

Examiners' Report  
June 2012

GCE Biology 6BI05 01

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## **Introduction**

This paper offered a variety of opportunities for candidates to display their knowledge, understanding and ability to apply these in new situations. It was gratifying to see candidates presenting some most encouraging responses and demonstrating a thorough appreciation of the subject matter. Credit must go to both the candidates and their teachers for this.

Whilst all questions elicited the full mark range, it was pleasing to see that the number of candidate answers remaining ambiguous or insufficiently clear to award marks continues to decrease.

## Question 2 (a) (i)

Whilst most candidates appreciated that this question was asking about the term human genome and offered answers that appropriately referred to all the genes, some gave an explanation of the human genome project.

This is a typical correct example.

- 2 The Human Genome Project is helping in the design of new drugs to treat a variety of human diseases and in the development of synthetic tissues.
- (a) (i) Explain the meaning of the term **Human Genome**. (1)
- All the genes in a human organism.



**ResultsPlus**

**Examiner Comments**

In this response, the candidate has focused on the individual rather than the whole species which was acceptable.

## Question 2 (a) (ii)

A sizeable percentage of candidates supplied a creditworthy answer to this question about the ethical implications relating to the knowledge gained from the analysis of the human genome.

This was a clear and detailed answer which was awarded the mark.

- (ii) Describe **one** ethical implication associated with the use of information obtained from the analysis of the human genome. (1)

It could be used by insurance companies to unfairly discriminate against people with a genetic predisposition to a certain trait or disease.



**ResultsPlus**

**Examiner Comments**

This response focused on marking point 1 which was the most common ethical implication given by candidates. Marking point 3 was the second most frequently given answer.

## Question 2 (b) (i)

Most candidates displayed a sufficient appreciation of the Human Genome Project to offer either marking points 1 or 2.

This is an example of a good answer that achieved full marks.

(b) Melanoma is an aggressive form of skin cancer.

Very few patients with this cancer survive for more than five years. Some melanomas are associated with a genetic mutation identified by the Human Genome Project.

Drug R (R05185426) has been developed to treat patients with these melanomas. In clinical trials, drug R has been shown to cause a 50% shrinkage of melanomas in only a few months.

(i) Suggest how work on the Human Genome Project helped in the development of drug R.

(3)

It may identify the gene responsible for causing the Melanoma and therefore a drug could be created to target that specific gene. The location of the gene would allow a drug to be designed to alter the way the gene worked or reduce its expression. This would prevent the tumor from increasing in ~~size~~ size.



### ResultsPlus Examiner Comments

The reference to gene, rather than allele, responsible for causing the melanoma was acceptable as an alternative for marking point 1.

Marking point 2 was also achieved in the same sentence and marking point 3 in the subsequent sentence.

## Question 2 (b) (ii)

A variety of approaches were taken by candidates for this question.

Candidates who focused on the how drug R may have interacted with the cells of the melanoma or the aberrant allele tended to score more highly than those who gave a general account.

Whilst this example makes reference to cells, it does not offer suggestions as to how the drug may reduce melanoma size.

(ii) Suggest how drug R may have caused the melanoma to shrink in only a **few months**.

(4)

Using the <sup>human</sup> genome project to build a better understanding of the cancerous cells and the type of binding sites on their membrane surface, a drug that has ~~the~~ just the right binding site for the cancerous cells can be formulated. This makes the drug more effective and results will be seen in a short period.



**ResultsPlus**  
Examiner Comments

No marks could be awarded for this response.

## Question 2 (b) (iii)

Most candidates handled this question with confidence, gaining both marks.

A comprehensive answer that covers several marking points.

(iii) Drug R needs one more round of testing, in a phase III trial, before it can be approved for use.

Explain what is meant by a **phase III trial**.

(2)

A large sample of over a thousand patients are given the drug <sup>or</sup> a placebo using a double blind trial. Results are then taken to see how effective it is allowing it to be approved by the scientific world and produced commercially



**ResultsPlus**

**Examiner Comments**

This candidate response gained marking points 2, 4 and 3 in the first sentence.



**ResultsPlus**

**Examiner Tip**

Always be as precise as you can in an answer. Marking point 2 needs to refer to both large numbers and patients, not just people or volunteers.

## Question 2 (c)

This question focused on why the synthetic corneas were not rejected.

Whilst some candidates offered thorough and detailed responses, a number focused on the yeast cell and felt that the cornea was made of these cells. The example below offers another commonly seen view.

This response focuses on the presence of human DNA being the reason for non rejection. It was not infrequent for candidates to state that the corneas were made of DNA.

