1. *Answers should be written in continuous prose. Credit will be given for biological accuracy, the organisation and presentation of the information and the way in which the answer is expressed.*

Cancer may be treated by chemotherapy. This involves using drugs which kill cancer cells but have no effect on normal healthy cells. Unfortunately. cancer cells develop from normal cells so the two types of cell are similar to each other. Trials have begun which involve adding a new gene to the normal cells in the body. This gene makes a protein which protects these healthy cells against the drug being used. The cancer cells do not produce this protein. so they are killed.

(a) Describe the features of a gene which enable it to code for a particular protein.

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(b) Explain how enzymes and vectors may be used to isolate genes and insert them into another organism.

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(c) Describe how the new protein is made once the gene has been inserted into the cell.

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(7)
(QWC 3)
(Total 20 marks)

2. *Write an essay on the topic below. Credit will be given not only for the biological content, but also for the organisation and presentation of the essay; and the use of grammar, punctuation and spelling.*

The functions of nucleic acids.

(Total 25 marks)

3. *Write an essay on the topic below. Credit will be given not only for the biological content, but also for the organisation and presentation of the essay; and the use of grammar, punctuation and spelling.*

The factors which influence the concentration of glucose in the blood.

(Total 25 marks)

4. *Write an essay on the topic below. Credit will be given not only for the biological content, but also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.*

Relationships between animals and plants

(Total 25 marks)

5. *Write an essay on the topic below. Credit will be given not only for the biological content, but also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.*

How the structure of cell organelles is related to their functions

(Total 25 marks)

6. *Write an essay on the topic below. Credit will be given not only for the biological content, but also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.*

The process of diffusion and its importance in living organisms.

(Total 25 marks)

7. *Write an essay on the topic below. Credit will be given not only for biological content but also for the organisation and presentation of the essay, and use of grammar, punctuation and spelling.*

Maintaining constant conditions in the body.

(Total 25 marks)

8. *Write an essay on the topic below. Credit will be given not only for biological content but also for the organisation and presentation of the essay, and use of grammar, punctuation and spelling.*

The many causes of human disease.

(Total 25 marks)

9. *Write an essay on the topic below. Credit will be given not only for biological content but also for the organisation and presentation of the essay, and use of grammar; punctuation and spelling.*

The different ways in which living organisms obtain their nutrients.

(Total 25 marks)

10. *Write an essay on the topic below. Credit will be given not only for biological content but also for the organisation and presentation of the essay, and use of grammar; punctuation and spelling.*

The factors which determine an organism's phenotype.

(Total 25 marks)

11. (a) Describe how a particular gene can be removed from the DNA of an animal cell.

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(b) Describe how this gene can then be inserted into the genetic material of a bacterium.

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(Total 6 marks)

12. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

The different ways in which organisms use ATP

(Total 25 marks)

13. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

How the structure of cells is related to their function

(Total 25 marks)

14. Some organisms are adapted for living in hot, dry environments.

Explain what causes the activity of reptiles living in a desert to vary greatly over a twenty-four hour period.

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(Total 5 marks)

15. *Write an essay the following topic. You should select and use information from different parts of the specification. Credit will be given, not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

How bacteria affect human lives

(Total 25 marks)

16. *Write an essay the following topic. You should select and use information from different parts of the specification. Credit will be given, not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

The biological importance of water

(Total 25 marks)

17. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

The structure and functions of carbohydrates

(Total 25 marks)

18. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Cycles in biology

(Total 25 marks)

