Examiners' Report/
Lead Examiner Feedback

June 2014

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 1: Principles in Science (20460E)

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June 2014
Publications Code BF038166

Introduction

This report has been written by the lead examiner for the BTEC Principles of Science unit. It is designed to help you understand how learners performed overall in the exam. For each question, there is a brief analysis of learner responses. You will also find example learner responses from Level 2 Pass and Distinction learners. We hope this will help you to prepare your learners for future examination series.

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

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

Provisional qualification outcomes for BTEC First Level 1/Level 2 Award.

The provisional qualification outcomes for the BTEC Level 2 awards can be found below.

2013 – 2014	D*	D	M	P	L1	U
Claims: 52,247	0.45	1.38	13.39	71.90	96.21	100.00

These outcomes reflect the cumulative percentage of learners who have received each grade for the qualification this year.

These figures are provisional because we are expecting more learners to claim their overall qualification outcome over the coming weeks. We will publish updated qualification outcomes in due course.

Outcomes explained
An aggregate qualification grade is where all unit outcomes are joined together to give a final grade for the qualification. Full details on how the qualification grade has been calculated can be found here (page 30):

http://www.edexcel.com/migrationdocuments/BTEC%20Firsts%20from%202012/BF029943-Specification-BTEC-Level-1-2-First-Award-Principles-of-Applied-Science.pdf

2013 – 2014	D*	D	M	P	L1	U
Claims: 82,247	1.56	5.31	22.62	65.25	96.21	100.00

Number of claims released by August 2014

Eg: proportion of learners claimed & grades released achieving a merit or above 2014

We will be publishing full year qualification outcomes for BTEC in the autumn.

Overall comments

This was the fourth time that this paper has been set.

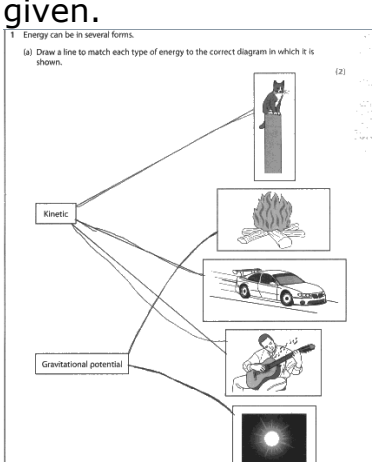
Learners that did well this series, did so because they had learnt key terms and used good scientific language. They were well prepared for the exam and could apply their knowledge of the science. Learners that did well could use, transform and evaluate equations to give correct answers. They were also able to apply the scientific concepts that they had been taught to new situations.

Calculations are, however, still an issue for many.There are still a significant number of candidates that write an answer without working, so working marks cannot be credited if necessary. The evidence shows that this session more learners came prepared for the exam, by bringing their calculators with them; however there seemed to be a lack of understanding of how to deal with numbers that use standard form.

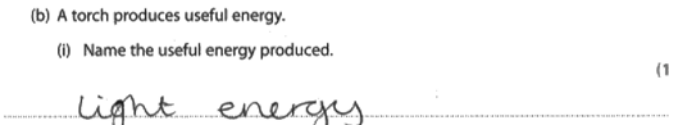
Exam technique is still an issue for some learners. Centres need to prepare learners for the exam. E.g. by practicing exam technique, especially in relation to reading the question carefully andteaching key questioning terms so that the learners understand what is required and can then apply their knowledge correctly. Learners should be taught that they should be checking that the question set has been addressed in the answer given and that they must use 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. One way this could be achieved would be to practice structuring extended writing questions as this is a skill that the learners are still not proficient in and with many still not attempting these questions.

Feedback on Specific Questions.

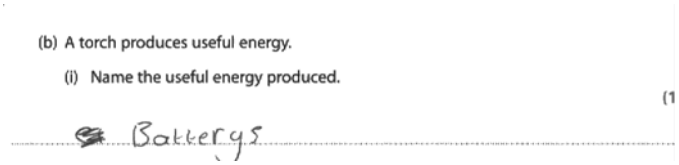
Q1a.
This question was generally well answered with many gaining full credit. However, many learners lost marks here as they drew more than one line from the box, so the correct answer was negated by the incorrect answer given.



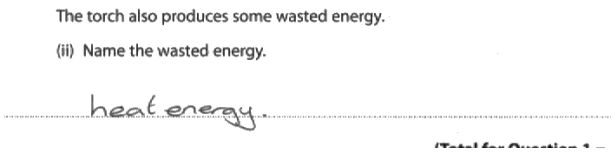
Q1bi.
The majority of learners were able to give the type of useful energy that a torch produced.



