

WJEC (Eduqas) Biology GCSE
Topic 7.1 The Genome and Gene
Expression
Questions by Topic

1.

- (a) Use words from the list below to complete the following sentences about chromosomes. [3]

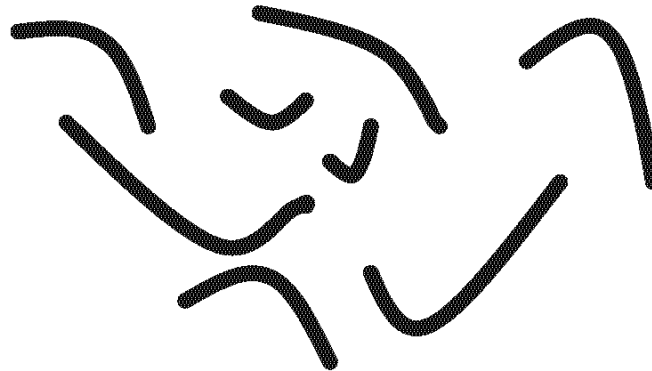
nucleus cytoplasm circle gene protein membrane

Chromosomes are found in the of a cell. Sections of DNA form units of inheritance. Each unit is called a Each unit is a code for the production of one

- (b) The table below gives the number of chromosomes in the body cells of some animals.

animal	number of chromosomes in body cells
human	46
meerkat	36
kangaroo	16
fruit fly	8
mosquito	6

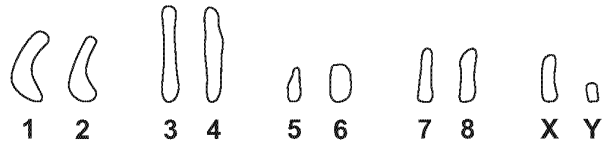
The diagram below shows the chromosomes from an egg cell in one of the animals in the table above.



- (i) I How many chromosomes are shown in the diagram above? [1]
II State the animal from which this egg cell was taken. Give a reason for your answer. [2]

.....

2. The diagram below shows all the chromosomes in a body cell of an animal.



(a) (i) How many chromosomes are shown? [1]
.....

(b) Use words from the list below to complete the following sentences. [3]

allele wall protein DNA nucleus

(i) Chromosomes are found inside a cell in a structure called the
.....

(ii) Chromosomes contain genes, which are made of a chemical called
.....

(iii) A gene codes for the order of amino acids that make up a particular
.....

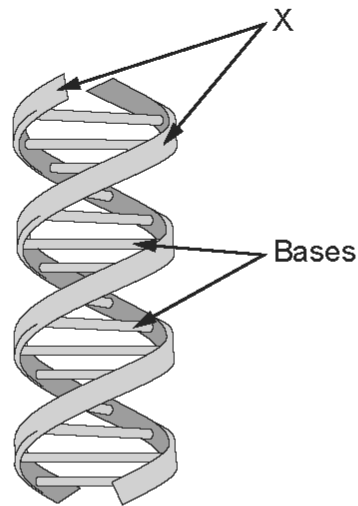
(c) A change to a gene is called a mutation. What form of solar radiation causes a mutation? [1]
.....

3. (a) Complete the following sentences about genes. [2]

(i) Genes are found in the nucleus of a cell on paired structures called
.....

(ii) Genes are sections of a long molecule called

4. (a) Which part of a plant cell contains DNA? Underline your answer. [1]
- vacuole nucleus cytoplasm cell membrane
- (b) The diagram below shows a small section of DNA.



Use the information in the diagram above and your own knowledge to answer the following questions. Underline the correct answer for each question.

- (i) Which molecules make up the two strands labelled X? [1]
- sugar and protein
- phosphate and protein
- sugar and phosphate
- phosphate and salt
- (ii) There are four bases A, G, T and C. How are they paired in DNA? [1]
- A with T and G with C
- A with G and C with T
- A with C and G with T
- A with A, C with C, T with T and G with G

(iii) What term is used to describe the structure of DNA?