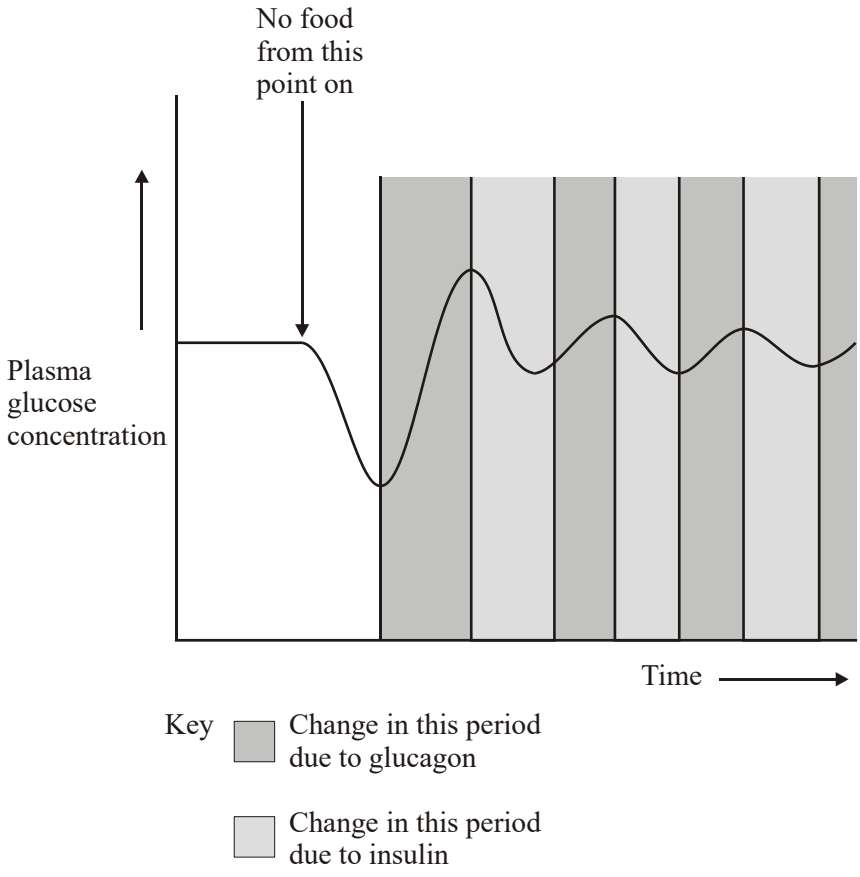
19. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

How carbon dioxide gets from a respiring cell to the lumen of an alveolus in the lungs.

(Total 25 marks)

20. Homeostatic mechanisms maintain a constant environment in the body.

(a) The graph shows changes in plasma glucose concentration that occurred in a person who went without food for some time.



Use evidence from the graph to explain the role of negative feedback in the control of plasma glucose concentration.

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(b) (i) Explain how normal core body temperature is maintained when a person moves into a cold room.

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S (ii) How does maintaining a constant body temperature allow metabolic reactions in cells to proceed with maximum efficiency?

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(Total 15 marks)

21. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

The transfer of energy between different organisms and between these organisms and their environment

(Total 25 marks)

22. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Ways in which different species of organisms differ from each other

(Total 25 marks)

23. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Negative feedback and its importance in biology.

(Total 25 marks)

24. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content, but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Condensation and hydrolysis and their importance in biology.

(Total 25 marks)

25. (a) The table describes some reproductive hormones in a female mammal.
Complete the table by adding the name of the hormone which matches each description.

Hormone	Description
	Produced by the corpus luteum
	Produced by the pituitary gland and stimulates growth of the corpus luteum
	Produced by the developing follicle

(3)

(b) Menopause is the time when women stop ovulating and the menstrual cycle stops. There are very few follicles remaining in the ovaries of a woman at menopause. Explain why the FSH concentration in the blood rises at menopause.

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(3)
(Total 6 marks)

26. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given for the biological content. It will also be given for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Inorganic ions include those of sodium, phosphorus and hydrogen.
Describe how these and other inorganic ions are used in living organisms.

(Total 25 marks)

27. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given for the biological content. It will also be given for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Bacteria affect the lives of humans and other organisms in many ways.
Apart from causing disease, describe how bacteria may affect the lives of humans and other organisms.

(Total 25 marks)

28. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Polymers have different structures. They also have different functions. Describe how the structures of different polymers are related to their functions.

(Total 25 marks)

29. *Write an essay on the following topic. You should select and use information from different parts of the specification. Credit will be given not only for the biological content but also for the selection and use of relevant information, and for the organisation and presentation of the essay.*

Heat and many different substances are transferred within the body and between the body and the environment. Explain how surface area is linked to this transfer.

