AQA GCSE Biology | 8461

SPECIFICATION POINT 4.5.3.1

Human endocrine system

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**13**
Available paper years	**2007–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.5.3.1 Human endocrine system

Answer 01 · Mark scheme June 2007 | BLY1A | Original Q2 | Legacy

Two	**A**	FSH	**3**
	B	FSH and LH	**4**
	C	LH	**1**
	D	oestrogen	**2**

	A	B	C	D

Answer 02 · Mark scheme June 2007 | BLY1H | Original Q5 | Legacy

The full source mark scheme begins on page 19. Follow original question 5 in that document.

Answer 03 · Mark scheme June 2008 | BLY1AP | Original Q7 | Legacy

Seven	**1**	**1**	**1**	**4**

Answer 04 · Mark scheme November 2009 | BLY1AP | Original Q9 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 05 · Mark scheme June 2010 | BLY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	embryo	2
	B	ovary	1
	C	pituitary gland	3
	D	womb	4

Answer 06 · Mark scheme March 2011 | BLY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	liver	**4**
	B	pituitary gland	**1**
	C	kidney	**3**
	D	skin	**2**

4.5.3.1 Human endocrine system

Answer 07 · Mark scheme

June 2011 | BLY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	kidney	4
	B	liver	1
	C	ovary	3
	D	pituitary gland	2

4.5.3.1 Human endocrine system

Answer 08 · Mark scheme

January 2013 | BL1HP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	**A** – pituitary **B** – ovary / ovaries	allow hypothalamus	1 1
2(a)(ii)	in blood (stream)	accept in plasma ignore dissolved	1
2(b)(i)	FSH and Luteinising Hormone (LH)		1
2(b)(ii)	fertilised OR reference to sperm form embryos / ball of cells or cell division (embryo) inserted into mother's womb / uterus	 allow (fertilised egg) is inserted into mother's womb / uterus	1 1 1
2(b)(iii)	any **one** from: • multiple births lead to low birth weight • multiple births cause possible harm to mother / fetus / embryo / baby / miscarriages	 allow premature ignore reference to cost / ethics / population	1
2(c)(i)	any **one** from: • almost identical • both approximately 20%	 allow S (slightly) more successful	1
2(c)(ii)	larger numbers (in clinic R) (in 2007) results likely to be more repeatable (in 2008)	allow only 98 (in S) (compared to 1004 (in R)) allow more reliable do **not** accept more reproducible / accurate / precise	1 1
Total			**11**

4.5.3.1 Human endocrine system

Answer 08 · Mark scheme

January 2013 | BL1HP | Original Q2 | Legacy

BL1HP

4.5.3.1 Human endocrine system

Answer 09 · Mark scheme

June 2019 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	pituitary		1	AO1 4.5.3.3
06.2	ADH		1	AO1 4.5.3.3
06.3		allow ecf for name of hormone from Question **06.2** ignore name of gland		4.5.3.3
	high(er) concentration of blood **causes** (more) ADH / hormone release	allow low(er) water potential of blood causes (more) ADH / hormone release allow alternative descriptions in terms of – eg low(er) water concentration / level **or** high(er) osmotic pressure **or** high(er) solute concentration / level	1	AO2
	(and hormone / ADH causes) increased permeability of kidney tubules (to water)	allow increased permeability of collecting duct / distal convoluted tubule	1	AO1
	(so) increased water reabsorption	allow more water taken back into blood ignore reference to urine	1	AO1

4.5.3.1 Human endocrine system

Answer 09 · Mark scheme

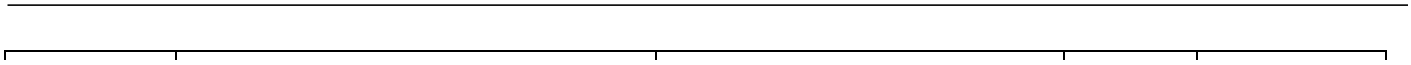
June 2019 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		allow converse if clearly describing dialysis explanation must match reason		AO3 4.5.3.3
	changes in concentrations / levels of substances / urea are minimised	allow no change in concentration / level of substances / urea allow correctly named substances	1	
	(so) less / no chance of causing damage to body cells / tissues	allow eg less / no osmotic stress **or** not poisoned by urea	1	
	not repeatedly puncturing skin **or** blood not in contact with machine	allow blood does not leave the body	1	
	(so) less / no chance of infection **or** less / no chance of blood clots **or** no need to take anti-clotting drugs	allow less / no chance of microorganisms entering body allow only one operation so less chance of infection for **2** marks allow dialysis requires anti-clotting drugs and so may lose more blood if cut for **2** marks	1	
Total			**9**	

