

Past-paper walk-through

Cells as the basic units of living organisms ■ 1.2

eXercise

Questions in this set

- 9700/11 N25 Q3 ■ 1 mark
- 9700/11 N25 Q4 ■ 1 mark
- 9700/12 N25 Q2 ■ 1 mark
- 9700/12 N25 Q5 ■ 1 mark
- 9700/13 N25 Q2 ■ 1 mark
- 9700/13 N25 Q7 ■ 1 mark
- 9700/14 N25 Q3 ■ 1 mark
- 9700/14 N25 Q4 ■ 1 mark
- 9700/22 N25 Q1 ■ 14 marks
- 9700/24 N25 Q1 ■ 12 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 3

9700/11 N25 ■ Q3 ■ 1 mark

- 3 A cell in the human body is specialised for synthesis and secretion of lipids.

Which row shows the organelles required by the cell for synthesis **and** secretion of lipids?

	mitochondria	smooth endoplasmic reticulum	vesicles
A	✓	✓	✓
B	✓	x	x
C	x	✓	✓
D	x	✓	x

key

✓ = required

x = **not** required

Solution 3

Answer: **A**

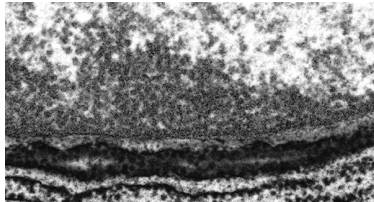
Why

- Lipids are made on the *smooth* endoplasmic reticulum, so that is required.
- Vesicles are needed to carry the lipid to the membrane for secretion.
- Mitochondria supply ATP for the secretion, so all three are involved.

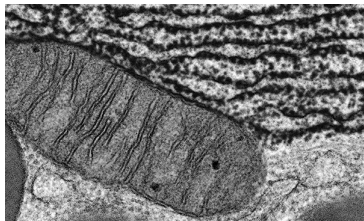
Question 4

9700/11 N25 ■ Q4 ■ 1 mark

4 The photomicrograph shows part of a cell.



Question 4



Which row is correct?

	this cell will contain 70S ribosomes	this could be part of a plant cell	the organelles shown could be used to make antibodies
--	--	--	--

Question 4

A	✓	✓	✓	key
B	✓	x	x	✓ = correct
C	x	✓	x	x = not correct
D	x	x	✓	

Solution 4

Answer: **A**

Why

- The organelles shown are eukaryotic, so the ribosomes are 80S, not 70S.
- Antibodies are proteins made by plasma cells, which are animal cells – so this is not plant tissue.
- Rough ER with Golgi and vesicles is exactly the machinery for making and exporting antibodies.

Question 2

9700/12 N25 ■ Q2 ■ 1 mark

2 Which structures will be present in a cell that causes cholera?

- 1 circular DNA
- 2 cytoplasmic DNA
- 3 70S ribosomes

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Solution 2

Answer: **A**

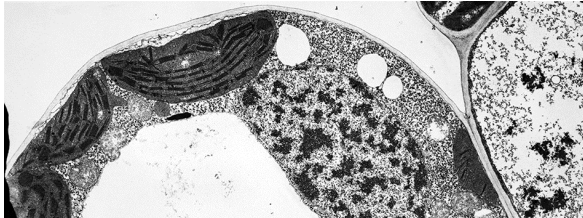
Why

- Cholera is caused by a bacterium, so the cell is prokaryotic.
- Prokaryotes have circular DNA lying free in the cytoplasm, so 1 and 2 both apply.
- Their ribosomes are the smaller 70S type, so all three are present.

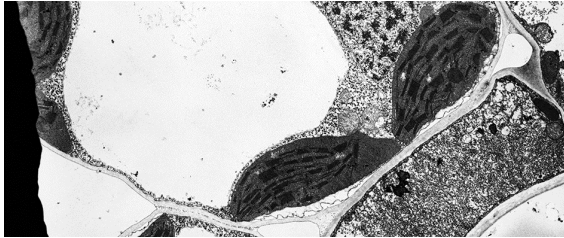
Question 5

9700/12 N25 ■ Q5 ■ 1 mark

5 The electron micrograph shows a section through a cell.



Question 5



What would be present in this type of cell?

