Examiners' Report/
Lead Examiner Feedback

Summer 2017

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 1: Principles of Science (20460E)

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August 2017
Publications Code 20460E _1706_MS

Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade (Distinction, Merit, Pass and Level 1 fall-back). The grade awarded for each unit contributes proportionately to the overall qualification grade and each unit should always be viewed in the context of its impact on the whole qualification.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark should be for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each test we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each test, because then it would not take into account that a test might be slightly easier or more difficult than any other.

Grade boundaries for this, and all other papers, are on the website via this link: qualifications.pearson.com/gradeboundaries

Unit 1: Principles of Science (20460E)

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	13	22	31	41

Unit 8 Level 2 BTEC applied science report

June 2017

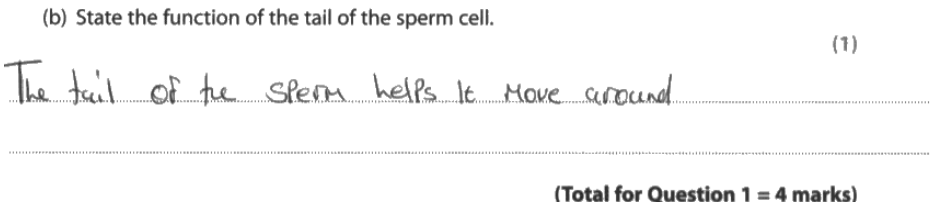
General comment

Candidates that did well this series, did so because they had learnt key terms and used good scientific language. They were also able to apply the scientific concepts that they had been taught to new situations. It was pleasing to see that at the top end, learners were proficient at writing balanced chemical equations, were able to use equations and evaluate them to give correct answers with correct standard form.

Exam technique is an ongoing issue for the weaker learners sitting this paper, learners must be better prepared for the exam by practicing exam technique, especially in relation to reading the question carefully and checking that the question set has been addressed in the answer given, using appropriate scientific knowledge and vocabulary. There is also the need for Centres to continue to focus on learners learning the key scientific knowledge in the specification. Learners are still relying on their common knowledge rather than their scientific knowledge to answer questions.

Question 1b

The majority of learners started the paper well and knew in question 1 part (b) that the function of the tail of the sperm was to move towards the egg cell.

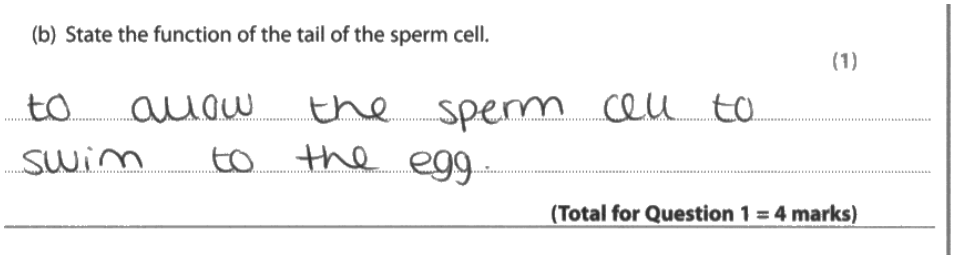

(b) State the function of the tail of the sperm cell.

(1)

The tail of the sperm helps it move around

(Total for Question 1 = 4 marks)

Many stated that the function was to make the sperm 'swim' to the egg, which was accepted.

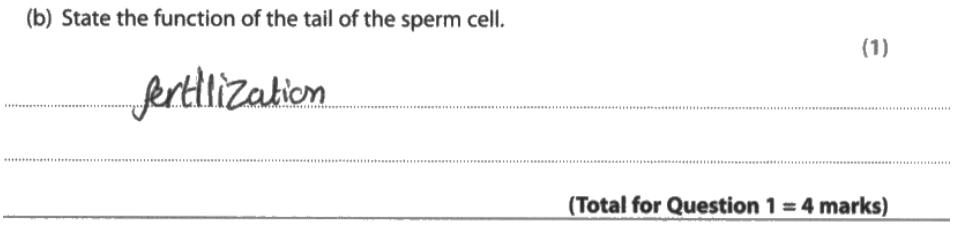

(b) State the function of the tail of the sperm cell.

(1)

to allow the sperm cell to swim to the egg.

(Total for Question 1 = 4 marks)

Some learners did not read the question carefully and stated that the function was to fertilize the egg or words to that effect and so did not score any credit.


(b) State the function of the tail of the sperm cell.

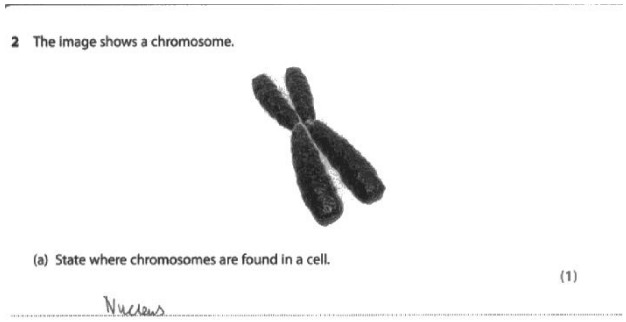
(1)

fertilization

(Total for Question 1 = 4 marks)

Question 2a

Some learners knew that chromosomes are found in the nucleus of a cell.

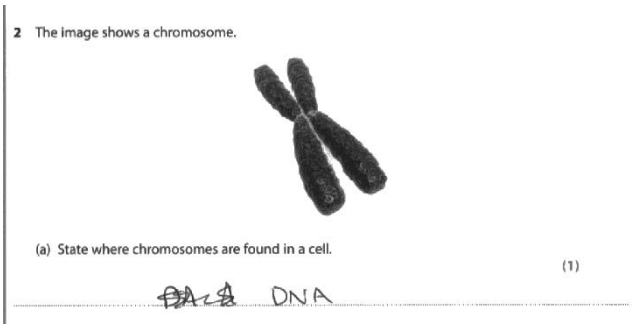


2 The image shows a chromosome.

(a) State where chromosomes are found in a cell. (1)

Nucleus

However, a significant proportion of learners thought that chromosomes are found in the



2 The image shows a chromosome.

(a) State where chromosomes are found in a cell. (1)

DNA

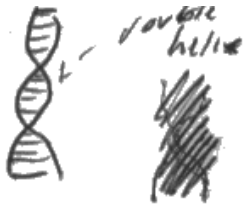
DNA or genes

Question 2b

(b) DNA contains complementary base pairs.