4.5.3.1 Human endocrine system

Answer 09 · Mark scheme

June 2019 | 8461/2H | Original Q6



4.5.3.1 Human endocrine system

Answer 10 · Mark scheme November 2021 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1		ignore examples		AO1 4.5.2.1
	response / reaction	ignore action	1	
	automatic **or** no thinking **or** not conscious **or** involuntary	ignore reference to brain ignore quick	1	
06.2	receptor (in skin of finger / hand) detects stimulus / temperature change	allow receptor detects heat ignore pain	1	AO1 4.5.2.1
	(electrical) impulses pass along neurones	allow electrical signals pass along nerve cells ignore messages	1	
	(impulses pass from) sensory to relay to motor neurones		1	
	synapse between neurones where chemical crosses gap	allow neurotransmitter / acetylcholine for chemical allow by diffusion	1	
	(synapses) in spinal cord / CNS	ignore brain	1	
	muscle contraction (to pull hand away) **or** effector is a muscle		1	
06.3	coordination by endocrine system is:	allow converse points if clearly indicating nervous co-ordination answers must be comparative		
	slower		1	AO1
	longer-lasting		1	AO1
	(chemical / hormone) via blood instead of electrical / impulse / neurones		1	AO2 4.5.2.1 4.5.3.1

4.5.3.1 Human endocrine system

Answer 10 · Mark scheme

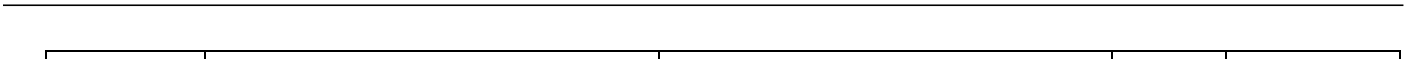
November 2021 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		ignore reference to days of menstrual cycle		
	FSH (release from pituitary) stimulates maturation of egg / ovum / follicle	allow FSH stimulates development / growth of egg	1	AO1 4.5.3.1 4.5.3.4
	oestrogen (release from ovary) inhibits FSH production **and** stimulates LH production		1	
	LH (release from pituitary) stimulates ovulation	allow LH stimulates release of egg	1	
	progesterone (release from ovary) inhibits FSH **and** LH production	allow (release from corpus luteum)	1	
	oestrogen **and** progesterone maintain the uterus lining	allow oestrogen **and** progesterone build up the uterus lining	1	
Total			**16**	

4.5.3.1 Human endocrine system

Answer 10 · Mark scheme

November 2021 | 8461/2H | Original Q6



4.5.3.1 Human endocrine system

Answer 11 · Mark scheme

June 2023 | 8461/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1		allow answers in terms of insulin for hormone **A** and / or glucagon for hormone **B** allow answers in terms of blood glucose (concentration) for substance **Q**		AO3 4.5.3.7 4.5.3.2 4.5.3.1
	if (concentration of substance) **Q** becomes high (hormone) **A** is released / used		1	
	if (concentration of substance) **Q** becomes low (hormone) **B** is released / used		1	
	hormone(s) / **A** / **B** brings (concentration of) substance **Q** back to ideal / normal		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	(thyroxine) increases (basal) metabolic rate	allow (thyroxine) increases metabolism allow (thyroxine) increases respiration allow (thyroxine) increases reactions in cells	1	AO1 4.5.3.7 4.4.2.1 4.4.2.3
	<u>respiration</u> releases energy	allow <u>respiration</u> releases heat do **not** accept energy being produced / made / created allow <u>respiration</u> is exothermic	1	