(Total 25 marks)

30. All living organisms exist in changing external environments and many are able to control their internal environments.

(a) Explain how the body of a mammal may respond to a rise in the environmental temperature.

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(b) Describe the important differences between the nervous and hormonal co–ordination systems found in a mammal.

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(4)
(Total 12 marks)

31. Epidemiology has shown that there is a link between high fat diets and cancer of the colon, but this type of research tells us nothing about how such a diet actually causes the disease. More recently, investigators have tried to identify the events which take place before a malignant tumour develops. They have been looking for biological markers which show that there is an increased risk of cancer. Some of these markers are related to stages along the pathway from being exposed to a risk factor to developing cancer. These markers include particular chemicals attached to molecules of DNA, mutation of specific genes and abnormal cell growth. Other markers are associated with genetic factors such as inherited inefficiencies in destroying carcinogens, repairing DNA or in the way in which the immune system recognises tumour cells. This work has helped us to understand that malignant tumours usually arise from accumulated damage to the genes present in a single cell.

(a) The base sequence of a specific gene is known. Explain how a mutation of this gene could be detected in a sample of cells from human blood.

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(b) Suggest how the information acquired through research on biological markers could be used to reduce deaths from cancer.

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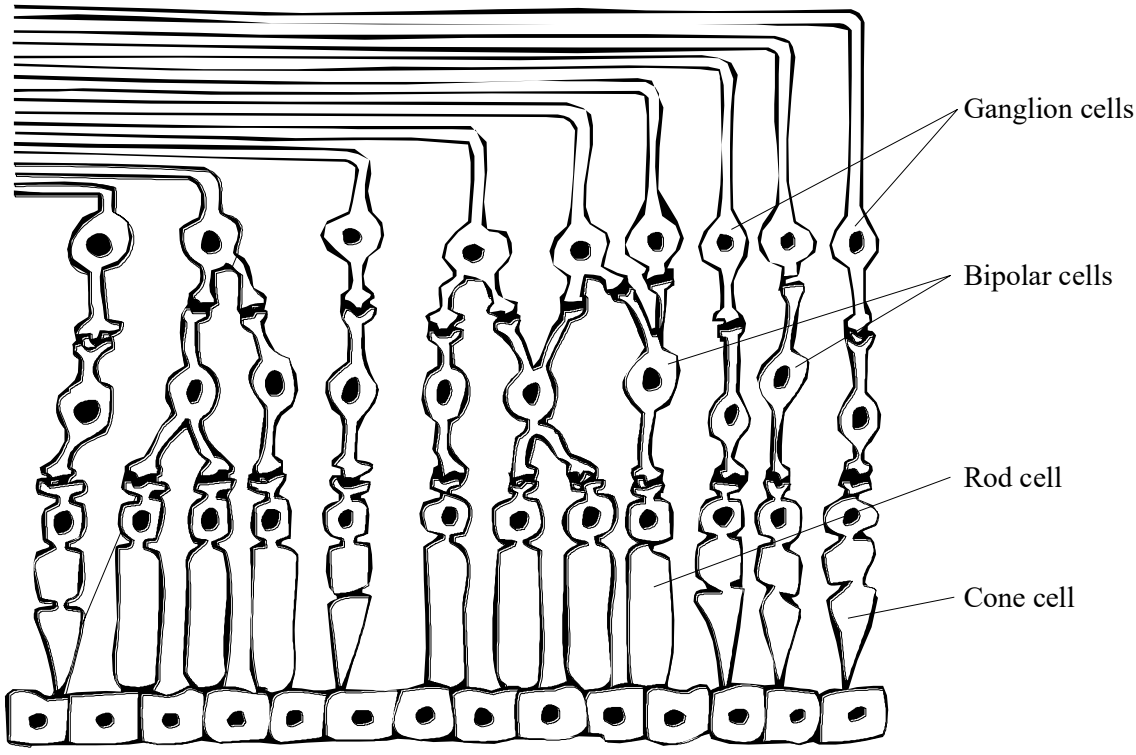
(3)

(Total 6 marks)

32. The diagram shows the structure of the retina.



Use the diagram to help you to explain how the structure of the retina and its neuronal connections enable a person to have

(i) a high degree of visual sensitivity in low light levels;

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(ii) a high degree of visual acuity.