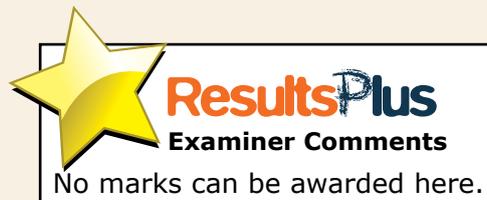
(c) Yeast cells were genetically modified, using human DNA, to produce collagen.  
This collagen can be used to make synthetic corneas.

Ten patients who were blind were each given a synthetic cornea. They were all able to see with no reported complications due to tissue rejection.

Suggest why these synthetic corneas were not rejected.

(2)

Human DNA was used so the body  
did not assume it was foreign  
and try to attack it.



### Question 3 (a) (i)

Most candidates appreciated the need to place the group Q rats in the same cage for four hours as happened to the rats of group P, hence one mark was the most common score.

In this response neither sentence could be credited for marking point 2.

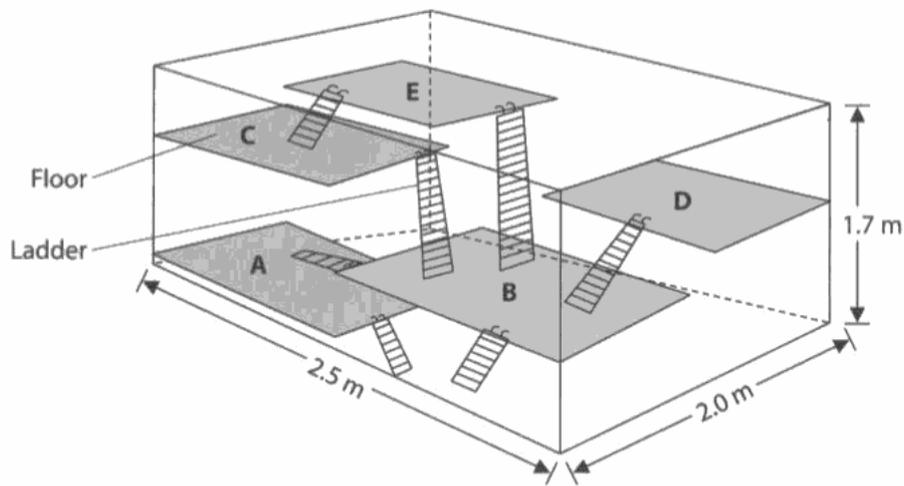
- 3 (a) An investigation was carried out to study the ability of rats to learn. A number of rats were divided into two groups, P and Q.

The rats in group P were deprived of food for twenty hours and then released into a cage. The cage contained hidden food and the rats were left in this cage for four hours each day.

This was repeated each day for fourteen days.

The diagram below shows the cage.

In the cage, the floors A, B, C, D and E had hidden food, water, wooden blocks, freshly cut wood chips, branches, fresh leaves, plastic containers and paper bags.



- (i) The rats in group Q were used as a control.  
Describe how the rats in control group Q would have been treated.

(2)

Rats in group Q would not have been deprived of food at any time. Kept in a cage full of food.



### Question 3 (a) (ii)

The majority of candidates recognised the function of food deprivation.

This answer succinctly states the rats hunger and their searching for food response.

(ii) Explain why the rats were not fed for twenty hours each day.

(1)

So that when they are in the cage they will be hungry  
and so will look for the hidden food.



The mark was awarded.

### Question 3 (b)

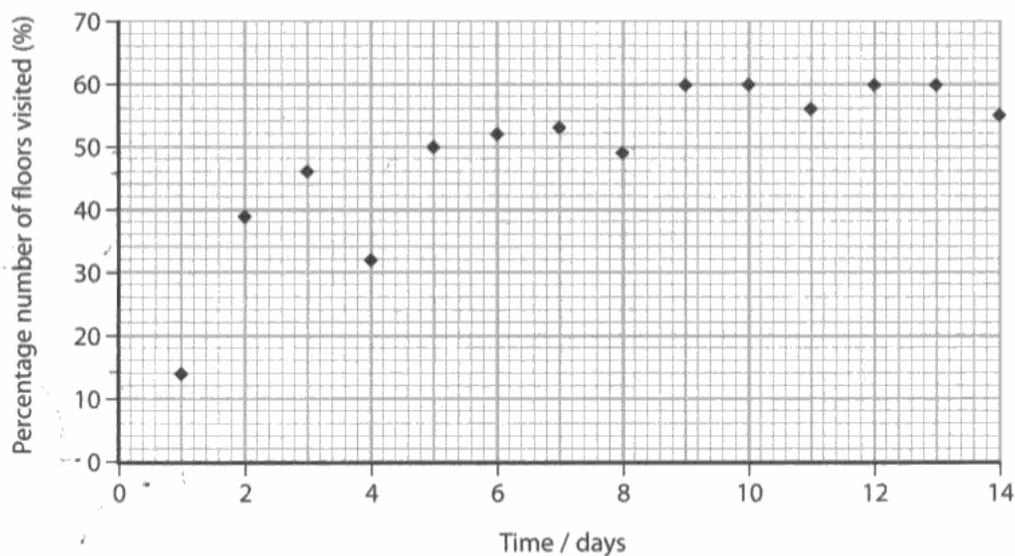
Whilst there were some irregularities in the data relating to the percentage of floors visited by group P rats over the study period, most candidates were able to successfully describe the overall trend.

