3.2 Meiosis

Question Paper

Course	DP IB Biology
Section	3. Genetics
Topic	3.2 Meiosis
Difficulty	Medium

Time allowed: 20

Score: /10

Percentage: /100

Question 1

Which of the following statements correctly describes meiosis?

A   It is a mechanism of nuclear division that occurs in all cells.

B   It produces haploid cells during the first nuclear division.

C   It involves interphase, prophase, metaphase, anaphase and telophase.

D   It is the only process that generates genetic variation.
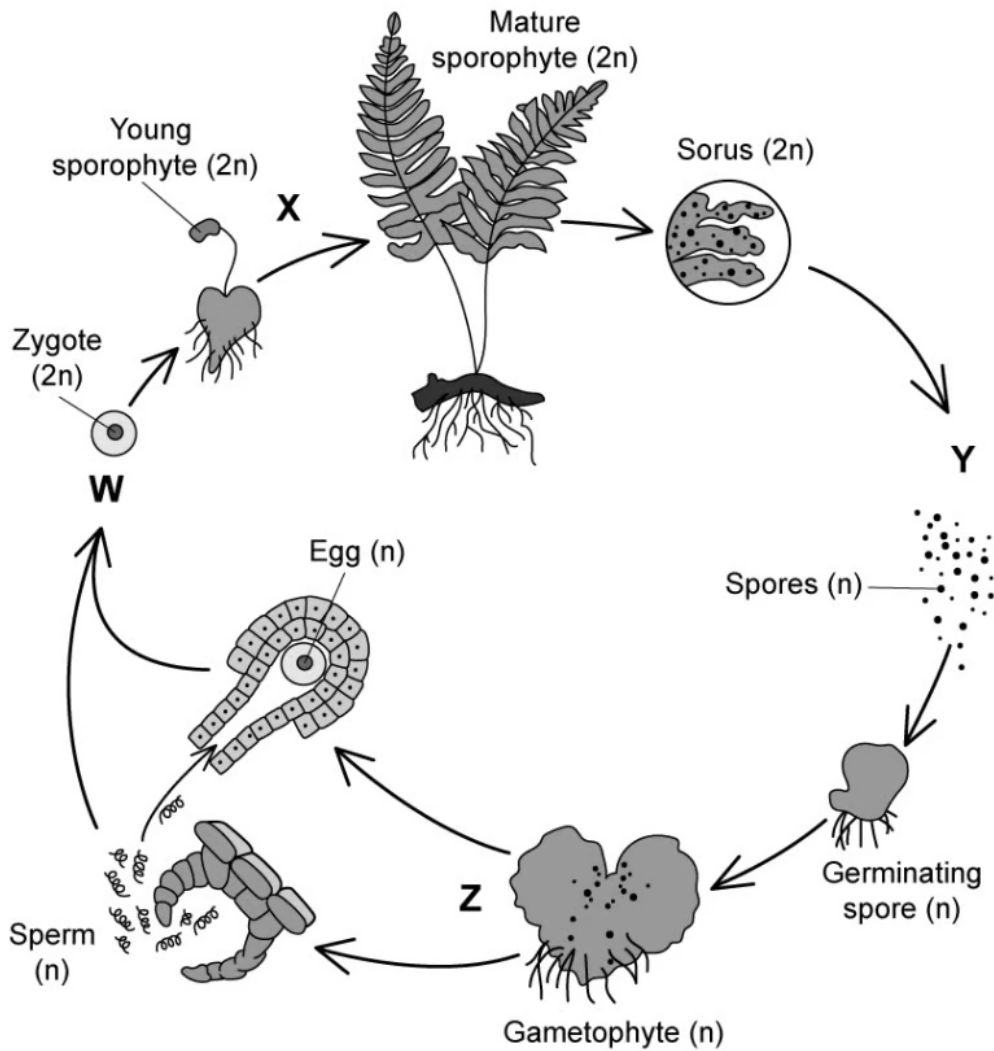
[1 mark]

Question 2

Which of the following led to the discovery of meiosis?

A   The development of the hypothesis that there must be a special type of cell division that halves chromosome number.

B   Careful scientific observation using stains and electron microscopes.

C   The use of research organisms in which meiosis took place very quickly.

D   Careful scientific observation using stains and light microscopes.

