Examiners' Report/
Lead Examiner Feedback

June 2016

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 1: Principles of Science (20460E)

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June 2016
Publications Code 20460E_ER

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

General comments

Learners that did well this series, did so because they had learnt key terms and used good scientific language, they were able understand what was being asked for in the question and therefore apply their knowledge of the science well. Learners that excelled had learnt the scientific principles and were able to apply them to new situations.

As in previous series, exam technique is still an issue for the weaker learners. Centre's need to fully prepare learners for the exam by practising exam technique, especially in relation to reading the question carefully and not repeating the stem of the question.

Scientific knowledge was lacking in some questions, only the best learners were able to apply their scientific knowledge to new situations such as those in Q3(b), Q6 and Q9.

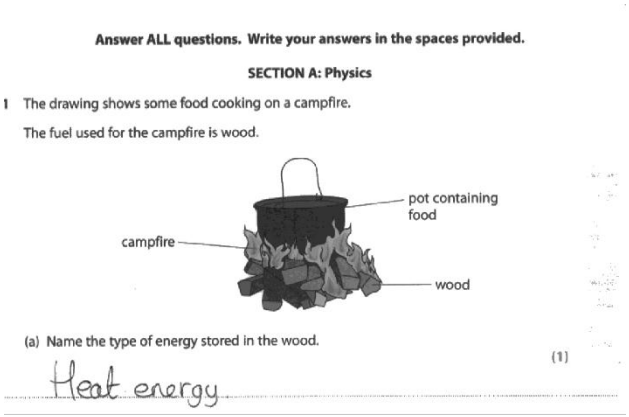
Learners should also be taught that when they have answered the question, they should ensure that the question set has been addressed in the answer they have given and that they have used appropriate scientific knowledge and vocabulary.

Feedback on specific questions

Question 1

Learners found Q1(a) quite difficult, with few understanding that the stored energy in wood is chemical energy. A common misconception seen was that heat energy was stored in the wood.

Only the better learners scored this mark.



Answer ALL questions. Write your answers in the spaces provided.

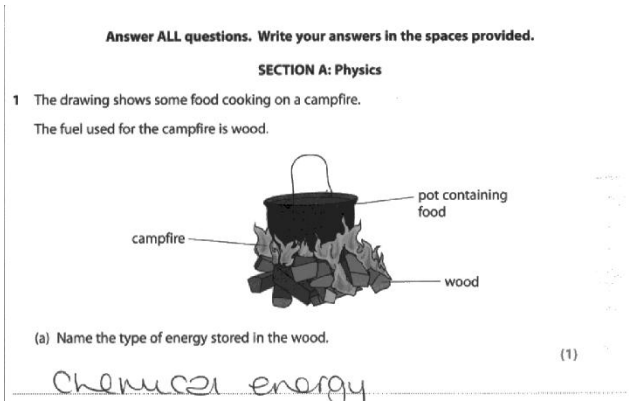
SECTION A: Physics

1 The drawing shows some food cooking on a campfire.

The fuel used for the campfire is wood.

(a) Name the type of energy stored in the wood. (1)

Heat energy.



Answer ALL questions. Write your answers in the spaces provided.

SECTION A: Physics

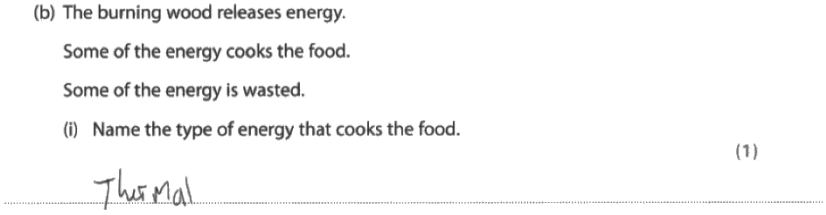
1 The drawing shows some food cooking on a campfire.

The fuel used for the campfire is wood.

(a) Name the type of energy stored in the wood. (1)

Chemical energy

Learners performed better Q1(b)(i), with most understanding that energy used to cook the food was thermal. Some learners stated that it was the heat energy, which was accepted for the mark.



(b) The burning wood releases energy.

Some of the energy cooks the food.

Some of the energy is wasted.

(i) Name the type of energy that cooks the food. (1)

Thermal

(b) The burning wood releases energy.

Some of the energy cooks the food.

Some of the energy is wasted.

(i) Name the type of energy that cooks the food.

(1)

Heat

In Q1(b)(ii), the majority of learners were able to give a form of energy that is wasted, with the majority giving light as a source and some stating sound.

(ii) Name the type of energy wasted.

(1)

light

(ii) Name the type of energy wasted.

(1)

Sound energy.

Some learners did not read the question carefully and stated that the wood was wasted, rather than naming a form of energy that was wasted.

(ii) Name the type of energy wasted.

(1)

Wood

Q1(c) posed problems for some learners. The better learners understood that wood is a renewable source of energy because the wood comes from trees that can be replanted or regrown.

(c) Wood is a renewable source of energy.

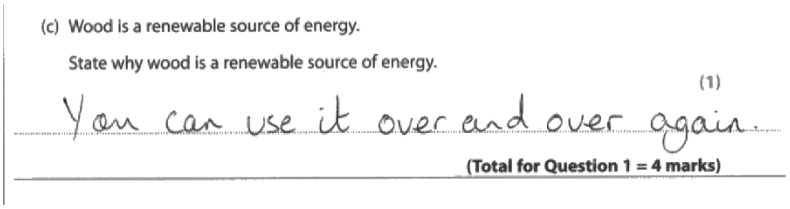
State why wood is a renewable source of energy.

(1)

Wood comes from trees, trees can be re planted

(Total for Question 1 = 4 marks)

Unfortunately, a common misconception seen was that the wood could be reused or burnt over and over again. This did not gain credit.



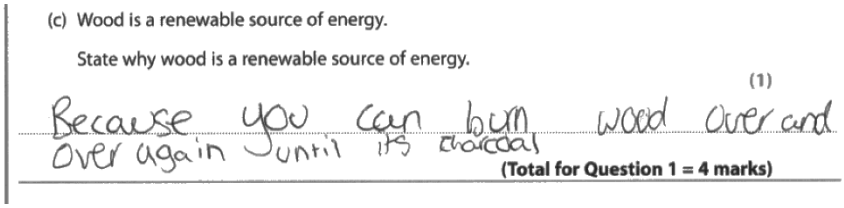
(c) Wood is a renewable source of energy.

State why wood is a renewable source of energy.

(1)

You can use it over and over again.

(Total for Question 1 = 4 marks)



(c) Wood is a renewable source of energy.