Cytosine (C) pairs with guanine (G).

Name the base that pairs with thymine (T).



(A)

The majority of learners knew that the base that paired with thymine is adenine. Most simply wrote the capital A, which was fine for the mark.

Some learners did not show this understanding and repeated the complementary base pair in the question stem.

(b) DNA contains complementary base pairs.

Cytosine (C) pairs with guanine (G).

Name the base that pairs with thymine (T).

(1)

cytosine (c)

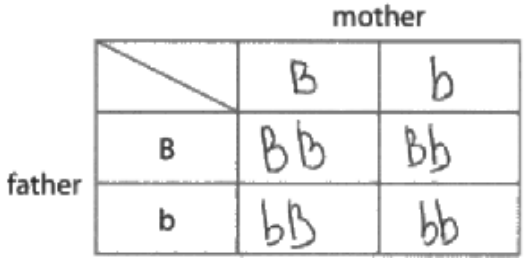
Question 2c

The more able learners were able to complete the correct genotype for the mother using the information given in the stem of the question and then completed the rest of the Punnett square correctly to score both marks available. .

(c) The allele for brown eyes is B.
The allele for blue eyes is b.
A father is heterozygous for brown eyes, and has the genotype Bb.
A mother is homozygous for blue eyes.

Complete the Punnett square using this information.

(2)

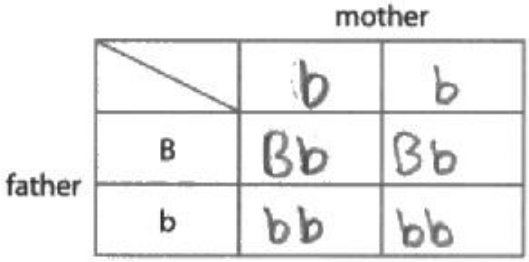


However, a large proportion of learners were not able to give the correct genotype for the mother. Of these, some were still able to correctly complete the Punnett square to gain the second mark, even though the first mark was lost.

(c) The allele for brown eyes is B.
The allele for blue eyes is b.
A father is heterozygous for brown eyes, and has the genotype Bb.
A mother is homozygous for blue eyes.

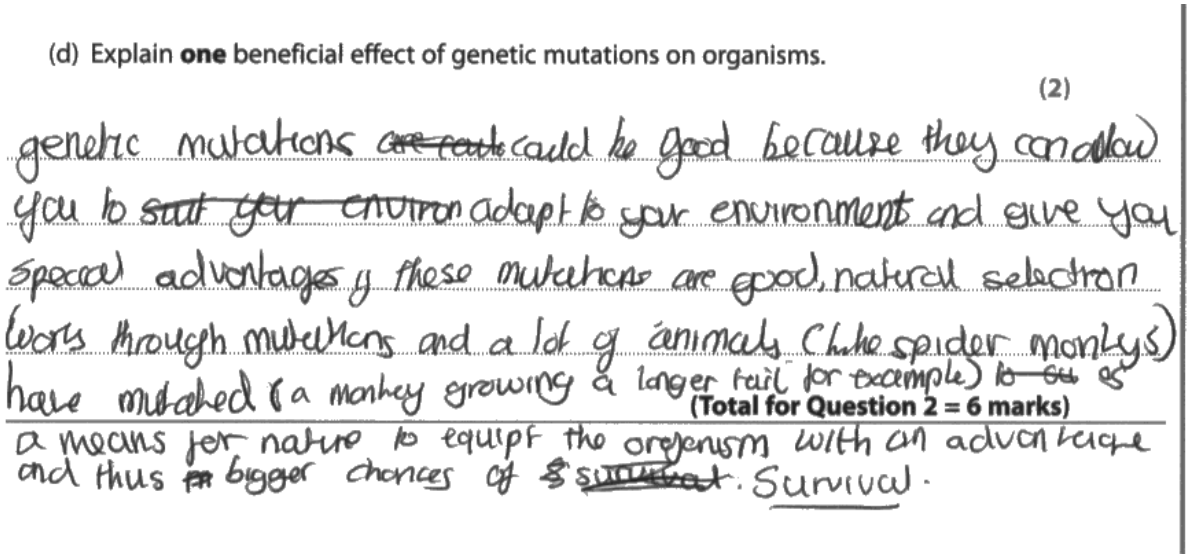
Complete the Punnett square using this information.

(2)



Question 2d

Learners found question **2d** quite difficult, although better learners we able to explain how genetic mutations could be beneficial to organisms. Often these learners gave an example of a specific organism and how it has adapted to give it a better chance of survival.



