Microorganisms and Biotechnology P2 Questions

Microorganisms and biotechnology

Content

14.1 Microorganisms

14.2 Food biotechnology

14.3 Industrial biotechnology

Learning outcomes

Candidates should be able to:

(a) **list the main characteristics of the following groups: viruses, bacteria and fungi**

(b) **outline the role of microorganisms in decomposition**

(c) **explain the role of yeast in the production of bread and alcohol**

(d) **outline the role of bacteria in yoghurt and cheese production**

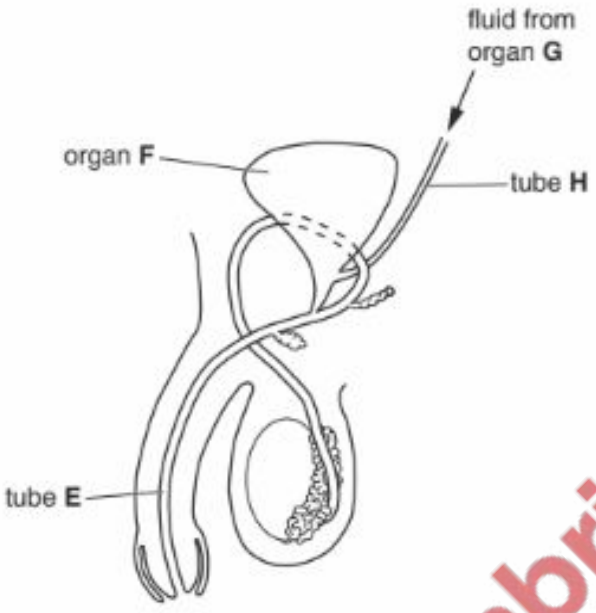
(e) **describe the use of fermenters for large-scale production of antibiotics and single cell protein**

(f) **describe the role of the fungus *Penicillium* in the production of penicillin.**

Microorganisms and Biotechnology P2 Questions

0/N18/22/Q2

The diagram shows the human male reproductive organs and associated structures.



(a) (i) Identify each of the following:

tube **E** .....

organ **F** .....

organ **G** .....

tube **H** ..... [4]

(ii) State **one** difference between the fluids carried by tube **E** and tube **H**.

.....

..... [1]

(b) (i) State **one** way in which the fluid from organ **G** may be different in a person with diabetes compared to a person without diabetes.

.....

..... [1]

(ii) A person with diabetes may be treated with insulin produced by genetically modified bacteria.

Outline how such genetically modified bacteria may be produced and used to manufacture human insulin on a commercial scale.

.....

.....

.....

.....

.....

.....[4]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

M/J18/22/Q8

(a) Outline the role of a **named type** of microorganism in the production of each of the following products:

yoghurt .....

.....

.....

.....

.....

bread .....

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.....

.....

[6]

(b) Describe how a **named type** of microorganism can be used to produce human insulin on a commercial scale.

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.....[4]

[Total: 10]

O/N17/21/Q7

Fig. 7.1 shows a fermenter used for the production of an antibiotic.

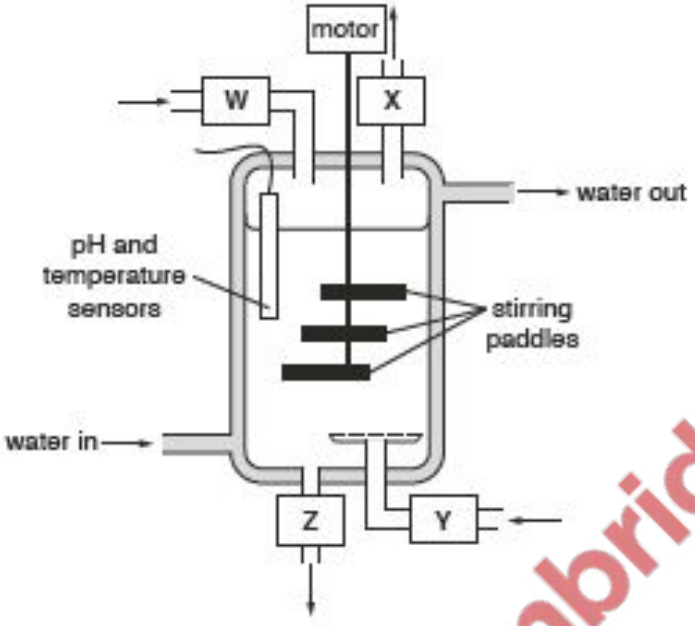

Fig. 7.1

(a) (i) Identify what enters or leaves through each of W, X, Y and Z in Fig. 7.1.

W .....

X .....

Y .....

Z ..... [4]

(ii) Explain the importance of the substance entering through Y in the production of the antibiotic.

.....

.....

.....[2]

(b) Explain why it is important to detect and to control the pH and temperature of the contents of the fermenter.

.....

.....

.....

.....

.....[3]

(c) Suggest one advantage of the motor being located outside, rather than inside, the reaction vessel of the fermenter.

.....

.....

.....[1]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

M/J17/21/Q1

Spirulina is classified in the group bacteria. *Spirulina* is green in colour and is able to synthesise its own food.

(a) List **three** characteristics of bacteria.

1 .....

2 .....

3 ..... [3]

(b) **(i)** Suggest the name of the chemical that gives *Spirulina* its green colour.

..... [1]

(ii) Write, in words or symbols, the equation for the process by which *Spirulina* synthesises its own food.

..... → ..... [2]

(c) *Spirulina* can be eaten by humans.

The United Nations World Health Organization (WHO) made the following statement about *Spirulina*:

'For WHO Spirulina represents an interesting food for multiple reasons. Rich in iron and protein, it can be given to children without any risk. We at WHO consider it to be a very suitable food.'

