



# Examiner's Report/ Lead Examiner Feedback

March 2015

NQF BTEC Level 1/Level 2 Firsts in  
Applied Science

Unit 1: Principles in Science (20460E)

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March 2015

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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.

## Overall comments

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

Learners that did well this series, did so as in previous series because they had learnt key terms and used good scientific language. They were able understand what would be asked for in the question and therefore apply their knowledge of the science well.

Again as in previous series, exam technique is still an issue for learners. Centres need to prepare learners for the exam by practicing exam technique, especially in relation to reading the question carefully. Key terms from the specification should be taught so that learners are able to fully access the question. Terms such as 'function' in question 3aii seemed to confuse learners and meant that they lost marks. Teaching the meaning of key questioning terms such as 'explain' and 'describe' so that the learners understand what is required and can then apply their knowledge correctly is also important. Learners should be taught that they should be checking that the question set has been addressed in the answer given and that they must use appropriate scientific knowledge and vocabulary. There is also the need for centres to continue to focus on learners learning the key scientific knowledge in the specification. One way this could be achieved would be to practice structuring extended writing questions as this is a skill that the learners are still not proficient in. Many learners are repeating large sections of the stem of the question and gain no credit for this.

## 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

## Feedback on Specific Questions

### 1b

In this question, the learners are asked about the effect responses that keep the body temperature constant have on the body. Learners have been asked to draw one line from each response to its effect on the body.

In many cases learners did not read the stem of the question carefully and tried to draw multiple lines so that all effects on the body have been linked.

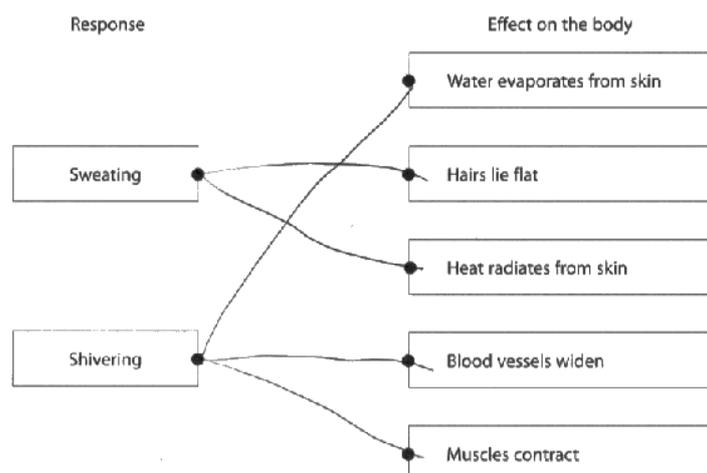
In this example, the learner scored no marks as they have linked the responses of the body in each case to more than one effect on the body.

Centres must teach learners to read questions carefully and ensure that in questions like this, they do only draw line as requested.

(b) Two responses that keep the body temperature the same are sweating and shivering.

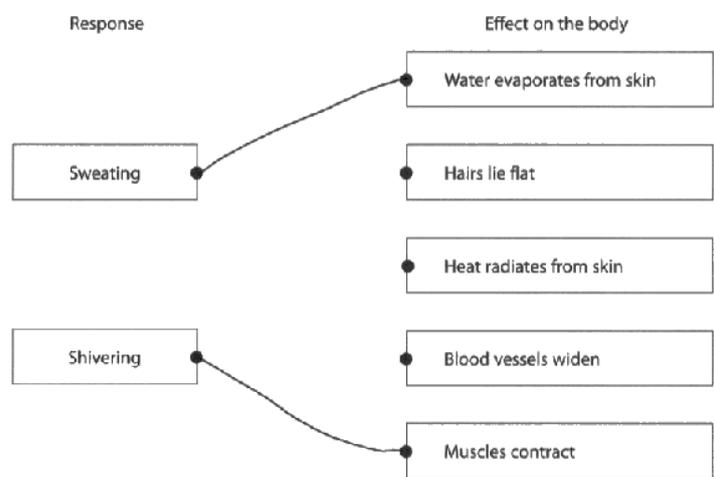
Draw **one** line from **each** response to its correct effect on the body.

