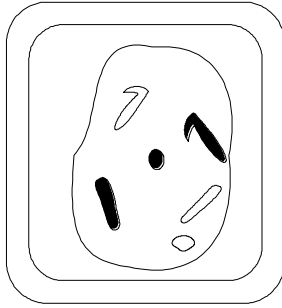


1. The diagram represents a plant cell in which the diploid number of chromosomes is six



(a) Draw a diagram to show

(i) this cell during anaphase of mitosis;

(2)

(ii) the chromosomes in a gamete produced from this cell by meiosis.

(1)

(b) Asexual reproduction involves only mitosis. Give **one** reason why offspring produced by asexual reproduction may vary in

(i) genotype;

.....

(1)

(ii) phenotype but not in genotype.

.....

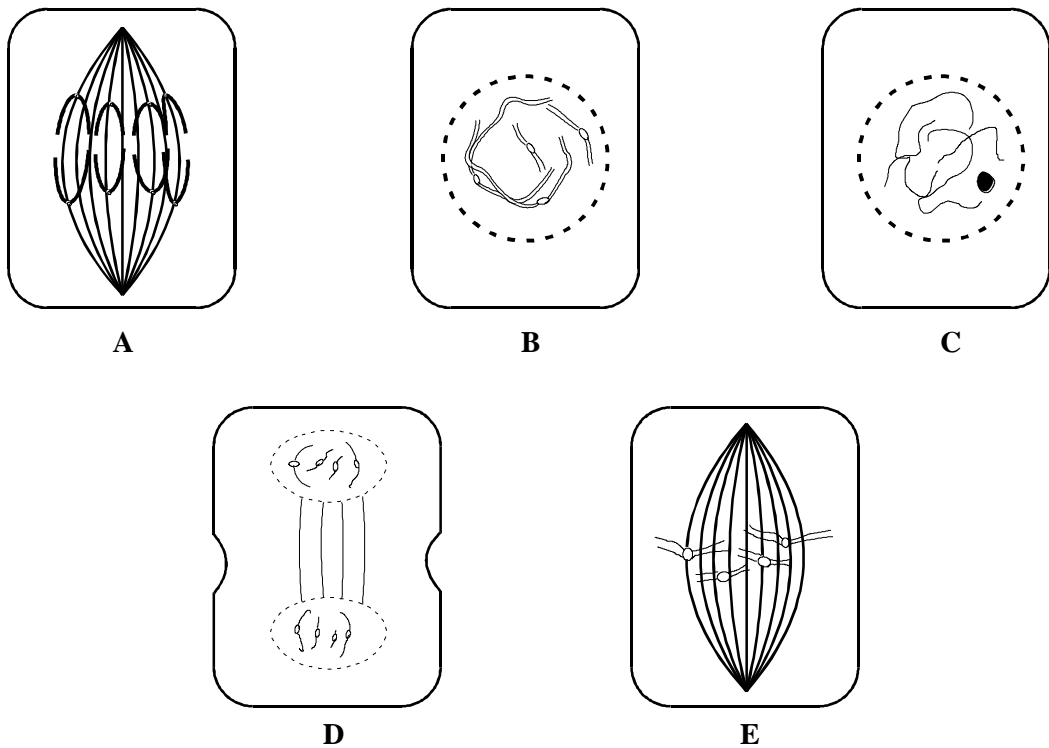
(1)

(c) The formation of gametes during sexual reproduction involves meiosis. Give **two** ways in which meiosis results in genetic variation in the gametes produced.

1. ....
- .....
2. ....
- .....

(2)  
(Total 7 marks)

2. The diagrams A-E show stages of mitosis in an animal cell.



- (a) Which of the drawings A-E shows
- (i) anaphase;.....
  - (ii) telophase;.....
  - (iii) metaphase?.....

(3)

(b) Name **one** stain which could be used to stain the chromosomes in these cells.

.....

(1)

(c) The table shows the average duration of each stage in the cells of a grasshopper embryo.

Stage	Mean duration/minutes
Interphase	20
Prophase	105
Metaphase	13
Anaphase	8
Telophase	54

Give **one** piece of evidence from the table which indicates that these cells are dividing rapidly.

.....  
 .....

(1)

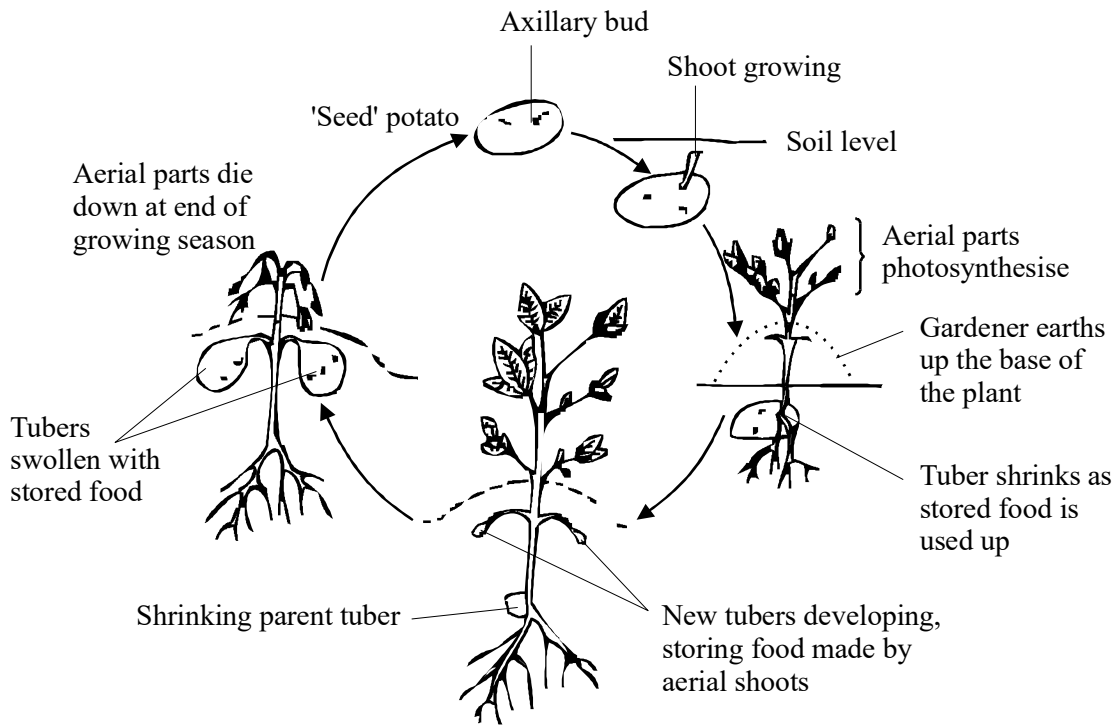
(d) Give **two** processes which occur during interphase and which are necessary for nuclear division to take place.

1.....  
 .....  
 2.....  
 .....

(2)

(Total 7 marks)

3. The drawing shows how potato tubers are produced.



(Reproduced from Food Production, *Biology Advanced Study Series* by Larkcom & Miller, by permission of Nelson Thornes Ltd.)

(a) Name the type of reproduction which results in the production of tubers.

.....

(1)

(b) Explain **two** advantages of growing potato crops from tubers rather than seeds.

1. ....

.....

2. ....