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(Total 6 marks)

33. Describe the processes by which the sequence of subunits in DNA determines the mRNA and protein products in a cell.

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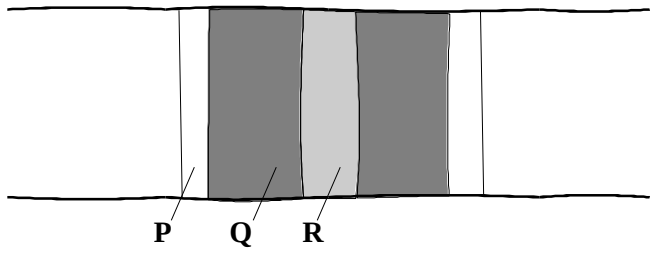
(Total 8 marks)

34. (a) The diagram shows the appearance of a sarcomere from a relaxed muscle fibril, as seen with a light microscope.



(i) Use your knowledge of the sliding filament hypothesis to explain the appearance of each of the bands **P, Q** and **R**.

P.....

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Q.....

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R.....

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(3)

(ii) Draw a similar diagram to show the appearance of the sarcomere when the fibril is contracted.

(1)

(b) Muscles use energy from respiration for contraction. Describe how the energy released in mitochondria during respiration produces contraction of a muscle fibril.

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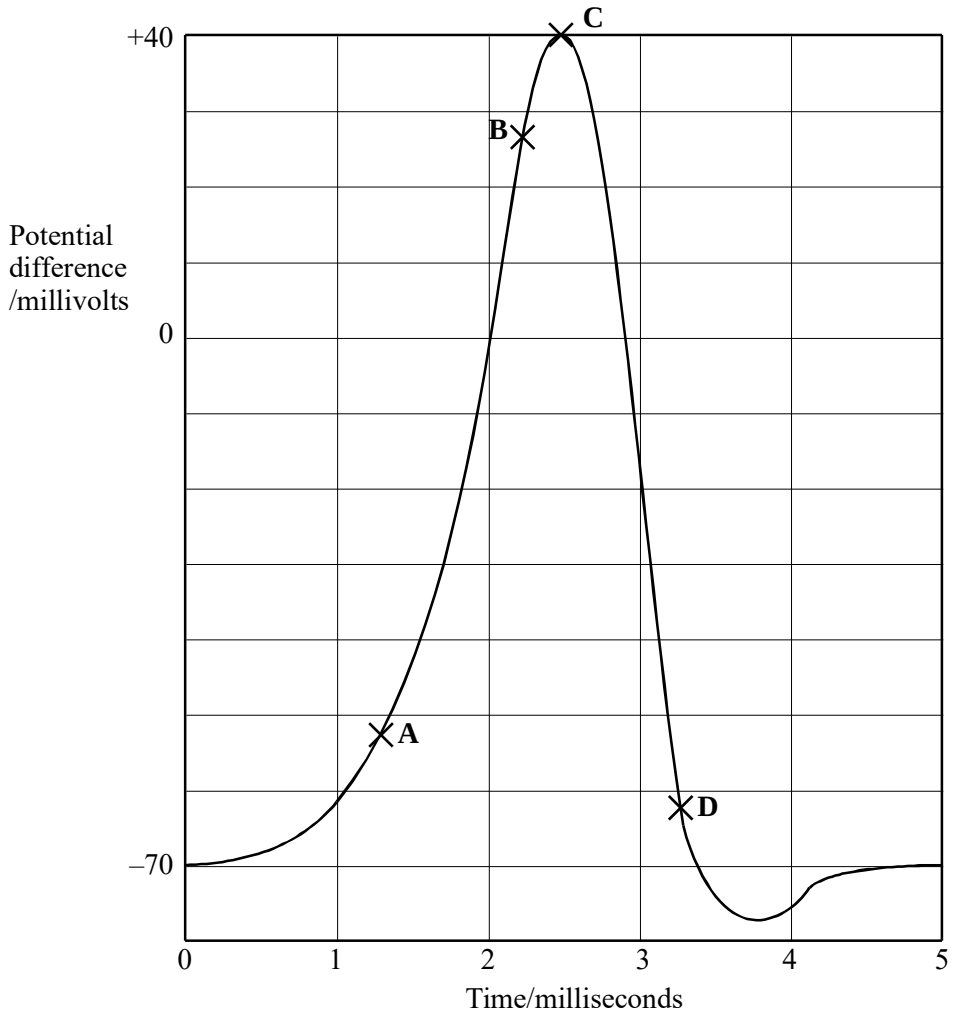
(4)
(Total 8 marks)