It was pleasing to see a number of candidates manipulating the data such as a x3.9 increase in number of floors visited over the 14 days. The example below illustrates another example of correct data manipulation.

This answer offers a common alternative manipulation of the data.

(b) During each four-hour period in the cage, the number of floors visited by the rats in group P was recorded as a percentage of the total number of floors.

The graph below shows the results of this experiment.



Using the information in the graph, describe the behaviour of the rats in group P over the fourteen-day period during this investigation.

(3)

As the days increase the % number of floors visited gradually increases. There is a decrease in the % number of floors visited on day 4 at only 32% compared to the previous day 46% which is a difference of 14%. After day 4 the results then increase to around 50% and above



**ResultsPlus**  
Examiner Comments

Full marks awarded for this response.



**ResultsPlus**  
Examiner Tip

Look to manipulate the data rather than repeat the data already given.

### Question 3 (c)

The majority of candidates successfully gained mark point 4 but it was less common to see other points being offered. Of those that did, the most frequent was marking point 2.

This is a fairly typical example of a one mark candidate response.

(c) In a second experiment, the two groups of rats were placed in a maze containing hidden food.

The percentage of rats from each group that found the food in a short period of time was recorded.

The results are shown in the table below.

Group	Percentage of rats finding food (%)
P	85
Q	0

Explain the effect of the first experiment on the ability of rats to find food in a short period of time.

(2)

As shown of the previous graph and data collected, there is evidence to suggest that the rats in group P had learnt how to hunt and look for food. Therefore, this suggests that this skill learnt in experiment 1 had a big impact of the rats ability to find food in a short period of time ~~was~~ in experiment 2.



**ResultsPlus**  
Examiner Comments

Marking point 4 can be given towards the end of the first sentence. However, much of the second sentence repeats the stem of the question.

### Question 3 (d)

This question item focused on spinal density and most candidates recognised that group P rats had a higher number of synapses per neurone. An encouraging number were able to gain two marks with both marking points 2 and 3 seen.

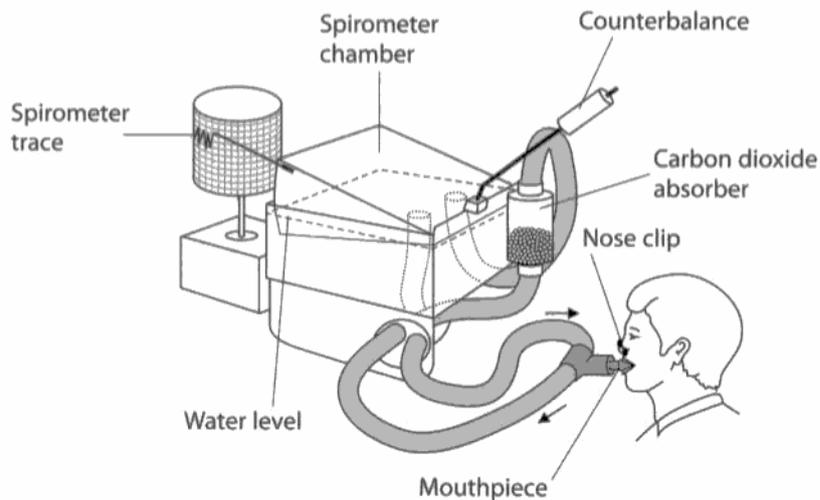
## Question 4 (a)

This QWC question item dealt with the use of spirometer traces.

A variety of answers were seen along with a range of marks. Some candidates gave thorough answers but a number restricted their responses to a general definition of tidal volume or/and breathing rate rather than explaining how the traces from the spirometer could be used.

This candidate has given a response that suitably explains how a spirometer trace can be used to establish the tidal volume (in the second sentence) and the breathing rate (in the third sentence).