[1]

double coil

double helix

double spiral

single helix

(c) Complete the sentence below.

[1]

The order of the bases A, G, T and C in DNA forms a code which controls how

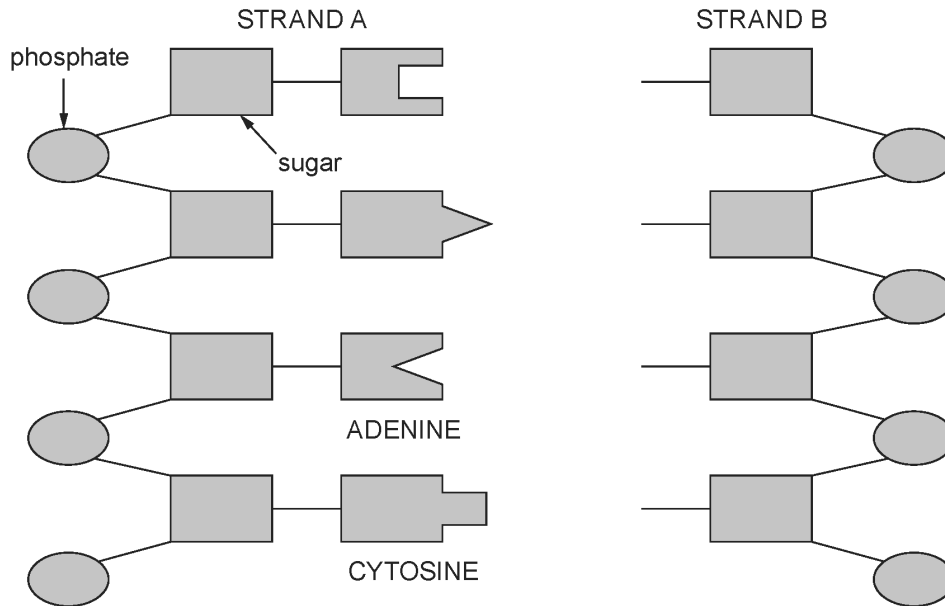
..... are linked together to form different

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5. A DNA molecule consists of two coiled strands. When cells divide, the two strands in the DNA separate. The bases of each strand pair with complementary bases to make new DNA.

(a) Complete the diagram below to show the sequence of complementary bases that would appear in this DNA molecule by:

- (i) drawing the shapes of the **four** missing complementary bases in strand B; [2]
- (ii) labelling



(b) Describe how a section of DNA can control the formation of a protein. [2]

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6. (a) Name two scientists whose work led to the discovery of the structure of DNA. [2]

- i.
- ii.

(b) A section of a single strand of DNA has the following sequence of bases:

A T C T G T A C A G

(i) What will be the complementary sequence of bases to that shown above? [1]

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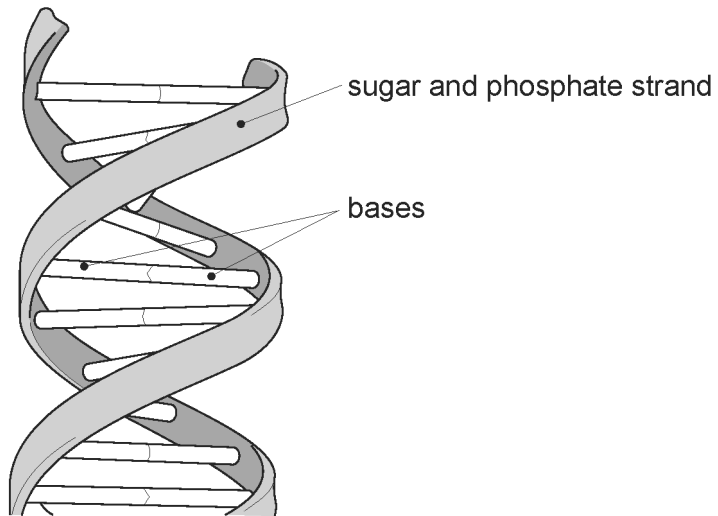
(ii) State the maximum number of amino acids that could be coded by the sequence shown. [1]

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7.

