



# Examiners' Report/ Lead Examiner Feedback

November 2015

NQF BTEC Level 1/Level 2 Firsts in  
Applied Science

Unit 1: Principles in Science (20460E)

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## **Introduction**

This report has been written by the lead examiner for the BTEC Principles of Science unit. It is designed to help you understand how learners performed overall in the exam. For each question, there is a brief analysis of learner responses. You will also find example learner responses from Level 2 Pass and Distinction learners. We hope this will help you to prepare your learners for future examination series.

## Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	13	22	31	41

### Provisional qualification outcomes for BTEC First Level 1/Level 2 Award.

The provisional qualification outcomes for the BTEC Level 2 awards can be found below.

2013 – 2014	D*	D	M	P	L1	U
Claims: 52,247	0.45	1.38	13.39	71.90	96.21	100.00

These outcomes reflect the cumulative percentage of learners who have received each grade for the qualification this year.

These figures are provisional because we are expecting more learners to claim their overall qualification outcome over the coming weeks. We will publish updated qualification outcomes in due course.

Outcomes explained

An aggregate qualification grade is where all unit outcomes are joined together to give a final grade for the qualification. Full details on how the qualification grade has been calculated can be found here (page 30):

<http://www.edexcel.com/migrationdocuments/BTEC%20Firsts%20from%202012/BF029943-Specification-BTEC-Level-1-2-First-Award-Principles-of-Applied-Science.pdf>

2013 – 2014	D*	D	M	P	L1	U
Claims: 82,247	1.56	5.31	22.62	65.25	96.21	100.00

Number of claims released by August 2014

Eg: proportion of learners claimed & grades released achieving a merit or above 2014

We will be publishing full year qualification outcomes for BTEC in the autumn.

## **Overall comments**

Learners that did well this series, did so as they had learnt the key scientific terms from the specification and had used good scientific language. Learners seemed to have improved in their ability to complete calculations, however some still find it difficult to rearrange equations when necessary.

As in previous series, exam technique is still an issue for learners; centres need to prepare learners for the exam better by practicing exam technique, especially in relation to reading the question carefully, ensuring that they are answer the question set, not a question that they think is there.

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.

It was found, this series, that learners seemed to be able to complete some sections of the paper better than others, for example the first section on Chemistry was very well answered and then the second section on Biology, not so well answered.

## Feedback on Specific Questions.

Q1a.

Many learners found question 1a.iii difficult as they did not understand that the question was asking for the indicator that could be used to measure pH and so just gave an indicator such as litmus. Litmus was not accepted as it only tests between acid and alkali rather than giving a pH as requested by the question.

(iii) Give the name of the indicator that could be used to measure the pH of the acid. (1)

litmus paper

In some cases, learners gave the word 'indicator' or 'colour indicator' as in this example, which was insufficient for the mark.

(iii) Give the name of the indicator that could be used to measure the pH of the acid. (1)

A colour indicator

The better learners that had read and understood the question correctly stated 'universal indicator', which scored 1 mark.

(iii) Give the name of the indicator that could be used to measure the pH of the acid. (1)

Universal indicator

Q1aiv.

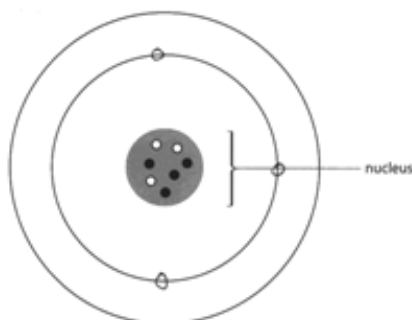
In part aiv of question 1, learners found it difficult to give the expected pH of an acid. Some gave a range which was accepted for the mark. However if this range included pH 7, the mark was not awarded.

(iv) Suggest a value for the pH of the acid. (1)

~~PH~~ ~~PH~~ ~~PH~~ PH1 - PH6

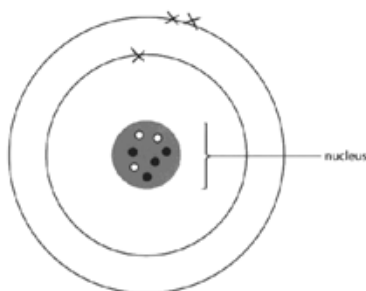
Q2.

