AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.5.3.6

# Feedback systems (HT only)

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **3** |
| Available paper years | **2021–2024** |

## 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.

### 4.5.3.6 Feedback systems (HT only)

**Answer 01 · Mark scheme** November 2021 | 8464/B/2H | Original Q5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | any **one** from:<br>• previous intake of caffeine that day<br>• usual intake of caffeine (on previous days)<br>• concentration of caffeine<br>• volume of caffeine<br>• time of day<br>• amount of sleep<br>• body mass<br>• previous experience of the test<br>• which hand (of student **B**) holds the stopwatch | allow named caffeinated drink for caffeine<br>allow amount / mass / type of caffeine for **1** mark<br>allow fatigue<br>allow (body) weight / BMI | 1 | AO1<br>4.5.2<br>RPA6 |
| **05.2** | any **two** from:<br>• (student **A**) does not press both start buttons simultaneously<br>• (student **A**) may not say stop and press button simultaneously<br>• student **B** could be distracted<br>• idea that student **B** anticipated student **A** stopping the stopwatch<br>• stopwatch malfunction | allow (stop)watches may not be <u>accurate</u> | 2 | AO3<br>4.5.2<br>RPA6 |
| **05.3** | no value / result / number occurs more than once<br>**or**<br>all the values / results / numbers are different | | 1 | AO2<br>4.5.2<br>RPA6 |

4.5.3.6 Feedback systems (HT only)

Answer 01 · Mark scheme

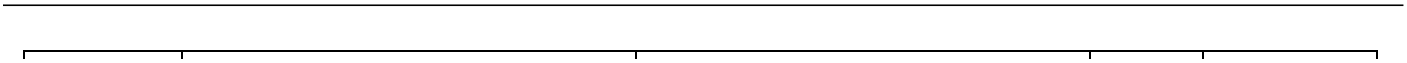
November 2021 | 8464/B/2H | Original Q5

| | | | | |
|---|---|---|---|---|
| **05.4** | add(ed) the other (7) results and divide(d) by 7 | allow correctly shown calculation<br><br>ignore leave out the result for pair 8 | 1 | AO2<br>4.5.2<br>RPA6 |
| **05.5** | (adrenaline) increases heart rate<br><br>(which) increases oxygen / glucose to brain / muscle (cells)<br><br>(which) increases rate of respiration<br><br>(so) releasing more energy for (faster / more) muscle <u>contraction</u> | allow increases blood flow<br><br><br><br><br>allow (so) releasing more ATP for (faster / more) muscle <u>contraction</u><br>do **not** accept energy produced / made / created | 1<br><br>1<br><br>1<br><br>1 | AO1<br><br>AO1<br><br>AO2<br><br>AO2<br><br>4.5.3.6<br>4.5.2 |
| **05.6** | synapse | allow synaptic cleft | 1 | AO1<br>4.5.2 |
| **05.7** | fewer adenosine (molecules) can bind to the receptors<br>**or**<br>adenosine has no / less effect on the (relay) neurone<br><br>therefore impulses in relay neurone are more frequent | <br><br><br><br>allow impulses in relay neurone are faster<br>allow there are more impulses in relay neurone<br>allow impulses in relay neurone not delayed / reduced (in number)<br><br>ignore caffeine binds to adenosine receptors | 1<br><br><br><br>1 | AO2<br><br><br><br>AO3<br><br>4.5.2 |
| **Total** | | | **12** | |

