Cell Structure – AS 9700 November 2023

1. Nov/2023/Paper_ 9700/11/No.1

Until recently, the typical viruses known to science were 20–150 nm in size.

In 2003, the Mimivirus was discovered with a size of approximately 680 nm.

In 2013, the Pandoravirus was discovered which has a size of over 1000 nm.

Which viruses can be seen using a light microscope with a maximum resolution of 0.25 µm **and** an electron microscope?

	typical virus	Mimivirus	Pandoravirus
A	✓	✓	✓
B	✗	✓	✓
C	✗	✗	✓
D	✗	✗	✗

key

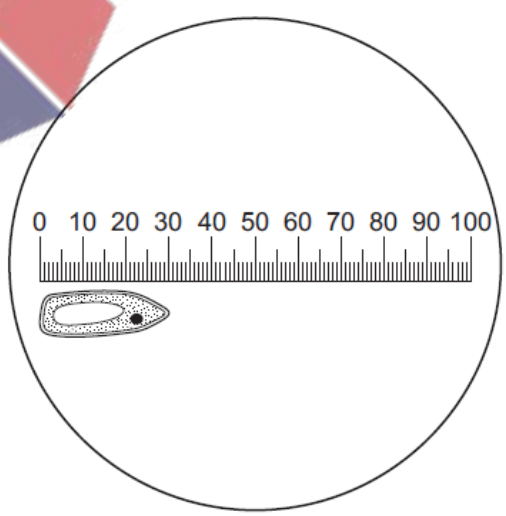
✓ = can be seen

✗ = cannot be seen

2. Nov/2023/Paper_ 9700/11/No.2

The diagram shows an eyepiece graticule and a cell viewed through a microscope. When the eyepiece graticule was calibrated at this magnification, the whole length of the graticule shown covered 12 divisions of a stage micrometer scale.

There were 100 divisions in 10 mm of the stage micrometer.



What is the actual length of the cell?

A 2.5 µm **B** 3.6 µm **C** 360 µm **D** 3 mm

3. Nov/2023/Paper_ 9700/11/No.3

Tay-Sachs disease results in a build-up of lipids in cells.

Which cell structure does **not** function correctly in this disease?

A Golgi body

B lysosome

C mitochondrion

D smooth endoplasmic reticulum

4. Nov/2023/Paper_ 9700/11/No.4

Which animal cells would have the most extensive Golgi bodies?

A ciliated epithelial cells

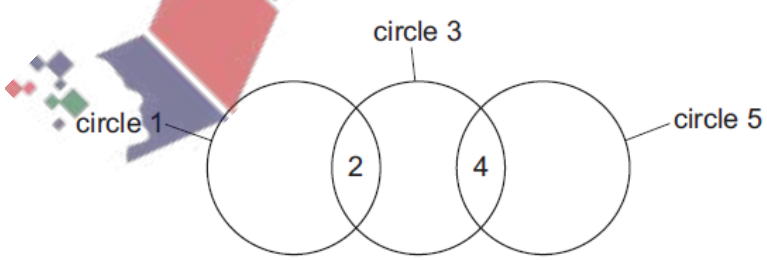
B goblet cells

C red blood cells

D smooth muscle cells

5. Nov/2023/Paper_ 9700/11/No.5

The diagram shows three circles, 1, 3 and 5, and the shared structures, 2 and 4.



Which row correctly identifies the three circles and some of the structures that are shared between them?

	circle 1	2	circle 3	4	circle 5
A	chloroplasts	circular DNA	mitochondria	80S ribosomes	prokaryotes
B	chloroplasts	80S ribosomes	mitochondria	circular DNA	prokaryotes
C	prokaryotes	circular DNA	mitochondria	circular DNA	chloroplasts
D	prokaryotes	70S ribosomes	chloroplasts	80S ribosomes	mitochondria

6. Nov/2023/Paper_ 9700/11/No.6

Which row about the genetic material in animal cells and prokaryotic cells is correct?

	animal cells contain linear DNA	prokaryotic genetic material is surrounded by a double membrane	prokaryotic genetic material is double-stranded DNA
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key

✓ = correct

✗ = not correct

7. Nov/2023/Paper_ 9700/11/No.7

What is present in **all** viruses?