Use your knowledge of animal nutrition to suggest and explain why WHO considers *Spirulina* to be a 'very suitable food'.

.....

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.....

.....

.....

.....[4]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

O/N16/22/Q1

Two separate strains, **A** and **B**, of the *same species* of microorganism are used in the making of bread and beer (a drink that contains alcohol).

(a) **(I)** Name this type of microorganism .....[1]

(II) Name the gas released by this microorganism during the production of bread and beer.

.....[1]

(b) Fig. 1.1 shows the volume of gas released by the *strains* while they are being used.

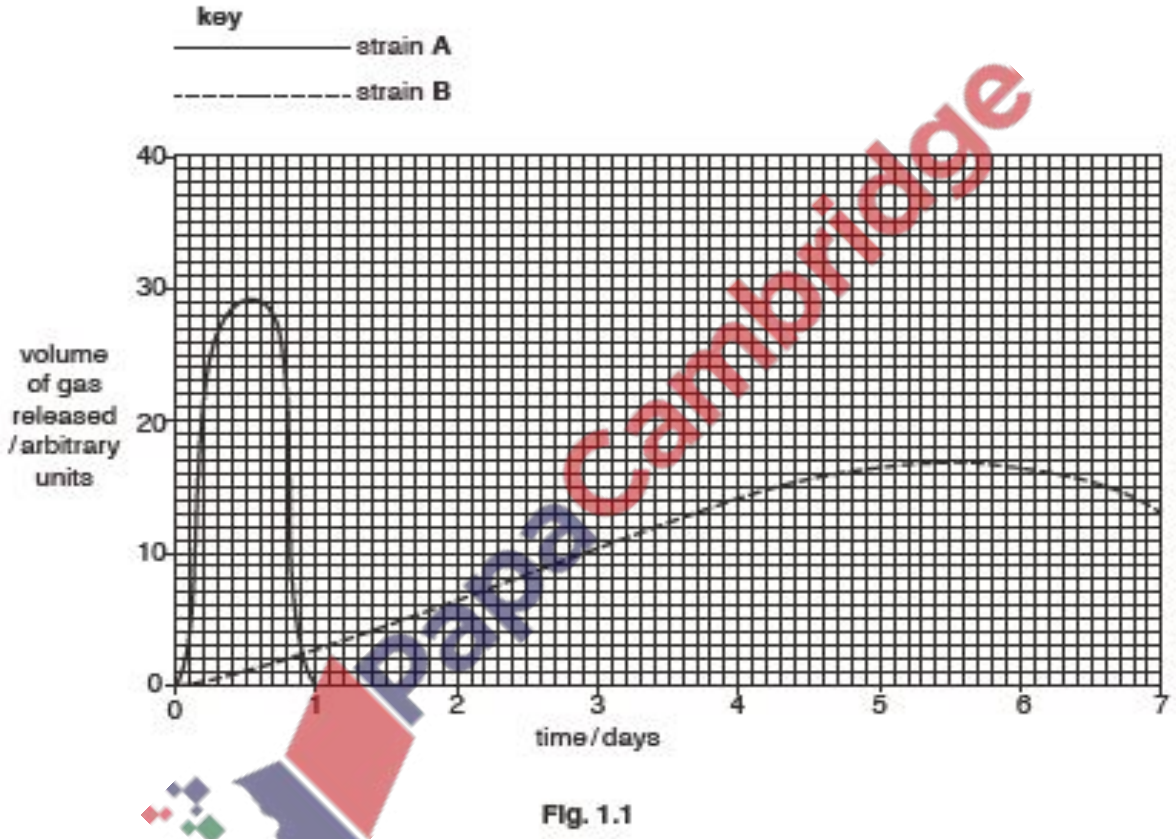

Fig. 1.1

(I) Fig. 1.1 shows the gas released by strain **B** at a temperature of 18 °C.
Draw a curve on Fig. 1.1 to show the effect on *strain* **B** of increasing the temperature by 10 °C. [3]

(II) Name **two** other external factors that would change the shape of the curves shown in Fig. 1.1.

1 .....

2 .....
[2]

(c) Strain **A** has a sweet taste and strain **B** has a bitter taste.
Suggest which strain is used for making bread. Give reasons for your answer.

strain used in making bread .....

reasons .....

.....

.....

.....

.....

.....

.....[3]

[Total: 10]

