



Examiners' Report/ Lead Examiner Feedback

March 2014

NQF BTEC Level 1/Level 2 Firsts in
Applied Science

Unit 1: Principles of Science (20460E)

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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

General comments

This was the third time that this paper has been set. Learners did appear to slightly better prepared for the paper than in the previous session with more learners attempting the calculation questions and attempting the long answer questions.

Candidates that did well this series, did so because they had learnt key terms and used good scientific language, they were able to use equations and evaluate them to give correct answers. They were also able to apply the scientific concepts that they had been taught to new situations. Numerical work appears to be improving, but there is still a significant number of candidates that write an answer without working or are without a calculator so that they cannot evaluate an answer.

It is apparent that centres are using previous papers to prepare candidates, which is good practice. However, in some cases, where similar assessment criteria to previous series were being tested some learners attempted to use ideas from earlier exams to answer the question without realizing that the question was about another aspect of the criteria for example in question 2c.

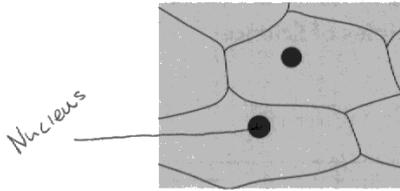
Exam technique is still an issue, centres need to prepare learners better for the exam by practicing exam technique, especially in relation to reading the question carefully and checking that the question set has been addressed in the answer given, using appropriate scientific knowledge and vocabulary. There is also the need for Centres to continue to focus on learners learning the key scientific knowledge in the specification. One way this could be achieved would be to practice structuring extended writing questions. This is a skill that the learners are still not proficient in with many not even attempting these questions.

Feedback on Specific Questions.

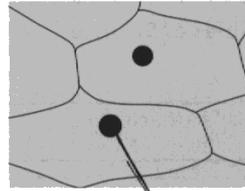
Q1a.

The majority of learners were able to correctly label a nucleus in the group of cells.

1 This is a diagram of a group of cells.



1 This is a diagram of a group of cells.



Q1b

Some candidates were able to correctly name the structure present in the nucleus that contained the DNA.

(ii) Name the structures in the nucleus that contain DNA.

However many Chromosomes learners let themselves down as they did not read the question fully or correctly. Many candidates read the questions as far as 'name the structures in the nucleus' and gave their answer as neutrons or neutrons and protons.

(ii) Name the structures in the nucleus that contain DNA.

Some learners neutrons read the question incorrectly and stated the function of the nucleus.

(ii) Name the structures in the nucleus that contain DNA.

It is important The nucleus controls everything that centres practice exam technique with their learners so that they do not lose marks by answering questions that they think are there rather than the actual question posed.

Q1c.

Learners found this question hard and only the best learners could give the name of a group of specialised cells that work together.

This example shows the show correct answer, which was rarely seen.

(b) Give the name of a group of specialised cells that are similar and work together to carry out a particular function.

(1)

Again in some cases learners did not read the question carefully and instead of giving a name of a group of specialised cells, gave the name of a specialised cell.

Tissues

(b) Give the name of a group of specialised cells that are similar and work together to carry out a particular function.

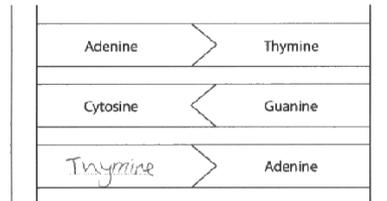
(1)

Red blood cells

Q1d

Most learners were able to give the missing base in the diagram.

- (c) DNA contains a sequence of base pairs.
A section of DNA is shown in the diagram.
Complete the diagram by filling in the missing base. (1)



Q2ai

Learners found it hard to name the central nervous system as the organ system that is made up of the brain and spinal cord.

- (a) (i) Name the organ system that is made up of the brain and the spinal cord. (1)

Central nervous system

Learners that abbreviated the central nervous system were given credit.

