

Examiners' Report/
Lead Examiner Feedback
Summer 2013

next generation NQF BTEC
Level 1/Level 2 First in Applied Science

Unit 1: Principles of Science (20460E)

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Summer 2013

Publications Code BF037397

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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 candidates.

We hope this will help you to prepare your learners for future examination series.

Grade Boundaries

Introducing external assessment

The new suite of 'next generation' NQF BTECs now include an element of external assessment. This external assessment may be through a timetabled paper-based examination, an onscreen, on demand test or a set-task conducted under controlled conditions.

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 fallback).

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. We will be awarding grade boundaries for the first time for our new next generation BTECs, so this means that a learner who receives an 'Distinction' grade next year, will have similar ability to a learner who has received an 'Distinction' grade this year. Awarding grade boundaries is conducted to make sure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in externally assessed question papers

Each exam 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 year on year because then it wouldn't take into account that a paper may be slightly easier or more difficult than the year before.

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	14	24	34	45

General Comments on Exam

The questions targeted at the higher grades were not attempted by all learners, particularly in the Physics section and in any question where a calculation was required. The questions with higher marks tended to generate answers, but in quite a number of cases these tended to not answer the question set.

In the calculation questions it was evident that some learners did not have a calculator to use. Substitution into correct equations was seen, but the evaluation was not possible, and attempts at long multiplication or division were seen, that were unsuccessful. In terms of showing working, many learners did not show any at all and gave incorrect answers. Centres have some work to do here in teaching the skills needed to answer calculation questions.

Many learners did better on longer answer questions than they did on some of the short answer or multiple choice questions. This showed that they could apply some of the science which is good. However, it also shows a lack of basic science knowledge which is essential in this course. Centres must increase focus on learners learning this science knowledge when preparing for the exam.

Question 1

1 (a) (ii)

Targeted Specification Area: Learning Aim F.4

Most learners were able to access this question and give a sensible response with a use for gamma. Most answers were about detection of cancer, treatment of cancer, kill cancer, sterilising food, some but fewer for sterilising medical equipment.

A few learners gave responses that were not thought out or sensible e.g. t.v. remote and some gave uses of other electromagnetic waves e.g. satellite transmissions.

Level 2 Distinction candidate response:

(ii) Give one use of gamma rays.

(1) Q01aii

It can be used to sterilise food and equipment.

1 (b)

Targeted Specification Area: Learning Aim F.5

Many learners were able to give a danger of UV radiation. Most chose cancer, skin cancer, sunburn and eye damage as relevant dangers.

Some learners had not remembered that the issues with UV were likely to be surface based and said that the UV would damage body cells or were not specific in their answer i.e. organ damage

Level 2 Distinction response:

(b) State one harmful effect of exposure to ultraviolet waves.

(1) Q01b

It can cause skin cancer.

Question 2

2 (a) (ii)

Targeted Specification Area: Learning Aim E.3

Very few learners were able to name convection as the heat energy transfer method involved.

Many said heat rises and some were at least able to explain that it was due to hot air rising. Some learners were able to give a reasonable description of convection.

Most gave a vague answer and just stated what they saw in the picture i.e. because the spiral is over the flame.

Scientific terms are important, ensure the correct terms are used as using less scientific terms can lead to answers that are inadequate as the science behind them would no longer work.

Level 2 Distinction candidate response:

(ii) How is energy transferred from the candle flame to the spiral paper?

(1) Q02aii

Convection

2 (b) (ii)

Targeted Specification Area: Learning Aim E.5

Very few learners were able to give the correct number on the answer line.

Some were able to calculate 48 as an answer and then thought they had to do more and did a variety of calculations to give a different answer.

Few learners could rearrange the equation correctly in the first instance and substituted 40 into the equation in place of the value they were trying to calculate and got a value of 33.

Most had a go at this but the majority of learners were getting the sum the wrong way round and doing $120/40$ giving them 3.