35. The diagram shows a typical action potential in a neurone.



(a) Explain how the movement of ions brings about the changes in potential difference occurring between points **A** and **B**, and between points **C** and **D**.

A-B.....

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C-D.....

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(3)

(b) Describe the process of transmission across a neuromuscular junction.

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(7)

(c) Explain how transmission of information in the nervous system may be modified by summation.

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(2)

(Total 12 marks)

36. Hormones and the nervous system are involved in controlling the functions of the body.

(a) During the oestrous cycle in a mammal, one or more follicles mature. Ovulation then takes place. Describe the part played by hormones in controlling these events.

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(6)

(b) The ears of a rabbit play an important part in helping the animal to keep its body temperature constant. After a period of exercise, the insides of a rabbit's ears become redder in colour as the blood flow to the skin surface increases. Explain how the different components of nervous communication are involved in the process leading to the response shown by the rabbit's ears.

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(6)
(Total 12 marks)

37. Read the following passage.

Cone snails extend a long, whippy tube tipped with a poisonous barb disguised as food. Fish that swallow the bait are instantly harpooned, their fate sealed by a dose of paralysing toxins squirted through the barb.
Research at Stanford University has shown that some of the toxins block the tiny channels that allow sodium ions through the membranes of the nerve and muscle cells. Other toxins paralyse fish by blocking the receptors for acetylcholine at neuromuscular junctions.
Cone snails produce many different toxins. These toxins are very small; they are protein fragments seldom longer than 30 amino acids or shorter than 10.

(a) Describe the structure of the channels that allow sodium ions through membranes.

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(2)

(b) Explain how each of the following leads to paralysis of fish.

(i) blocking of sodium channels in nerve cells

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(ii) blocking of receptors for acety choline in nerve cells

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(6)

(Total 8 marks)

38. In 1987 an attempt was made to produce human insulin from genetically engineered yeast. Genes for human insulin were inserted into small loops of DNA called plasmids. These plasmids were then used to try to carry the insulin genes into yeast cells.

(a) Describe how an insulin gene could be removed from human DNA and inserted into the plasmid DNA.

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(4)

(b) The yeast used to produce insulin was a mutant strain that did not have the gene for an enzyme needed by the yeast in respiration. The missing enzyme is called triose phosphate isomerase. The DNA of the plasmids, however, did contain the gene for triose phosphate isomerase.

Explain the importance for insulin production of using plasmids that have the gene for triose phosphate isomerase and a mutant yeast that does not have this gene.

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(Total 7 marks)

39. (a) Describe the role of hormones in controlling the development of the changes associated with puberty in girls.

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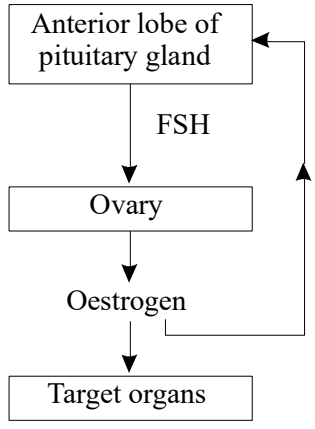
(6)

(b) The diagram shows the way in which hormones control the first part of the menstrual cycle.



(i) Some oral contraceptives contain oestrogen. Using information from the diagram, explain how these oral contraceptives function.

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(3)

(ii) The ovaries of women who have passed through the menopause no longer contain active follicles. The concentration of oestrogen and of FSH in the blood change after menopause. Use information from the diagram to explain why.