M/J16/21/Q4

Fig. 4.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

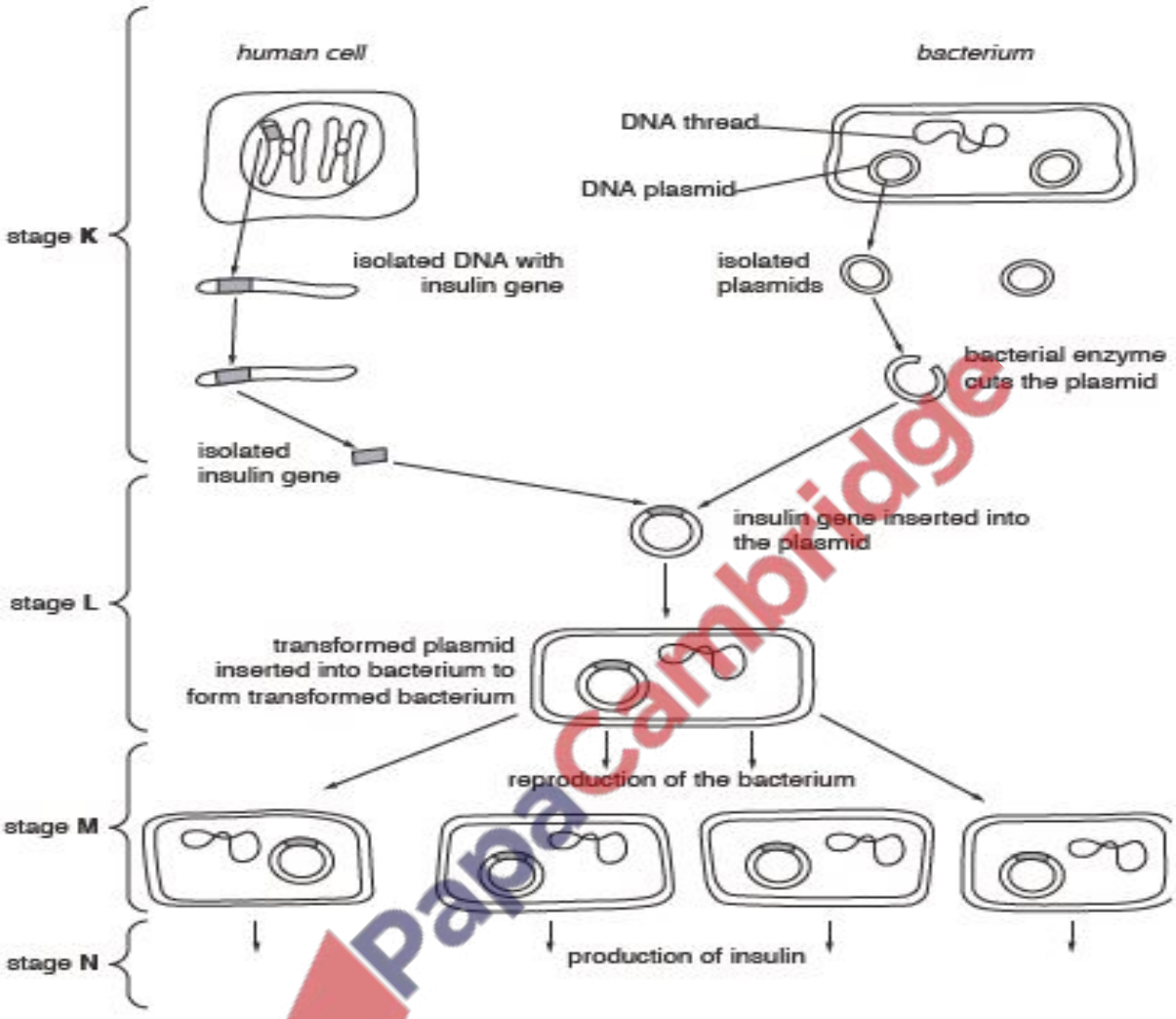

Fig. 4.1

(a) (i) Describe how the location and organisation of genetic material in the human cell shown in stage **K** of Fig. 4.1 is different from that in the bacterial cell shown.

.....

.....

.....

..... [3]

(II) Use your knowledge of bacterial cells to name **two** structures that the transformed plasmid must pass through to form a transformed bacterium in stage **L** of Fig. 4.1.

..... and ..... [2]

(III) State the type of reproduction that takes place in stage **M** of Fig. 4.1. Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction .....

explanation .....

.....

.....

..... [3]

(IV) Name the condition in humans that is treated using insulin produced by the bacteria in stage **N** of Fig. 4.1.

..... [1]

(V) Stage **N** of Fig. 4.1 may take place in a container similar to that used in the large-scale production of antibiotics.

State the name of this type of container.

..... [1]

(b) Genetic engineering can also be used to produce crop plants for humans to eat.

Discuss the potential advantages and dangers of using genetic engineering to produce crop plants for humans to eat.

advantages .....

.....

.....

.....

dangers .....

.....

.....

..... [4]

[Total: 14]

Microorganisms and Biotechnology P2 Questions

M/J16/22/Q8

(a) Describe the industrial manufacture of single cell protein.

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.....

.....

.....[8]

(b) Suggest problems of using viruses in biotechnology.

.....

.....

.....

.....[2]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

0/N15/22/Q8

(a) Describe how a bacterial cell differs from a typical animal cell.

.....

.....

.....

.....

.....

.....[3]

(b) Describe the role of bacteria in nitrogen fixation.

.....

.....

.....

.....

.....

.....[3]

(c) Describe the part played by bacteria after a river has been polluted by sewage.

.....

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.....

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.....

.....

.....

.....

.....[4]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

M/J15/22/Q8

(a) Outline the role of microorganisms in the production of yoghurt.

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.....

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.....

.....

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.....

.....

..... [6]

(b) Explain how a slice of bread, if left exposed to the air, decomposes due to the growth of fungi.

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..... [4]

[Total: 10]

O/N14/22/Q4

Fig. 4.1 is an incomplete flow chart of the process of anaerobic respiration in yeast and in muscles.

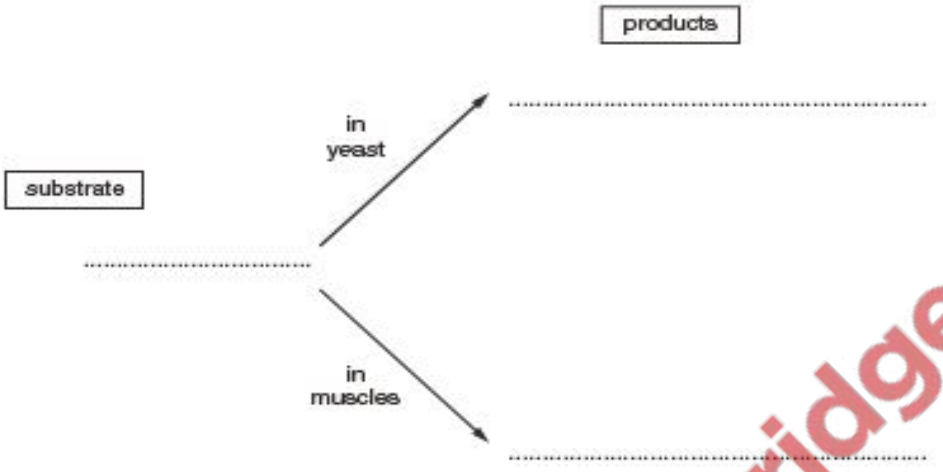

Fig. 4.1

(a) Complete Fig. 4.1 to show the substrate and products for anaerobic respiration in yeast and in muscles. [4]

(b) Yeast cells may be killed by their use in food biotechnology. Explain what causes the death of the yeast in each of the following.