Learners found question 2 difficult throughout. Although learners had been given the electronic configuration of the lithium atom, they often found it difficult to translate this to the diagram of the lithium atom. A common error seen was to place all three electrons in the first shell of the atom, as in this example, which scored no credit.



In some cases the learners did not show an understanding that the shells fill closest to the nucleus first and then outwards and so gave a configuration of 1.2 rather than 2.1.

The diagram shows the structure of a lithium atom.  
The diagram is not complete.



Q2b.

In part b, over half of all learners were unable to identify the correct number of protons in the atom, with many giving 4 as their answer rather than 3. In part C learners found it difficult to give the relative mass of the proton and relative charge of the neutron, with many leaving it blank.

Q2d.

In part d, learners found it very difficult to explain, in terms of electronic configuration, why lithium is placed in group 1. Some learners answered in terms of lithium being a metal so therefore on the left hand side, although many learners wrongly identified Lithium as a non-metal.

(d) Lithium is in group 1 of the periodic table.

Explain in terms of electronic configuration why lithium is in group 1.

(2)

Lithium is in group one because it is an metal and all metals are on the left side of the periodic table.

(Total for Question 2 = 6 marks)

(d) Lithium is in group 1 of the periodic table.

Explain in terms of electronic configuration why lithium is in group 1.

(2)

Because it has has 1 electron on the outer shell

(Total for Question 2 = 6 marks)

Often learners stated information that had already been given in the question, which did not gain credit.

Where learners understood that this question was about electronic configuration, they generally got both marks for a concise and to the point answer.

(d) Lithium is in group 1 of the periodic table.  
 Explain in terms of electronic configuration why lithium is in group 1. (2)

Because the electronic configuration for lithium is 2,1

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(Total for Question 2 = 6 marks)

### Q3ai

In question 3ai, it was disappointing to see that learners found it very difficult to give the test for hydrogen. The majority of learners did not read the question correctly and therefore gave a description of how the experiment could be carried out.

3 Magnesium reacts with sulfuric acid to produce magnesium sulfate and hydrogen gas.  
 (a) (i) Describe the test to show that the gas produced is hydrogen. (2)

Test You put magnesium into a bowl of beaker with sulfuric acid and wait for it to react.

Result When they react it turns into or produces magnesium sulfate and hydrogen gas.

Others attempted to write a word equation, writing the reactants for the test and the products for the result.

Where learners had read the question correctly, they often lost marks as they did not give the test and therefore could not score the mark for the result.

3 Magnesium reacts with sulfuric acid to produce magnesium sulfate and hydrogen gas.  
 (a) (i) Describe the test to show that the gas produced is hydrogen. (2)

Test Squeaky pop

Result IF there is hydrogen it will make a Squeaky pop.

3 Magnesium reacts with sulfuric acid to produce magnesium sulfate and hydrogen gas.  
 (a) (i) Describe the test to show that the gas produced is hydrogen. (2)

Test You place a lit splint inside the test tube containing Hydrogen.

Result If there is hydrogen present, a pop sound will be made.

Those that understood the question were able to give the correct test and result for hydrogen gas.



### Q3aii

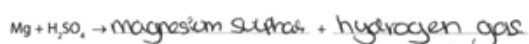
Learners found question 3aii very difficult, only the best were able to correctly complete the balanced equation to score both marks.

(ii) Complete the balanced symbol equation for this reaction. (2)



Some learners tried to complete the balanced equation with words, which was not acceptable and scored no marks.

(ii) Complete the balanced symbol equation for this reaction. (2)



### Q3b.

Many learners attempted question 3b, however many used common knowledge rather than their scientific knowledge of facts to answer the question. Those learners that used and applied their scientific knowledge done well in this question. As in this example, here the learner shows an understanding that indigestion occurs when too much acid is present in the stomach. They have recalled that calcium carbonate is a base and that therefore this will neutralise the excess acid in the stomach. The learner has then gone to give the generic equation for an acid reacting with a metal carbonate followed by a specific equation of calcium carbonate with an acid. Whilst the learner has incorrectly given sulfuric acid rather than hydrochloric acid as the acid present in the stomach, this was ignored.