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(3)

(Total 12 marks)

40. Read the following passage.

Diabetes

Diabetes mellitus is a group of disorders that all lead to an increase in blood glucose concentration (hyperglycaemia). The two major types of diabetes mellitus are type I and type II. In type I diabetes there is a deficiency of insulin. Type I diabetes is also called insulin-dependent diabetes mellitus because regular injections of insulin are essential. It most commonly develops in people younger than age twenty.

Type II diabetes most often occurs in people who are over forty and overweight. Clinical symptoms may be mild, and the high glucose concentrations in the blood can often be controlled by diet and exercise. Some type II diabetics secrete low amounts of insulin but others have a sufficient amount or even a surplus of insulin in the blood. For these people, diabetes arises not from a shortage of insulin but because target cells become less responsive to it. Type II diabetes is therefore called non-insulin-dependent diabetes mellitus.

(a) Describe how blood glucose concentration is controlled by hormones in an individual who is **not** affected by diabetes.

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(6)

(b) Suggest how diet and exercise can maintain low glucose concentrations in the blood of type II diabetics.

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(3)
(Total 9 marks)

41. (a) Describe the sequence of events which leads to the transmission of an impulse at a cholinergic synapse.

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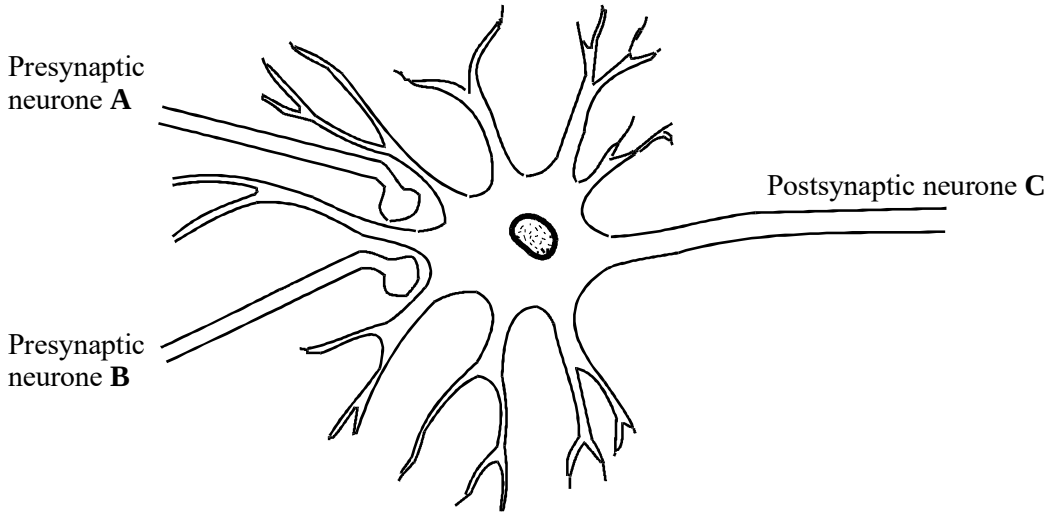
(6)

(b) The diagram shows axons from two presynaptic neurones, **A** and **B**, and the synapse they form with postsynaptic neurone, **C.**



The table shows the results of four experiments to determine the effects of action potentials in neurones **A** and **B** on neurone **C.**

Experiment	Action potentials in presynaptic neurone(s)	Effect on neurone **C**
1	Single action potential in **A**	No action potential
2	Single action potential in **B**	No action potential
3	Simultaneous action potentials in **A** and **B**	Action potential
4	Two action potentials in **A** in rapid succession	Action potential

Explain why an action potential was produced in **C** in experiments 3 and 4, but not in experiments 1 and 2.

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(6)

(Total 12 marks)

42. Genetic engineering has made it possible to transfer genes from one species to another. For example, a gene that gives resistance to herbicide and another gene which gives resistance to insect attack have been transferred into maize. Some people think that there will be great advantages in growing maize with these genes. Others are equally convinced that there are long-term dangers in growing crops of this maize.

Evaluate both of these viewpoints.

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(Total 6 marks)

43. S *Write an essay on the topic below.*

The different ways in which organisms use ATP.

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

44. S *Write an essay on the topic below.*

How the structure of cells is related to their function.