Another interesting approach which often gave the correct answer was 10% of $120 = 12$, then 40% of $120 = 48$.

Learners should always show their working and then put their answers on the answer line at the bottom.

Level 2 Distinction candidate response:

(ii) The torch bulb is supplied with 120 joules of energy.

The bulb is 40% efficient.

How much useful light energy does the bulb produce?

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

Show your working.

$$40\% = \frac{x}{120} \times 100$$

$$x = \frac{40}{100} \times 120$$

$$= 0.4 \times 120$$

$$\boxed{= 48}$$

(2) 2 Q02b

48 J

Question 3

3 (b) (i)

Targeted Specification Area: Learning Aim E.4

Few learners were able to give 225000 as the correct response to gain two marks.

Many learners were awarded one mark for multiply 750×5 to give 3750. They seemed to have little experience of the equation given to them or of converting unit from one to another i.e. few learners understood that the 5 minutes needed to be converted to seconds by multiplying by 60.

Learners should always show their working and then put their answers on the answer line at the bottom.

Level 2 Pass candidate response:

(b) Jane chooses a hairdryer that uses 750 watts. ^{power}
energy = power x time
(i) Calculate how much energy is used when Jane dries her hair for 5 minutes. ^{time} (2) 1 Q03bi

$$750 \times 5 = 3750.$$

$$\text{Energy} = \overset{\text{Power}}{750} \times \overset{\text{Time}}{5} = 3750.$$

3750

Level 2 Distinction candidate response:

(b) Jane chooses a hairdryer that uses 750 watts.
energy = power x time
(i) Calculate how much energy is used when Jane dries her hair for 5 minutes. (2) 2 Q03bi

$$750 \times 300 = 225'000 \text{ J}$$

$$5 \text{ mins} = 300 \text{ secs}$$

225'000

3 (b) (ii)

Targeted Specification Area: Learning Aim E.4

Very few learners scored more than 1 mark on this question. However many scored the compensatory mark for 30×4 or giving the time in hours. Two marks tended to be given in situations where both of the previous 2 ideas were given. Beyond 2 marks was rare.

Few learners were able to make a reasonable attempt at the calculation to gain 3 marks for getting to a power of 0.3, showing that they had some understanding of how to do the calculation.

Few learners had any concept of converting W to KW.

Many were able to work out that the time involved was 2hours/120minutes. Learners seemed ill prepared to do the calculations involved.

Ensure that when answering calculation questions all your working is given. Marks are awarded for chemistry not for using the calculator so if the answer is incorrect but working is written down correctly then credit can still be awarded.

Level 2 Pass candidate response:

(ii) Jane uses her hairdryer 4 times a week for half an hour each time.

The electricity to use her hairdryer each week costs Jane 45p.

Calculate how much 1kWh of electricity will cost Jane.

(4) 1 Q03bii

$$\begin{aligned}
 & 30 \times 4 = 120 \text{ mins.} \\
 & \text{Power} \times \text{time} = 120 \\
 & I \times 120 = 120 \\
 & \frac{120}{45} = 2.66 \\
 & \text{Cost } \underline{2.66} \text{ p}
 \end{aligned}$$

Level 2 Distinction candidate response:

(ii) Jane uses her hairdryer 4 times a week for half an hour each time.

The electricity to use her hairdryer each week costs Jane 45p.

Calculate how much 1kWh of electricity will cost Jane.

(4) 4 Q03bi

$$\begin{aligned}
 \text{Cost} &= \frac{\text{kWh} \times \text{p}}{\text{kWh}} \times \text{time (h)} \\
 45\text{p} &= \frac{0.75 \times x}{2} \\
 4 \times 30 &= 120 \text{ mins} \\
 &= 2 \text{ hrs} \\
 I &= \frac{45}{0.75} = 30 \\
 \text{Cost} & \underline{30} \text{ p}
 \end{aligned}$$

Question 4

4 (a) (ii)

Targeted Specification Area: Learning Aim C.1

This was quite mixed in response. Many learners knew that chlorine had the letters c and l in it, but were unsure of the correct convention i.e. capital letter followed by lower case.