(i) brewing

.....

.....

.....

..... [2]

(ii) making bread

.....

..... [1]

(c) Explain why muscle cells are not killed by anaerobic respiration in a healthy person.

.....

.....

.....

..... [2]

(d) Suggest why anaerobic respiration does not release as much energy as aerobic respiration for each molecule of the same substrate.

.....

.....

.....

..... [2]

[Total: 11]

Microorganisms and Biotechnology P2 Questions

M/J14/21/Q9

(a) Outline the role of a **named** type of microorganism in the production of each of the following products.

bread

type of microorganism .....

role .....

.....

.....

.....

yoghurt

type of microorganism .....

role .....

.....

.....

.....

[4]

(b) Describe and explain how a fermenter is used to produce the antibiotic penicillin from a **named** microorganism.

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.....[6]

[Total: 10]

Microorganisms and Biotechnology P2 Questions

M/J14/22/Q7

(a) Describe how a virus differs from a bacterium.

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.....[6]

(b) Explain how microorganisms are involved in the recycling of materials in dead organic matter.

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.....[4]

[Total: 10]

O/N13/22/Q2

2 Fig. 2.1 shows how an alcoholic drink is produced in some countries.

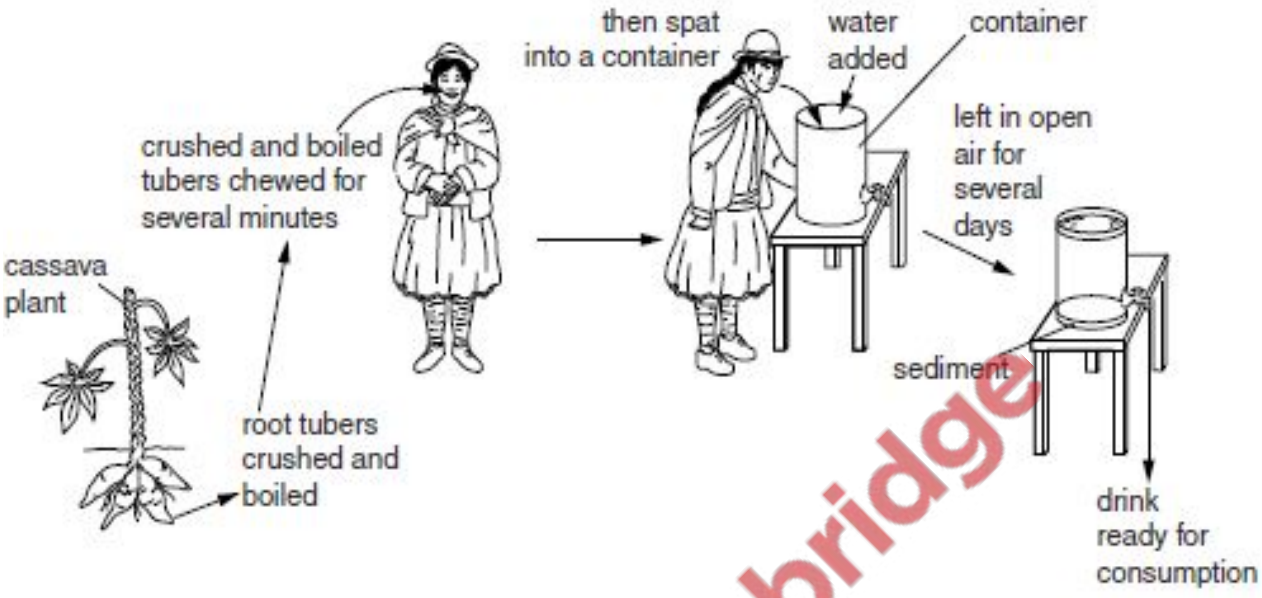

Fig. 2.1

(a) The root tubers of the cassava plant store starch. After removal from the plant, the tubers are crushed and boiled.

Suggest the effect that crushing and boiling will have on the cells of the tubers.

.....

..... [2]

(b) After they have been crushed and boiled, the cassava tubers are chewed for several minutes.

Explain what happens to the starch during this time.

.....

.....

.....

..... [3]

(c) (i) Name the process that must occur in the container to produce alcohol and, in the space below, give an equation for this process.

process.....

equation

[3]

(ii) Name the type of organism, whose spores are found in soil and floating in the air, that will bring about the production of alcohol.

.....[1]

(d) Suggest why the sediment in the bottom of the container increases in quantity as the container is left to stand for several days.

.....

.....

.....

.....[2]

[Total: 11]

Microorganisms and Biotechnology P2 Questions

M/J13/22/Q5

Fig. 5.1 shows a fermenter used for the large-scale production of antibiotics by microorganisms.

