

Diagram A below shows the different phases during the cell cycle of a eukaryotic cell. Diagram B shows the amount of DNA present during the different phases. G₁ and G₂ represent the gap phases during which cell growth may occur. S is an intermediate phase. Mitosis and Cytokinesis are the final stages of division.

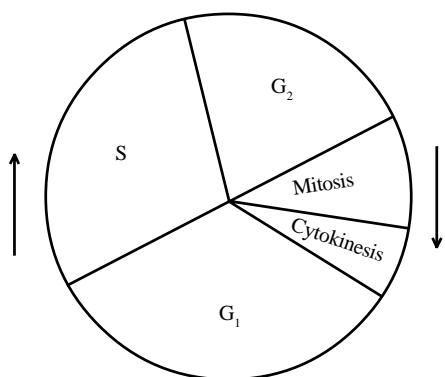


DIAGRAM A

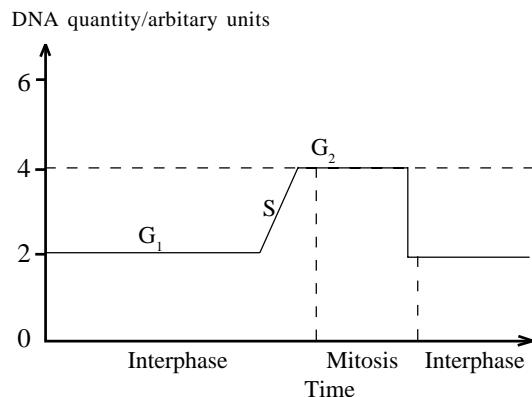


DIAGRAM B

(a) Describe how the quantity of DNA in cells is increased during phase S.

.....

[4]

(b) What will be the quantity of DNA in arbitrary units at the end of mitotic cell division?

.....

[1]

(c) How is the quantity of DNA returned to this level?

.....

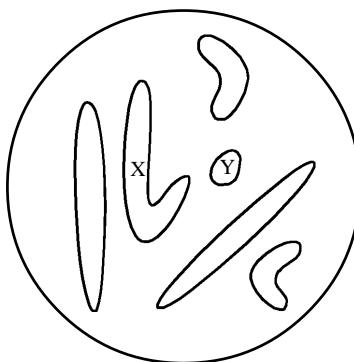
[3]

(d) What would be the quantity of DNA in arbitrary units at the end of a meiotic division.

.....

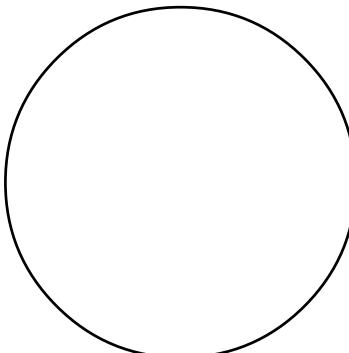
[1]

The diagram below shows the chromosomes of a white blood cell from a mammal (not human).



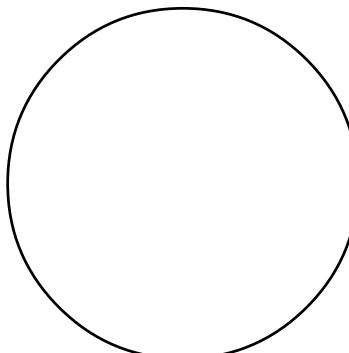
(a) In the circles below draw the chromosome content for the same species of mammal of:

- (i) an epithelial cell.



[2]

- (ii) an egg cell.



[2]

(b) What sex of the mammal did the above chromosomes come from? Explain your answer.

.....
.....

[2]

(a) There are 18 chromosomes in the somatic (body) cells of a cabbage. How many chromosomes would be present in each of the following?

- (i) male nucleus in the pollen grain.

.....

[1]

- (ii) a cell in anaphase of mitosis.

.....