.....

(2)

- (c) Explain why a viral infection may destroy a whole crop of potatoes grown from tubers produced in this way.

.....

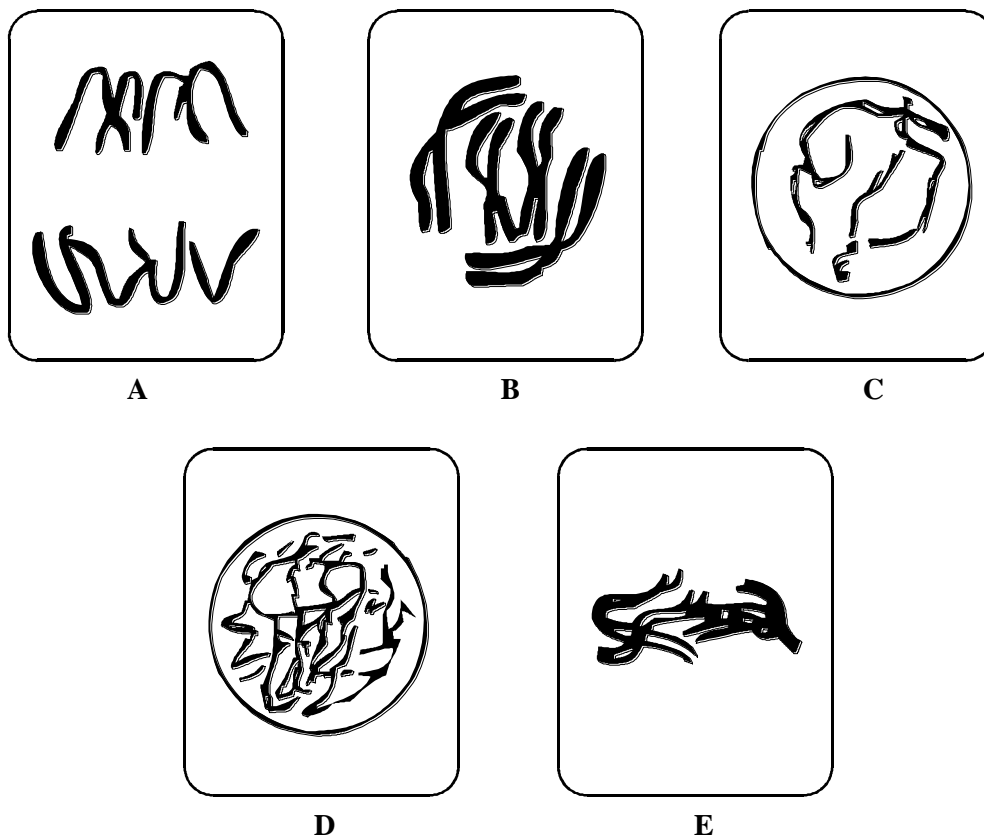
.....

.....

.....

(2)  
(Total 5 marks)

4. Diagrams A-E show some of the stages of mitosis in cells from the same flowering plant.



- (a) Use the letters A-E to give the correct sequence of stages.

.....

(1)

(b) Describe what happens to the chromosomes in each of the following stages.

(i) Stage A

.....  
.....

(1)

(ii) Stage C

.....  
.....

(1)

(c) A root tip squash was prepared in order to observe the stages of mitosis. Explain why

(i) dilute hydrochloric acid was added;

.....  
.....

(1)

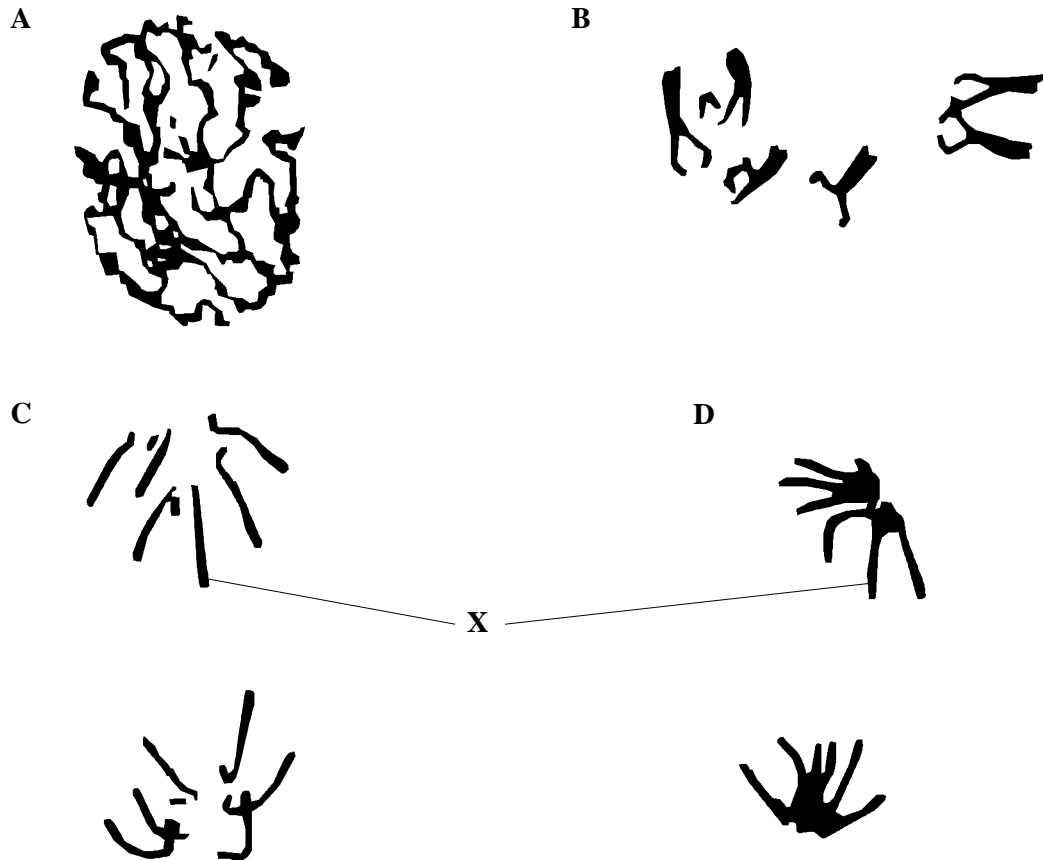
(ii) the preparation was squashed with a coverslip.

.....  
.....

(1)

**(Total 5 marks)**

5. The photographs show stages in mitosis labelled **A-D**. The stages are in sequence with stage **A** being the earliest.



(a) Describe what occurs between

(i) stage **A** and stage **B**;

.....  
 .....  
 .....

(2)

(ii) stage **B** and stage **C**.

.....  
 .....  
 .....

(2)

- (b) Describe what happens to structure **X** between the end of stage **D** and the next time stage **A** occurs.

.....