You may include appropriate word or symbol equations to support your answer. (4)

your stomach produces hydrochloric acid which helps to digest your food. if there is too much acid is produced it will cause an indigestion. so, calcium carbonate is a base to neutralise the <sup>excess</sup> acid in the stomach.

Acid + metal carbonate  $\rightarrow$  Salt + Carbon dioxide + water

sulfuric acid + calcium carbonate  $\rightarrow$  calcium sulfate + carbon dioxide + water

(Total for Question 3 = 8 marks)

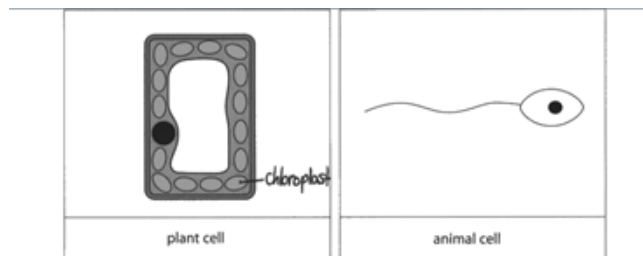
Many learners re-stated that the calcium carbonate can reduce acid in the stomach, which was simply a repeat of the stem of the question and not worthy of credit. A common misconception was that the pH decreased.

(b) Calcium carbonate is an ingredient in indigestion remedies.  
 Explain how calcium carbonate can help reduce acid indigestion in the stomach.  
 You may include appropriate word or symbol equations to support your answer. (4)

Calcium can help reduce  
 acid in the stomach by  
 lowering the acid and putting  
 the pH down

Q4ai

In question 4ai, the majority of learners were able to recognise a component of a cell that is in both plant and animal cells, with many naming the nucleus and some naming the cell membrane or cytoplasm.



(a) (i) Name one cell component that is in both plant and animal cells. (1)

Nucleus

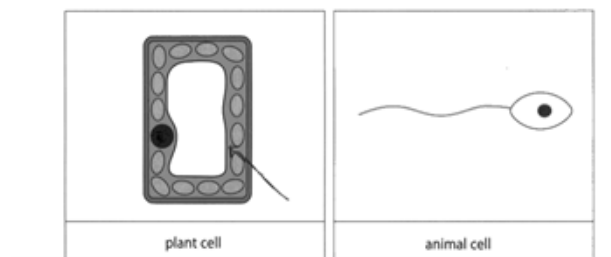
Q4aii

In part 4aii, the majority of candidates were able to label a chloroplast, although in some cases learners lost marks as they did not carefully label the chloroplast and ended up labelling the cytoplasm rather than the chloroplast and so scored no credit.

SECTION B: Biology

Answer ALL questions

4 The table shows two different types of cell.



Q4aiii

Learners found question 4 part aiii much more difficult. Only the best learners were able to give a complete description, which included the idea that the function of a chloroplast was to absorb light energy for photosynthesis.

(iii) The plant cell shown in the table is from the surface of a leaf.

Describe the function of a chloroplast.

(2)

Chloroplast contains a green pigment called chlorophyll which absorb light energy from the sun for photosynthesis to take place.

Many learners however, showed an understanding that chloroplasts are involved with photosynthesis and scored 1 mark.

(iii) The plant cell shown in the table is from the surface of a leaf.

Describe the function of a chloroplast.

Photosynthesis. (2)

Function of chloroplast is photosynthesis

In some cases learners did not read the question carefully and gave the function of cytoplasm rather than the function of a chloroplast and so did not gain credit.

(iii) The plant cell shown in the table is from the surface of a leaf.

Describe the function of a chloroplast.


(2)

to I where chemical reactions happen.

Q4b.

Learners also found explaining an answer in part 4b quite difficult. Only the better learners were able to explain how the red blood cells are adapted for their function of carrying oxygen. In cases where the learner had sound understanding, they generally answered in a concise manner and scored both marks available, as in this case below.