(a) The diagram below shows DNA.

Bases A, C, T and G join two strands of sugar and phosphate molecules.

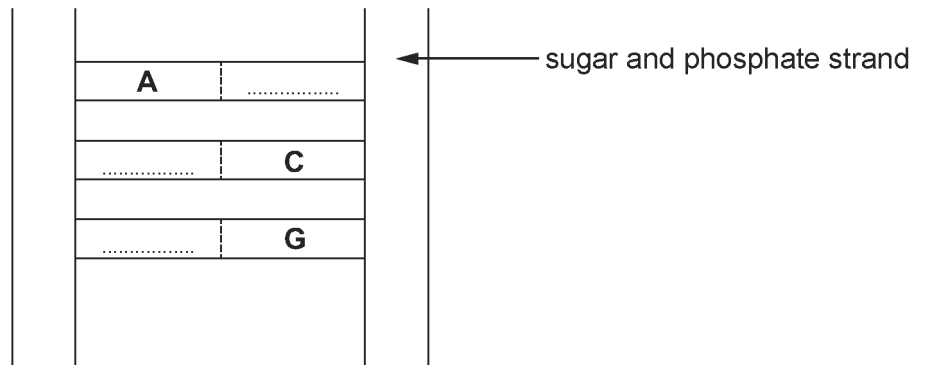


(i) What name is given to the shape of DNA? [1]

Underline your answer

double spiral double fold double helix double coil

(ii) The diagram below shows a very small section of DNA. Complete the diagram by adding the missing bases. [2]



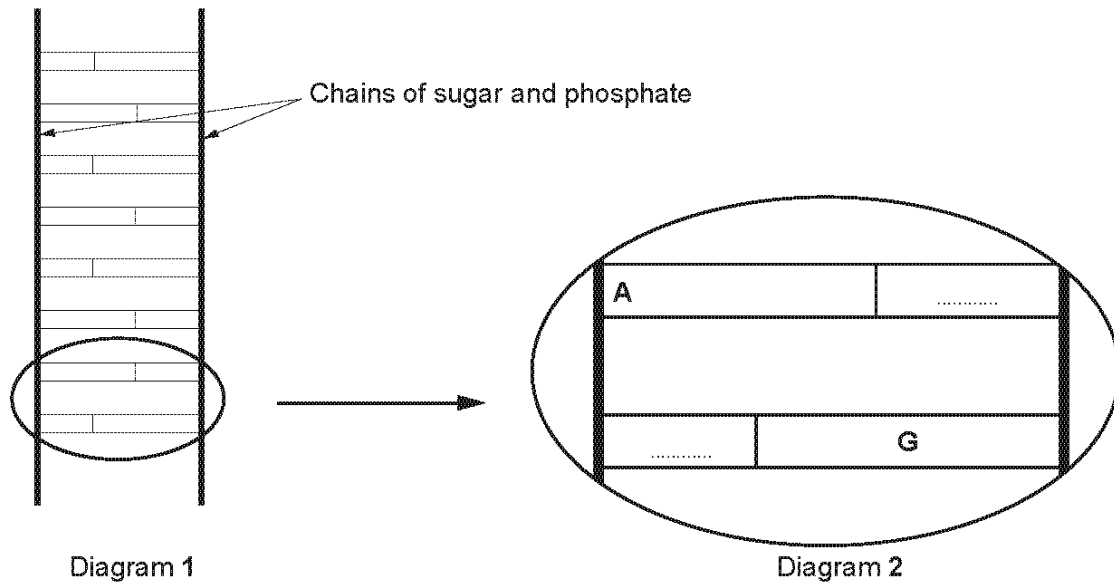
(b) Use some of the words below to complete the sentence. [1]

salts amino acids minerals proteins

The bases in DNA form a code which is important in building

from

8. The diagrams below show part of a DNA molecule with a small section in detail.



- (a) Molecules known as **A**, **T**, **C** and **G** join the chains of sugar and phosphate as shown in the diagrams.
- (i) What is the general name for these molecules? [1]
Underline your answer.
- bases acids proteins
- (ii) Fill in the two missing letters on the dotted lines in Diagram 2. [1]
- (b) (i) Which part of a living cell contains DNA? [1]

- (ii) The diagrams show DNA as a ladder-like structure. How is the **shape** different in a living cell? [1]

9. (a) The photograph below shows a scientist who worked on the structure of DNA in the 1950s.



