Manipulating genomes – 2021/20 GCE Biology A Component 02

1. Nov/2021/Paper_H420/02/No.9

Which of the following substances is **not** required in DNA sequencing?

A DNA polymerase

B primers

C RNA nucleotides

D terminator bases

Your answer ☐ **[1]**

2. Nov/2021/Paper_H420/02/No.10

DNA fragments can be separated using gel electrophoresis.

Which of the following explains how gel electrophoresis is able to separate DNA fragments?

A DNA carries a negative charge and large fragments are pulled more strongly than small fragments towards the positive electrode.

B DNA carries a negative charge and small fragments are able to travel more quickly than large fragments towards the positive electrode.

C DNA carries a positive charge and large fragments are pulled more strongly than small fragments towards the negative electrode.

D DNA carries a positive charge and small fragments are able to travel more quickly than large fragments towards the negative electrode.

Your answer ☐ **[1]**

3. Nov/2021/Paper_H420/02/No.11

Gene sequencing has a number of uses.

Which of the following is **not** a use of gene sequencing?

A determining the amino acid sequence of a polypeptide

B the classification of newly-discovered organisms

C the polymerase chain reaction

D the selection of the correct vaccine in a disease outbreak

Your answer ☐ **[1]**

4. Nov/2021/Paper_H420/02/No.16(b)

(b) DNA profiling makes use of the fact that DNA varies between individuals.

(i) When creating a DNA profile, DNA is first extracted from a sample of tissue.

Outline the subsequent steps involved in producing a DNA profile.

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..... **[4]**

(ii) **Fig. 16.2** shows a DNA profile used to determine fatherhood in a paternity case.

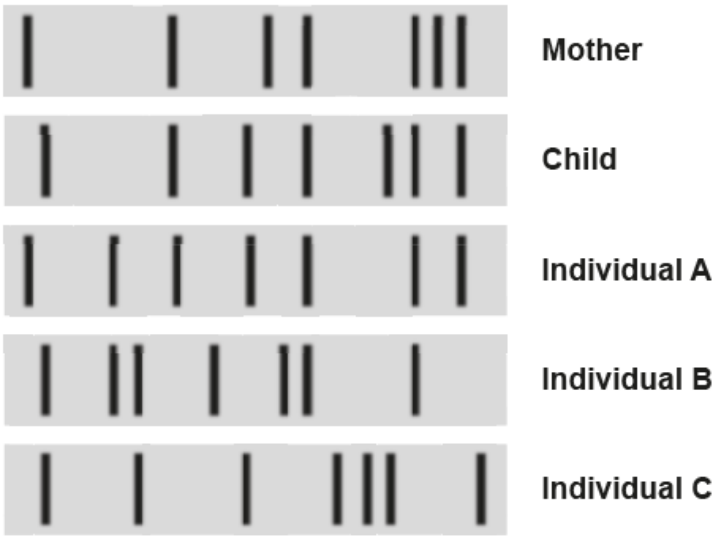

Fig. 16.2

Identify the individual who is most likely to be the child's father.

Justify your answer.

Individual .....

Justification .....

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.....

[2]

5. Nov/2021/Paper_H420/03/No.1(c)

(c) Lungs are the specialised gas exchange surfaces in mammals. Dogs are mammals.

A disease called canine pulmonary fibrosis (CPF) can affect lung function in dogs. CPF can reduce the tidal volume of a dog's lungs.

(i) The West Highland Terrier develops CPF more often than other breeds of dog.

The lung function of a West Highland Terrier was tested. At rest, its ventilation rate was $1.44\,dm^3\,min^{-1}$ and its breathing rate was 24 breaths min^{-1}.

Calculate the tidal volume of the West Highland Terrier in cm^3.

Tidal volume = ... cm^3 **[1]**

(ii) Explain how the high occurrence of CPF in West Highland Terriers could have been a result of artificial selection.

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

(iii) Explain how DNA sequencing could help scientists understand how the West Highland Terrier's genes affect its probability of developing CPF.

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

(iv) Another disease that affects dogs is caused by parvovirus. Dogs can be vaccinated against parvovirus at six weeks of age.

Suggest what the parvovirus vaccine is likely to contain.

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

(v) Dogs need a booster vaccination against parvovirus when they are one year old.

Explain why a booster vaccination is needed.