The diagram below shows a spirometer.



Explain how you would use the traces from this spirometer to compare the tidal volumes and breathing rates of male and female human subjects.

(6)

~~The tidal volume can be measured by~~ Two spirometer traces can be produced: one for male and one for female. The tidal volume of each subject can be ~~measured~~ measured by measuring the distance between a peak and a trough. The breathing rates can be measured by counting the number of peaks in a minute. The two values can then be compared.



**ResultsPlus**  
Examiner Comments

Two marks awarded, marking points 3 and 5.

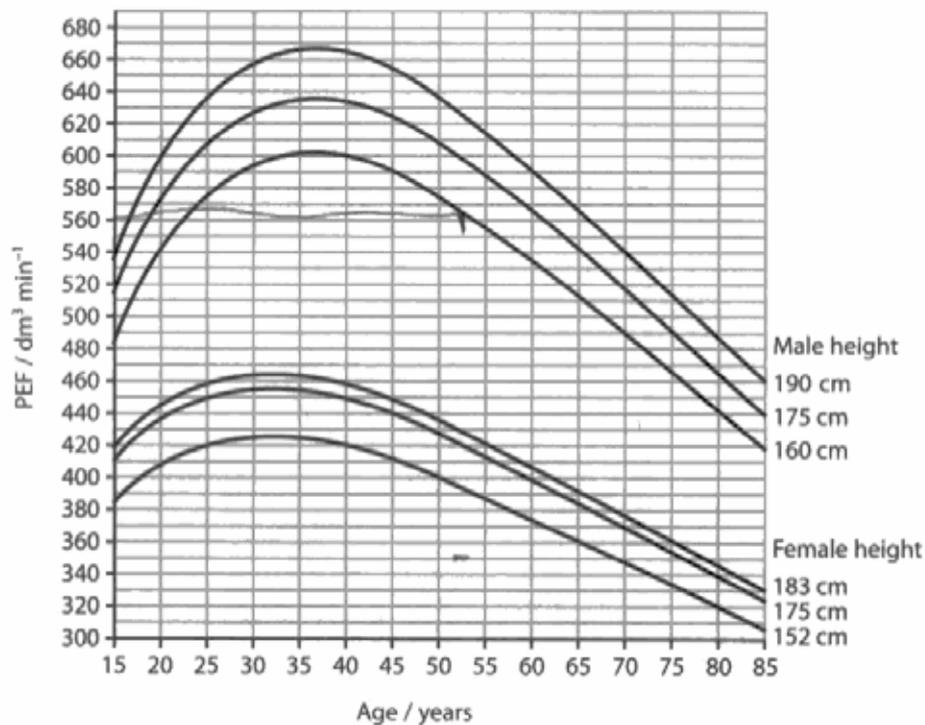
### Question 4 (b) (i)

It was encouraging to see a number of excellent answers to this graphical question. However, it was relatively rare to see examples with correct data manipulation. Some candidates limited themselves to just describing the general trend.

This candidate has correctly identified the age of the maximum PEF for females and males as well as describing the overall trend of the data.

(b) The peak expiratory flow (PEF) is a measure of how fast a person can breathe out. This can indicate any obstruction in the airways of the lungs. It is measured using a peak flow meter.

The graph below shows the expected PEF values for people aged 15 to 85 years of various heights.



(i) Using the information in the graph, describe the effect of age on PEF. (4)

