3.1 Genes & Chromosomes

Question Paper

Course	DP IB Biology
Section	3. Genetics
Topic	3.1 Genes & Chromosomes
Difficulty	Easy

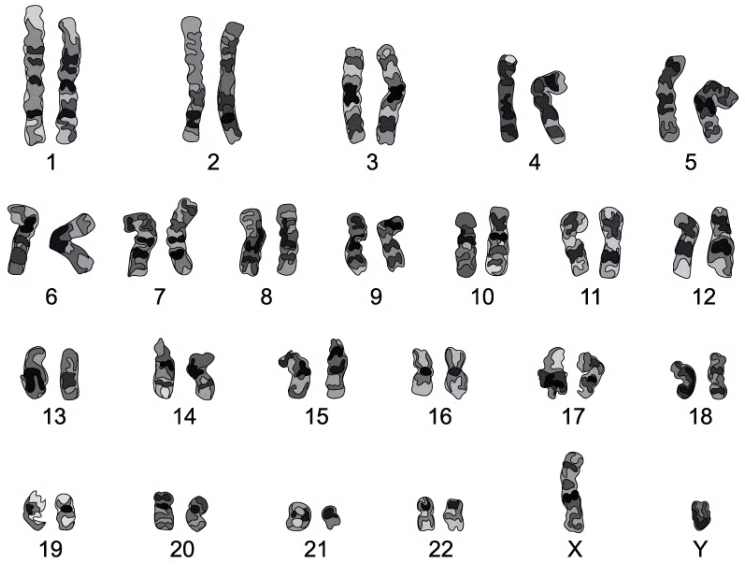
Time allowed: 50

Score: /40

Percentage: /100

Question 1a

a)
The following diagram shows the karyogram of an individual.



i)
Identify the sex of this individual.

[1 mark]

ii)
State a reason for your answer in part i).

[1 mark]

[2 marks]

Question 1b

b)
Cells in metaphase of mitosis were used to construct the karyogram from part a).

Explain the reason for this.

[1 mark]

[1 mark]

Question 1c

c)
List **two** characteristics of the chromosomes that are used to arrange them in a karyogram.

[2 marks]

[2 marks]

Question 1d

d)
Apart from sex determination, state **one other** use of studying the karyotype of an individual.

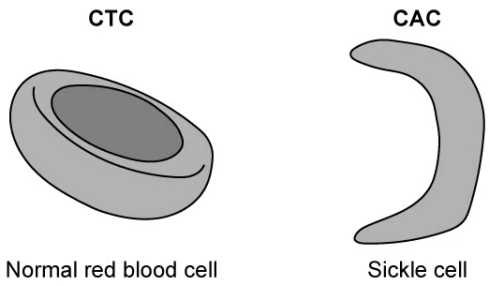
[1 mark]

[1 mark]

Question 2a

a)
Sickle cell anaemia is a genetic disease where a DNA triplet base in the gene coding for alpha-globin in haemoglobin changes from CTC to CAC. This mutation results in sickle shaped red blood cells that can cause a range of different symptoms.

The diagram below shows the DNA base triplet change and the resulting change in the structure of red blood cells.



i)
Identify the type of mutation that is illustrated in the diagram.

[1 mark]

ii)
State a reason for your answer in part i).

[1 mark]

[2 marks]

Question 2b

b)
List **two** consequences of the change in shape of the red blood cells in a person suffering from sickle cell anaemia.

[2 marks]

[2 marks]

Question 2c

c)
Some mutations, such as those causing sickle cell anaemia, may be inherited by offspring.

Describe how mutations can be inherited by offspring.

[2 marks]

[2 marks]

Question 2d

d)
Gene mutations lead to the formation of new alleles in a population.

Define the term 'allele'.

[1 mark]

[1 mark]

Question 3a

a)
During the process of fertilisation, haploid sperm and egg cells fuse together to form a diploid zygote.

Define the term 'haploid'.

[1 mark]

[1 mark]

Question 3b

b)
There are certain advantages to cells being diploid.

List **two** advantages of cells containing two sets of chromosomes.

[2 marks]

[2 marks]

Question 3c

c)
A couple is expecting a child and wondering which sex the baby will be.

The following genetic diagram shows the sex chromosomes present in the gametes of both parents.

Gametes	X	X
X		
Y		

Calculate the percentage chance of the baby being a girl by completing the genetic diagram.

Show your working.

[3 marks]

[3 marks]

Question 3d

d)
One of the genes carried on the Y chromosome is the SRY gene.

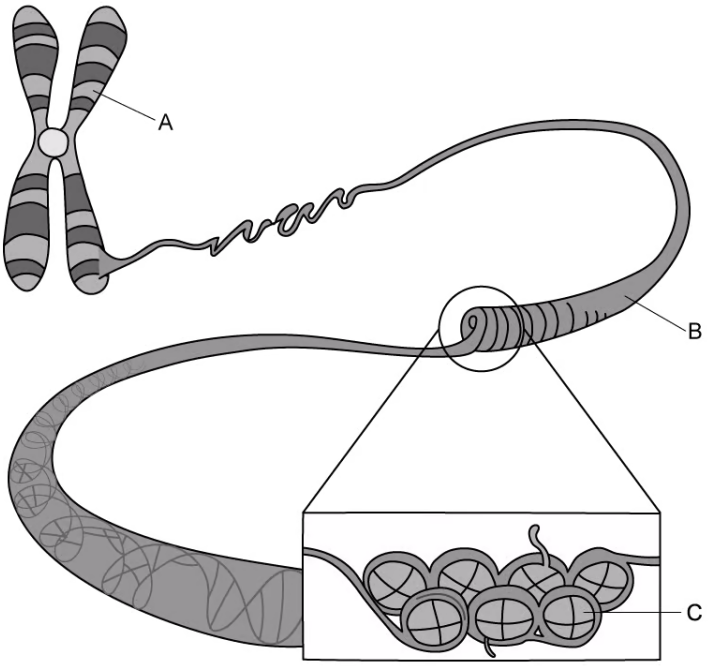
State **one** role of this gene in the development of male embryos.

[1 mark]

[1 mark]

Question 4a

a)
The following diagram shows the arrangement of DNA in a eukaryotic chromosome.



i)
Label structure **A** in the diagram.

[1 mark]

ii)
State what is represented by the banding pattern on structure **A**.

[1 mark]

[2 marks]

Question 4b

b)
Use the information in the diagram in part a) to:

i)
Identify structures **B** and **C**.

[1 mark]

ii)
Describe the relationship between structures **B** and **C**.

[1 mark]

[2 marks]

Question 4c

c)
Chromosomes in diploid cells will occur in homologous pairs.

Define the term 'homologous chromosomes'.

[1 mark]

[1 mark]

Question 5a

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

a)
The Human Genome Project was an international, collaborative research programme to sequence the entire human genome.

List **four** of the main applications of the Human Genome Project.

[4 marks]

[4 marks]

Question 5b

b)
Plasmids are small, circular DNA molecules commonly found in prokaryotic cells.

Describe the role of a plasmid.

[3 marks]

[3 marks]

Question 5c

c)
Advancements in genome sequencing has led to developments in scientific research.

Outline the technique used to sequence a genome.

[8 marks]

[8 marks]