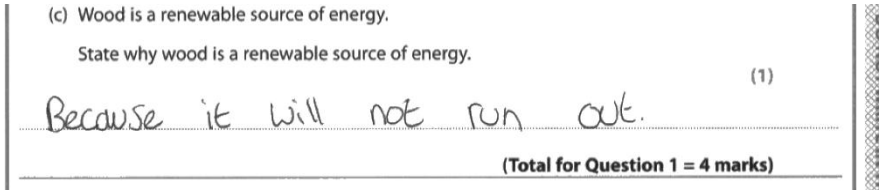
State why wood is a renewable source of energy.

(1)

Because you can burn wood over and over again until its charcoal

(Total for Question 1 = 4 marks)

Some learners simply stated that the wood would not run out, but they did not state why the wood might not run out so could not score the mark.



(c) Wood is a renewable source of energy.

State why wood is a renewable source of energy.

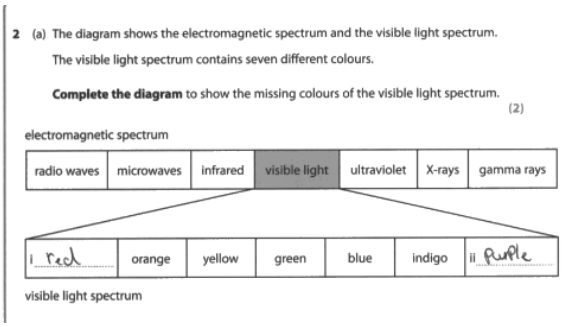
(1)

Because it will not run out.

(Total for Question 1 = 4 marks)

Question 2

Learners performed well in Q2(a), with the majority being able to complete the diagram to show the missing colours in the visible light spectrum.



2 (a) The diagram shows the electromagnetic spectrum and the visible light spectrum.

The visible light spectrum contains seven different colours.

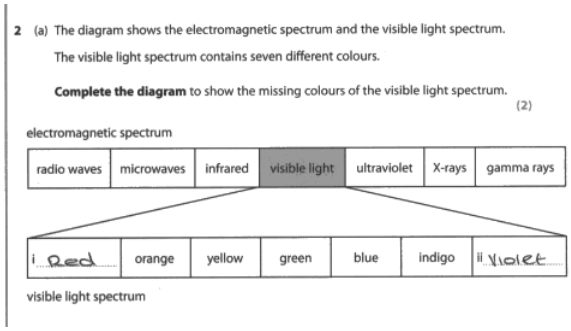
Complete the diagram to show the missing colours of the visible light spectrum. (2)

electromagnetic spectrum

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

i red	orange	yellow	green	blue	indigo	ii Purple

visible light spectrum



2 (a) The diagram shows the electromagnetic spectrum and the visible light spectrum.

The visible light spectrum contains seven different colours.

Complete the diagram to show the missing colours of the visible light spectrum. (2)

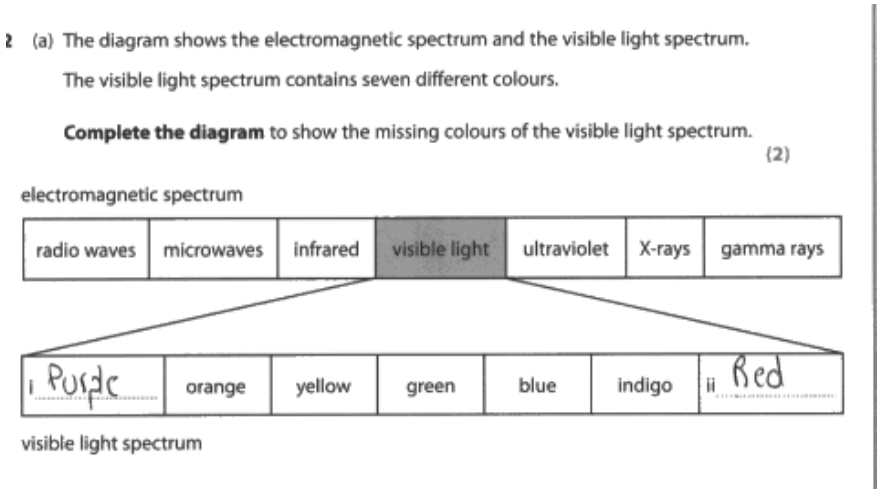
electromagnetic spectrum

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

i Red	orange	yellow	green	blue	indigo	ii Violet

visible light spectrum

In some cases, learners had the spectrum in the wrong order and placed the two colours at the wrong ends of the spectrum, which gained no credit.



2 (a) The diagram shows the electromagnetic spectrum and the visible light spectrum.

The visible light spectrum contains seven different colours.

Complete the diagram to show the missing colours of the visible light spectrum.

(2)

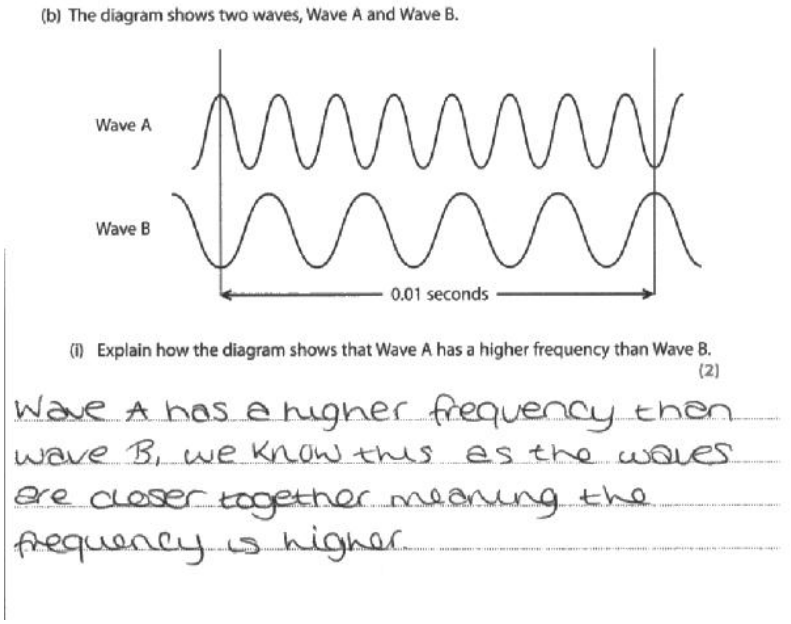
electromagnetic spectrum

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

i Purple	orange	yellow	green	blue	indigo	ii Red

visible light spectrum

Q2(b)(i) was generally well attempted by learners. Many showed an understanding that wave A had a higher frequency than because it had more waves.



(b) The diagram shows two waves, Wave A and Wave B.

