



**June 2018**

**Level 2 BTEC First in Applied  
Science**

**Unit 1: Principles of Science (20460E)**

## **Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications website at <http://qualifications.pearson.com/en/home.html> for our BTEC qualifications.

Alternatively, you can get in touch with us using the details on our contact us page at <http://qualifications.pearson.com/en/contact-us.html>

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson. Their contact details can be found on this link:

<http://qualifications.pearson.com/en/support/support-for-you/teachers.html>

You can also use our online Ask the Expert service at <https://www.edexcelonline.com>  
You will need an Edexcel Online username and password to access this service.

## **Pearson: helping people progress, everywhere**

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your learners at: [www.pearson.com/uk](http://www.pearson.com/uk)

August 2018

Publications Code 20460E\_1806\_ER

All the material in this publication is copyright

© Pearson Education Ltd 2018

## Grade Boundaries

### What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

### Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external 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 is for a particular grade.

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

### Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:  
<http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html>

## Unit 1: Principles of Science 20460E

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	13	22	31	40

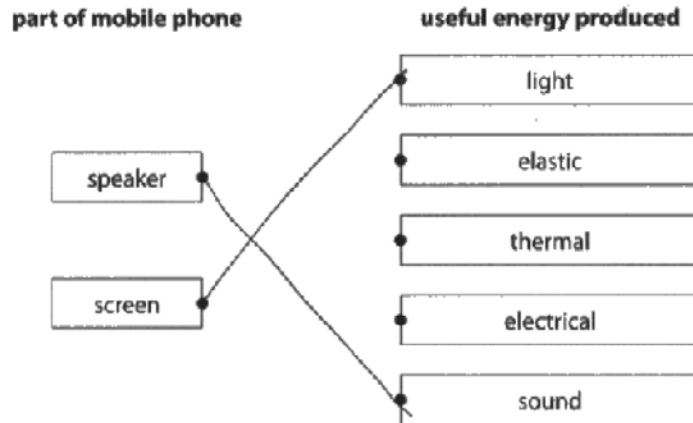
# Introduction to the Overall Performance of the Unit

Learners that did well in this summer 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 apply their knowledge of the science well. The highest scoring learners were able to apply scientific knowledge to new situations, write chemical formula and complete symbol equations and rearrange equations in physics.

As in previous series, exam technique is still an issue for the less able learners. Copying the stem of the questions and giving an answer that is not specific to what the question has asked for is an ongoing problem. Learners should be taught that *explain* questions will require a point to be made along with a linked expansion on that point to gain all the marks available.

# Individual Questions

In question 1 (a)(ii), the majority of learners link the different parts of the mobile phone to the type of useful energy it produces to score both marks available.



Learners found question 1 (b) quite straightforward and were able to state one type of energy that the mobile phone wasted, with the majority stating thermal or heat energy, both of which scored 1 mark.

(b) State **one** type of energy that is wasted by the mobile phone.

Thermal

(b) State **one** type of energy that is wasted by the mobile phone.

Heat

A common incorrect answer was to state that electrical energy was wasted.

(b) State **one** type of energy that is wasted by the mobile phone.

electrical

Question 1c was less well answered by learners. Some were able to state that it is chemical energy that is stored in the battery of the mobile phone to gain the mark.

(c) State the type of energy stored in the battery of the mobile phone.

chemical

Learners that did not score often stated again that electrical energy was stored in the battery.

(c) State the type of energy stored in the battery of the mobile phone.

electrical

Question 2 of the physics section was generally well answered by learners, the majority were able to state watts as the unit of power to gain 1 mark.

2 (a) Power is the amount of energy transferred per second.

State the unit of power.

(W)- watts

In some cases, learners state joules per second which was accepted.

2 (a) Power is the amount of energy transferred per second.

State the unit of power.

2 (a) Power is the amount of energy transferred per second.

State the unit of power.

~~Watts~~ Joules

However, those that just stated joules did not gain the mark.

Learners found the first calculation quite straightforward with many scoring the full two marks for correctly calculating the efficiency as 6.5%.

In some cases, learners were able to calculate the useful energy supplied but then could not take this further to correctly calculate the efficiency. This example shows the importance of learners showing their working. 2600 on the answer line would not have scored any marks however 1 mark was able to be awarded for the 400-374 shown in the working.