- (a) (i) Name the organ system that is made up of the brain and the spinal cord. (1)

CNS system

However many learners did not state that the organ system in the question is the central nervous system and so therefore did not score.

Although phonetic spellings of key terms were accepted, because this response omitted the 'central' it did not gain credit.

- (a) (i) Name the organ system that is made up of the brain and the spinal cord. (1)

Nervose system

Common incorrect answers usually involved naming organ systems such as the circulatory or cardiovascular system.

- (a) (i) Name the organ system that is made up of the brain and the spinal cord. (1)

cardiovascular system

Q2aii

Only the best learners were able to name the organ system that contains glands that release hormones.

- (ii) Name the organ system containing glands that release hormones. (1)

the endocrine system

Some candidates tried to reword the question to give the answer hormone or hormonal system which was not given credit. Centres should ensure that learners are aware that if their answer is simply a repeat of the stem of the question, then they will not gain credit.

(ii) Name the organ system containing glands that release hormones. (1)

hormone system

Many learners did not understand what was meant by the term system and instead of naming a system, simply named an organ such as the heart, brain or lungs.

(ii) Name the organ system containing glands that release hormones. (1)

Heart

Q2bi

Learners seemed to prefer this way of presenting the question, with many more attempting this than in previous sessions, however many got confused between q2bi and 2bii and then changing their mind at the last minute by putting double headed arrows between their answers, often incorrectly. Although the spelling of neuron in this example is not correct, credit was given, as it is clear that the learner does understand the required science here.

(b) The simple reflex arc is important in protecting the body from harm. Fill in the missing components of the reflex arc.

(i) Receptor → Sensory neurone → spinal cord (1)

Some learners wrote nerve alone which was insufficient to gain credit.

(b) The simple reflex arc is important in protecting the body from harm. Fill in the missing components of the reflex arc.

(i) Receptor → nerve → spinal cord (1)

Q2bii

It was pleasing to see some learners correctly identifying the motor neurone.

(ii) Spinal cord → motor neurone → effector

However, a common mistake was to confuse the motor neurone and the sensory neurone in 2bi and 2bii, therefore losing two marks.

(ii) Spinal cord → sensory neurone → effector

Q2c

Many Learners were able to state a reason that Julie's body temperature was the same, however, they were unable to follow this up with an explanation. For example, many scored the sweating mark, but failed to go on to explain the heat loss through evaporation. Very few learners were able identify vasodilation as a reason that the body temperature remains the same. Learners that did try to give an answer centred on vasodilation, often lost marks as they referred to the 'blood vessels rising to the surface of the skin', which is not worthy of credit.

Many learners attempted to answer the question on the basis of a response used in a previous examination, this related to hairs lying flat.

the same.

Explain **one** reason why Julie's body temperature stays the same. (2)

~~Her~~ body Her body carries out certain things to make sure your body temperature stays constant. The hairs on her body lying flat because this is a way of letting the heat in your body exit the body.

(Total for Question 2 = 6 marks)

Her blood vessels may also be widening, which is increasing her blood flow which lets out most heat that is in our body.

A common misconception seen, was that Julie's body temperature would only increase if she was ill as her body tries to fight off infection and so therefore the radiator would have no effect on Julies body. It was obvious that these learners had not been taught the concept of Homeostasis.



(c) Julie is sitting in a hot room and her skin goes red. Her body temperature stays the same.

Explain **one** reason why Julie's body temperature stays the same. (2)

Because her body temperature will only rise if there's something wrong on the inside e.g. a cold or ~~an~~ an illness. AS the radiator is outside her body her body temperature cannot increase.

(Total for Question 2 = 6 marks)

This response scored one mark only as it has stated that sweat is released by it has not gone on to explain the science of the sweating, i.e. the body uses the heat to evaporate the sweat, which cools Julie down.



(c) Julie is sitting in a hot room and her skin goes red. Her body temperature stays the same.