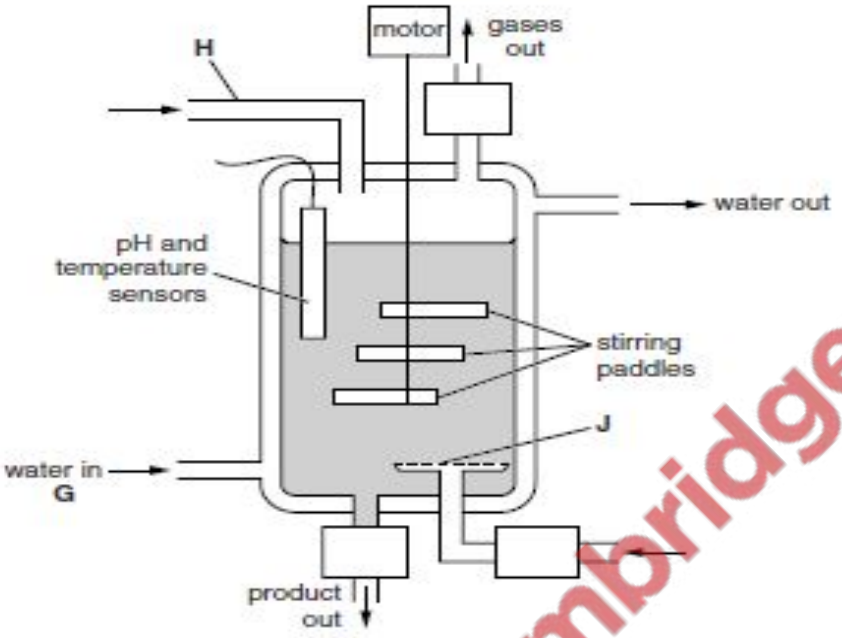

Fig. 5.1

(a) State the term for the manufacture of antibiotics using a fermenter.

.....[1]

(b) State the purpose of the water which enters the fermenter at **G**.

.....[1]

(c) Explain the importance of controlling the pH and temperature of the contents of the fermenter.

.....

.....

.....

.....

.....[2]

(d) Describe the function of part **H** and part **J**.

part **H** .....

.....

.....

.....

part **J** .....

.....

.....

.....[5]

[Total: 9]

O/N12/21/Q5

Fig. 5.1 shows a palisade cell from the leaf of a flowering plant.

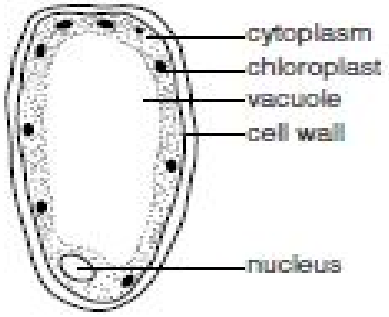

Fig. 5.1

(a) State **three** ways in which this cell differs from a fungal hypha.

palisade cell	fungal hypha
1.	.....
2.	.....
3.	.....

[3]

Fig. 5.2 shows the apparatus used to produce 5 dm^3 of red wine from grape juice.

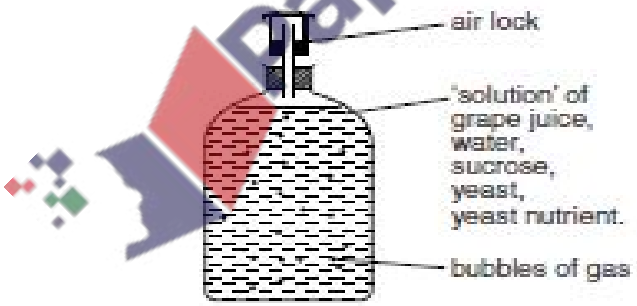

Fig. 5.2

(b) State an equation for the chemical process by which the alcohol is produced.

..... [2]

(c) Suggest a suitable temperature to ensure a good yield of alcohol.

..... [1]

Table 5.1 shows the rate of bubble release and the concentrations of sugar and alcohol in the grape juice over the first 10 days.

Table 5.1

time /days	number of bubbles per hour	concentration of sugar/grams per dm^3	concentration of alcohol/%
1	60	200	0.0
2	40	150	0.0
3	20	100	0.0
7	2	50	0.5
10	1	30	2.0

(d) (i) State the process that was occurring from day 1–3 to produce the bubbles of gas.

..... [1]

(ii) Explain why alcohol started to be produced only after several days.

.....

.....

..... [2]

(iii) When the alcohol content reached 15%, no further bubbles were produced. Suggest why the alcohol content could not increase further.

.....

..... [1]

[Total: 10]

M/J12/21/Q2

Fig. 2.1 shows a fresh fruit and the same fruit after being left at a temperature of 25 °C for 14 days.

fresh fruit

fruit after 14 days

Fig. 2.1

Bacteria and fungi are two groups of microorganism which cause the fruit to change appearance during the 14 days.

(a) Complete Table 2.1 to show three **differences** between the characteristics of bacteria and fungi.

Table 2.1

	bacteria	fungi
1		
2		
3		

[3]

(b) Name the process that is responsible for the appearance of the fruit after 14 days.

.....

[1]

(c) Fungi reproduce by asexual reproduction.

(i) Name the type of cell division that occurs during asexual reproduction.

.....

[1]

(ii) Explain how asexual reproduction results in genetically identical offspring.

.....

.....

..... [2]

(d) Microorganisms use glucose ($C_6H_{12}O_6$) found in the fruit to carry out aerobic respiration. Complete the equation for aerobic respiration.

Glucose ($C_6H_{12}O_6$) + ... → ..... + ...

[1]

(e) **(i)** Explain why increasing the temperature surrounding the fruit would speed up the changes shown in Fig. 2.1.

.....

.....

..... [2]

(ii) Suggest two ways in which the fruit may be preserved to prevent the changes shown in Fig. 2.1 from occurring.

1. .....

2. .....