[1 mark]

Question 3

The diagram below shows the life cycle of a fern. The term *2n* is used to represent diploid cells and the term *n* is used to represent haploid cells.
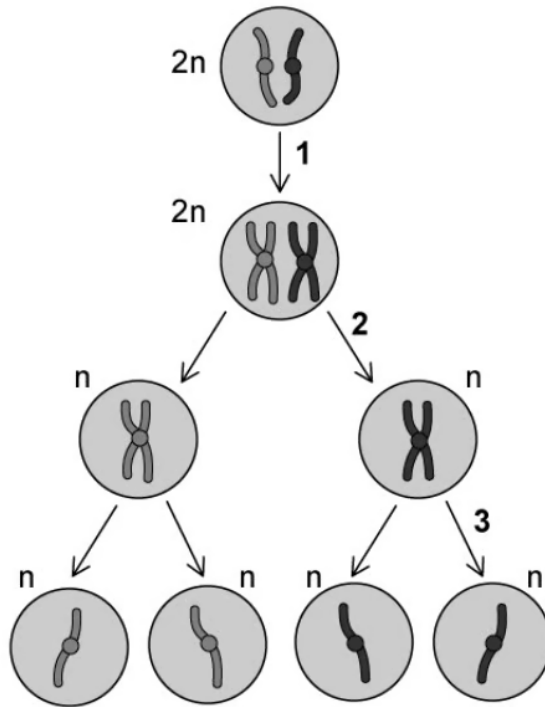

Which stage represents meiosis?

A   W

B   X

C   Y

D   Z

[1 mark]

Question 4

Which events are taking place at stages 1, 2, and 3 in the diagram of meiosis below?

|	1	2	3
A	DNA replication	Random fertilisation	Sister chromatids become chromosomes
B	Mitosis	Separation of homologous pairs	Separation of sister chromatids
C	DNA replication	Random orientation	Separation of homologous pairs
D	DNA replication	Crossing over	Separation of sister chromatids

[1 mark]

Question 5

The micrographs below show cells undergoing meiosis.
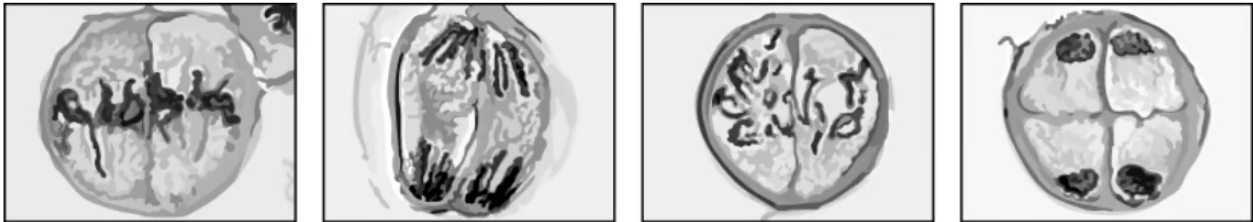
Which sequence correctly identifies the stage of meiosis in each micrograph from left to right?

   A   Metaphase I, anaphase I, prophase I, telophase I

   B   Metaphase II, anaphase II, prophase II, telophase II

   C   Prophase II, anaphase II, metaphase II, telophase II

   D   Prophase I, anaphase I, metaphase I, telophase I

[1 mark]

Question 6

Which of the following statements about genetic variation and meiosis are correct?

I.   Meiosis generates genetic variation through crossing over, random orientation, and random fusion of gametes.
II. The number of different combinations of chromosomes that are possible as a result of random orientation is 2^n, where n is the number of chromosomes in a diploid cell.
III. Crossing over can take place at any location along a chromosome.

A   I only

B   I and III only

C   II and III only

D   I, II, and III

[1 mark]

Question 7

A group of scientists carried out a study looking at the relationship between the number of crossing over events taking place during meiosis and the distance between the crossing over events and the centromere in male trout (a species of fish). Some of their results are shown in the graph below.
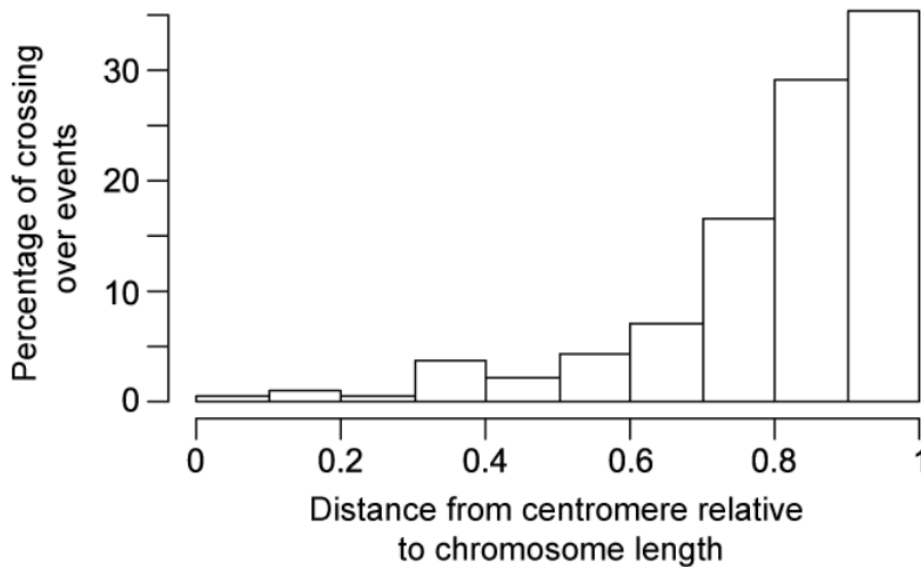
What can be concluded from the graph?

