CAMBRIDGE INTERNATIONAL AS & A LEVEL BIOLOGY · 9700

BIOLOGY



EXAM QUESTION PACK

5 THE MITOTIC CELL CYCLE

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Chapter 5

The mitotic cell cycle

5.1 Replication and division of nuclei and cells

692. 9700_m20_qp_12 Q: 19

Which cells contain telomeres that are longer than those in a helper T-lymphocyte secreting cytokines?

1 bone marrow stem cells

2 mature red blood cells

3 activated memory B-lymphocytes

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

---

693. 9700_m20_qp_12 Q: 20

In which stage of the cell cycle are telomeres needed to prevent the loss of genes?

A prophase

B cytokinesis

C G_1 phase

D S phase

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694. 9700_m20_qp_12 Q: 21

Which row shows **part** of the correct sequence of mitosis?

A	chromosomes condense	→	chromosomes line up at the equator	→	nuclear envelope disappears	→	spindle fibres shorten
B	chromosomes line up at the equator	→	spindle fibres shorten	→	chromosomes condense	→	nuclear envelope reappears
C	chromosomes line up at the equator	→	spindle fibres shorten	→	nuclear envelope reappears	→	chromosomes uncoil
D	chromosomes uncoil	→	nuclear envelope disappears	→	spindle fibres shorten	→	chromosomes line up at the equator

---

695. 9700_s20_qp_11 Q: 17

Which feature of stem cells enables them to replace cells in tissues such as the skin?

A They are undifferentiated cells that are present at birth.

B They differentiate to form skin cells.

C They divide by mitosis to supply some cells that can differentiate.

D They have the full number of chromosomes.

---

696. 9700_s20_qp_11 Q: 18

During prophase, a scientist stains the chromosomes of a diploid animal cell with a fluorescent dye to stain telomeres. This cell has 32 chromosomes.

How many telomeres will the scientist observe?

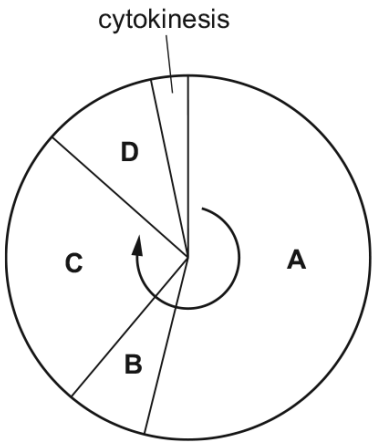
A 32 **B** 64 **C** 96 **D** 128

---

697. 9700_s20_qp_11 Q: 19

The diagram shows the cell cycle.

During which phase do chromosomes condense and become visible?



---

698. 9700_s20_qp_12 Q: 19

Which description of chromosome structure is correct?

A A chromosome at the beginning of interphase consists of two identical chromatids, each containing one linear molecule of DNA.

B Telomeres are lengths of non-coding DNA found at one end of each chromatid to prevent loss of genes during cell division.

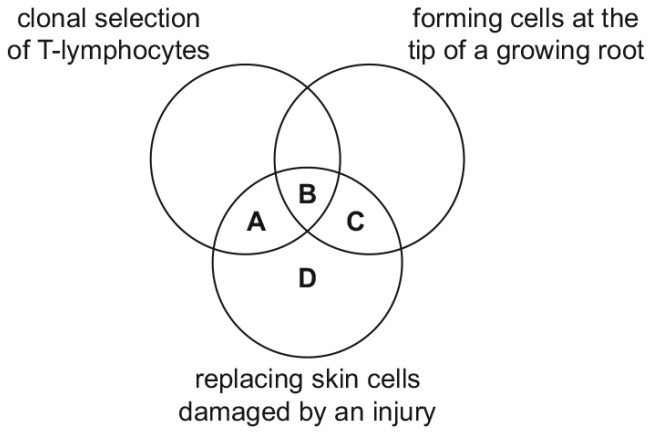
C The two identical chromatids of a chromosome are held together by a centromere in which there is no DNA.

D The very long DNA molecule of each chromatid is coiled and held together by proteins called histones.

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699. 9700_s20_qp_12 Q: 20

Which processes involve mitosis?

