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Answer ALL questions in the spaces provided.

1. Complete the table below by placing in each box a tick (✓) if you would expect the feature to be present or a cross (✗) if you would expect it to be absent.
The first row has been done for you.

Feature	Sperm	Egg
Tail	✓	✗
Haploid nucleus		
Acrosome present		
Mitochondria present		
Cytoplasm containing many lipid droplets		
Use ATP for movement		

Q1

(Total 5 marks)



2. This question is about the preparation of a microscope slide that would enable you to see the stages of mitosis.

(a) Name a suitable organism and tissue which could be used to study mitosis.

(i) organism (1)

(ii) tissue (1)

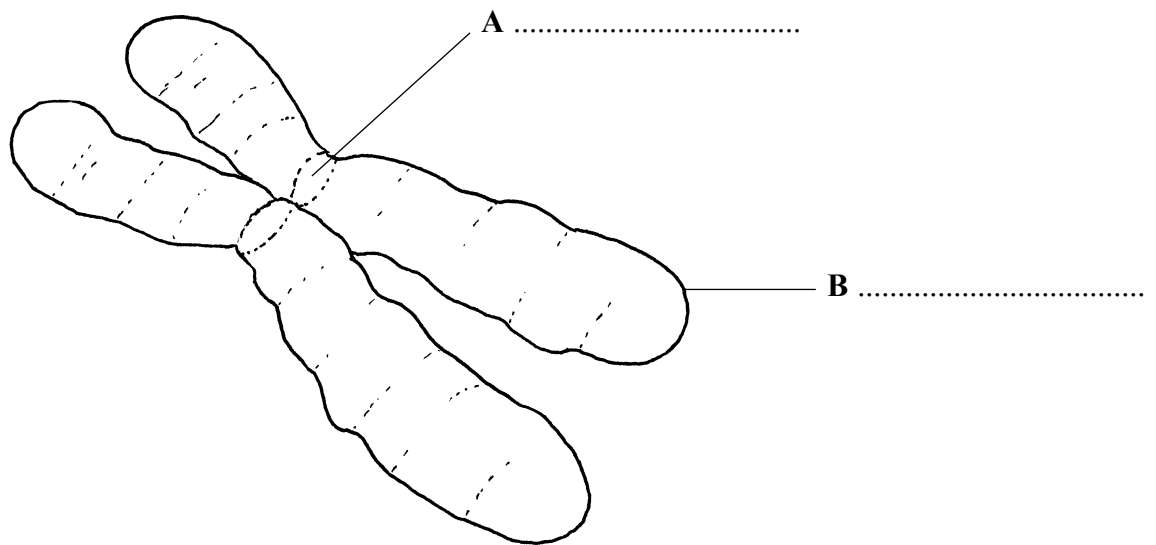
(b) Name a stain you might use to make the chromosomes visible.

..... (1)

(c) Explain why the cells are warmed in acid during the preparation of the slide.

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..... (1)

(d) The diagram below shows a chromosome during an early stage of mitosis. Write the names of the parts labelled **A** and **B** on the lines provided.



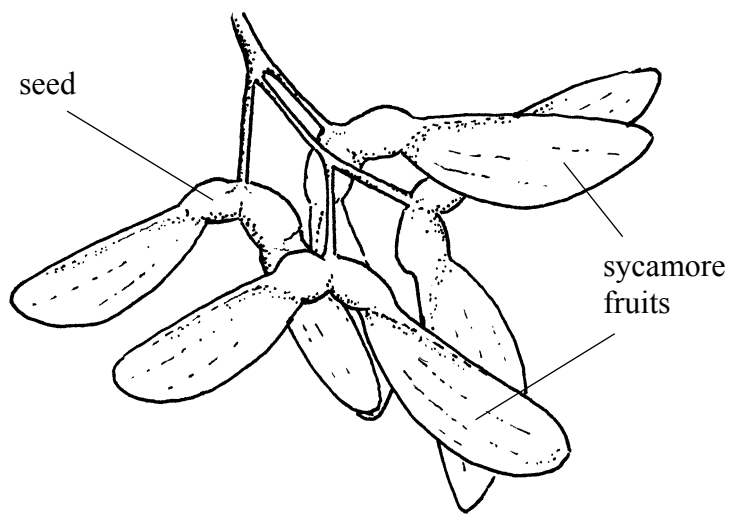
(2)

Q2

(Total 6 marks)



3. (a) With reference to the diagram below, suggest how the seeds of a sycamore tree are dispersed.



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(2)



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(b) Explain how an embryo in a seed is:

(i) protected

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(1)

(ii) provided with nutrition.

