

Past-paper walk-through

Chromosome behaviour in mitosis ■ 5.2

eXercise

Questions in this set

- 9700/11 N25 Q19 ■ 1 mark
- 9700/11 N25 Q21 ■ 1 mark
- 9700/12 N25 Q22 ■ 1 mark
- 9700/12 N25 Q23 ■ 1 mark
- 9700/13 N25 Q23 ■ 1 mark
- 9700/14 N25 Q21 ■ 1 mark
- 9700/22 N25 Q1 ■ 14 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 19

9700/11 N25 ■ Q19 ■ 1 mark

19 A human muscle cell contains 46 chromosomes.

How many centromeres will be present in a cell during the stages of the mitotic cell cycle?

	early prophase	metaphase	anaphase
A	46	46	92
B	46	92	92
C	46	46	46
D	92	46	46

Solution 19

Answer: **A**

Why

- A centromere holds the two sister chromatids of one chromosome together.
- In prophase and metaphase there are still 46 chromosomes, so 46 centromeres.
- At anaphase each centromere splits, giving 92.

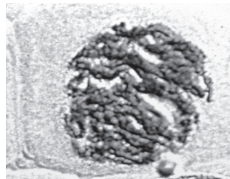
Question 21

9700/11 N25 ■ Q21 ■ 1 mark

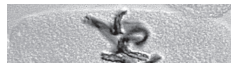
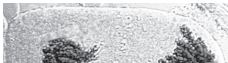
21 The photomicrographs show stages of mitosis.



1



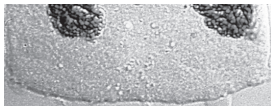
2



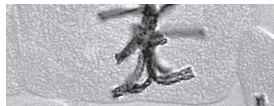
Question 21



3



4



5

What is the correct order for the stages of mitosis?

- A** 2 → 3 → 5 → 1 → 4
- B** 2 → 4 → 1 → 5 → 3
- C** 3 → 2 → 5 → 4 → 1
- D** 5 → 1 → 4 → 3 → 2

Solution 21

Answer: **A**

Why

- Put the stages in the order the chromosomes move: condensing, lining up, separating, re-forming nuclei.
- Metaphase is the one with chromosomes in a single line across the equator.
- Anaphase follows, with V-shaped chromatids being pulled to the poles.

Question 22

9700/12 N25 ■ Q22 ■ 1 mark

22 Which events listed are part of mitosis?

1 interphase

2 prophase

3 cytokinesis

A 1, 2 and 3

B 1 and 2 only

C 1 only

D 2 only

Solution 22

Answer: **D**

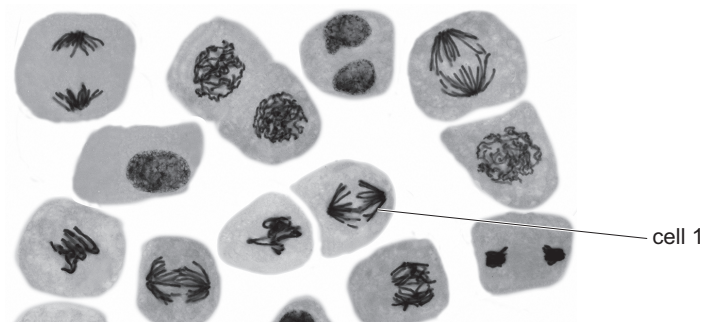
Why

- Mitosis is the division of the *nucleus*: prophase, metaphase, anaphase and telophase.
- Interphase happens before mitosis begins.
- Cytokinesis divides the cytoplasm afterwards, so only prophase is part of mitosis itself.

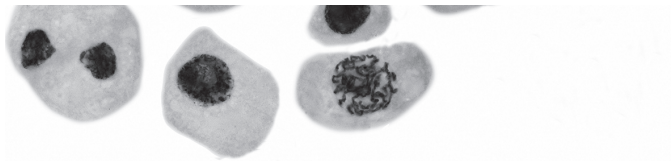
Question 23

9700/12 N25 ■ Q23 ■ 1 mark

23 The photomicrograph shows 17 cells in different stages of the mitotic cell cycle.



Question 23



Which row is correct for this photomicrograph?

	the role of a centromere in cell 1	the proportion of the cells in the photomicrograph in telophase
A	attaches daughter chromosomes to spindle fibres	> 0.2
B	holds sister chromatids together	> 0.2

Question 23

	holds sister chromatids together	< 0.2
C	attaches daughter chromosomes to spindle fibres	< 0.2
D	holds sister chromatids together	< 0.2

Solution 23

Answer: **A**

Why

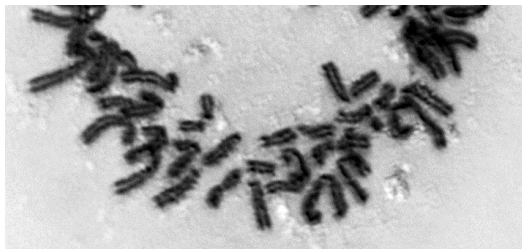
- A centromere is where the spindle fibres attach and where the sister chromatids are held together.
- Count the cells in telophase and divide by the total number of cells shown.
- The proportion in a stage reflects how long that stage lasts.

Question 23

9700/13 N25 ■ Q23 ■ 1 mark

23 The photomicrograph shows a stage of the cell cycle.





Which stage is shown in the photomicrograph?

