1 **(a)** Fig. 7.1 represents part of a DNA molecule.

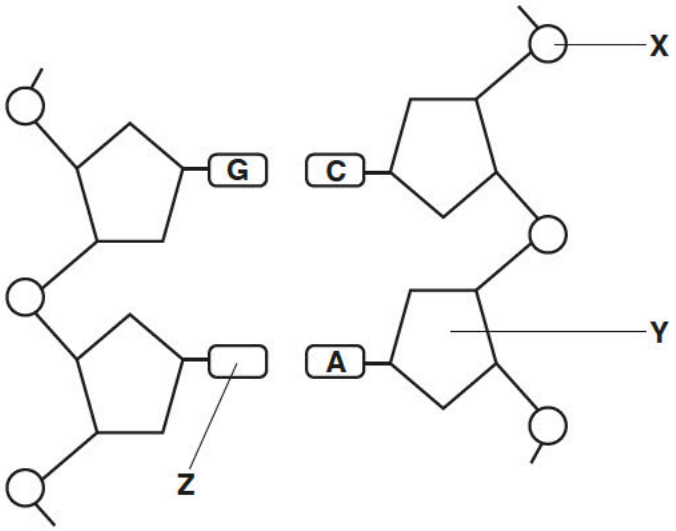


Fig. 7.1

State the **precise name** of each of the parts of the DNA molecule labelled **X**, **Y** and **Z**.

X .....

Y .....

Z ..... **[3]**

(b) Describe how the DNA molecule replicates.

In your answer, you should make clear the sequence of events.

[7]

[Total: 10]

2 DNA and RNA are nucleic acids.

(a) The table below contains a number of statements relating to nucleic acids.

Complete the table, using a letter **D**, **R** or **B**, to show whether each statement applies to:

- DNA only (**D**)
- RNA only (**R**)
- both DNA and RNA (**B**).

The first one has been done for you.

statement	DNA only (**D**) or RNA only (**R**) or both DNA and RNA (**B**)
contains thymine	D
contains ribose	
consists of two chains connected to each other with hydrogen bonds	
has a sugar-phosphate backbone	
has four different nitrogenous bases	
contains a pentose sugar	
is found in the nucleus and cytoplasm	

[6]

(b) It has been found that 98.4% of chimpanzee DNA is identical to that of a human.

(i) Suggest how the information obtained by DNA analysis can be useful to taxonomists.

.....

.....

.....

..... **[2]**

(ii) State **two** types of evidence, other than biochemical evidence, that are used by taxonomists when classifying organisms.

.....

.....

.....

..... **[2]**

(c) Cytochrome C is a protein found in living organisms. The structure of cytochrome C varies between different organisms. However, closely related organisms have similar cytochrome C.

Fig. 5.1 shows a possible evolutionary tree for vertebrates.
Common ancestors are indicated by the number 1 and various letters.