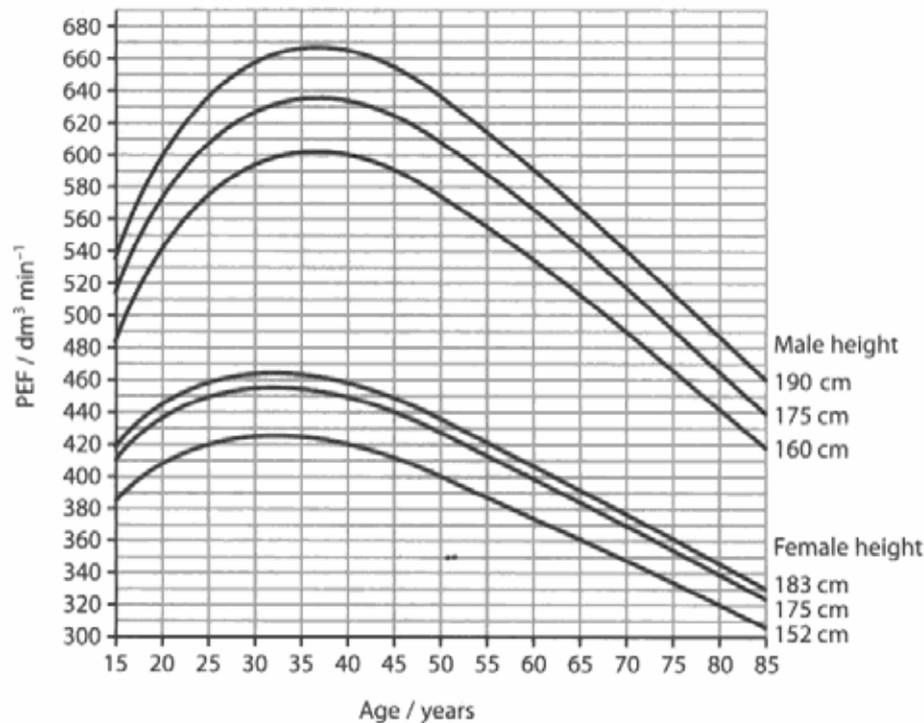
Between 15 and 35 you're still <sup>developing</sup> ~~growing~~ so muscles, so ~~your~~ your PEF increases as you can force air out faster. ~~PE~~ It peaks for <sup>males</sup> ~~males~~ at around ~~40~~ 37 years. And levels at 32 years. ~~Male~~ Males PEF decreases after 37 rapidly, ~~is shown~~ shown by steep gradient. Females have shallower gradient. A male at 160cm still has greater PEF than female taller than ~~the~~ 160cm.



**ResultsPlus**  
Examiner Comments

3 marks given, as marking points 1, 2 and 3.

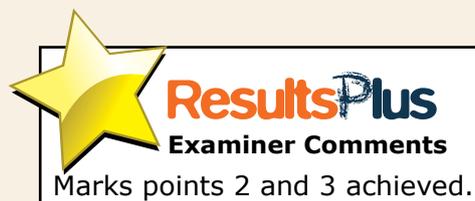
This candidate has successfully identified an appropriate age for the maximum PEF for both females and males.



(i) Using the information in the graph, describe the effect of age on PEF.

(4)

- For men after the age of about 38 the PEF value starts decreasing.
- For women after the age of about 33 the PEF value starts decreasing.
- At 15 years the PEF is only between 385-419 and 483-537.
- 38 is the peak PEF value for men and 33 is the peak PEF value for women.



### Question 4 (b) (ii)

This question considered a reason why the PEF changes between the ages of 35 and 85. A number of general answers were seen but both weakening of muscles and loss of elasticity of lungs were supplied by candidates as displayed below.

A clear answer to this question.

- (ii) Using the information in the graph, give one reason for the difference in PEF values between ages 35 years and 85 years.

(1)

There is a continuous fall in PEF between 35 years and 85 years possibly due to weaker intercostal and diaphragm muscles as age increases.



### Question 4 (b) (iii)

The majority of candidates were able to use the information from the graph effectively to score both marks. One approach is illustrated below.

This candidate took another appropriate approach to marking point 1.

- (iii) If a person with asthma has a PEF 30% below the expected value, it may indicate that their asthma is not under control.

A 52-year old man with asthma has a PEF reading of  $350 \text{ dm}^3 \text{ min}^{-1}$ .

Using the information in the graph, state whether or not his asthma is being kept under control. Give a reason for your answer.

(2)

$350 - 61\%$   $100 - 61 = 39$   
~~670~~ Depends on his height also but  
570 even for the lowest measurement of  
160 cm his PEF is 39% below the  
expected value indicating asthma so it  
is not being kept under control.



### Question 4 (b) (iv)

Most candidates recognised the importance of knowing the person's height for making an accurate asthma diagnosis.

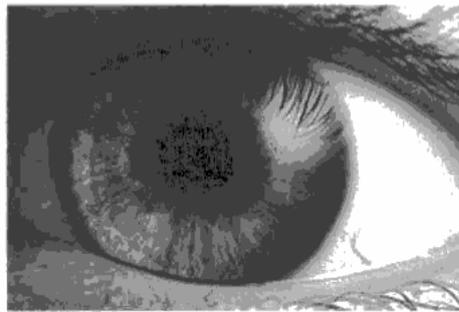
### Question 5 (a) (i)

This question considered why the pupil of the eye appears black.

Whilst a number of candidates gained the mark, it was not uncommon for candidates to feel that the pupil reflected all the light or that it comprised of rods (and cones). Another common response is shown in the example below.

This answer focused on the size of the pupil.