4.5.3.1 Human endocrine system

Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	(kidney) tubules less permeable to water		1	AO1
	(so) less water is reabsorbed	allow (so) less water taken back into the blood	1	AO1
	(so) more water in urine causing increased rate of production (of urine)	allow (so) more water in urine causing increased volume (of urine)	1	AO2
	(so) more water in urine causing lower concentration of dissolved substances (in urine)	(so) more water in urine causing more dilute urine	1	AO2 4.5.3.3

Total Question 5	9

4.5.3.1 Human endocrine system

Answer 12 · Mark scheme

June 2024 | 8461/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1	any **two** from: • same starting position of rule(r) • more precise scale • repeat **and** calculate mean **or** repeat **and** eliminate anomalies • convert distance to time • student (**B**) rests hand / arm on table	allow ensure the starting position of rule(r) is at 0cm allow other control variables allow two control variables for **2** marks allow rule(r) with mm scale ignore more accurate scale	2	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	any **two** from: *endocrine system:* • (hormones) via blood • chemical transmission • slower • longer-lasting	allow converse if clearly referring to nervous system allow not via neurones / cells allow not (electrical) impulses allow not electrical signals ignore messages ignore hormones answers must be comparative ignore reference to target organs	2	AO1 4.5.2.1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	thyroxine	do **not** accept thyroxide ignore reference to TSH / TRH	1	AO1 4.5.3.1 4.5.3.7

4.5.3.1 Human endocrine system

Answer 12 · Mark scheme

June 2024 | 8461/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.4	any **one** from: • insulin • glucagon		1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	any **two** from: • increases heart rate • increases breathing rate • increases oxygen delivery to cells / tissues / organs • increases glucose delivery to cells / tissues / organs • increases respiration / metabolism • increases sweat(ing)	allow increases blood flow allow examples of cells / tissues / organs allow increases energy release do **not** accept energy produced / made / created allow dilation of pupils allow vasoconstriction in skin **or** vasoconstriction in digestive system allow raises blood sugar / glucose level **or** increase conversion of glycogen to glucose allow vasodilation in (skeletal) muscles **/** brain allow increased blood pressure allow slows digestion allow other correct effects of adrenaline if no other marks awarded allow **1** mark for prepares for 'fight or flight'	2	AO1 4.5.3.7

4.5.3.1 Human endocrine system

Answer 12 · Mark scheme

Question	Answers	Mark	AO / Spec Ref.
05.6	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.5.3.4 4.5.3.5 4.5.3.6
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content **contraception:** • use of hormones oestrogen and progesterone **or** progesterone (only) o inhibition of FSH (production / release) - lack of FSH prevents follicle / egg development / maturation - therefore there is no egg to fertilise o inhibition of LH (production / release) - lack of LH prevents ovulation - therefore there is no egg to fertilise • contraceptive methods include oral contraceptive pill, injection, implant, skin patch, IUD / IUS with hormones **treatment of infertility:** • use of FSH o (FSH) stimulates **maturation** of (several) egg(s) / follicle(s) - (FSH) increases number of eggs matured • use of LH o (LH) stimulates ovulation - (LH) allows eggs / follicles to be collected (from ovary) - (so) increased chance of fertilising an egg - IVF and insertion of embryo(s) into uterus • use of progesterone o (to) maintain uterus lining - increased chance of implantation For **Level 3**, details of both contraception and infertility treatment are required.		

Total Question 5	14

4.5.3.1 Human endocrine system

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	ADH **or** antidiuretic hormone	allow other correct pituitary hormone eg FSH / LH / TSH ignore functions of hormones	1	AO1 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	any **one** from: • (it would) be digested to amino acids • (it would) be digested by protease • (it would) be digested (by enzymes) in the stomach • (it would) be digested (by enzymes) in the small intestine • (it would) be digested so (hGH is) not absorbed	allow 'broken down' for digested throughout	1	AO2 4.2.2.1 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	isolate (hGH) gene from human DNA / chromosome	allow cut (hGH) gene from human DNA / chromosome	1	AO1 4.6.2.4
	join (hGH) gene to (cut) <u>plasmid</u>		1	
	put plasmid (containing gene) into bacteria		1	
	enzyme used at a suitable stage: to cut (hGH) gene from human DNA **or** to insert / join (hGH) gene to plasmid	allow reference to named enzyme used in genetic engineering allow to insert / join (hGH) gene to bacterial DNA	1	