Explain **one** reason why Julie's body temperature stays the same. (2)

Julie's body temperature stays the same because the body releases sweat when you are hot so the sweat cools you down.

(Total for Question 2 = 6 marks)

Many learners also gave the correct definition of homeostasis which, whilst was perfectly correct, did not answer the question posed and so did not gain credit.

Q3a

Punnett squares appear to be understood by many learners. It was pleasing to see that the majority of learners were able to correctly complete the punnet square to show the alleles the children would have.

(a) Complete the Punnett square to show the alleles their children may have.

(2)

		Woman	
		B	b
Man	B	BB	Bb
	b	Bb	bb

Q3c

Learners found question 3c much more difficult. The majority of learners completed the punnet square however many made the mistake of repeating Tt for both sets of gametes and hence lost a mark.

The cat breeder thinks that cat 3 is heterozygous for a long tail.
Show how breeding cat 3 with a short-tailed cat can determine this.
You should use the Punnett square to help you.
T is the allele for long tails.
t is the allele for short tails.

(4)

		T	t
		T	Tt
	t	tT	tt

Because ~~half~~ the genes of the offspring will be 50% cat 3 and 50% of another cat breeding a long tailed cat and a short tailed cat will only be determined by how dominant the alleles are.

(Total for Question 3 = 8 marks)

Whilst one mark was lost here for these learners, the error was however carried forward and so learners that were able to complete the punnet square correct for their gametes were awarded credit. From this point forward however, marks were very rarely seen as learners found it very difficult to draw correct conclusions from the results of their punnet square.

In this response the learner was able to complete the punnet square correctly but was then not able to interpret this any further to draw conclusions on the percentage of offspring that would have short tails.

The cat breeder thinks that cat 3 is heterozygous for a long tail.
Show how breeding cat 3 with a short-tailed cat can determine this.
You should use the Punnett square to help you.
T is the allele for long tails.
t is the allele for short tails.

(4)

		T	t
		t	Tt
	t	Tt	tt

(Total for Question 3 = 8 marks)

TOTAL FOR SECTION A = 18 MARKS

Q4b

Learners found this question hard and correct answers that scored both marks, as seen here, were rarely seen.

(b) Name the **two** elements in hydrochloric acid. (2)

(i) Chlorine

(ii) hydrogen

A very common error was to state that one element present was chloride instead of chlorine.

(b) Name the **two** elements in hydrochloric acid. (2)

(i) hydrogen

(ii) chloride

Many learners tried to use their common sense to answer the question rather than their scientific knowledge.

(b) Name the **two** elements in hydrochloric acid. (2)

(i) acid

(ii) water

Q4di and 4dii

This was another pair of questions where it was rare to see a correct answer such as the examples below.

(ii) Give the formula for sodium chloride. (1)

NaCl

(Total for Question 4 = 6 marks)

(i) Give the formula for hydrochloric acid. (1)

HCl

It was clear that clear some learners had not been taught some key scientific vocabulary, as a very common error was for learners to try to write a word equation rather than the formula of hydrochloric acid and sodium chloride.

(i) Give the formula for hydrochloric acid. (1)

(ii) Give the formula for sodium chloride. (1)

sodium + chlorine → sodium chloride

Q5ai and 5aii

In this question learners were asked to give the chemical symbols of calcium and nitrogen and in general they were able to do this competently. In some cases learners did take a guess and give the first letter of the name for calcium, or in the case of nitrogen, the first two letters.

(a) (i) Give the chemical symbol for calcium.	(1)
..... (a) (i) Give the chemical symbol for calcium.	(1)
..... C	
(ii) Give the chemical symbol for nitrogen.	(1)
..... N	
..... Ni	(1)

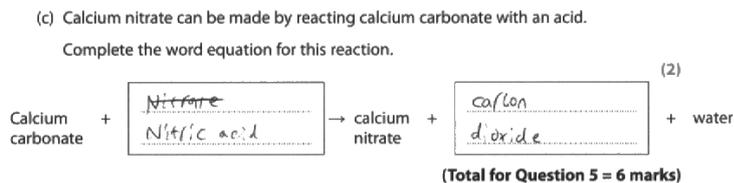
Some learners were let down in this question as they did not understand the term chemical symbols and gave hazard symbols instead.