- 5 (a) The picture below shows the human eye with the black pupil in the centre. The pupil can change size to allow either more or less light into the eye. Its size is controlled by the iris muscles surrounding it.



Magnification  $\times 2$

- (i) Suggest why the pupil appears black.

(1)

It is dilated to allow more light into the eye.



### Question 5 (a) (ii)

Candidates generally handled this question about why the radial and circular muscles need to be antagonistic in a confident manner.

This candidate has supplied a detailed answer that achieved all three marks.

- (ii) There are two sets of iris muscles, the radial muscles and the circular muscles. They work antagonistically to alter the size of the pupil.

Explain why these two sets of muscles need to be antagonistic.

(3)

Circular muscles contract to constrict the pupil and let less light in. whereas radial muscles contract to dilate the pupil and allow more light to enter the eye. They need to be antagonistic because muscles can only pull, they only work in one direction. If they weren't antagonistic there could be no control of movement. As one contracts the other relaxes. It allows them to work against each other and obtain precise movements.



**ResultsPlus**

**Examiner Comments**

Marking points 1 and 2 are offered in the first sentence and marking point 4 in the second sentence.

### Question 5 (a) (iii)

This question required candidates to explain how the neurones are involved in enabling the pupil diameter to increase in dim light.

Candidates generally dealt with this question effectively and the most common score gained was the maximum of three.

This logical answer correctly offers marking points 2, 4 and then 6.

(iii) The pupil increases in diameter in dim light.  
Explain how neurones enable this response to occur.

*rhodopsin!*

(3)

Light enters the eye through the pupil and hits the photoreceptors found on the retina. These photoreceptors send impulses via bipolar cells to the optic nerve. The optic nerve sends impulses via the ~~sympathetic~~ to the brain. The brain sends impulses via the sympathetic nervous system to the iris muscles, causing the radial muscles to contract and the circular muscles to relax. This increases the diameter of the pupil. Rhodopsin is the pig photoreceptor pigment in dim-light.



## Question 5 (b)

This suggest question dealt with tropicamide, a drug found in eye drops.

Most candidates delivered creditworthy suggestions, with two marks being the most regularly achieved score.

In this example the candidate has given a good description relating to pupil diameter and the marks awarded here were the two most frequently given.

(b) Tropicamide is a drug used in eye drops.

Tropicamide has an effect on the diameter of the pupil in the eye.

This makes it easier for the doctor to examine the retina or lens in the eye of a patient.

Suggest how tropicamide in the eye drops makes it easier to examine the retina.

(3)

Tropicamide may stimulate contraction of the radial muscles so that the size of the pupil increases. In order to examine the retina doctors must look into the eye through the pupil. The wider the doctors can get the pupil, the easier it will be to look into the eye and so examine the retina.



### ResultsPlus Examiner Comments

The two marks achieved were marking points 2 and 4.

The reference to easier to see into the eye to observe the retina towards the end of the answer is essentially a repeat of the question stem. This is not marking point 6.



### ResultsPlus Examiner Tip

Be careful not to just repeat what is given in the question.

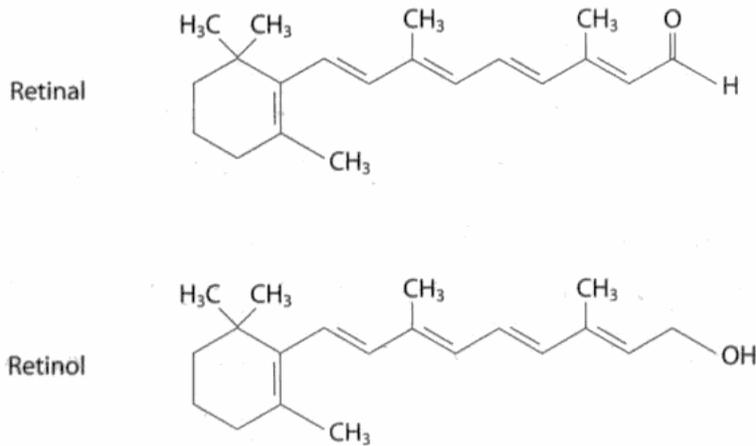
### Question 5 (c)

This suggest question presented candidates with two diagrams, one showing the structure of retinol and the other showing retinal.

Many candidates were able to take this question in their stride and a majority gained two or more marks.

The candidate correctly recognised the similarity between the two given molecules.

(c) The diagrams below show the structure of two molecules, retinal and retinol.



Retinol is the most common form of dietary vitamin A and retinal is part of the structure of rhodopsin.

Suggest how a deficiency of vitamin A would adversely affect a person's vision.

(3)

Rhodopsin is the usual pigment, used for black and white vision.