	mitochondria	peptidoglycan cell wall	histone proteins	key
A	✓	✓	✗	

Question 5

B	✓	x	✓	✓ = present
C	x	✓	x	x = not present
D	x	x	✓	

Solution 5

Answer: **B**

Why

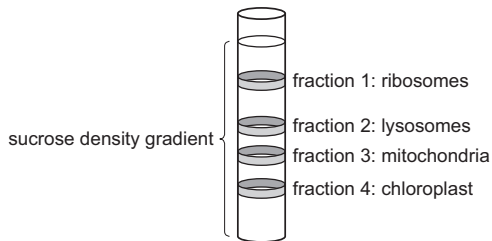
- Read the micrograph for the giveaway features before deciding the cell type.
- A peptidoglycan wall belongs only to bacteria; histones and mitochondria belong only to eukaryotes.
- So the three cannot all be present – decide which pair goes together.

Question 2

9700/13 N25 ■ Q2 ■ 1 mark

- 2 Cell structures can be isolated by centrifuging the cells in a sucrose density gradient. This breaks up the cells and separates the cell structures into fractions.

The diagram shows the positions of some of these fractions in a sucrose density gradient.



Which fractions contain cell structures that carry out protein synthesis?

Question 2

- A** 1, 2 and 3 **B** 1, 3 and 4 **C** 1 only **D** 2, 3 and 4

Solution 2

Answer: **B**

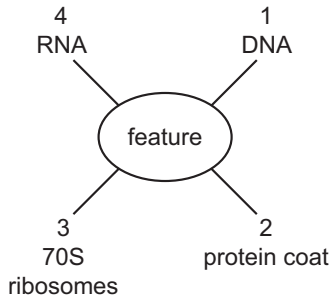
Why

- A density gradient separates structures by density, densest travelling furthest.
- Ribosomes are tiny and dense; nuclei are the largest and heaviest organelles.
- So read the order of the fractions to identify each structure by its relative density.

Question 7

9700/13 N25 ■ Q7 ■ 1 mark

7 Which features shown in the diagram can be present in viruses?



Question 7

A 1, 2 and 3

B 1, 2 and 4

C 1, 3 and 4

D 2, 3 and 4

Solution 7

Answer: **B**

Why

- A virus has a nucleic acid core, which may be DNA *or* RNA, inside a protein coat.
- So features 1, 2 and 4 can all be present.
- No virus has ribosomes of any kind – it borrows the host's, so 3 is impossible.

Question 3

9700/14 N25 ■ Q3 ■ 1 mark

3 It is thought that some organelles in eukaryotic cells evolved from free-living prokaryotes.

Which organelles have features that suggest they evolved from free-living prokaryotic ancestors?

- A** chloroplasts and mitochondria
- B** chloroplasts and Golgi bodies
- C** mitochondria and smooth endoplasmic reticulum
- D** Golgi bodies and smooth endoplasmic reticulum

Solution 3

Answer: **A**

Why

- Mitochondria and chloroplasts each have their own circular DNA.
- They also have 70S ribosomes and a double membrane.
- Those are prokaryotic features, which is the evidence for the endosymbiotic theory.

Question 4

9700/14 N25 ■ Q4 ■ 1 mark

- 4 A student completed a table showing the structures that are found in four different types of cells.

cell structure	cell Q	cell R	cell S	cell T
cell surface membrane	✓	✓	✓	✓
cellulose cell wall	✓	✓	✗	✓
chloroplast	✓	✗	✗	✗
mitochondrion	✓	✓	✗	✓
nucleus	✓	✓	✗	✗

key

✓ = present

✗ = **not** present

How many of these types of cells can be found in plants?

A 1**B** 2**C** 3**D** 4

Solution 4

Answer: **C**

Why

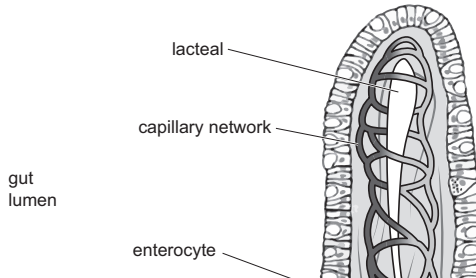
- Work through the table column by column, deciding what each combination of structures means.
- A cellulose cell wall and chloroplasts together indicate a plant cell.
- No nucleus and no mitochondria indicates a prokaryote.