(2)



In this example, the learner has correctly identified the effect on the body of each response.

(b) Two responses that keep the body temperature the same are sweating and shivering.  
Draw **one** line from **each** response to its correct effect on the body. (2)



## 2bi

Learners found question 2bi difficult. Many learners did not understand that the stimulus was external and answered the question of 'what made the hand move' giving answers such as muscles, reflex or motor neurone.

In this example the learner has understood that the question is referring to reflex actions. However, they have not read the question correctly and given an answer of receptor rather than the stimulus of the broken glass or the pain.

(b) Doug accidentally breaks a glass.  
When he tries to clear up the broken glass the sharp edge cuts his hand.  
He quickly drops the broken glass.

(i) Give the stimulus that makes Doug move his hand.

(1)

Receptor

However, whilst saying the above, a good number of learners were able to give the stimulus. In the following examples, The learners have answered the question simply and gained the mark, in the second example, despite the poor spelling, it is clear that the learner knew that the broken glass was the stimulus and credit was therefore awarded.

(b) Doug accidentally breaks a glass.  
When he tries to clear up the broken glass the sharp edge cuts his hand.  
He quickly drops the broken glass.

(i) Give the stimulus that makes Doug move his hand. (1)

\_\_\_\_\_ pain \_\_\_\_\_

(b) Doug accidentally breaks a glass.  
When he tries to clear up the broken glass the sharp edge cuts his hand.  
He quickly drops the broken glass.

(i) Give the stimulus that makes Doug move his hand. (1)

\_\_\_\_\_ broken glass \_\_\_\_\_

## 2c

The concept of regulation of glucose, tested in 2c, is still an area that learners find difficult. It is very important that learners focus on the correct spellings of the key terms. This is especially vital here as the spelling of the terms are so close yet refer to significantly different substances and only completely correct spellings of the key terms are acceptable.

In this example, whilst the learner has stated that 'it is stored in the liver' as they are referring to the insulin rather than glycogen no marks can be awarded.

(c) When Doug eats too much glucose his pancreas releases insulin to lower the glucose level in his blood.

Describe how insulin lowers the blood glucose level.

(2)

The pancreas releases insulin that is stored in the liver and the liver releases it slowly

(Total for Question 2 = 6 marks)

In this case, the learner has described how insulin is released to lower glucose by transforming it into glycogen that is then stored in the liver, this answer scored the two marks available.

(c) When Doug eats too much glucose his pancreas releases insulin to lower the glucose level in his blood.

Describe how insulin lowers the blood glucose level.

(2)

The insulin is released to lower the glucose level in his blood. It then transforms into glycogen which is then stored in the liver.

(Total for Question 2 = 6 marks)

In this example, the learner has simply repeated the information given to them in the question which scores no marks.

(c) When Doug eats too much glucose his pancreas releases insulin to lower the glucose level in his blood.

Describe how insulin lowers the blood glucose level.

(2)

insulin takes glucose away to lower the glucose level

(Total for Question 2 = 6 marks)

### 3a ii

Learners found giving the function of the genes very difficult. Named features were frequently quoted without reference to the control of the feature by the gene. Another response often seen was that genes are passed down from parent to child. Others gave vague answers such as 'make you who you are' or 'genes are what you look like'.

In this example, 'provide you with your own personal characteristics' is just about sufficient and gained the mark.

(ii) Chromosomes are made up of genes.

Give the function of the genes.

(1)

Genes provide you with your own personal characteristics.

Many learners gave answers similar to the next example that did not score credit.

(ii) Chromosomes are made up of genes.

Give the function of the genes.

(1)

Genes determine what something looks like.

3bi

Learners found question 3bi quite difficult. Some were able to show that they understood that all the offspring contained a dominant allele via a correctly drawn Punnett square but were unable to follow this up with a correct statement about the fact that a dominant allele being present means that only dominant traits are seen. The majority of learners simply repeated the stem of the question or stated that red tomatoes are dominant.

Some learners did not apply their knowledge of science to the question asked and gave answers that related to yellow tomatoes being tomatoes that had not ripened or that have not had enough water when growing.

