has been treatable for many years, but treatments are always improving.

Evaluate the treatments for type 1 diabetes that have been used in the past as well as current and potential future treatments.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

Additional answer space if required.

.....

.....

.....

.....

.....

Questions, mark schemes and examiners' report extracts © OCR.

Mark schemes

Question 1 · A level Paper 1 · June 2023 · Q18(a)(i) · 1 mark

18	(a)	(i)	synaptic , cleft / gap ✓	1	1.1	**IGNORE** synapse

Question 2 · A level Paper 1 · June 2023 · Q18(a)(ii) · 1 mark

18	(a)	(ii)	structure **A** **and** vesicles (fused with membrane) **OR** exocytosis / neurotransmitter released ✓	1	3.1

MUST include structure **A and** a reason for one mark.

Question 3 · A level Paper 1 · June 2022 · Q21(a)(i) · 2 marks

21	(a)	(i)	(a group of cells that) secretes / releases / produces , hormones ✓ (directly) into the blood (stream) ✓	2	1.2

DO NOT ALLOW excretes

ALLOW doesn't have ducts / ductless

Question 4 · A level Paper 1 · June 2022 · Q21(a)(ii) · 1 mark

21	(a)	(ii)	(because digestive enzymes) are released into ducts ✓	1	2.1

ALLOW (because digestive enzymes) are not released (directly) into the blood

Question 5 · A level Paper 1 · June 2022 · Q21(b) · 2 marks

21	(b)	inside cells / in cytoplasm / in the nucleus ✓ because steroids can cross the , cell surface / plasma , membrane ✓		2	2.1

ALLOW can cross phospholipid bilayer

Questions, mark schemes and examiners' report extracts © OCR.

Question 6 · A level Paper 3 · June 2024 · Q5(b) · 3 marks

5	(b)		A = islet of Langerhans B = (branch of pancreatic) duct C = (named) blood vessel	3

ALLOW α-cell / β-cell
ALLOW (intralobular) duct
ALLOW artery / arteriole / vein / venule
ALLOW red blood cell / erythrocyte
DO NOT ALLOW capillary (contains too many erythrocytes) / incorrectly named blood vessel (e.g. hepatic artery)

Question 7 · A level Paper 1 · June 2018 · Q16(a)(i) · 2 marks

16	(a)	(i)	(Type) 2 / II / two ✓ *explanation:* insulin is (still) produced ✓ beta / β , cells still working ✓ *idea that* (liver) cells no longer respond to insulin ✓ fewer / damaged , (insulin) receptors ✓ if it was Type I then the woman would not produce (normal levels of) insulin ✓	**2 max**

ALLOW it is diabetes mellitus not diabetes insipidus
ALLOW late onset

1 mark max for explanation

DO NOT ALLOW B / b , cells

ALLOW (develop) insulin resistance
ALLOW (insulin) receptors not working

Questions, mark schemes and examiners' report extracts © OCR.

Question 8 · A level Paper 1 · June 2018 · Q16(a)(ii) · 2 marks

(ii)	low , carbohydrate / sugar , diet ✓ exercise ✓ manage weight (gain) ✓ drugs to control glucose levels ✓	**2 max**

List Rule

If **both** prompt lines used and more than one suggestion is on the line mark the **first** one on each line. If only **one** line used but there is more than one suggestion listed mark first two written.

ALLOW regulate / control / reduce , for "low"
ALLOW named sugar / starch
IGNORE low fat / healthy / balanced / low "carb" , diet
ALLOW example of exercise e.g. walking

ALLOW named drug e.g. metformin
ALLOW ref to injecting insulin

Question 9 · A level Paper 1 · June 2018 · Q16(b)(i) · 1 mark

(b)	**(i)**	liver (tissue) ✓	**1**	**ALLOW** hepatic (tissue) **IGNORE** hepatocytes / cells **IGNORE** muscle

Questions, mark schemes and examiners' report extracts © OCR.

