

Topic 5: New technologies

A Living factories

1 Useful chemicals from microorganisms

Microorganisms are grown in huge tanks called fermenters. A wide range of products can be made in this way.

a Here is a list of products. Decide whether the product is an *enzyme*, another kind of *protein*, or an *antibiotic*. Then draw lines to match each product to its use.

Product	Type	Use
Quorn		breaks down lignin and cellulose in waste plant material; the sugar produced can be used to make biofuel
protease		food
chymosin		treating disease caused by bacterial infections
lignocellulase		'bio' detergent
penicillin		vegetarian 'rennet' used to make cheese

b List five conditions that need to be controlled in the fermenter.

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Bacteria have many features that make them ideal for industrial and genetic processes.

i The following are steps in the process for making molecules from bacteria. Number the steps in the correct order.

ii Draw a straight line from each step to its correct feature(s).

No.	Step	Feature
	The conditions are monitored and controlled to produce the greatest quantities of product as possible.	ability to make complex molecules
	Bacteria are chosen that have the potential to make required molecule.	lack of ethical concerns for bacteria
	Bacteria are grown in the fermenter.	presence of plasmid
	The required molecule is extracted.	simple biochemistry
	If needed, new genes are introduced into the plasmid so that the bacteria can make the required molecule.	rapid reproduction

B Genetic modification

1 New genes for cells

Genetically modified (GM) organisms are used to make new products or improve efficiency.

a In the diagram showing the genetic modification of a bacterium, add notes to describe the three main steps in the process.