	
It provides plants with calcium and nitrogen to keep them healthy.	
(a) (i) Give the chemical symbol for calcium.	(1)
..... 	
(ii) Give the chemical symbol for nitrogen.	(1)
..... X	

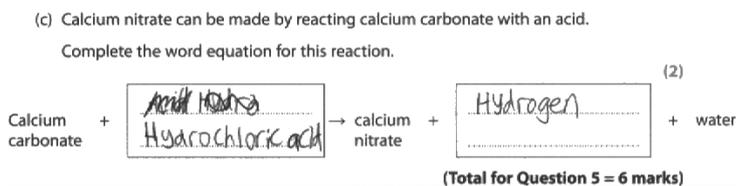
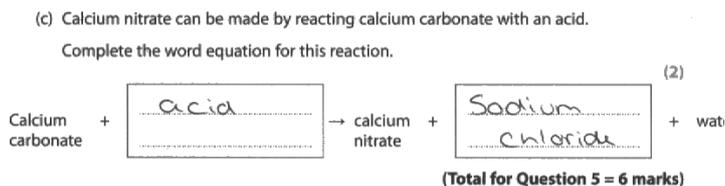
It is important that centres teach learners the correct scientific terms so that they are able to access the questions posed.

5c

Learners found completing the word equation in question 5c very difficult, with very few being able to identify the correct acid required to produce a nitrate as well as being able to give the correct gas produced as seen below.



The majority of learners went for the only acid they knew and wrote hydrochloric acid and many simply stated 'acid' in the missing product box. Another common misconception was that hydrogen was the gas produced in the reaction.



6

Most learners attempted this question and those that gained marks for this question, were able to state that calcium oxide should be added to one sample of soil and calcium carbonate to the other sample

Many learners were aware that there would be a need to test the pH of the soils, however very few were able to give a way in which this could be done, for example with universal indicator or using a pH probe. Some learners stated that litmus paper could be used to test the pH. This did not gain credit as litmus would not test the pH but simply if the soil was acidic or alkaline. Learners were also confused with the pH scale, stating that the best chemical being the one that gives the lowest pH.

The majority of learners were able to give a good description of what variables they should control. Many did not remember to include that the only variable that they would change would be the type of chemical that was used.

Many learners let themselves down as they did not give a detailed account

of how Tamoor would know which chemical was most effective.

A common misconception was that learners thought that repeating the test would make it more valid. Learners are still using the term fair test with no further clarification which gained no credit.

This response scored 4 marks, the learner states that the soil and water should be mixed and shaken and that calcium oxide should be added to one sample and calcium carbonate to the other sample. Whilst there is some idea that the pH should be measured, there is no mention of how this could be done. The learner gives a complete list of variables that should be controlled, same amount of soil, same amount of water, same amount of chemical, shaking at same rate/time which was an acceptable alternative for 'keep all variables the same'. Whilst they have stated in the method that they would use two different chemicals, they have not stated that this is the only variable that is changed. The learner states that the soil solution that is closest to neutral is the most effective.

- a description of a method that Tamoor could use
- how he would make the test valid
- how he would know which chemical is the most effective.

First take two equal amounts of soil, then measure the water making sure the water levels are both equal. Place soil into each pot of water at the same time, take a stop watch and shake them both at the same time at the same rate also. Measure the pH of the soil solution during the same time after that get out your pH indicator with all the colours on it, your aim is to get it neutral for this you will need to put calcium oxide in one pot of water with the soil in and in the other put calcium carbonate in the other making sure they measure the same. Then put the pH in at the same time take them out at the same time and measure them on a pH scale the one with all the colours on your aim is to get it to go neutral which is the green part on the scale which ever one is the nearest or on green is the most effective.