When candidates lost marks, it was because they read they misread the question. A common incorrect answer seen was 'batteries', where learners had thought that the question was asking where the energy had come from.



Q1bii.
Learners found this question more difficult. Although many showed the understanding that heat is a form of energy that was wasted by the torch, some stated that sound energy was wasted, which was an acceptable alternative.



Incorrect answers seemed to have some relation to the production of energy, but were not directly related to the question posed.

The torch also produces some wasted energy.

(ii) Name the wasted energy.

carbon dioxide

The torch also produces some wasted energy.

(ii) Name the wasted energy.

oil, gas & coal

Those learners that had been successfully taught the electromagnetic spectrum did very well on questions 2ai-2bii.

In part 2ai, some learners were able to correctly state the name of an electromagnetic wave that is used to sterilise medical equipment. Those that got this correct generally gave gamma as their answer, ultraviolet and microwave were seen less often.

2 The diagram shows part of the electromagnetic spectrum.

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	G

(a) (i) Name an electromagnetic wave that is used to sterilise medical equipment.

Gamma

A common incorrect answer seen was visible light, which gained no credit.

2 The diagram shows part of the electromagnetic spectrum.

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gar

(a) (i) Name an electromagnetic wave that is used to sterilise medical equipment.

Visible Light

In part 2aii the majority of learners were able to name infrared as the electromagnetic wave that is used in television remote controls. A common misconception was that radio waves are used for this purpose.

(ii) Name the electromagnetic wave that is used in television remote controls.

Infrared

In part 2bi , some learners knew that radio waves were the wave with the longest wavelength.

(b) (i) Name the electromagnetic wave that has the longest wavelength.

Radio waves

However, many had their magnetic spectrum the wrong way round in their head and stated that gamma rays had the longest wavelength.

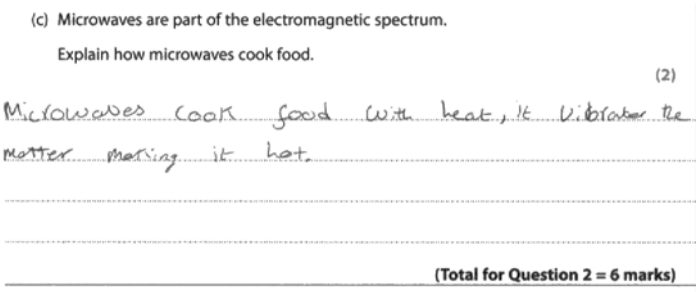
Q2bii Many learners knew that gamma rays have the highest frequency.

(b) (i) Name the electromagnetic wave that has the longest wavelength.

(ii) Name the electromagnetic wave that has the highest frequency.

Gamma rays

Q2c.
Many learners found this question very difficult and it was very poorly answered by the majority of learners. Although the fact that microwaves are part of the magnetic spectrum was given, learners ignored this and took the common usage of the word.
Good answers were rare, but were seen, here the idea that microwaves produce heat by causing molecules to vibrate is fine and the answer gained full credit.


(c) Microwaves are part of the electromagnetic spectrum.

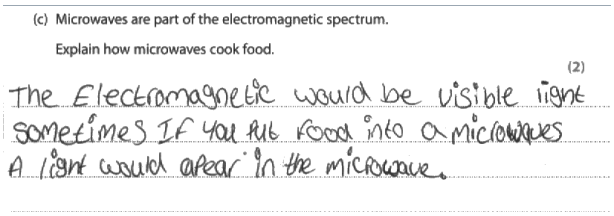
Explain how microwaves cook food.

(2)

Microwaves cook food with heat, it vibrates the matter making it hot.

(Total for Question 2 = 6 marks)

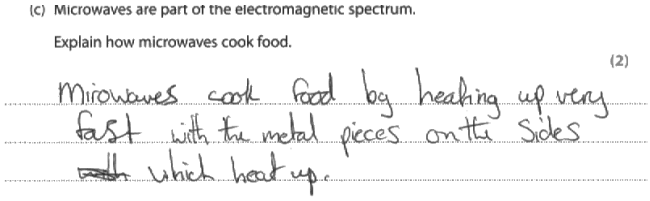
The majority of learners answered the question in terms of microwave oven and gave answers relating the microwave heating up or the glass table turning. Many made reference to the light inside the microwave giving off heat to cook the food, all of which were not creditworthy.


(c) Microwaves are part of the electromagnetic spectrum.

Explain how microwaves cook food.

(2)

The Electromagnetic would be visible light sometimes If you put food into a microwaves A light would apear in the microwave.

