

Cloning & Biotechnology

Model Answers 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Genetics, evolution and ecosystems
Topic	Cloning & biotechnology
Booklet	Model Answers 1

Time allowed: 38 minutes

Score: /28

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

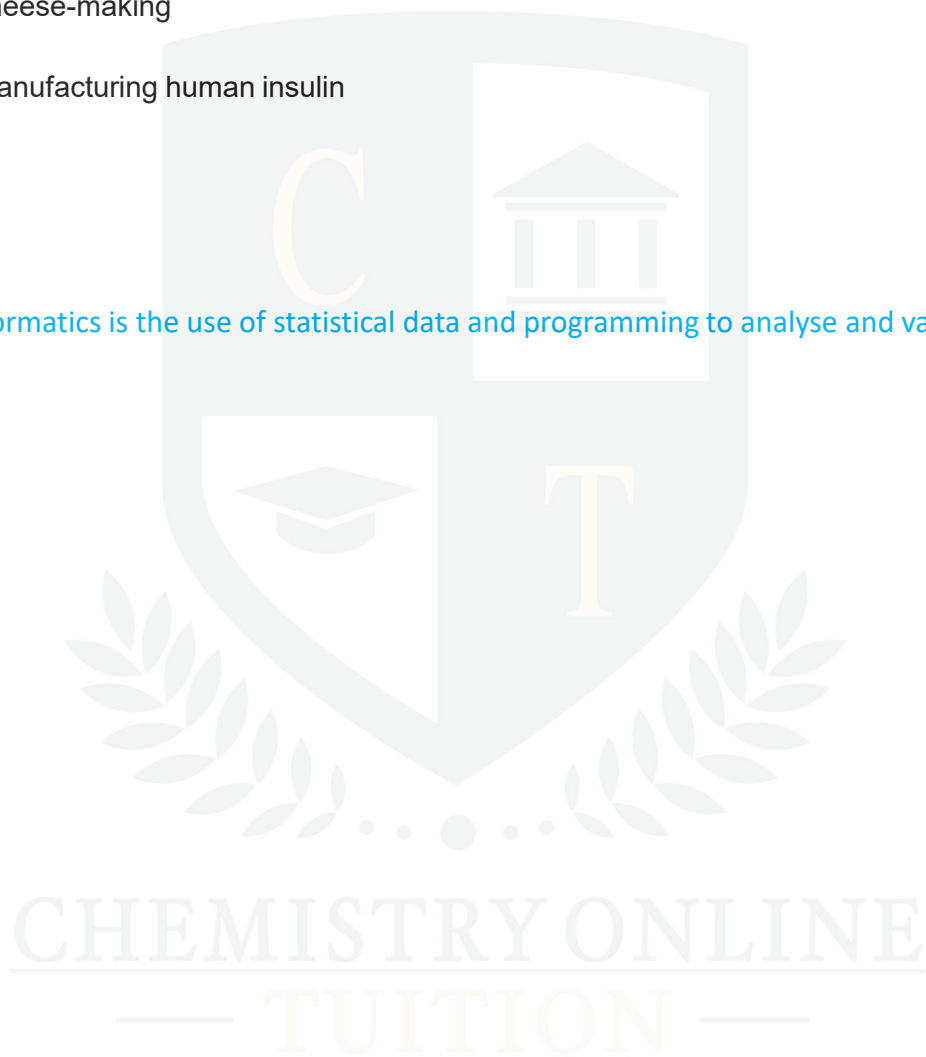
Bacteria are used in many areas of biotechnology.

In which of the following processes, **A** to **D**, do bacteria **not** play an active role?

- A** bioinformatics
- B** bioremediation
- C** cheese-making
- D** manufacturing human insulin

[1]

Bioinformatics is the use of statistical data and programming to analyse and validate results



Question 2

Mycoprotein is a food produced using the fungus *Fusarium venenatum*.

Which statement about mycoprotein is correct?

- A. production of protein is slower than in animals and plants
- B. production is dependent on seasons
- C. waste products can be used as a substrate
- D. there are no ethical issues associated with production

[1]

Mycoprotein is sometimes known as single cell protein. The waste products can be used to create animal feed