A uracil

B ribose

C thymine

D guanine

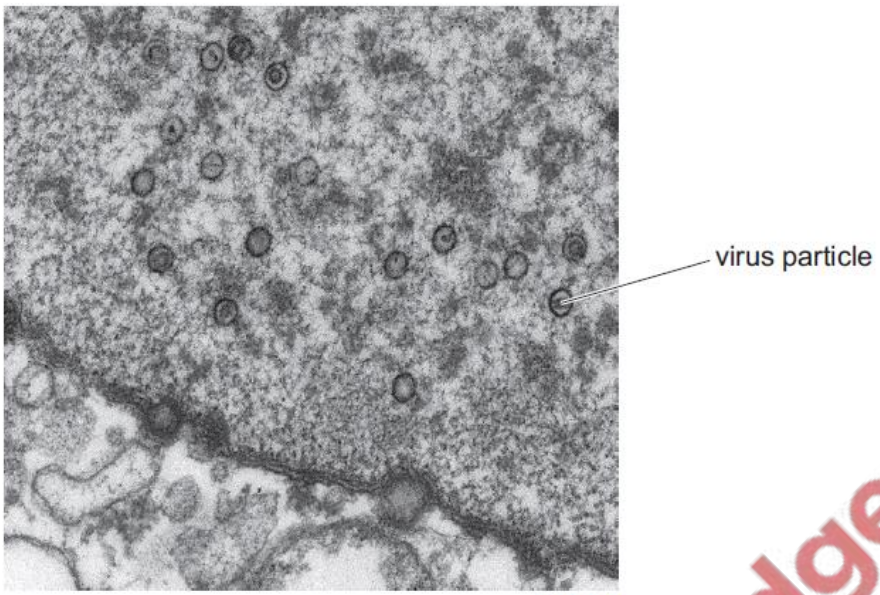
8. Nov/2023/Paper_ 9700/12/No.1

Which combination of lenses for a light microscope will give the greatest magnification?

	eyepiece lens	objective lens
A	×5	×100
B	×10	×40
C	×15	×40
D	×15	×100

9. Nov/2023/Paper_ 9700/12/No.2

The diagram shows an electron micrograph of virus particles in a human nucleus.



×24 000

What is the diameter of the labelled virus particle?

A $1.5 \times 10^{0}\,\mu m$

B $1.5 \times 10^{-2}\,\mu m$

C $1.5 \times 10^{0}\,nm$

D $1.5 \times 10^{2}\,nm$

10. Nov/2023/Paper_ 9700/12/No.3

What is correct about the synthesis and release of the glycoprotein mucin in goblet cells?

1 The protein is produced on ribosomes and a carbohydrate chain is added in the Golgi body.

2 The glycoproteins are packed into vesicles in the Golgi body forming lysosomes.

3 Secretory vesicles containing the glycoprotein move from the Golgi body and fuse with the cell surface membrane.

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

11. Nov/2023/Paper_ 9700/12/No.4

What are functions of microtubules?

1 allowing movement of cilia in a bronchus

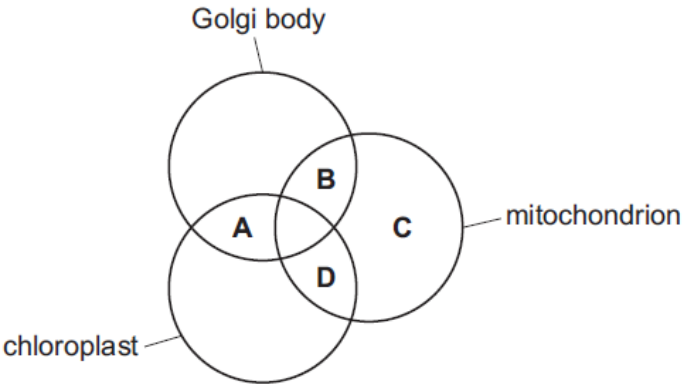
2 attachment to centromeres during metaphase

3 moving secretory vesicles around a cell

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

12. Nov/2023/Paper_ 9700/12/No.5

Which organelles contain nucleic acids?



13. Nov/2023/Paper_ 9700/12/No.6

Some features of cells are listed.

1 cell wall

2 cell surface membrane

3 ribosomes

Which features can be found in plant cells **and** in prokaryotic cells?

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

14. Nov/2023/Paper_ 9700/12/No.7

Which bonds are present in **all** viruses?