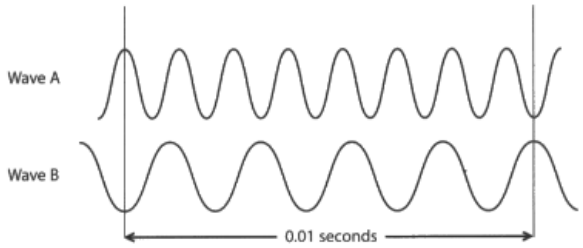
(i) Explain how the diagram shows that Wave A has a higher frequency than Wave B.

(2)

Wave A has a higher frequency than wave B, we know this as the waves are closer together meaning the frequency is higher.

Only the better learners were able to complete this by stating that it was more waves per 0.01 seconds (as shown in the diagram) or per unit time.

(b) The diagram shows two waves, Wave A and Wave B.



(i) Explain how the diagram shows that Wave A has a higher frequency than Wave B.

(2)

diagram A has a higher frequency then wave B because theres more waves within 0·01 seconds.

Learners also performed well in Q2(b)(ii), with many being able to rearrange the equation given correctly and using it to calculate the wavelength of the wave given.

(ii) Wave B has a wave speed of 800 m/s and a frequency of 400 Hz.

Calculate the wavelength of Wave B.

wave speed (m/s) = wavelength (m) × frequency (Hz)

Show your working.

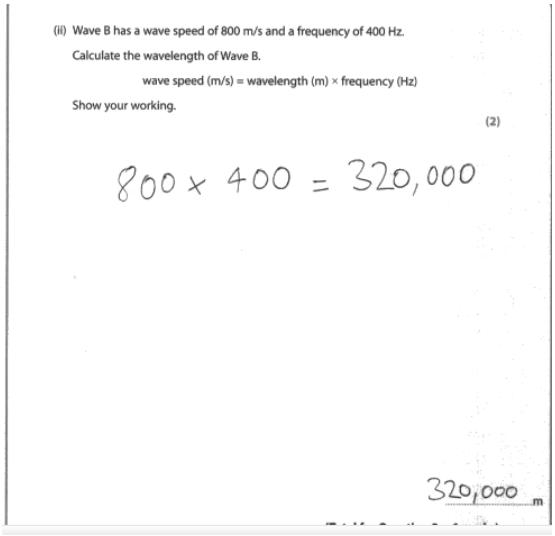
(2)

WaveSpeed and frequency

800 m/s ÷ 400 Hz = 2

2 m

Weaker learners were not able to rearrange the equation correctly and therefore multiplied the wave-speed by the frequency to obtain an answer of 320,000 which was incorrect and gained no credit.


(ii) Wave B has a wave speed of 800 m/s and a frequency of 400 Hz.

Calculate the wavelength of Wave B.

wave speed (m/s) = wavelength (m) × frequency (Hz)

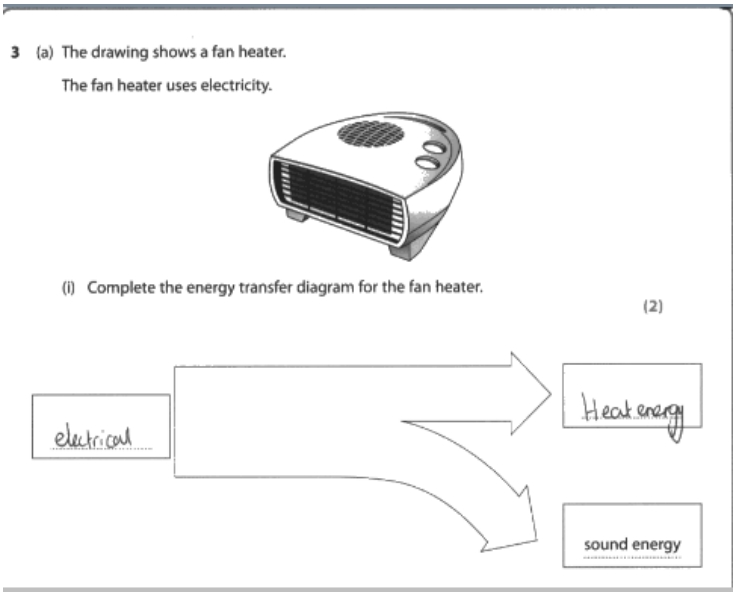
Show your working.

(2)

800 x 400 = 320,000

320,000 m

In Q3(a)(i) the majority of learners were able to complete the energy transfer diagram for the fan heater.


3 (a) The drawing shows a fan heater.

The fan heater uses electricity.

(i) Complete the energy transfer diagram for the fan heater.

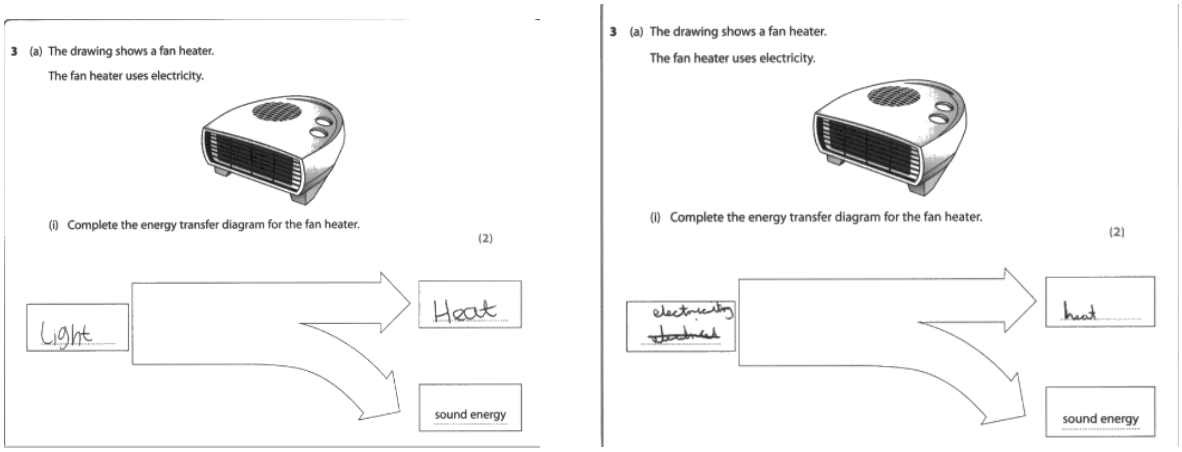
(2)

electrical

Heat energy

sound energy

Weaker learners often did not score credit in this question as the input energy was incorrect. In some cases, the learners gave a form of energy but not an input energy. In other cases, learners gave electricity as the energy input instead of electrical energy, which gained no credit.



3 (a) The drawing shows a fan heater.

The fan heater uses electricity.

(i) Complete the energy transfer diagram for the fan heater. (2)

Light

Heat

sound energy

3 (a) The drawing shows a fan heater.

The fan heater uses electricity.