In this example, the learner has scored one mark for drawing a correct Punnett square showing that all of the offspring contained a dominant allele.

He breeds Type 1 tomatoes with Type 2 tomatoes.

- Type 1 tomatoes have genotype RR.
- Type 2 tomatoes have genotype yy.

R represents the allele for red tomatoes. This is a dominant allele.

y represents the allele for yellow tomatoes. This is a recessive allele.

(i) Explain why all the offspring will be red.

(2)

The offspring would be red because of the dominant alleles from the red tomato. The dominant alleles would overpower the recessive alleles. There is a 100% chance that the offspring would be red.

X	R	R
y	Ry	Ry
y	Ry	Ry

In this next example the learner has simply repeated information from the stem of the question, which is not worthy of credit.

(b) A farmer is growing two types of tomatoes.

- Type 1 tomatoes are red.
- Type 2 tomatoes are yellow.

He breeds Type 1 tomatoes with Type 2 tomatoes.

- Type 1 tomatoes have genotype RR.
- Type 2 tomatoes have genotype yy.

R represents the allele for red tomatoes. This is a dominant allele.

y represents the allele for yellow tomatoes. This is a recessive allele.

(i) Explain why all the offspring will be red.

### 3bii

Learners seemed to be able to apply their knowledge much more successfully in 3bii than 3bi. Many learners were able to complete the Punnett square with the correct genotypes and offspring. The better learners were then also able to see that the Punnett square contained two dominant genes and so 150% of the tomatoes were red.

(ii) The farmer has a third type of tomato (Type 3) that is also red.

Type 3 tomatoes have genotype Ry.

When he breeds these tomatoes with the Type 2 tomatoes some of the offspring are red and some of the offspring are yellow.

Use a Punnett square to explain what percentage of the offspring will be red.

(4)

	R	y
y	Ry	yy
y	Ry	yy

The percentage of offspring will be 50% because there are two dominant alleles and two recessive.

(Total for Question 3 = 8 marks)

In this example, the learner has correctly completed the genotypes for the Type 2 tomato. The genotypes for the Type 3 tomato however are incorrect. The learner has correctly completed the Punnett square for the genotypes they have given which was worthy of credit. In the final sentence, the learner has given a fraction of the amount of tomatoes that would be red, which is not worthy of credit as a percentage was asked for.

(ii) The farmer has a third type of tomato (Type 3) that is also red.

Type 3 tomatoes have genotype Ry.

When he breeds these tomatoes with the Type 2 tomatoes some of the offspring are red and some of the offspring are yellow.

Use a Punnett square to explain what percentage of the offspring will be red.

(4)

	R	y
R	RR	Ry
y	Ry	yy

3/4 of the the tomatoes will be red and  
1/4 tomatoes will be yellow.

(Total for Question 3 = 8 marks)

This last example scored no marks. The Type 2 alleles are not correct as the learner has used capital Y instead of lower case showing the recessive gene. They have then carried this forward into the Punnett square as a lower case y which means that the offspring are incorrect for the genotypes they have used. The type 3 alleles are also incorrect and no percentage has been attempted.

(ii) The farmer has a third type of tomato (Type 3) that is also red.

Type 3 tomatoes have genotype Ry.

When he breeds these tomatoes with the Type 2 tomatoes some of the offspring are red and some of the offspring are yellow.

Use a Punnett square to explain what percentage of the offspring will be red.

(4)

	<del>R</del>	<del>R</del>
<del>R</del>	<del>Ry</del>	<del>Ry</del>
<del>R</del>	<del>Ry</del>	<del>Ry</del>

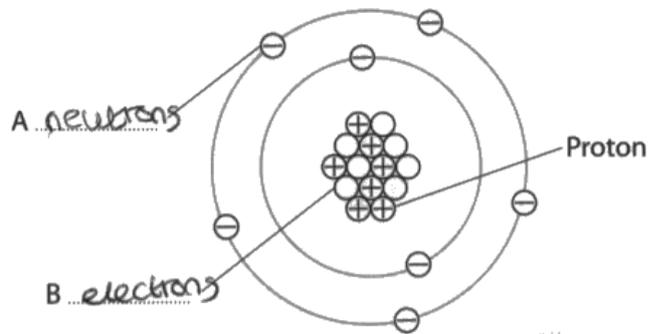
(Total for Question 3 = 8 marks)

#### **4bi**

In general learners performed well in question 4bi. Most knew that the two particles in the atoms to be labelled were the electrons and protons. Where learners made errors, it was often as they had the two particles labelled but in the wrong positions as in the example below.