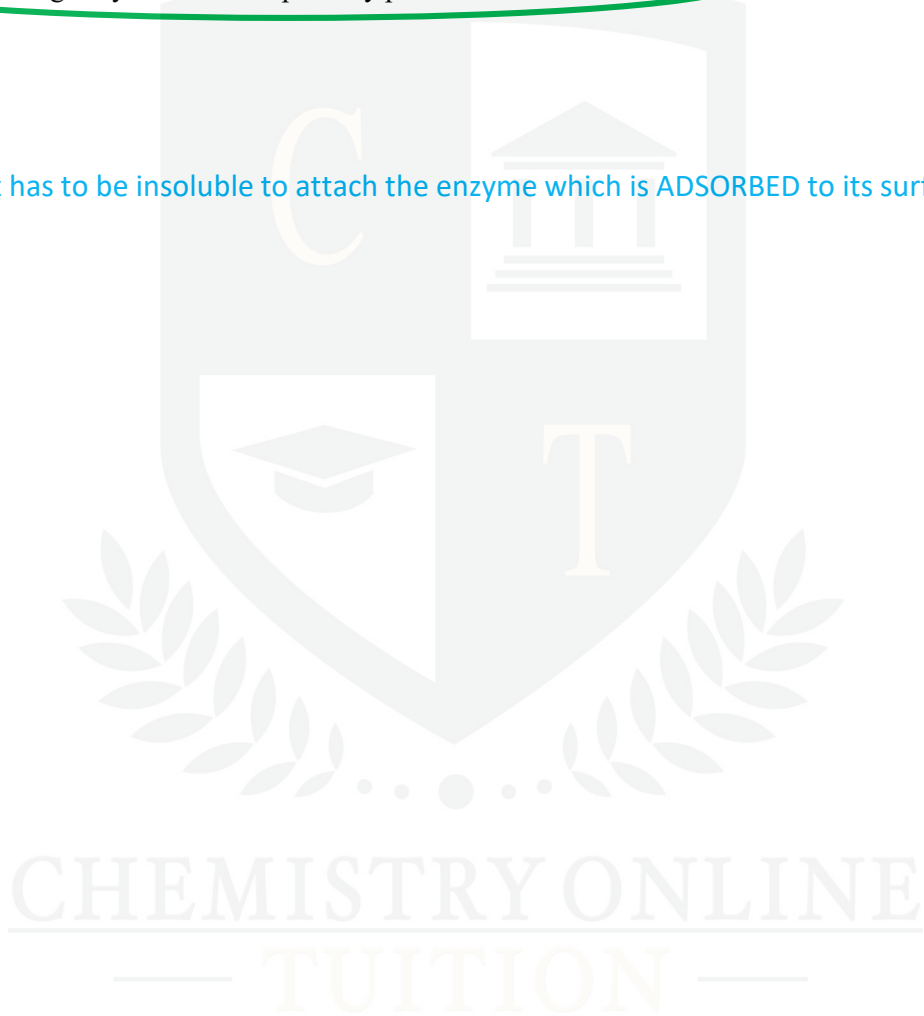
Question 3

Immobilised enzymes can be produced by which of the following methods?

- A binding enzyme to a soluble matrix
- B intermolecular hydrogen bonding of enzymes
- C absorbing enzymes onto the surface of a gel
- D enclosing enzymes within a partially permeable membrane**

[1]

The matrix has to be insoluble to attach the enzyme which is ADSORBED to its surface



Question 4

The last giant Galapagos tortoise died in 2012. Scientists froze some of the tortoise's cells.



The following statements describe processes involved in potential cloning of the giant Galapagos tortoise using the cells. They are **not** in the correct order.

- 1 A donor egg is enucleated.
- 2 The embryo develops into a mature egg, which is incubated.
- 3 A somatic cell from the tortoise is defrosted and the nucleus is removed.
- 4 Electrofusion of the host cell and new nucleus.
- 5 The somatic cell nucleus is inserted into the enucleated oocyte.
- 6 The transformed egg divides *in vitro*.

Which option states the correct order for producing a clone of the giant Galapagos tortoise?

- A** 1, 3, 4, 5, 6, 2
- B** 3, 5, 1, 4, 2, 6
- C** 1, 6, 3, 5, 4, 2
- D** 3, 1, 5, 4, 6, 2

[1]

The haploid nucleus in the egg is removed and is replaced with the diploid nucleus from a somatic cell. This then divides by mitosis to form an embryo

Question 5

Fig. 21 shows some of the steps involved in producing a genetically modified bacterium.