Calculate the efficiency of the machine.

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

Show your working.

(2)

$$400 - 374 = 26$$
$$\left( \frac{26}{400} \right) \times 100 = 6.5\%$$

efficiency = 6.5 %

Learners found question 2d quite difficult with few being able to explain an advantage of using fuel cells to score both marks available. In this example the learner has shown an understanding that the fuel cells are more efficient and that they are better for the environment.

(d) Fuel cells can be used to provide energy.

Explain **one** advantage of using fuel cells to provide energy.

(2)

Fuel cells are efficient, more efficient to use than other cells, there is more useful energy given out than waste, better for the environment.

(Total for Question 2 = 6 marks)

A proportion of learners were able to score at least 1 mark for showing an understanding that the fuel cell would not pollute the atmosphere or that it would be better for the environment as in the example.

(d) Fuel cells can be used to provide energy.

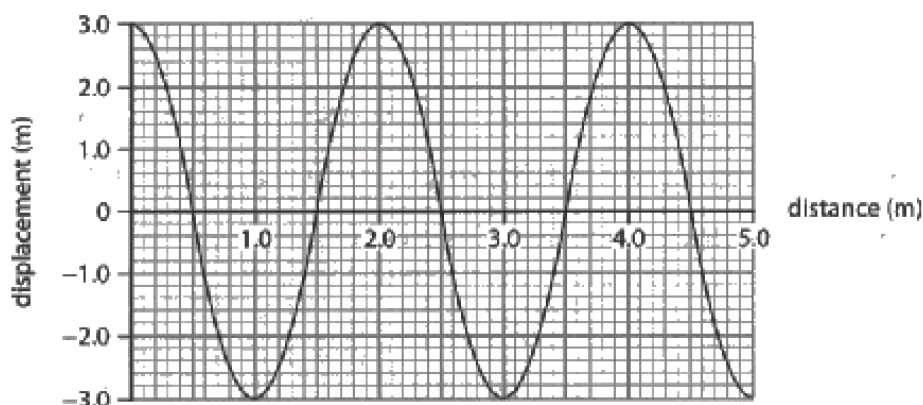
Explain **one** advantage of using fuel cells to provide energy.

(2)  
one advantage of using fuel cells to provide energy is that it's not affecting the air pollution throughout the earth

(Total for Question 2 = 6 marks)

In question 3 part (a)(i) and (a)(ii) the majority of learners were able to correctly give the amplitude and the wavelength of the wave shown scoring 1 mark for each.

3 (a) The graph shows a wave.



(i) Give the amplitude of the wave.

(1)

amplitude = 3.0 m

(ii) Give the wavelength of the wave.

(1)

wavelength = 2.0 m



Learners found the second calculation in the physics section more difficult however a good proportion were able to score both marks for calculating the frequency of the wave to be 240Hz.

(b) A different wave has a wave speed of 360 m/s and a wavelength of 1.5 m.

Calculate the frequency of the wave.

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

Show your working.

*360 = 1.5 \times \text{frequency}* (2)

*frequency = 240 Hz*

A common error was where learners were not able to rearrange the equation correct and multiplied the wave speed and wavelength to gain an answer of 540 rather than dividing them.

(b) A different wave has a wave speed of 360 m/s and a wavelength of 1.5 m.

Calculate the frequency of the wave.

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

Show your working.

(2)

$$\text{frequency} = \dots 540 \dots \text{ Hz}$$

Many learners gained some credit on, **question 5**, the last question of the physics section of the paper. However, only the highest scoring learners were able to explain a benefit and a risk of using gamma rays in hospitals. Many learners were able to gain at least two marks for giving a benefit and a risk. Common correct answers were the benefit of sterilizing medical equipment and the risk of causing cancer.

(c) Gamma rays are used in hospitals.

Explain **one** benefit and **one** risk of using gamma rays in hospitals.

(4)

benefit: gamma rays can sterilize medical  
~~equipment~~ equipment.

risk: gamma rays can cause cancer. cells  
in your body.

The majority of learners were able to state the meaning of the hazard shown. Moderate hazard, irritant and skin sensitizer were all accepted answers and scored 1 mark.