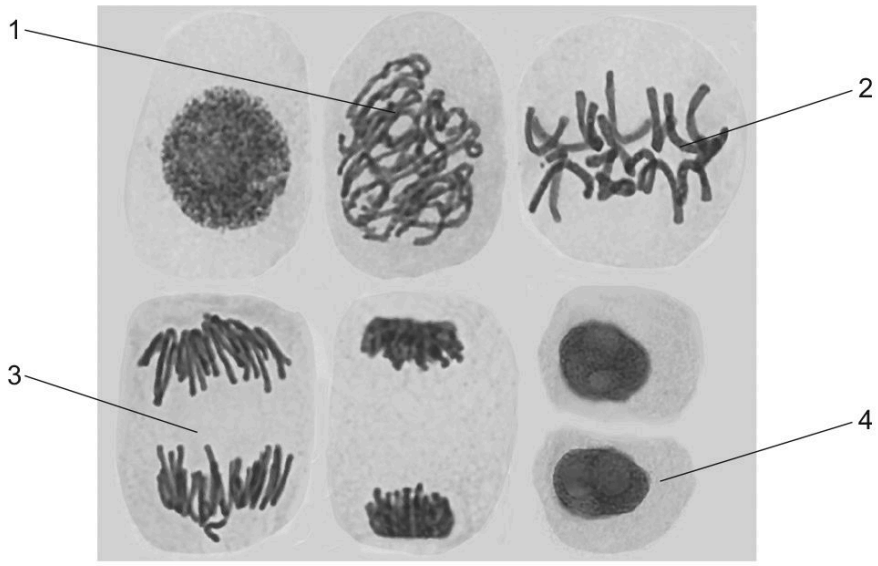


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700. 9700_s20_qp_12 Q: 21

A drug has been developed to treat certain types of cancer. It prevents mitosis by binding to the spindle and preventing sister chromatids being separated and moving to opposite poles of the cell.

The photomicrograph shows cells in different phases of mitosis.



What represents the stages of mitosis that will be able to occur in a cell which is entering prophase when treated with this drug?

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

---

701. 9700_s20_qp_13 Q: 17

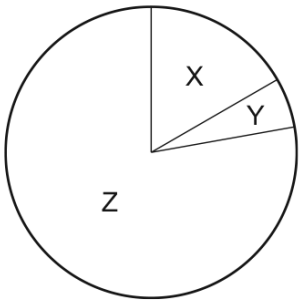
Which row correctly describes parts of chromosome structure present during mitosis?

	centromere	chromatid	telomere
A	region of a chromosome with no DNA	single DNA polynucleotide with histone proteins	region of DNA with many cytosine and guanine bases
B	region of non-coding DNA holding two chromatids together	double-stranded DNA molecule with histone proteins	region of DNA with many short repeated sequences of bases
C	region of DNA with no histone proteins that allows separation of chromatids during anaphase	DNA molecule coiled round histone proteins to form a chain of nucleosomes	region of DNA with no proteins that protects the end of a chromatid
D	region that attaches to spindle microtubules and divides during prophase	one of two identical DNA molecules that was replicated during interphase	region of non-coding DNA holding the ends of the chromatids together

---

702. 9700_s20_qp_13 Q: 18

The diagram shows the relative time taken for each stage in the cell cycle.



Which row identifies the correct sequence of the stages in the cell cycle?

	cytokinesis	interphase	mitosis
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	X	Y

---

703. 9700_s20_qp_13 Q: 19

Scientists have made a nucleic acid, HNA, that has a sugar with the same number of carbon atoms as glucose instead of deoxyribose. Although genetic information can be stored by HNA, naturally occurring DNA polymerase cannot replicate HNA.

Which statements could explain why naturally occurring DNA polymerase cannot replicate HNA?

1 DNA polymerase cannot form bonds between the sugars of two HNA nucleotides.

2 DNA polymerase cannot form hydrogen bonds between two HNA nucleotides.

3 HNA nucleotides do not fit into the active site of DNA polymerase.

4 The shape of an HNA nucleotide is slightly larger than that of a DNA nucleotide.

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

---

704. 9700_w20_qp_11 Q: 18

During telophase of mitosis, a scientist stains the chromosomes of a diploid animal cell with a fluorescent dye to observe the telomeres.

This cell has 22 chromosomes.

How many telomeres will the scientist observe in one of the nuclei?

A 22 **B** 44 **C** 66 **D** 88

---

705. 9700_w20_qp_11 Q: 19

Methotrexate is a drug used to treat cancer. It can act as an enzyme inhibitor preventing the synthesis of nucleotides containing thymine.

Cells treated with methotrexate are not able to complete the cell cycle.

A cell entering telophase is treated with methotrexate.

Which stage of the cell cycle will be affected by the action of methotrexate?

A anaphase

B interphase

C metaphase

D prophase

---

706. 9700_w20_qp_11 Q: 20

Which stage of mitosis is correctly described?

A In anaphase chromosomes line up across the equator.

B In metaphase the centrosomes replicate.

C In prophase chromatids move to opposite poles.

D In telophase chromosomes uncoil to form chromatin.

---

707. 9700_w20_qp_12 Q: 17

During the cell cycle, the mass of DNA in a cell is doubled.