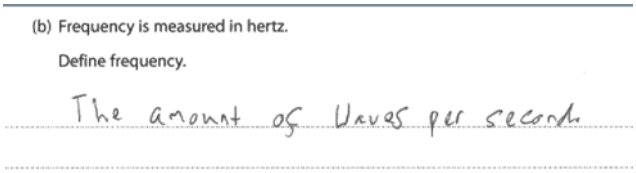

(c) Microwaves are part of the electromagnetic spectrum.

Explain how microwaves cook food.

(2)

Microwaves cook food by heating up very fast with the metal pieces on the sides which heat up.

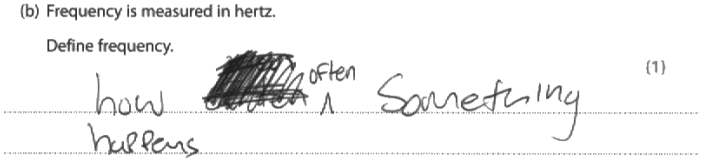
Q3b
In question 3b, there were a few good answers seen, that gave a concise definition of frequency, unfortunately these were rare.


(b) Frequency is measured in hertz.

Define frequency.

The amount of Waves per second.

Much more common, were answers that related to the generic use of the term frequency.

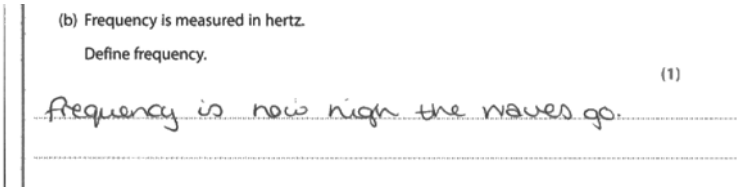

(b) Frequency is measured in hertz.

Define frequency.

how often something happens

(1)

Many candidates tried to refer back to the diagrams in the beginning of the question and defined the amplitude of wavelength instead of the frequency. Some just repeated the stem of the question and stated that it is measured in Hertz, which gained no credit.


(b) Frequency is measured in hertz.

Define frequency.

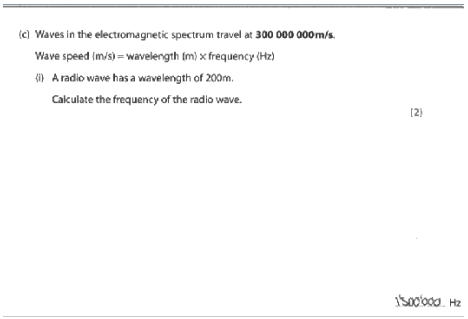
(1)

frequency is how high the waves go.

Centres should spend more time with their learners teaching them that answers should be specifically scientific and not generic and that information given in the stem of the question, will not gain credit.

Q3ci

In general, leaners coped well with this first calculation, with many scoring full marks. However many learners are still not showing their working, as below. In this case there is no problem as the answer is correct.


(c) Waves in the electromagnetic spectrum travel at **300 000 000m/s.**

Wave speed (m/s) = wavelength (m) x frequency (Hz)

(i) A radio wave has a wavelength of 200m.

Calculate the frequency of the radio wave.

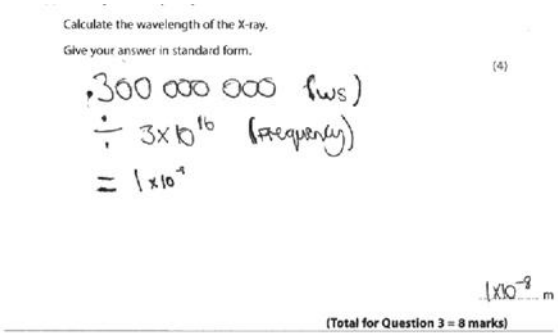
[2]

1500000 Hz

Q3cii

This second calculation was not as well answered as the former. Standard form was poorly understood and many learners appeared to give up and leave the page blank as they did not know how to deal with the question because of the refernce to standard form.

The correct answer, that scored the full four marks available, was seen, although not very often.


Calculate the wavelength of the X-ray.

Give your answer in standard form.

(4)

300 000 000 (ws)

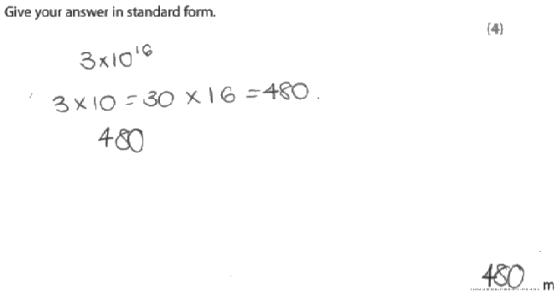
÷ 3×10^{16} (frequency)

