

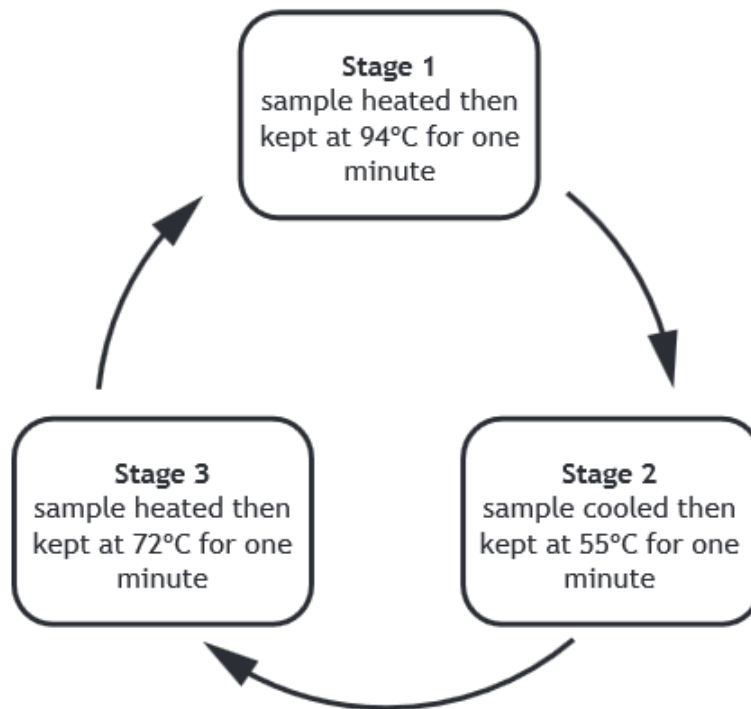
Structure and Replication of DNA

1. The genetic material in human mitochondria is arranged as

- A linear chromosomes
- B circular plasmids
- C circular chromosomes
- D inner membranes.

3. The polymerase chain reaction (PCR) amplifies specific sequences of DNA.

The flow chart shows how a sample of DNA was treated during a cycle of the PCR procedure.



(a) Explain the purpose of the different heat treatments in Stage 1 and Stage 2.

2

Stage 1 _____

Stage 2 _____

- (b) The number of DNA molecules doubles during each cycle of the PCR procedure.

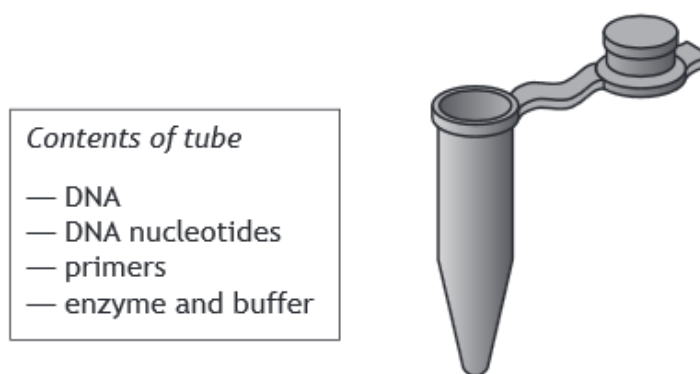
Calculate the number of cycles needed to produce 128 copies of a single DNA molecule.

1

Space for calculation

_____ cycles

- (c) The diagram shows the contents of a tube used in PCR.



Describe the contents of a suitable control tube designed to show that primers are needed in the reaction.

1

- (d) State **one** practical application of PCR.

1

A Describe DNA under the following headings.