(b) The diagram shows an atom of nitrogen.

The protons have been labelled.



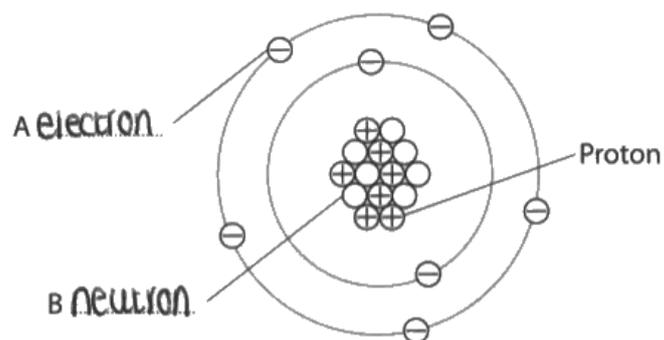
(i) Label particles A and B in the nitrogen atom.

(2)

This example shows a fully correct response that scored both marks available.

(b) The diagram shows an atom of nitrogen.

The protons have been labelled.



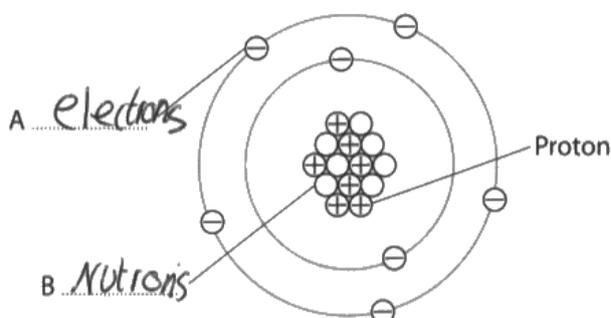
(i) Label particles A and B in the nitrogen atom.

(2)

Phonetic spellings are accepted. This example therefore scored two marks for 'electrons' and 'nutrons'.

(b) The diagram shows an atom of nitrogen.

The protons have been labelled.



(i) Label particles A and B in the nitrogen atom.

(2)

## 5ai

Learners also did well in question 5ai. The majority of learners showed a good understanding of the action that should be taken if you were to spill a chemical with this hazard symbol on it, onto your skin.

5 Copper chloride is used in fireworks because it burns with a blue-green flame.

One method for making copper chloride is to react hydrochloric acid with copper carbonate.

Hydrochloric acid is an irritant and has the hazard symbol shown in the diagram.



(a) (i) State what you should do if you spill hydrochloric acid on your skin.

(1)

Wash it off you skin

A common incorrect answer that was seen was 'to go to hospital'.

Hydrochloric acid is an irritant and has the hazard symbol shown in the diagram.



(a) (i) State what you should do if you spill hydrochloric acid on your skin. (1)

get to the hosbitly as quick  
as you can.

Some learners tried to apply their scientific knowledge and thought that you should pour an alkali on the acid to neutralise the acid, this was however, not an acceptable response.

carbonate.  
Hydrochloric acid is an irritant and has the hazard symbol shown in the diagram.



(a) (i) State what you should do if you spill hydrochloric acid on your skin. (1)

~~with an alkali~~ immediately Neutralize it  
with an alkali

## 5b

Question 5b, although very straightforward, caused learners significant difficulties. Only the best learners knew that to test for carbon dioxide, limewater should be used, which would go cloudy.

-----

One of these products is carbon dioxide gas.

Describe the test for carbon dioxide gas. (2)

Test

~~adding~~ add in some limewater.