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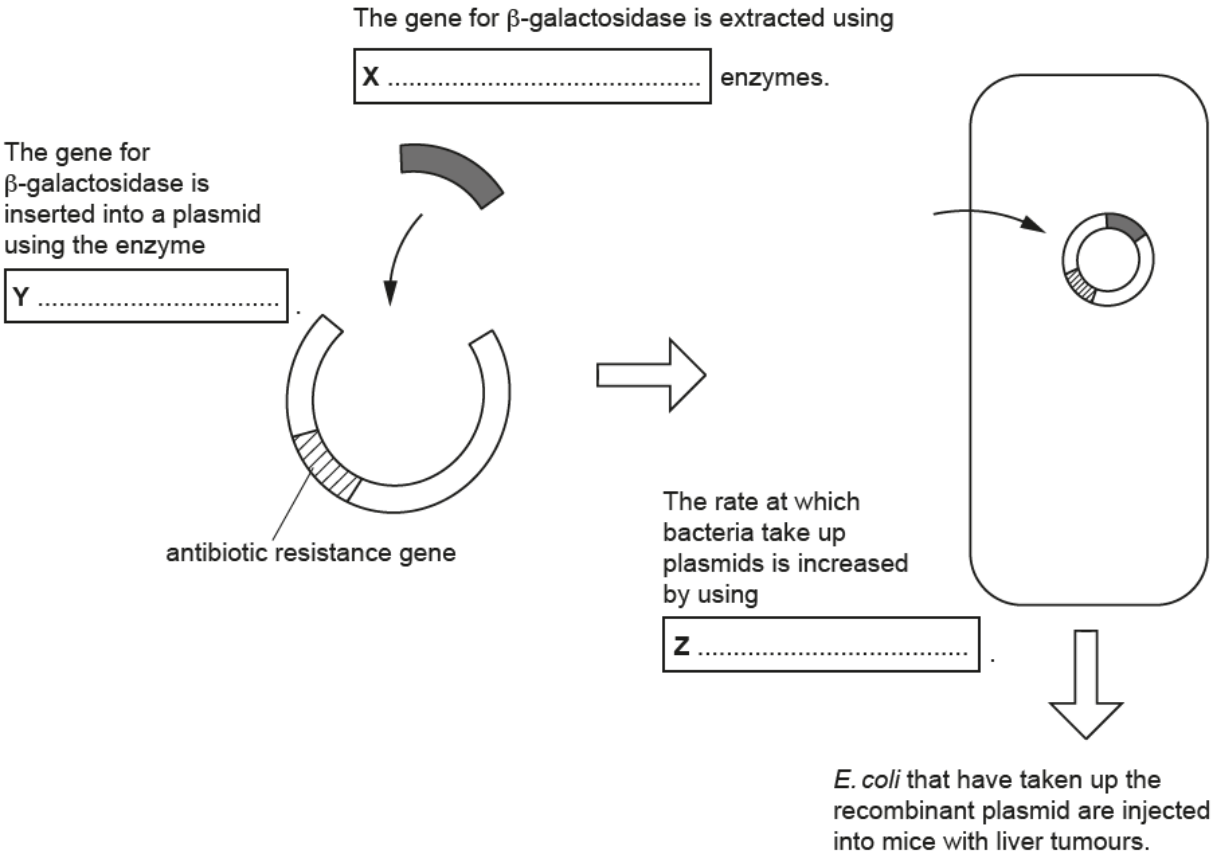
..... **[1]**

6. Nov/2020/Paper_H420/03/No.4(c)

(c) Bacteria such as *E. coli* can be genetically engineered for use in medical science.

An example of the genetic engineering of *E. coli* is shown in the diagram below.



(i) Complete the diagram above by writing the missing words or phrases in the boxes labelled **X**, **Y** and **Z**.

.....Answer **on** the diagram..... **[3]**

(ii) Suggest why the scientists used a plasmid that contained an antibiotic resistance gene.

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

(iii) The scientists observed the following:

- 1 in 400 bacteria took up the plasmid
- 1 in 1000 of the plasmids taken up by bacteria contained the β-galactosidase gene.

Calculate the percentage of bacteria that contained the β-galactosidase gene.

percentage of bacteria = ... % **[2]**

(iv) A technique called quantitative PCR is used to check that the *E. coli* population is growing on the mice liver tumours rather than on healthy tissue.

Suggest how the scientists could use PCR to **compare** *E. coli* growth rates on cancerous liver tissue and healthy tissue.

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

(v) Some people think that the genetic engineering of certain organisms is unethical.

However, there are very few ethical concerns about the genetic engineering of bacteria such as *E. coli*.

Suggest why there are very few ethical concerns about the genetic engineering of *E. coli*.

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