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Rosalind Franklin

How was the structure of DNA discovered?

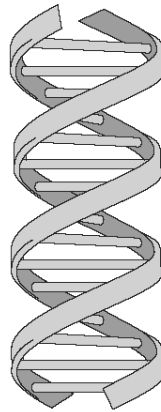
Choose one of the following statements to answer the question.

[1]

- A by one scientist using a number of different techniques
- B by many scientists using a number of different techniques
- C by many scientists using the same technique
- D by one scientist using one technique

Letter

The diagram below shows part of a DNA molecule.



DNA

(b) Complete the sentences about DNA using some of the words below. [3]

phosphate bases amino acids helix sugar

DNA is made up of two long chains of alternating and
..... molecules which are joined by the
A, T, C and G. DNA is twisted to form a double

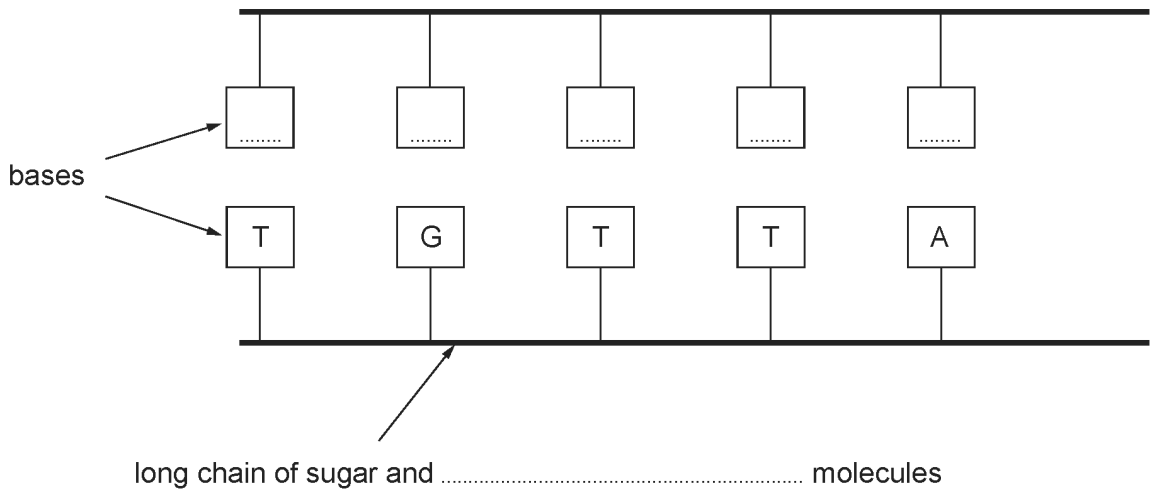
(c) Why is the order of the molecules A, T, C and G in DNA important in the production of proteins? [1]

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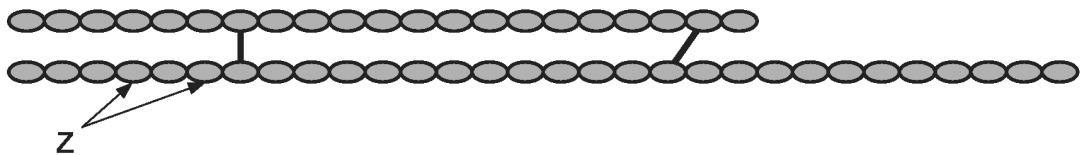
10.

(a) The diagram below shows a small section of DNA.



