

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCE

Biology

Advanced

Unit 5: Energy, Exercise and Coordination

Friday 22 June 2012 – Morning

Time: 1 hour 45 minutes

Paper Reference

6BI05/01

You must have:

A copy of the scientific article taken from The Biologist articles
(enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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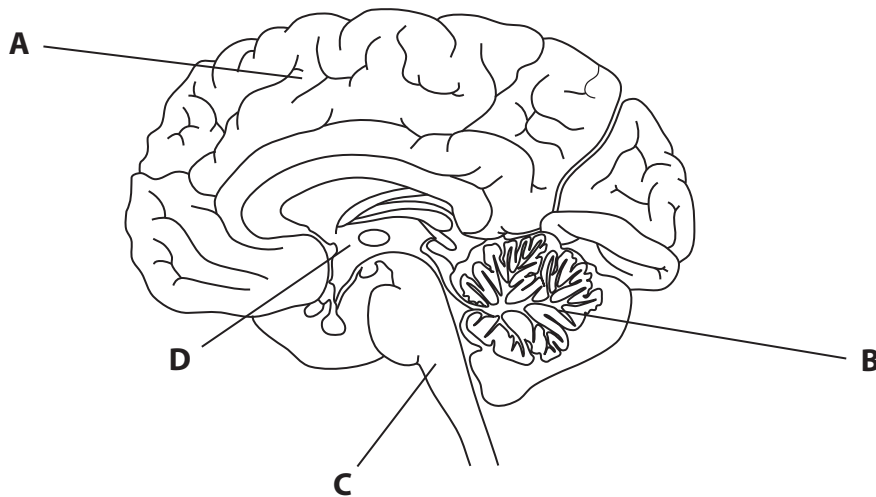


PEARSON

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1** (a) The brain acts as the main coordinating centre for nervous activity. It receives information, interprets it and responds accordingly.



- (i) Coordination of movement is controlled by the part of the brain labelled

(1)

- ☒ **A** Cerebral hemisphere
- ☒ **B** Cerebellum
- ☒ **C** Medulla oblongata
- ☒ **D** Hypothalamus

- (ii) During exercise, chemoreceptors in the carotid artery detect a decrease in pH due to increased carbon dioxide. This results in nerve impulses being sent to the

(1)

- ☒ **A** Cerebral hemisphere
- ☒ **B** Cerebellum
- ☒ **C** Medulla oblongata
- ☒ **D** Hypothalamus



(b) At the start of depolarisation, the ions that move into the axon causing the action potential are

(1)

- ☐ **A** Calcium
- ☐ **B** Chloride
- ☐ **C** Potassium
- ☐ **D** Sodium

(c) When an impulse arrives at a synapse, the ions that enter the pre-synaptic membrane are

(1)

- ☐ **A** Calcium
- ☐ **B** Chloride
- ☐ **C** Potassium
- ☐ **D** Sodium

(d) Acetylcholine is a chemical which acts as

(1)

- ☐ **A** an enzyme
- ☐ **B** a hormone
- ☐ **C** a neurotransmitter
- ☐ **D** a receptor

(e) The drug MDMA (ecstasy) changes behaviour by

(1)

- ☐ **A** decreasing the concentration of adrenaline in brain synapses
- ☐ **B** decreasing the concentration of serotonin in brain synapses
- ☐ **C** increasing the concentration of adrenaline in brain synapses
- ☐ **D** increasing the concentration of serotonin in brain synapses

(Total for Question 1 = 6 marks)



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)

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

(1)



(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.

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- (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)

(Total for Question 2 = 13 marks)