= 1×10^{-8}

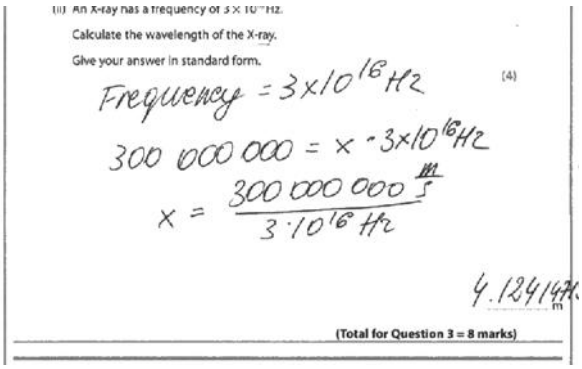
1×10^{-8} m

(Total for Question 3 = 8 marks)

A very common incorrect reponse was 480, this was brought about my the misconception that
3×10^{16} meant that the sum 3 x 10 x 16 had to be carried out and was evidence that the candidates had a poor understanding of how to use standard form

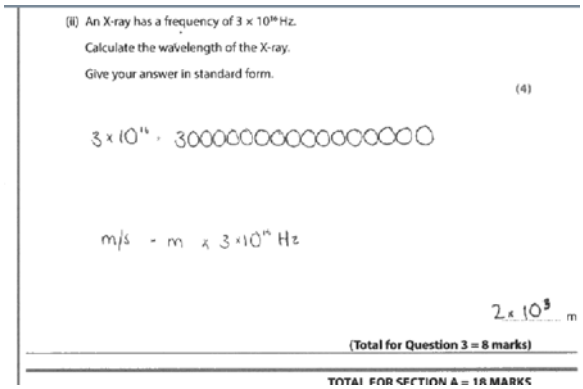


The next response is evidence as to why it is so important that learners are taught to show their working in calculation questions. Whilst the answer on the answer line is incorrect, the candidate had shown evidence of the correct identification of the wavelength, the correct transformation and substitution and so scored three marks out of the four marks available. If this working had not been present, then no marks would



have been scored.

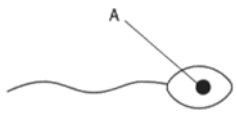
Again in this answer, whist the answer is incorrect, the learner has shown an appreciation of what standard form represents and gained one mark for correctly writing the full version of 3 x 10^{16} and so gains one mark from the working shown.



Q4a

This question was well answered by the majority, with most being able to identify the animal sex cell as a sperm cell.

4 The diagram shows an animal sex cell.

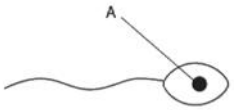


(a) (i) Name the animal sex cell.

Sperm

A common misconception seen, in those that did not score on this question, was that the cell was a tadpole.

4 The diagram shows an animal sex cell.



(a) (i) Name the animal sex cell.

[redacted] Tadpole (amphibian)

Q4aii

The majority of learners were also able to name the nucleus as the part of the sperm that had been labelled. The spelling of nucleus was often incorrect, however phonetic spellings were accepted.

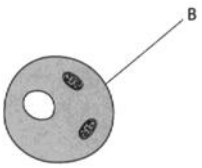
(ii) Name the part of the cell labelled A.

Nucleus

Q4bi

Again many learners were able to recognise the female sex cell as an egg cell.

The diagram shows a different animal sex cell.



(b) (i) Name the animal sex cell.

egg cell

Q4bii

Whilst Q4bi was very well answered Q4bii was not, with many not reading the question carefully. It was clear that many learners either did not understand the term function, or did not read the question carefully and tried to give a label for B, even though it had been stated in the question that label B was the cell membrane.

The most common answer was cell wall, where learners had tried, incorrectly, to give a label for B, rather than the function of the cell membrane at B.

(ii) State the function of the cell membrane labelled B.

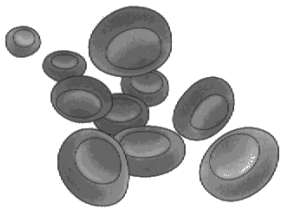
(1)

Cell wall

Q4ci

This was question was generally answered well with many candidates showing an understanding that the function of red blood cells was to carry oxygen around the body.

) The diagram shows some red blood cells.



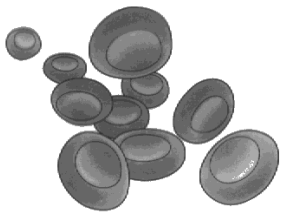
(i) Give the function of red blood cells.

(1)

The red blood cell carries oxygen around the body.

A common misconception shown was the red blood cells carried blood around the body, or helped to pump blood around the body. Some learners confused red blood cells with white bloods and stated that their function was to fight off infections/kill bacteria or to produce antibodies.