(b) The diagram shows some red blood cells.




Red blood cells carry oxygen around the body.  
Explain how red blood cells are adapted for their function. (2)

*It has a large surface area to carry more oxygen.*

It was the case that many learners were able to give adaptations of the red blood cells and in many cases, gave more than one. However learners were generally not able to complete this by giving the reason for the lack of nucleus or large surface area, being that the cell could hold or take up more oxygen.

(b) The diagram shows some red blood cells.




Red blood cells carry oxygen around the body.  
Explain how red blood cells are adapted for their function. (2)

*it adapts by having a large surface area and has no nucleus.*

Many learners lost marks as they simply repeated the stem of the question which could not score credit.

(b) The diagram shows some red blood cells.



Red blood cells carry oxygen around the body.  
Explain how red blood cells are adapted for their function. (2)

*Red blood cells adapted to their function by moving and carry oxygen around the body.*

Q5a.

Question 5a was not answered well by the majority of learners. Only the best candidates were able to state the term used to maintain a constant internal environment in the body as homeostasis.

5 The human body maintains a constant internal environment.  
(a) State the term used to describe this process. (1)

~~Homeostasis~~ Homeostasis

Many learners left this blank or answered a different question and gave a condition in the human body that is controlled in the body by homeostasis.

5 The human body maintains a constant internal environment.  
(a) State the term used to describe this process. (1)

Body temperature

Q5b.

Learners found question 5b easier however and most were able to give the brain as the other part of the central nervous system.

(b) The spinal cord is one part of the central nervous system.  
Give the other part of the central nervous system. (1)

brain

Again, those learners that did not do well on this question, did so as they answered a different question and gave the name of another hormone system rather than another part of the central nervous system.

(b) The spinal cord is one part of the central nervous system.  
Give the other part of the central nervous system. (1)

hormone system.

Q5d.

Learners found question 5d quite difficult, with very few learners being able to correctly explain how raised hair on the skin help to keep the internal temperature of the body at 37°C. Some were able to score one mark for correctly stating that the hairs trapped air.

(d) The human body works to keep a constant internal temperature of 37°C.  
Explain how raised hairs on the skin help to keep the internal temperature of the body at 37°C. (2)

raised hair on the ~~skin~~<sup>skin</sup> help  
the internal temperature of the body  
by trapping hot air so you  
to be warm.

(Total for Question 5 = 6 marks)

Some could state that the raised hairs prevented heat loss, but few were able to put these two ideas together to give a correct explanation.

(d) The human body works to keep a constant internal temperature of 37°C.  
Explain how raised hairs on the skin help to keep the internal temperature of the body at 37°C. (2)

The hairs on your body raise when you are  
cold, this helps to prevent heat loss.

(Total for Question 5 = 6 marks)

In some cases, learners incorrectly thought that the raised hairs stopped heat from being released from the body altogether.

(d) The human body works to keep a constant internal temperature of 37°C.  
Explain how raised hairs on the skin help to keep the internal temperature of the body at 37°C. (2)

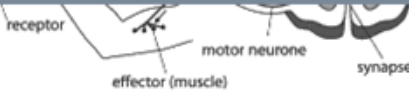
When the hairs are raised ~~on~~  
the skin, it keeps the heat inside the  
body and doesn't allow any of  
the heat to be lost from the body.

(Total for Question 5 = 6 marks)

Q6.

Question 6 was the first of the two longer answer six mark questions with a mark based mark scheme. Although the majority of learners made an attempt at this question, often they found it very difficult and the majority simply described the diagram rather than explaining how the reflex arc allowed the body to respond quickly.

In this example, the learner has understood what was required from the question and has tried to explain how the reflex arc allows the body to react very quickly. The learner states that electrical impulses move via the motor neuron and that this is fast. They also state that the information does not travel to the brain.



Explain how the reflex arc allows the body to respond quickly in order to keep the body from harm. <sup>(6)</sup>

The reflex arc allows the body to respond quickly because the electrical ~~no signal~~ signal what tells what the body to do doesn't go to the brain it travels to the synapse what give a short burst of energy of electrical ~~no~~ impulses to the motor neurone then to the effectors and back to the receptors. This reaction is fast that the body will act with out thinking because the information didn't travel to his brain, the reflex arc keeps the body from harm from moving away quickly.