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(2)

Q3

(Total 5 marks)



4. (a) In the UK, the average height of people has increased by about 8 cm in the last 150 years. Scientists have made a number of observations. Explain how each of the following observations could explain this increase in average height.

(i) On average taller men have more children.

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(3)

(ii) The amount of protein in the diet has increased.

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(2)

(iii) Children are less likely to suffer from serious infectious diseases than in the past.

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(1)



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(b) Cancers are caused by chemical or physical damage to DNA. Smoking tobacco gives a very high risk of cancer caused by chemical damage.

Explain how the biological changes caused by smoking can lead to lung cancer.

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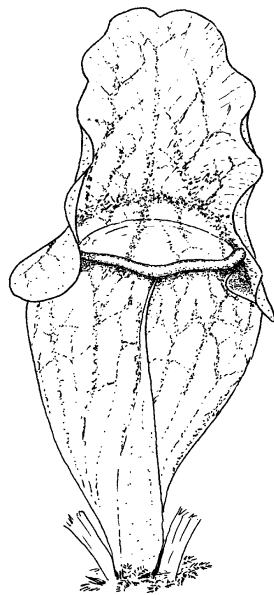
(3)

Q4

(Total 9 marks)



5.



Pitcher plant leaf

Northern Canada has long and cold winters and the short summers usually end in early August. Populations of the pitcher plant mosquito (*Wyeomyia smithii*) were recently found to be hibernating (becoming dormant) in late July, an average of 9 days later than they used to 30 years ago. The mosquitoes hibernate as larvae in the fluid-filled leaves of the pitcher plant.

- (a) The mosquito larvae hibernate because they cannot survive in an active state once environmental temperatures fall in autumn.

Suggest why the mosquito larvae cannot remain active below a certain temperature.

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(1)

- (b) Suggest a possible explanation for the pitcher plant mosquitoes in Canada going into hibernation later than they used to.

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(1)



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- (c) Scientists now think that the mosquitoes hibernate partly in response to the days getting shorter in late summer.

Suggest why it could be an advantage to the survival of the mosquitoes to respond to shortening day length rather than to falling temperature.

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(1)

- (d) The climate in Florida, 2000 km south of Canada, is much warmer and the winters are much shorter. The native Florida pitcher plant mosquito begins hibernation in November. If the Canadian mosquitoes are taken to Florida they start hibernating in late July, as though they were still back in Canada.

Suggest why the two types of mosquito behave differently despite being in the same environmental conditions.

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(2)

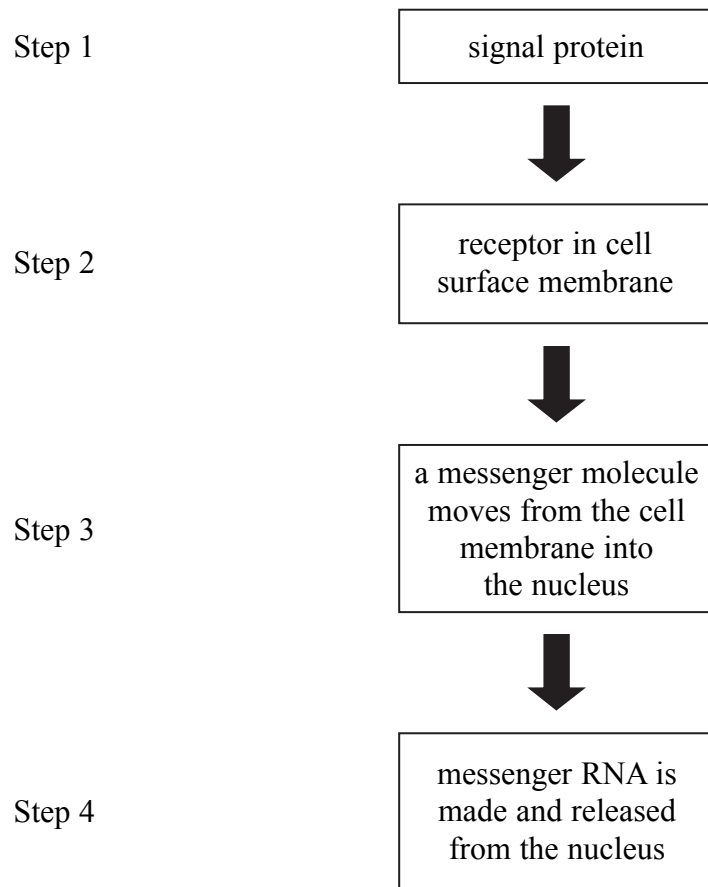
Q5

(Total 5 marks)



6. The growth and development of an organism is co-ordinated by signal proteins.

The diagram below summarises the steps involved for one cell.