- (i) Five bases are shown on one strand of the DNA. Fill in the **five** missing letters for the bases on the other strand. [2]
- (ii) Complete the label on the diagram by writing the missing word on the dotted line. [1]

(b) Insulin is a protein. The structure of insulin is shown below.



- (i) Underline the name of the small molecules labelled Z which make up the protein. [1]

amino acids

fatty acids

mineral salts

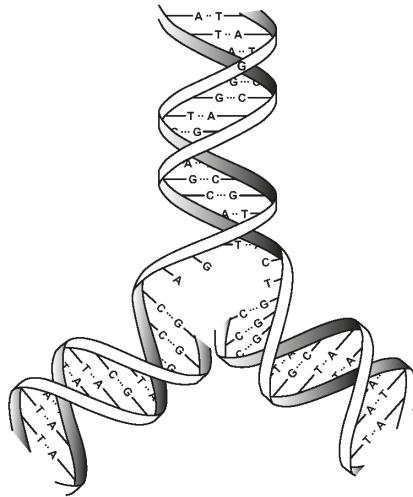
- (ii) Why are the bases in DNA important in building proteins from these small molecules? [2]

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11.

The diagram shows part of a molecule of DNA during the process of cell division.



(a) In which part of a human cell would DNA be found? [1]

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(b) In DNA the ratio of adenine to thymine is always 1:1 and the ratio of guanine to cytosine is always 1:1. Use the information from the diagram to give a reason for these observations. [1]

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12.

The DNA molecule is a double helix with each strand linked by a series of bases.

There are four different bases in DNA.

(a) The table shows the percentage of each base found in a sample of DNA taken from a rat (*Rattus rattus*).

Complete the table to give the names of the two missing bases. [1]

Percentage of base	Name of base
28.6	adenine
21.4	guanine
28.6
21.4

(b) A DNA molecule contains 1000 base pairs. 30% of the bases are guanine. Calculate how many adenine bases are contained in this DNA molecule. Show your working. [2]

answer =

13. Describe the structure and function of DNA (Diagrams will not be credited).

[6 QER]

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- 14.** (a) In DNA there is a genetic code which determines the order in which certain chemicals are linked together to form proteins.
- (i) Name the four bases which make up the genetic code in DNA. [2]

- (ii) Name the types of chemicals which are linked together to form proteins. [1]

15. The relative masses of bases in DNA, in three different animals, are shown in the table.

	mass of base /a.u.			
source of DNA	adenine	guanine	thymine	cytosine
human	30.9	19.9	29.4	19.8
salmon	29.7	20.8	29.1	20.4
sheep	29.3	21.4	28.3	21.0

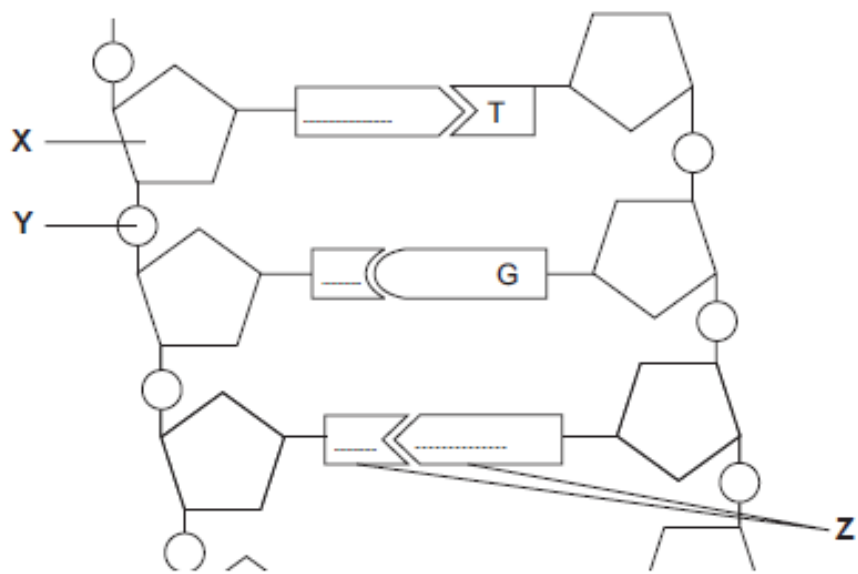
- (a) How do the data above give evidence for base pairing? [2]

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16. (a) The diagram below shows a small section of DNA.