There were lots of mixed letters i.e cl CL cL.

Some learners thought that it was Ch, CH or ch. They clearly didn't know, but applied logic to using the first letters from chlorine as a response. Many learners had a fundamental lack of knowledge about how symbols are represented in the Periodic table.

Level 2 Distinction candidate response:

Chlorine is an element in group 7 of the periodic table.

(ii) Give the chemical symbol for chlorine.

(1) Q04aii

cl

4 (a) (iii)

Targeted Specification Area: Learning Aim C.1

In many cases learners gave interesting but irrelevant responses relating to the other properties of the element. It appeared that some learners were unsure as to how to use a periodic table and there were clearly a number of guesses.

Level 2 Distinction candidate response:

(iii) How can you tell chlorine is a non-metal from its position in the periodic table?

(1) Q4aiii

It is on the ~~left~~ right side of the down step which is where non-metals are positioned.

Question 6

Targeted Specification Area: Learning Aim D.13

Few learners scored more than 1 mark on this question.

Learners seem to have a basic lack of chemical knowledge about neutralisation reactions and few were even able to suggest using indicator to test the pH or to observe when the reaction had become neutral.

Most marks were gained from the idea of validity in the experiment, timing in some way or making a comparison of some sort, i.e

- ◇ use the same amount for acid or tablet.
- ◇ Time how long the reaction took to become neutral
- ◇ The tablet that is most effective is the one that neutralised the acids the fastest.

However many learners had limited knowledge of the chemistry. Common misconceptions seemed to be that the tablets will dissolve, either in water or acid. Learners were unable to differentiate between reacting or dissolving. Few mentioned neutralisation.

Few knew the role of an indicator and most learners assumed a safe method would be to give the indigestion tablets to other learners or individuals and see how long they took to 'feel better'.

Few learners understood the concept of comparability and gave vague comments about fair tests, without any evidence that they understood what this meant.

We didn't see many responses relating to titration or large scale clinical trials.

There is a clear message in this question that centres need to take note of, and that is that experimental approaches need to be factored into revision. This was one of the poorest answered questions, with many learners appearing to guess at a possible answer.

BTEC has a practical emphasis and so it should be expected that learners could answer this style of question.

Marking point 6 was often awarded. Learners who had engaged with the question generally got round to writing an adequate conclusion.

Generally learners answered the question in favour of the timing method. The compensatory marking allowed almost all learners one mark.

Level 2 Pass candidate response:

Marwa works for a company that makes indigestion tablets.

2 Q06

Calcium carbonate is present in indigestion tablets, which neutralises excess acid.

Marwa needs to investigate 3 different indigestion tablets to see which is best at treating indigestion.

Explain **one** method that Marwa could use to investigate which is the most effective tablet.

You **must** include in your answer:

- how you would make the test valid
- what process you would use
- how you would know which is the most effective tablet.

Put a different indigestion tablets into 3 beakers
with the same amount of acid in each and
time it to see how long it takes for the
tablet to neutralise the acid in the beakers

Ensure that you read the question set carefully and that you answer the question set. This question is about chemistry reactions not biological ones and so should be answered in terms of chemistry reactions.

Level 2 Distinction candidate response:

3 Q06
Marwa could use a neutralisation reaction using three beakers of hydrochloric acid (the acid present in the stomach). She could drop a different tablet in each one and observe the results. She could then use universal indicator to see which beaker was closest to green - neutral - and therefore the most effective. To ensure a fair test, she would have to keep the amount of acid the same, the dose of tablet the same and the amount of universal indicator the same. She would also have to leave them for the same amount of time.

* eg is the product be safe for consumption?

- if it bubbles right up then it wouldn't be.

Question 7

7 (b)

Targeted Specification Area: Learning Aim A.2

Many learners were able to say that the nucleus controlled the cell, contained genes or contained DNA.