4.5.3.1 Human endocrine system

Answer 13 · Mark scheme

June 2025 | 8461/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	any **two** from: • (hGH) easier to isolate / purify / extract • made in larger quantities • no / less chance of immune reaction • no / less chance of passing on disease / pathogens (from animals to humans) **or** no / less chance of infection (of humans) • no / less chance of containing antibiotics / urea / drugs • it is the specific human hormone so may be more effective (in human body)	allow converse if clearly referring to GH ignore reference to speed of production allow no / less chance of rejection ignore reference to side effects allow named (animal) disease eg BSE allow animal GH may not be the correct shape ignore ethical / religious reasons ignore reference to cost	2	AO3 4.6.2.4

Total Question 4	8

4.5.3.1 Human endocrine system

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Biology 4411

BLY1H Unit Biology 1

Mark Scheme

2007 examination - June series

4.5.3.1 Human endocrine system

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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4.5.3.1 Human endocrine system

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.5.3.1 Human endocrine system

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.3.1 Human endocrine system

BLY1H Question 1

	answers	extra information	mark
(a)	scientists figures based on research / calculations / data **or** scientists sample whole area	ignore reasons based on bias	1
	fishermen based on impression / hearsay / experience **or** fishermen fish in well-stocked / limited areas	scientists sample a wider area = **2** marks fishermen only fish in well-stocked areas = **2** marks if no marks gained fishermens' opinion **and** scientists' opinion gains **1** mark	1
(b)	any **two** from: • economic considerations • political impact • pressure groups **or** fears of extinction	eg fear for jobs, profits, big demand for cod eg allow EU / government decide or laws will be passed	2
total			4

4.5.3.1 Human endocrine system

BLY1H Question 2

	answers	extra information	mark
(a)	any **two** from: • area of bed sampled • sampling time • size of net • kicking action • net position	control variables from information given	2
(b)	any **two** from: • some animals not dislodged • some animals missed / through / escaped net • invertebrates difficult to identify • invertebrates from outside area	must be ideas related to a sample ignore reliability etc	2
(c)	10 to 99 **or** 10 – 99 **or** 99 to 10 **or** 99 – 10		1
(d)	any **two** from: • increased / goes up • 0 at sample 4 • to (more than) 100	allow increase implied from all data described	2
(e)	mayfly because not found downstream of point where sewage enters stream **or** only in the unpolluted water		1 1
total			9

4.5.3.1 Human endocrine system

BLY1H Question 3

	answers	extra information	mark
	adaptation and linked advantage eg	max **2** for 3 adaptations	max 2 max 2
	• roots widespread / long (1) to collect water from large area (1)	ignore large roots accept to collect more water	
	• some roots deep / long (1) to collect water from deep down (1)	ignore large roots accept to collect more water	
	• absence of leaves (1) reduces water loss (1)		
	• swollen stem (1) to store water (1)		
	• roots near surface (1) to absorb rainwater (1)		
	• roots widespread (1) support in sandy soil (1)		
total			4

4.5.3.1 Human endocrine system

BLY1H Question 4

	answers	extra information	mark
(a)(i)	viruses live inside cells		1
	viruses inaccessible to antibiotic	allow drug / antibiotic (if used) would (have to) kill cell	1
(ii)	mutation	ignore mutation caused by antibiotic	1
	natural selection **or** no longer recognised by antibiotics	accept description of natural selection	1
(b)	(stimulate) antibody production	ignore antitoxin	1
	(by) white cells		1
	<u>rapidly</u> produce antibody on re-infection	ignore antibodies remain in blood	1
total			7