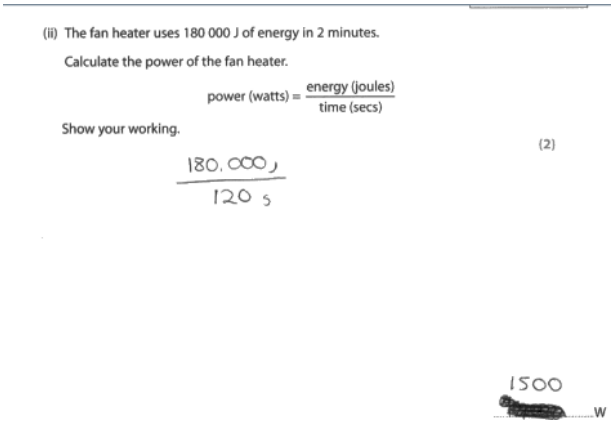
(i) Complete the energy transfer diagram for the fan heater. (2)

electricity

heat

sound energy

The second equation in Q3(a)(ii) also performed well, with many candidates remembering to covert the minutes in seconds and calculating the power correctly.



(ii) The fan heater uses 180 000 J of energy in 2 minutes.

Calculate the power of the fan heater.

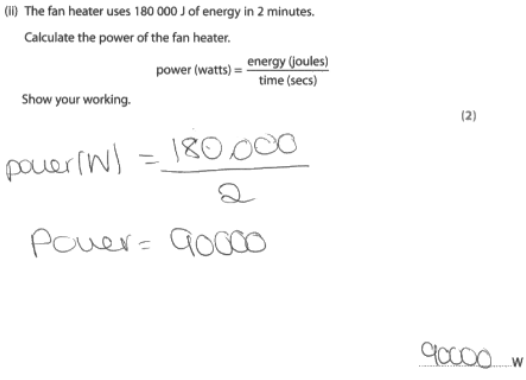
$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (secs)}}$$

Show your working. (2)

$\frac{180,000\text{ J}}{120\text{ s}}$

1500 W

Some learners lost marks as they forgot to convert the minutes into seconds so scored just one mark.



(ii) The fan heater uses 180 000 J of energy in 2 minutes.

Calculate the power of the fan heater.

$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (secs)}}$$

Show your working. (2)

$\text{power (W)} = \frac{180,000}{2}$

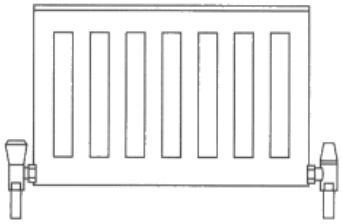
Power = 90000

90000 W

Learners found Q3(b) quite difficult. Many learners were very confused as to how a radiator worked and were not able to apply their knowledge of conduction and convection to this context. Some learners were able to use the information from the stem and their knowledge to show an understanding that it is the hot water following through the radiator that heats the metal. Unfortunately, they were not able to take this any further to give any further explanation of conduction or convection.

(b) The diagram shows a metal radiator.

The radiator is used to heat the room.



Hot water is pumped through the metal radiator.

Explain how conduction and convection transfer the thermal energy from the hot water to the room.

(4)

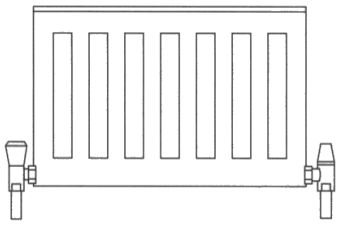
conduction conduction transfers the thermal energy by absorbing the heat from the water and heating up the whole radiator

convection convection transfers the thermal energy and releases it around the room

Only the best learners were able to describe the convection current in the second part of the explanation.

(b) The diagram shows a metal radiator.

The radiator is used to heat the room.



Hot water is pumped through the metal radiator.

Explain how conduction and convection transfer the thermal energy from the hot water to the room.

(4)

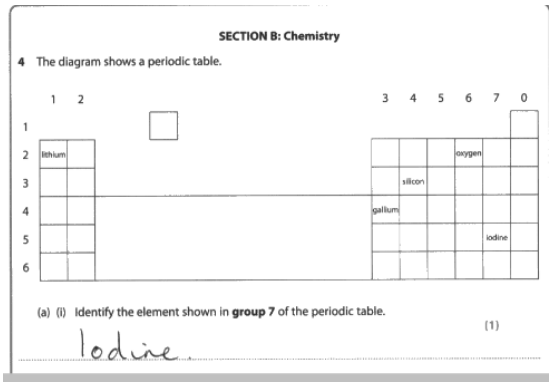
conduction The hot water gets pumped into the radiator, the radiator is metal which heats very quickly.

convection when the radiator is hot it starts to heat the particles in the air. The hot air particles rise up causing the cooler air particles to sink these particles then warm up creating a convection cycle.

(Total for Question 3 = 8 marks)

Question 4

The majority of learners done well in Q4(a)(i) and were able identify iodine as the element shown on the periodic table that was in group 7.



SECTION B: Chemistry

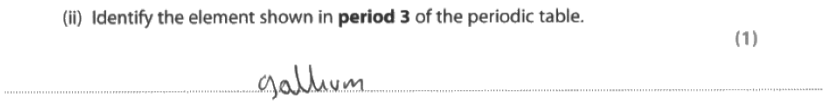
4 The diagram shows a periodic table.

	1	2							3	4	5	6	7	0
1														
2	lithium											oxygen		
3										silicon				
4									gallium					
5													iodine	
6														

(a) (i) Identify the element shown in **group 7** of the periodic table. (1)

Iodine

Learners did less well on Q4(a)(ii), with many confusing group 3 with period 3 and stating that gallium was in period 3.



(ii) Identify the element shown in **period 3** of the periodic table. (1)

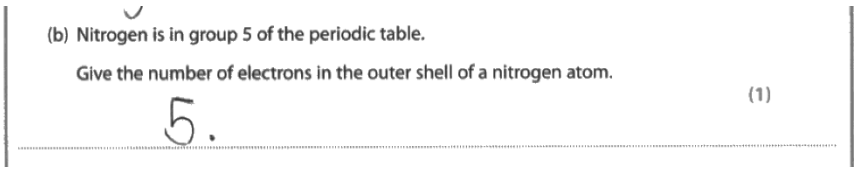
gallium

Only the better learners understood the difference between a group and a period and were able to recognize silicon as the element shown on the table that was in period 3.

(1)

Silicon

In general learners performed well in Q4(b), with many understanding the link between the group number and the number of outer electrons in the outer shell of an atom.



(b) Nitrogen is in group 5 of the periodic table.

Give the number of electrons in the outer shell of a nitrogen atom. (1)

5.