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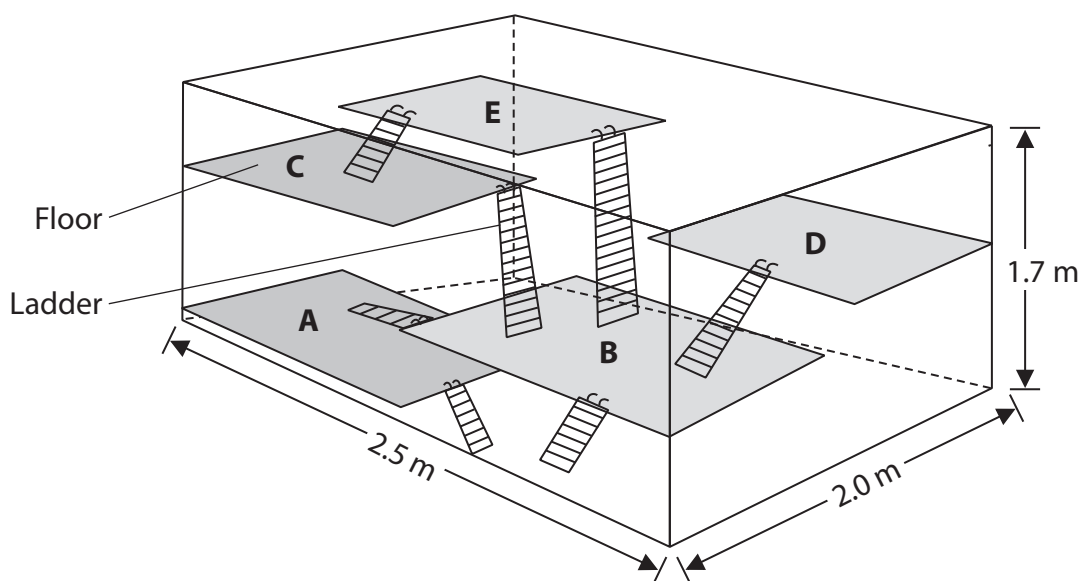
- 3 (a) An investigation was carried out to study the ability of rats to learn. A number of rats were divided into two groups, P and Q.

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.

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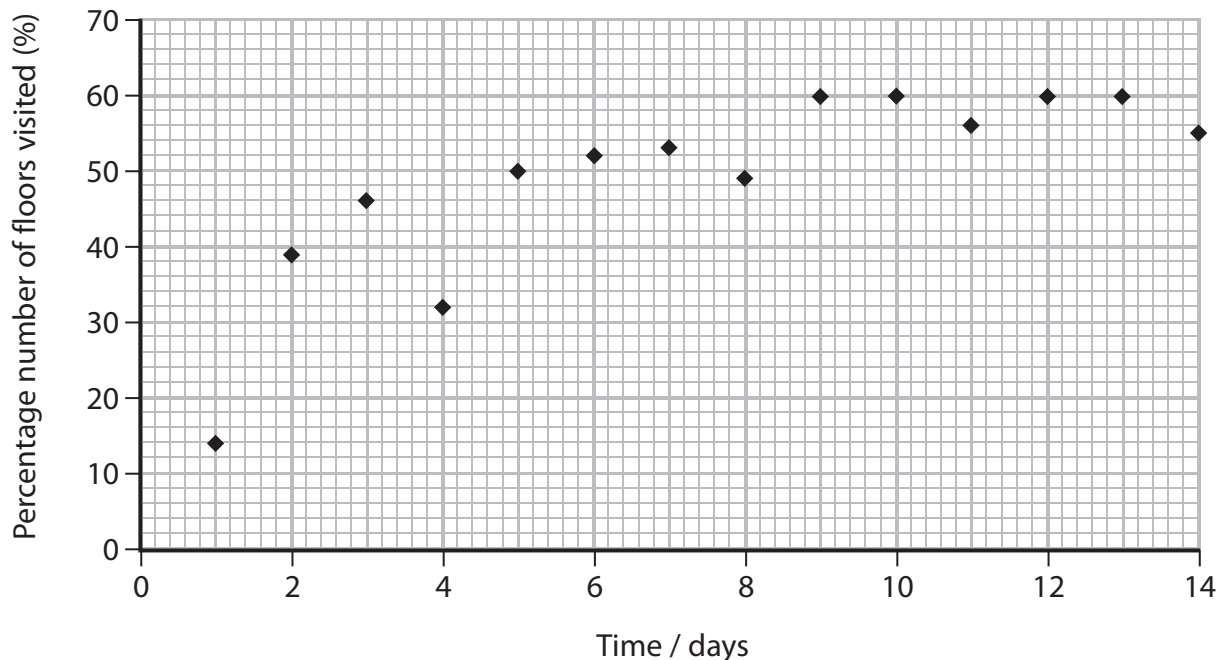


(ii) Explain why the rats were not fed for twenty hours each day.

(1)

(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)



- (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)

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- (d) The brains of both groups of rats were examined.
The mean spine density per neurone for each group was calculated.

Spine density represents a measure of the number of synapses per neurone.

The results are shown in the table below.

Group	Mean spine density / arbitrary units
P	1.96
Q	1.78

Suggest how these results explain the effect of the first experiment on the ability of rats to find food using the cage.