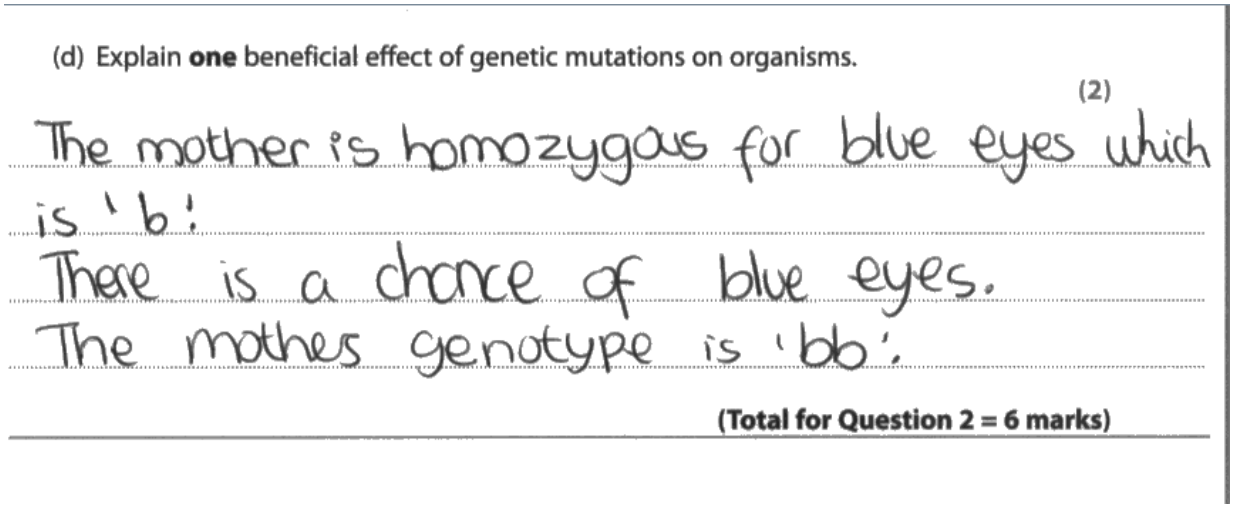
(d) Explain **one** beneficial effect of genetic mutations on organisms.

(2)

genetic mutations ~~are really~~ could be good because they can allow you to ~~suit your environ~~ adapt to your environment and give you special advantages if these mutations are good, natural selection works through mutations and a lot of animals (like spider monkeys) have mutated (a monkey growing a longer tail for example) ~~to su~~ as a means for nature to equipt the organism with an advantage and thus ~~in~~ bigger chances of ~~survival~~ survival.

(Total for Question 2 = 6 marks)

Many learners however, did not read the question carefully and related their answer to the Punnett square in part (c) of the question, making comments on the eye colour of the mother and/or the offspring.



(d) Explain **one** beneficial effect of genetic mutations on organisms.

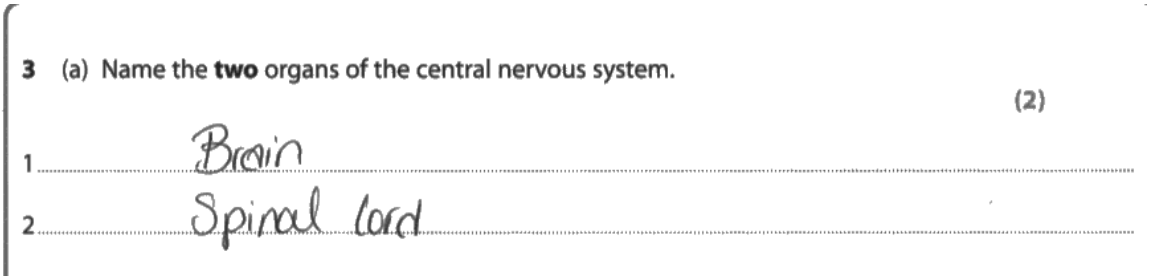
(2)

The mother is homozygous for blue eyes which is 'b'.
There is a chance of blue eyes.
The mothes genotype is 'bb'.

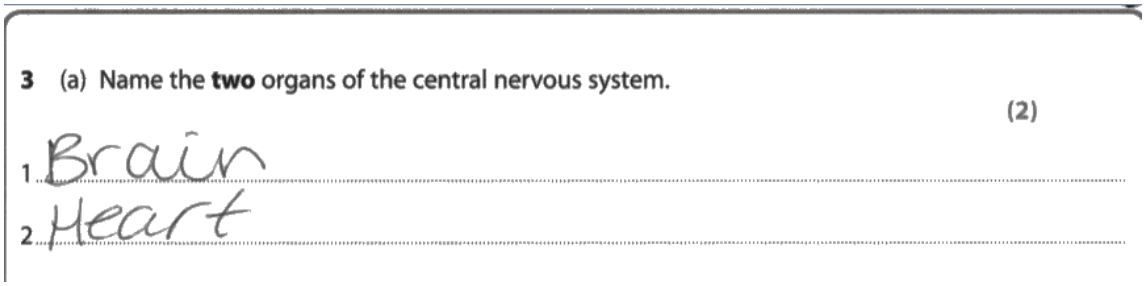
(Total for Question 2 = 6 marks)

Question 3

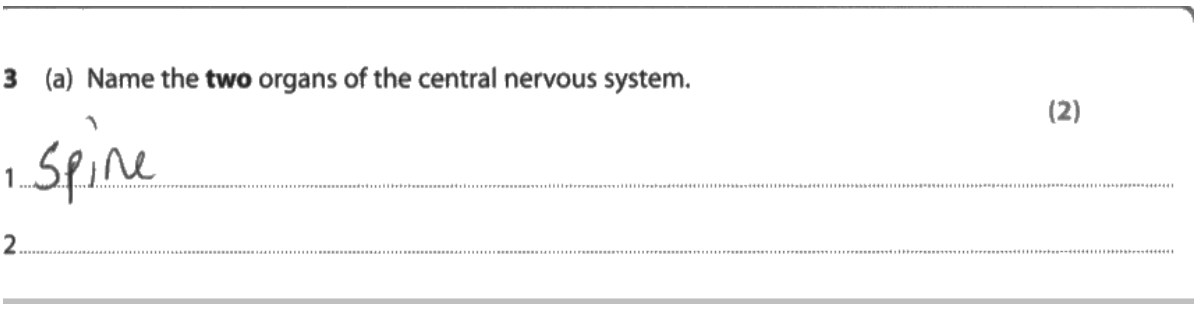
In part **(a),** many learners were able to correctly name the two organs that make up the central nervous system.



A large proportion of learners thought that the heart was one of the organs that make up the central nervous system.



In some cases, the learner was confused between the spinal cord and the spine and so did not gain credit.



