



Examiners' Report/ Lead Examiner Feedback

November 2016

NQF BTEC Level 1/Level 2 Firsts in
Applied Science

Unit 1: Principles of Science (20460E)

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General comments.

Students that did well this series, knew the meanings of key terms and could apply them to their answers to questions posed. They used good scientific language and were able to understand what was being asked for in the question and therefore apply their knowledge of the science well. The best students were able to apply scientific knowledge to new situations, write chemical formula and complete symbol equations.

As in previous series, exam technique is still an issue for the weaker students; Centre's need to fully prepare Students for the exam by practicing exam technique, especially in relation to reading the question carefully and not repeating the stem of the question, also re-reading the question with the answer they have given to check that they have answered the question set.

Feedback on specific questions.

Q1(a) (i) - In general students were able to answer this question well, with many knowing that either water or sodium hydroxide was a compound.

1 (a) Sodium is an element.

Sodium reacts with water to produce sodium hydroxide and hydrogen gas.

The word equation for the reaction is



(i) State the name of a **compound** in this reaction.

(1)

Sodium hydroxide.....

Students who got this wrong generally did so as they thought that sodium was a compound.

1 (a) Sodium is an element.

Sodium reacts with water to produce sodium hydroxide and hydrogen gas.

The word equation for the reaction is



(i) State the name of a **compound** in this reaction.

(1)

~~Sodium~~ Sodium.....

Q1 (a) (ii) - The majority of students were able to recall that the metals were found on the left hand side of the periodic table. In some cases, Students gave the number of a group that contained metals which was acceptable.

(ii) Sodium is a metal.

State where metals are found on the periodic table.

(1)

Left side of periodic table

In some cases, it seems that students have been revising from a coloured periodic table and stated that the metals were found 'in the blue section'. Unfortunately, this and any other coloured sections referred to did not gain any marks as it is not clear where on the periodic table the student was referring to.

(ii) Sodium is a metal.

State where metals are found on the periodic table.

(1)

Blue section

Q1 (a)(iii). Many Students were able to correctly recall and write the chemical symbol of sodium.

The students that did not know appeared to guess. A very common incorrect answer was 'So'.

(iii) (iii) Give the chemical symbol for sodium.

(1)

Na

In Q2(a)(i) and Q2(a)(ii) It was pleasing to see that most students knew the symbol that should be present on a container of a corrosive substance and that they knew a pH of 1 would be a strong acid.

In Q2(b) (i) few students were able to explain why farmers spread substances such as calcium carbonate on their fields by relating it to the presence of acidic soil and the need to neutralize this soil to score full marks.

(b) Calcium carbonate reacts with sulfuric acid to form calcium sulfate, carbon dioxide and water.

(i) Explain why some farmers spread calcium carbonate on their fields.

(2)

Farmers spread calcium carbonate on their fields as it neutralises the acidic soil allowing crops to grow.

In some cases, students did not use subject specific knowledge and tried to use their common knowledge stating that the calcium carbonate was added to help plant growth which was insufficient for credit.

(b) Calcium carbonate reacts with sulfuric acid to form calcium sulfate, carbon dioxide and water.

(i) Explain why some farmers spread calcium carbonate on their fields.

(2)

Farmers spread calcium carbonate on their fields as the calcium carbonate is used to make some crops grow.

Some students thought that the calcium carbonate stopped animals, birds or insects eating the crops. While others said it destroyed bacteria in the soil. Others said that this reaction supplied carbon dioxide and water for the crops to photosynthesize.

(b) Calcium carbonate reacts with sulfuric acid to form calcium sulfate, carbon dioxide and water.

(i) Explain why some farmers spread calcium carbonate on their fields.

(2)

to stop animals or bugs eating the crops

Q2 (b) (ii) Students still find writing symbol equations difficult, it was found that more than in previous sessions were able to complete the equation for the reaction

(ii) Complete the equation for the reaction between calcium carbonate and sulfuric acid. (2)



Students that lost marks on this question did so because they wrote the word equation or did not follow the correct scientific conventions for writing formulae.

(ii) Complete the equation for the reaction between calcium carbonate and sulfuric acid. (2)



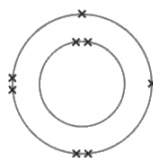
(ii) Complete the equation for the reaction between calcium carbonate and sulfuric acid. (2)



Q3 (a)(i) a good proportion of students were able to recall the charge on the neutron and mass of a proton. Many students were able to relate the number of electrons on the outer shell of oxygen to the group in which it is found for part b, in some cases Students knew oxygen was in group 6 but failed to give a reason why and so did not score the second mark.