1 phosphodiester

2 peptide

3 covalent

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

15. Nov/2023/Paper_ 9700/12/No.8

A student carried out the Benedict's test on four different concentrations of glucose solution and then recorded the time taken for the first appearance of a colour change (the end-point).

The student found it difficult to identify the first appearance of a colour change and consistently timed each solution for two seconds after the colour change first appeared. This introduced a source of error into the experiment.

Which statements about this error are correct?

1 The effect of the error will be reduced if the student performs three repeats at each concentration of glucose.

2 The error will prevent the student from identifying which solution has the highest concentration of glucose.

3 The error is systematic as the student consistently timed each solution for two seconds after the end-point.

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

16. Nov/2023/Paper_ 9700/13/No.1

Which statement about light microscopy is correct?

A As the resolution increases, the magnification increases.

B As the magnification increases, the image always becomes clearer.

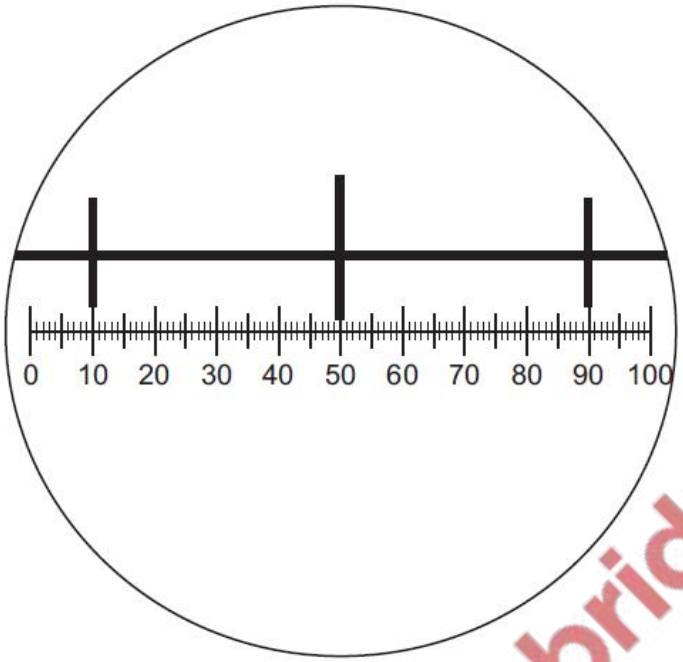
C The resolution will decrease as coloured light of increasing wavelengths is used.

D Magnification and resolution are terms that relate to the same factor.

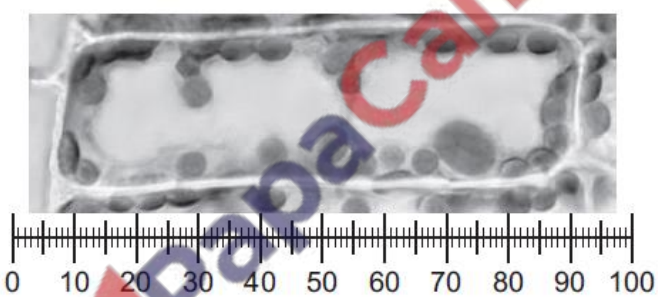
17. Nov/2023/Paper_ 9700/13/No.2

The diagram shows a stage micrometer scale viewed through an eyepiece containing a graticule.

The small divisions of the stage micrometer scale are 0.1 mm.



The stage micrometer scale is replaced by a slide of a plant cell.



What is the maximum actual length of the nucleus in the plant cell?

A 8 µm **B** 25 µm **C** 200 µm **D** 0.8 mm

18. Nov/2023/Paper_ 9700/13/No.3

What is the correct order for the involvement of the cell structures in the synthesis and secretion of an enzyme?

1 cell surface membrane

2 Golgi body

3 nucleus

4 rough endoplasmic reticulum

A 1 → 2 → 3 → 4

B 2 → 1 → 3 → 4

C 3 → 4 → 2 → 1

D 4 → 3 → 2 → 1

19. Nov/2023/Paper_ 9700/13/No.4

Centrioles, cilia, microtubules and microvilli are structures found in eukaryotic cells.

Which statement about these cellular structures is correct?

A Centrioles, cilia and microvilli are composed of microtubules.

B Centrioles play a role in mitosis and semi-conservative DNA replication.

C Cilia and microvilli both increase the cell surface area for absorption.