Question 3,

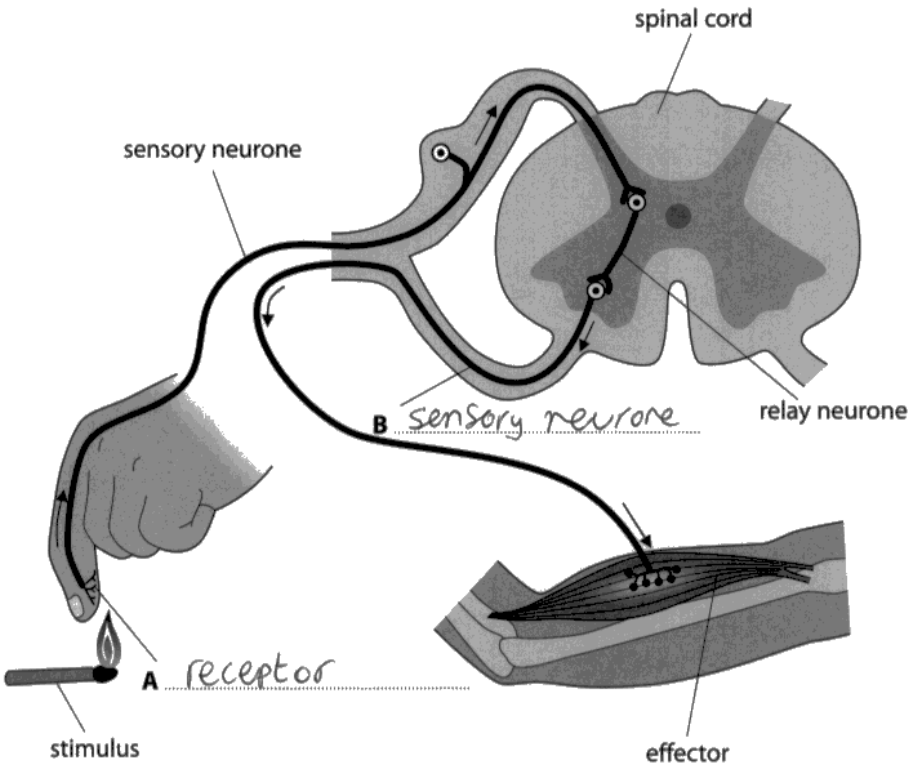
Part **(c)** was well attempted, with many learners being able to complete the reflex arc by labelling the receptor and the motor neurone.

(b) The diagram shows a reflex arc.

(b

Complete the labels, **A** and **B**, of the reflex arc.

(2)

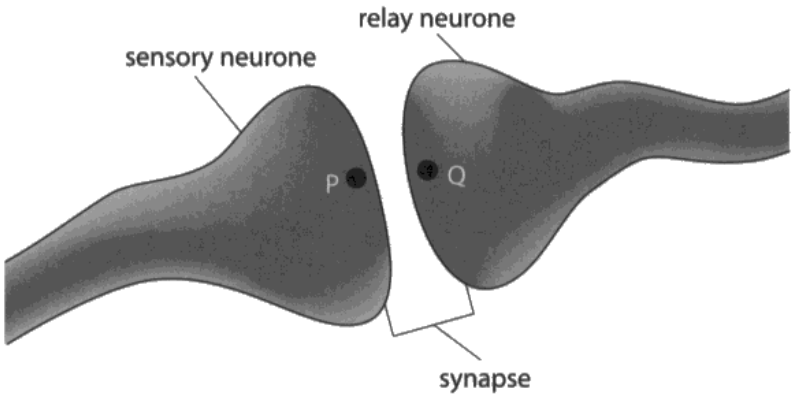


In some cases, learners were confused between the sensory and the motor neurone as in this example and so did not score both marking points.

Learners found question 3, part **(d)** quite difficult, with only the best learners being able to explain how information travels across the synapse from point P to point Q.

(c) The diagram shows a sensory neurone and a relay neurone.

The gap between the neurones is called a synapse.



Explain how information travels from point P to point Q.

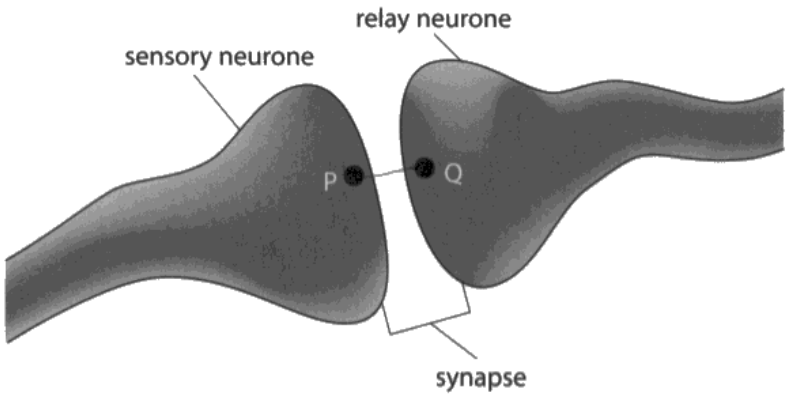
(4)

The information travels from point P to Q when the information arrives at P the synapse triggers a chemical called neurotransmitters that travel through the gap to reach the relay neurone where it is recived and relays the information.

Many learners thought the information trvelled fro point P to point Q by vibrations between the points which gained no credit.

(c) The diagram shows a sensory neurone and a relay neurone.

The gap between the neurones is called a synapse.



Explain how information travels from point P to point Q.

(4)

information travels from point p to point Q by the vibrations between the points are picked up and then carried on through to the next neurone. The vibrations are quick and then this would make the reaction shaw quicker for the neurones to pick up.

(Total for Question 3 = 8 marks)

Question 4

Learners found part **(a)(ii)** quite difficult, only the better learners were able to give the letters of all of the substances that are molecules as in this example.