Question 1

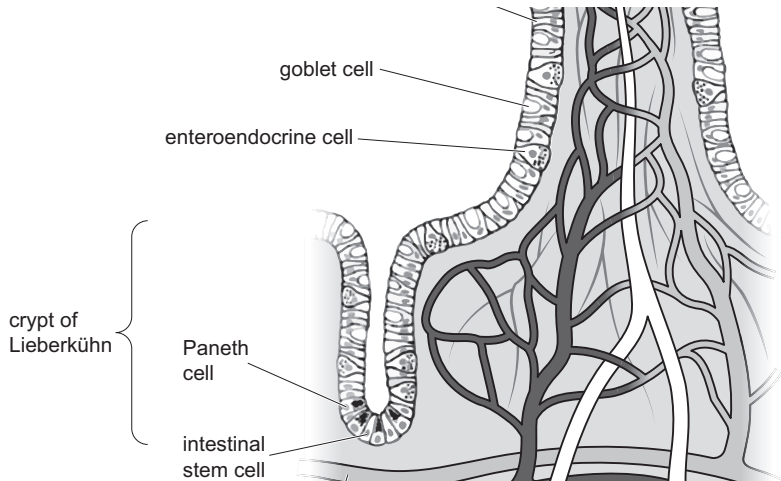
9700/22 N25 ■ Q1 ■ 14 marks

- 1 The wall of the small intestine is highly folded to form villi. Between the villi are infoldings known as crypts of Lieberkühn.

Fig. 1.1 is a diagram of a section through a single villus and a crypt of Lieberkühn.



Question 1



Question 1

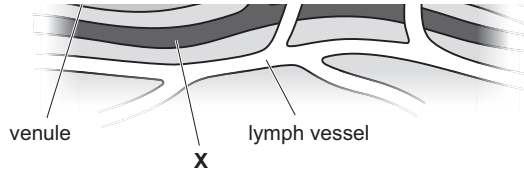


Fig. 1.1

Fig. 1.1 shows that the epithelium of the villus contains mainly goblet cells and cells known as enterocytes. Both cell types have microvilli on the apical surface (surface facing the gut lumen).

Goblet cells are involved in the production of mucus.

Enterocytes are adapted for the absorption of the soluble products of digestion. These products enter the circulatory system.

(a) A student incorrectly stated that an enterocyte has many **cilia** on its apical surface.

Question 1

Explain the difference between a cilium and a microvillus.

Question 1

(b) Suggest **one** role of the mucus produced by the goblet cells of the villus.

Question 1

- (c) In Fig. 1.1, blood vessel **X** delivers blood to the capillary network of the villus, where tissue fluid is formed. Some of the fluid passes back into the capillaries and then into the venule.
- (i) Blood vessel **X** receives blood from an artery.

Name the type of blood vessel represented by **X**.

Question 1

- (ii) Describe the formation of tissue fluid in the capillary network of the villus.

Question 1

- (d) In response to the presence of compounds in the gut lumen, enteroendocrine cells synthesise and release peptides (short chains of amino acids) that are cell-signalling molecules. One of these cell-signalling molecules is known as GLP-1.

GLP-1 initiates a number of responses in different body cells. Some of these responses include:

- the increase in release of the hormone insulin from cells in the pancreas
- the decrease in release of acid from cells in the stomach.

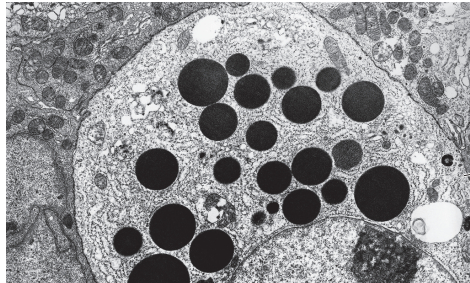
Outline, **in sequence**, the main stages involved in the process of cell signalling by GLP-1.

Question 1

- (e) Paneth cells, which are secretory cells, are located between intestinal stem cells at the base of the crypt of Lieberkühn, as shown in Fig. 1.1.

A Paneth cell has a very different appearance to an intestinal stem cell.

Fig. 1.2 is a transmission electron micrograph of a Paneth cell.