[1]

- (iii) a cell in anaphase I of meiosis.

.....

[1]

- (iv) a cell in anaphase II of meiosis.

.....

[1]

- (v) a nucleus in telophase II of meiosis.

.....

[1]

(b) The diploid chromosome number of the radish is also 18 chromosomes.

- (i) How many chromosomes would there be in a diploid nucleus of the hybrid offspring produced by crossing a cabbage with a radish? Show your working.

Answer:

[1]

- (ii) Suggest why such a hybrid would be infertile.

.....

.....

.....

[2]

(a) What type of cell division occurs in the following tissues?

- (i) the apical meristem of a flowering plant.

.....

- (ii) red bone marrow of a mammal.

.....

- (iii) a pollen sac in the anther of a flowering plant.

.....

- (iv) the embryo sac in the ovule of a flowering plant.

.....

- (v) the inner layer of a seminiferous tubule in a mammalian testis.

.....

[5]

(b) Mitosis is usually involved in producing diploid cells from diploid cells. However there are examples in nature where it produces haploid cells from haploid cells. Give two such examples.

Example 1:

Example 2:

[2]

Although mitosis is a continuous process, for ease of reference it is conventionally divided into the following stages:
interphase, prophase, metaphase, anaphase and telophase.

(a) Name the stages of mitosis during which,

- (i) the chromatids separate and move to the poles.

.....

[1]

- (ii) the nuclear membrane reforms and cytokinesis follows.

.....

[1]

- (iii) the chromosomes align on the equator of the spindle.

.....

[1]

- (iv) the chromosomes become stainable and the spindle starts to form.

.....

[1]

(b) If the amount of DNA present in the cell at metaphase is 20 units, how much DNA will be present in each nucleus:

- (i) at the start of prophase.

.....

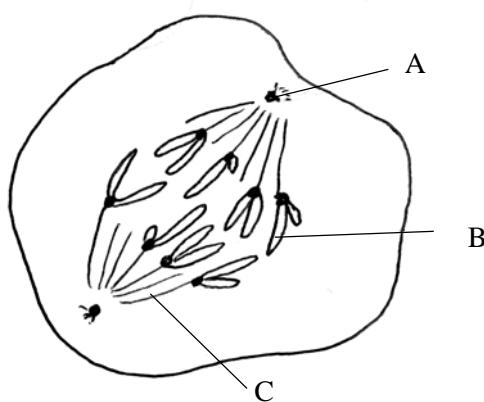
[1]

- (ii) immediately after telophase.

.....

[1]

The diagram below shows the nucleus of a cell during mitosis.



(a) Identify structures A, B and C:

A.

B.

C.

[3]

(b) Name the stage in which each of the following processes takes place.

(i) condensation of chromosomes.

..... [1]

(ii) movement of daughter chromosomes to the poles.

..... [1]

(c) The substance colchicine can be used specifically to inhibit the formation of spindle fibres and so stop mitosis at a particular stage. At which stage would colchicine stop mitosis?

..... [1]

(d) Name two precise locations where mitosis occurs in plants.

1.

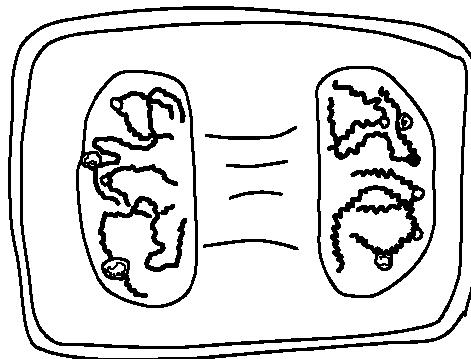
2. [2]

(a) Outline the sequence of changes undergone by chromosomes, during mitosis.

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

[5]

(b) The diagram shows a plant cell at a particular stage of mitosis.



(i) Identify the stage of mitosis shown.

.....

[1]

(ii) Briefly describe the events of the next stage of cell division.