4.5.3.1 Human endocrine system

BLY1H Question 5

	answers	extra information	mark
(a)	ovary or ovaries		1
(b)	(hormone) implant		1
(c)	do not have to remember to take		1
(d)	does not involve hormone **or** it is a mechanical method	allow coil may be dislodged allow egg <u>is</u> fertilised / released allow not preventing egg fertilisation / release	1
(e)	involves death of fertilised egg **or** (regard) fertilised egg as human **or** stops fertilised egg developing	allow embryo / baby for fertilised egg ignore against religion only allow fertilised egg is alive ignore side effects	1
(f)(i)	inhibit FSH (production) so no eggs mature / develop / are produced	allow inhibits LH allow (LH) <u>stimulates</u> egg release ignore progesterone	1 1
(ii)	contains FSH which causes egg to mature / develop / be produced **or** in women whose FSH is low	allow contain LH allow (LH) <u>stimulates</u> egg release	1 1
total			9

4.5.3.1 Human endocrine system

BLY1H Question 6

	answers	extra information	mark
(a)	asexual reproduction / mitosis **or** no fusion of gametes **or** division after fusion **or** from fertilised egg **or** from same embryo **or** from same egg **and** sperm	ignore cloning	1
	each embryo has identical genetic information / genes / DNA / chromosomes		1
(b)	any **two** from: • experimental subject and control are identical **or** fair test since monkeys identical • monkeys similar to humans, so effect of drugs likely to be similar • all identical so will have same reaction to drugs / disease • it's better than catching wild ones	allow closely related so… ignore evolved from	2
total			4

4.5.3.1 Human endocrine system

BLY1H Question 7

	answers	extra information	mark
(a)	any **two** from: • balance between two important for good heart health • high LDL causes heart disease / high cholesterol • high HDL reduces heart disease / cholesterol	ignore blood pressure do **not** accept converse argument do **not** accept converse argument	2
(b)	heart attacks greater amongst patients with low HDL levels statins reduce heart attacks of patients **or** placebo is less effective	ignore statins cause heart disease ignore comparative effects of the two statins allow pravastatin is more effective supported by appropriate calculations eg pravastatin > 39 33% < 39 31.4% Average 32.4 > 39 32% < 39 28.2% Average 30.05%	1 1
total			4

4.5.3.1 Human endocrine system

BLY1H Question 8

	answers	extra information	mark
(a)	present day organisms have evolved from simpler organisms	ignore answers in terms of natural selection	1
	over long periods of time **or** millions / billions of years		1
(b)	(natural selection operates on successful) characteristics produced by chance / (random) mutation		1
	in this experiment caused by hormones / environment	allow this example indicates inheritance of acquired characteristics for **2** marks allow this is Lamarckism only for **1** mark	1
total			4

4.5.3.1 Human endocrine system

Answer 10 · Examiner comments — November 2021 | 8461/2H | Original Q6

Question 6 (standard, standard/high & high demand)

This question was about coordination by the nervous and endocrine systems. Most students were able to state that a reflex action was either a response (reaction) or that it was automatic with around one-third providing both points.

06.2 was worth 6 marks for describing how a person's nervous system would coordinate the withdrawal of a hand from a hot object by reflex action. A few students scored full marks and just under a half scored half-marks or more. Common errors included misnaming the neurones involved, using the term 'messages' instead of impulses, thinking that this reflex involved the brain, and referring to the spinal cord as the 'spine'. Omissions included the mechanism of synaptic transmission via a chemical crossing the gap and the location of the synapses in the spinal cord.

In **06.3**, very few students were able to give three differences between coordination by the endocrine and nervous systems, although just under half could give at least one. The most common correct answers were that endocrine coordination was generally slower and longer-lasting than nervous coordination. While many students alluded to a chemical, or hormone being involved in endocrine action, few explained that this was transmitted via the blood rather than along neurones. Some answers were inadequate as they were not comparative, eg hormonal coordination is not just 'slow' but slower than nervous coordination.

Answer 11 · Examiner comments — June 2023 | 8461/2H | Original Q5

Question 5

This question was about homeostasis controlled by hormones.