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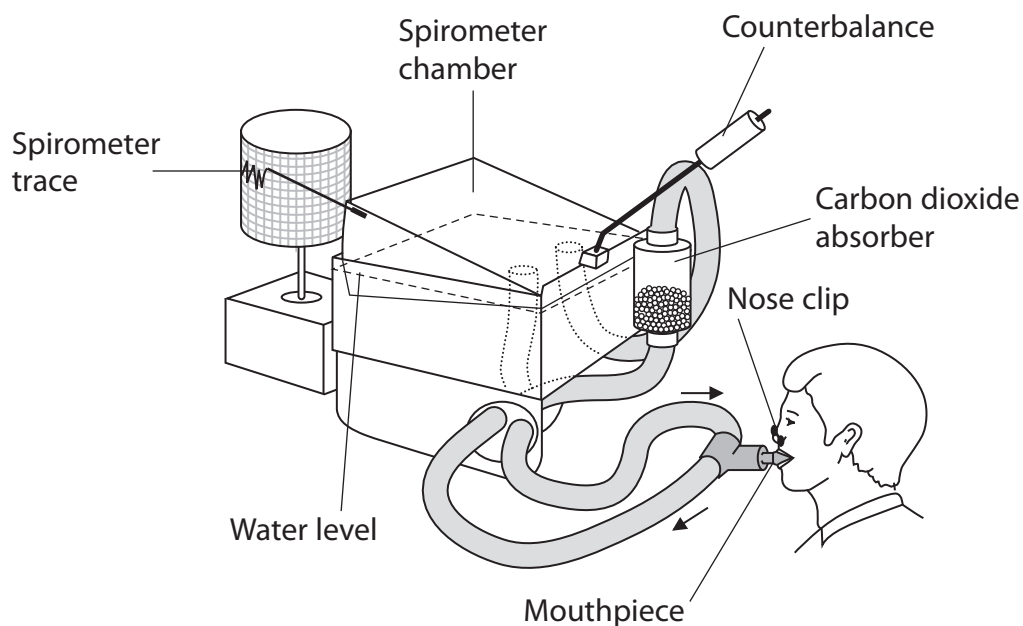
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(Total for Question 3 = 10 marks)



4 *(a) A spirometer can be used to measure tidal volumes and breathing rates.

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.

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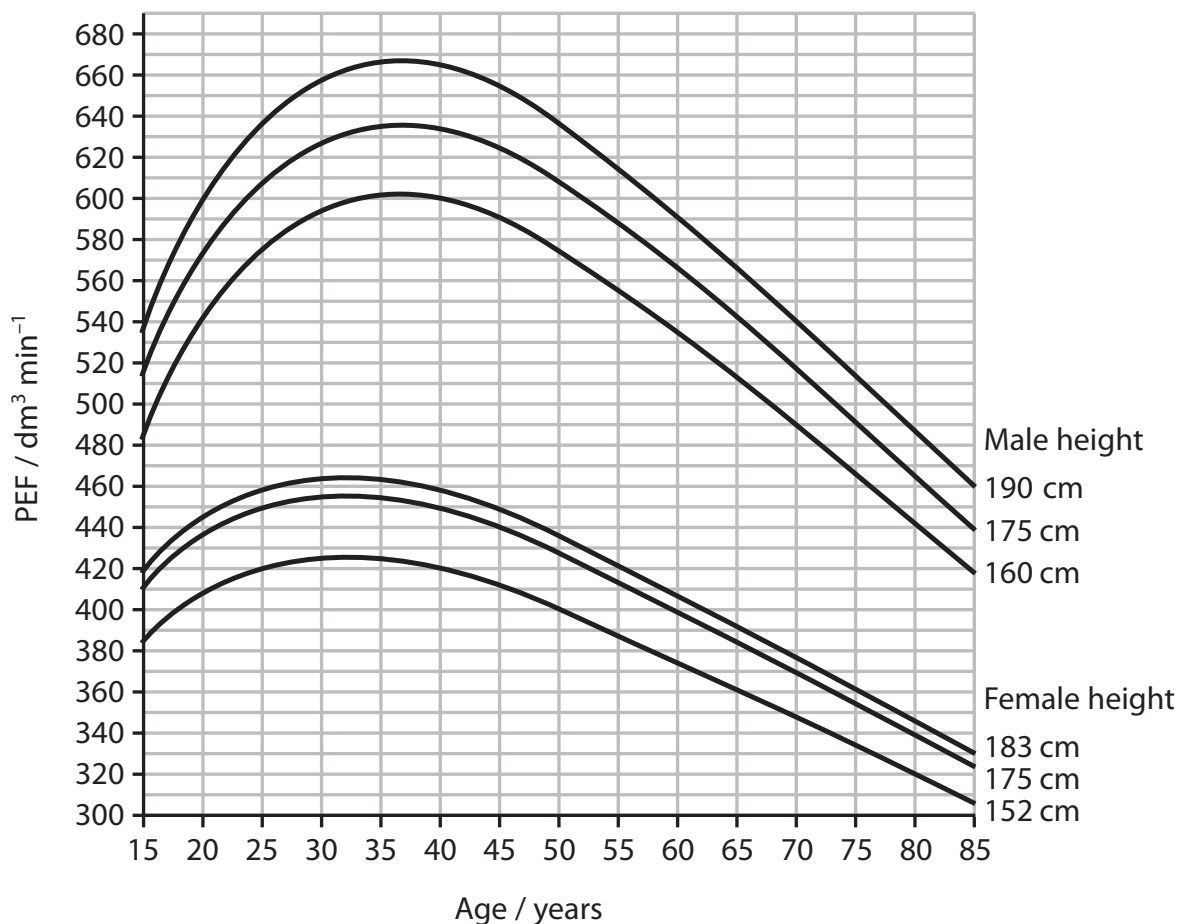
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Question 4 continues on the next page