When students did not gain marks, it was often as they thought oxygen was in group 8 as it has 8 electrons or group 2 as it has 2 shells.

(b) The diagram shows the electronic configuration of an atom of oxygen.

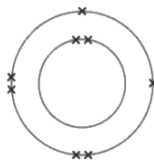


Explain what group of the periodic table oxygen is in. (2)

Oxygen is Oxygen is in group six in the periodic table.

Some students did not give a group number at all and just said it was on the non-metal side of the Periodic Table or it was in the gases group because it is a gas.

(b) The diagram shows the electronic configuration of an atom of oxygen.



Explain what group of the periodic table oxygen is in.

(2)

Oxygen is in the gases group, because well its a gas.

Q3 (b) few students were able to gain all 4 marks for giving a concise answer and being able to explain a similarity and a difference between the two isotopes.

(c) Nitrogen has two natural isotopes.

The symbols for the two isotopes are shown.



Explain a similarity and a difference between the structures of the two nitrogen isotopes.

(4)

the two Nitrogen isotopes have the same atomic number of 7 which means that they have the same number of electrons and protons, they have a different mass number because they don't have the same number of neutrons.

However, many students lost marks as they were not specific in their answers. Some students were able to gain 2 marks by stating that the isotopes had the same atomic number but different mass number or same number of protons/electrons but different number of neutrons.

(c) Nitrogen has two natural isotopes.

The symbols for the two isotopes are shown.



Explain a similarity and a difference between the structures of the two nitrogen isotopes.

(4)

Nitrogen 14 and 15 are similar as they have the same atomic number. However they have different mass numbers. This is what makes it an isotope.

However, it was quite common for students to get confused and say they had the same mass number but different atomic number or same number of neutrons but different numbers of protons/electrons. Weaker students simply stated what they could see, that they both had a 7 and one had 14 and one had 15 but did not relate this to anything specific.

(c) Nitrogen has two natural isotopes.

The symbols for the two isotopes are shown.



Explain a similarity and a difference between the structures of the two nitrogen isotopes.

(4)


$\begin{array}{|c|} \hline {}^{14}_7\text{N} \\ \hline \end{array}$ $\begin{array}{|c|} \hline {}^{15}_7\text{N} \\ \hline \end{array}$

they are only one number apart.

Students found Q4 (a) (i) and Q4 (a) (ii) quite difficult with many thinking that the energy wasted was kinetic energy.

SECTION B: Physics

4 Mark has a wind-up torch.



(a) Winding the handle will charge the battery in the torch.
 (i) State **one** type of energy wasted when winding the handle on the torch. (1)

Kinetic Energy

Q4 (a) (ii) few students knew that the energy stored in the battery was chemical energy.

(ii) State the type of energy stored in the battery when the torch has been charged. (1)

Chemical Energy

Q4(b) many students were able to complete the diagram to show the missing parts of the electromagnetic spectrum. In some cases, students knew the missing parts but placed them in the incorrect order. Some Students simply guessed and gave other terms from the specification that they knew.

(b) The torch produces visible light energy.
 Visible light is one part of the electromagnetic spectrum.
 The diagram shows the electromagnetic spectrum.
Complete the diagram to show the missing parts of the electromagnetic spectrum. (2)

radio waves	<u>microwaves</u>	<u>infrared</u>	visible light	ultraviolet	X-rays	gamma rays
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Complete the diagram to show the missing parts of the electromagnetic spectrum. (2)

radio waves	<u>battery</u>	<u>Energy</u>	visible light	ultraviolet	X-rays	gamma rays
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Q4 (c) (i) was well attempted by most students with many being able to give a use of ultraviolet light, most also knew a harmful effect of excessive exposure to ultraviolet light.

(c) Ultraviolet light is part of the electromagnetic spectrum.

(i) State **one** use of ultraviolet light.

(1)

To detect forged bank notes

(ii) State **one** harmful effect of excessive exposure to ultraviolet light.

(1)

Can give you skin cancer.

Q5 (a) was well attempted by students with many showing a clear understanding of the advantages of using the movement of waves as a renewable source of energy, with most stating that the waves do not give off any harmful gases or that they do not form pollution.

5 (a) The movement of waves can be used as a renewable source of energy.

(i) Give **one** advantage of using the movement of waves, rather than fossil fuels, as a source of energy.

(1)

No pollution is produced using the process of wave movement.

