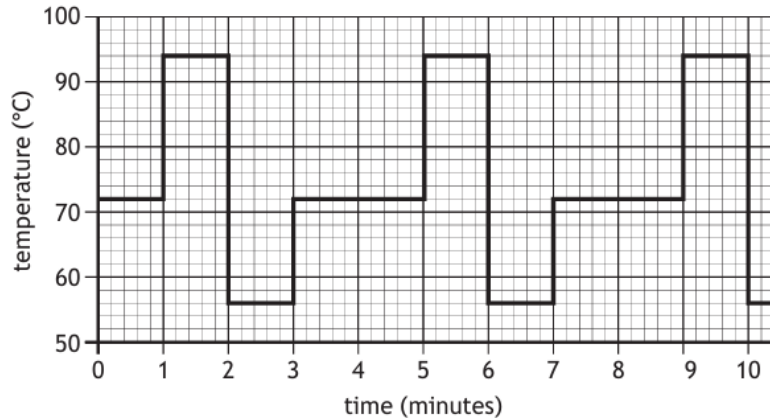


Processing PCR Calculations

1. The graph shows how temperature changes during repeated cycles of a polymerase chain reaction (PCR).



If there were 500 molecules of DNA at the start, predict how many copies there will be after 20 minutes.

- A 16 000
- B 8000
- C 2500
- D 2000

- 2 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

- 3 PCR is a reaction that amplifies a section of DNA and involves three temperature changes per cycle.

Calculate how many temperature changes the reaction would undergo if there were 256 copies of the DNA section produced.

- A 3
- B 8
- C 21
- D 24

- 4 PCR was used to amplify a region of DNA. After 5 cycles 32 copies were present. Calculate the number of **additional copies** present after 4 further cycles.

- A 224
- B 256
- C 480
- D 512

Processing PCR Calculations

5. One complete cycle of a PCR took 3 minutes.

Calculate how many copies of the DNA there would be after 9 minutes from an original sample of 30 DNA molecules.

1

Space for calculation

_____ copies

6. Calculate the number of DNA molecules produced from a single molecule of DNA after 10 cycles of PCR.

1

Space for calculation

_____ DNA molecules

7. Each PCR cycle produces two copies of a section of DNA.

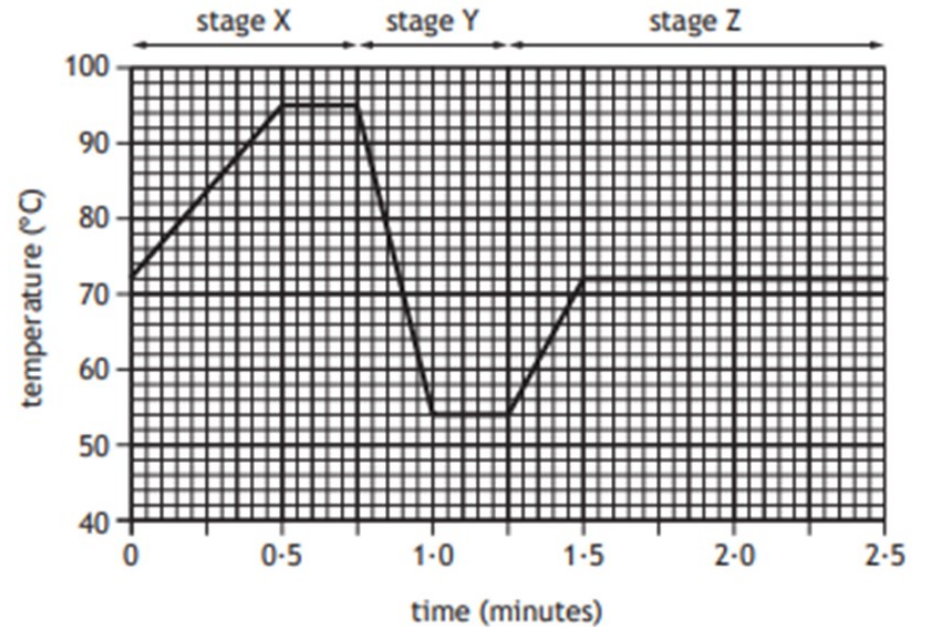
This PCR cycle takes 3 seconds.

Calculate how long it would take for at least 2000 copies of the original section to be produced.

1

Space for calculation

_____ s



8. Before the reaction began there were 1000 copies of a DNA fragment in the reaction tube.

Calculate the time it would take until there were at least one million copies of this DNA fragment present.