(ii) Give the letters of **all** the substances from the diagram that are molecules. **(1)**

W, X, Z

Some tried to name the molecules from the diagram rather than give the letters, whilst giving the name was acceptable, the name had to be correct and so this example did not score the mark.

(ii) Give the letters of **all** the substances from the diagram that are molecules. **(1)**

Hydrogen, Oxygen, Chlorine

In some cases, the learner identified some of the molecules, but not all of them and so could not gain credit.

(ii) Give the letters of **all** the substances from the diagram that are molecules. **(1)**

X , Z

In question 4 part **(a)(iii),** the majority of learners were able to state the meaning of the hazard symbol shown.

(iii) A container of substance X is labelled with this hazard symbol.

State the meaning of this hazard symbol.

(1)

Flammable

Some lost marks as they described what they saw in the picture instead of stating the meaning of the hazard symbol.

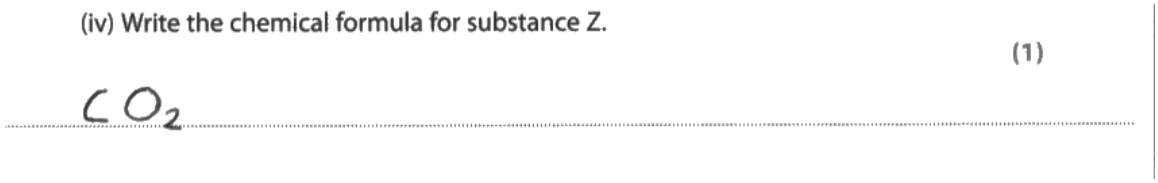
(iii) A container of substance X is labelled with this hazard symbol.

State the meaning of this hazard symbol.

(1)

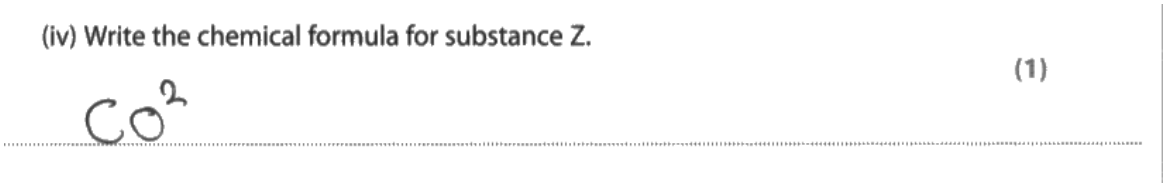
Fire

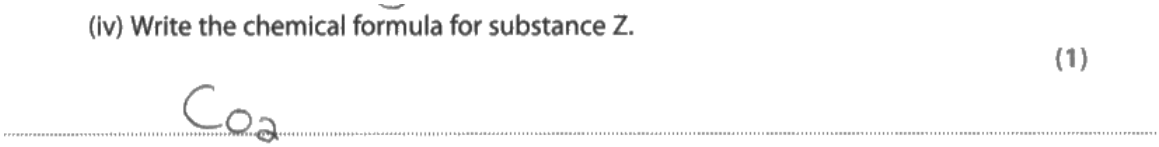
Learners still find writing chemical formula using the correct scientific conventions in question 4, part **(a) (iv).** Some learners were able to correctly represent the formula.



However, many learners wrote the formula using a superscript 2 rather than a subscript 2 so did not gain the mark.

Some learners lost marks as they did not use a capital letter for the oxygen, therefore representing cobalt rather than carbon and oxygen.





Question 4

Part (b) asked learners to describe the test for hydrogen gas.

(b) Hydrogen is an element.

Describe the test for hydrogen.

(2)

Test place a lighted Splint and the mouth of the test tube,

Result If you hear a Squeaky pop, that means hydrogen is present.

In some cases, learners were confused with the hydrogen test and the test for carbon dioxide test and so gained no marks.

(b) Hydrogen is an element.

Describe the test for hydrogen.

(2)

Test You blow into limewater through a straw

Result It would turn a milky colour.

Question 5

Many learners were able to give the pH of a neutral solution in question **5 (a)(i)**

5 (a) Sam adds sodium hydroxide solution to hydrochloric acid to form a neutral solution.

He then adds universal indicator solution.

(i) State the pH of the neutral solution.

(1)

pH 7

However, it was found that a significant proportion of learners did not show this understanding and gave values other than 7.

5 (a) Sam adds sodium hydroxide solution to hydrochloric acid to form a neutral solution.

He then adds universal indicator solution.

(i) State the pH of the neutral solution.

(1)

pH 4.

In question 5 part (a)(ii), most learners knew that the colour of universal indicator in a neutral solution would be green.

(ii) State the colour of the universal indicator in the neutral solution.

(1)

green

Other learners gave other colours that could be found on the scale for universal indicator but not in a neutral solution and so did not gain credit.

(ii) State the colour of the universal indicator in the neutral solution.

(1)

Orange / yellow

Many learners found question 5 **part (b)** quite difficult. Only the best learners were able to explain why the reaction is a neutralisation reaction. The better learners were able to state that the indigestion remedy is a base or gave the name of a specific base. They were then able to explain that the reaction of the stomach acid with the base produced salt and water.

(b) Indigestion is caused by excess stomach acid.

When indigestion remedies are taken, a neutralisation reaction takes place.

Explain why this is a neutralisation reaction.

(2)

Because the base from the remedy meets acid so it ~~xx~~ neutralises the acid and gets rid of the indigestion. Base + acid = salt + water

A significant number of learners stated that the indigestion is an alkali which was accepted. Although many then repeated the stem of the question and stated that is neutralizes acid or that it is a neutralisation reaction.

(b) Indigestion is caused by excess stomach acid.

When indigestion remedies are taken, a neutralisation reaction takes place.

Explain why this is a neutralisation reaction.

(2)

The indigestion remedies contain alkali substances which neutralises the acid in the stomach that causes indigestion which is called a neutralisation reaction.