.....

.....

[2]

(a) Outline the function of each of the following in the process of mitosis:

- (i) centromere.

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

[2]

- (ii) spindle.

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

[2]

(b) Outline the significance of meiosis in the process of gamete formation.

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

[2]

(a) Explain why it is inappropriate to call interphase a 'resting stage'?

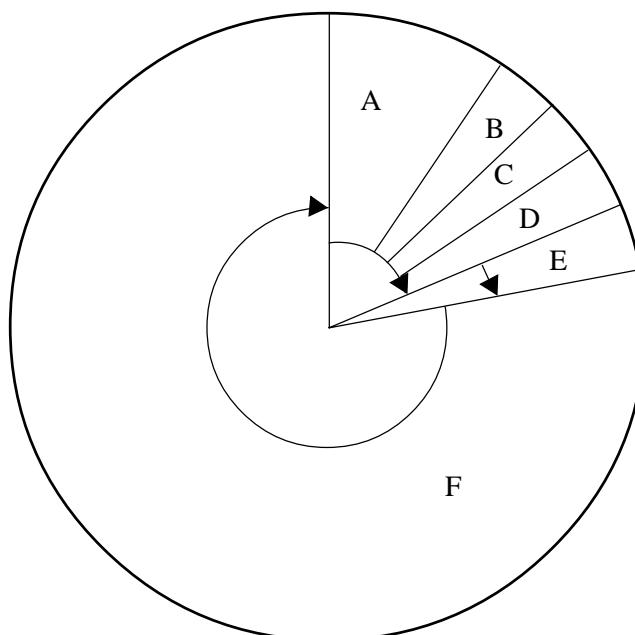
.....

.....

.....

[3]

(b) The diagram below represents the cell cycle.



Identify the stages A, C, E and F.

A:

C:

E:

F:

[4]

- (a) The statements in the list below the table describe some of the stages of mitosis. Complete the table by writing in the correct statement with the appropriate stage.

Stage	Description
Prophase	
Metaphase	
Anaphase	
Telophase	
Interphase	
Cytokinesis	

nuclear membranes reappear.

chromosomes replicate except at their centromeres.

division of the cytoplasm occurs.

chromosomes become shorter and thicker.

chromosomes attach to spindle ends at equator.

daughter chromosomes move to the poles.

[6]

- (b) How does cytokinesis in plants differ from cytokinesis in animals?

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

[2]

The drawing below shows a dividing animal cell nucleus at the anaphase stage of mitosis.



(a) Briefly describe what you can see happening in this stage of mitosis.

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

[4]

(b) (i) In the space below draw accurately the appearance of the same nucleus at the metaphase stage of mitosis.

[3]

(ii) On your drawing label a centromere and a centrosome (aster).

[2]

- (a) Read through the following passage about mitosis and then complete it by writing the most appropriate word or words in the spaces.

In flowering plants the process of mitosis is restricted to the apical and to In growing mammals mitosis can occur throughout the body. However, not all regions of the young mammal grow at the same rate and this is called growth.

In the cell cycle, replication of DNA occurs in the phase, after which there is a lag or gap phase, called the phase, before actual mitosis starts. The chromosomes also replicate before the onset of mitosis, but this replication is not visible until the middle of the stage.

At this stage, each chromosome consists of two held together by a

In the kangaroo, there are 10 pairs of chromosomes. Thus in mitosis an anaphase cell will contain chromosomes with migrating to each pole. The daughter cells therefore have the number of $2n = \dots$.

[12]

- (b) The drug colchicine is used in chromosome studies since it inhibits mitosis at metaphase when the chromosomes are most clearly visible. It does this by inhibiting spindle formation or by breaking down the spindle. Colchicine is produced by the roots of the Autumn Crocus (*Colchicum autumnale*). Suggest an advantage to Autumn Crocus plants of producing colchicine.

.....

.....

[2]