[2]

[Total: 12]

Microorganisms and Biotechnology P2 Questions

O/N11/21/Q6

(a) Describe and explain how microorganisms are used to produce a hormone commercially.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[7]

(b) State the advantages of obtaining hormones by this method.

.....

.....

.....

.....

.....

.....[3]

[Total:10]

Microorganisms and Biotechnology P2 Questions

M/J11/22/Q1

Fig. 1.1 shows three types of organism (not drawn to the same scale).

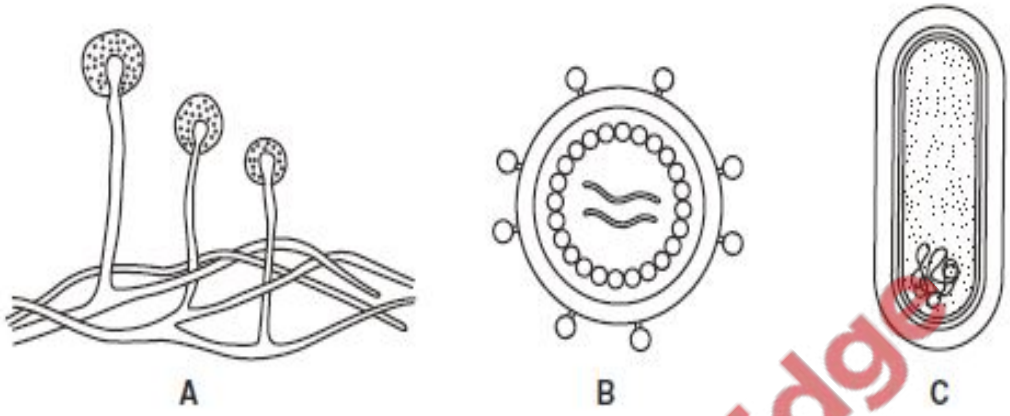

Fig. 1.1

(a) Identify the three types of organism shown in Fig. 1.1.

A .....

B .....

C ..... [3]

(b) (i) List the organisms in Fig. 1.1 in order of their actual size, starting with the largest.

.....[1]

(ii) State which of these organisms might bring about decay of organic matter.

.....[2]

(c) On Fig. 1.1, label

- a structure (**N**) that is always made mostly of DNA,
- a structure (**P**) that is made only of protein. [2]

(d) A microorganism, similar to one shown in Fig. 1.1, is used commercially to make human insulin. Name the microorganism and suggest why this process is referred to as *genetic engineering*.

microorganism name .....

why the process is called genetic engineering

.....

.....

.....

.....[3]

[Total: 11]

Microorganisms and Biotechnology P2 Questions

MARK SCHEME

Mark schemes will use these abbreviations:
; separates marking points
/ alternatives
() contents of brackets are not required but should be implied
R reject
A accept (for answers correctly cued by the question, or guidance for examiners)
Ig ignore (for incorrect but irrelevant responses)
AW alternative wording (where responses vary more than usual)
AVP alternative valid point (where a greater than usual variety of responses is expected)
ORA or reverse argument
underline actual word underlined must be used by candidate
+ statements on both sides of the + are needed for that mark

O/N18/22/Q2

2(a)(i) (E) urethra ;

(F) bladder ;

(G) kidney ;

(H) ureter ;

R gall (bladder)

2(a)(ii) semen / seminal fluid / sperm / gametes + carried by

E / not carried by

H ; 1

2(b)(i) (contains) glucose ;

2(b)(ii) insulin gene ;

from + human

+ DNA / chromosome / genome ;to

+ bacterial

+ DNA / chromosome / genome / plasmid ;

fermenter ;

reproduce / multiply / divide / mitosis / binary fission

Microorganisms and Biotechnology P2 Questions

M/J18/22/Q8

8(a) **1** enzymes **;**
(yoghurt)
2 bacteria / *Lactobacillus* / *Streptococcus* **;**
3 sugar / lactose **+** milk **;**
4 production **AW +** of acid **or** reduction in pH **;**
5 thickens / curdles / coagulates / reference to taste **;**
(bread)
6 fungus/ yeast / *Saccharomyces* **;**
7 anaerobic **+** respiration **or** fermentation **;**
8 production **AW +** carbon dioxide **;**
9 rising **;**
6 A once for **either** *yoghurt* **or** *bread*
8(b) **1** genetic **+** engineering / modification **;**
2 bacteria / fungus / named bacteria / named fungus **;**
3 reference to insulin gene **;**
4 from human **+** DNA / chromosome / genome **;**
5 to bacterial / fungal **+** DNA / chromosome / genome / plasmid **;**
6 fermenter **;**
7 reproduce / multiply / divide / mitosis / binary fission **;**

O/N17/21/Q7

7(a)(i) ***(W)***
fungus / microorganism / bacteria / nutrient /
yeast / water **;**
(X)
carbon dioxide **;**
(Y)
oxygen **;**
(Z)
antibiotic / named antibiotic **;**
7(a)(ii) respiration **;**
aerobic **;**
reference to increased yield **;**
sparger / bubbles / more surface area **;**
growth **;**
7(b) detect changes **;**
enzymes **;**
denature **;**
reduce rate of reaction / product formed **;**
kill microorganisms or named **;**
maintain optimum / best conditions **;**
7(c) heat production / temperature **;**
ease of maintenance **;**
prevents water damage to motor **;**
doesn't take up space (in fermentation vessel) **AW ;**