The weaker learners did not read the question carefully and tried to use their common knowledge rather than their scientific knowledge to explain how indigestion might be caused rather than why it is a neutralisation reaction.

(b) Indigestion is caused by excess stomach acid.

When indigestion remedies are taken, a neutralisation reaction takes place.

Explain why this is a neutralisation reaction.

(2)

Say like you eat a lot of meat that produces fat + iron the stomach will then begin a reaction with the fat causing acid to build up over time until the fat is either destroyed or consumed by the stomach acid.

Question 5 **part (c),** proved very hard for learners with only the very best being able to complete the symbol equation for the reaction. The best learners could complete the equation to show the zinc sulfate and water.

(c) The reaction of zinc oxide with sulfuric acid is another neutralisation reaction.

Complete the symbol equation to show the products of this reaction.

(2)

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

Question 6

This question was well attempted by learners, many learners were able to explain that sodium was in group 1 because it has 1 electron in its outer shell, could give the numbers of protons and therefore electrons and then either drawn or state its electronic configuration. Fewer could give the period that sodium is in and link it to the fact that it has 3 shells of electrons. Some good responses were seen, this example gained the full 6 marks available.

6 The diagram shows some information about sodium.

This information can be used to determine its electronic configuration.

Explain the position of sodium in the periodic table, referring to its electronic configuration.

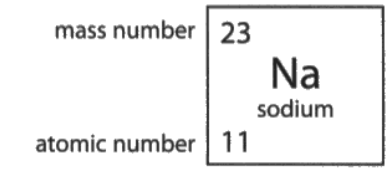
(6)

First of all Sodium has 11 protons which means it has 11 electrons, because the number of protons is the same number of electrons. After that we first drew electronic configuration, as you can see in the top diagram you can see that sodium has 3 ~~circles~~ shells of electronic configuration the reason it has three ~~circles~~ shells is that sodium is in the 3rd period/row of the periodic table. Now we are going to talk about how many electrons are on the last or 3rd shell, you can see that there is only one electron on the last shell which ~~that~~ means that sodium is on the 1st group of the ~~p~~ periodic table. Because the number of electrons on the last shell or 3rd shell determines which group it is going to be in.

In the following example, the learner has stated that sodium is in group 1 of the period table and has given the electronic configuration of the atom, to gain 2 marks. They have tried to explain why sodium is in group 1, but has not sufficiently explained that the outer shell has just one electron, to gain any further marks.

6 The diagram shows some information about sodium.

This information can be used to determine its electronic configuration.



2,8,1

Explain the position of sodium in the periodic table, referring to its electronic configuration.

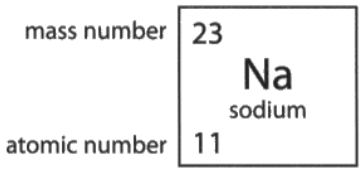
(6)

Sodium is in group one of the periodic table. Sodium has the electronic configuration of 2,8,1. It is in group one because every element in group one has 1 incomplete outer shell.

In this example, the learner has simply restated information from the stem of the question and therefore earned no credit.

6 The diagram shows some information about sodium.

This information can be used to determine its electronic configuration.



Explain the position of sodium in the periodic table, referring to its electronic configuration.

(6)

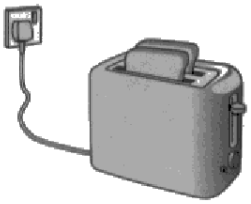
Sodium would be in the middle of the periodic table because it has a mass number of 23 and a atomic number of 11.

Question 7

Part (a) was well answered by many learners to name the type of energy used to power the toaster

SECTION C: Physics

7 The picture shows a toaster.



(a) Name the type of energy used to power the toaster.

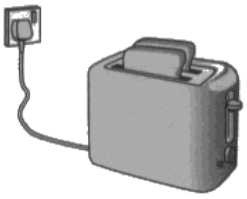
(1)

electrical energy

A common incorrect answer seen was 'electricity'

SECTION C: Physics

7 The picture shows a toaster.



(a) Name the type of energy used to power the toaster.

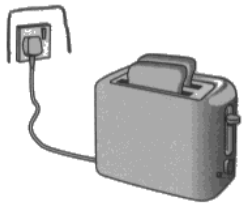
(1)

eg heat electricity

Some learners did not read the question carefully and stated that heat energy was used to power the toaster.

SECTION C: Physics

7 The picture shows a toaster.



(a) Name the type of energy used to power the toaster.

(1)

heat energy

In **part (b)**, the majority of learners were able to name the type of energy used to toast the bread as thermal or heat energy.

(b) Name the type of energy used to toast the bread.

(1)

Thermal.

(b) Name the type of energy used to toast the bread.

(1)

heat energy

Learners that could not name the type of energy used to toast the bread often gave other, irrelevant forms of energy.

(b) Name the type of energy used to toast the bread.

(1)

Kinetic energy

In **part (c),** most learners knew that sound or light energy were wasted by the toaster.

(c) Name **one** type of energy wasted by the toaster.

(1)

Sound energy.

(c) Name **one** type of energy wasted by the toaster.

(1)

light

Learners that did not interact with the question properly gave answers that were irrelevant.

(c) Name **one** type of energy wasted by the toaster.

(1)

carbon dioxide

Part (d) was well answered by the majority of learners with most scoring the mark.

(d) The toaster transfers 138 000 joules of energy in 60 seconds.

Calculate the power of the toaster.

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

Show your working.

(1)

$$\text{power} = \frac{138000}{60} =$$

Power = 2300 W

Learners that did not score the mark, tried to rearrange the equation and multiple the energy with the time rather than dividing it.

(d) The toaster transfers 138 000 joules of energy in 60 seconds.

Calculate the power of the toaster.

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

Show your working.

138,000 x 60 = 8280000 (1)

Power = 8280000 W

Question 8

Part (a)(i) was generally well answered, with most candidates being able to recall that it is the electromagnetic spectrum that contains radio waves and X-rays.