- (i) Which one of the following pairs of substances correctly describes labels X and Y on the diagram?

Underline your answer

[1]

salt and sugar

sugar and phosphate

acid and phosphate

salt and acid

- (ii) The structures labelled Z are bases.

Complete the letter names for the **four** missing bases on the diagram.

[2]

- (iii) State why the order of the bases in DNA is important in the production of proteins.

[2]

.....

.....

- (b) Apart from identical twins, no two persons have identical DNA. Samples of DNA can be analysed to produce DNA profiles which can be used to identify individuals in criminal investigations.

The diagram below shows five DNA profiles.

DNA from crime scene	DNA from suspects			
	suspect 1	suspect 2	suspect 3	suspect 4
████████	████████	████████	████████	████████
████████	████████		████████	████████
████████		████████	████████	
████████	████████	████████		████████
████████	████████		████████	████████
████████	████████	████████	████████	████████
████████			████████	████████
████████	████████	████████	████████	

- (i) From the diagram, identify the suspect whose DNA was found at the crime scene. Give a reason for your answer. [1]

Suspect

Reason

- (ii) Apart from criminal investigations, state **one other** use of DNA profiling. [1]

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- (iii) After DNA profiles have been used in investigations they are often retained for future reference. Suggest **one** reason why some people may object to their DNA profiles being retained by the police. [1]

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17. Outline the basic structure of DNA and explain the meaning and importance of the genetic code in the production of proteins. An account of protein synthesis is not required.

DO NOT USE DIAGRAMS.

[6 QWC]

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18. A high level of blood cholesterol increases the risk of heart disease. One cause of high blood cholesterol is the inherited condition known as FH (familial hypercholesterolaemia).

FH is caused by a dominant allele (**B**). The recessive form of this allele (**b**) results in low levels of cholesterol (non-FH).

(a) State the meaning of the terms:

(i) allele; [1]

.....

.....

(ii) recessive. [1]

19.

(a) Explain what is meant by the term *genetic profiling*. [1]

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(b) State **two** uses of genetic profiling. [2]

(i)

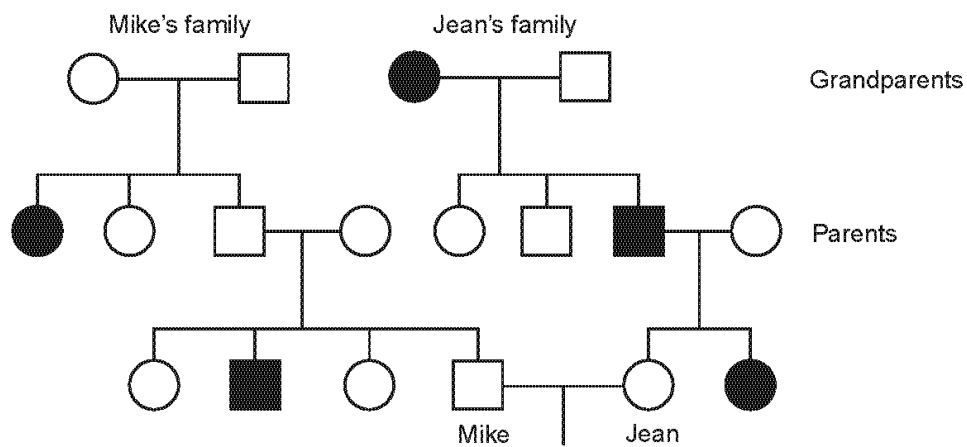
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(ii)

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20.

The patterns of inheritance of cystic fibrosis in two families is shown as a family tree below.