Microorganisms and Biotechnology P2 Questions

M/J17/21/Q1

1(a) single-celled ;
no nucleus / nucleus not membrane bound ;
no organelles ;
cell wall ;
(cell wall) not cellulose ;
cell membrane / cytoplasm ;
flagella / flagellum ;
DNA circular / loop **OR** plasmid / single chromosome ;
smaller than animal / plant cells **OR** 1–2 μm ;
1(b)(i) chlorophyll ;
1(b)(ii) carbon dioxide / $6CO_2$ **+** water / $6H_2O$;
glucose / $C_6H_{12}O_6$ **+** oxygen / $6O_2$;
1(c) iron **+** haemoglobin / red blood cells ;
prevent anaemia ;
protein **+** growth / repair ;
protein **+** (production of) enzymes / antibodies ;
carbohydrates / glucose / starch / vitamins / ions ;
reference to a component of balanced diet / dietary supplement **OR** to alleviate malnutrition / famine ;

O/N16/22/Q1

1(a)(i) yeast / fungus / *Saccharomyces* ;
1(a)(ii) carbon dioxide / CO_2 ;
1(b)(i) starting at zero ;
line above that on graph at least up to (the drawn line's) peak ;
peaking earlier (than dotted line on graph) ;
reaches same height as dotted line ;
1(b)(ii) pH ;
substrate (or named carbohydrate) concentration / amount ;
toxins / named toxin ;
amount of yeast / microorganism / strain A / strain B ;
competing microorganism **AW** ;
pressure / (presence of) oxygen ;

M/J16/21/Q4

4 (a) (i) in nucleus (human) / within
nuclear membrane ORA ;
in cytoplasm (bacteria) ;
thread + plasmid(s) (bacteria) ;
correct reference to
chromosomes AW ;
genes / chromosomes paired
(human) ;
(ii) (cell) wall ;
(cell) membrane ;
(iii) type:
asexual / binary fission / mitosis ;

explanation:
genetically + identical (cells
produced)
OR clones ;
all capable of producing
insulin / same product ;
A to produce insulin in large
quantities / to produce a large number of
bacteria / produce bacteria quickly
(iv) diabetes ;
(v) fermenter ;

M/J16/22/Q8

8 (a) 1. sterilised / aseptic technique ;
2. fermenter ;
3. bacterium / fungus / algae /
named example ;
4. substrate / cultured medium or
named / broth / any two
chemicals in the medium ;
5. oxygen / air ;
6. bubbles / sparger / aerator /
paddle / stirrer AW ;
7. temperature
regulation / control / cooling
jacket ;
8. pH ref ;
9. optimum or best for growth or
reproduction of organism ;
10. filtration / collection / harvesting /
separating (the product) ;
11. name / use of product e.g.
mycoprotein / meat
substitute / cattle feed ;
(b) 1. size reference / extremely small
AW ;
2. reproduce only in living
cells / pathogenic AW / parasitic ;
3. specific ;
4. may need to separate them from
living tissue / difficult to isolate

Microorganisms and Biotechnology P2 Questions

O/N15/221/Q8

8 (a) bacterial cell has cell wall ;
no (true) nucleus ;
ref. different arrangement of DNA eg plasmid ;
(may) have flagella ;
capable of independent existence ;
size reference e.g. bacterial cells smaller ;
bacteria produce spores ;
bacteria have slime capsules / no mitochondria / smaller ribosomes ;
A reverse argument throughout
I tail
(b) conversion of nitrogen ;
to ammonium / amino acids ;
free-living (bacteria) or named (Azotobacter) ;
in root nodules / named bacteria (Rhizobium) ;
leguminous plant / named plant ;]
I fixation of nitrogen as mentioned
in question
(c) decomposition / breakdown / decay ;
of organic matter / faeces / urea ;
using up O_2 / aerobic / dissolved oxygen decreases ;
for respiration ;
resulting in lack of O_2 / anaerobic conditions ;
ref. eutrophication ;

M/J15/22/Q8

8 (a) 1. bacteria (or named e.g.
Lactobacillus) ;
2. milk ;
3. incubation / 32 – 50 °C ;
4. reproduction of bacteria ;
5. ref. to enzymes / lactase ;
6. sugar / lactose ;
7. to lactic acid ;
8. coagulation / curdling of + milk /
protein / casein ;
9. imparts texture / flavour ;]
(b) 1. spores ;
2. produce hyphae / mycelium ;
3. enzymes ;
4. ref. suitable temperature ;
5. external digestion / description of ;
6. of starch ;
7. of protein ;
8. soluble / diffusible OR named ;
9. ref. (fungal) respiration ;

Microorganisms and Biotechnology P2 Questions

O/N14/22/Q4

4 (a) glucose / $C_6H_{12}O_6$ (substrate) ;
(yeast) alcohol / ethanol / C_2H_5OH ;
(yeast) carbon dioxide / CO_2 ;
(muscles) lactic acid / lactate / $C_3H_6O_3$;
(b) (i) food / glucose deficiency / AW ;
(killed) by alcohol ;
poisoned by competing organisms (e.g. bacteria) ;
(ii) (killed) by heat / baking / high temperature ;
(c) lactic acid removed / broken down / converted ;
by circulation / blood / AW ;
lactic acid not toxic (at concentrations experienced) ;
(d) substrate / glucose not completely broken down ;
chemical energy ;
still contained within product / lactic acid / alcohol ;

M/J14/21/Q9

9 (a) bread:
fungus / yeast ;
fermentation / (anaerobic) respiration ;
CO_2 production + dough rises / improves texture of bread ;
yoghurt:
bacteria/bacterium / Lactobacillus ;
(milk sugar / lactose) to lactic acid ;
(lactic acid) thickens / clots milk / gives sour taste ;

b) Penicillium;
sterilised + prevent contamination AW ;
substrate / nutrient medium / culture medium ;
protein / amino acids provided ;
for growth ;
carbohydrate / glucose provided ;
for respiration / ref. energy ;
supply of oxygen / air ;
ref. sparger + bubbles or ref. surface area / paddles + stirring ;
ref. control of temp ;
ref. control of pH ;
extraction / filtration / purification / crystallisation ;