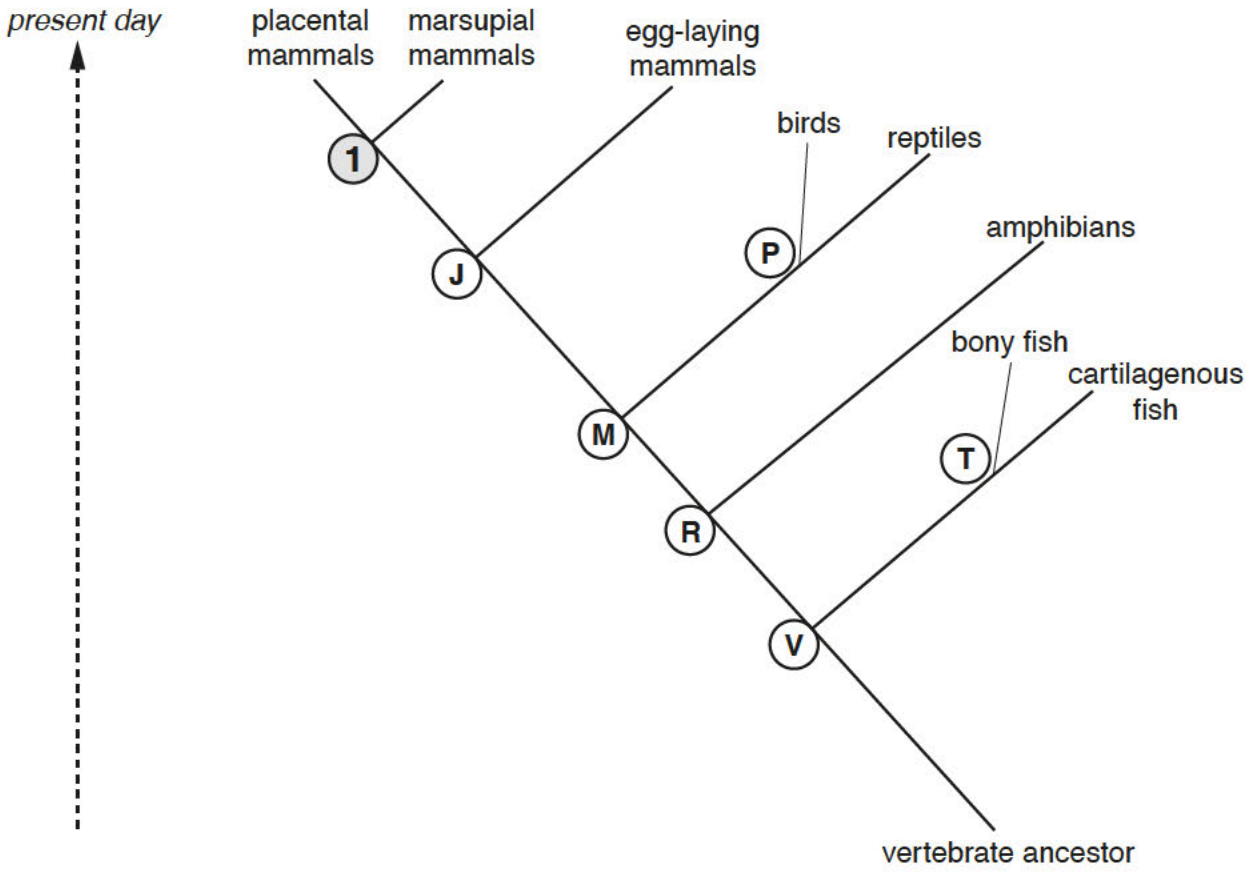


Fig. 5.1

State the **letter** of the common ancestor that has cytochrome C which will be:

most similar in structure to common ancestor **1** .....

least similar in structure to common ancestor **1** ..... **[2]**

(d) The pine marten is a small mammal that is rare in the United Kingdom. Its numbers are particularly low in Wales and there have been few confirmed sightings of this animal in the past 50 years. There have been plans to introduce pine martens from other areas of the United Kingdom into Wales to increase the size of the population.

The DNA of museum specimens of Welsh pine martens in the National Museum of Wales was tested, the most recent specimens dating from 1948. The DNA analysis suggests that Welsh pine martens are genetically distinct from those found elsewhere in the United Kingdom.

(i) The relevance of this analysis has been questioned by some scientists.

Suggest why the findings from the museum specimens may not relate closely to the current pine marten population of the United Kingdom.

.....

.....

..... **[1]**

(ii) Suggest why some people are concerned about the plan to introduce pine martens from other areas into Wales.

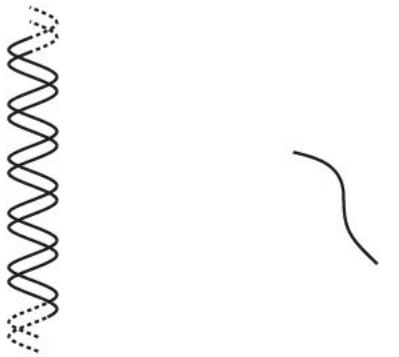
.....

.....

..... **[1]**

[Total: 14]

3 **(a)** Fig. 4.1 is a drawing that represents molecules of DNA and messenger RNA (mRNA)



DNA **mRNA**

Fig. 4.1

The mRNA molecule is shorter than the DNA molecule.

(i) State, using **only** the information in Fig. 4.1, **one other** way to distinguish between DNA and mRNA.

.....

..... **[1]**

(ii) Give **one** further difference in **structure** between DNA and RNA.

.....

..... **[1]**

DNA and mRNA are both involved in protein synthesis. The mRNA molecule, carrying the code for protein, leaves the nucleus and attaches to a ribosome. The ribosome is the site where a protein molecule is formed.

(iii) Complete the following statement:

A sequence of DNA nucleotides that codes for a protein is a ..... **[1]**

(iv) Suggest why DNA is not able to leave the nucleus.

.....

.....

..... **[1]**

(v) Explain why the mRNA molecule is shorter than a DNA molecule.

.....

.....

.....

.....

..... **[2]**

(b) Enzymes are involved in the production of mRNA in eukaryotic cells. One enzyme is inhibited by the toxin, α-amanitin.

Fig. 4.2 shows the effect when α-amanitin attaches to this enzyme.