-  female without cystic fibrosis
-  female with cystic fibrosis
-  male without cystic fibrosis
-  male with cystic fibrosis

Cystic fibrosis results from a homozygous pair of recessive alleles. People who are heterozygous for cystic fibrosis have one normal allele and one cystic fibrosis allele. They are carriers of cystic fibrosis but do not suffer from it.

(a) In the family trees shown, if **N** = the normal allele and **n** = the allele for cystic fibrosis, what is the genotype of: [2]

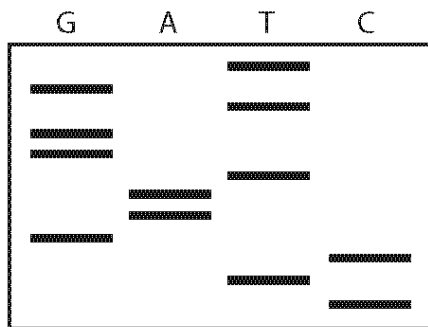
(i) Mike's grandfather;

(ii) Jean?

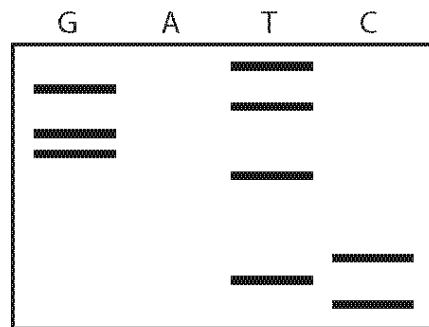
(b) What is the percentage chance that Mike is a carrier of cystic fibrosis? [1]

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- (c) Chromosomes from Mike and Jean's developing baby and from Mike were examined. A genetic analysis of the alleles present was carried out. The results are shown below as a sequence of bars.



Genetic analysis of Mike's alleles



Genetic analysis of Mike and Jean's developing baby's alleles

- (i) What term is used for this sequence of bars? [1]

- (ii) Cystic fibrosis is caused by a change in protein made in the cells. Explain why the protein made in the cells of the developing baby is different from the protein being made in Mike's cells. [2]

21. In the 1850s it was thought that there were two species of elephants living on Earth. In the 1950s some scientists suggested that three species of elephants existed. These were:

1. *Elephas indicus*, the Indian elephant
2. *Loxodonta africana*, the African plains elephant
3. *Loxodonta cyclotis*, the African forest elephant

In 2011, an analysis of the chemical structure of chromosomes of African, Indian and fossil elephants was carried out. This provided evidence that African and Indian elephants had a common ancestor 2.5 million years ago and confirmed that three species of elephants exist today.

(a) Name: [2]

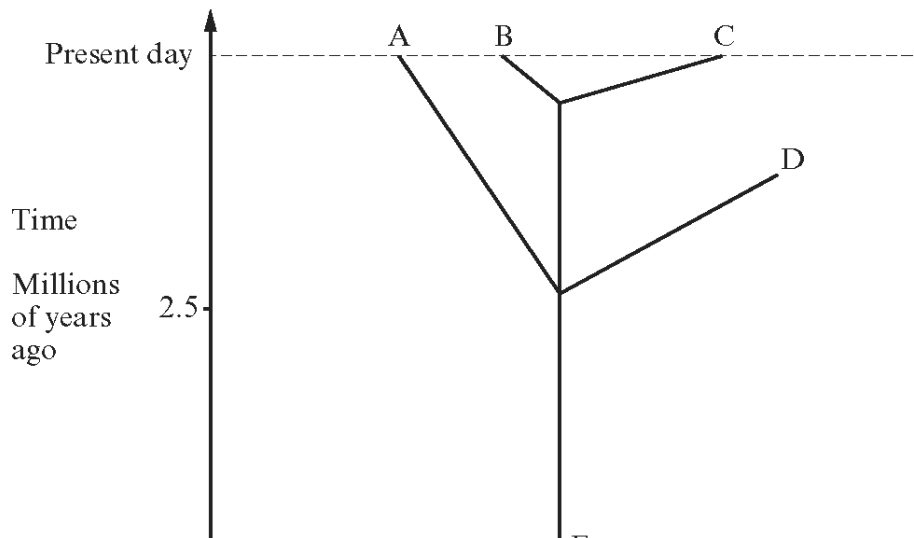
(i) the chemical in the chromosomes that was analysed;

.....