The diagram shows some red blood cells.



(i) Give the function of red blood cells.

(1)

red blood cells carry blood around the body

Q4cii

This part of the question was generally done well, with many giving a correct adaptation of the red blood that made it suitable for its function.

body

(ii) State how red blood cells are adapted to their function.

(1)

they have no nucleus and their shape is biconcave

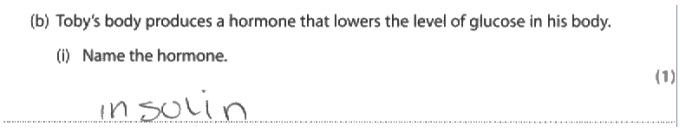
The most common correct answer is that the cells have no nucleus although many also stated that they have a large surface area. Although the question was only worth one mark, many learners' answers included many of the acceptable alternatives from the mark scheme.

Q5a

Question 5 parts ai and aii, was generally well answered. The majority of learners were able to correctly label the graph to show when Toby's blood glucose level was at its highest, they were also able to suggest what time Toby ate his breakfast.

Q5b

In the second section of question 5, many learners were able to recall insulin as the hormone that lowers the levels of glucose the body.

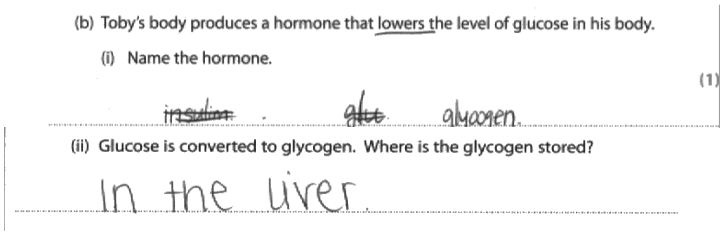

(b) Toby's body produces a hormone that lowers the level of glucose in his body.

(i) Name the hormone.

(1)

insolin

Some used information from the stem of the next question to incorrectly inform their answer.


(b) Toby's body produces a hormone that lowers the level of glucose in his body.

(i) Name the hormone.

(1)

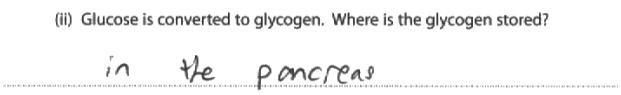
~~insulin~~ . ~~glu~~ glucagen.

(ii) Glucose is converted to glycogen. Where is the glycogen stored?

In the liver.

In part bii, less learners were able to state where glycogen is stored. Some learners were able to give the correct answer as liver.

The most common incorrect answer seen was that glycogen is stored in the pancreas which did not gain credit.

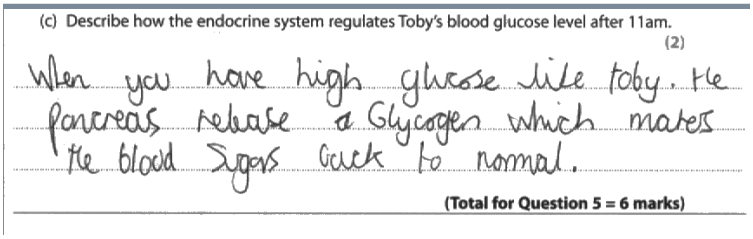

(ii) Glucose is converted to glycogen. Where is the glycogen stored?

in the pancreas

Q5c

The third section of question 5 was very poorly answered, with very few learners scoring any marks here and very few showing a good understanding of the endocrine system. If glycogen had been mentioned by the learner, it was often in an incorrect context for example 'glucose converts into glycogen' or 'glycogen lowers blood sugars'. Many learners misinterpreted the question and gave their answer in terms of the production of insulin and diabetes.

This learner has made a good attempt, however they have confused glycogen for glucagon so does not score.



(c) Describe how the endocrine system regulates Toby's blood glucose level after 11am.

(2)

When you have high glucose like toby, the pancreas release a Glycogen which makes the blood Sugars back to normal.

(Total for Question 5 = 6 marks)

Q6.

Many learners scored in this question, however very few gained more than one or two marks. The quality of answers were very varied and ranged from answers that showed detailed scientific knowledge to answers of single words with no explanation, which showed no scientific understanding. Some learners did not appear to understand the question and talked about people getting radiation poisoning and chemicals burning the skin.

Learners found the explaining of a beneficial effect, the most difficult, some learners talked about radiation being used to treat cancer, which was not accepted. Better responses included ideas about genetic changes in the peppered moth and giraffes which help their survival. A significant number of learners thought that a benefit would be that people would gain superhuman powers, give you strength or make you clever.