- (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.

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

(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)

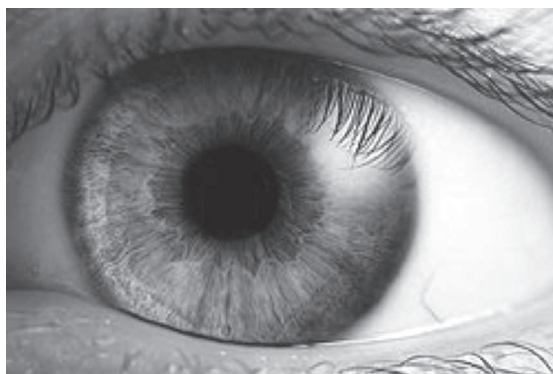
- (iv) Give one other piece of information that is needed before an accurate diagnosis of his asthma can be made.

(1)

(Total for Question 4 = 14 marks)



- 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)

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- (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.

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

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- (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.

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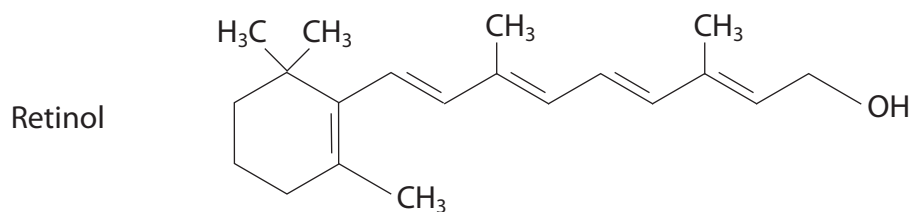
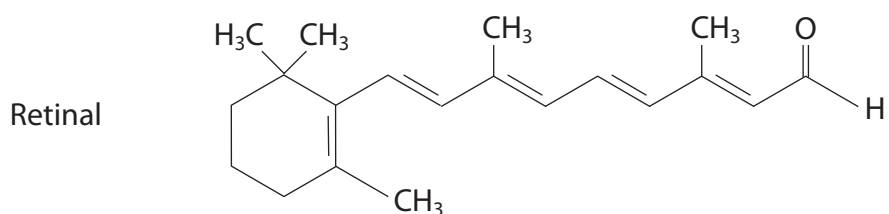
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(c) The diagrams below show the structure of two molecules, retinal and retinol.



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.

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(Total for Question 5 = 13 marks)



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- 6 The table below shows some statements relating to photoreceptors (phytochromes) in plants.

Complete the table with a tick (✓) if the statement is correct or a cross (×) if the statement is not correct.

(4)

Statement	Tick (✓) or cross (×)
Cause cell depolarisation	
Affected by all wavelengths of light	
Involved in plant growth and development	
Affected by darkness	

(Total for Question 6 = 4 marks)



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).

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

(2)

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

(2)

Answer = %



(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)

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

(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)

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

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

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

(3)

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

(5)

[illegible]

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

(2)

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS



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