### 4.5.3.6 Feedback systems (HT only)

**Answer 01 · Mark scheme**

November 2021 | 8464/B/2H | Original Q5



4.5.3.6 Feedback systems (HT only)

Answer 02 · Mark scheme

June 2023 | 8464/B/2H | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | any **one** from:<br>• blood glucose / sugar (concentration)<br>• water (content of the body) | allow pH<br>allow ions / salt<br>allow carbon dioxide<br>allow oxygen<br>allow blood pressure | 1 | AO1<br>4.5.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | to maintain (temperature close to) optimum / optimal conditions / temperature | | 1 | AO1<br>4.5.1 |
| | for enzyme action | allow for cells to function<br>allow for reactions in cells<br><br>allow for **2** marks enzymes have an optimum temperature | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.3 | $\frac{37.0 - 35.5}{4}$ | allow $\frac{1.5}{4}$ | 1 | AO2<br>4.5.1 |
| | 0.375 (°C per hour) | allow 0.4 **or** 0.38 (°C per hour)<br>ignore minus sign | 1 | |

### 4.5.3.6 Feedback systems (HT only)

**Answer 02 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.4** | $37 \times \frac{5.5}{100}$ | allow $37 \times 0.055$ | 1 | AO2<br>4.5.1 |
| | 2.035 (°C) | | 1 | |
| | (37 − 2.035 =) 34.965 | allow 34.97 | 1 | |
| | 35 (°C) | allow an incorrectly calculated temperature given correctly to 2 significant figures<br>do **not** accept 35.0 (°C) | 1 | |
| | alternative method:<br>$1 - \frac{5.5}{100}$ (1) | | | |
| | 0.945 (1) | | | |
| | (37 × 0.945 =) 34.965 (1) | allow 34.97 | | |
| | 35 (°C) (1) | allow an incorrectly calculated temperature given correctly to 2 significant figures<br>do **not** accept 35.0 (°C) | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.5** | pituitary (gland) | | 1 | AO1<br>4.5.3.1 |

### 4.5.3.6 Feedback systems (HT only)

**Answer 02 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.6** | (adrenal glands) release / produce adrenaline | | 1 | AO1 |
| | (to) increase heart rate | | 1 | AO1 |
| | (so) more / faster delivery of oxygen **and** glucose to brain / muscles | | 1 | AO2 |
| | (because) more oxygen / glucose needed for respiration | | 1 | AO2 |
| | to move muscles to increase body temperature<br>**or**<br>to release energy / heat to increase body temperature | allow for shivering to increase body temperature<br><br>do **not** accept energy is made / produced / created<br><br>ignore flight or fight | 1 | AO3<br><br>4.5.3.6<br>4.5.3.1<br>4.5.1 |

4.5.3.6 Feedback systems (HT only)



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.7 | (decreasing body temperature causes thyroid gland to) release / produce thyroxine | | 1 | AO2 4.5.3.6 |
| | (which) increases / stimulates (basal) metabolic rate | allow (which) increases metabolism<br>allow (which) increases respiration<br>allow (which) increases reactions in cells | 1 | |
| | (so) increasing body temperature which decreases the release / production of thyroxine | | 1 | |

| Total Question 6 | 18 |
|---|---|

4.5.3.6 Feedback systems (HT only)

Answer 03 · Mark scheme

June 2024 | 8464/B/2H | Original Q6

## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.1 | pituitary | | 1 | AO1 4.5.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.2 | increased blood flow to muscles | | 1 | AO1 4.5.3.6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.3 | receptor(s) (cells / neurones) | allow sensory (cells / neurones) | 1 | AO1 4.5.1 |

4.5.3.6 Feedback systems (HT only)

Answer 03 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.4 | | allow converse if clearly describing people who do not have diabetes | | |
| | blood glucose (concentration) varies more (than in people who do not have diabetes) | allow blood glucose (concentration) increases / decreases more<br><br>allow blood glucose (concentration) goes very high<br><br>allow to get a sufficient range of blood glucose (concentrations) | 1 | AO2<br>4.5.3.2 |
| | (because) less / no insulin produced when blood glucose (concentration) increases<br>**or**<br>(because) less / no insulin produced to decrease blood glucose (concentration) | | 1 | |