Question 10 · A level Paper 3 · June 2019 · Q2(b)(i) · 2 marks

	b	**i**	no, action potentials / (electrical) impulses (in response to acid stimulus) ✓ (along) sensory neurones / neurones to CNS ✓ (because) no / few, <u>voltage gated</u> (sodium) channels open ✓ less depolarisation (of receptor membrane) / fewer Na^+ ions move in ✓

2 max	**ALLOW** fewer, action potentials / (electrical) impulses, generated **ALLOW** neurones to brain **IGNORE** fewer sodium ion channels opened **DO NOT ALLOW** no depolarisation / no Na^+ ions move in

Question 11 · A level Paper 3 · June 2019 · Q2(b)(ii) · 1 mark

b	**ii**	converts, chemical / stimulus, to action potential / electrical energy / electrical impulse ✓	**1**

ALLOW kinetic energy / pressure / temperature / mechanical energy / H^+ ions as examples of stimuli (as question states a pain receptor) **IGNORE** 'sensory information' / 'pain'

Questions, mark schemes and examiners' report extracts © OCR.

Question 12 · A level Paper 1 · June 2018 · Q21(a)(i) · 4 marks

21	**(a)**	**(i)**	sodium ions / Na ions / Na+ , cannot enter ✓ no / prevents , depolarisation of membrane ✓ (membrane) remains at resting potential ✓ prevents action potential being generated ✓ impulse not conducted (along axon) ✓ (so) no release of neurotransmitter ✓	**4 max**

Award 3 max if explanation refers to what would normally happen in neurone instead of in presence of TTX
DO NOT ALLOW cannot enter membrane
ALLOW sodium ions / Na ions / Na+ , stay outside

ALLOW action potential for impulse

Question 13 · A level Paper 1 · June 2018 · Q21(b) · 1 mark

(b)		no nodes of Ranvier ✓ shorter local , currents / circuits ✓ whole axon needs to be depolarised ✓	**1 max**
		Total	**10**

IGNORE ref to jumping between nodes
ALLOW more local currents / circuits

ALLOW e.g. action potentials need to be generated all the way along the axon

Questions, mark schemes and examiners' report extracts © OCR.

Question 14 · A level Paper 1 · June 2022 · Q21(c)(i) · 2 marks

21	(c)	(i)	cortisol / glucocorticoids , regulate carbohydrate metabolism ✓ lack of , aldosterone / mineralocorticoids , cause , low blood pressure / salt craving , as regulate ion concentration ✓	2	2.1

ALLOW helps regulate availability of glucose **or** ref to gluconeogenesis **or** glycogenolysis
IGNORE aldosterone

ALLOW for ions either sodium ions **or** Na^+ **or** potassium ions **or** K^+
DO NOT ALLOW cortisol

Question 15 · A level Paper 1 · June 2022 · Q21(c)(ii) · 3 marks

21	(c)	(ii)	**any three from:** ACTH only affects (adrenal) cortex ✓ adrenaline is produced by the (adrenal) medulla ✓ adrenaline is responsible for , response to danger / flight or fight response ✓ response to danger / fight or flight response , is also , mediated by / AW , (autonomic/sympathetic) nervous system ✓	3	2.1

ALLOW ACTH does not affect medulla
DO NOT ALLOW parasympathetic

Question 16 · A level Paper 1 · November 2021 · Q17(b)(i) · 1 mark

17	(b)	(i)	beta / β (cells) ✓	1	1.1

Question 17 · A level Paper 1 · November 2021 · Q17(b)(ii) · 2 marks

17	(b)	(ii)	glucose (concentration) causes release of insulin / AW ✓ change in insulin secretion is high enough to be measured / AW ✓	2	3.3 2.3

IGNORE synthesis or production of insulin

ALLOW amount of insulin (secreted by the cells) was high enough to measure

Questions, mark schemes and examiners' report extracts © OCR.

Question 18 · A level Paper 1 · November 2021 · Q17(b)(v) · 2 marks

17	(b)	(v)		**2**	2.4
			Ca^{2+} / calcium ions , do not enter (cells) ✓ less / no , exocytosis ✓		

ALLOW for **1 max** description of what happens without the inhibitor

ALLOW less / no , movement of vesicles towards membrane

ALLOW less / no , vesicles fuse with membrane

DO NOT ALLOW vesicles not secreted

Questions, mark schemes and examiners' report extracts © OCR.