Marks awarded for the harmful effects were more common, with many learners understanding that a harmful effect of a mutation would be cancer, although this was not explained by many. Many learners gained a mark for stating that the genetic mutation could be passed down onto an organism's offspring. Some candidates were too generic with their answers and just stated that it might make a person disabled or deformed which was not specific enough to gain credit.

This is an example of a distinction level response. The beneficial effect receives credit for producing useful characteristics such as white fur, which helps the fox to suit the environment they live in which is equivalent to adapting to the environment. The harmful effects score credit for giving cystic fibrosis as a genetic mutation which was an acceptable answer and then stating that it can be passed down onto the offspring. Cancer is also stated but this is not linked to cells dividing and

Explain **one beneficial** effect and **two harmful** effects of genetic mutations.

Beneficial effect It can allow certain animals species to evolve and suit the environment they live in. For example it can cause foxes that live in the artic to have white fur so they adapt like their environment and works as a camoflauge. This happens to lot's of other species of animal that need to adapt to their environment. It can be very useful to have this specific for certain animals and organisms.

Harmful effect Genetic mutations can cause genetic diseases like Cystic Fibrosis, which makes people ill and live shorter lives than those without the mutation It is inherated by parents and passed down through generations and their is no cure for this. It causes a person to need daily therapy to be able to live their life normally and get rid of the excess mucus which this disease causes. It affects the airways, which produce excess mucus and it makes breathing difficult for them.

Harmful effect It can cause a faulty cancer gene. This can make people ~~dose~~ have an increased risk of developing cancer throughout their lifetime. This is passed on through families, but if a sibling did not carry the gene, their children couldn't either. The person with the gene is more likley to develop certain types of cancer and they have to be careful with this throughout their whole lives because they could develop cancer at any time.

the fact that it can be passed down onto the offspring has already been credited.

In this response, a beneficial effect (immunity to malaria) of a genetic mutation (sickle cell disease) has been given which is good for 2 marks. The candidate then goes on to give an incorrect harmful effect (cells to stop dividing) which causes cancer. Whilst the mutation part is incorrect credit was awarded for understanding that cancer is a harmful effect of a genetic mutation. The last harmful effect did not gain credit.

6 Genetic mutations can happen spontaneously or because of exposure to radiation or chemicals.

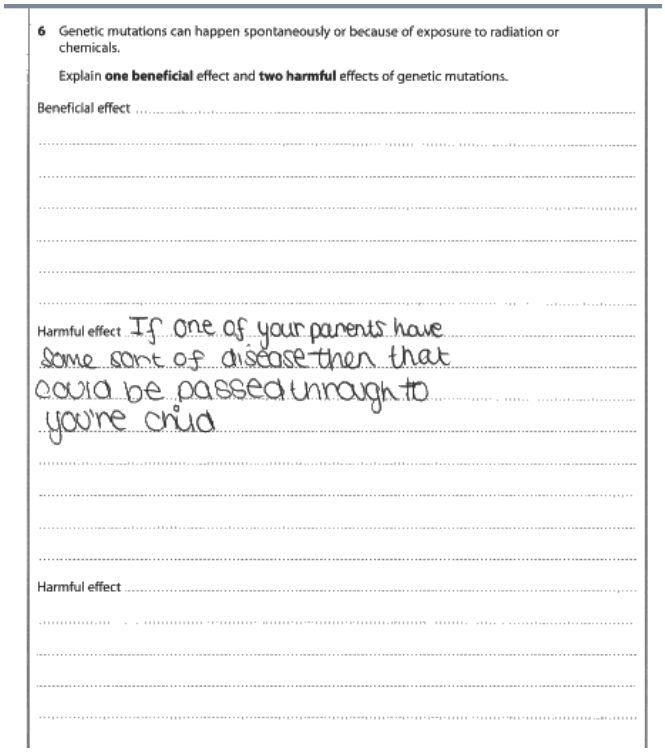
Explain **one beneficial** effect and **two harmful** effects of genetic mutations.

Beneficial effect It can give traits that are beneficial to the plant or animal in their environment for example the sickle cell trait makes the carrier of this gene imune to malaria.

Harmful effect It can cause the cell to stop dividing and never die, this deseas is known as cancer; cancer can lead to death.

Harmful effect ~~one~~ Instead of you gaining a good trait you could get a bad trait, this could be the cause of allergy's to nuts.

This response gains just one mark for passing down the disease to your child.



6 Genetic mutations can happen spontaneously or because of exposure to radiation or chemicals.

Explain **one beneficial** effect and **two harmful** effects of genetic mutations.