- A** anaphase
- B** interphase

C metaphase

D telophase

Solution 23

Answer: **C**

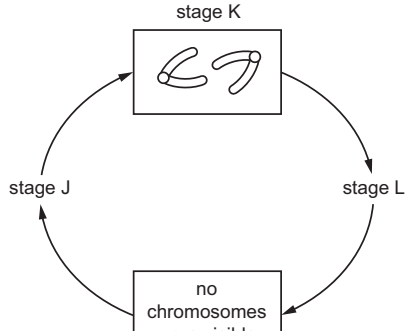
Why

- In metaphase the chromosomes are lined up in a single plane across the equator.
- In anaphase they are already separating towards the poles.
- In interphase no individual chromosomes are visible at all.

Question 21

9700/14 N25 ■ Q21 ■ 1 mark

21 A student made a drawing of two chromosomes at stage K of a mitotic cell cycle.



Question 21

were visible

stage M

Which row shows the possible events that occur in stages J, L and M?

	J	L	M
A	spindle attachment	cytokinesis	DNA replication
B	chromosome condensation	spindle attachment	cytokinesis
C	DNA replication	chromosome condensation	spindle attachment
D	cytokinesis	DNA replication	chromosome condensation

Solution 21

Answer: **A**

Why

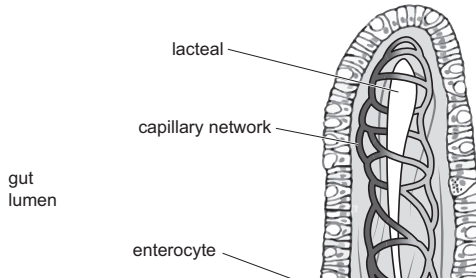
- No chromosomes visible means interphase, so that stage comes before condensation.
- Two visible chromosomes each with two chromatids means prophase or metaphase.
- DNA replication must therefore come earlier, and cytokinesis last.

Question 1

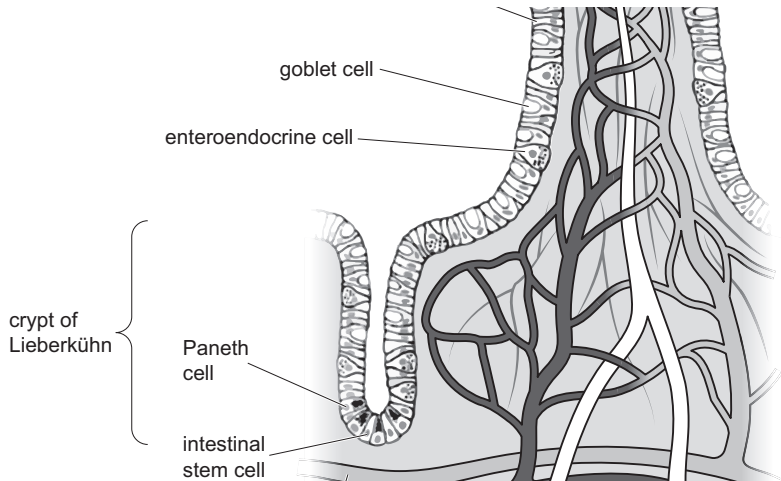
9700/22 N25 ■ Q1 ■ 14 marks

- 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

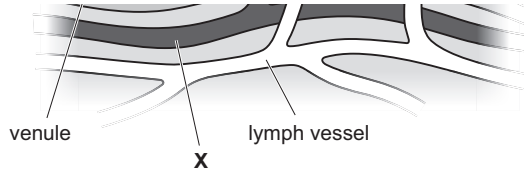


Fig. 1.1

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.

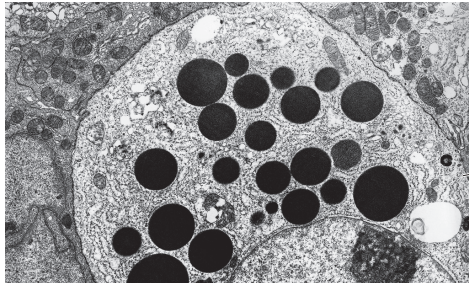
Outline, **in sequence**, the main stages involved in the process of cell signalling by GLP-1.

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

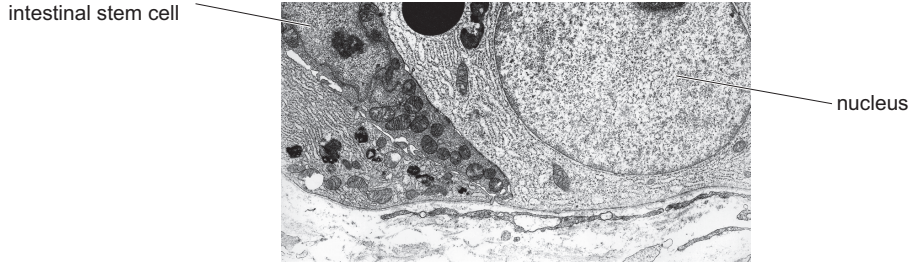


Fig. 1.2

- (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

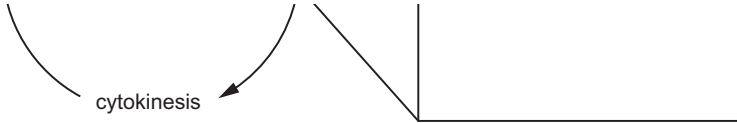


Fig. 1.3

[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
- 9700/22
- October/November 2025

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