Retinol has ~~the~~ a similar structure to retinal

Rhodopsin is bleached to split into retinal and opsin

~~Transmit~~ Retinal is used to send impulses through the brain via optic nerve, through depolarisation of bipolar neurone

Person would not be able to see in the light, blurred vision

(Total for Question 5 = 13 marks)



**ResultsPlus**  
Examiner Comments

Marking point 1 was the mark awarded here.

## Question 6

The first question was correctly answered by many candidates.

Whilst many candidates correctly tackled the second question, it was the least often achieved of the four components.

The third question was the one most regularly correctly identified by candidates.

The fourth question was also tackled effectively by the majority of candidates.

## Question 7 (a)

Very few candidates offered an answer that was not worthy of credit. Indeed, the majority gained both marks.

This answer not only offers marking point 2, but also the reference to figures for the NHS was considered a suitable alternative for marking point 3.

7 The scientific article you have studied is adapted from articles in *The Biologist*. Use the information from the article and your own knowledge to answer the following questions.

(a) Explain why obesity is 'a big problem' for society (paragraph 2).

(2)

Obesity increases the risk of cardiovascular disease and diabetes among other health problems which costs the NHS £4.2 billion a year.



## Question 7 (b)

The majority of candidates were able to successfully describe the structure of a triglyceride as illustrated in the example below.

A short but accurate answer that elicited marking points 1 and 2.

(b) Describe the structure of triglyceride fat found in white adipose tissue (WAT). (2)

A glycerol molecule joined with three fatty acids.



**ResultsPlus**  
Examiner Comments

Both marks achieved.



**ResultsPlus**  
Examiner Tip

As illustrated here, candidates do not need to necessarily fill up all the lined space available to them to achieve the marks.

## Question 7 (c)

A number of candidates were able to offer a creditworthy answer to this calculation question.

A clear answer that gained both marks.

(c) Calculate the percentage increase in deaths for young girls with anorexia (paragraph 6). (2)

$$\begin{aligned}80 \times 0.10 &= 8 \\80 \times 0.20 &= 16 \\&= 8 - 16\%\end{aligned}$$

Answer = 8 - 16%.



**ResultsPlus**  
Examiner Comments

Marking points 1 and 2 awarded.

### Question 7 (d)

Many candidates were able to access the appropriate material, from paragraphs 8 to 14 of the article, to gain between 2 and 4 marks for this question concerning parts of the brain involved in dealing with information relating to body image.

This relatively short response accurately identified a number of salient points and achieved full marks.

(d) State the evidence supporting the idea that specific parts of the brain are responsible for the gender differences in the processing of information related to body image (paragraphs 8 to 14).

(4)

mPFC was activated in women when they were shown overweight images and were told to imagine it was them. Men showed no activation of mPFC even when presented with overweight images. The pre-frontal amygdala showed increase in activation in women when they heard words such as 'obesity', 'compulence' and 'heavy' while the left side of mPFC (associated with rational thought) became inactive. However, in men it was the reverse.



**ResultsPlus**  
Examiner Comments

This candidate offered marking point 2 in the first sentence and 3 in the second. The third sentence dealt with marking points 4 and 5, giving a maximum of four marks. However, the final sentence made a correct reference to marking point 6.

## Question 7 (e)

This question elicited at least one mark for the majority of candidates.

This candidate not only made reference to at least one long term risk factor but also to cortisol levels being raised for some time.

(e) Explain why the raised cortisol levels due to dieting in females, may be a long term risk factor (paragraph 18).

(2)

Prolonged exposure to increased levels can lead to higher blood pressure, impaired immunity and increased intra-abdominal fat. These can contribute to long term conditions such as heart disease, diabetes and cancer. Impaired immunity could cause diseases caused by opportunistic infections.



## Question 7 (f)

This suggest question focused on the possible advantages of having many small lipid droplets in BAT rather than in a large mass.

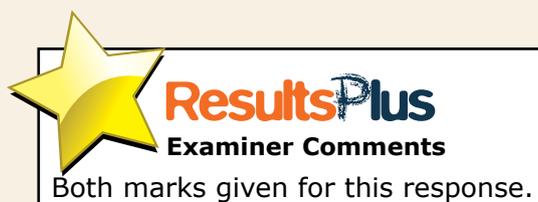
It proved challenging for the some candidates and only a minority gained both marks. Marking point 1 was quite frequently encountered but candidates often then suggested that this made it easier for an enzyme to hydrolyse the lipid rather than referring to more rapidly hydrolysed or that more lipase could combine.