(Total for Question 6 = 6 marks)

Q7a.

Question 7a was well answered, with many learners being able to give a renewable energy source.

SECTION C – Physics

7 Natural gas can be used to generate electricity in a power station.

In the power station natural gas is burned to heat water to produce steam.

The steam passes into a turbine.

This makes the blades in the turbine spin.

(a) Natural gas is a non-renewable energy source.

State a renewable energy source.

(1)

hydroelectricity

Q7b.

Question 7b, was answered less well. Some learners gave other energy sources rather than the type of energy stored. In some cases learners gave different types of energy.

(b) Give the type of energy stored in natural gas. (1)

nuclear

(b) Give the type of energy stored in natural gas. (1)

kinetic

Only the best learners could give chemical energy as the type of energy stored in natural gas.

(b) Give the type of energy stored in natural gas. (1)

Chemical

Learners found it hard to give a form of energy wasted energy when natural gas is burned in question 7c, with the majority thinking that heat energy was wasted

(c) Give a form of wasted energy released when natural gas is burned. (1)

Heat

In some cases learners gave two answers, one correct and one incorrect, in these cases credit cannot be awarded for the correct answer. Learners should be taught not to give more than one answer when just one is required.

(c) Give a form of wasted energy released when natural gas is burned. (1)

light and Heat



Q7d.

In question 7d, many learners linked the word turbine with wind turbines, rather than the turbine described in the question and therefore gave the answer as wind, rather than kinetic.

(d) Name the form of energy produced by the blades in the turbine.

(1)

wind

(Total for Question 7 = 4 marks)

Better learners read the question carefully and gave the correct answer of kinetic energy.

(d) Name the form of energy produced by the blades in the turbine.

(1)

~~kinetic~~. Kinetic energy.

(Total for Question 7 = 4 marks)

Q8a.

In question 8a many learners related to the context in the question and were able to give two types of useful energy produced by a mobile phone.

8 Energy stored in a mobile phone battery can be transferred into useful energy.



(a) Give **two** types of useful energy produced by a mobile phone.

(2)

1

sound energy

2

kinetic energy

Q8b.

The first calculation in question 8b was well answered by learners with many learners scoring full credit for being able to correctly calculate the energy used by the phone charger in one minute.

(b) The mobile phone charger uses 5 W of power.

Calculate the amount of energy the phone charger uses in one minute.

$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (secs)}} \quad \frac{300}{60} = 5$$

Show your working.  $5 \times 60 = 300$

(2)

300

In some cases learners did show a correct answer within their working, however they also gave other combinations of answers also and so could not gain credit.

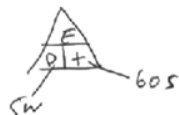
(b) The mobile phone charger uses 5 W of power.

Calculate the amount of energy the phone charger uses in one minute.

$$\text{power (watts)} = \frac{\text{energy (joules)}}{\text{time (secs)}} \quad 15 \cdot \quad 1 \times 60 = 60$$

Show your working.

(2)



$$5 \times 60 = 300$$

$$\frac{5}{60}$$

$$\frac{300}{60} = 5 \text{ J}$$

$$\frac{60}{5} = 12$$

Although some learners were unable to fully complete the calculation, credit could be awarded for working shown. In this example, the learner scored one mark for being able to substitute the correct values into the equation. It is therefore very important that learners are taught to show all working so that credit can be awarded where necessary.

(b) The mobile phone charger uses 5 W of power.

Calculate the amount of energy the phone charger uses in one minute.

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

Show your working.

(2)

$$5 \text{ (watts)} = \overline{60 \text{ seconds}}$$

Q8c.

The second calculation in question 8 part c was not as well completed, however it was pleasing to see that many learners were able to show an understanding of standard form to gain one mark.

(c) Mobile phones use microwave radiation to receive signals.

This microwave radiation has a wave speed of 300 000 000 m/s and a frequency of  $8.8 \times 10^8$  Hz.