05.1 Most students understood the simple representation of negative feedback shown in Figure 8 for the regulation of the concentration of a substance dissolved in the blood. The main omission, by one-quarter of students, was in not pointing out that the action of each hormone would return the concentration back to the ideal, or normal, concentration. Just under one-half of students gained full marks.

05.2 Understanding of the action of thyroxine, in the context of raising body temperature, was very limited. Many invoked temperature-regulation mechanisms such as vasoconstriction. Only 1 in 9 fully appreciated that thyroxine raised the metabolic rate and that one aspect of this – respiration – would release energy, or heat.

05.3 Table 2 showed the effects of different concentrations of ADH in the blood on the concentration of dissolved substances in urine and on the rate of urine production. Students had to explain the effects of a decrease in ADH between two of the values in the table. Hardly any mentioned that a lowering of ADH would decrease the permeability of the kidney tubules to water. Many understood that the change would decrease the reabsorption of water by the kidneys but the consequential effect on the urine was often poorly explained – few could relate the volume increase and the concentration decrease to more water being in the urine. Only 1 in 40 scored all 4 marks and only one-quarter scored half-marks. Some students just described the function of ADH without relating their answer to the decrease given in the question. Others used the inadequate term 'absorption' rather than reabsorption. Others thought that absorption related to water entering the kidney tubule rather than leaving it.

4.5.3.1 Human endocrine system

Answer 12 · Examiner comments June 2024 | 8461/2H | Original Q5

Question 5 (standard, standard/high and high demand)

05.1 Almost 30% of students were able to suggest two ways to improve the student's method for measuring human reaction time, with a further 45% gaining one mark. Some students suggested extensions to the method rather than improvements, such as testing with caffeine or using a computer programme - which did not answer the question. A number of students gave vague responses such as 'repeat it' or 'put the ruler closer to the hand' which were insufficient for credit at this level.

05.2 Students were asked to give two ways that coordination by the endocrine system is different from coordination by the nervous system. The full range of available marking points were seen for this question, with over half of students gaining full marks. Most comparisons involved 'slower', 'longer lasting' or reference to 'electrical impulses' in the nervous system. The better answers included multiple comparisons in the same sentence ie 'endocrine is slower but longer lasting' and 'nervous involves electrical impulses carried along neurones whereas endocrine is chemicals carried in the blood.'

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4.5.3.1 Human endocrine system

Answer 12 · Examiner comments

05.3 Over 80% of students correctly identified thyroxine as the hormone produced by gland A. Common errors included naming the gland (thyroid) rather than the hormone, or naming hormones released from the pituitary gland such as FSH, LH or ADH.

05.4 Around 80% of students were able to name one hormone produced by gland B, with insulin being the most popular response. Common incorrect responses named hormones involved in the menstrual cycle. There were mostly good spellings for 'glucagon' which has not been the case in previous years.

05.5 Almost 55% of students could describe two effects of adrenaline on the human body, the most common of which were increased heart rate and increased breathing rate. Some answers lacked detail such as 'increased awareness' or 'they have more energy' which are insufficient for credit at this level. A significant number of students gave the fall-back mark relating to preparing the body for the flight or fight response, which was only credited if no other correct responses had been given.

05.6 This was an extended response question with three levels, the highest of which was set at high demand. Students were asked to explain the use of hormones in both contraception and the treatment of infertility. Less than 10% of students were able to access Level 3, commonly due poor articulation or use of vague scientific terminology. Those that did however, showed very clear links between the correct hormones, their roles in contraception/infertility treatment and the associated consequences of using them.

Around 45% of students obtained marks in Level 2, after correctly explaining the use of at least one hormone for both contraception and infertility. Students that did not include an explanation for both contraception and the treatment of infertility were restricted to Level 1. Students are reminded to read the question carefully and ensure all parts are answered to the same standard. It was noticeable that many students spent more time explaining the roles of hormones in contraception, and then went on to possibly rush their explanation for infertility.

Regarding contraception, many students could refer to progesterone and/or oestrogen, and the subsequent inhibition of FSH and LH, but then did not specifically indicate which hormone undertook which function, and so failed to link to a consequence for either hormone. The general consequence of 'no eggs to fertilise' was regularly seen in place of these.