(Total for Question 6 = 6 marks)

TOTAL FOR SECTION B = 18 MARKS

This response gained 3 marks. The learner states that the calcium oxide and calcium carbonate should be added to separate samples of soil and water. They state that they need to look on the pH scale to see which is most acidic however this is insufficient as they do not state how the pH would be measured. The learner gives a few variables that would be controlled. They also state that they are trying to see which is the most acidic but this is insufficient as a conclusion, as they do not state which would be best (most acidic would not be best)

oxide or calcium carbonate could be used.

How can Tamoor test which chemical would be the most effective to use on his soil?

You **must** include in your answer:

- a description of a method that Tamoor could use
- how he would make the test valid
- how he would know which chemical is the most effective.

Tamoor could get some calcium oxide and some calcium carbonate and get some of his ^{soil} ~~soil~~ then put soil with calcium oxide in water and some soil with calcium carbonate in water and look on the pH scale which one is more acidic and which one is it to make his test valid he would measure out the same amount of soil the same amount of calcium oxide and calcium carbonate to make the test valid Tamoor ~~crashes~~ ~~the soil and shake it in water this could test~~ chemicals of the

This response gains just one mark for adding calcium oxide to one and calcium carbonate to the other. There is no mention of any variables that should be kept the same or which would be the only variable to change. Whilst this learner does state that they will know which chemical is most effective by the outcome of the plant, will they die or not, because they have not stated what the desired outcome e.g the one that lasts the longest is the most effective, then no marks were awarded.

He then measured the pH of the soil solution.
 He found his soil was too acidic for his plants.
 He researched how to lower the acidity of the soil and found that either calcium oxide or calcium carbonate could be used.
 How can Tamoor test which chemical would be the most effective to use on his soil?
 You **must** include in your answer:

- a description of a method that Tamoor could use
- how he would make the test valid
- how he would know which chemical is the most effective.

Tamoor should test this by planting the plants in the soil. He should have to separate plants. To one he will add calcium oxide and to the other one he should use calcium carbonate. He should then leave both the plants for a while and see which one dies or if the best for the plant. He should repeat this 3 times so that his results are reliable and valid. He will know which chemical is more effective by the outcome of the plants. Will they be alive or will they be dead, mainly the difference between them.

(Total for Question 6 = 6 marks)

8b

This was a poorly answered question which was often left blank. Some learners put oxygen and some put hydrogen but rarely both. Incorrect gases cited were carbon dioxide, which was quite common and nitrogen. Methane and natural gas were sometimes seen, but some just cited gas, which did not score.

- (b) Electricity can be produced from fuel cells. Give the names of the **two** gases used to produce electricity in fuel cells. (2)
- (i) hydrogen
- (ii) oxygen

- (b) Electricity can be produced from fuel cells. Give the names of the **two** gases used to produce electricity in fuel cells. (2)
- (i) Methane
- (ii) ~~CO₂~~ oxygen oxygen

This was another instance where learners had not read the question carefully and simply gave raw materials used to produce electricity or alternative forms of energy such as nuclear or solar or types of energy such as light, heat or electrical.

(b) Electricity can be produced from fuel cells. Give the names of the **two** gases used to produce electricity in fuel cells. (2)

- (i) Fossil fuels
 (ii) Coal

(b) Electricity can be produced from fuel cells. Give the names of the **two** gases used to produce electricity in fuel cells. (2)

- (i) light
 (ii) solar

8ci

A significant number of learners gained the full two marks for this calculation.

(i) Calculate how much energy the torch uses.

$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (seconds)}} \quad (2)$$

$$e = t \times p$$

$$e = 30 \times 2$$

$$e = 60$$

60

However, when learners lost marks, it was because they had carried out the correct calculation $30 \times 2 = 60$ but then went on to give further incorrect working. Centres should ensure that they emphasize to learners that they should always include their working in their answer. The response below scored 1 mark, however if the working had not been present no marks would have been scored.