However, an almost equal number seem to confuse the nucleus with a brain or another function of part of the cell. For example many learners said that it controlled what went in and out of the cell or said that it controlled the whole plant. Some 'hedged their bets' by giving a list of cell functions in the hope of hitting the right answer.

A few learners had no idea and did not offer a response at all. Many recurring incorrect answers for this one: 'heart of the cell', 'brain of the cell' or including this in longer answers. 'Keeps the plant alive', 'protects the cell', 'helps it grow', 'photosynthesis', 'controlling characteristics

Level 2 Distinction candidate response:

(b) Give one function of the nucleus.

(11) Q07b

It contains gene which controls the cell.

Question 8

8(b)

Targeted Specification Area: Learning Aim A.1

Many learners were able to label the cell body with this mark being awarded the most. Fewer were able to correctly identify the axon and labelled the nucleus of the cell as the axon.

There were a few learners who labelled the parts of the cell i.e. nucleus, cell membrane, instead of the cell body as asked. This was fine if they had also added the cell body label.

About 30% got the labels round the wrong way all together.

Some student added lots of lines to 'hedge their bets' as an effective list and did not gain the marks.


Level 2 Distinction candidate response

(ii) Give the name of the system in the body that controls our voluntary and involuntary actions.

(1) 1 Q08aii

Central nervous System

(b) This is a diagram of a motor neuron.



(i) Label the cell body. (1) 1 Q08bi

(ii) Label the axon. (1) 1 Q08bii

The diagram shows a hand-drawn motor neuron. It consists of a central, star-shaped cell body with several short, radiating processes. A long, thin, wavy line extends from the cell body, representing the axon. The word 'Axon' is written in cursive and has a line pointing to the long extension. The word 'Cell body' is also written in cursive and has a line pointing to the star-shaped central part.

8 (c)

Targeted Specification Area: Learning Aim B.8

Few learners were able to give a coherent explanation of how the hormones insulin and glucagons change the glucose concentration in the blood.

Many learners:

- ◇ left the response blank
- ◇ repeated the stem of the question
- ◇ thought that one hormone influenced the other

A few learners understood the pancreas was involved in producing the hormones, but were often confused about the mechanism. A few learners mixed up what the hormones did i.e. thought insulin raised blood glucose concentration. This is despite this information being in the stem of the question.

A very limited number of learners understood the mechanism and were able to explain the role of the liver. Although some thought the glucose remained stored in the liver. A few were able to say that glucose was converted to glycogen.

Getting confused with spellings was a massive issue with this question. On the whole learners had a complete lack of understanding of how glucose levels are regulated in the body.

Common wrong answers included:

- ◇ Discussions on hormone levels in the body and mood swings/changes.
- ◇ Diabetes and sugar control and the role of insulin.
- ◇ Hormone changes and the effect of exercise.
- ◇ Changes caused by exercise on the blood sugar levels.
- ◇ Answers relating to puberty, menstruation and pregnancy.

Level 2 Pass candidate response:

(c) Some responses in your body are controlled by hormones.

Explain how the hormone insulin lowers and the hormone glucagon raises the concentration of glucose in the blood stream.

(40) Q08c

When your body is running low on glucose then your insulin releases more into your blood stream

Ensure that when answering the question, the answer does not just re-state information that is given in the question, as anything given in the question will not be given credit in the answer.

Level 2 Distinction candidate response:

(c) Some responses in your body are controlled by hormones.

Explain how the hormone insulin lowers and the hormone glucagon raises the concentration of glucose in the blood stream.

(44) Q08c

When a person finishes a meal, the blood glucose level goes up, encouraging the pancreas to produce insulin. The insulin encourages liver and skeletal cells to take up glucose, therefore lowering the glucose concentration in the blood. When the blood glucose is high, insulin is produced. When blood glucose lowers, insulin production stops. When blood glucose lowers, glucagon is produced. Glucagon encourages the breakdown of glycogen - a carbohydrate - into glucose, therefore raising the glucose concentration in the blood stream. When blood glucose is high, glucagon is not produced.