Regarding infertility, the same pattern was seen, so very few consequential links were credited. However, many students described the process of IVF and insertion of the embryo into the uterus, to gain credit for a general consequence.

The use of progesterone to maintain the uterus lining was often muddled with contraception, and the idea of increased *chance* of implantation, or increased *chance* of fertilising an egg for the use of LH was rarely seen.

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Answer 13 · Examiner comments

June 2025 | 8461/2H | Original Q4

Question 4 (Standard/high demand)

04.1

Almost all students attempted this question, with just over 80% of gaining the mark. ADH and FSH were the most common creditworthy answers seen. Common incorrect answers, although seen relatively rarely, included adrenaline, thyroxine, and progesterone.

04.2

Only a third of students gained credit in this question. Whilst many students were able to begin their answer to this question, a number did not give sufficient detail at this level of demand to gain the mark. Stronger responses often covered several marking points in one succinct sentence e.g. 'The hGH would be digested by protease into amino acids within the stomach and so would not be absorbed into the blood', whilst those that were less successful did not refer to either what would break down the hGH, or where this breakdown would occur.

A significant proportion of students cited the stomach acid as breaking down the protein, with many going on to refer to denaturation of enzymes. A number also referred incorrectly to the hGH 'dissolving', rather than being digested.

Some students misunderstood the question and wrote about the hormone taking longer to get into the blood stream if taken orally, rather than focussing on the hormone being digested as a protein. Other less successful responses correctly recognised that the hormone would be digested but implied that the products of this digestion would work in the same way as the undigested hormone when later absorbed into the bloodstream. The idea of lack of absorption because the hormone was 'too big' was also seen relatively frequently.

04.3

This question differentiated well, with the full range of marks awarded. While a quarter of students scored no marks, a third of students were able to gain 3 or 4 marks. High level responses often went beyond the scope of the specification, using terminology such as recombinant DNA, restriction enzymes / endonucleases and DNA ligase in the correct contexts. 'Sticky ends' also featured frequently with some good descriptions of how these were used within the process. Some students confused 'ligase' with 'lipase' which meant that they were unable to earn credit for mark point 4.

A very small minority of students answered the question in relation to production of insulin rather than hGH, but a number of responses detailed parts of the process of adult cell cloning, rather than genetic engineering.

Some students found explaining the process of genetic engineering difficult and used only the information provided in the question. Reference to plasmids as vectors for mark point 3 and the sweeping statement 'using enzymes and plasmids' were not creditworthy without further qualification as this information was given to them in the question.

Less successful responses often confused the role of the hormone and the enzymes in the process, with the enzyme occasionally being inserted into the plasmid, or the hGH hormone itself (rather than the gene) being cut out, or placed into the plasmid/bacteria.

04.4

50% of students scored no marks on this question. Students are reminded that when answering 'compare' style questions they should make it absolutely clear to what they are referring when writing in the converse and to be mindful when using the word 'it'. In the

4.5.3.1 Human endocrine system

Answer 13 · Examiner comments June 2025 | 8461/2H | Original Q4

context of this question, 'it' referred to the hormone produced by genetic engineering as this was the subject of the question and therefore, an answer of 'it might spread infection' is incorrect. There was a significant number of responses where marks could not be awarded due to this lack of clarity.

Bullet points 2, 3 and 4 were the most commonly awarded, although for bullet point 4, a lack of qualification relating to the disease being passed on or spreading to humans (rather than the disease just being present in urine) meant this bullet point could not be awarded.

A number of uncreditworthy responses referred to the difficulties in physically collecting the urine from the animal, as well as ideas that the recombinant hormone is simply 'cheaper', 'easier', 'safer' or 'quicker'. A significant proportion of students described recombinant production in purely hygienic terms (e.g. 'cleaner' or 'more sanitary') without recognising it is easier to purify.

Only a very small number of students were able to access bullet point 6, often due to a lack of precision with their wording; many students did state that it was a 'specific human hormone' but often neglected to go on to relate this to effectiveness.