Some students did not gain credit as they simply repeated the stem of the question and stated that the advantage was that they are renewable. Others gave vague answers such as "not harmful to the environment" or "environmentally friendly" which were not creditworthy.

5 (a) The movement of waves can be used as a renewable source of energy.

(i) Give **one** advantage of using the movement of waves, rather than fossil fuels, as a source of energy.

(1)

The movement of waves is renewable also more eco friendly

Q5 (a)(ii) 5, the majority of students were able to name one other renewable energy source with the majority giving solar or wind as their answer.

(ii) Name **one** other renewable energy source.

(1)

Solar energy

Q5 (b) students often scored 1 mark for calculating the number of waves per minute.

(b) To produce power, waves hit a wave turbine in the sea.

The waves hit the wave turbine with a frequency of 0.2 Hz

(i) Calculate how many waves hit the wave turbine in one hour.

Show your working.

$$0.2 \times 60 = 120$$

(2)

12 waves

The higher ability students then multiplied by 60 again to get the amount of waves in an hour.

(b) To produce power, waves hit a wave turbine in the sea.

The waves hit the wave turbine with a frequency of 0.2 Hz.

(i) Calculate how many waves hit the wave turbine in one hour.

Show your working.

$$\text{Waves per second} = 0.2 \text{ Hz}$$

$$\text{Waves per minute} = 12 \text{ Hz}$$

$$\text{Waves per hour} = 720 \text{ Hz}$$

(2)

720 waves

Students seemed to perform better in this second calculation in Q5 than in previous series, with many understanding how to calculate the wavelength of the wave.

(ii) The waves have a wave speed of 2.5 m/s.

Calculate the wavelength of the waves.

$$\overset{2.5}{\text{wave speed (m/s)}} = \overset{0.2}{\text{frequency (Hz)}} \times \text{wavelength (m)}$$

Show your working.

$$\cancel{\text{m/s}} \text{ m} = \frac{\text{m/s}}{\text{Hz}} = \frac{2.5 \text{ m/s}}{0.2 \text{ Hz}}$$

(2)

12.5 m

A common mistake that was observed was to multiply the 2 numbers together giving an answer of 0.5. Some did the division upside down giving an answer of 0.08.

(ii) The waves have a wave speed of 2.5 m/s.

Calculate the wavelength of the waves.

$$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$$

Show your working.

(2)

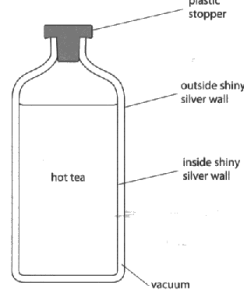
$$2.5 = \frac{\text{frequency}}{\text{wavelength}}$$

$$2.5 \times 0.2 = 0.5$$

0.5 m

It was pleasing to see that many Students attempted Q6, although they did find it demanding. Only more able students were able to score full marks for explaining how the vacuum flask is able to keep the flask hot and considering ideas about conduction, convection and radiation.

- 6 Zoe has a vacuum flask containing hot tea.
 The vacuum flask has two shiny silver walls.
 The air has been removed from between the shiny silver walls to form a vacuum.
 The plastic stopper makes the flask airtight.
 The diagram shows Zoe's vacuum flask.



Explain, using your knowledge of conduction, convection and radiation, how Zoe's vacuum flask keeps her tea hot.

(6)

Firstly the shiny silver wall ~~is~~ doesn't absorb heat, it reflects it meaning that the heat will keep circulating inside the flask. the heat particles will rise to the top and fall when they cool, repeating this process constantly. The airtight plastic stopper doesn't allow air in meaning that air can't circulate to cool down. Also the plastic material it is made of acts as an

insulator therefore it doesn't conduct heat. Lastly the vacuum between the two silver walls means that heat can't radiate through out the sides of the flask. The vacuum has no particles so therefore particles can't conduct heat by rubbing together into each other. Overall all these factors make Zoe's flask keep her tea hotter for longer.