(a) (i) State the meaning of this hazard symbol.

irritant/skin sensitiser



(a) (i) State the meaning of this hazard symbol.

Moderate hazard

Those that did not score, often did not as they were too vague with their answer and stated just hazard alone or they gave the meaning of a different symbol such as corrosive or toxic.

(a) (i) State the meaning of this hazard symbol.

Hazard

(a) (i) State the meaning of this hazard symbol.

Corrosive

In question 5(a)(ii) whilst a good proportion of learners were able to recall that the limewater test tests for carbon dioxide to score a mark. Answers given both in words and formula were accepted and gain a mark.

Name the gas produced in the reaction.

Carbon dioxide

Name the gas produced in the reaction.

CO<sub>2</sub>

A large number of learners thought that it tested for other substances including, sodium chloride, sodium hydroxide, hydrogen or water.

Name the gas produced in the reaction.

Hydrogen.

Name the gas produced in the reaction.

H<sub>2</sub>O

Question 5(b)(i) was answered well with many learners being able to describe the test for hydrogen to gain the full two marks available.

(b) Martin carried out a different experiment with magnesium strips and dilute hydrochloric acid.

Magnesium chloride,  $MgCl_2$ , and hydrogen gas were produced.

(i) Describe how Martin should show that hydrogen gas was produced.

(2)

By using a lit wooden splint and a test/or boiling tube.  
If hydrogen is produced a squeaky pop will occur and the splint will go out.

In some cases, learners stated how to test for the gas, but did not state what the positive result of the test should be. Learners should be taught that when a test is asked for they should give the method of testing and the positive result of the test.

(b) Martin carried out a different experiment with magnesium strips and dilute hydrochloric acid.

Magnesium chloride,  $MgCl_2$ , and hydrogen gas were produced.

(i) Describe how Martin should show that hydrogen gas was produced.

(2)

~~Using~~ hold a flame to it.

In some cases, learners described how they might report an experiment rather than how they would prove that the gas is hydrogen. This did not gain credit.

(b) Martin carried out a different experiment with magnesium strips and dilute hydrochloric acid.

Magnesium chloride,  $MgCl_2$ , and hydrogen gas were produced.

(i) Describe how Martin should show that hydrogen gas was produced.

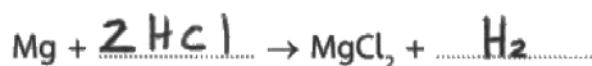
(2)

he should take pictures of the experiment  
as he does it

Question 5(b)(ii) proved quite difficult for learners. The best learners were however able to score both marks as in this example.

(ii) Complete the balanced symbol equation for the reaction of magnesium with hydrochloric acid.

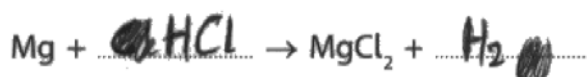
(2)



Where learners did score a mark, it was often for correctly giving the formula for hydrogen.

(ii) Complete the balanced symbol equation for the reaction of magnesium with hydrochloric acid.

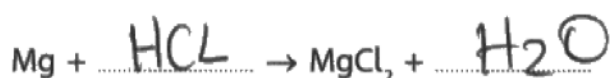
(2)



A common error seen was where learners thought that water, rather than hydrogen was produced. Capital letters for the 'l' in chlorine were also not accepted. Learners should be taught how to correctly represent chemical formula, including the need to capitalize the first letter of a formula with a lower case for the second letter, where appropriate.

(ii) Complete the balanced symbol equation for the reaction of magnesium with hydrochloric acid.

(2)



A noticeable proportion of learners tried to complete the equation by placing words rather than formula into the equation. Learners should be taught that words will not be accepted in place of symbols when a symbol equation has been asked for.

(ii) Complete the balanced symbol equation for the reaction of magnesium with hydrochloric acid.

(2)



(Total for Question 5 = 6 marks)

Question 6 was a very good discriminator. The highest scoring learners were able to explain the issues with the production of Sulphur dioxide when fossil fuels are burned and were able to explain how neutralization reactions were able to reduce the negative effects. The following example scored 6 marks.

6 Fossil fuels often contain sulfur.

When the sulfur in the fossil fuel burns, sulfur dioxide is produced.