Microorganisms and Biotechnology P2 Questions

M/J14/22/Q7

7 (a) Viruses
DNA or RNA both must be noted for mark and as possibilities;
parasitic / disease causing AW / reproduce only in host cell ;
Bacteria
contain DNA ;
saprotrophic / decomposers AW ;
ref. binary fission / asexual reproduction / mitosis ;
Comparative points
protein coat / no protein coat ;
not truly living / living ;
no (cell) wall / (cell) wall ;
no spores / forms spores ;
no cytoplasm* / cytoplasm ;
not affected by / affected by antibiotics ;
size comparison ;
GUIDANCE:
Accept points on labelled diagrams
A harmful / active only in host cell
Ig loop / strand / RNA
R protein wall
A acellular
Ig composition of the wall
*A no ribosomes / protoplasm / flagella / plasmid / cell membrane ORA R nucleus / mitochondria
viruses less than 300 nm – bacteria c. × 50 larger
A viruses small(er) than bacteria

(b)
decomposition / decay / putrefaction ;
saprotrophic ;
release enzymes / ref. external digestion ;
insoluble to soluble ;
example of macromolecule and breakdown product, e.g. protein to amino acids ;
respiration ;
CO_2 released N photosynthesis ;
water released N later use ;
nitrification ;
NH_4^+ / NO_2^- / NO_3^{2-} ;
salts for plant uptake ;

Microorganisms and Biotechnology P2 Questions

O/N13/22/Q2

(a) damage / breaks AW (cells / tuber);
ref. cell wall / membrane;
releasing (cell) contents / starch;
kills cells / denatures enzymes / stops metabolic reactions; [max 2]
(b) amylase / carbohydrase;
digests / breaks down / hydrolyses + starch;
(to) maltose; [3]
(c) (i) fermentation / anaerobic respiration; [1]
left hand side of equation
glucose / $C_6H_{12}O_6$;
right hand side of equation
$2C_2H_5OH + 2CO_2$ / alcohol/ethanol + carbon dioxide; [2]
(ii) fungus / yeast ; [1]
(d) yeast (cells) + reproduce / increase in number / multiply;
(sediment contains) yeast (cells) / bacteria / chewed tuber AW
yeast (cells) dead + sugar / food used up / alcohol is toxic AW; [max 2]
[Total 11]

M/J13/22/Q5

5 (a) biotechnology / fermentation / culturing;
(b) to control / lower / the temperature;
(c) enzymes;
prevention of denaturation / destruction / prevents death of fungus / microorganism / bacterium;
optimum / best / better / + for growth / reproduction;
high(er) yield;
(d) any ref. sterile;
(H) for introduction of microorganism or named;
and food / nutrients / culture medium;
e.g. amino acids / protein / carbohydrates or named;
(J) for introduction of air / oxygen;
bubbles / large surface area (as O_2 passes through grille) / sparger;
for respiration;

O/N12/21/Q5

5 (a) one nucleus per cell in palisade v hypha – coenocytic / several nuclei;
separate cells each with wall v not separate cells;
large central vacuole v several small vacuoles;
stores starch v stores glycogen;
chloroplasts / chlorophyll present v absent;
walls are made of different materials (chitin for hypha); [max 3]
(b) $C_6H_{12}0_6 \rightarrow 2\ C_2H_5OH + 2C0_2$;
glucose / sucrose; → alcohol / ethanol + carbon dioxide;
A a word or chemical equation, 1 mark each side, but if chemical, must balance. [2]
(c) 25 – 40 °C; [1]

(d) (i) respiration;
R anaerobic / fermentation [1]
(ii) the oxygen has been used (up);
and no more can enter ;
the yeast starts to respire anaerobically; [max 2]
(iii) yeast has died;
depletion of substrate or named;
respiration / fermentation ceases; [max 1]
[Total: 10]

M/J12/21/Q2

2 (a) ref. presence / absence hyphae / mycelium;
ref. reproduction by spores / sporangia / absence of spores / sporangia;
ref. cell wall composition;
ref prokaryote / eukaryote OR no true nucleus / true nuclei AW;
unicellular / multicellular;
reasonable size ref.;
vacuole / no vacuole; [3]
(b) decay / decomposition / rot(ting) / putrefaction; [1]
(c) (i) mitosis / mitotic /; [1]
(ii) one parent;
same / no new combination of genes / alleles; [2]
(d) oxygen / $6O_2$ + carbon dioxide / $6CO_2$ + water / $6H_2O$; [1]

(e) (i) digestion / chemical breakdown qualified (increases);
correct ref. enzymes;
rate of reaction/respiration increases;
more / faster reproduction microorganism(s); [2]
(ii) (any two from)
drying, freezing, cooling, pickling, jamming, vacuum packing, chemical (preservatives) or any named, canning, radiation,;; [2]
[Total: 12]

O/N11/21/Q6

6 (a) human/named donor animal/named cell;
gene or DNA for hormone/insulin;
cut/removed from chromosome;
ref. use of enzymes;
inserted into plasmid/DNA;
of bacterium;
culture medium AW (R agar plate);
oxygen supplied/aeration;
suitable temperature/pH/sterility;
bacteria divide/reproduce;
the gene makes insulin/hormone;
separated from infusion;
(b) conditions (or named) can be controlled;
for maximum yield/large amounts;
no harm to human;

no harm to animal/sheep AW;
insulin is (exact) match of human insulin– not of another animal AW;
cheaper AW/higher profits/safer/no transmission of disease;
[Total: 10]