A   There are significantly more crossing over events further away from the centromere.

B   30 % of crossing over events occur at a relative distance of 0.6.

C   A higher percentage of crossing over events take place as distance from the centromere increases in male trout.

D   A higher percentage of crossing over events take place as distance from the centromere increases in fish species.

[1 mark]

Question 8

Chromosome non-disjunction in the sex chromosomes can result in gametes that contain more than one sex chromosome.

The graph below shows the results of a study looking at the impact of age on sex chromosome non-disjunction in men.
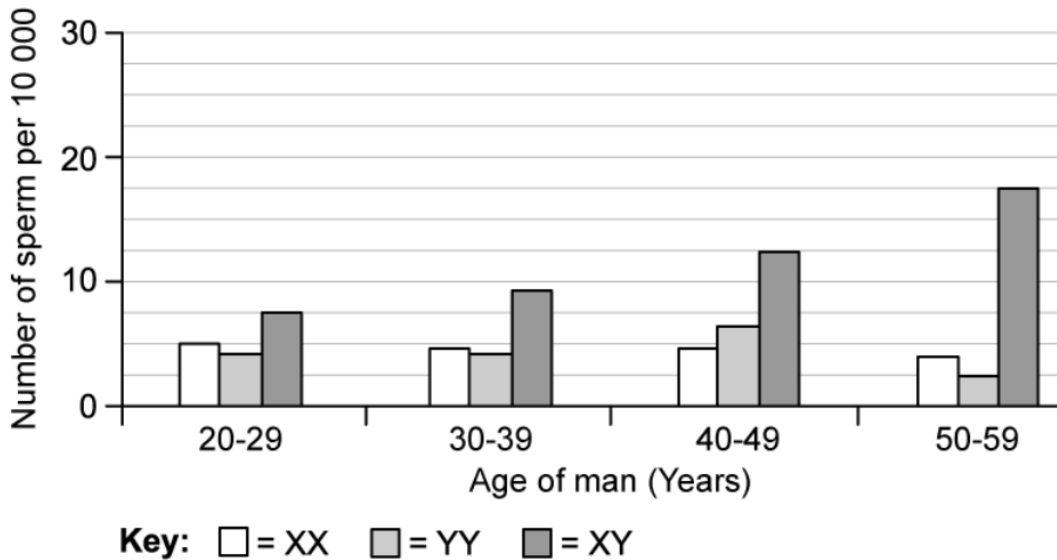
How many XY sperm would be predicted in a sample of 1 000 000 sperm from a 45 year old man?

A   1 250

B   12.5

**C**   125

D   12 500

[1 mark]

Question 9

Which of the following sets of statements correctly describes a process that would now be used for karyotype analysis?

	Stage 1	Stage 2	Stage 3
A	A needle through the abdomen wall samples cells from amniotic fluid	Chromosomes are photographed using a microscope before the image is cut up with scissors and rearranged by size	The resulting karyotype image is analysed to diagnose chromosome abnormalities
B	A tube via the vagina samples cells from amniotic fluid	Chromosomes are photographed using a microscope before the image is digitally rearranged by size	The resulting karyogram image is analysed to diagnose chromosome abnormalities
C	A tube via the vagina samples cells from the chorion	Chromosomes are photographed using a microscope before the image is digitally rearranged by size	The resulting karyotype image is analysed to diagnose chromosome abnormalities
D	A needle through the abdomen wall samples cells from amniotic fluid	Chromosomes are photographed using a microscope before the image is digitally rearranged by size	The resulting karyogram image is analysed to diagnose chromosome abnormalities

[1 mark]

Question 10

The micrograph below shows an image of a cell undergoing meiosis.
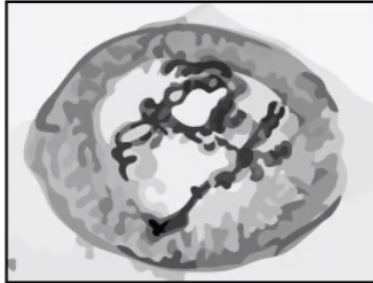
Which stage of meiosis can be seen in the image, and why?

	Stage of meiosis	Reason
A	Prophase II	Chromosomes are condensed and randomly arranged in the cell
B	Prophase I	Chromosomes are condensed and randomly arranged in the cell
C	Prophase I	Chromosomes are condensed in a haploid cell
D	Metaphase I	Chromosomes are lined up down the centre of a cell

[1 mark]