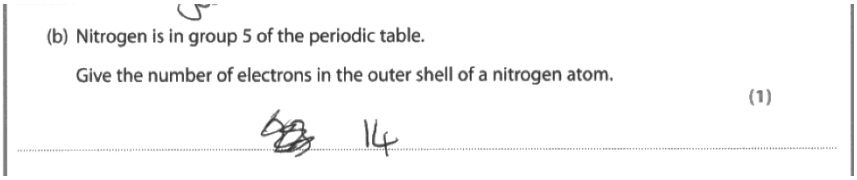
(c) Oxygen is a molecule.

(i) Give the formula for a molecule of oxygen.

(1)

O_2

Learners that did not understand this link, tried to find other links, some gave the atomic mass of nitrogen.

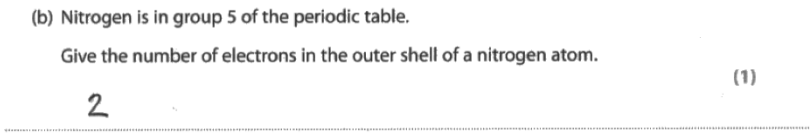

(b) Nitrogen is in group 5 of the periodic table.

Give the number of electrons in the outer shell of a nitrogen atom.

(1)

14

Some seemed to be confused and gave the number of electrons on the inner most shell instead of the outer shell.


(b) Nitrogen is in group 5 of the periodic table.

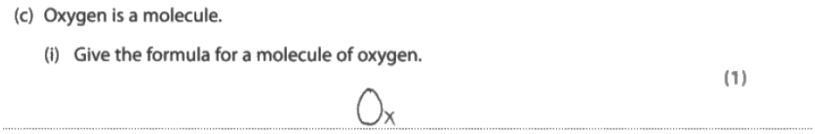
Give the number of electrons in the outer shell of a nitrogen atom.

(1)

2

Learners are still finding it difficult to recall the formula of simple elements and compounds and be able to write them correctly.

Many learners were not able to recall the correct formula of a molecule of oxygen.

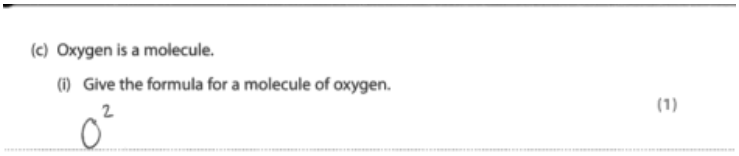

(c) Oxygen is a molecule.

(i) Give the formula for a molecule of oxygen.

(1)

Ox

Of those that could remember the correct formula, many were not able to write it in using the correct scientific conventions.


(c) Oxygen is a molecule.

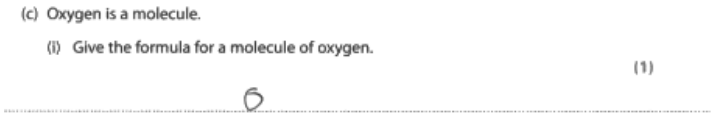
(i) Give the formula for a molecule of oxygen.

(1)

O^2

Only the better learners remembered the correct formula and were able to represent it correctly also.

Some learners did not read the question correctly and gave the formula of an atom rather than a molecule of oxygen.


(c) Oxygen is a molecule.

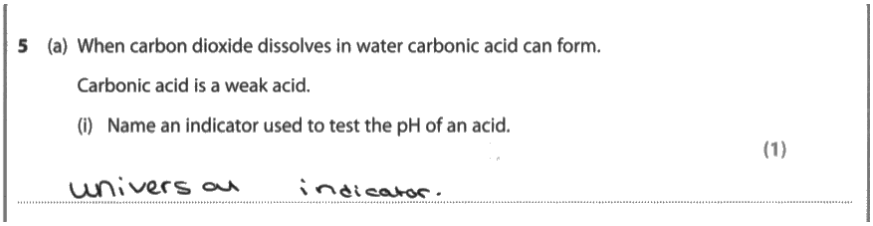
(i) Give the formula for a molecule of oxygen.

(1)

O

Question 5

In Q5(a)(i) learners were often able to name an indicator that would test the pH of the acid. Some learners gave vague answers such as indicator strip, which was not acceptable. In some cases, learners gave litmus paper as an answer, which was not acceptable as litmus only distinguishes between an acid and an alkali rather than giving a pH value.

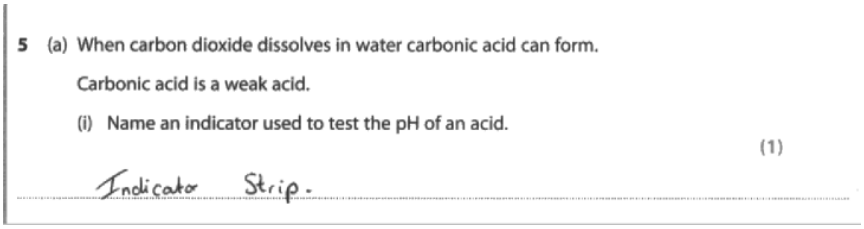

5 (a) When carbon dioxide dissolves in water carbonic acid can form.

Carbonic acid is a weak acid.

(i) Name an indicator used to test the pH of an acid.

(1)

universal indicator.


5 (a) When carbon dioxide dissolves in water carbonic acid can form.

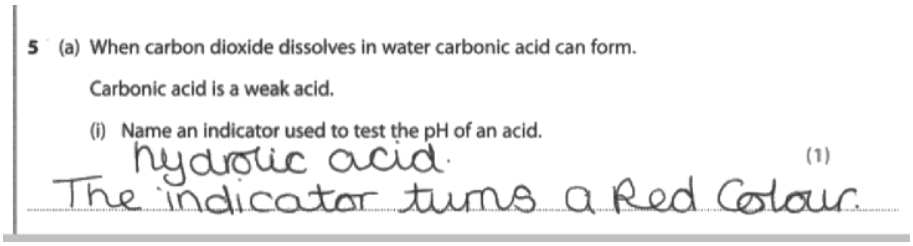
Carbonic acid is a weak acid.

(i) Name an indicator used to test the pH of an acid.

(1)

Indicator Strip.

Some learners did not read the question carefully and gave what they thought would be the result of a test with universal indicator paper rather than the name of the indicator.


5 (a) When carbon dioxide dissolves in water carbonic acid can form.

Carbonic acid is a weak acid.

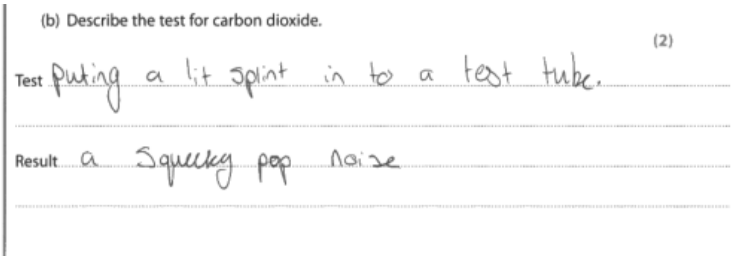
(i) Name an indicator used to test the pH of an acid.