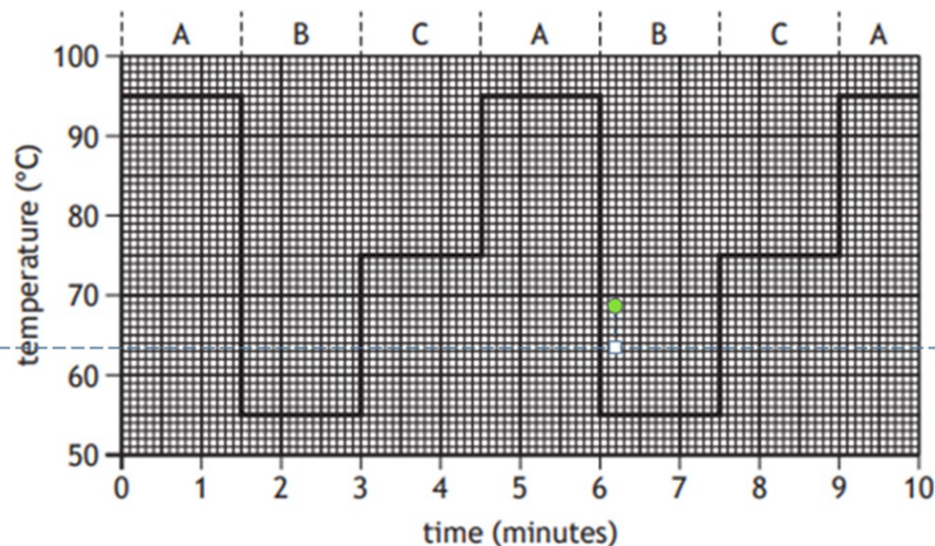
1

Space for calculation

_____ minutes

Processing PCR Calculations

9. The graph shows the changes in temperature during this process.

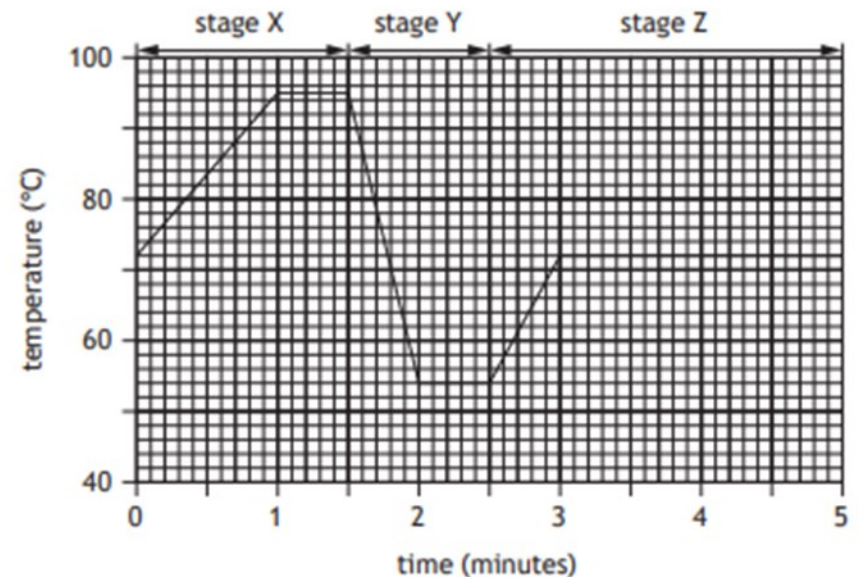


- (ii) An original sample of DNA contained 100 copies of the target sequence.
Calculate how long it would take to produce at least 25 000 copies of this sequence.

Space for calculation

1

_____ minutes



10. A forensic scientist discovered a tiny spot of blood at a crime scene.
A sample taken from this spot contained 10 molecules of DNA.
The sample underwent PCR cycles for 30 minutes.
Use data from the graph to calculate how many molecules of DNA would be present after this time.

Space for calculation

1

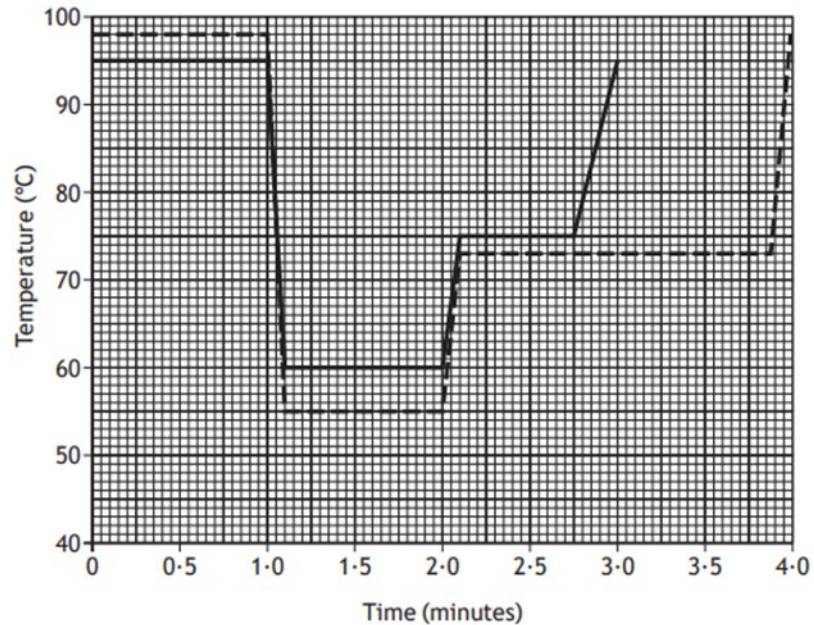
_____ molecules

Processing PCR Calculations

11. Two heat-tolerant DNA polymerases used in polymerase chain reactions (PCR) are *Taq* and *Pfu*.

Pfu has “proof reading” activity. It checks that the correct nucleotides are inserted during replication of a target sequence and then corrects any errors.

The graph shows the temperatures during a single PCR cycle required to amplify a target sequence using *Taq* and *Pfu*.



Key: ——— *Taq* polymerase
 - - - - *Pfu* polymerase

- Calculate the time taken for 16 copies of the target sequence to be made from one DNA fragment using *Taq* polymerase.

1

Space for calculation

Processing PCR Calculations Answers

1. A
2. C
- 3 D
- 4 C
5. 240
6. 1024
7. 33
8. 25
9. 36
10. 640
11. 12