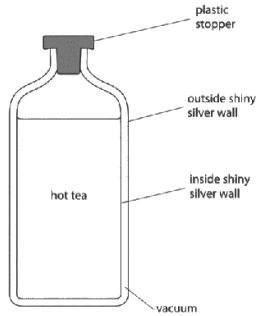
(Total for Question 6 = 6 marks)

TOTAL FOR SECTION B = 18 MARKS

In this example, the student has an understanding that shiny silver wall reflects the heat which gains 1 mark. They state have some understanding that particles will circulate in the flask rising and falling as they cool - which although they have not described it as such, is the mechanism for convection which gained credit. They go on to state that the fact that there is an airtight lid, prevents the circulation from occurring as air cannot get in which gained further credit. Lastly they state that the plastic material of the lid is an insulator which can gained credit in the conduction section. There is another marking point that could be scored on the last section of the second page, stating that the vacuum has no particles so therefore particles cannot conduct, however this conduction marking point had already been scored for the plastic being an insulator so they were not awarded credit here.

The understating of heat transfers is an area that does not seem well understood by Students with many showing clear misconceptions in their answers.

6 Zoe has a vacuum flask containing hot tea.
 The vacuum flask has two shiny silver walls.
 The air has been removed from between the shiny silver walls to form a vacuum.
 The plastic stopper makes the flask airtight.
 The diagram shows Zoe's vacuum flask.



Explain, using your knowledge of conduction, convection and radiation, how Zoe's vacuum flask keeps her tea hot.

(6)

Because the flask has silver walls the radiation (X-rays) can't go through it so they start heating up the walls, and because silver reflect light the light reflected is ~~trans~~ transformed into heat, just like X-rays.

(Total for Question 6 = 6 marks)

TOTAL FOR SECTION B = 18 MARKS

In general Students did well in the first two parts of the biology section in Q7. The majority were able to correctly complete the Punnett square to show the genotypes of the offspring. Of those, most were able to then state the percentage of the offspring that would have black hair. Some Students confused themselves and by swapping the alleles Bb and bB in the same Punnett square, whilst this meant that full marks could still be awarded for part ai, it did mean that they found it hard to give the correct answer for aii and gave the answer 50% rather than 100%. Part ciii confused Students with very few understanding the key term phenotype and many stating bb or b as their answer rather than giving the hair colour of blonde.

SECTION C: Biology

7 (a) The diagram shows a Punnett square for the inheritance of hair colour.
 The allele, B, for black hair is dominant.
 The allele, b, for blonde hair is recessive.

(i) Complete the Punnett square to show the genotypes of the offspring. (2)

		female	
		B	B
male	b	bB	bB
	b	Bb	Bb

(ii) State the percentage of the offspring that will have black hair. (1)

50%

(iii) Give the phenotype for the male in the Punnett square. (1)

b

Only the more able students were able to score all four marks on this section, as in this case.

SECTION C: Biology

7 (a) The diagram shows a Punnett square for the inheritance of hair colour.
 The allele, B, for black hair is dominant.
 The allele, b, for blonde hair is recessive.

(i) Complete the Punnett square to show the genotypes of the offspring. (2)

		female	
		B	B
male	b	Bb	Bb
	b	Bb	Bb

(ii) State the percentage of the offspring that will have black hair. (1)

100%

(iii) Give the phenotype for the male in the Punnett square. (1)

Blonde hair

The majority of students were able to give both organs in the central nervous system in Q8 (a).

8 (a) Homeostasis involves both the central nervous system and the peripheral nervous system.
 Name the **two** organs that make up the central nervous system. (2)

organ 1 Brain

organ 2 Spinal cord

In some cases, students were lazy with their response and gave an answer as spine rather than spinal cord and so could not gain credit.

8 (a) Homeostasis involves both the central nervous system and the peripheral nervous system.
 Name the **two** organs that make up the central nervous system. (2)

organ 1 spine brain

organ 2 spine

Q8 (b) many Students were able to state that temperature is a condition in the body that is controlled by homeostasis.

(b) Blood glucose concentration is one condition in the body that is controlled by homeostasis.
 Name **two** other conditions in the body that are controlled by homeostasis. (2)

condition 1 internal temperature of body

condition 2 hormones

However, a notable number repeated the stem of the question and stated that blood glucose as an answer and many others copied the key terms from the following question.

(b) Blood glucose concentration is one condition in the body that is controlled by homeostasis.
Name **two** other conditions in the body that are controlled by homeostasis. (2)

condition 1 the blood sugar

condition 2 nerves

(b) Blood glucose concentration is one condition in the body that is controlled by homeostasis.
Name **two** other conditions in the body that are controlled by homeostasis. (2)

condition 1 insulin

condition 2 glucagon

Fewer students attempted Q8 (c) than the other longer response questions. Those that did attempt the question usually knew that insulin and glucagon were used to control blood sugar levels but answers were often vague or confused. Many Students thought insulin raised blood sugar and glucagon lowered it. Glucagon, glycogen and glucose were terms that were often used incorrect in their answers. Often Students did not read the stem of the question carefully and talked about diabetics having to inject insulin rather than answering the question posed.