Result

cloudy chalk colour ~~is~~ ~~is~~ which means there's carbon dioxide.

Some learners remembered the test from practical lessons when they had blown into limewater, which then went cloudy. This showed an understanding of the test and its result and was considered sufficient for the two marks.

Unfortunately, the majority of responses seen, gave the test for hydrogen, or the name of the test, as in the response below, rather than the test for carbon dioxide.

(b) The reaction between hydrochloric acid and copper carbonate gives copper chloride and two other products.

One of these products is carbon dioxide gas.

Describe the test for carbon dioxide gas. (2)

Test

You do the Squicky Pop test

Result

If there is any carbon dioxide you will here it make a pop.

Centres should ensure that learners have learnt both of these gas tests that are on the specification and can isolate each where necessary.

6

Question 6 was the first of the two extended answer, six mark questions. It had a points based mark scheme. Learners found this question very hard. Learners that attempted the question, often wrote a large amount of irrelevant material about chlorine's electron shells or the uses of chlorine. Some learners were able to recognise that chlorine is an isotope, however they found it very hard to follow this with any explanation of what this meant. Many learners thought that chlorine contained half an electron, proton or neutron and this was why the relative atomic mass is not a whole number. Some learners thought that it was because the chlorine atom shared its electrons with other atoms and so therefore it did not have a whole 'atom's worth' any more. In essence, Isotopes is not an area of the specification that learners have understood well.

In this example, the learner has stated that there are two types of chlorine, which is worthy of credit. They have gone on to give two correct mass numbers and explained that averaging these masses causes the chlorine to have a mass, which is not a whole number, this was worth 3 marks.

---

6 Most elements have a relative atomic mass that is shown as a whole number on the periodic table.

For example, the relative atomic mass of oxygen is shown as 16.

The relative atomic mass for chlorine on the periodic table is not a whole number.

Explain, using your knowledge of atomic structure, why the relative atomic mass for chlorine is not a whole number.

The relative atomic mass for chlorine is not a whole number because there are two types of chlorine. One with an atomic mass of 35 and the other with an atomic mass of 37. With the types of chlorine scientists had to make an average atomic mass between the two types of chlorine giving them a rough average of 35.5. The atomic mass for chlorine which is not a whole number is 35.5.

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(Total for Question 6 = 6 marks)

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In this example, the learner scored just one mark for stating that chlorine is an isotope.

6 Most elements have a relative atomic mass that is shown as a whole number on the periodic table.  
For example, the relative atomic mass of oxygen is shown as 16.  
The relative atomic mass for chlorine on the periodic table is not a whole number.  
Explain, using your knowledge of atomic structure, why the relative atomic mass for chlorine is not a whole number.

Chlorine on the periodic table isn't a whole number because it's an isotope. ~~An~~ An isotope is where you have a different mass number and relative atomic mass number.  
If these two numbers were the same for example oxygen has 16 so it would be 6 mass number and 6 relative atomic mass to make a whole number.

In this example the learner scores no marks. The first sentence is simply a repeat of the stem of question. The learner goes on to state that chlorine has a different number of neutrons to the amount of electrons and protons. This is true, but does not explain why the relative atomic mass is not a whole number and so no credit was awarded.

6 Most elements have a relative atomic mass that is shown as a whole number on the periodic table.  
For example, the relative atomic mass of oxygen is shown as 16.  
The relative atomic mass for chlorine on the periodic table is not a whole number.  
Explain, using your knowledge of atomic structure, why the relative atomic mass for chlorine is not a whole number.

The reason that chlorine's atomic mass is not a whole number is because chlorine has a different amount of neutrons to the amount of electrons and protons which changes the atomic mass. Because of this, the atomic mass is 0.1 and it isn't the same.

## 8aii

Question 8aii was attempted by most, however few learners gave a correct scientific use of radio waves. The most common error was where learners misunderstood the questions and had answered 'Give one use of a radio', rather than of radio waves and therefore answered to listen to music or gives off sound.

(ii) Give **one** use of radio waves.

(1)

Gives off sound

Some learners gave a correct answer as in this example. Again minor spelling errors were ignored.