(i) Calculate how much energy the torch uses.

$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (seconds)}} \quad (2)$$

$$2 \times 30 = 60 \div 100 = 0.6$$

0.6

It was apparent that some learners lost marks as they did not know how to rearrange the equation and so therefore wrote down the two possibilities. This response score no marks.

(i) Calculate how much energy the torch uses.

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

$$30 \times 2 = 60 \quad 30 \div 60 = 0.5 \quad (2)$$

0.5

8cii

Learners found the second of the two calculations more difficult. Some learners were able to give an answer correct to the power of ten to gain one mark. As in 8ci some learners worked out the correct answer as 22.5 but they went on to do further incorrect working which lost them a mark, some of which showed this working and some of which didn't. Again those learners that had shown their working would have at least scored one mark.

$$\text{efficiency} = \frac{\text{useful energy}}{\text{total energy}} \times 100\%$$

(2)

$$5 = \frac{x}{450} \times 100$$

$$450 \times 5 = 2250 \div 100 = 22.5$$

$$\frac{22.5}{450} = 0.05 \times 100 = 5$$

22.5

(Total for Question 8 = 8 marks)

9.

Learners found this question difficult. In the main this was because they did not use the stem of the question to help form their answer. Learners seemed to read that advantages and disadvantages were needed and tried to give them but often neglected to give the specific examples of either the waves or the devices that use them. Many learners just recited the whole of the electromagnetic spectrum but did not relate it to any use or advantage or disadvantages of the use or the wave.

This response scored no marks. Many learners lost marks as they gave their answer in very generic terms. The question asks for specific examples and the advantages and disadvantages of each. This response gives no specific examples and does not state which waves in the electromagnetic spectrum they were giving the advantages and disadvantages for so therefore no credit could be given.

9 Waves from the electromagnetic spectrum are used in many **wireless** communications.

Giving specific examples, discuss the advantages and disadvantages of using different types of electromagnetic waves for communication.

Some waves from the electromagnetic spectrum are used in many wireless communications. One disadvantage of these waves is if exposed directly, for long periods of time they can damage some cells in the body. One advantage of waves from the electromagnetic spectrum being used in many wireless communication is they are more likely to get less interference than waves not from the electromagnetic spectrum.

This is a level 1 answer. In this response, the learner has given an example of radio waves used in mobile phones. The learner has then given an advantage (can use virtually anywhere) although it is poorly explained. They have tried to give a second advantage by saying radio waves are not extremely harmful but they have contradicted

9 Waves from the electromagnetic spectrum are used in many **wireless** communications.

Giving specific examples, discuss the advantages and disadvantages of using different types of electromagnetic waves for communication.

An example of a wireless communicator would be a mobile phone. An advantage to using a mobile phone would be you can use virtually anywhere to talk to people, however a disadvantage would be the radio waves given off. Radio waves are not extremely harmful to the body but do have some effects, for example killing cells.

This example was given a mark in the lower merit band. The learner has given two devices and related them to the relevant waves in the electromagnetic spectrum. However whilst they have tried to give an advantage for each neither of the advantages given are fully developed so therefore the lower mark in the merit band was awarded.

9 Waves from the electromagnetic spectrum are used in many **wireless** communications.

Giving specific examples, discuss the advantages and disadvantages of using different types of electromagnetic waves for communication.

Waves from the electromagnetic spectrum are used in wireless communication such as radio waves which are used in mobile phones, this is an advantage as people can easily and quickly communicate with others. Another advantage is gamma rays which are used in cancer treatment, and also infrared wave which is used in things such as TV remotes as it makes it easy for people to change the channel. Although a huge disadvantage from the electromagnetic spectrum is ultra violet waves as that can cause harm to your skin which can later on result to diseases such as skin cancer which is likely to cause long term damage.

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