(ii) the units made of this chemical which make up chromosomes.

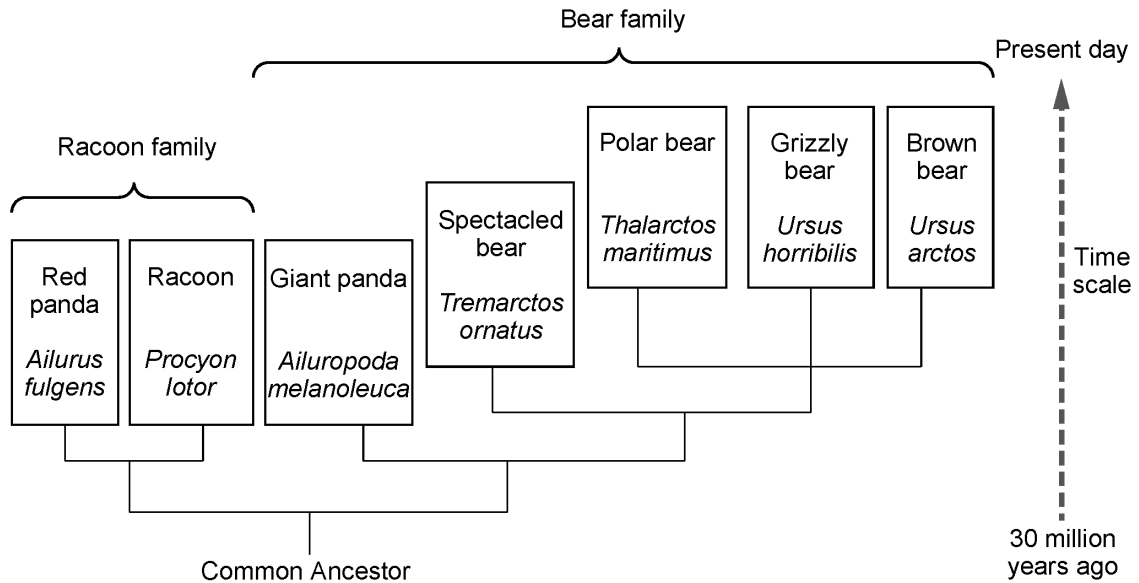
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The diagram below is a simplified family tree showing the evolution of elephants and their ancestors. Each letter represents a species.



22.

The diagram shows a suggested simplified evolutionary history for bears, racoons and pandas.



- (ii) Name the technique that would be used to analyse DNA samples from these animals. [1]

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23.

In 2013 specimens of sea snails (molluscs) were collected from a deep sea trench near the north of Scotland. They were sent to a scientist at the National Museum of Wales, Cardiff, for identification.

Most of the specimens were known as *Volutopsius norwegicus* but one showed some differences in appearance to the known specimens and also showed some similarities.

It was concluded that the unknown specimen belonged to the same genus as the known specimens. The scientist reported that the differences might be due to:

EITHER

A – the sea snail's development under different environmental conditions

OR

B – natural selection from a group of snails showing continuous variation

- (b) Name the technique that could be used to confirm the scientist's conclusions. [1]

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24. *Plasmodium falciparum* is a single-celled organism which causes malaria when it is in human blood.

Chloroquine is a medication which kills *Plasmodium falciparum*.

In the early 20th century a lot of chloroquine was used throughout Africa and was very successful. By the 1980s *Plasmodium falciparum* showed widespread resistance to chloroquine.

The mutation which caused resistance was originally very rare in the population.

(a) (i) Name the chemical that had become mutated.

[1]