D Microtubules are made of protein and form the spindle in mitosis.

20. Nov/2023/Paper_ 9700/13/No.5

Which description of plasmodesmata is correct?

A They are channels through plant cell walls, lined by the cell surface membrane.

B They are channels through plant cell walls that are formed from proteins.

C They are channels required for the movement of water through the apoplast pathway.

D They can become lignified and form pits in the walls of xylem vessel elements.

21. Nov/2023/Paper_ 9700/13/No.6

Which cell organelle does **not** have nucleic acids?

A chloroplast

B Golgi body

C mitochondrion

D ribosome

22. Nov/2023/Paper_ 9700/13/No.7

Which processes occur in eukaryotes **and** prokaryotes?

1 hydrolysis

2 mitosis

3 transcription

4 translation

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

23. Nov/2023/Paper_ 9700/13/No.8

Which bonds are present in **all** viruses?

1 covalent

2 ester

3 phosphodiester

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

24. Nov/2023/Paper_ 9700/21/No.2

Fig. 2.1 is a transmission electron micrograph showing a section of a specialised epithelial cell found in the lining of the stomach. This cell produces extracellular proteins that are released into the bloodstream.

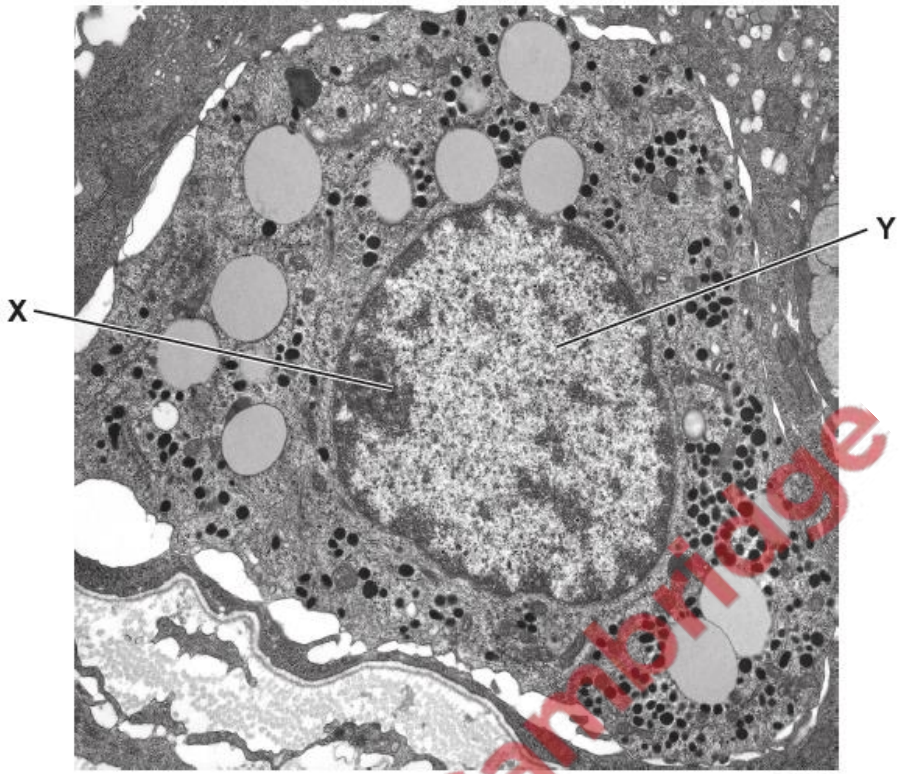


Fig. 2.1

(a) Outline the role of structure **X** and structure **Y**, as shown in Fig. 2.1, in the production of extracellular proteins.

structure **X** .....

.....

.....

structure **Y** .....

.....

.....

[2]

(b) The cell in Fig. 2.1 releases ghrelin, a small protein that acts as a cell signalling molecule.

Fig. 2.2 shows the sequence of amino acids in a ghrelin molecule.

The amino acid serine (Ser) in position 3 in Fig. 2.2 has been modified by the addition of a saturated fatty acid chain.