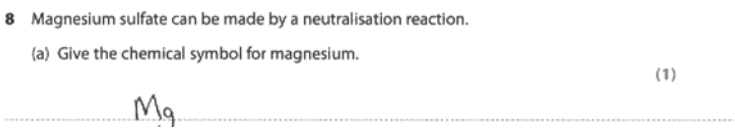
Beneficial effect

Harmful effect If one of your parents have some sort of disease then that could be passed unrough to you're child

Harmful effect

Q7
Questions 7ai to 7aiii and 7b were generally well answered by the majority of learners.

Q8
In question 8a, many learners were able to give the correct chemical symbols for magnesium.



8 Magnesium sulfate can be made by a neutralisation reaction.

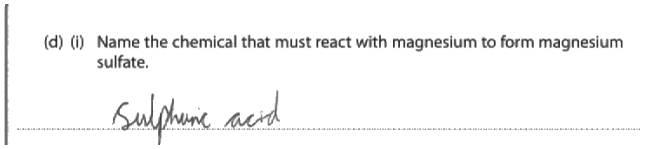
(a) Give the chemical symbol for magnesium.

(1)

Mg

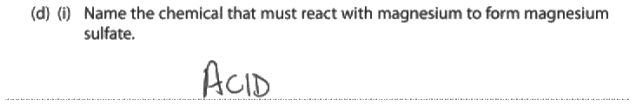
Question 8bi and 8bii were also well attempted by most, with learners being able to use the electronic structure given to work out how many electrons were in the atom and how many shells of electrons were present.
Part 8c was no so well answered with learners finding it difficult to name the chemical that must react with magnesium to form magnesium sulphate.

The correct answer shown here was rarely seen.


(d) (i) Name the chemical that must react with magnesium to form magnesium sulfate.

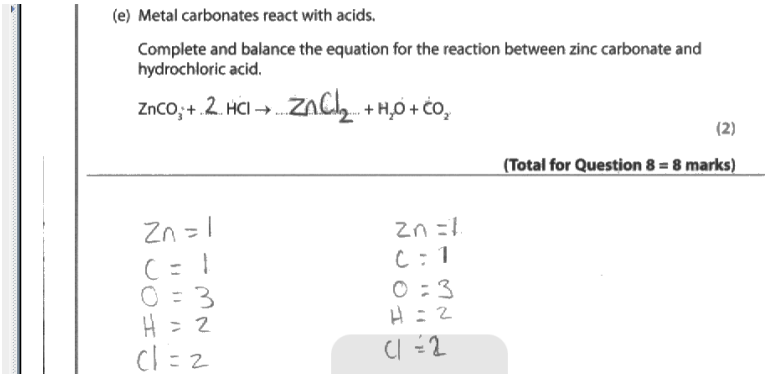
Sulphuric acid

Some learners just gave acid as their answer which was not specific enough to gain credit.


(d) (i) Name the chemical that must react with magnesium to form magnesium sulfate.

ACID

In part 8e, learners found it very difficult to complete and balance the equation given and only the best learners scored here.
This response showed that the learner had a good understanding of the chemistry and gained both marks.


(e) Metal carbonates react with acids.

Complete and balance the equation for the reaction between zinc carbonate and hydrochloric acid.

$ZnCO_3 + 2\ HCl \rightarrow ZnCl_2 + H_2O + CO_2$

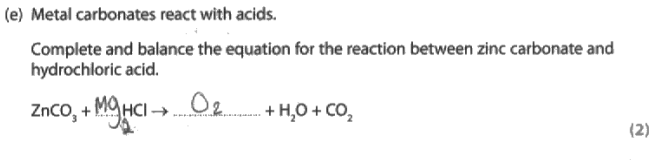
(2)

(Total for Question 8 = 8 marks)

Zn = 1
C = 1
O = 3
H = 2
Cl = 2

Zn = 1
C = 1
O = 3
H = 2
Cl = 2

This response was typical of many seen, where the answer given was irrelevant to the question and showed a real lack of understanding of the chemistry involved.


(e) Metal carbonates react with acids.

Complete and balance the equation for the reaction between zinc carbonate and hydrochloric acid.

$ZnCO_3 + MgHCl \rightarrow O_2 + H_2O + CO_2$

(2)

Q9.

Question 9 was the second of the two six mark questions. Marks were often lost here as the answers given were too vague. Many learners mentioned the pH scale but not how to measure the acidity. Those that did give a correct test did not differentiate between the two acids correctly. Many learners stated that limewater is cloudy rather than it goes cloudy when carbon dioxide is bubbled through it, some knew that if you blew through the limewater it would go cloudy which was an acceptable alternative.

Too many learners did not use any scientific knowledge and just wanted to mix the contents of the bottles to see how they reacted or identify them by appearance, smell or to see if they irritated the skin. It was clear that many learners were not familiar with limewater and thought that it was a food substance that would taste and smell of lime.