Question 19 · A level Paper 1 · November 2020 · Q18(b)(ii) · 4 marks

18	**(b)**	**(ii)**	***conclusion is valid because:*** **1** concentration of Ca^{2+} is proportional to strength of stimulus ✓ **2** Ca^{2+} change from low to , medium / high , causes increase in (membrane) potential ✓ **3** action potential in , presynaptic neurone / synaptic bulb , leads to , opening of Ca^{2+} channels / entry of Ca^{2+} ✓ **4** Ca^{2+} , causes / AW , release of (named) neurotransmitter ✓ **5** (named) neurotransmitter causes , Na+ / sodium ion , channels to open in (post-synaptic) neurone ✓ **6** if threshold is exceeded this causes , action potential in (postsynaptic) neurone / depolarises (postsynaptic) membrane ✓ ***conclusion may not be valid because:*** **7** changes in Ca^{2+} concentration may not be the cause of (postsynaptic) action potential ✓ **8** Ca^{2+} change from medium to high but no change in (membrane) potential ✓

4 max	2.4 3.2	**ALLOW** calcium ions for Ca^{2+} throughout **DO NOT ALLOW** Ca^{+} / calcium but penalise once then ECF **ALLOW** reference to +40 mV as alternative to action potential throughout **IGNORE** ref to fluorescence / FURA-2 **MP 1 ALLOW e.g.** the greater the strength of stimulus the greater the Ca^{2+} concentration **MP2 ALLOW** figs go from -60 to +40mV **MP8 ALLOW** figs stay at + 40mV

Questions, mark schemes and examiners' report extracts © OCR.

Question 20 · A level Paper 1 · November 2021 · Q17(c) · 6 marks

17	(c)*		***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
			Level 3 (5–6 marks) An evaluation that includes treatments with insulin (past **and** current) **AND** includes another treatment (current / potential) e.g. transplant. Includes advantage **and** disadvantage statements for insulin **and** another treatment. *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)** An evaluation that includes treatment with insulin (past **or** current) **AND** includes another treatment (current / potential) e.g. transplant. Includes advantage **and** disadvantage statements for **either** insulin **or** another treatment. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Description of any treatment for Type I diabetes. Includes an advantage **OR** disadvantage statement. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	**6**	1.1 3.2	*Indicative scientific points include:* **Insulin treatments:** *past* • from animal pancreas e.g. pig *current* • from e.g. GM / recombinant bacteria / humulin **Other current / potential treatments:** • transplant of pancreas / islets • transplant of (pancreatic) stem cells • immunotherapies / gene therapy *Advantages /disadvantages should be linked to treatment being discussed* **Advantages of insulin** *animal-derived insulin* • tried and tested method • early treatment kept people alive *'human' insulin* • high purity • less risk of allergic reaction • lower production cost • overcomes religious / ethical issues of animal products • use of smart pens / pumps • detail of pump use e.g. monitored by apps **Disadvantages of insulin**
			0 marks *No response or no response worthy of credit.*			*animal-derived insulin* • needs to be purified • risk of allergic reaction • high production cost • religious / ethical issues of animal products *'human' insulin* • people persuaded to change from previous insulin regime e.g. animal insulin • some may not understand technology of injection routine • side effects of pumps e.g. hard lumps forming under skin **Advantages of other treatments** *e.g. transplants* • less / no need for insulin injections • more physiological control of blood glucose compared with injection • reduce risk of 'hypos' • improved quality of life • stem cells turned into functioning β-cells *e.g. immunotherapies* • 'reprogrammes' immune system • prevents / stops damage to β-cells **Disadvantages of other treatments:** *e.g. transplants* • requirement for immunosuppression • availability of donor tissue • ethical issues associated with stem cells • risk of cancer with stem cells • not suitable for certain people e.g. those with poor kidney function • may still need low dose of insulin • initial high costs *e.g. immunotherapies* • still in early stages • need clinical trials

Question	Answer	Mark	AO element	Guidance

Questions, mark schemes and examiners' report extracts © OCR.