(ii) Give **one** use of radio waves.

(1)

To trans~~mit~~te frequencys so ~~pe~~ople can <sup>hear</sup> ~~hear~~ you

## 8b

The majority of learners did not score well in question 8b. A very high proportion of learners simply stated that microwaves and infra-red cause cancer. As in previous sessions, learners are confusing microwaves from the electromagnetic spectrum with microwave ovens and answered in terms of dangers of cooking and placing metal objects in the microwave oven.

In this example, the references to cancer were ignored, although 'can cause healthy cells to die' was acceptable for the harmful effect of microwaves.

(b) Give the harmful effects of excessive exposure to microwaves and infrared.

(2)

Microwave They can cause healthy cells to die or create cancer cells.

Infrared They can cause cells to mutate.

In this example no marks were awarded for the reference to burning kidneys for microwaves. A mark was awarded for 'burn your skin' for a harmful effect of infrared. Again the reference to cancer was ignored.

(b) Give the harmful effects of excessive exposure to microwaves and infrared.

(2)

Microwave If you stand in front of it for too long it can burn your kidney

Infrared If you expose yourself to infrared it could burn your skin, or could cause cancer.

### 8c

Question 8c was generally well attempted by learners. Many were able to score 1 mark for calculating how many waves there would be in one minute, but only the very best learners were able to take this further and give their answer in standard form.

The following example, shows a very good response, where the learner has shown their working and then converted their answer to standard form.

(c) A wave has a frequency of 1000 Hz.

(i) Calculate how many waves there will be in a minute.

Give your answer in **standard form**.



(2)

$$1000 \text{ Hz} \times 60 = 60,000$$

$$6 \times 10^4$$

$$6 \times 10^4$$

A common mistake seen was where learners had used the correct numerical values but have divided the numbers rather than multiplied them.

(c) A wave has a frequency of 1000 Hz.

(i) Calculate how many waves there will be in a minute.

Give your answer in **standard form**.

(2)

$$1000 \div 60 =$$

16.6

### 8cii

It was found that Question 8cii was better attempted than similar questions in previous series. Many learners were able to correctly rearrange the equation and substitute the values for wave speed and frequency. Learners that attempted this question, but lost marks, generally did so as they multiplied the two values rather than dividing them.

(ii) The wave has a wave speed of 2500 m/s.

Calculate the wavelength of the wave.

Wave speed (m/s) = wavelength (m)  $\times$  frequency (Hz)

(2)



$$\text{wavelength (m)} = \text{wavespeed (m/s)} \div \text{Frequency (Hz)}$$

$$= 2500 \text{ m/s} \div 1000 \text{ Hz}$$

$$= 2.5 \text{ m}$$

2.5 m

This example shows a very good learner that has shown how they have rearranged the equation and then substituted the values to calculate the wavelength of the wave.

In this example, the learner has correctly substituted the values into the equation for the first marking point. They have however not taken this any further and so do not gain any further credit.

(ii) The wave has a wave speed of 2500 m/s.

Calculate the wavelength of the wave.

Wave speed (m/s) = wavelength (m)  $\times$  frequency (Hz)

(2)

$$2500 = 0.001 \times 1000 = \cancel{25} 10$$

10

(Total for Question 8 = 8 marks)

In this last example of question 8cii, the learner has used the numbers from the question, however they have multiplied the numbers rather than divided them,

(ii) The wave has a wave speed of 2500 m/s.

Calculate the wavelength of the wave.

Wave speed (m/s) = wavelength (m)  $\times$  frequency (Hz)

(2)

$$2500 \times 1000 = \underline{\underline{2500000}} \text{ (m/s)}$$

(Total for Question 8 = 8 marks)

therefore no credit is awarded.

## 9

Question 9 was the second of the two six mark questions that has a levelled mark scheme. Many more learners attempted this last question than in previous series. Learners that attempted this question did not always gain credit as they simply repeated the stem of the question by stating that there are limited supplies and that it is a good energy source.