Explain the effect sulfur dioxide has on lakes and how neutralisation reactions are used to reduce the effect.

You may use equations to support your answer.

(6)

When sulfur dioxide goes into the atmosphere, it reacts with water particles that go into clouds to become rain water to form acid rain. When acid rain falls it can burn the leaves off of pine trees and can even melt statues and buildings. But probably the biggest problem is that it can turn lakes more acidic. This can kill underwater plants and animals such as fish because the lake would be more uninhabitable for them. However there is a ~~sort~~ solution. People can use helicopters that spray calcium carbonate which reacts with the acid and neutralises it making the waters less acidic. The equation for this is: acid + alkali  $\rightarrow$  water + salt.

The next example scored 3 marks, the learner has stated that the lake can become acidic and that that the fish cannot survive, which was accepted for fish will die. However, they then discuss eutrophication which was ignored. They discuss neutralization and that the need to return the pH to pH 7, this was not sufficient for reducing acidity, if they had stated that the pH is raised then credit could have been awarded. They do however state that calcium carbonate and should be added and so a final mark was awarded.

Explain the effect sulfur dioxide has on lakes **and** how neutralisation reactions are used to reduce the effect.

You may use equations to support your answer.

(6)

Sulfur dioxide causes lakes to become very acidic and this can cause aquatic life to become in danger as aquatic plants + fish cannot survive in highly acidic water. Sulfur dioxide can also cause the oxygen in the water to become limited and cause nitrogen levels to rise this also can be a concern to aquatic life as they need high oxygen levels and low nitrogen levels to survive. Neutralisation reactions can be used to help as they can neutralise the acidic water and return it to a neutral pH of 7, this can be achieved by adding for example a calcium carbonate or calcium oxide to the water as these are able to react with the acidic water and return the pH levels to neutral.

(Acid + Base  $\rightarrow$  neutralisation reaction)  
returning pH to 7 (neutral)

Many learners were able to score at least 1 mark for stating the effect of the acidic water on the organisms in the lake.

6 Fossil fuels often contain sulfur.

When the sulfur in the fossil fuel burns, sulfur dioxide is produced.

Explain the effect sulfur dioxide has on lakes **and** how neutralisation reactions are used to reduce the effect.

You may use equations to support your answer.

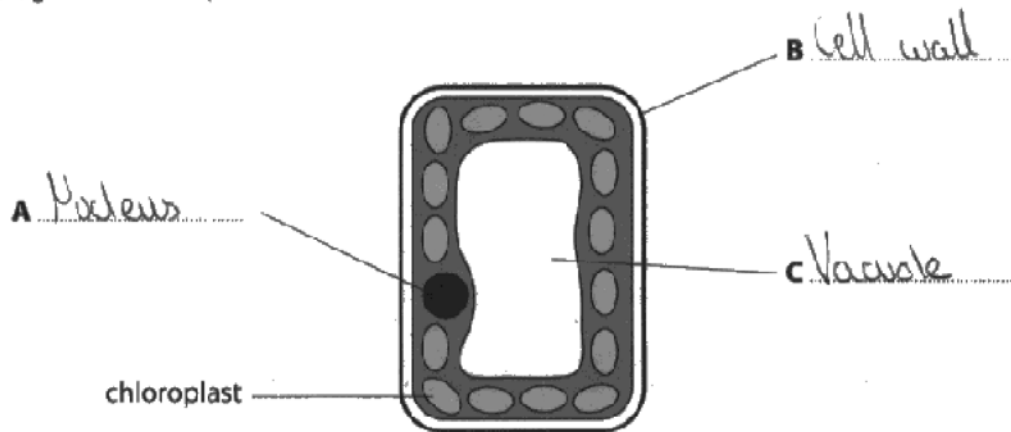
(6)

Sulfur dioxide pollutes lakes causing death to plants & wildlife such as fishes etc.

Learners performed well in the first question on the biology section, **question 7a**, with the majority being able to label all three parts of the palisade cell scoring 3 marks.

7 A leaf contains palisade cells.

The diagram shows a palisade cell.