(1)

hydrolic acid.

The indicator turns a Red Colour.

Learners did not perform well in Q5(b). The majority of learners gave the test for hydrogen rather than the test for carbon dioxide.

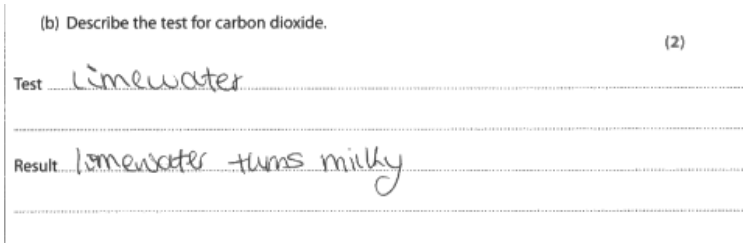

(b) Describe the test for carbon dioxide.

(2)

Test puting a lit splint in to a test tube.

Result a Squeeky pop noise

Only the best learners knew that the test for carbon dioxide uses limewater and that the positive result of the test is that the limewater would turn cloudy.


(b) Describe the test for carbon dioxide.

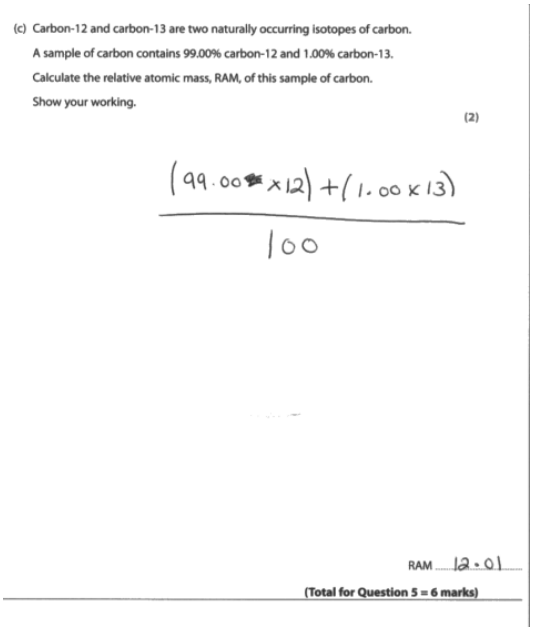
(2)

Test Limewater

Result limewater turns milky

Learners also found Q5(c) very challenging. The majority of learners thought that they should be multiplying the abundance of each carbon by each other. In other cases, they divide the abundance of each carbon.

Only the very best learners were able to correctly calculate the relative atomic mass of the sample of carbon.

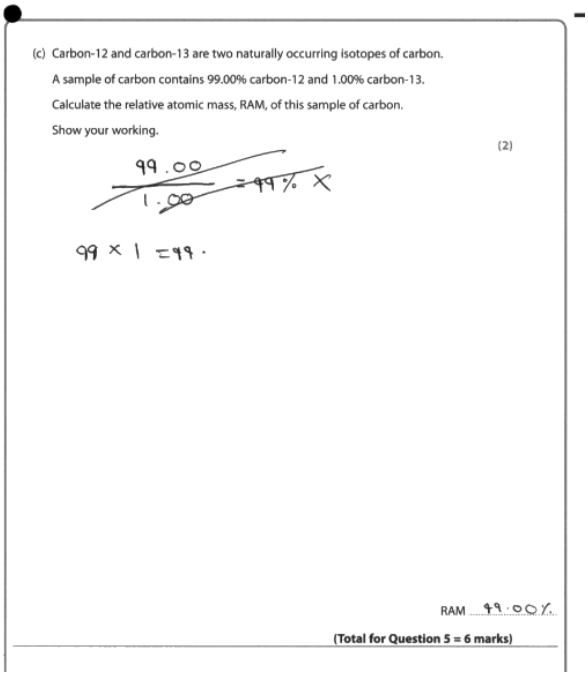

(c) Carbon-12 and carbon-13 are two naturally occurring isotopes of carbon.
A sample of carbon contains 99.00% carbon-12 and 1.00% carbon-13.
Calculate the relative atomic mass, RAM, of this sample of carbon.
Show your working.

(2)

$\frac{(99.00 \times 12) + (1.00 \times 13)}{100}$

RAM 12.01

(Total for Question 5 = 6 marks)


(c) Carbon-12 and carbon-13 are two naturally occurring isotopes of carbon.
A sample of carbon contains 99.00% carbon-12 and 1.00% carbon-13.
Calculate the relative atomic mass, RAM, of this sample of carbon.
Show your working.

(2)

$\frac{99.00}{1.00} = 99\% \times$

$99 \times 1 = 99.$

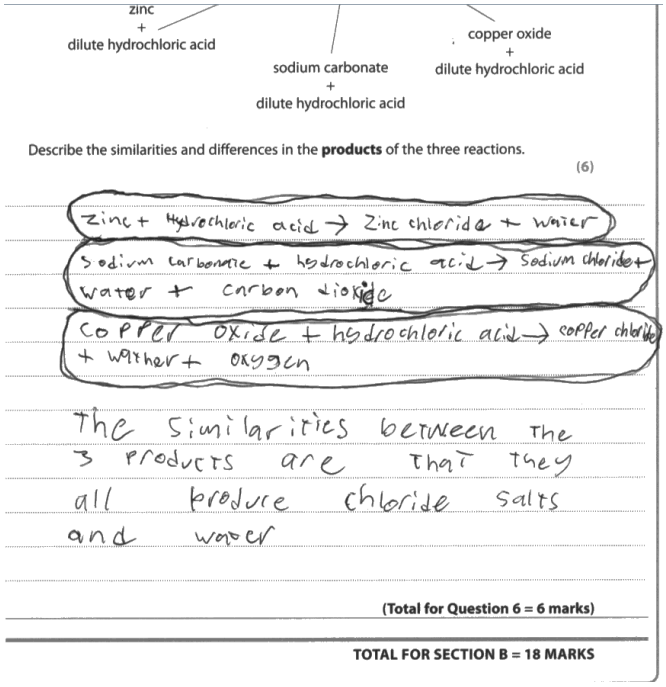
RAM 99.00%

(Total for Question 5 = 6 marks)

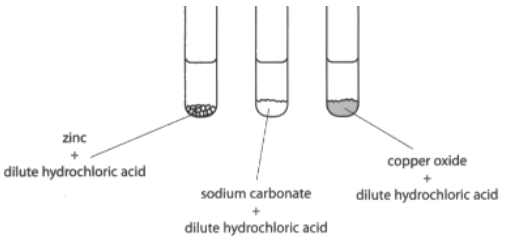
Question 6

Learners at every level found Q6 very challenging. In some cases, learners showed an understanding that all the reactions would produce a salt, but very few read the question carefully, with most giving a range of controls that Nicola should use in the experiment and some giving a method that Nicola should use. Some gave observations that might be seen although many of these were incorrect. None of these ideas addressed the question given and so none were able to gain credit.

In this first example, the learner has shown an understanding that all three reactions made a salt that was a chloride. However, there were no further comparisons in terms of similarities and differences and the rest of each equation given was incorrect.



The top scoring learners however were able to work out the products of each reaction and then come to conclusions on the similarites and differences, to give a good answer which gained the full six marks available to them.



Describe the similarities and differences in the **products** of the three reactions.

(6)

zinc + hydrochloric acid → zinc chloride + hydrogen

Sodium carbonate + hydrochloric acid → sodium chloride + H_2O + CO_2

copper oxide + hydrochloric acid → copper chloride + H_2O

- similarities
  - they all formed salts for their end products
  - 2 formed water (H_2O)
- Differences
  - (Sodium carbonat + acid) formed the product of CO_2 in the end which others did not
  - (zinc + acid) formed hydrogen while the two others formed water.

(Total for Question 6 = 6 marks)

Question 7

Q7(a) was well attempted by learners, although a common misconception seen was confusing the cell membrane with the cell wall.

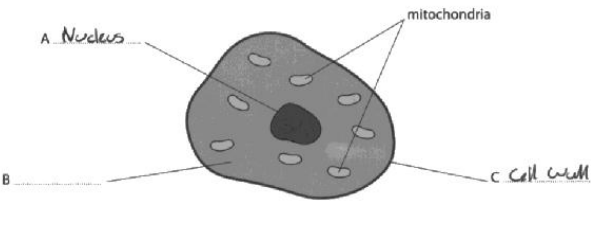
SECTION C: Biology

7 The diagram shows an egg cell.

Some of the mitochondria have been labelled.

(a) Complete the labels, **A**, **B** and **C**, for the other components of the egg cell.

(3)



Learners found recalling the function of the mitochondria in Q7(b) much more difficult. A common incorrect answer seen was that the function of mitochondria is to fight off unwanted cells or bacteria. Many learners misread the question and gave the function of an egg cell and gave functions that related to fertilization.

(b) State **one** function of the mitochondria.

(1)

~~To protect the cell and~~ the cell fight off any unwanted cells

(Total for Question 7 = 4 marks)

(b) State **one** function of the mitochondria.

(1)

its inside the body which can coarse a baby.

(Total for Question 7 = 4 marks)

Question 8

Many learners did well in Q8(a)(i) and were able to give a function of the root of a plant. The most common correct answer seen was to absorb water. Some learners stated that the root was to store water or provide water which was not acceptable for the mark.

8 (a) The root is a plant organ.

Roots contain phloem.

(i) State **one** function of the root of a plant.

(1)

to absorb water

8 (a) The root is a plant organ.

Roots contain phloem.

(i) State **one** function of the root of a plant.

(1)

Stores water to keep the plant Hydrated

Learners found Q8(a)(ii) more challenging and only the best learners could recall the function of the phloem.

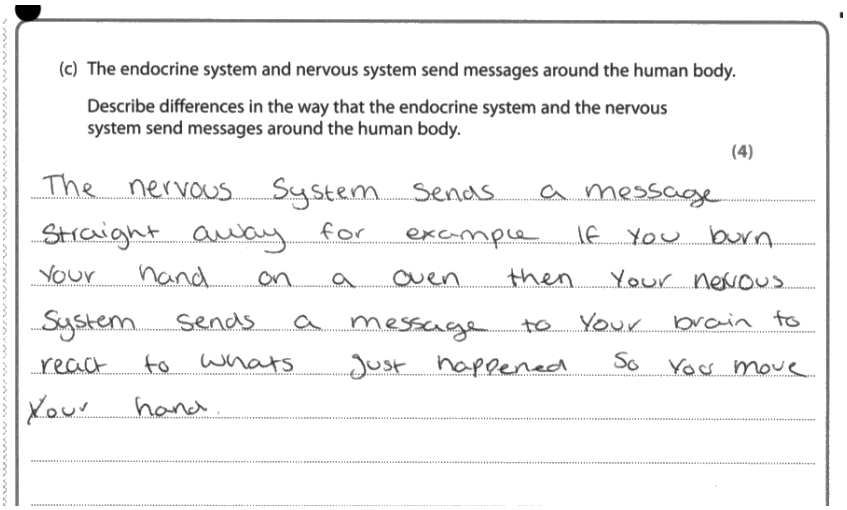
= (ii) Give the function of the phloem.

(1)

TO help transport Sugar around the plant

Q8(c) was well attempted by learners but only the better learners were able to properly address the question posed by describing differences in the ways that the endocrine and nervous systems send messages around the body.

The weakest learners gave answers that related to what the purpose of the nervous system was, and some tried to describe the reflex arc.



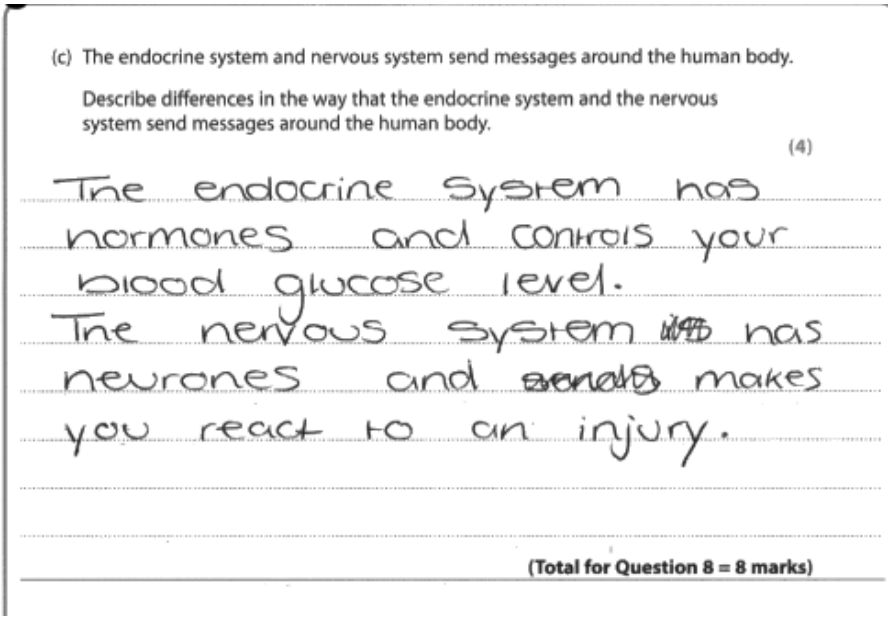
(c) The endocrine system and nervous system send messages around the human body.

Describe differences in the way that the endocrine system and the nervous system send messages around the human body.

(4)

The nervous System Sends a message straight away for example if you burn your hand on a oven then your nervous System sends a message to your brain to react to whats just happened so you move your hand.

Better learners were able to give answers that gained some credit. In this example the learner has understood that the endocrine system uses hormones and that the nervous system uses neurons.



(c) The endocrine system and nervous system send messages around the human body.

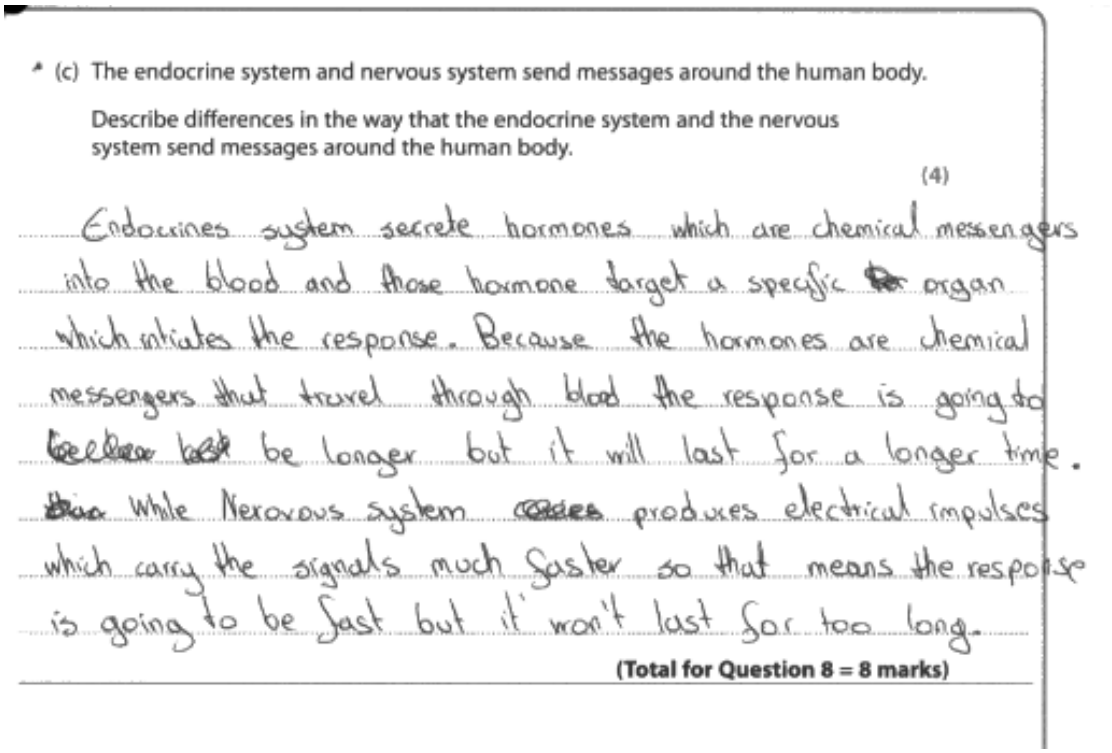
Describe differences in the way that the endocrine system and the nervous system send messages around the human body.

(4)

The endocrine System has hormones and controls your blood glucose level.
The nervous system has neurones and makes you react to an injury.

(Total for Question 8 = 8 marks)

Better learners were able to describe the differences in detail. In this example, the learner shows an understanding that the endocrine system uses hormones via the blood stream which takes longer but lasts longer, they also go on to describe the nervous system as being much faster due to the electrical impulses that, although fast, do not last as long. This is an excellent answer that scored full credit.



* (c) The endocrine system and nervous system send messages around the human body.

Describe differences in the way that the endocrine system and the nervous system send messages around the human body.

(4)

Endocrines system secrete hormones which are chemical messengers into the blood and those hormone target a specific organ which initiates the response. Because the hormones are chemical messengers that travel through blood the response is going to be longer but it will last for a longer time. While Nervous system produces electrical impulses which carry the signals much faster so that means the response is going to be fast but it won't last for too long.

(Total for Question 8 = 8 marks)

Question 9

Q9 was well attempted by learners. In general, most could access the question well and were able to state at least one mechanism that Malik's body would use to bring his temperature down. Many did not go on to give the extra detail to explain why the method of cooling worked. Learners that did not do well, generally did so as they did not read the question carefully and had tried to describe why Malik's temperature had gone up whist he was running

In the first example, the learner starts by stating that it is the process of homeostasis that is important here. They go on to explain two methods that the body uses to cool down. They state that the body sweats and the sweat is evaporated. They do not give the extra detail that it is the heat that is removed from the body that causes the sweat to evaporate.

They then state that body hairs will lie flat to stop the hot air being trapped. The detail regarding the blood vessels narrowing is incorrect and so was ignored.

The learner has shown an understanding of homeostasis and given two methods of cooling down. One of the methods is well explained and therefore the learner was awarded 5 marks at distinction level.

9 Malik runs on a running machine at the gym.

The table shows Malik's body temperature before running and after running.

	body temperature (°C)
before running	37.2
after running	37.7

After 30 minutes of rest Malik's body temperature has returned to 37.2 °C. Homeostasis

Explain how Malik's body works to lower his body temperature from 37.7 °C back down to 37.2 °C.

(6)

Homeostasis keeps ~~the body~~ Maliks body regulation constant. ~~He may s~~ His sweat glands may release sweat. His sweat will evaporate (dry), helping him cool down. His body hairs will lie flat to stop hot air being trapped. His blood vessels will ~~widen~~ get narrower, which will help him cool down and keep keep his temperature at a constant level.

In this second example, the learner has given two methods of cooling the body, 'veins' widening and sweat evaporating. Veins was allowed acceptable alternative to blood vessels. The learner has partially explained both methods and therefore a mark of 4 was awarded.

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	body temperature (°C)
before running	37.2
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After 30 minutes of rest Malik's body temperature has returned to 37.2 °C.

Explain how Malik's body works to lower his body temperature from 37.7 °C back down to 37.2 °C.

(6)

Malik's skin would have started to go red, this is because his blood veins are widening therefore letting more blood through. He would also start sweating and as the sweat evaporates it takes the heat with it.

In the final example, the learner has given three methods that the body uses to cool down when it is hot: blood vessels widen, hair 'sticks' down, sweats. However, as none of these methods are explained, credit beyond pass level was not possible.

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After 30 minutes of rest Malik's body temperature has returned to 37.2 °C.

Explain how Malik's body works to lower his body temperature from 37.7 °C back down to 37.2 °C.

(6)

His blood vessels widen, his hair sticks down onto his skin to stop ~~air~~ HOT from coming in to the body. He sweats to cool himself down.