This focused answer correctly referred to a greater surface area in the first sentence for marking point 1. The statement in the second sentence was an acceptable alternative for marking point 2.

(f) Suggest why it may be an advantage to have lipids stored in 'many small droplets rather than in a large mass' in brown adipose tissue (BAT) (paragraph 28).

(2)

The many small droplets give the lipid a larger surface area. This increases the rate at which the lipid can be broken down.



Both marks given for this response.

## Question 7 (g)

Only a handful of candidates did not supply a mark worthy answer to this question and most were able to gain the maximum of three marks.

It was pleasing to see a good number of candidates offering a suitable suggestions for marking point 4.

A succinct answer that covered marking points 2, 3 and 5.

(g) Suggest how the uncoupling agent UCP-1 might affect the production of ATP and heat (paragraph 28).

(3)

UCP-1 disrupts the electron transport chain where ATP is made. Therefore it reduces the amount of ATP produced and increases the amount of heat produced as the energy is converted to heat.



## Question 7 (h)

This proved to be a challenging question for a number of candidates. Those that did gain marks, almost invariably included marking point 1. There were various ways to gain this point, and one is illustrated in the example below.

The most common approach that delivered all marks was to follow mark point 1 by a reference to the fate of the breakdown products of 18F-FDG in terms of not interacting with enzyme active sites.

This candidate has presented an answer that achieved marking point 1 only. This was the most cited correct suggestion given.

(h) Suggest why 18F-fluorodeoxyglucose (18FFDG) becomes 'trapped' in the cells, unlike glucose which is rapidly metabolised (paragraph 32).

(3)

It is more stable ~~to~~ than glucose and requires energy and more time to be broken down and metabolised in the cell. It only undergoes glycolysis the first step of metabolism.



**ResultsPlus**

**Examiner Comments**

The candidate gained the mark in the second sentence for referring to glycolysis as the first stage of metabolism. Another alternative for this marking point would have been that 18F-FDG cannot enter a mitochondrion.

## Question 7 (i)

This three mark question required candidates to consider how a seaweed pigment could cause a reduction in abdominal fat in rats. A majority of answers gained 1 or 2 marks and a sizeable minority achieved all three marks.

This candidate delivered a clear response that covered three marking points in one sentence to gain the maximum score.

- (i) Explain why the seaweed pigment fucoxanthin caused a reduction in abdominal fat in rats (paragraph 38).

(3)

Increased production of UCP-1 which disrupts the electron transport chain causing more energy to be lost as heat rather than stored as abdominal fat.



## Question 7 (j)

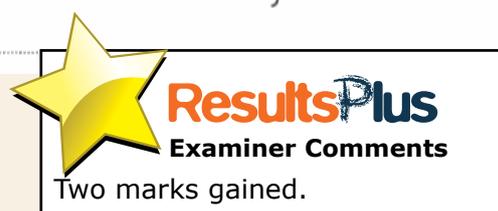
This question delivered a good spread of marks with most of the candidature gaining 2 or 3 marks out of 5.

This answer gains marking points 4 and 5 in the first sentence.

- \*(j) Give the scientific evidence for the protein PRDM16 being responsible for potential weight loss (paragraphs 40 and 41).

(5)

When PRDM16 is artificially overexpressed in white fat cells, it causes them to become brown fat cells, exhibiting BAT characteristics, increasing UCP-1 production. Increased UCP-1 production ~~inhibits~~ <sup>disrupts</sup> ATP formation at the electron transport chain, losing heat to the environment.



## Question 7 (k)

This final part of question 7, and of the paper, required candidates to give two pieces of evidence showing that environmental factors can alter gene expression. Most were able to supply at least one piece of suitable evidence.

Whilst this candidate example gained marks by considering marking points 1 and 2, marking point 3 was also regularly seen.

(k) Give **two** pieces of evidence showing that environmental factors can alter gene expression (paragraphs 45 to 47).

(2)

Decreased body fat content of patients with anorexia was accompanied by a reduction in ~~AA~~ mRNA coding for fat synthesis. Resistin ~~AA~~ mRNA expression increased in anorexics.

(Total for Question 7 = 30 marks)



## **Paper Summary**

Many candidates demonstrated a pleasing appreciation of the unit 5 material tested in this paper. Likewise, they were generally able to deal with the various synoptic elements effectively.

Question 7, which dealt with the scientific article, was handled in an encouraging manner by a pleasing number of candidates.

To further support candidates, they should: i) always read the stem of each question carefully; ii) take note of the command word used in each question; iii) not focus on repeating data which has already been supplied in the stem of the question.

## **Grade Boundaries**

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