4.5.3.6 Feedback systems (HT only)

Answer 03 · Mark scheme

June 2024 | 8464/B/2H | Original Q6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.5 | any **two** from:<br>• prior familiarity with reaction time test<br>• type of (reaction time) test<br>• insulin (injections)<br>• example of named drug (that would affect reaction time)<br>• amount of sleep<br>• distractions | ignore health unqualified<br>allow practice<br>allow description of part of a reaction time test to control eg which hand is used to catch the ruler<br>ignore caffeine / alcohol<br>allow tiredness / sleep | 2 | AO1<br>4.5.3.2<br>RPA6 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.6 | low / high blood glucose (concentration) is dangerous / unsafe | allow (to monitor for) unconsciousness / coma / headache / dizziness<br>ignore hypoglycaemia / hyperglycaemia unqualified | 1 | AO3<br>4.5.3.2 |

### 4.5.3.6 Feedback systems (HT only)

**Answer 03 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.7** | lowest reaction times recorded in (range of) blood glucose (concentration) found in people who do not have diabetes | allow high **and** low blood glucose (concentration) increase (mean) reaction time<br><br>allow lowest reaction times recorded in range 4.0 to 7.8 ($mmol/dm^3$) | 1 | AO3 |
| | homeostasis keeps blood glucose (concentration) in a narrow / small range<br>**or**<br>low(er) reaction times are a survival advantage | | 1 | AO2<br><br>4.5.1<br>4.5.3.2 |

4.5.3.6 Feedback systems (HT only)

Answer 03 · Mark scheme



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.8 | when blood glucose (concentration) increases the pancreas releases insulin | allow when blood glucose (concentration) is / nears 7.8 ($mmol/dm^3$) the pancreas releases insulin<br><br>allow when blood glucose (concentration) is high the pancreas releases insulin | 1 | AO1<br>4.5.1<br>4.5.3.2 |
| | (insulin causes) glucose to move (from the blood) into the liver / muscle (cells) | if neither mark awarded allow **1** mark for glucose moves into cells | 1 | |
| | in (liver / muscle) (excess) glucose is converted to glycogen | | 1 | |
| | when blood glucose (concentration) decreases the pancreas releases glucagon | allow when blood glucose (concentration) is / nears 4.0 ($mmol/dm^3$) the pancreas releases glucagon<br><br>allow when blood glucose (concentration) is low the pancreas releases glucagon | 1 | |
| | (glucagon causes) glycogen to be converted into glucose and released into the blood | allow (glucagon causes) glycogen to be converted into glucose which increases blood glucose (concentration) | 1 | |

4.5.3.6 Feedback systems (HT only)



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 06.9 | any **two** from:<br>(if more chemical produced / present)<br>• diffusion of chemical (across synapse) is faster<br>• an impulse in relay / motor / next neurone is more likely<br>• an impulse is more likely to reach muscle | allow electrical signal for impulse throughout<br>ignore signal / message<br>allow an impulse in relay / motor / next neurone is faster / stronger / bigger<br>allow there will be more impulses in relay / motor / next neurone(s)<br>allow an impulse reaches muscle in less time<br>allow an impulse reaches muscle faster<br>allow bigger impulse causes faster muscle contraction | 2 | AO2<br>AO3<br>4.5.2 |

| Total Question 6 | 17 |
|---|---|

### 4.5.3.6 Feedback systems (HT only)

**Answer 01 · Examiner comments** November 2021 | 8464/B/2H | Original Q5

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

Some students read and understood the reaction time method provided. Some however, made assumptions that this was a 'ruler drop' method and then struggled to answer questions relating to control variables and possible sources of random error in the method.

In **05.4** students had to link their knowledge of the effect of adrenaline on the body to reaction time. A common misconception seen was that reaction time decreasing must mean slower reactions. Few students referred to oxygen or glucose supply to muscles or the brain, and fewer referred to the rate of respiration or energy released for muscle contraction. The common errors referring to energy being 'produced' were seen.

Students could generally recall the term 'synapse'. Few could apply their knowledge to the scenario given in **05.7**. Many students simply repeated the information provided, which is never awarded credit.