Question 9

Targeted Specification Area: Learning Aim B.8

Most learners were able to give some sort of relevant response to this question. Most were able to identify hairs raising and hairs lowering along with sweating and shivering as responses by the body to regulating temperature. Many learners were able to give some balance to the answer, by discussing too hot or too cold.

Most learners were able to explain their answer by linking what they had said to how it would affect the body. i.e they could link shivering to warming the muscles/body, sweating to cooling. Most understood that raising the hairs trapped air against the skin with less understanding how hairs lowering worked, other than it had a 'cooling effect'.

Some learners were able to explain vasodilation and vasoconstriction, even if they did not use these terms. Learners were able to explain the role of blood flow to or away from the skin in terms of heating and cooling. However, there was some confusion about the mechanism itself. Many learners thought that the blood vessel came to the surface or went deeper into the skin. Very few talked about capillaries dilating to allow more blood to flow nearer the surface of the skin.

Weaker learners scored zero in situations where they described what happened in general terms on a walk on a cold day, and ideas of keeping warm with clothing and ideas about going from hot to cold, without mentioning any of the marking points. In general it was a better answered question than Q6 with fewer blanks. Marking on the indicative criteria proved straightforward and the mark scheme gave opportunity for many learners to show some positive achievement. Overall the main problem in terms of answering was that learners wrote down irrelevant or superficial information. This was often, I believe, as a result of not reading properly what the question was asking of them, therefore relevant points were not made.

For full marks it is important to answer the whole question so responses to hot and cold must be given.

Level 2 Pass candidate response:

The conditions inside the body are controlled by homeostasis.

If you went for a walk on a winter's day and then went home into a warm house your internal body temperature would stay constant.

2 Q09

Explain how homeostasis ensures that your body temperature stays constant.

The Homeostasis adjusts to the temperature of the environment for example; if it was a hot day the body will begin to sweat and the hair will face up waves to let air rise the skin which helps the body stay normal temperature. But if it was a cold day the body will begin to shiver to warm up and the hair will lie flat on the body to not let any cold or through. This way it helps the body stay constant.

It is important to answer the whole question set. This question asked how homeostasis kept the body temperature consistent so to get full marks an answer should consider the body's response to hot temperatures and to cold temperatures.

Level 2 Distinction candidate response:

The conditions inside the body are controlled by homeostasis.

If you went for a walk on a winter's day and then went home into a warm house your internal body temperature would stay constant. 6 Q09

Explain how homeostasis ensures that your body temperature stays constant.

Homeostasis is keeping a constant internal environment. When you are cold, the hypothalamus detects this and causes the ^{body} vessels to ~~stand~~ ^{constrict} on end. This helps to trap a layer of warm air which insulates the ~~body~~ skin. Vasoconstriction occurs, blood vessels nearer to the surface of the skin narrow, conserving heat in the body. The body also shivers, these contractions from the movement of muscles generate heat, which warms you up. However when the body temperature ~~falls below~~ ^{rises above} 37°C , the hypothalamus detects this and causes the ~~body to sweat~~ sweat glands to secrete sweat on the surface of the skin, which evaporates, ~~and~~ ^{removing} heat. Vaso^{dilation} ~~constriction~~ also occurs, the widening of blood vessels, causes more blood to flow ~~to~~ ^{near} to the surface of the skin where ~~it is lost~~ ^{it is lost} ~~it is lost~~ heat can be lost. The body hairs lie flat that helps to stop warm air from being trapped.

The body is ensured that the temperature stays constant because of negative feedback, meaning as a change in body happens e.g. a rise in temperature, the ~~body tries to~~ ^{the} mechanisms in ~~the~~ ^{the} body work in the opposite direction, so you don't get too cold or too hot. Resulting in ~~us~~ ^{the} body keep a constant temperature.

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