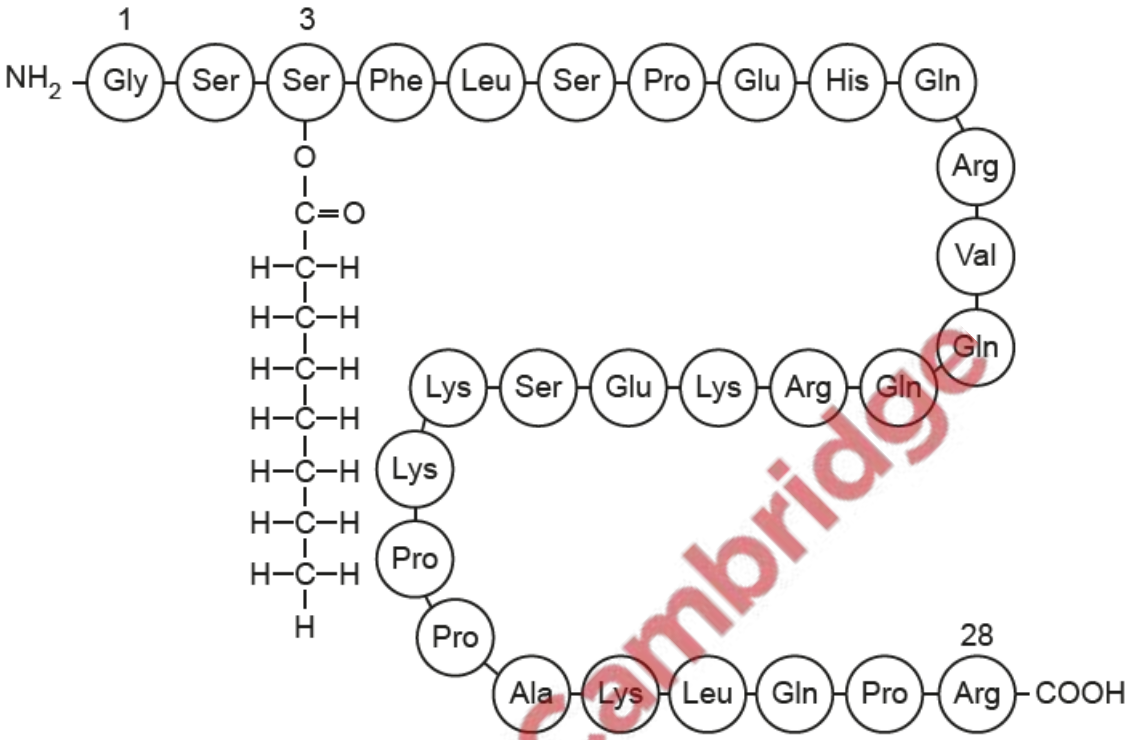


Fig. 2.2

(i) State the level of protein structure shown in Fig. 2.2.

..... [1]

(ii) State **one** similarity between the structure of a saturated fatty acid molecule and an amino acid molecule.

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..... [1]

(iii) The addition of the fatty acid chain allows ghrelin to function as a cell signalling molecule.

Suggest how the addition of this fatty acid chain allows a ghrelin molecule to act as a cell signalling molecule.

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..... [3]

(c) Scientists have discovered that the gene coding for ghrelin contains 5000 base pairs. This is a much larger number of base pairs than is needed to code for the ghrelin molecule shown in Fig. 2.2.

(i) Calculate the percentage of base pairs found in the gene that codes for the ghrelin molecule shown in Fig. 2.2.

Show your working and give your answer to one decimal place.

..... [2]

(ii) The primary transcript produced from the ghrelin gene is a longer molecule than the mRNA found in the cytoplasm.

Explain how the primary transcript is modified before translation.

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..... [2]

[Total: 11]

25. Nov/2023/Paper_ 9700/22/No.1

During interphase and mitosis of the cell cycle, the chromosomes within a cell go through a number of changes. Each chromosome is composed of DNA complexed with proteins.

(a) In interphase, individual chromosomes are too diffuse (long and thin) to be visible using a microscope. In this stage, the chromosomal material is known as chromatin.

State the term used to describe the proteins that are complexed with DNA and form part of chromatin.

..... [1]

(b) When viewed through a microscope, a chromosome is most clearly visible during the metaphase stage of mitosis.

Complete Fig. 1.1 to produce a labelled diagram of the metaphase stage of mitosis in an **animal** cell with **two** chromosomes.

Fig. 1.1

[3]

(c) Outline the changes that occur to the structure and behaviour of a chromosome:

- from the start of the S phase to the end of interphase
- during prophase of mitosis.

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..... [3]

[Total: 7]