(a) With reference to the diagram, describe the mechanism by which a signal protein causes the synthesis of mRNA.

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(3)



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(b) Explain why mRNA is released from the nucleus in step 4, but DNA always remains in the nucleus.

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(2)

(c) Signal proteins are inactive when released from the ribosomes but leave the cell as active signal proteins.

Outline the events that take place after the proteins leave the ribosome, until they are released from the cell.

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(3)

(Total 8 marks)

Q6



7. (a) Name the processes described below, selecting the most appropriate answer from the following list:

- absorption combustion decomposition**
photosynthesis respiration transpiration

	Description	Process
(i)	Carbon dioxide in the atmosphere is converted into wood by growing trees	
(ii)	Dead wood is converted to substances which can be readily absorbed by fungi	
(iii)	Carbon dioxide is released from carbohydrates animals have eaten	
(iv)	Carbon dioxide is released from wood in a wood-fired power station	

(4)

(b) (i) Explain why coal reserves represent a carbon sink.

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(1)

(ii) Explain why burning wood is described as 'carbon neutral', unlike the burning of fossil fuel.

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(2)



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(c) The UK Forestry Commission has calculated that, in order to remove the carbon dioxide produced by an average family car during an average driver's lifetime, it would be necessary to plant 0.5 hectares (5000 m²) of new forest.

Suggest and explain **one** reason why planting extra forests may not be a complete long term solution to the problem of rising carbon dioxide levels in the atmosphere.

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(2)

Q7

(Total 9 marks)

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8. (a) Explain the difference between the terms 'global warming' and 'the greenhouse effect'.

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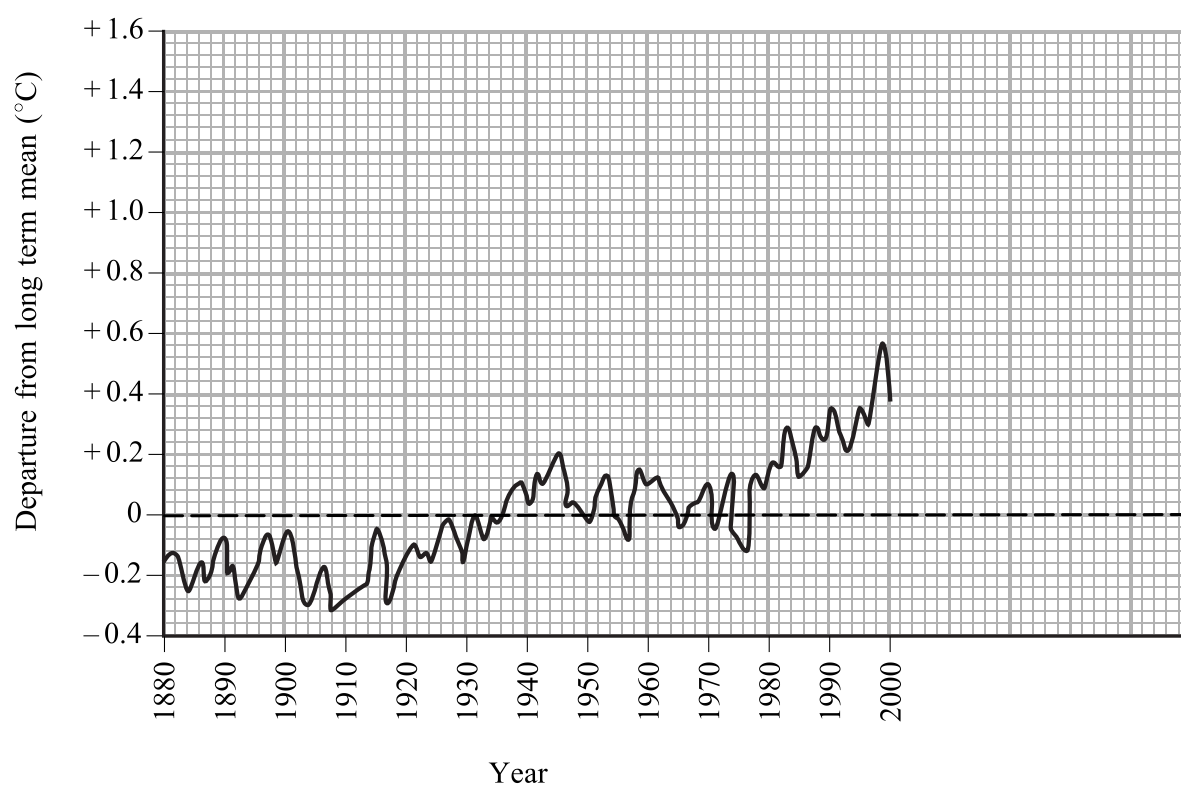
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(3)

(b) The graph below shows the changes in mean global surface temperature between the years 1880 and 2000.