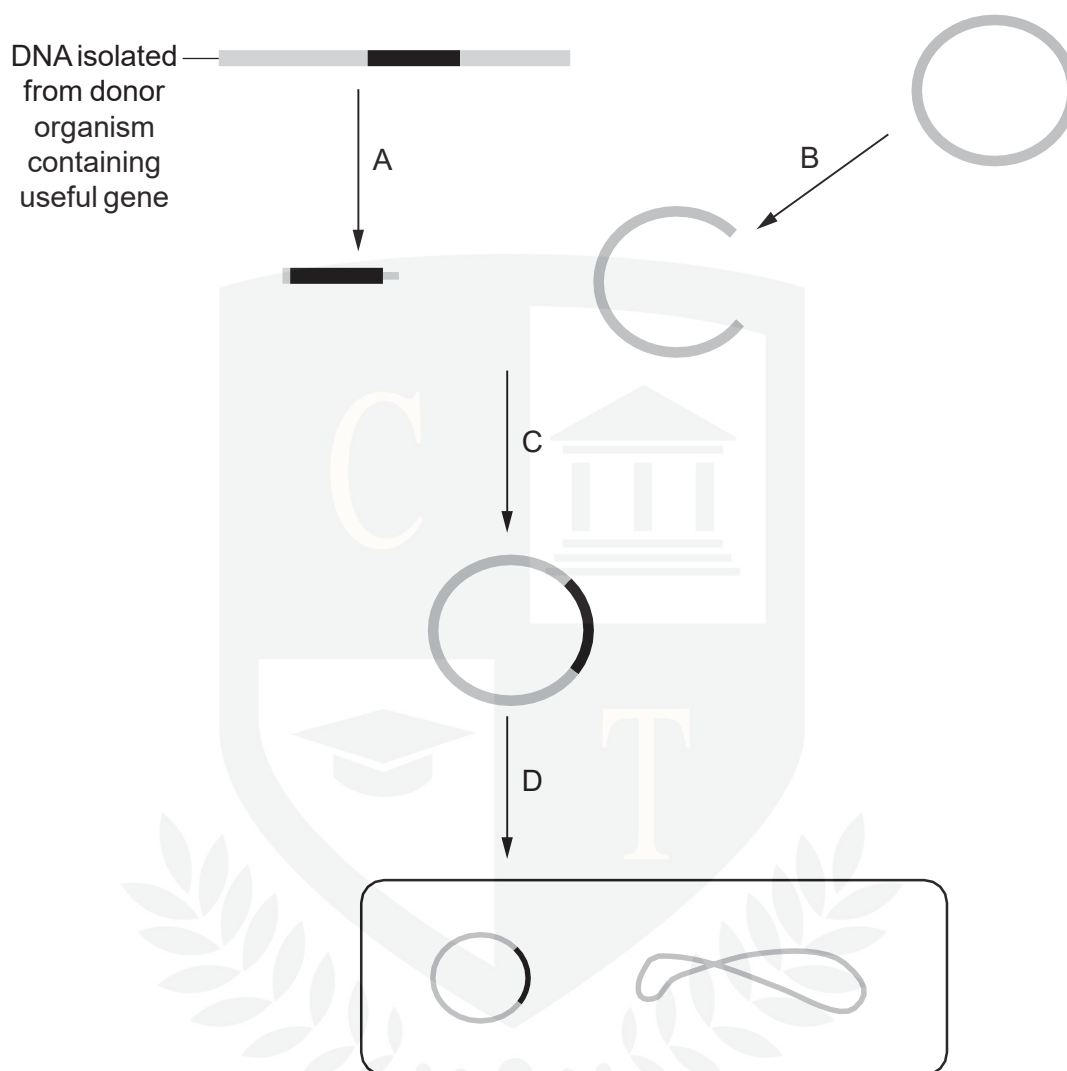


Fig. 21

- (a) The following passage describes steps A and B. Complete the passage using the most appropriate terms.

A gene is cut from the DNA of the donor organism using a Restriction enzyme.

The same enzyme is used to cut open a small piece of bacterial DNA so that the base sequences at the end of each piece of DNA are complementary.

[3]

(b) Describe the **events** that are taking place at the step labelled C. [3]

- The gene is inserted into the plasmid
 - Using complementary base pairing
 - Using hydrogen bonding
 - Creating phosphodiester bonds
 - Using DNA ligase
- By using the same restriction enzyme it breaks at the same sequence of bases creating 'sticky ends' that allow complementary base pairing

(c) Step D results in a transformed bacterium.

Many individual bacteria are not transformed successfully during this procedure.

Explain how scientists can determine the success of step D in this procedure.

- Use a marker gene
- Use a gene for colour change or fluorescence
- Use antibiotic genes
- Test for antibiotic marker gene by growing on agar with the antibiotic

[3]

If the insertion of a gene breaks at the point of an antibiotic resistance gene, then any bacteria taking those plasmids up, will be killed by that antibiotic. A technique called replica plating is used to transfer the colonies onto different combinations of agar with antibiotics

(d) Bacteria can be genetically modified to produce human insulin.

The process is similar to that shown in **Fig. 21** with some differences.

First, instead of isolating DNA that contains the insulin gene, mRNA that codes for insulin is extracted from human pancreas cells.

What needs to be done with the mRNA in order for the rest of the genetic modification to be completed? **[2]**

- The enzyme reverse transcriptase would be used
- To convert mRNA back to single stranded DNA
- DNA polymerase is then used to convert this to double stranded DNA

This technique can be used to isolate the gene for insulin for example. Take pancreatic cells, extract the mRNA (which will obviously code for the gene for insulin) then repeat the above procedure. Reverse transcriptase is obtained from retroviruses that use RNA as the genetic material

(e) Some people are concerned about genetic modification.

