17. Inheritance

17.1 Chromosomes, genes and proteins

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 The inheritance of coat texture in guinea pigs is controlled by a single gene.

(a) Define the term gene.

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.....

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..... [2]

2 **(c)** Fig. 5.2 is a diagram showing all of the chromosome pairs in a cell from a human male. The twenty-third pair of chromosomes are the sex chromosomes.

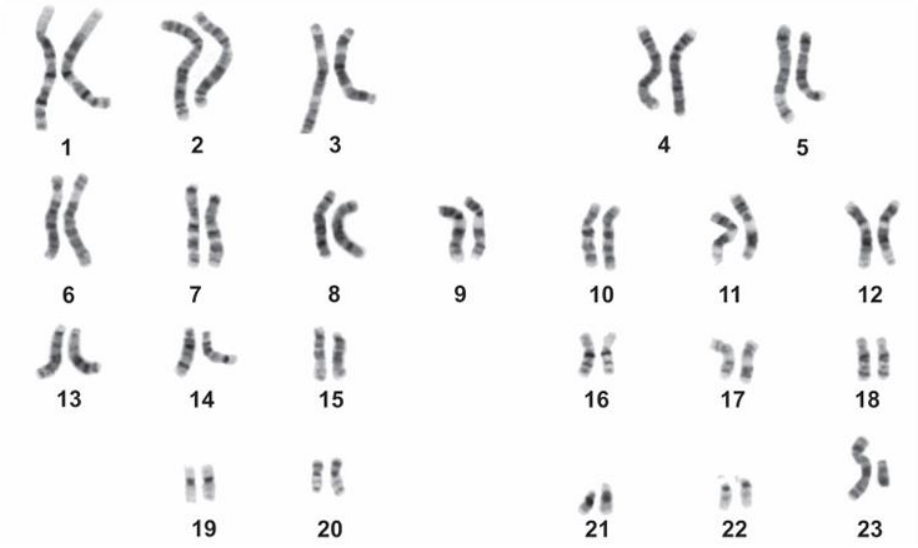

Fig. 5.2

Describe how the chromosomes in a human female differ from those shown in Fig. 5.2.

.....

.....

..... [1]

3 **(a)** Fig. 8.1 is a Punnett square used to show the inheritance of sex in humans.

Complete the Punnett square in Fig. 8.1.

		male parent chromosomes	
		X	**Y**
female parent chromosomes	**X**	.....	.....
	.....	.....	.....

Fig. 8.1

[2]

(b) **Circle** the percentage chance of a baby being male.

0 **25** **50** **75** **100** [1]

(c) State the name of the structure, in a gamete, that contains chromosomes.

..... [1]

4 **(a)** Table 7.1 contains the definitions of terms used in genetics.

Complete Table 7.1 by writing the term for each definition.

Table 7.1

definition	term
A thread-like structure of DNA, carrying genetic information in the form of genes.	
A length of DNA that codes for a protein.	
The observable features of an organism.	
The transmission of genetic information from generation to generation.	

[4]

(b) Fig. 7.1 shows a photomicrograph of the chromosomes present in the body cells of a human.

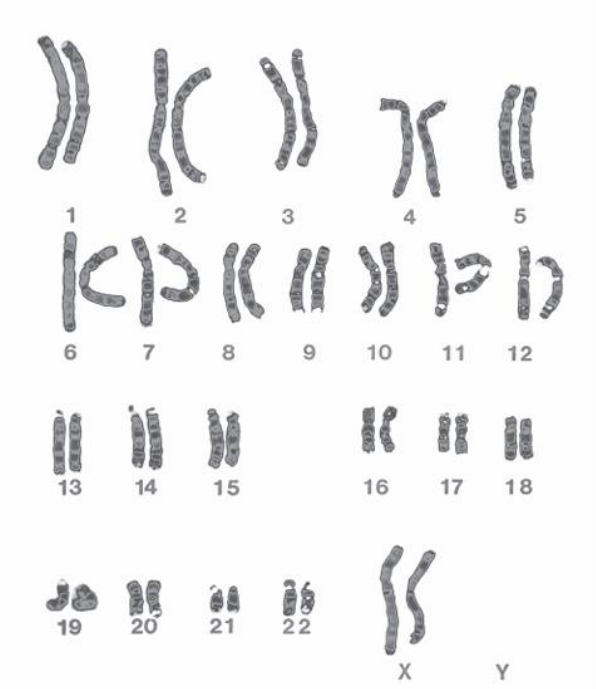

Fig. 7.1

(i) State the number of chromosomes present in human body cells.