4.5.3.6 Feedback systems (HT only)

Answer 02 · Examiner comments



## Question 6 (Standard, Standard/High and High demand)

**06.1** The most common correct answer was blood glucose concentration. Incorrect answers seen included disease, sweating, stomach acid, diabetes, immune system, hormone levels, heart rate, metabolism, urea, blood flow, light intensity.

**06.2** Note that optimum / optimal is underlined in marking point 1 and is therefore required for the mark. Descriptions of optimum, such as 'ideal conditions', were insufficient.

For marking point 2, responses of 'Enzymes don't denature' gained credit. Some students answer efficiently, so a response of 'Enzymes have an optimum temperature' gained 2 marks.

Many students gave answers that were too vague, such as 'needed for organs to work', or stated that hypothermia or hyperthermia would occur.

**06.3** Students should sense check their answers to calculations. This may be a general issue with students not understanding the idea of 'rate' or 'per hour'. Many such students gave incorrect answers such as 35.5 °C.

There were some responses where the decrease after each hour was found, added together and divided by 4, ie (0.05 + 0.25 + 0.5 + 0.7) ÷ 4. This was acceptable.

**06.4** Many students gained all 4 marks for this question. Generally, if students attempted to give their answer to 2 significant figures, it was then correct.

Some students did not sense check their final answers, suggesting that the swimmer was only at risk of hypothermia when the body temperature decreased to 2 °C.

**06.5** Phonetic spelling of pituitary was allowed and many variations were seen. Common incorrect answers were thyroid and pancreas.

**06.6** Most students knew that the adrenal glands release adrenaline when the body temperature decreases. The next most commonly awarded mark was for knowing that adrenaline increases heart rate. Few students gained marks beyond this.

Some incorrect references were seen to energy being produced / made / created.

Some students were confused between the thyroid and adrenal glands.

**06.7** Many responses show references to TSH. This was not worth credit alone, but was often followed by marking point 1.

We allowed phonetic spellings for thyroxine. Many responses recognised that the thyroid gland releases thyroxine. However, a substantial number referred to adrenaline or simply stated 'hormone'.

Where a response gave the incorrect hormone in marking point 1, marking point 2 could still be awarded if the named hormone would increase metabolic rate. For example, if adrenaline is wrongly stated in marking point 1, marking point 2 could still be credited because adrenaline increases metabolic rate. Likewise, 'TSH increases metabolic rate' would gain marking point 2. If no hormone was named in marking point 1, then marking point 2 could still be credited.

For marking point 2, the abbreviation BMR could be substituted for (basal) metabolic rate. It was insufficient to say 'controls' or 'helps' metabolic rate: there needed to be an indication of an increase.

### 4.5.3.6 Feedback systems (HT only)

**Answer 02 · Examiner comments**



The best responses gained marking point 3 and clearly understood how negative feedback applies in this situation, but weaker responses simply stated that it was negative feedback, or described negative feedback in general terms, which was insufficient.

Some students interpreted the decrease in body temperature as needing a decrease in metabolic rate. Although this was an incorrect interpretation, some of these responses still gained one or two marking points as detailed on the mark scheme.

4.5.3.6 Feedback systems (HT only)

Answer 03 · Examiner comments



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

**06.1** Nearly all students could identify that the pituitary gland releases hormones to control other glands.

**06.2** Most students knew that adrenaline increases blood flow to muscles.

**06.3** Most students could give the correct answer of receptor or sensory neurone/cell.

Some students were unaware that receptors that respond to stimulus are types of cells. Common incorrect answers were red blood cells, white blood cells, effector, muscle, named organs and nerve cells or neurones unqualified.

**06.4** Very few students gained 2 marks. Many students stated that blood glucose goes up or is high in people with diabetes, but this is also true of people without diabetes, so the mark could not be awarded. The answer needed to be comparative.