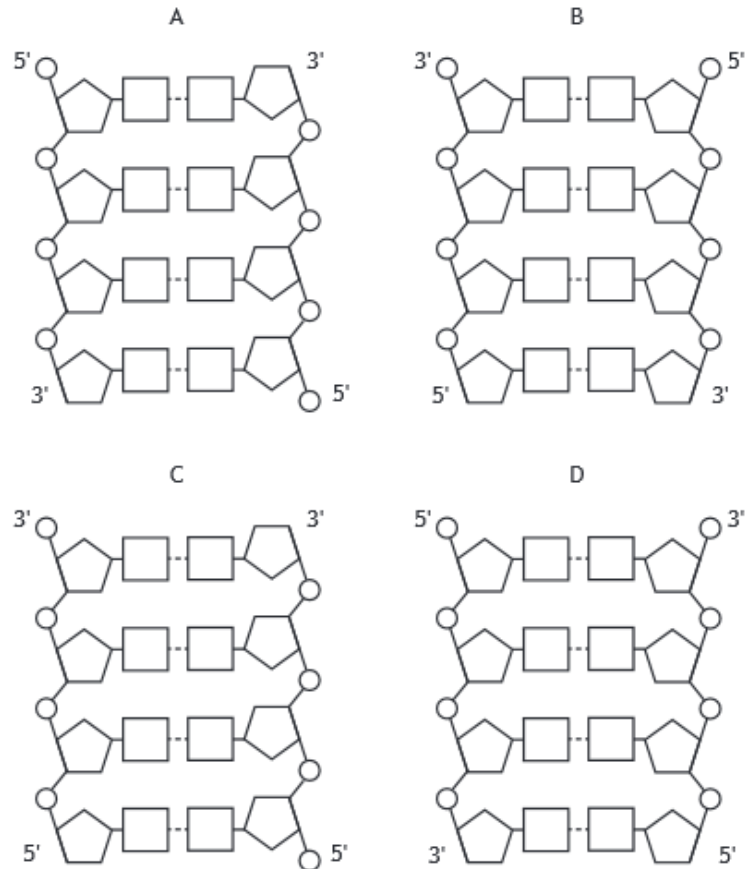
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- (i) Structure of DNA
- (ii) Replication of DNA

A Write notes on DNA under the following headings.

- (i) Organisation of DNA in prokaryotic and eukaryotic cells; 4
(ii) The polymerase chain reaction (PCR). 5

1. Which of the following diagrams shows the correct structure of DNA?



2. A section of double stranded DNA was found to have 60 guanine bases and 30 adenine bases.

What is the total number of deoxyribose sugars in this section?

- A 30
B 90
C 180
D 270

3. The following terms describe different structures into which DNA can be organised within cells.

- 1 Linear chromosome
- 2 Circular chromosome
- 3 Circular plasmid

Which of these terms describe how DNA is organised within photosynthetic plant cells?

- A 1 only
- B 2 only
- C 1 and 2 only
- D 2 and 3 only

4. Which of the following molecules are required in the replication of the lagging strand of a DNA molecule?

- A DNA polymerase and ligase only
- B DNA polymerase and primers only
- C Ligase and primers only
- D DNA polymerase, ligase and primers

(b) A scientist was planning to amplify DNA using PCR.

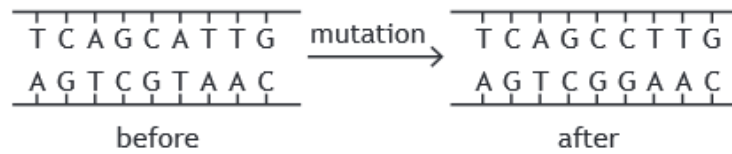
State which DNA polymerase should be used and describe the advantage of using this polymerase. 1

DNA polymerase _____

Advantage _____

(c) Explain the importance of using heat-tolerant DNA polymerases in PCR. 1

1. The diagram below shows part of a DNA molecule before and after a mutation.



The type of mutation shown is

- A deletion
 - B substitution
 - C insertion
 - D inversion.
2. Which of the following are required in a polymerase chain reaction (PCR)?
- A DNA polymerase, template strand and primers
 - B RNA polymerase, template strand and primers
 - C DNA polymerase, template strand and ligase
 - D RNA polymerase, ligase and primers
3. Each cycle of a polymerase chain reaction (PCR) takes 5 minutes.
- If there are 1000 DNA fragments at the start of the reaction, how long will it take for the number of fragments produced by the reaction to be greater than 1 million?
- A 15 minutes
 - B 35 minutes
 - C 50 minutes
 - D 55 minutes

2. DNA holds the genetic information in both prokaryotic and eukaryotic cells.

- (a) (i) Describe **one** organisational difference between prokaryotic and eukaryotic chromosomal DNA. 1

- (ii) Name the substance with which DNA is packaged in eukaryotes. 1

- (b) State **one** location, other than the nucleus, where DNA is found in eukaryotic cells. 1

- (c) During DNA replication two new daughter strands are synthesised using the original strands as templates.

- (i) State why the antiparallel nature of the DNA molecule results in one of the strands being synthesised in short fragments. 1

- (ii) Template DNA, enzymes and ATP are necessary for DNA replication. State **one** other substance required. 1

- (d) Explain why cells need to carry out DNA replication. 1