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

45. **S** *Write an essay on the topic below.*

The biological importance of water.

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.

Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material

The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

46. **S** *Write an essay on the topic below.*

The movement of substances within living organisms.

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.

Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material

The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

47. *Write an essay on the topic:*

The structure and functions of carbohydrates

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

48. *Write an essay on the topic:*

Cycles in biology

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

49. This question should be answered in continuous prose.
Quality of Written Communication will be assessed in the answer.

(i) Starting with mRNA, describe how the process of translation leads to the production of a polypeptide.

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(ii) Normal tomato plants have an enzyme that softens tomatoes as they ripen. Genetically engineered tomatoes ripen and soften more slowly. A gene was inserted which reduces the amount of softening enzyme produced.

The diagram shows matching parts of the base sequences for the mRNA produced by the gene for the softening enzyme and that produced by the inserted gene.

Softening gene mRNA …AAUCGGAAU…

Inserted gene mRNA …UUAGCCUUA…

Suggest how the inserted gene reduces the production of the softening enzyme.

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(2)
(Total 6 marks)

50. *Write an essay on the topic below.*

S How the structure of proteins is related to their functions

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

51. *Write an essay on the topic below.*

S The causes of variation and its biological importance

In the answer to this question you should bring together relevant principles and concepts from as many different modules as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

52. *Write an essay on the topic below.*

The process of osmosis and its importance to living organisms.

In the answer to this question you should bring together relevant principles and concepts from different parts of the specification.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

53. *Write an essay on the topic below.*

Energy transfers which take place inside living organisms.

In the answer to this question you should bring together relevant principles and concepts from different parts of the specification.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

54. Research scientists can increase the nutritional value of potatoes by genetically engineering potato plants. A gene which results in increased protein production has been removed from cells of an amaranth plant and inserted into cells of a potato plant.

(a) Describe how a gene could be removed from cells of an amaranth plant and inserted into cells of a potato plant.

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(6)

(b) Describe the advantages of using vegetative propagation rather than sexual reproduction to reproduce genetically engineered potato plants.

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(3)

(c) Whole potato plants can be produced from genetically identical potato cells grown in a tissue culture. Use your knowledge of genes to suggest how different cells, such as leaf and root cells, can develop from genetically identical cells.

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(2)

(Total 11 marks)

55. S *Write an essay on the topic below.*

Enzymes and their importance in plants and animals

In the answer to this question you should bring together relevant principles and concepts from as many different parts of the specification as possible.
Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.
The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

56. S *Write an essay on the topic below.*

Negative feedback in living organisms

In the answer to this question you should bring together relevant principles and concepts from different parts of the specification.

Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.

The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

57. S *Write an essay on the topic below.*

Mean temperatures are rising in many parts of the world. The rising temperatures may result in physiological and ecological effects on living organisms. Describe and explain these effects.

In the answer to this question you should bring together relevant principles and concepts from different parts of the specification.

Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.

The essay should be written in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

58. **S** *Write an essay on the topic below.*

Cells are easy to distinguish by their shape. How are the shapes of cells related to their function?

In the answer to this question you should select and use relevant principles and concepts from different parts of the specification.

Your essay will be marked not only for its scientific accuracy, but also for the selection of relevant material.

Write your essay in continuous prose.

The maximum number of marks that can be awarded is:

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of Written Communication	*3*

(Total 25 marks)

59. Write an essay on one of the following topic.

Mean temperatures are rising in many parts of the world. The rising temperatures may result in physiological and ecological effects on living organisms. Describe and explain these effects.

You should write your essay in continuous prose.
Your essay will be marked not only for its scientific accuracy, but also for your selection of relevant material from different parts of the specification.

The maximum number of marks that can be awarded is

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of written communication	*3*

(Total 25 marks)

60. Write an essay on one of the following topic.

The causes of variation and its biological importance.

You should write your essay in continuous prose.
Your essay will be marked not only for its scientific accuracy, but also for your selection of relevant material from different parts of the specification.

The maximum number of marks that can be awarded is

Scientific content	*16*
Breadth of knowledge	*3*
Relevance	*3*
Quality of written communication	*3*

(Total 25 marks)