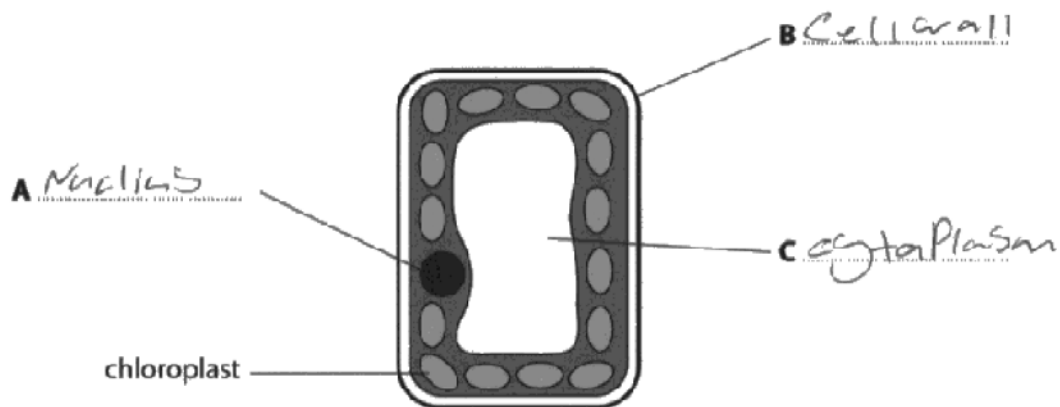




A common mistake seen was to the label C as the cytoplasm rather than the vacuole.

**7 A leaf contains palisade cells.**

The diagram shows a palisade cell.



Part (b) of question 7 was also well answered with many learners be able to recall the function of the chloroplast to score the mark.

**(b) A chloroplast has been labelled.**

State the function of the chloroplast.

(1)

It is where photosynthesis occurs.

Some gave extra detail to state that the chloroplast absorbs energy for photosynthesis and gained the mark.

**(b) A chloroplast has been labelled.**

State the function of the chloroplast.

(1)

The Chloroplasts are what absorb the energy from the sun for photosynthesis.

In some cases, learners lack of scientific terminology lost them marks. In this example, the learner states that the chloroplast makes food for the plant, this was not accepted. Had the learner stated that the function was to make glucose, this would have gained the mark.

(b) A chloroplast has been labelled.

State the function of the chloroplast.

(1)

~~helps hold things getting~~ makes food for  
the leaf (plant)

In question 8(b)(i), many learners were able name the two organs that make up the central nervous system to gain both marks.

(b) The central nervous system helps maintain a constant internal environment.

(i) Name the **two** organs that make up the central nervous system.

1. Spinal cord

2. Brain

In some cases, learners stated that the spine was one of the organs, this was not accepted, and this response gained just 1 mark for the brain.

(b) The central nervous system helps maintain a constant internal environment.

(i) Name the **two** organs that make up the central nervous system.

1. Spine

2. Brain

Less able learners did not read the question carefully and gave the name of two organs but not two organs that make up the central nervous system.

(b) The central nervous system helps maintain a constant internal environment.

(i) Name the **two** organs that make up the central nervous system.

1. Kidney

2. Lung

Learners found question part (b)(ii) of question 8 more difficult, with few being able to name the system that transmits electrical impulse to and from the central nervous system. However, this example gained 1 mark.

(ii) Name the system that transmits electrical impulses to and from the central nervous system.

Peripheral Nervous System (1)

Less able learners simply restated the stem of the question and gave the answer nervous system or central nervous system again, gaining no marks.

(ii) Name the system that transmits electrical impulses to and from the central nervous system.

Nervous system (1)

(ii) Name the system that transmits electrical impulses to and from the central nervous system.

Central central nervous system (CNS) (1)

Question 8(c) was well attempted by most, but only the highest scoring learners were able to score both marks for fully explaining how sweating and hairs lying flat on the skin help to cool the body when the temperature is too high. This example scored the full four marks available.

(c) Explain how sweating and hairs lying flat on the skin help to cool the body when its temperature is too high.

(4)  
When we sweat, heat energy is needed to evaporate the sweat on the body. And due to this, the heat energy used is also lost, thereby reducing the temperature of the body.

When the hair is standing up straight, it acts as an insulator for the air. When the hair is lying flat, the air is no longer being insulated and therefore can come into contact with the body.