8 Radio waves and X-rays are two parts of a spectrum of waves.

(a) (i) Name this spectrum of waves. (1)

Electromagnetic spectrum

Learners that did not read the question carefully and re-stated either radio waves or X-rays.

8 Radio waves and X-rays are two parts of a spectrum of waves.

(a) (i) Name this spectrum of waves. (1)

radio wave

The majority of learners performed well in question 8 (a)(ii) and were able to give one other wave in the spectrum to gain the mark.

(ii) State **one** other wave in this spectrum.

Gamma

(ii) State **one** other wave in this spectrum.

Ultraviolet

Again, learners lost marks as they did not read the question and re-stated radio waves or X-rays from the stem of the question.

(ii) State **one** other wave in this spectrum.

(1)

Radio waves.

Question 8

In part (b) many learners were able to score at least one mark for showing an understanding that X-rays can cause mutation or damage to cells, many knew that excessive exposure to X-rays can cause cancer. Fewer could gain the second mark for showing an understanding that the X-rays cannot penetrate the lead screen. The following example gained two marks.

(b) Explain why some healthcare workers stand behind a screen made of lead when taking X-ray images.

(2)

1. X-ray emitts radition which can burn/mutate skin and skin cells. Lead is a material which X-ray cant penetrate through. This prevents Cancer and Much more.

The following example gained just the first mark for stating the harmful effect of X-rays.

(b) Explain why some healthcare workers stand behind a screen made of lead when taking X-ray images.

(2)

Because x-ray can damage the cells in a human ~~body~~ body. Also because ~~x-ray~~ ~~too~~ too much x-ray can cause cancer.

Where learners lost marks, it was generally because they described why healthcare workers take an X-ray rather than explaining why they stand behind the screen when doing so.

(b) Explain why some healthcare workers stand behind a screen made of lead when taking X-ray images.

(2)

Because the x-ray machine detects if there is anything wrong with you inside the body. They can see you as a skeleton. They use these at hospitals for when you broke your arm or leg to see if its actually broken.

Learners found question 8 **part (c)** quite difficult. Only the very best learners could calculate the wavelength of the radio wave and give their answer in standard form. This learner calculated the wavelength, showing their working and gave their answer in standard form, to gain the full 4 marks.

(c) The speed of radio waves is 3×10^8 m/s.

A radio wave has a frequency of 600 000 Hz.

Calculate the wavelength of this radio wave.

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

Give your answer in standard form.

Show your working.

3×10^8 m/s = 300000000 m/s.

radiowave = 600000 Hz.
frequency

speed of = 300000000 m/s
radiowaves.

$\frac{300000000 \text{ m/s}}{600000 \text{ Hz}} = 500$? (4)

5×10^2 m/s.

Wavelength = ... m

(Total for Question 8 = 8 marks)

A fair proportion of learners were able to calculate the wavelength of the radio wave to gain three marks, but lost the fourth mark as they were unable to give the answer in standard form.

(c) The speed of radio waves is 3×10^8 m/s. 300000000

A radio wave has a frequency of 600 000 Hz.

Calculate the wavelength of this radio wave.

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

Give your answer in standard form.

Show your working. $3 \times 10^8 = ? \times 600{,}000$ (4)

$\frac{300{,}000{,}000}{600{,}000} = 500$

Wave length = 500m.

Wavelength = 500 m

(Total for Question 8 = 8 marks)

Learners often lost marks as they did not rearrange the equation correctly and multiplied the values instead of dividing them. Whist the working was incorrect, a mark was still awarded in these cases if an understanding of standard form was shown by either giving the frequency to correct standard form, writing the speed of the radio wave in full or writing their answer in standard form.

(c) The speed of radio waves is 3×10^8 m/s.

A radio wave has a frequency of 600 000 Hz.

Calculate the wavelength of this radio wave.

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

Give your answer in standard form.

Show your working.

(4)