Some learners seemed to confuse the term conserve with preserve and many gave answers in relation to storing the crude oil in air tight containers or large barrels. Some learners gave disadvantages of crude oil and the fact that it or products obtained from it, might cause pollution when burnt.

Learners that did well on this question did so as they knew that crude oil is a non-renewable energy source and that it can be conserved by using other, alternative, energy sources. Learners that knew that alternative energy sources should be used, were often then able to discuss the disadvantages of using the alternative energy sources.

In this example, the learner has understood that crude oil is a non-renewable fuel and that we need to conserve it for use in the future. They go on to discuss an alternative to crude oil being wind power. The detail of the disadvantages of the alternative - that it is unsightly and noisy and only works when it's windy is then discussed. This learner has therefore covered all three areas of the question posed; this is worthy of credit in the distinction band for 6 marks.

---

There are methods available to conserve crude oil including the use of other energy sources.

Discuss the conservation of crude oil including in your answer

- why it is important to conserve crude oil
- methods to conserve crude oil
- the disadvantages of using these methods.

It is important to conserve crude oil because people are using excessive amounts. I know that due to the excessive amounts being used that it is slowly running out and in a couple of years or more it will all be gone as it is an example of a non-renewable energy source, so it is important to conserve it so there is some left for in the future if it is needed. A methods to conserve crude oil would be wind turbines. This is a good way as using wind is free and it will never run out as it is always there. But by using this it does hold disadvantages. One disadvantage is that it costs loads of money to build the wind turbines and also the ground that they are built on. Another disadvantage is that it depends on the weather so some days it may be windy and some not so on the days it is not windy not much energy will be generated. Another disadvantage would be that they are very large and ruin scenery and generate a lot of noise.

---

In this second example, the learner starts by stating that crude oil is very useful. As there is no qualification as to what very useful means this is not creditworthy. The learner then discusses the fact that the planet is running out of crude oil. This is essentially a repeat of the stem that 'there are limited supplies of crude oil' so, again, this is not worthy of credit. However, the learner does then start to describe 'methods of conserving crude oil' by listing wind, solar and hydroelectric power. 'The disadvantages of using the alternative methods' are then discussed in detail, talking about destruction of habitats and the fact that they have to be sited in remote, windy places and that they can be unsightly. There is no credit for references to cost of renewable sources. The learner has therefore discussed two areas of the question and is worthy of credit in the merit level – 3 marks.

- why it is important to conserve crude oil
- methods to conserve crude oil
- the disadvantages of using these methods.

It is important to conserve crude oil because it has lots of different uses and the planet is running low. Instead you could put up more wind turbines, more solar panels and build more dams with water turbines in. The disadvantage of ~~getting~~ putting more wind turbines up is that they are very expensive. They would also need to be put in remote, windy places. The disadvantage of putting more solar panels up is that they too are expensive and if it isn't sunny you have to rely on a tiny bit of stored energy. The disadvantage of building dams with water turbines is that it can ruin a wild life's habitat. It can be very expensive also. And it can also annoy the public for it may be loud or take away something which was once picturesque.

In this example, the learner has discussed 'why it is important to conserve oil' in some detail. When stating that crude oil is mainly used for fuel, whilst this is not totally correct, it is just about sufficient. The learner also understands that crude oil is a non-renewable fuel. The learner has made some references to pollution being a disadvantage of using crude oil, whilst this is correct science, it does not answer the question posed and so therefore is ignored. There is no discussion of any 'methods to conserve crude oil' or 'disadvantages to alternative methods' and so, as only one area has been discussed. The learner was awarded credit in the pass level. 2 Marks.

There are limited supplies of crude oil.

There are methods available to conserve crude oil including the use of other energy sources.

Discuss the conservation of crude oil including in your answer

- why it is important to conserve crude oil
- methods to conserve crude oil
- the disadvantages of using these methods.

Crude oil is very important because it is mainly used for fuel ~~and~~ and it can be used at Nuclear power plants. To conserve crude oil people should keep it at a certain temperature in a secure area. The disadvantages using these methods is that crude oil is not a renewable energy when you use it or is unstable. Also crude oil can cause a lot of damage to the environment and could cause pollution if it's not secure.

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