At which stage in the cell cycle is the mass of DNA in a cell reduced?

A anaphase

B cytokinesis

C interphase

D prophase

---

708. 9700_w20_qp_12 Q: 18

How many of the listed structures typically contain genetic material that has telomeres?

- bacterial cell
- chloroplast
- mitochondrion
- nucleus

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

---

709. 9700_w20_qp_12 Q: 19

In eukaryotes, the chromosomes become shorter and thicker during mitosis. The thickening may be increased by molecules called protamines. The protamines replace part of the structure of the chromosome.

Which part of the chromosome is replaced by protamines?

A centromeres

B chromatids

C histones

D telomeres

---

710. 9700_w20_qp_13 Q: 19

Three parts of a chromosome and their functions are listed.

part		function	
p1	centromere	f1	holds the coils of DNA together
p2	histone proteins	f2	holds two chromatids together
p3	telomere	f3	prevents loss of genes

Which part is matched with its correct function?

A p1 and f2 **B** p2 and f2 **C** p2 and f3 **D** p3 and f1

---

711. 9700_w20_qp_13 Q: 21

Some events in the cell cycle are listed.

Which events are part of mitosis?

1 interphase

2 metaphase

3 cytokinesis

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

---

712. 9700_m19_qp_12 Q: 19

During mitosis in animal cells, which process occurs after prophase?

A Centrioles move towards the poles of the cell.

B Centromeres attach to spindle microtubules.

C Chromatids join to form chromosomes.

D Chromosomes condense and become visible.

---

713. 9700_m19_qp_12 Q: 20

Embryonic stem cells are able to replicate continuously.

What happens to the telomeres during repeated mitotic cell cycles of embryonic stem cells?

A Their lengths increase.

B Their lengths decrease.

C They are completely lost.

D They stay the same length.

---

714. 9700_s19_qp_11 Q: 18

A scientist stains the chromosomes of a diploid plant cell with a fluorescent dye to observe the telomeres.

This cell has 38 chromosomes.

How many telomeres will the scientist observe in one of the nuclei during telophase of mitosis?

A 38 **B** 76 **C** 114 **D** 152

---

715. 9700_s19_qp_11 Q: 20

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

---

716. 9700_s19_qp_12 Q: 15

Three parts of a chromosome and their functions are listed.

part	function
P1 centromere	F1 holds the coils of DNA together
P2 histone proteins	F2 holds two chromatids together
P3 telomere	F3 prevents loss of genes

Which part is matched with its correct function?

A P1 and F1 **B** P2 and F1 **C** P2 and F3 **D** P3 and F2

---

717. 9700_s19_qp_12 Q: 16

The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells need to transcribe telomerase enzyme?

1 cancer cells

2 stem cells

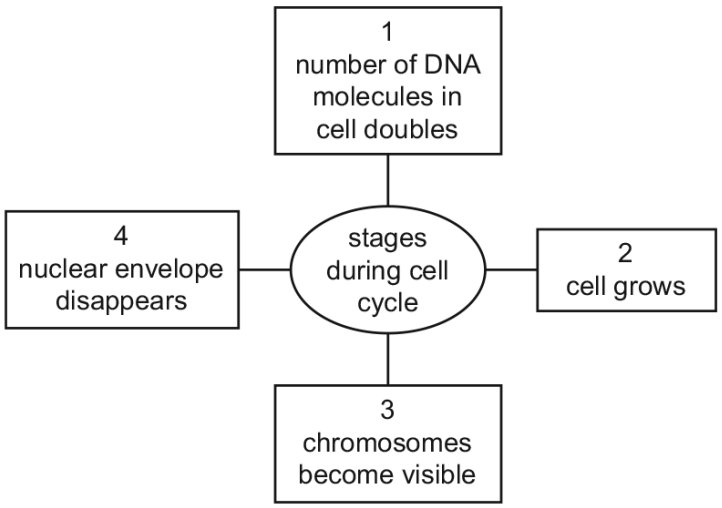
3 activated memory B-lymphocytes

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

---

718. 9700_s19_qp_12 Q: 17

The diagram shows some of the stages which take place during the cell cycle.



Which two stages take place during interphase?

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

---

719. 9700_s19_qp_13 Q: 21

Some parts of a typical human chromosome are more numerous than others.

Which of the parts are listed in order from the most numerous to the least numerous?

A centromere, nucleotide, histone

B DNA molecule, telomere, centromere

C histone, telomere, DNA molecule

D telomere, centromere, nucleotide

---

720. 9700_s19_qp_13 Q: 22

The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells need to transcribe telomerase enzyme?

