1 DNA and RNA are nucleic acids.

(a) (i) State the components of a **DNA** nucleotide.

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

(ii) Describe how the structure of RNA differs from that of DNA.

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

(b) Before a cell divides, the DNA needs to be accurately replicated.

Describe how a DNA molecule is replicated.



In your answer you should make clear how the steps in the process are sequenced.

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..... **[7]**

(c) (i) State what a gene codes for.

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

(ii) Suggest how changing the sequence of DNA nucleotides could affect the final product the DNA codes for.

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

[Total: 15]

2 Charles Darwin sailed on HMS Beagle on its voyage around the world between 1831 and 1836.

(a) Darwin made the following observation:

'offspring generally appear similar to their parents'

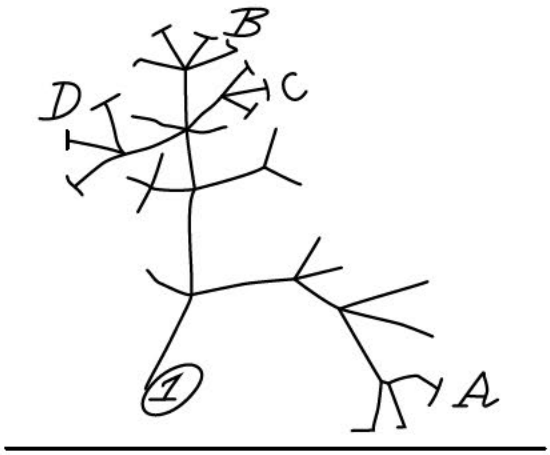
State the conclusion that Darwin drew from this observation.

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

(b) Shortly after the voyage, Darwin sketched a diagram in his notebook.

His sketch is shown in Fig. 5.1.



Charles Darwin (1837)

Fig. 5.1

- A, B, C and D represent different modern day organisms.
- (1) represents an ancestral organism.

Explain what the sketch shows about the relationship between organisms A, B, C, and D.

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

(c) In 1859, Darwin published his book, *On the Origin of Species*, in which he explained how organisms evolve by natural selection:

- Darwin's book caused controversy at the time of its publication
- his theory of natural selection is now widely accepted by scientists.

Why is natural selection now more widely accepted by scientists than it was in the 19th Century?

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

(d) Genes are important in the process of natural selection. Genes are made of DNA.

(i) State the role of a gene.

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

(ii) Explain how the structure of DNA allows replication.

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..... **[5]**

(e) During the voyage of HMS Beagle, Darwin visited the Galapagos Islands off the coast of South America.

He observed that many of the closely related species showed significant variation.

(i) State the name given to the evolution of a new species.

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

(ii) Suggest why a higher number of species have evolved in the Galapagos Islands, compared with an area of the same size on the South American mainland.

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

[Total: 12]

3 **(a)** Complete the following passage by using the most appropriate terms from the list to fill the gaps.

Each term should not be used more than once.

anti-parallel	**β-pleated sheet**	**covalent**
double helix	**hydrogen**	**parallel**
polypeptide	**ribose**	**sugar-phosphate**

DNA is found in the nucleus. The molecule is twisted into a .... in which each of the strands are ..... . It has two ..... backbones attached to one another by complementary bases. These bases pair in the centre of the molecule by means of ..... bonds. **[4]**

(b) Table 1.1 shows the relative proportions of different DNA bases in four different organisms.

Table 1.1

	relative proportions of bases in DNA as a percentage			
organism	A	C	G	T
human	30.9	19.8	19.9	29.4
grasshopper	29.3	20.7	20.5	29.3
wheat	27.3	22.8	22.7	27.1
E. coli	24.7	25.7	26.0	23.6

(i) Describe the patterns shown by the data given in Table 1.1.

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

(ii) Suggest how the data given in Table 1.1 might have been helpful to scientists in working out the structure of DNA.

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

(c) DNA in the nucleus acts as a template for the production of RNA.

Complete the table below to show **three** ways in which the structure of DNA differs from that of RNA.

feature	DNA	RNA
number of strands		
bases present		
sugar present		

[3]

(d) DNA codes for the structure of polypeptides.

State the role of messenger RNA (mRNA).

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

[Total: 14]