<p>(c) Explain the role of insulin and glucagon in homeostasis. (4)</p> <p>insulin controls the amount of glucose in the body</p>	<p>(c) Explain the role of insulin and glucagon in homeostasis. (4)</p> <p>Insulin and glucagon is what controls your blood sugar and diabetes also suggests whether your sugar level is up or down as you can get diabetes for two reasons.</p>
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Unfortunately, in this case the student has not answered the question carefully, the question posed asks what the role of insulin and Glucagon is. This learner has stated when insulin is released so does not answer the question about the role of insulin and so does not gain credit. The same applies for the glucagon. If they had stated after each sentence so that the blood glucose is lowered (for insulin) raised (for Glucagon) then marks could have been awarded.

(c) Explain the role of insulin and glucagon in homeostasis.

after you eat your levels of sugar goes up and insulin is released. ⁽⁴⁾

when you don't eat for long times your levels of sugar go down and glucagon is released

This final example shows an excellent response that scored full marks.

(c) Explain the role of insulin and glucagon in homeostasis.

Insulin is released by the pancreas to lower the blood glucose levels when they get too high. The insulin turns glucose into glycogen and stores it. Glucagon does the opposite and is released when the blood sugar levels are too low and need to be raised. It turns glycogen back in to glucose. ⁽⁴⁾

(Total for Question 8 = 8 marks)

Q9 was the second of the two 6 markers with the levelled based mark-scheme. As in Q6 many Students attempted the question but this time often with more success than in Q6. Some good distinction level answers were seen.

Students that did less well, did so as they repeated what was in the stem of the question and therefore scored 0. Many Students were able to pick up one or two marks as pass level for understanding some simple biology such

as the evaporation of water from the leaves or the fact that the xylem carried water up the stem. Better Students developed these ideas and mentioned transpiration or talked about stomata and guard cells opening and closing to release water. However, many Students went on to talk about photosynthesis which was not relevant to this question. In this example the learner was awarded merit level with 4 marks. The learner has made clear points from the three areas. They have stated that root hairs absorb the water and that the water is carried up through the xylem. They have stated that water is lost to the air by transpiration and this involves the stomata losing water. This was found sufficient to gain the 4 marks.

9 The picture shows a plant being watered.



Explain how water is transported from the soil through the roots and stem and is then lost to the air through the leaves.

(6)

Small hairs on the roots absorb the water from the soil.

The water ~~soil~~ is then carried by the xylem tube up the stem to be used in the plant.

The glucose that is absorbed ~~is~~ is carried through the stem by phloem tubes to help feed the plant.

The plant ~~is~~ uses what it needs/wants and loses water through transpiration. As the stomata in the leaves ~~lets~~ let out what the plant doesn't want.

The stomata controls what goes in and out of the plant so allows all the excess water the plant doesn't want through the leaves.

(Total for Question 9 = 6 marks)

In this example the learner was awarded pass level with 2 marks. The first sentence is a repeat of the stem so gets no credit, learner should be reminded that repeated information from the stem of the question will gain no credit. The answer then goes on to describe the xylem carrying water from the roots to the stem which is incorrect and so is ignored. The last sentence some information regarding water being evaporated and its movement by transpiration, this was found to be sufficient for a pass level with 2 marks.

9 The picture shows a plant being watered.



Explain how water is transported from the soil through the roots and stem and is then lost to the air through the leaves.

Firstly the roots absorb the water from the surrounding soil and stores them in the plant. Then the xylem transports the water up the roots to the stem and then to the leaves. The water is then lost off the leaf through a process called transpiration.

(Total for Question 9 = 6 marks)

At first glance, in this last example, this answer looks as though it should gain credit. However, the first sentence is really a repeat of the stem. Any comments regarding the phloem are ignored as they are not relevant to the question. Students should be taught to select from the information that they know only write down what is relevant to the question at the time. In the last sentence, the learner mentions stoma, however this is not linked to losing water so is not creditworthy.

9 The picture shows a plant being watered.



Explain how water is transported from the soil through the roots and stem and is then lost to the air through the leaves.

(6)

Plant take in water and minerals through their roots. It is then transported by the stem. The stem transports water and minerals through the phloem cells which reaches all the leaves so that photosynthesis can take place there. The leaves have little holes in them called a stoma that releases oxygen in the air.

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