Paneth cell

nucleus of adjacent

Question 1

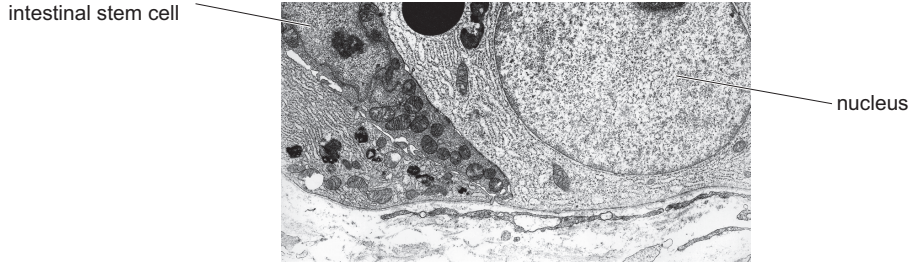


Fig. 1.2

- (i) Paneth cells are formed following the mitotic division of an intestinal stem cell during a cell cycle.

Complete the cell cycle shown in Fig. 1.3 by naming, **in sequence**, the stages of mitosis.



Question 1



/ | **names of stages of mitosis** |

Question 1

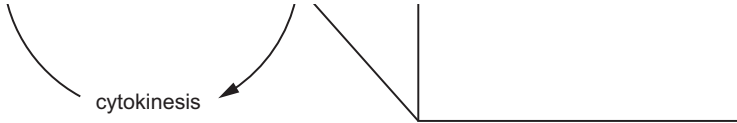


Fig. 1.3

[1]

- (ii) One of the functions of a Paneth cell is to synthesise and secrete peptides and proteins that act against pathogens in the gut lumen.

State **and** explain the evidence, **visible in Fig. 1.2**, which suggests that a Paneth cell:

- is a secretory cell
- synthesises many peptides and proteins.

Question 1

- (iii) Explain why a Paneth cell has a very different appearance to an intestinal stem cell.

Question 1

[Total: 14]

Solution 1

(a) Mark scheme

- any two from:
- allow oras
- 1
- cilium composed of microtubules
- or
- microvillus, composed of microfilaments / contains actin (filaments) ;
- 2
- cilium 9+2 (microtubule) arrangement ;

Solution 1

- 3
- cilium has basal body ; A has centrioles at the base
- 4
- cilium shows synchronous, rhythm / movement ; A whip-like / rhythmic, movement
- 5
- cilium, moves / wafts, mucus
- or
- microvillus increases, surface area / SA, for, absorption / uptake / secretion ;
- A increases SA to locate transport proteins AW
- 6

Solution 1

- AVP ; e.g. cilium has dynein (arms)
- cilium is, longer ($10\text{ }\mu\text{m}$) / wider ($0.2\text{ }\mu\text{m}$) or microvillus is, shorter ($1\text{ }\mu\text{m}$) / narrower (90 nm)
- 2

Solution 1

(b) Mark scheme

- any one from:
- protects (intestinal), epithelium / cells / lining ;
- A examples of protection e.g. damage from stomach acid / digestion by enzymes
- A less likely for epithelial cells to be damaged / AW
- A traps, pathogens or (harmful), bacteria / microbes / microorganisms
- I dust
- A prevents, pathogens / AW, from reaching cells

Solution 1

- eases / reduces friction for, movement of, gut contents / substances (through digestive system) ;
- habitat / nutrient source, for gut, microorganisms / flora ; AW
- AVP ; e.g. location for immune system cells
- R if stated as being in the gas exchange system
- 1

Solution 1

(c)(i)

Mark scheme

- arteriole ; A (small) artery
- 1
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Solution 1

(c)(ii) Mark scheme

- any two from:
- (at arteriole end of capillary) high, hydrostatic / blood, pressure ;
- A ref. to hydrostatic pressure gradient
- (ultra)filtration / described ; e.g. fluid / plasma / water and solutes, forced / comes out of, capillaries / blood
- glucose / amino acids / ions, leave (blood) or (large / plasma) proteins remain (in blood) ;
- R if stated, red blood cells / platelets, leave

Solution 1

- through, fenestrations / fenestrae / endothelial pores
- or
- pores / gaps / spaces, in, capillary wall / endothelium / between cells ;
- 2