Calculate the wavelength of the microwave radiation.

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

Show your working.

Give your answer in standard form.

(4)

$$300\ 000\ 000 =$$

$$8.8 \times 10^8 \text{ Hz} = 880000000$$

$$\underline{880000000} \text{ m}$$

The best learners were able to rearrange the equation, substitute into the equation, evaluate and write their answer in standard form to gain full marks.

(c) Mobile phones use microwave radiation to receive signals.

This microwave radiation has a wave speed of 300 000 000 m/s and a frequency of  $8.8 \times 10^8$  Hz.

Calculate the wavelength of the microwave radiation.

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

Show your working.

Give your answer in standard form.

(4)

$$\begin{array}{c} \text{wave speed (m/s)} \\ \text{wavelength (m)} \times \text{frequency (Hz)} \end{array}$$

$$8.8 \times 10^8 = 880000000$$

$$300,000,000 \div 880,000,000 = 0.3409$$

$$\cancel{8.8} \text{ standard form} = \boxed{3.4 \times 10^{-1}}$$

$$\underline{3.4 \times 10^{-1}} \text{ m}$$

Some learners were able to rearrange, substitute and evaluate, but did not give their answer in standard form, so gained 3 rather than the 4 marks available.

This microwave radiation has a wave speed of 300 000 000 m/s and a frequency of  $8.8 \times 10^8$  Hz.

Calculate the wavelength of the microwave radiation.

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

Show your working.

Give your answer in standard form. (4)

$$\text{Wavelength} = \frac{\text{wave speed}}{\text{frequency}}$$

$$Wl = \frac{300\,000\,000}{8.8 \times 10^8}$$

Wavelength = 0.3409

~~3.409~~ ~~3.409~~ m

(Total for Question 8 = 8 marks)

Q9.

The majority of learners made a good attempt at question 9. At pass level, learners were able to give an advantage and a disadvantage. Most showed an understanding that gamma rays can ‘kill cancer cells’, but at the same time can damage surrounding cells and tissue, as in this example.

9 Discuss the advantages and disadvantages of using gamma rays in the detection and treatment of cancer. (6)

The advantages are that it kills most if not all of the cancer cells however a disadvantage would be that it could damage the skin by burning it

At merit level learners were able discuss advantages and disadvantages of using gamma rays and at distinction level more detail was given about these advantages and disadvantages.

9 Discuss the advantages and disadvantages of using gamma rays in the detection and treatment of cancer. (6) 5 Q09

~~Advantages~~  
Gamma rays are excellent at detecting and destroying cancerous cells. ~~When~~ If they are concentrated onto the area with cancerous tissue they break down the cells to remove the cancer. However, the radiation can also cause cancer, by damaging healthy living cells. This damage can cause the cell to replicate uncontrollably, creating a cancerous growth, so gamma ~~radiation~~ rays must be used carefully.

(Total for Question 9 = 6 marks) 5

In many cases learners repeated the stem of the question in their question, which is not worthy of credit. In this example, the learner gives an advantage that "it can detect cancer". This in the stem of the question so did not gain credit. The learner does however state that the treatment can cause hair loss and make you become very ill. These are both side effects, but under the same indicative point, the learner scored 1 mark.

9 Discuss the advantages and disadvantages of using gamma rays in the detection and treatment of cancer. (6)

Gamma Rays are very strong which would mean it does have disadvantages and advantages. An advantage is that it can detect cancer and sometimes treat it but it causes radiation. So when getting treated for cancer it causes hair loss and to become very ill.

In many cases learners repeated the stem of the question in their question, which is not worthy of credit. In this example, the learner gives an advantage that "it can detect cancer". This in the stem of the question so did not gain credit. The learner does however state that the treatment can cause hair loss and make you become very ill. These are both side effects, but under the same indicative point, the learner scored 1 mark.

9 Discuss the advantages and disadvantages of using gamma rays in the detection and treatment of cancer. (6)

The advantages of using gamma rays is if cancer were and you want have cancer, it's easy to use.

The disadvantages are it may not work. It's expensive also you could become worse after the treatment.

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