Many students simply stated that people with diabetes do not produce enough insulin. This did not go far enough for either mark to be awarded.

Some students demonstrated confusion between Type 1 and Type 2 diabetes. Other students tried to answer in terms of how reaction time would be affected rather than blood glucose concentration.

Confusion was evident in terms of incorrect responses stating that 'insulin breaks down into glucose', or 'people with diabetes don't produce enough glucose'.

The answers to this question highlighted that many students did not understand the biological basis of diabetes. Common misconceptions included:

- people with Type 1 diabetes cannot make their own glucose (and this was sometimes followed by comments implying it is therefore safer for people with diabetes to drink glucose)
- glucose is the same as insulin
- insulin is converted to glucose
- insulin is converted to glycogen
- a lack of insulin means blood glucose concentration is lower.

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### 4.5.3.6 Feedback systems (HT only)

**Answer 03 · Examiner comments** June 2024 | 8464/B/2H | Original Q6

**06.5** The most frequent correct responses related to amount of sleep or minimising distractions.

Common misinterpretations of the question referred to controlling the volume or concentration of glucose solution. Students should take care to read all the information provided. Different volumes or concentrations of glucose solutions would be necessary to change the independent variable. Food and drink were controlled, so references to controlling caffeine and alcohol intake could not be credited.

Many students assumed the reaction time test was the ruler drop test. If they described a suitable control variable, such as 'using dominant hand to catch the ruler' this was credited, but often these attempts at control variables were incorrect, such as 'same ruler' or 'same person dropping the ruler'.

**06.6** Some students incorrectly interpreted the question as being an issue with recording accurate results. Many responses did not go far enough to be awarded the mark, such as 'blood glucose goes too high' without giving a reason why this is problematic. Common incorrect responses were too vague, such as 'in case they fell ill' or 'to give insulin injections'.

Some students suggested the health of the patient would affect the results/reaction times in the experiment, rather than considering the risk to the person with diabetes. These were not awarded the mark.

There were some good answers in which the students understood that both low and high blood glucose concentration are dangerous.

**06.7** Students found this question challenging. Many simply defined homeostasis rather than answering the question. Some students approached the right idea but were imprecise with their language, such as 'faster/slower reaction times' indicating confusion between reactions, reaction times and the time recorded. Students need to be careful they are not describing time as speeding up or slowing down, which is not possible. Reactions can be faster but not reaction times.

Some students did identify that reaction times in the range for people without diabetes were lower but did not go far enough to state lowest. Similarly, some identified high blood glucose concentration increased reaction time but did not refer to low blood glucose concentration.

**06.8** Many students are confused between glucose, glycogen, glucagon. Glycerol was also seen. Hybrid spellings between these terms was common and whilst phonetic spelling is acceptable, marks cannot be credited where there is ambiguity between technical terms.

Common misconceptions were that insulin or glucagon are broken down into glucose. For marking point 1, students often missed mention of the pancreas, in which case the mark would not be awarded. Few students gave marking point 2.

Some students misunderstood the question and described how people with diabetes control their blood sugar levels through diet and exercise.

Students sometimes spend time starting this style of question by re-writing the question. This is not necessary.