Less able learners often repeated the stem of the questions stating that when the body gets too hot that it creates sweat. A mark here was allowed for the sweat 'lifting heat' from the body. The learner has also stated that the sweat vaporizes for a second mark explaining how sweat cools us down. This learner has not addressed the part of the questions about how hairs lying flat on the skin also help cool the body down.

(c) Explain how sweating and hairs lying flat on the skin help to cool the body when its temperature is too high.

(4)

When the body gets too warm it begins to create sweat. The sweat water sweat helps to lift the heat from the body and then vapourises.

In this example, the learner did not read the question carefully and simply stated how the position of hairs change when the body is at different temperatures, it scored no marks.

(c) Explain how sweating and hairs lying flat on the skin help to cool the body when its temperature is too high.

(4)

~~This helps help cools the skin because they stand when it gets cold and~~  
when it is cold the hairs on your skin stand up and when when the temperature is high the hairs lay down;  
~~because~~

It was worrying to see that a fair number of learners seem to believe that the sweat or hairs lying flat on the skin would protect them from the sun.

(c) Explain how sweating and hairs lying flat on the skin help to cool the body when its temperature is too high.

(4)

- Sweat is your own personal sun screen and hairs lying down protects from the heat.

The levels based six-mark question, **question 9** was answered well by many learners with many scoring some credit. Less able learners often were able to gain some marks for being able to show some basic understanding of the function of each type of cell.

This example scored 2 marks in level 1 as they were able to give one basic fact about each type of blood cell.

9 Blood contains red blood cells and white blood cells.

Explain how the red blood cells and the white blood cells are adapted for their functions.

(6)

red blood cells ~~are~~ ~~is~~ red blood  
cells are there to help  
carry oxygen throughout  
our bodies.

white blood cells white blood cells  
help fight off any disease  
that enters our bodies.

The following example shows a learner that scored 4 marks in level 2.

The learner has attempted to give an explanation of the function and adaptations of the red blood cell, there are errors, such as the shape being like a white blood cell, the cell wall of the red blood cell and travelling 'with' haemoglobin. They have given one very brief explanation of the role of the white blood cell, they do not state what the cell engulfs. However, it was felt that there were sufficient linked scientific ideas for this to

9 Blood contains red blood cells and white blood cells.

Explain how the red blood cells and the white blood cells are adapted for their functions.

(6)

red blood cells have an adapted shape almost like a white blood cell but slightly thinner in the middle which increases their ~~total~~ surface area and ~~also~~ contain thin cell wall so that they can carry as much oxygen around the body as possible and their shape also allow them to travel through the body easily with the haemoglobin

white blood cells have a shape that they can alter in order to engulf

be awarded 4 marks in level 2.

The final example shows an example of a learner that scored full marks in level 3. The learner has discussed, with detail, the function and adaptations of the red and white blood cells. The answer is not perfect, but it does not have to be to gain 6 marks.

9 Blood contains red blood cells and white blood cells.

Explain how the red blood cells and the white blood cells are adapted for their functions.

(6)

red blood cells. Red blood cells function is to carry oxygen around the body, they are adapted for this function as they have a large surface area, they are flexible to fit through small blood vessels/capillaries, they are a biconcave shape and contain haemoglobin.

white blood cells. White blood cells function is to produce antibodies to fight/destroy pathogens, they have a large surface area and can secrete neutrophils to fight disease and destroy pathogens they are also adapted for their function as they can engulf cells and break them down and can also remember specific types of bacteria ~~the~~ <sup>they have</sup> fought before making ~~the~~ <sup>then</sup> immune from that disease the next time ~~the~~ <sup>they</sup> comes into contact with it.

(Total for Question 9 = 6 marks)



## Summary

To improve in future series, learner should:

- Practice exam technique ensuring that they read the question carefully and that their answer matches the question that is set.
- Practice answer questions giving specific scientific answers rather than generic.
- Practice writing and balancing symbol equations ensuring that they write formula using the correct scientific conventions.
- Learn definitions and basic concepts as outlined in the specification.
- Practice substituting into, rearranging and evaluating equations showing their working at all times.

Ofqual



Llywodraeth Cynulliad Cymru  
Welsh Assembly Government

For more information on Pearson qualifications, please visit  
<http://qualifications.pearson.com/en/home.html>

Pearson Education Limited. Registered company number 872828  
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE