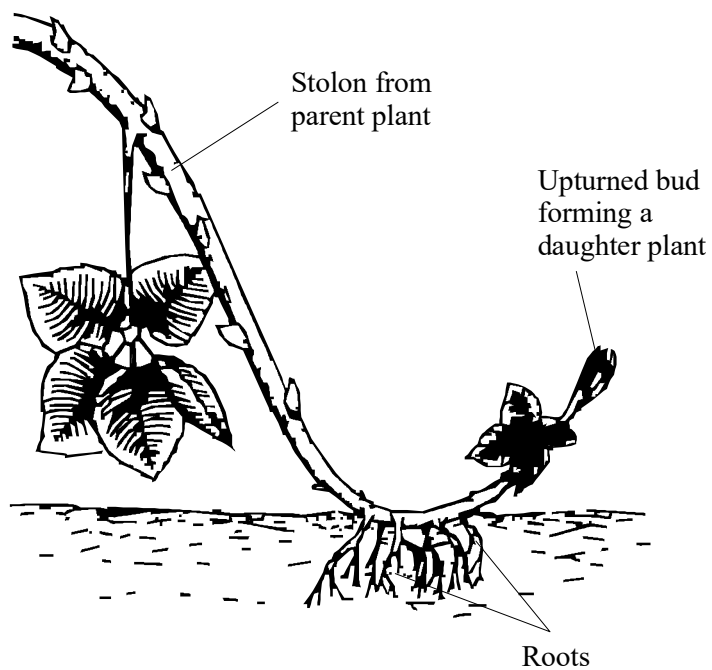
.....

.....

.....

(2)  
(Total 6 marks)

6. (a) The diagram shows one way in which blackberry plants reproduce.



Source: M Jepson *Biological Drawings* (John Murray)



Buds on the parent plant produce side-shoots called stolons. When a stolon touches the soil it produces a daughter plant.

Blackberry plants also produce flowers and seeds.

Commercial blackberry growers use plants produced from stolons rather than plants produced from seeds. Explain why.

.....

.....

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.....

.....

.....

.....

(3)

(b) Describe **one** method of cloning a mammal.

.....

.....

.....

.....

(2)

(Total 5 marks)

7. (a) Describe the features which would help you to recognise when a cell is

(i) in metaphase of mitosis;

.....

.....

.....

.....

(ii) in anaphase of mitosis.

.....

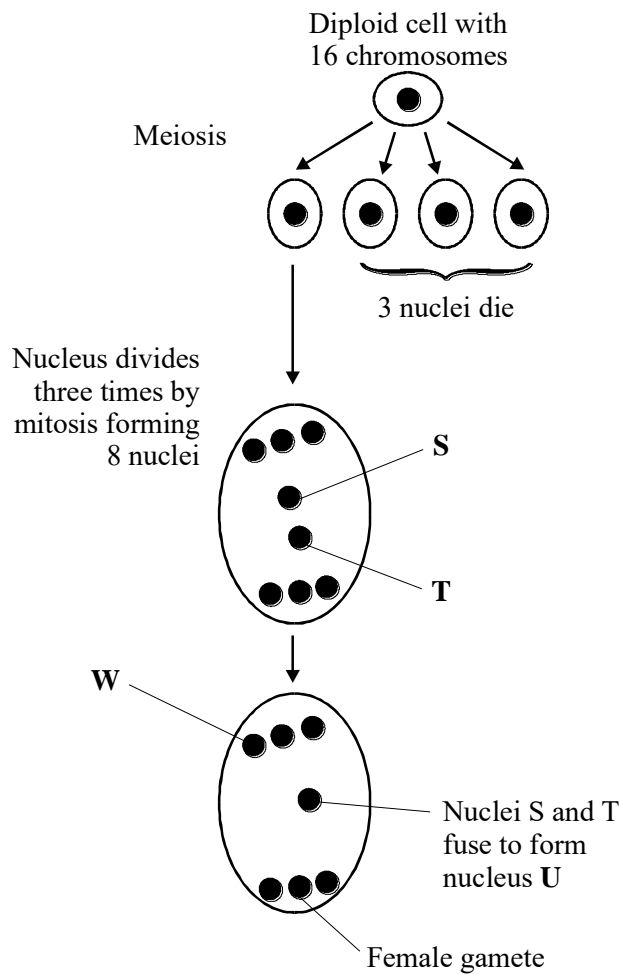
.....

.....

.....

(3)

(b) The diagram shows stages in the development of the female gametes in a flowering plant.



- (i) Diploid nuclei of this species of flowering plant contain 16 chromosomes. How many chromosomes has

nucleus **T**;.....

nucleus **U**?.....

(2)

- (ii) Does nucleus **W** have different alleles from nucleus **U**? .....  
Explain the reason for your answer.

.....  
.....  
.....  
.....

(2)

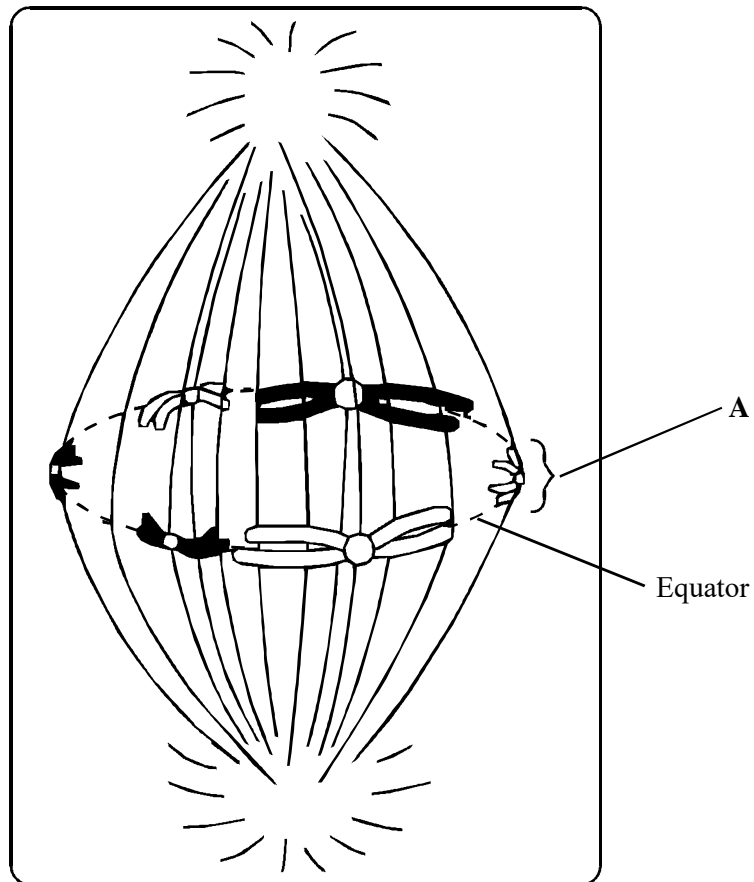
- (iii) During fertilisation, a haploid nucleus from a pollen grain fuses with nucleus **U**.  
How many chromosomes has the resulting nucleus?

.....

(1)

**(Total 8 marks)**

8. (a) The diagram shows a stage of mitosis in an animal cell.



- (i) Name this stage of mitosis.

.....

(1)

- (ii) What happens to structure A in the stage immediately following that shown in the diagram?

.....

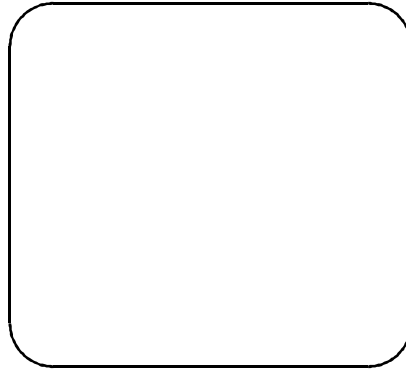
.....

.....

.....

(2)

- (iii) Complete the diagram to show the chromosomes for a gamete produced by this animal.



(2)

- (b) The amount of DNA in cells from a tissue undergoing mitosis was analysed. Some cells were found to have 7.6 units of DNA, others had only 3.8 units. Explain why.

.....

.....

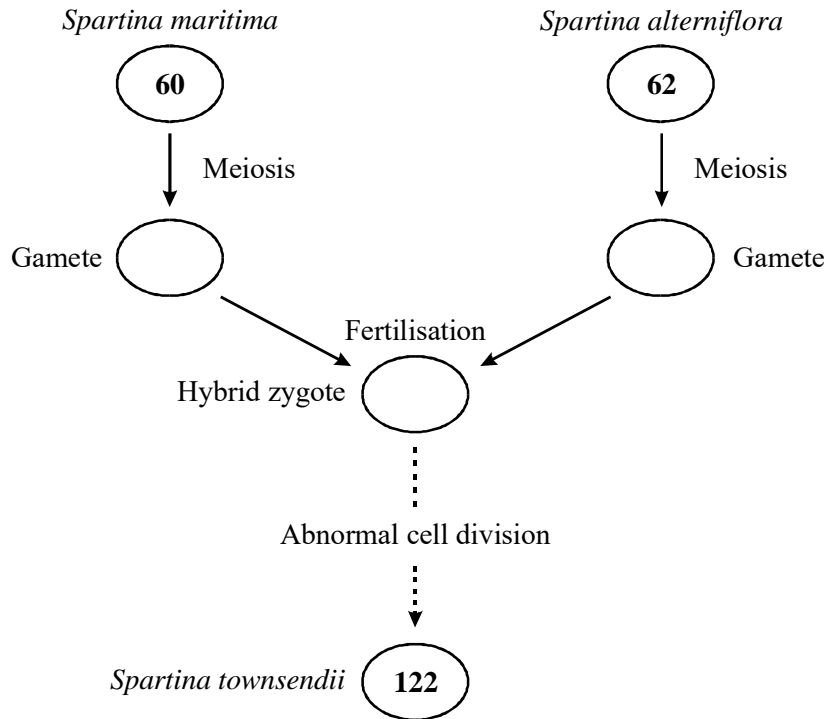
.....

.....

(2)  
**(Total 7 marks)**

9. *Spartina townsendii* is a hybrid species of grass. The diagram shows how this hybrid was formed when a gamete of *Spartina maritima* fused with a gamete of *Spartina alterniflora*.

The number of chromosomes in cells of each species of grass is given in the circles.



- (a) Complete the diagram by giving the number of chromosomes in the gametes and the number of chromosomes in the hybrid zygote.

(1)

- (b) *Spartina townsendii* was produced as a result of abnormal anaphase during mitosis of a hybrid cell. Suggest how anaphase in the abnormal mitosis producing *Spartina townsendii* differed from anaphase in normal mitosis.

.....

.....

.....

.....

(2)

(c) Explain how a plant may reproduce without producing gametes.

.....

.....

.....

.....

(2)  
(Total 5 marks)

10. The diagram shows four stages of mitosis in the cells of a crocus plant.



Stage 1



Stage 2



Stage 3



Stage 4

Adapted from Green N. Stout G and Taylor D *Biological Sciences 2* p800 (Cambridge) 1990

(a) Name **Stage 1**.

.....

(1)

- (b) Describe what happens after **Stage 4** to complete the process of cell division.

.....

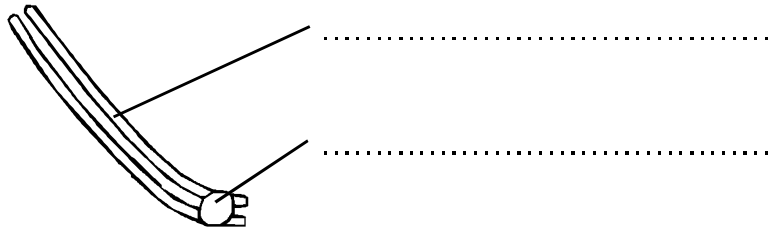
.....

.....

.....

(2)

- (c) Label the diagram below which shows one of the chromosomes from **Stage 2**.



(2)

- (d) What is the diploid number of the crocus?

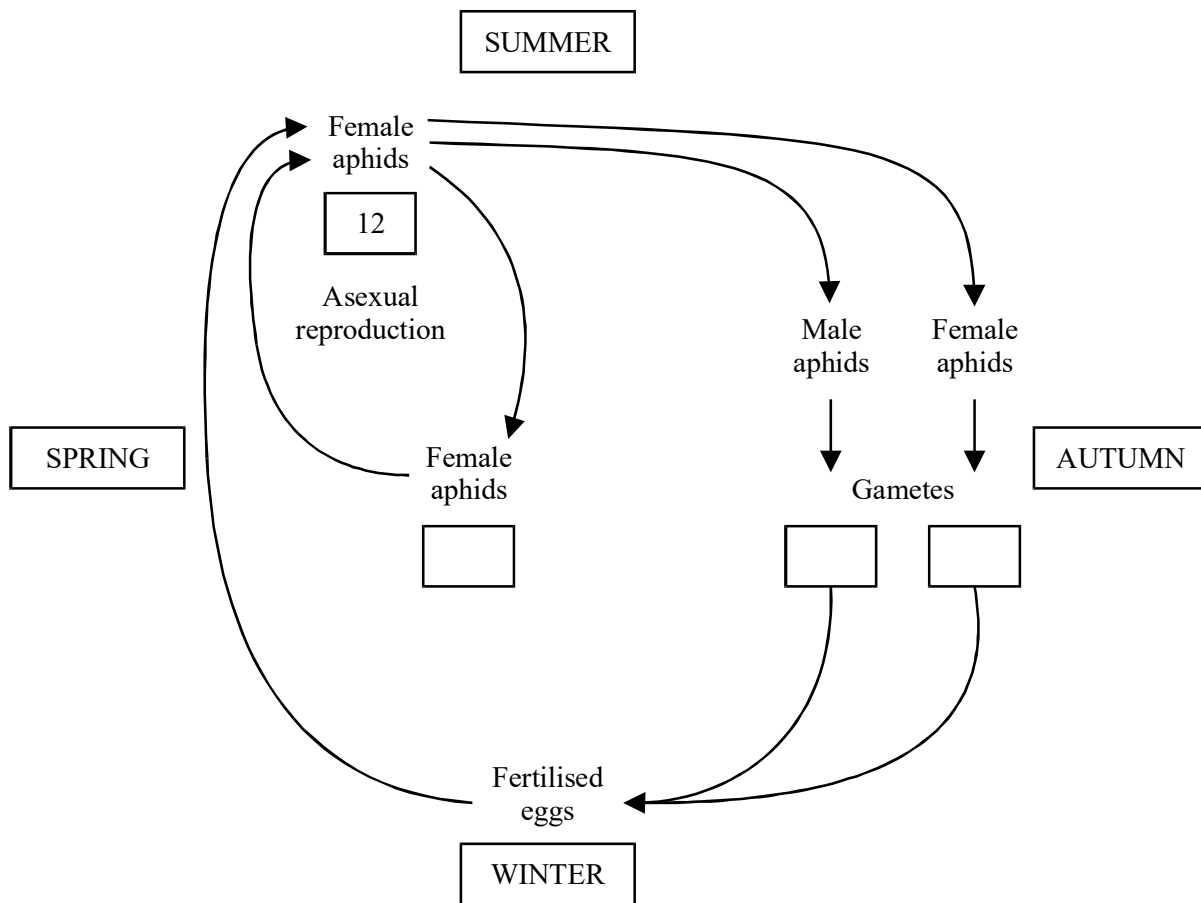
.....

(1)

(Total 6 marks)



11. The peach aphid is an insect pest. Its life cycle is shown in the diagram.



(a) Complete the boxes on the diagram to show the number of chromosomes present in cells of the peach aphids at various times in this life cycle.

(2)

(b) (i) Label an arrow on the diagram to show a stage when meiosis occurs.

(1)

(ii) Explain the importance of meiosis in a life cycle of this type.

.....  
 .....

(1)

- (c) Explain the advantage to the peach aphid of producing only female aphids during spring and summer.

.....  
.....  
.....  
.....

(2)

- (d) Suggest **one** advantage of producing both male and female aphids in the autumn.

.....  
.....

(1)

(Total 7 marks)

- 12. (a) Describe what happens to the chromosomes during each of the following stages of mitosis.

Prophase

.....  
.....

Metaphase

.....  
.....

Anaphase

.....  
.....

Telophase

.....  
.....

(4)

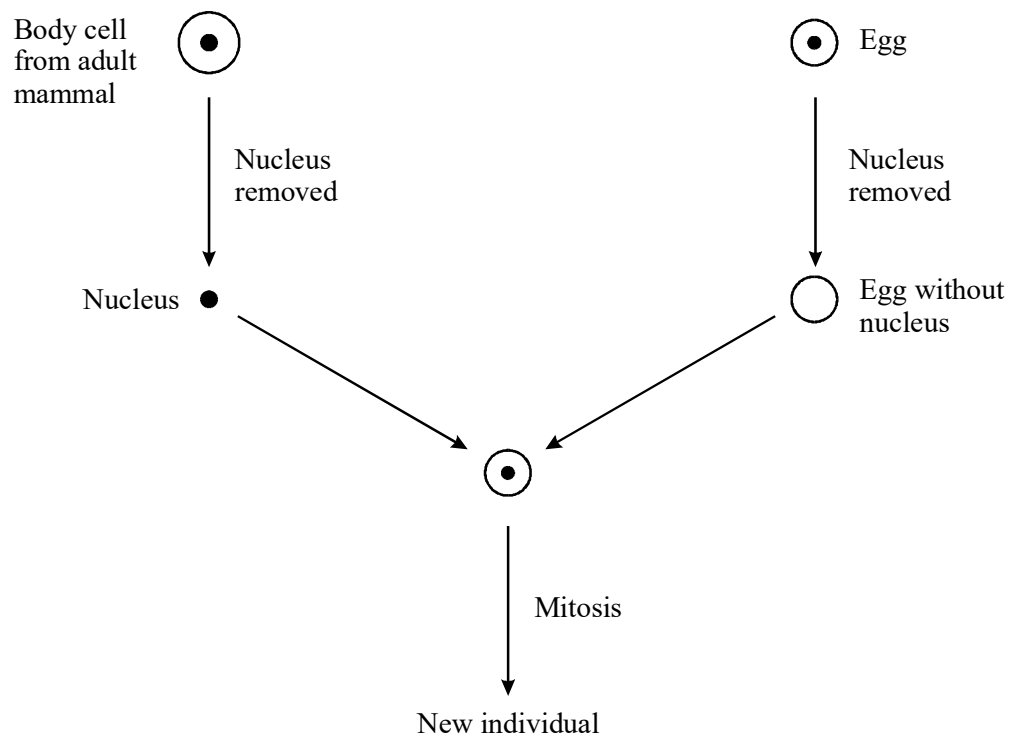
(b) Complete the table to give **two** differences between mitosis and meiosis.

Mitosis	Meiosis

(2)

(Total 6 marks)

13. The diagram shows one method of cloning mammals.



- (a) Explain why the new individual will be genetically identical to the adult mammal from which the body cell was taken.

.....

.....

.....

.....

(2)

- (b) Suggest why a nucleus from a body cell is used instead of a nucleus from a sperm or an egg.

.....

.....

(1)

- (c) Give **one** advantage and **one** disadvantage of producing mammals by cloning rather than by sexual reproduction.

- (i) advantage

.....

.....

(1)

- (ii) disadvantage

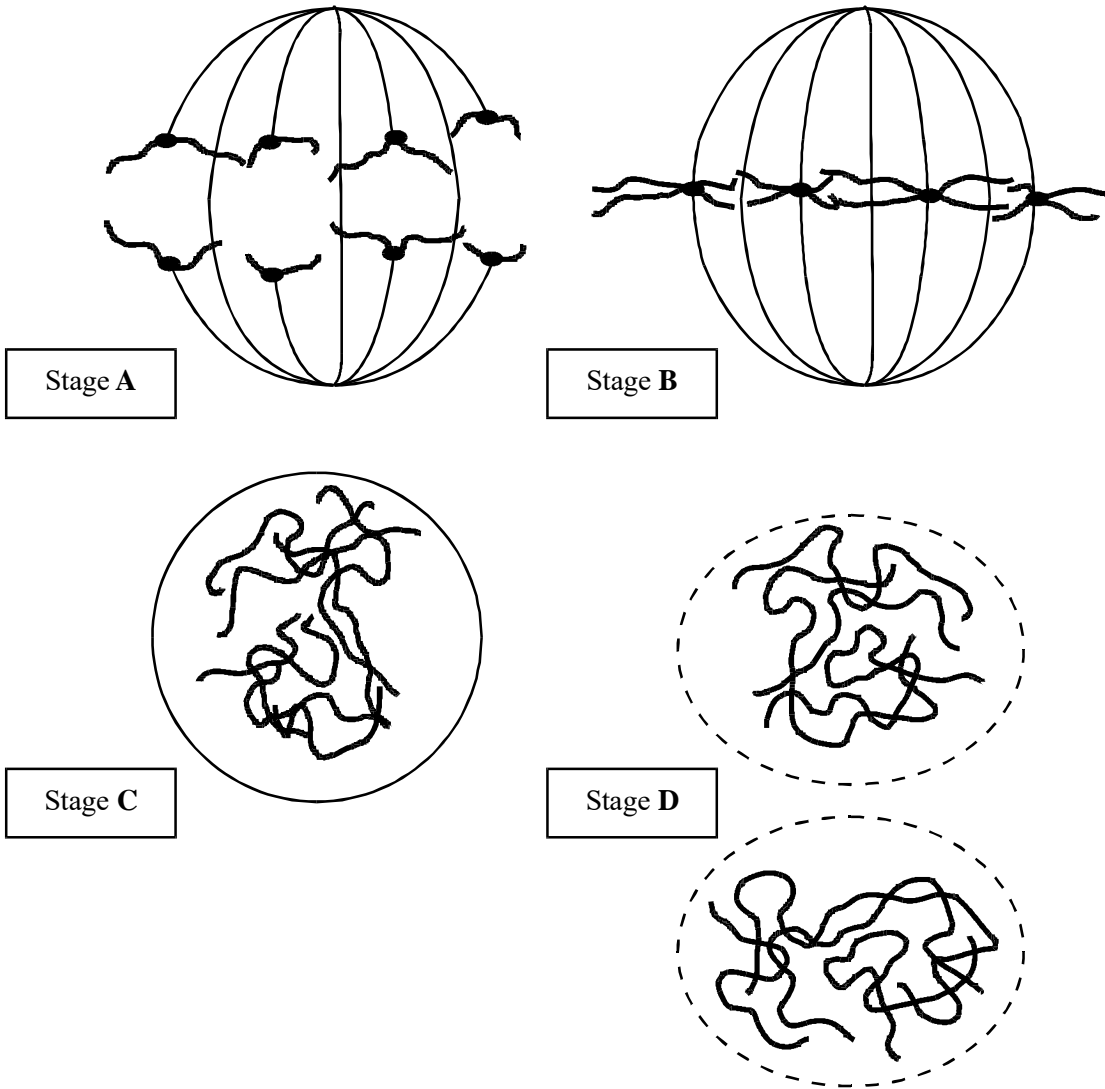
.....

.....

(1)

**(Total 5 marks)**

14. The diagrams show four stages of mitosis.



(a) (i) Name stage A.

.....

(1)

(ii) Starting with stage C, give the stages A to D in the correct order.

C ..... ..

(1)

(iii) Describe and explain the appearance of one of the chromosomes in stage **B**.

.....

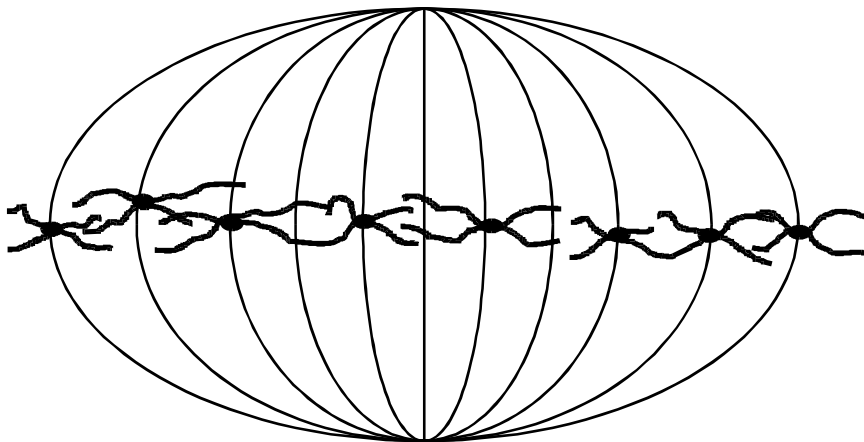
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.....

.....

(2)

(b) Colchicine is a substance that prevents the formation of the spindle in mitosis. Dividing cells were treated with colchicine. This stopped them dividing. After a few hours, the colchicine was removed and the cells began to divide again. The diagram shows the chromosomes from one of the treated cells at stage **B** after the cell began dividing again.



(i) What has happened to the chromosome number?

.....

(1)

(ii) Suggest an explanation for the change in the chromosome number.

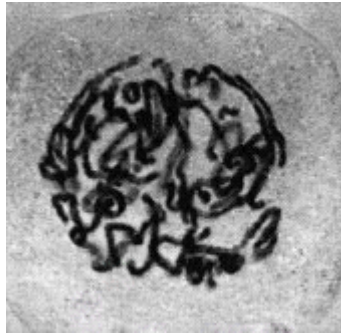
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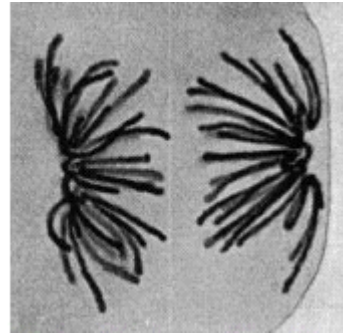
(1)

(Total 6 marks)

15. (a) The photographs show two stages in mitosis of a plant cell.



**A**



**B**

McLeish and Snoad, *Looking at Chromossomes*, (MacMillam and Co. Ltd.) 1958

Name stages **A** and **B**. In each case describe what is happening to the chromosomes.

- (i) Stage **A** .....

.....  
 .....  
 .....

(2)

- (ii) Stage **B** .....

.....  
 .....  
 .....

(2)

(b) Describe **two** events during interphase which prepare a cell for mitosis.

1 .....

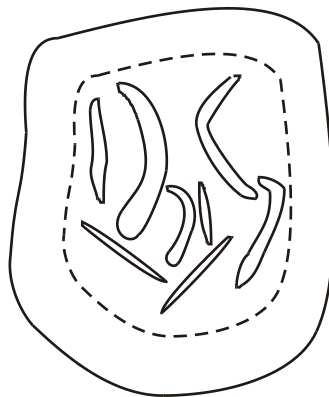
.....

2 .....

.....

(2)  
(Total 6 marks)

16. The diagram represents a cell from a fruit fly in which the diploid number is eight.



(a) Draw a diagram to show

(i) this cell during anaphase of mitosis;

(2)



(ii) the chromosomes in a gamete produced from this cell by meiosis.

(2)

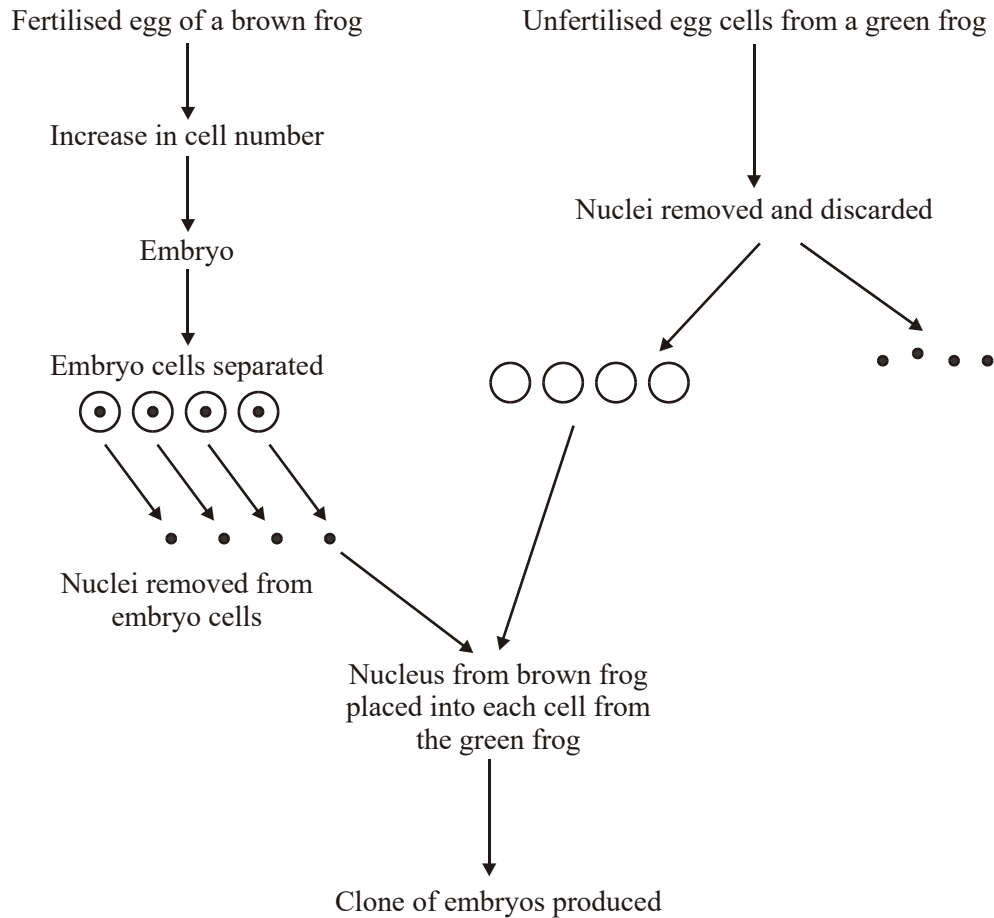
(b) Explain why meiosis is important in sexual reproduction, apart from producing gametes that are genetically different.

.....  
.....  
.....  
.....

(2)

**(Total 6 marks)**

17. A clone of frogs was produced by nuclear transfer. This procedure is summarised in the diagram.



- (a) What is a clone?

.....

.....

(1)

- (b) Name the type of cell division occurring in a developing embryo.

.....

(1)

- (c) The embryo cells used are from an early stage of development. Explain why.

.....  
 .....

(1)

- (d) What would be the colour of the cloned offspring? Explain your answer.

.....  
 .....

(1)

- (e) Give **two** differences between the nuclei removed from the embryo cells and the nuclei discarded from the unfertilised egg cells.

1 .....

2 .....

(2)

- (f) Only 30% of the cloned cells successfully developed into embryos. Suggest a reason for this low success rate.

.....  
 .....

(1)

(Total 7 marks)

18. (a) The drawing shows a stage of mitosis in an animal cell.



(i) Name this stage of mitosis.

.....

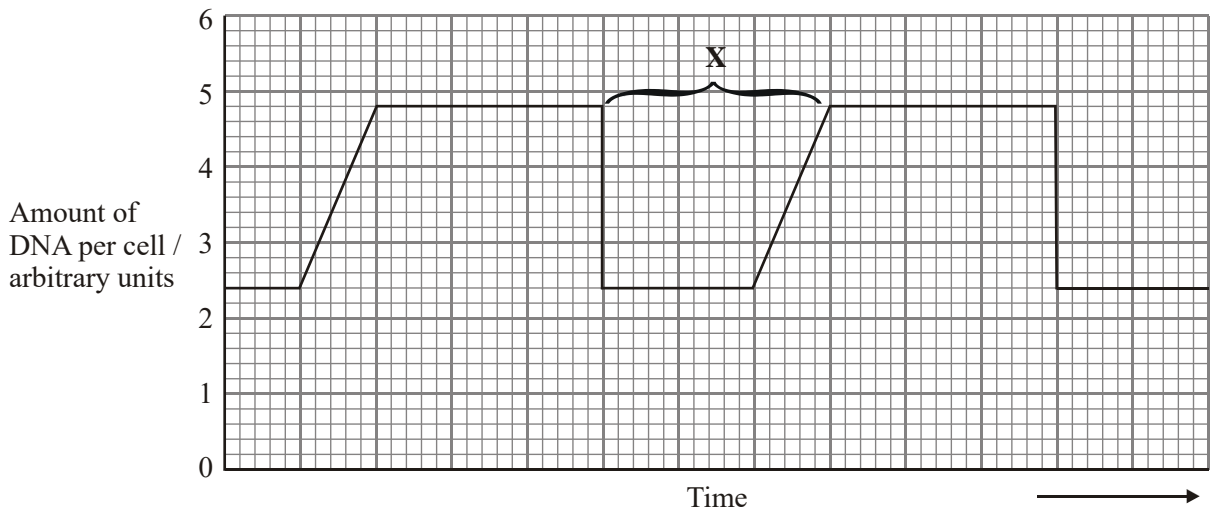
(1)

(ii) Describe and explain what happens during this stage which ensures that two genetically identical cells are produced.

.....  
 .....  
 .....  
 .....

(2)

(b) The graph shows the relative amounts of DNA per cell during two successive cell divisions in an animal.



(i) What stage of the cell cycle is shown by X?

.....  
 .....

(1)

- (ii) Apart from an increase in the amount of DNA, give **one** process which occurs during stage **X** which enables nuclear division to occur.

.....  
 .....

(1)

- (iii) How many units of DNA would you expect to be present in a gamete formed in this animal as a result of meiosis?

.....

(1)

- (c) The table shows the average duration of each stage of the cell cycle in the cells of a mammalian embryo.

Stage	Mean duration/ minutes
Interphase	12
Prophase	50
Metaphase	15
Anaphase	10
Telophase	42

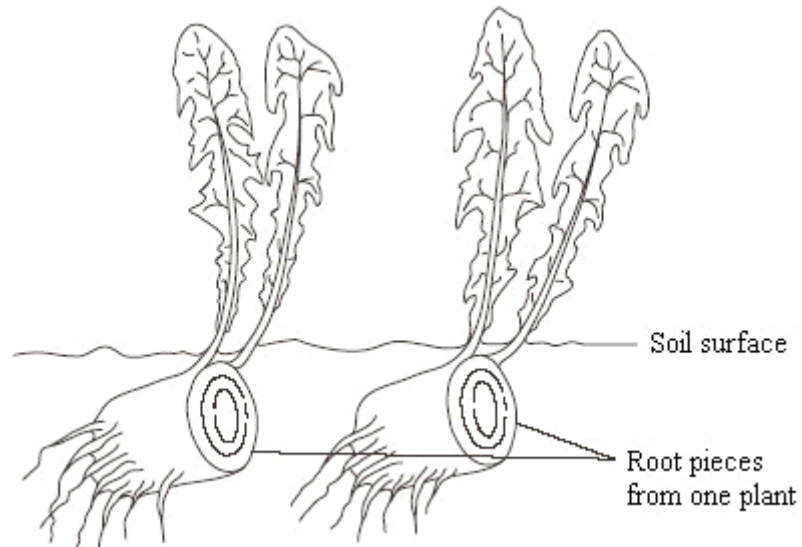
Give **one** piece of evidence from the table which indicates that these cells are multiplying rapidly.

.....  
 .....

(1)

(Total 7 marks)

19. It is difficult to get rid of dandelions from a garden because small pieces of the root are able to grow into new plants if left behind in the soil. This is shown in the drawing.



- (a) Explain why the plants produced form a clone.

.....

.....

.....

.....

(2)

- (b) Suggest **one** reason why the plants in a clone may not be identical in appearance.

.....

.....

(1)

- (c) Most plants produce seeds after fertilisation in sexual reproduction. However, dandelions produce small, windblown seeds without fertilisation taking place. Suggest **two** advantages to the dandelion of being able to reproduce from these seeds, as well as from pieces of root.

Advantage 1 .....

.....

Advantage 2 .....

.....

(2)

(Total 5 marks)

- 20. (a) Describe and explain how the structure of DNA results in accurate replication.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

- (b) Describe the behaviour of chromosomes during mitosis and explain how this results in the production of two genetically identical cells.