3×108

300000000×600000

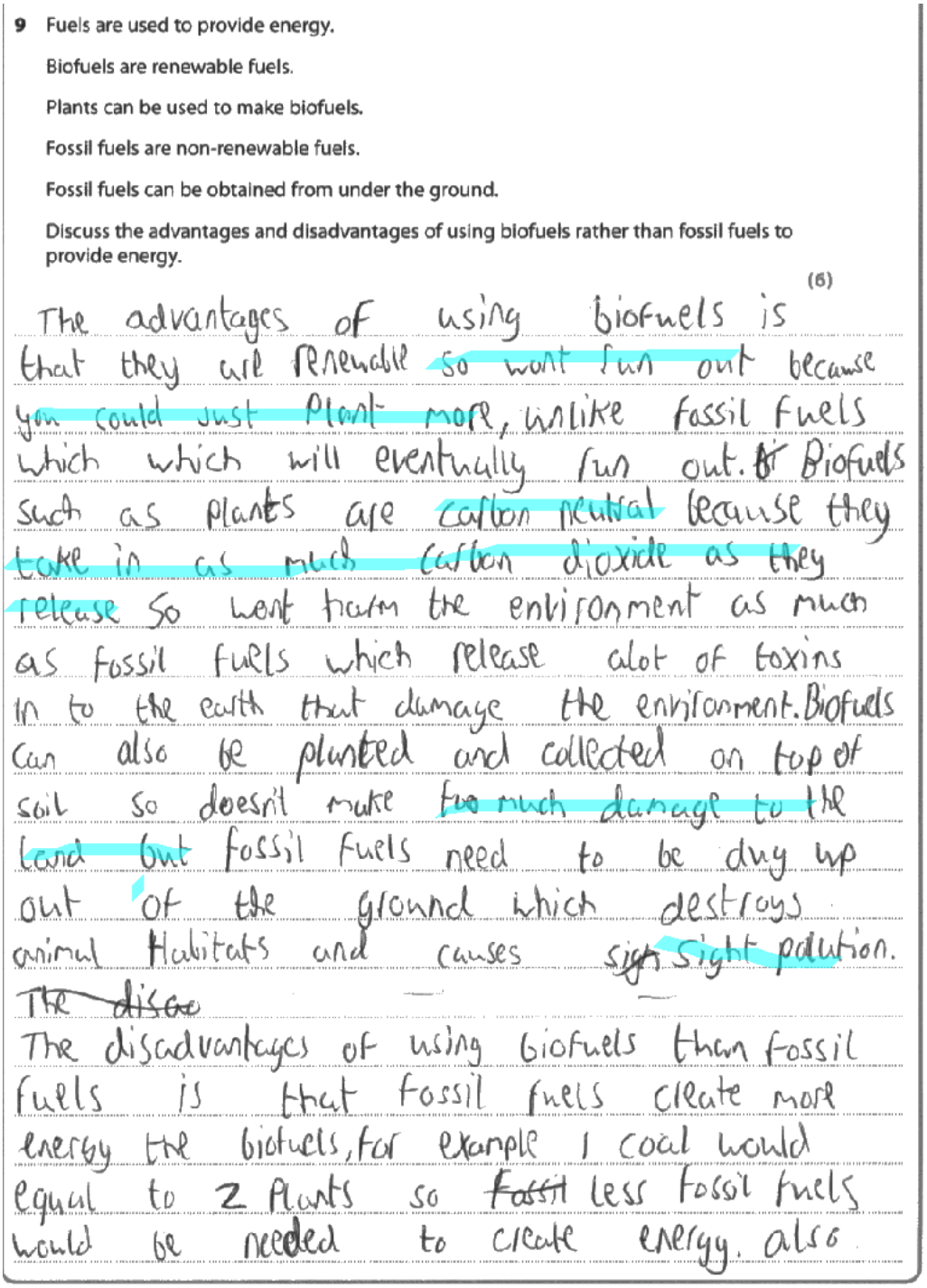
Wavelength = 1.8×10^{14} m

(Total for Question 8 = 8 marks)

Question 9

Learners found question 9 quite difficult. Only the best learners could discuss the advantages and disadvantages of using biofuels rather than fossil fuels to provide energy at a distinction level.

This example gained distinction level – 6 marks. The learner discusses why biofuels are renewable and why this is an advantage, they state that the biofuels are 'carbon neutral' and explains what this means.



9 Fuels are used to provide energy.

Biofuels are renewable fuels.

Plants can be used to make biofuels.

Fossil fuels are non-renewable fuels.

Fossil fuels can be obtained from under the ground.

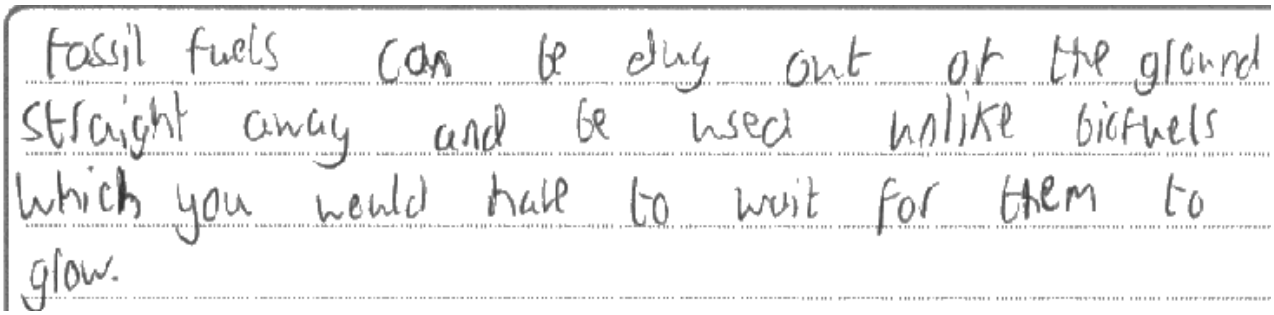
Discuss the advantages and disadvantages of using biofuels rather than fossil fuels to provide energy.

(6)

The advantages of using biofuels is that they are renewable so wont run out because you could just plant more, unlike fossil fuels which which will eventually run out. Biofuels such as plants are carbon neutral because they take in as much carbon dioxide as they release so wont harm the environment as much as fossil fuels which release alot of toxins in to the earth that damage the environment. Biofuels can also be planted and collected on top of soil so doesnt make too much damage to the land but fossil fuels need to be dug up out of the ground which destroys animal Habitats and causes sight sight pollution.

~~The disad~~

The disadvantages of using biofuels than fossil fuels is that fossil fuels create more energy the biofuels, for example 1 coal would equal to 2 plants so ~~fossil~~ less fossil fuels would be needed to create energy. also



In this next example, the learner has scored merit level - 4 marks. The learner has stated that biofuels are renewable and that they are made from plants, this was however ignored as it is in the stem of the question. They do however go on to state that you can keep planting the plants and so you can replace them easily which is worthy of credit, they go on to state that fossils fuels will run out which is another advantage of using biofuels and they give a disadvantage biofuels, that the plants will take up a lot of space, but do not explain either of these. If they had expanded either of the other points then distinction level could have been awarded.

Fossil fuels are non-renewable fuels.

Fossil fuels can be obtained from under the ground.

Discuss the advantages and disadvantages of using biofuels rather than fossil fuels to provide energy.

(6)

Bio fuels are renewable fuels. They are made from plants which is an renewable source, as you can keep planting plants, when you use them you can replace them easily.

Fossil fuels are non-renewable, they will run out eventually, an advantage of using fossil fuels is that they are underground and take up less space* as if we used biofuels (plants) we would have to have a lot of space to ~~keep it maintained~~ grow as well as being maintained

* and we can't see it

needed to be grow somewhere not so the weather could change, so biofuels would be a disadvantage for colder countries. There are many options of renewable energy sources including solar, wind, tidal, ~~energy~~ gravitational.

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