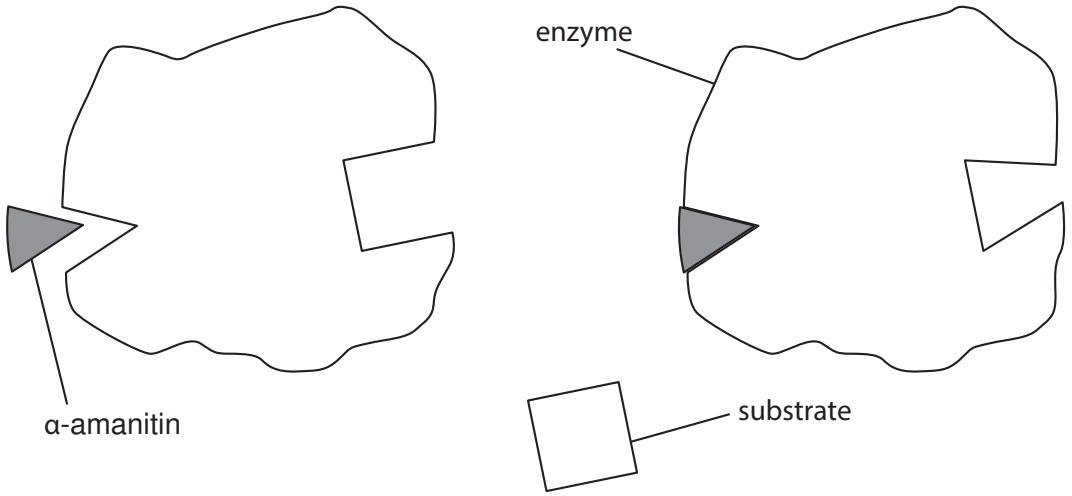


Fig. 4.2

(i) Explain how α-amanitin stops the formation of an enzyme-substrate complex during RNA production.

.....

.....

.....

.....

.....

..... **[2]**

(ii) The Roman Emperor Claudius was poisoned by his wife Agrippina when she gave him death cap fungus to eat. The death cap fungus contains α-amanitin.

Suggest how the toxin α-amanitin may lead to the death of an organism.

.....

.....

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.....

..... **[2]**

(c) (i) Enzymes are globular proteins with a specific three dimensional shape. The shape is determined by the primary structure.

State the meaning of the term *primary structure*.

.....

..... **[1]**

Fig. 4.3 shows some of the chemical bonds that hold the **tertiary** structure of a protein together.

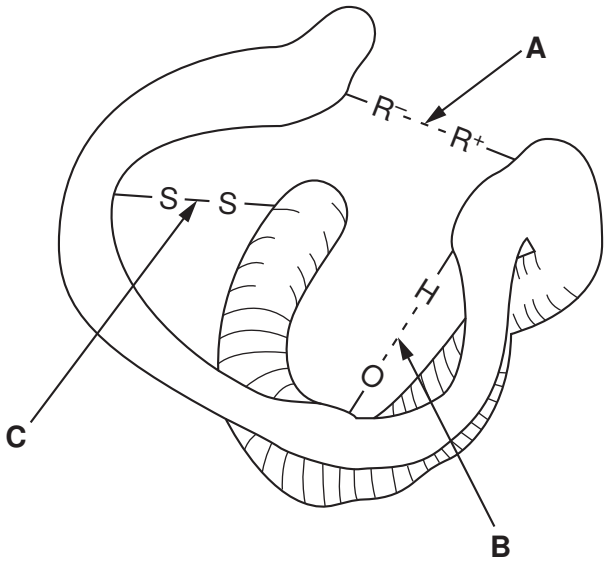


Fig. 4.3

(ii) Name the bonds labelled **A**, **B** and **C**.

A.....

B.....

C .....

[3]

(d) When proteins are heated to a high temperature, their tertiary structure is disrupted.

Explain how this occurs.

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..... **[3]**

[Total: 17]

4 **(a)** The fruit fly, *Drosophila melanogaster*, the zebra fish, *Danio rerio*, and the mouse, *Mus musculus*, have all been used by scientists to find out more about how genes control development in all animals, including humans. They are described as 'model organisms'.

(i) Suggest why information gained from studying such model organisms can be applied to humans.

.....

.....

.....

..... **[2]**

(ii) Suggest **two** characteristics that researchers should look for when choosing an organism for research into how genes control development.

1 .....

2 ..... **[2]**

(b) Fig. 3.1 and Fig. 3.2, **on the insert**, show the heads of two *Drosophila* fruit flies.

Fig. 3.1 shows a normal wild type fly.
Fig. 3.2 shows a mutant fly.

(i) Name the type of microscope used to take the two pictures.

..... **[2]**

(ii) State one significant difference between the two heads.

.....

..... **[1]**

(iii) Name the type of gene which, if mutated, gives rise to dramatic changes in body plan.

..... **[1]**

(c) Describe how the information coded on genes is used to synthesise polypeptides **and** how these polypeptides control the physical development of an organism.

In your answer, you should consider both the synthesis of polypeptides and their roles.

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.... **[8]**

[Total: 16]