..... [1]

(ii) The individual in Fig. 7.1 is female.

Describe the evidence from Fig. 7.1 that supports this statement.

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.....

..... [1]

(iii) Sometimes a genetic change occurs which results in a condition called Down's syndrome.

Fig. 7.2 shows the chromosomes from a body cell of a person with Down's syndrome.

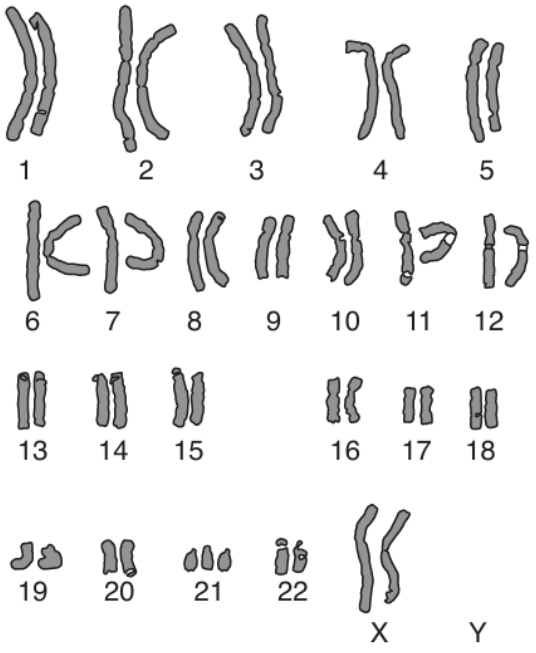

Fig. 7.2

Describe the genetic change that produces Down's syndrome using the information in Fig. 7.1 and Fig. 7.2.

.....

.....

..... [1]

[Total: 7]

5 **(c)** Sperm contain chromosomes that can become part of a zygote.

(i) Complete the definition of the term *chromosome*.

Use words from the list.

Each word can only be used once or not at all.

amino acids	**cells**	**DNA**	**hormones**
information	**genes**	**nerves**	**protein**

A chromosome is a thread-like structure of ..... , carrying genetic

..... in the form of ..... .

[3]

(ii) State **all** the possible sex chromosomes that a normal sperm can contain.

.....[1]

(iii) State **two** ways that sperm are adapted to their function.

1 .....

2 .....

[2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

6 **(d)** Red-green colour blindness is a sex-linked characteristic. It is controlled by a gene on the **X** chromosome.

There are two alternative versions of this gene:

- no colour blindness $\mathbf{X^A}$
- colour blindness $\mathbf{X^a}$.

(i) State the term used to describe an alternative version of a gene.

..... [1]

(ii) State the genotype of a male with colour blindness. **(extended only)**

..... [1]

7 Fig. 3.1 is a diagram of the junction between two neurones in a healthy person.

Fig. 3.2 is a diagram of the junction between the same two neurones in a person who has Parkinson's disease. This disease affects the nervous system.

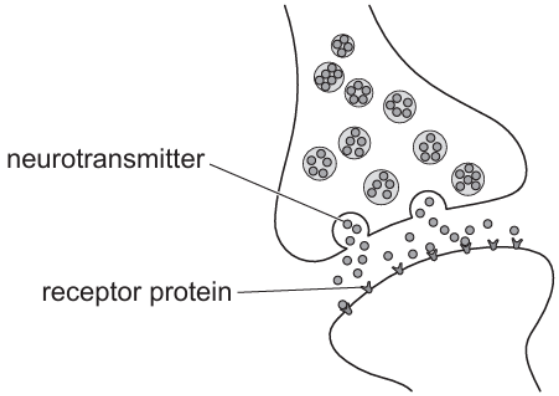

Fig. 3.1

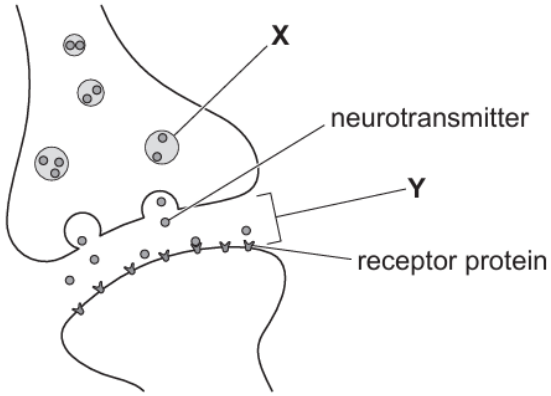

Fig. 3.2

(d) (i) The shape of the receptor proteins shown in Fig. 3.1 and Fig. 3.2 is important for their function.