The following example gained credit into the distinction level marks band. For the limewater test, 'adding' carbon dioxide into the limewater is just about acceptable, it would have been nicer to see that it was bubbled through. The result of the test, that it will go cloudy was fine. The acid test is also given - to use universal indicator and the result is also fine, that it would go yellow or orange/red. When describing the test for the more concentrated acid, the learner has recognised that universal indicator could also be used to test for this. However the results of two acid tests are not well described as acid going yellow/orange/red to


You should describe the tests she could carry out and explain how the results would enable her to label the bottles correctly.

For the limewater bottle she could pour it into a container and then add carbon dioxide, when she adds the Co2 the lime water will go Cloudy. She can lable the bottle with lime water if it goes cloudy.

For the acid she could add universal indicator. So if the colour of the liquid turns a yellow or orange/red colour she will be able to lable the bottle acidic.

For the more acidic bottle she could use the same test but if the liquid turns a stronger red/orange colour she can lable the bottle more/very acidic.

(Total for Question 9 = 6 marks)

concentrated acid orange/red is only just sufficient. Therefore a mark of 5 rather than 6 was awarded.

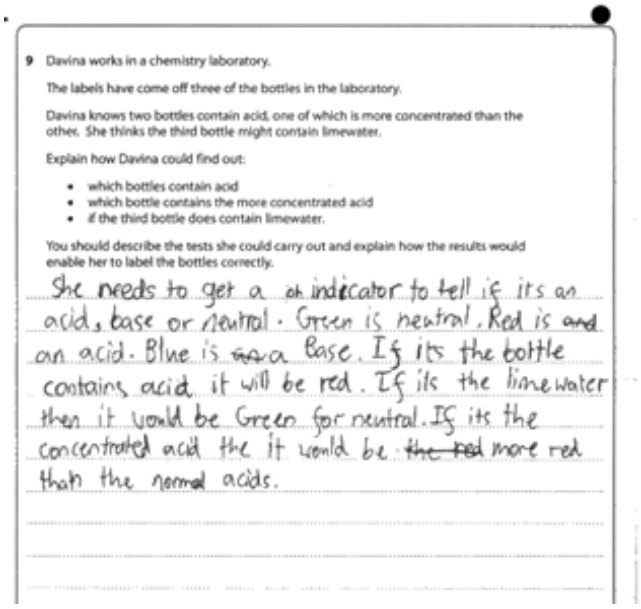
This response gained credit just into the merit level mark band. Whilst a significant amount of the answer was not creditworthy, about 2/3 down the learner does state that if you put magnesium in the acids you can see if it reacts with the acid by bubbling. They go on to say that it would react more with the more concentrated acid. They have therefore given one test with a comparison of results for both acids. Due to some incorrect science such as it reacting more rather than faster, a mark of 3 was given rather than 4.

- which bottle contains the more concentrated acid
- if the third bottle does contain limewater.

You should describe the tests she could carry out and explain how the results would enable her to label the bottles correctly.

to find out which acid is more concentrated she should put iodine/bromine in the acid, an the darker the colour/Red the more concentrated it is. to test for the limewater add a reactive metal and see if the water reacts over a bunsen burner* to test and see if the bottles contain a acid add a substance like magnesium and see wether or not it reacts by bo if it reacts more you also know that it is more concentrated.* the water should reacts by letting out a steam and should be bubbling cloudy.

This final response gained credit at pass level only. Using a pH indicator to see if it is acid and if it turns red it is an acid, was just sufficient for the acid test. The last comment, if it goes 'more red' was however insufficient for the concentrated acid test. Stating that the one that is neutral is limewater did not gain credit as this only tells us if it is neutral, it could be a whole host of other things. The question states that Davina thinks that the third bottle is limewater so therefore the only acceptable



9 Davina works in a chemistry laboratory.

The labels have come off three of the bottles in the laboratory.

Davina knows two bottles contain acid, one of which is more concentrated than the other. She thinks the third bottle might contain limewater.

Explain how Davina could find out:

- which bottles contain acid
- which bottle contains the more concentrated acid
- if the third bottle does contain limewater.

You should describe the tests she could carry out and explain how the results would enable her to label the bottles correctly.

She needs to get a ph indicator to tell if its an acid, base or neutral. Green is neutral. Red is ~~and~~ an acid. Blue is ~~a a~~ a Base. If its the bottle contains acid it will be red. If its the limewater then it would be Green for neutral. If its the concentrated acid the it would be ~~the red~~ more red than the normal acids.

test for lime water is to bubble carbon dioxide (or blow) through it.

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