(i) Draw the line of best fit on the above graph between 1940 and 2000.

(1)



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(ii) Using your line of best fit, estimate the increase in mean global surface temperature between 2000 and 2020. Indicate how you made your estimate on the graph **and** in the space below.

Estimated increase in temperature
(3)

(iii) Using the graph to support your answer, suggest why the estimated increase in temperature might **not** be an accurate prediction of mean global surface temperature in 2020.

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(3)

(c) Suggest why a relatively small increase in temperature may have a large effect on the survival of particular species of plants and animals in particular places.

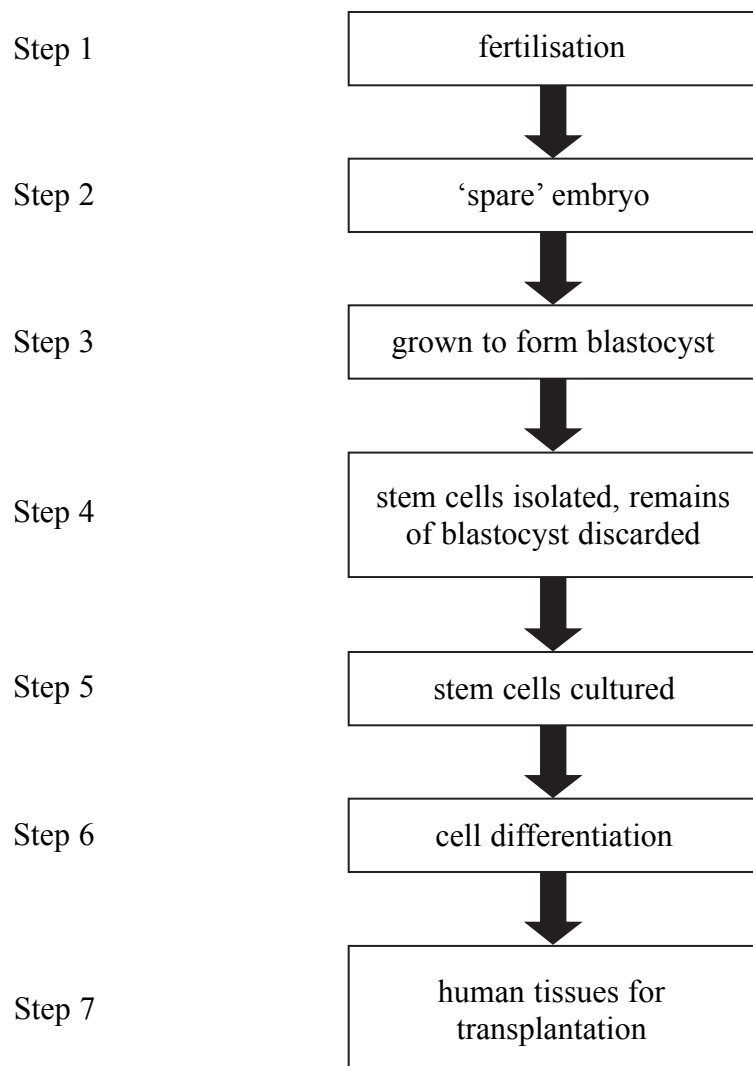
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(2)

(Total 12 marks)

Q8



9. The diagram below shows the steps needed to produce human tissues from embryonic stem cells. This procedure has not yet been successfully carried out although some scientists hope that it will soon be possible. Perhaps one day new nervous tissue will be produced that will enable people with spinal injuries to walk again.



(a) (i) Describe how scientists might obtain a supply of 'spare embryos' (Step 2) to produce tissues.

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(1)



(ii) After fertilisation, cells are totipotent but by the time a blastocyst has formed the cells are pluripotent. Explain what is meant by the terms **totipotent** and **pluripotent**.

totipotent

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pluripotent

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(2)

(b) Explain why the following are important in producing tissues from stem cells.

(i) **stem cells cultured** (Step 5)

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(2)

(ii) **cell differentiation** (Step 6)

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(2)



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(c) The use of embryonic stem cells to produce tissues in this way is controversial. Some people think that it should be banned, whilst other people think that it would be wrong not to try this technique. State whether you are for or against using embryonic stem cells to produce new tissues.

For or against?.....

Use your knowledge of stem cell research issues to justify your view.

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(4)

Q9

(Total 11 marks)

TOTAL FOR PAPER: 70 MARKS

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