Solution 1

(d) Mark scheme

- any three from:
- after, secreted / released, by enteroendocrine cells
- transport of, peptide / GLP-1 / ligand, in, blood / circulation ;
- to, target cells (which are cells of the, stomach / pancreas) ;
- binding of, peptide / GLP-1 / ligand, to receptor ; context can be cell surface membrane or intracellular
- ref. to, specificity / complementary ; must be in correct context of GLP-1 binding to receptor

Solution 1

- (binding) triggers / sets off / AW, events within (target) cell (leading to the response) ;
- A examples e.g. signal transduction / triggers enzyme cascade
- 3

Solution 1

(e)(i) Mark scheme

- prophase
- metaphase
- R if interphase or cytokinesis stated
- anaphase
- telophase
- 1
- ;
- 9700/22

Solution 1

- October/November 2025

Solution 1

(e)(ii) Mark scheme

- any three from:
- ref. to nucleus / nucleolus, is neutral
- presence of, vesicles / vacuoles, qualified ; e.g. many / secretory / Golgi
- A storage vesicles
- correct ref. to exocytosis ;
- A fusion of, vesicle / vacuole, with cell surface membrane
- much / high proportion of / a lot of / AW, rough endoplasmic reticulum ;
- I ER / RER / rough ER

Solution 1

- A many ribosomes
- rough endoplasmic reticulum / ribosomes, site of, peptide / polypeptide / protein / enzyme, synthesis ;
- ecf for abbreviating rough endoplasmic reticulum previously
- AVP ; e.g. presence of mitochondria to provide, ATP / energy, for, protein synthesis /
- movement of vesicle to cell surface membrane /
- exocytosis mp2 can also be awarded here only if ref. has been made within response to vesicles / vacuoles
- 3

Solution 1

(e)(iii)

Mark scheme

- Paneth cell is, differentiated / specialised (for, secretion / its function)
- or
- stem cells are, undifferentiated / not differentiation / not specialised ;
- 1

Question 1

9700/24 N25 ■ Q1 ■ 12 marks

- 1 There are similarities and differences between the structure of a typical plant cell and a typical animal cell.
 - (a) The nucleus of plant cells and animal cells contains chromosomes. In interphase of the cell cycle, individual chromosomes are present but cannot be seen. The chromosome material is known as chromatin.
 - (i) Changes occur in interphase, which result in a difference between the chromatin in the G1 phase compared with the chromatin in the G2 phase.

State **and** explain the difference in chromatin in the G1 phase compared with chromatin in the G2 phase.

Question 1

- (ii) Describe the features of a nucleus, **other than** containing chromatin.

You may use the space below the lines for a diagram.

Question 1

[3]

- (b) Starch, cellulose and pectins are polysaccharides found in plant cells but **not** in animal cells.

Pectins are complex polysaccharides that are found in the cell wall.

- (i) Describe the structural features of starch that are **different** from the structural features

Question 1

- (1) Describe the structural features of starch that are **different** from the structural features of cellulose.

Question 1

- (ii) Cell wall pectins can vary in different plant cell types and in different stages of cell development. Pectin molecules are released from cells as basic structures and then modified within the cell wall by adding side chains.

RG-I is a pectin molecule with a variable structure. The basic structure is a repeated disaccharide made from two different monosaccharides. RG-I has three different side chains that can be added in different positions.

Monoclonal antibodies (mAbs) are used to investigate the structure, location and role of cell wall pectins.

Suggest **and** explain why scientists need to use a number of different monoclonal antibodies when investigating a pectin such as RG-I.

Question 1

[Total: 12]

Solution 1

(a)(i) Mark scheme

- explanation
- semi-conservative replication / DNA replication / S phase, has occurred ;
- R if replication stated to occur in, G1 / G2
- I chromatin replicates
- difference between chromatin in G1 and G2:
- (allow ecf from mp1 if stated replication occurs in G2)
- Any one from:
 - double the / doubling in, quantity / number / amount, of, chromatin / DNA ;

Solution 1

- A chromatin has doubled
- sister / two identical, chromatids (formed, instead of one structure) ;
- A two chromatids joined at the centromere (in G2)
- (each) chromosome with 1 DNA molecule (in G1) has 2 DNA molecules (in G2) ;
- allow double, helix/ helices for molecule(s)
- treat as neutral ref. to chromatin / chromosome, state / behaviour
- e.g. decondensed / diffuse
- 2
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- October/November 2025