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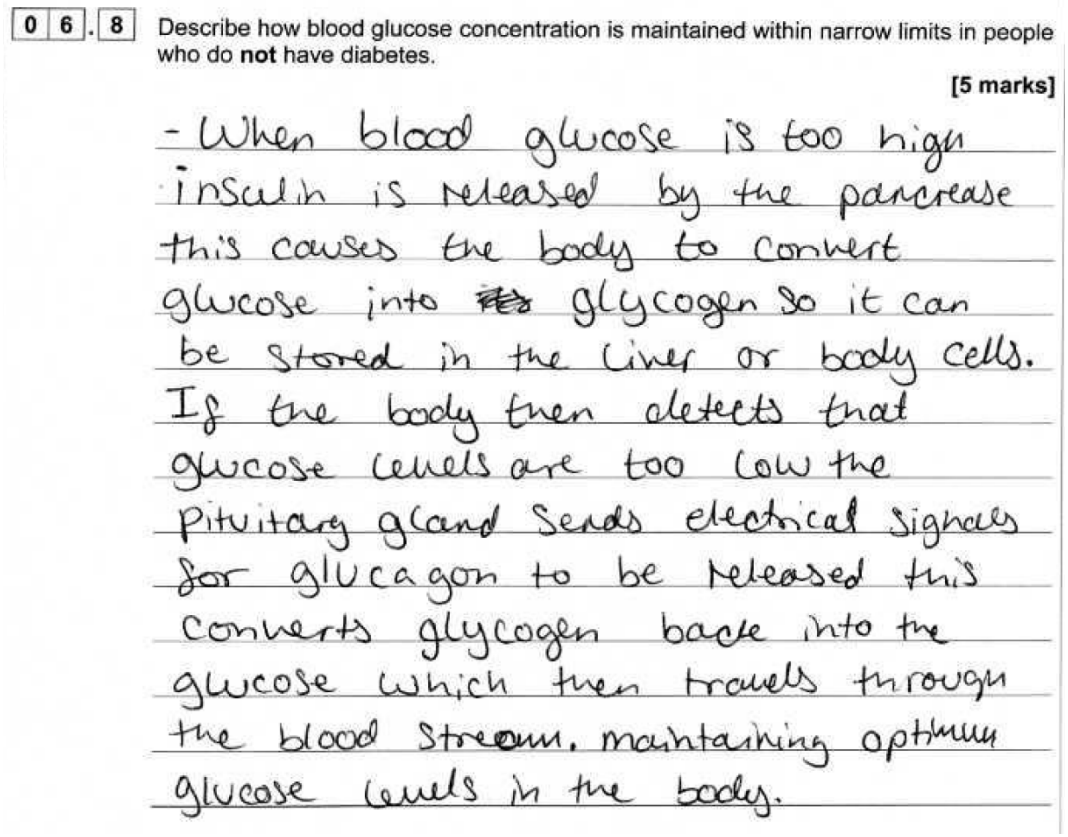
### 4.5.3.6 Feedback systems (HT only)

**Answer 03 · Examiner comments** June 2024 | 8464/B/2H | Original Q6

**0 6 . 8** Describe how blood glucose concentration is maintained within narrow limits in people who do **not** have diabetes.

**[5 marks]**


- When blood glucose is too high insulin is released by the pancrease this causes the body to convert glucose into ~~FES~~ glycogen so it can be stored in the liver or body cells. If the body then detects that glucose levels are too low the pituitary gland sends electrical signals for glucagon to be released this converts glycogen back into the glucose which then travels through the blood stream, maintaining optimum glucose levels in the body.

The student has given marking points 1 and 3. 'Pancrease' is given benefit of the doubt as a phonetic spelling of pancreas.

The student is not clear whether glucose or glycogen is entering liver cells, therefore marking point 2 cannot be awarded.

The student has not referred to where glucagon is released from when blood glucose concentration decreases, therefore marking point 4 cannot be given.

Marking point 5 is given, so the student gains 3 marks for this question.

**06.9** Many students answered as if the reaction time has increased, despite the question. For the first marking point, many stated that the increase in chemical would decrease the rate of diffusion, or 'overwhelm' the body. Few students made appropriate mention of impulses. Very few students could link the role of the diffusion of chemicals to impulses in the next/motor/relay neurone.

There was frequent use of incorrect terminology, such as:

- electrical impulses travelling across a synapse
- chemical impulses travelling across a synapse
- chemicals diffusing down neurones
- neurones moving from receptors to effectors.

Although it's beyond the specification, the term 'neurotransmitters' was seen and could be used.

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**4.5.3.6 Feedback systems (HT only)**



# Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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