.....

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.....

(7)

- (c) A cancerous tumour is formed by uncontrolled mitotic division. This results in a mass of cells with an inadequate blood supply. Drugs are being developed which only kill cells in a low oxygen environment. Suggest how these drugs could be useful in the treatment of cancer.

.....

.....

.....

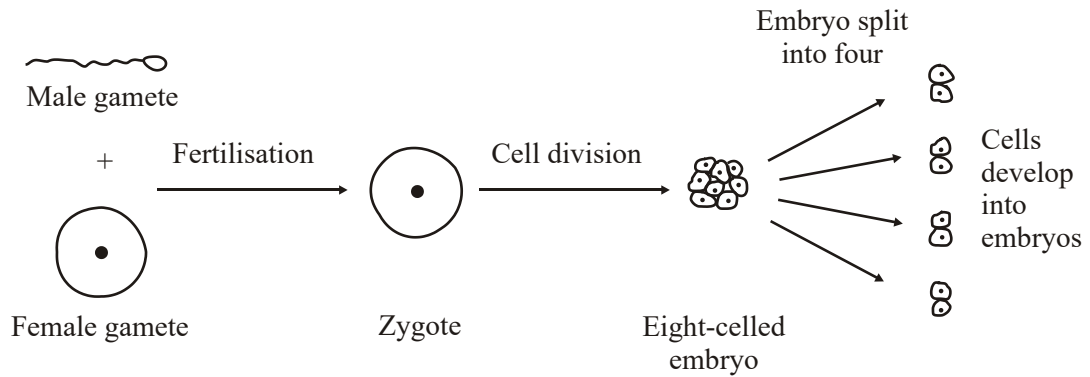
.....

(2)

**(Total 13 marks)**



21. An egg cell from a cow was fertilised in a laboratory and allowed to develop into an eight-celled embryo. This was split into four parts, each of which developed into a new embryo. This is shown in the diagram. The new embryos were later transferred into different surrogate cows.



- (a) Explain why the new embryos produced are a clone.

.....

.....

.....

.....

(2)

- (b) If embryos with more than eight cells are split up, the separated cells fail to develop into new embryos. Suggest why.

.....

.....

(1)

(c) Give **two** advantages to a farmer of using embryos produced by this procedure.

Advantage 1 .....

.....

Advantage 2 .....

.....

(2)  
(Total 5 marks)

22. (a) Boxes **A** to **E** show some of the events of the cell cycle.

<b>A</b>	Chromatids separate
----------	---------------------

<b>B</b>	Nuclear envelopes disappear
----------	-----------------------------

<b>C</b>	Cytoplasm divides
----------	-------------------

<b>D</b>	Chromosomes condense and become visible
----------	---

<b>E</b>	Chromosomes on the equator of the spindle
----------	---

(i) List these events in the correct order, starting with **D**.

**D**  
.....

(1)

(ii) Name the stage described in box **E**.

.....

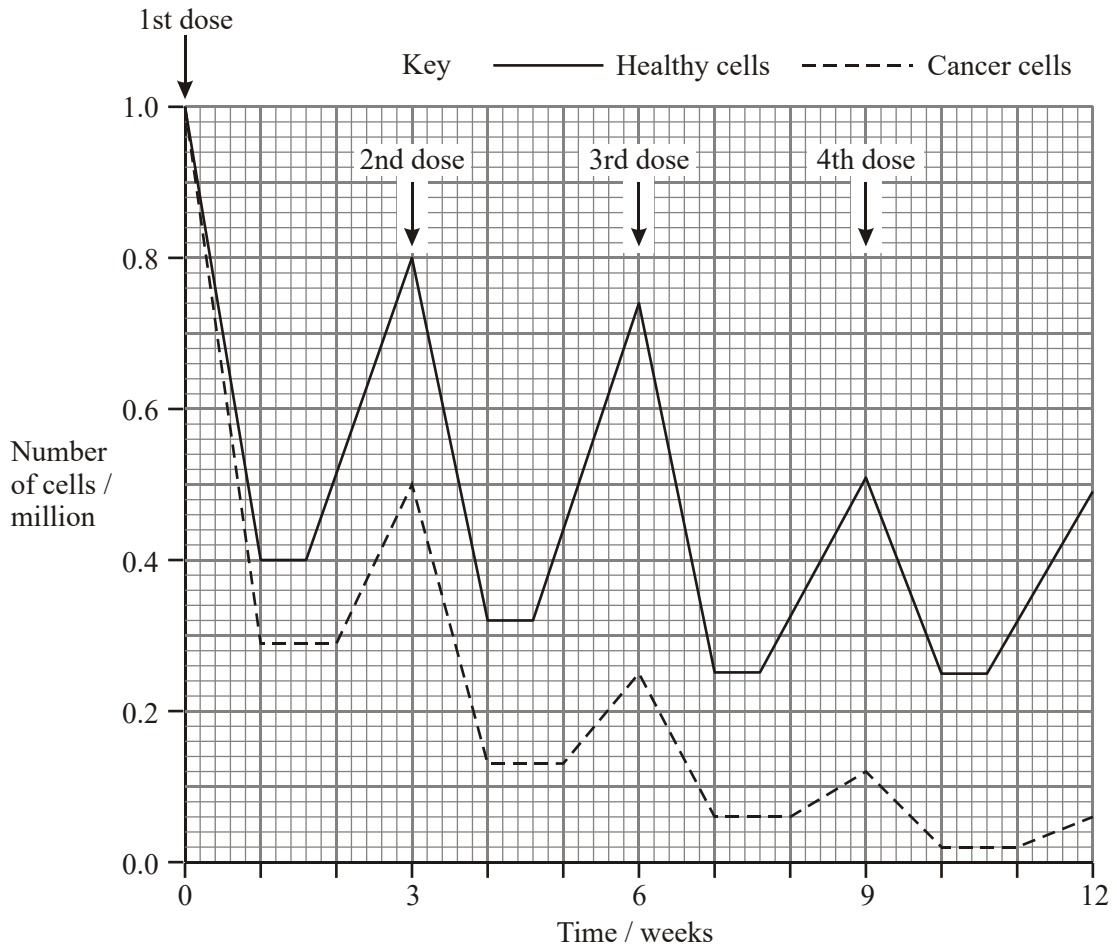
(1)

(b) Name the phase during which DNA replication occurs.

.....

(1)

- (c) Bone marrow cells divide rapidly. As a result of a mutation during DNA replication, a bone marrow cell may become a cancer cell and start to divide in an uncontrolled way. A chemotherapy drug that kills cells when they are dividing was given to a cancer patient. It was given once every three weeks, starting at time 0. The graph shows the changes in the number of healthy bone marrow cells and cancer cells during twelve weeks of treatment.



- (i) Using the graph calculate the number of cancer cells present at week 12 as a percentage of the original number of cancer cells. Show your working.

Answer .....%

(2)

- (ii) Suggest **one** reason for the lower number of cancer cells compared to healthy cells at the end of the first week.

.....  
.....

(1)

- (iii) Describe **two** differences in the effect of the drug on the cancer cells, compared with healthy cells in the following weeks.

1 .....

.....

2 .....

.....

(2)

**(Total 8 marks)**