1 The photograph shows a female gymnast on a narrow beam.

(a) The table below refers to two regions of the brain.

Complete the table by describing **one** role of each region of the brain, while she is on the beam.

(2)

Region of the brain	One role while she is on the beam
Cerebellum	
Medulla oblongata	

(b) This gymnast will generate a lot of heat while she is on the beam.

Describe and explain how changes in blood flow in the skin will help her to control her body temperature.

(4)

(c) Gymnasts can damage their cruciate ligaments.
This is an injury that can be repaired using keyhole surgery.

(i) Explain what is meant by the term **cruciate ligament**.

(2)

(ii) A gymnast was offered keyhole surgery to repair her damaged cruciate ligament.

Suggest and explain **two** reasons why she might choose this type of surgery.

(2)

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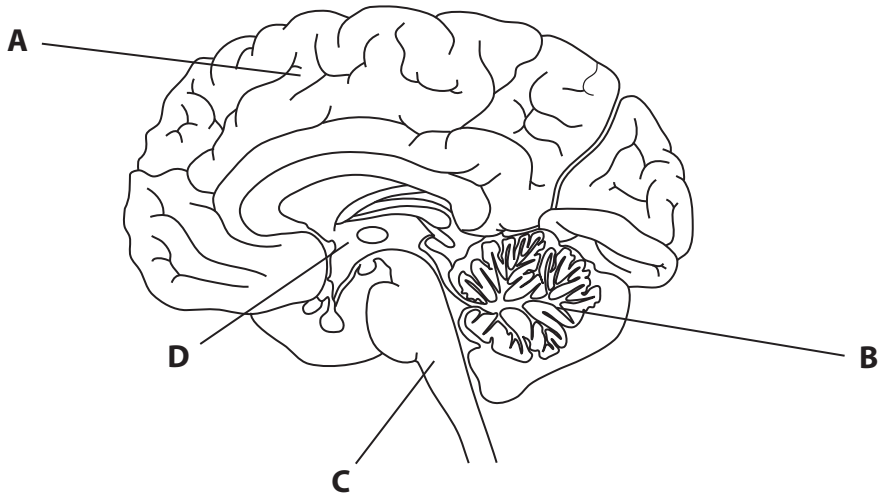
(Total for Question 1 = 10 marks)

2 (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 2 = 6 marks)

3 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)

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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)

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

(3)

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

(3)

(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)

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

(2)

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(Total for Question 3 = 30 marks)