State one valid concern that people have about the genetic modification of **bacteria**. **[1]**

Antibiotic resistance might develop in bacteria

[Total: 12]

Question 6

Laboratory techniques are used by workers in various professions, and by scientists.

- (a) A patient has been coughing blood, and it is suspected that bacteria will be found in the blood.

A medical technician cultures the blood on an agar plate. What measures should the technician take to keep the agar plate culture sterile?

[2]

- Work in an inoculating cabinet or replace the lid as soon as possible or work within the updraft of sterile air from a Bunsen
- Flame the inoculating loop
- Seal the plates before incubation

- (b) Tissue traces from a crime scene often need to be identified. DNA from the tissue is 'amplified' by the polymerase chain reaction (PCR) to get samples large enough for further analysis.

Modern PCR technique uses DNA polymerase from the bacterium *Thermus aquaticus*. Why is this enzyme chosen?

[2]

- The enzyme is thermally stable or it doesn't denature at 95 °C
- PCR can be recycled repeatedly without the need to replace the enzyme

Once the ingredients are all present (DNA polymerase, nucleotides, primers and the original DNA sample) the thermal block goes through a sequence of temperature changes. 95°C, 55 °C, 72 °C. Each cycle doubles the DNA content.

CHEMISTRY ONLINE
— TUITION —

- (c) Valine, citrulline, hydroxyproline and glutamic acid are amino acids that are normally found in considerable amounts in urine. Following certain diets can result in a change in the amino acids present in the urine of some people.

Plan a method to compare the amino acids present in the urine of a person who has been following one of these diets with that of a person who has not.

- Separate using paper chromatography
- Load the spots of the two urine samples
- Run alongside the urine samples, known samples of the amino acids
- Separate using an appropriate solvent
- Stain the amino acids / use ninhydrin
- Compare the distances moved by the samples compared to the known amino acids

[3]

Running known samples, alongside unknown is another application of chromatography. It has other functions other than just separation of mixtures. Comparing R_f s allows you to identify the unknowns.

[Total: 7]

CHEMISTRY ONLINE
— TUITION —

Question 7

Fig. 5.1 is a crossword that should contain five words relating to the use of microorganisms by humans.

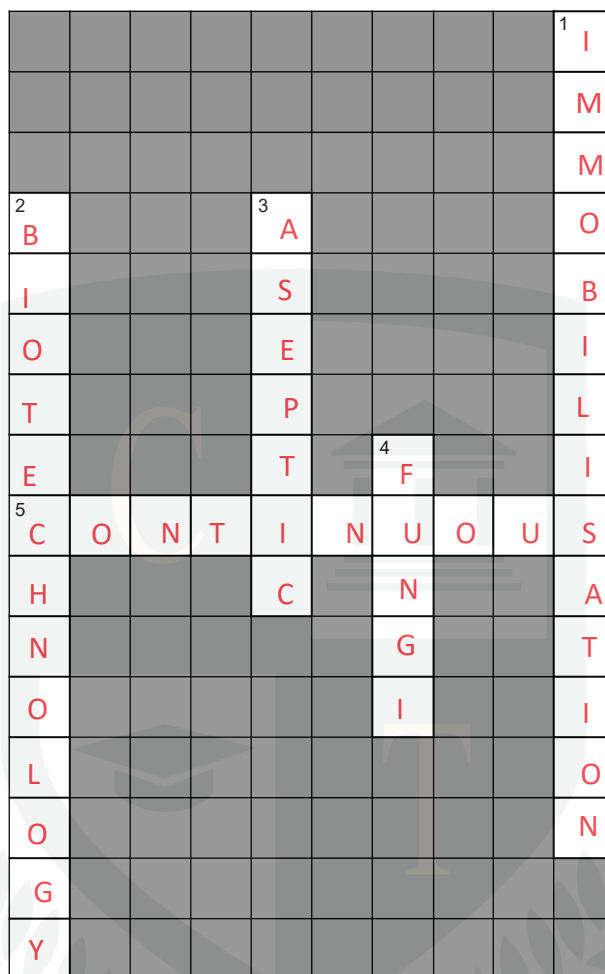


Fig. 5.1

Use the clues below to write the five appropriate words in the correct spaces on Fig. 5.1.

[5]

ACROSS

- 5** Microbial culture method in which nutrients are added and the product harvested throughout the fermentation process.

DOWN

- 1** Technique that makes enzymes more thermostable and allows them to be re-used.
- 2** The industrial use of living organisms to produce food, drugs or other products.
- 3** Sterile technique that prevents the growth of undesirable microorganisms.
- 4** Kingdom of eukaryotic microorganisms with cell walls made of chitin.