Solution 1

(a)(ii) Mark scheme

- any three from:
- check diagram to see if points can be awarded
- description of nucleus as having any two listed structures ;
- two from: nuclear envelope, nuclear pore(s), nucleolus, nucleoplasm
- correct spelling
- detail of nuclear envelope ;
- e.g. two membranes / double membrane accept from diagram

Solution 1

- encloses / protects, chromatin / DNA / chromosomes / genetic information / genetic material
- outer membrane continuous with rough endoplasmic reticulum
- outer membrane with ribosomes (on outer surface)
- controls exit and entry of substances
- if nuclear envelope not stated,
- A the nucleus is surrounded by a double membrane
- or
- a double membrane encloses, chromatin / AW
- or

Solution 1

- (it is) double-membrane bound / bound by a double membrane
- detail of nuclear pore(s) ;
- e.g. allows (m)RNA to, pass through / leave / AW (nucleus)
- allows ribosomal subunits to leave (nucleus)
- allows entry of proteins
- prevents exit of DNA
- (small) channel / passage, through the nuclear envelope
- can be shown on a diagram, with a label
- detail of nucleolus ;
- e.g. spherical

Solution 1

- can be shown as circle on diagram, labelled nucleolus
- one / can be more than one
- synthesis of, rRNA / ribosomal subunits A ribosomes
- densely staining / dense region / condensed region
- allow shaded in on a diagram, labelled nucleolus
- AVP ; e.g. nucleoplasm is fluid surrounding chromatin
- 3
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Solution 1

(b)(i) Mark scheme

- R the mp if feature of cellulose stated and, is incorrect / is not neutral
- for mps 1, 3, 4 can accept 'cellulose does not have ..'
- any four from:
- starch has
- 1 (monomer of) alpha glucose / α -glucose / α -1,4 (glycosidic) bond ;
- 1 glucose / glycosidic bond / 1, 4 bond (all shared with cellulose)
- 2 monomers / glucose, orientated the same way / AW ;
- ora for cellulose i.e. monomers rotated 180° to each other

Solution 1

- 1 cellulose / cellulose molecule, rotates 180°
- 3 made of, two different polysaccharides / two different polymers / amylose and amylopectin ;
- 4 amylopectin / starch, has (α -1,4 and) α -1,6 (glycosidic) bonds ;
- A 1-6 if alpha noted elsewhere
- A link / linkage, for bonds
- R 'can have α -1,4 or α -1,6 bonds'
- 5 amylose, helical / coiled R α -helix
- or
- amylopectin branched ; if both are stated, allow mp3 as well

Solution 1

- A starch, is branched / has branching
- (v cellulose, not branched / linear)
- R 'starch can be helical or branched'
- 6 no, hydrogen / H, bonds, to hold together / between / AW, molecules / polysaccharides ;
- A cellulose has
- 7 AVP ; e.g. forms, starch, grains / granules A 'cellulose does not have ..'
- does not have microfibrils / fibrils / fibres A 'cellulose has..'
- 4
- 9700/24

Solution 1

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Solution 1

(b)(ii) Mark scheme

- 1 (different) mAbs have, different / specific, antigen binding sites / variable regions ; 1 active site
- 2 (each) mAb has complementary shape for, binding / AW, antigen
- (combining with / attaching to)
- or
- mAbs are / a mAb is, specific / complementary, to particular, antigen(s) ;
- 3 idea that a (particular) pectin / RG-I , has different, shapes / conformations / antigens, in its structure ;

Solution 1

- 4 idea of (using) different / specific, (sets / combinations, of) mAbs to, recognise / identify / locate / use for, different pectins /
- types of RG-I / a particular RG-I ;
- 5 ref. to studying development e.g ;
- changes occurring / side chains added, during development need different mAbs
- some mAbs may be specific to side chains not yet added can help to show when modifications occur
- 6 AVP ; e.g. reason to use more than one mAB
- ■
- some mAbs may bind to more than one type of pectin
- ■

Solution 1

- other cell wall components, may have, similar structures / same side chains
- ■
- some areas of RG-I may be out of reach for a specific mAb
- ■
- can, obtain information about / investigate, shape / structure of the particular pectin
- 3