

10.1 Meiosis

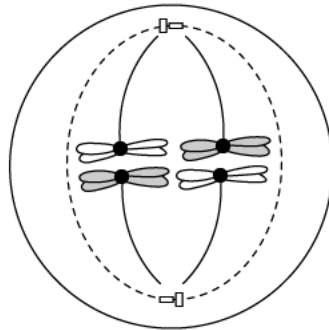
Question Paper

Course	DP IB Biology
Section	10. Genetics & Evolution (HL Only)
Topic	10.1 Meiosis
Difficulty	Medium

Time allowed: 60
Score: /44
Percentage: /100

Question 1a

a)
The following image shows a cell undergoing cell division.

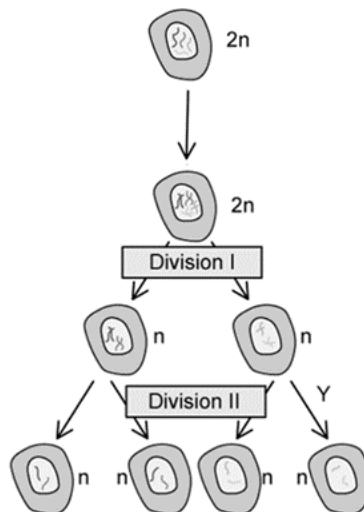


Identify, with a reason, the type of cell division shown in the image.

[2 marks]

Question 1b

b)
The image below illustrates the formation of sperm cells, also known as spermatozoa.



State and explain the change in chromosome number taking place during division I.

[2 marks]

Question 1c

c)
A sperm-producing cell in the testes has 46 chromosomes in its nucleus.
Calculate the number of **chromatids** that would be in the nucleus of this cell after it has undergone meiosis I.

[2 marks]

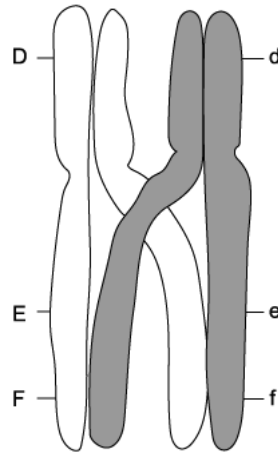
Question 1d

d)
Outline the first steps in the process of meiosis, known as prophase I.

[2 marks]

Question 2a

a)
The image below shows a pair of chromosomes during meiosis, taking place in a testis of *Drosophila melanogaster* (a fruit fly). The position of the alleles of some genes is indicated.

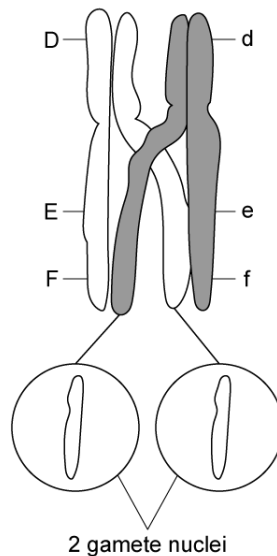


State the name of the arrangement of chromosomes shown in the image above.

[1 mark]

Question 2b

b)
The diagram below shows two of the gamete nuclei that formed at the end of the meiosis process shown in part a). Assume that the parent cell only contains 2 chromosomes.



Draw the chromosomes in each of the nuclei shown in the diagram to give their appearance at the end of meiosis.

[2 marks]

Question 2c

c)

Outline the events that occur during anaphase I of meiosis.

[2 marks]

Question 2d

d)

Explain how independent assortment contributes to genetic variation in gametes.

[2 marks]

Question 3a

a)

European rabbits (*Oryctolagus cuniculus*) have a diploid ($2n$) chromosome number of 44.

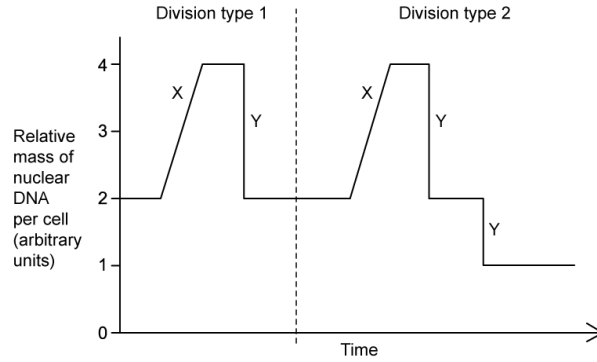
The number of possible chromosome combinations that are possible as the result of independent assortment can be calculated using the formula 2^n , where n is the haploid chromosome number.

Calculate the number of different possible chromosome combinations in the gametes of rabbits.

[2 marks]

Question 3b

b)
The graph below shows how the mass of DNA changes over time during two different types of cell division of a diploid organism.



Identify, with a reason, which of the division types represents meiosis.

[2 marks]

Question 3c

c)
Describe the two processes represented by the letters **X** and **Y** in the graph in part b).

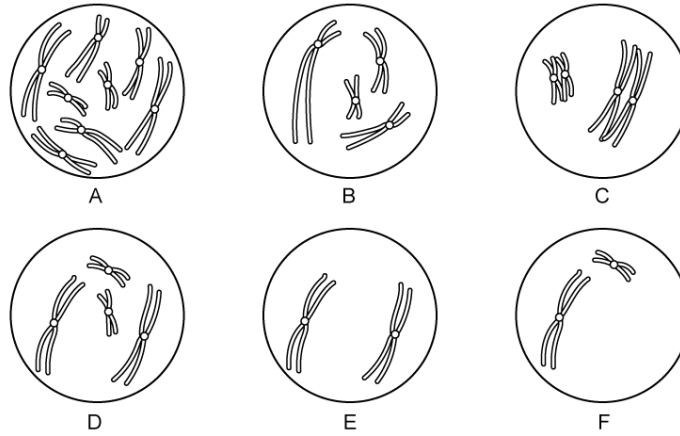
[2 marks]

Question 3d

d)

The fruit fly (*Drosophila melanogaster*) has a diploid number ($2n$) of 8.

The image below shows some cells from different organisms undergoing cell division.



Identify, with a reason, the cell which would represent a fruit fly cell that has just completed meiosis I.

[2 marks]

Question 4a

a)

Explain what is meant by the phrase 'non-Mendelian ratio'.

[2 marks]

Question 4b

b)

Explain how the work of Thomas Hunt Morgan provided a possible explanation for non-Mendelian ratios.

[2 marks]

Question 4c

c)

Hydra are small, freshwater invertebrates that can reproduce by forming buds on their cylinder-shaped bodies. These buds grow over time, developing tentacles like the adult hydra, and eventually detaching from the parent hydra's body.

Suggest why meiosis would not occur in Hydra during the process described above.

[2 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Describe the process of crossing over in prophase I.

[7 marks]

Question 5b

b)

Compare and contrast meiosis II and mitosis.

[5 marks]**Question 5c**

c)

Draw a diagram to show how chiasmata are formed.

[3 marks]