Explain how the shape of the receptor proteins is determined. **(extended only)**

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..... [2]

(ii) Cell membranes also contain protein carriers. Describe the role of protein carriers.

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..... [2]

8 **(a)** Fig. 5.1 shows the stages involved in protein synthesis.

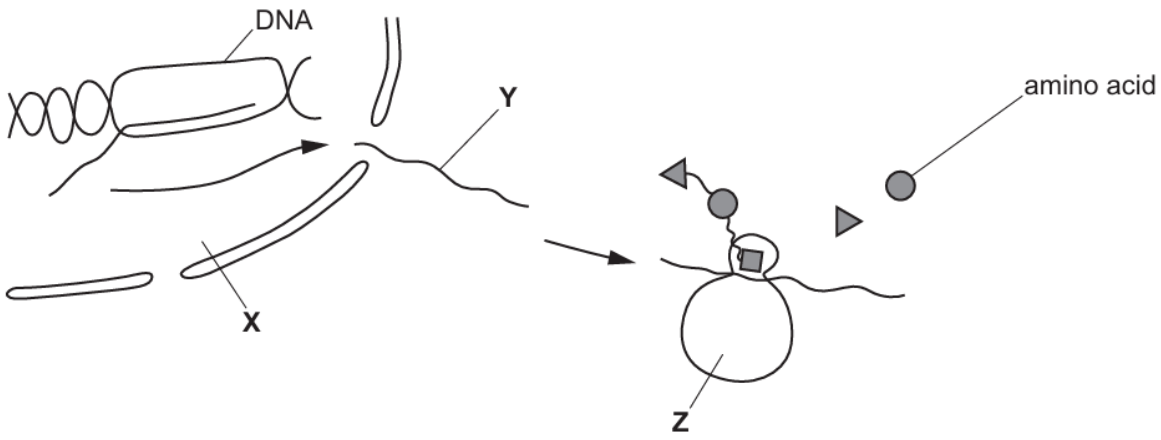

Fig. 5.1

(i) State the names of the parts labelled **X**, **Y** and **Z** in Fig. 5.1. **(extended only)**

X .....

Y .....

Z .....

[3]

(ii) State what determines the sequence of the amino acids in the protein that is produced.

(extended only)

.....

.....

..... [1]

(iii) Explain why the sequence of amino acids is important in the production of receptor molecules for neurotransmitters. **(extended only)**

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.....

.....

..... [2]

(b) Explain why body cells can have different specialised functions even though they contain the same genes. **(extended only)**

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.....

..... [2]

(c) Allele frequency in a population can be changed by natural selection and artificial selection.

State the meaning of the term allele.

.....

..... [1]

9 Fig. 6.1 is a diagram of DNA.

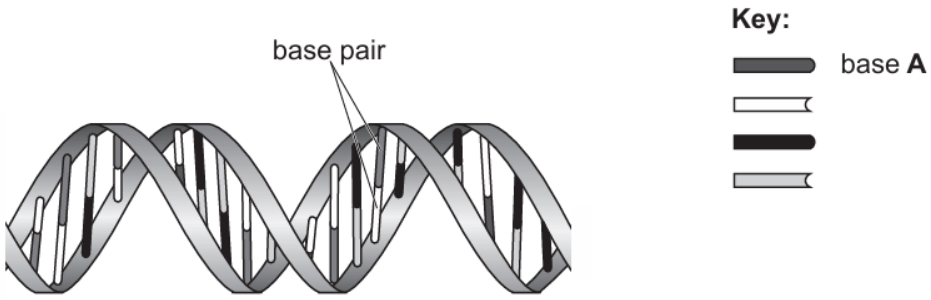

Fig. 6.1

(a) (i) State the letter of the base that pairs with **A**. **(extended only)**

..... [1]

(ii) State the letters of the other bases in DNA. **(extended only)**

..... [1]

(b) Outline the roles of DNA in a cell. **(extended only)**

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..... [2]

10 Fig. 2.1 shows a dwarf sunflower and a tall sunflower, *Helianthus annuus*. The height of the dwarf sunflower is 0.45 m and the height of the tall sunflower is 4.5 m.

not to scale

Fig. 2.1

(a) Define the term *allele*.

.....

..... [1]

(b) Shoot growth in plants is controlled by auxins. An enzyme in shoot tips converts molecules of an amino acid into auxins as shown in Fig. 2.2.

amino acid $\xrightarrow{\text{enzyme}}$ auxin

Fig. 2.2

Explain how a mutation in DNA results in an abnormal enzyme which does **not** catalyse the reaction shown in Fig. 2.2. **(extended only)**

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..... [3]