1 stem cells

2 activated memory B-lymphocytes

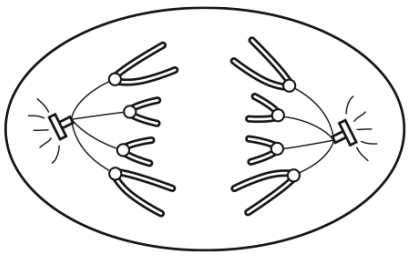
3 helper T-lymphocytes secreting cytokines

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

---

721. 9700_s19_qp_13 Q: 23

The diagram shows a cell during mitosis.



Which description correctly identifies the cell?

A a plant cell during anaphase

B a plant cell during metaphase

C an animal cell during anaphase

D an animal cell during metaphase

---

722. 9700_w19_qp_11 Q: 19

The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells transcribe a high concentration of telomerase?

1 neutrophils

2 mature red blood cells

3 activated memory T-lymphocytes

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

---

723. 9700_w19_qp_11 Q: 20

At which stage of mitosis do these events occur?

	centromeres separate	chromosomes become shorter and thicker
A	anaphase	interphase
B	anaphase	prophase
C	metaphase	interphase
D	metaphase	prophase

---

724. 9700_w19_qp_12 Q: 20

Which row shows the correct number of each component of a single chromosome during prophase of mitosis?

	centromeres	chromatids	polynucleotide strands	telomeres
A	1	0	2	2
B	1	2	4	4
C	2	0	4	2
D	2	2	2	4

---

725. 9700_w19_qp_12 Q: 21

The cell cycle includes mitosis.

Which are features of nuclear division?

1 forms cells of equal size to the parent cell

2 forms genetically identical nuclei

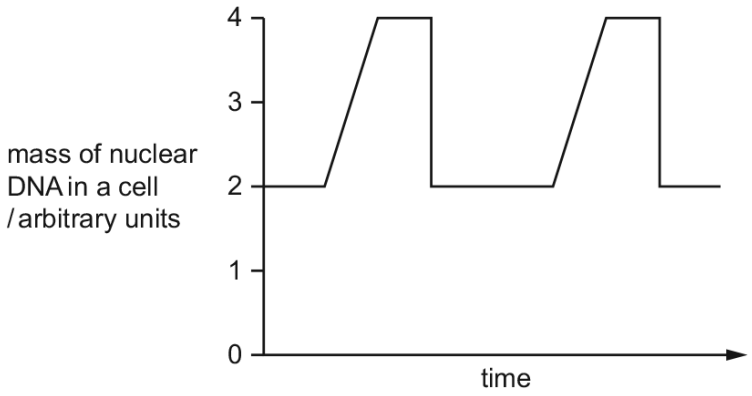
3 semi-conservative replication of DNA

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

---

726. 9700_w19_qp_13 Q: 17

Which processes that occur in cell division are represented in the diagram?



A DNA replication and nuclear division only

B DNA replication, nuclear division and cytokinesis

C mitosis and cytokinesis

D mitosis only

---

727. 9700_w19_qp_13 Q: 18

What happens to the telomeres during mitosis of a cancer cell?

A The length increases.

B The length decreases.

C They are completely lost.

D They stay the same length.

---

728. 9700_m18_qp_12 Q: 20

How many copies of each different DNA molecule will be found in a cell at the start of each of these stages of the mitotic cell cycle?

	G_2 of interphase	prophase	cytokinesis
A	1	1	2
B	1	2	1
C	2	1	2
D	2	2	2

---

729. 9700_m18_qp_12 Q: 21

Three parts of a chromosome and their functions are listed.

part

P1 centromere

P2 histone proteins

P3 telomere

function

F1 packages DNA into compact structures

F2 holds two chromatids together

F3 prevents loss of genes

Which combination is correct?

A P1 and F1 **B** P1 and F3 **C** P2 and F2 **D** P3 and F3

---

730. 9700_s18_qp_11 Q: 19

Which of these events are part of mitosis?

1 interphase

2 telophase

3 cytokinesis

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

---

731. 9700_s18_qp_11 Q: 20

During which phase of the cell cycle does DNA replication take place?

A G_1 **B** G_2 **C** M **D** S

---

732. 9700_s18_qp_11 Q: 21

Which row is correct for guanine?

	has a double ring structure	is a purine	joins its complementary base with three hydrogen bonds
A	✓	✓	✓
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

key
✓ = correct
✗ = incorrect

---

733. 9700_s18_qp_12 Q: 18

One of the chromosomes in a nucleus has a telomere which contains many repeats of the base sequence TTAGGG.

This chromosome was extracted from four different cells and the total number of bases in the telomere was determined.

Which total number of bases was found in the cell that had undergone the most mitotic divisions?

A 5548 **B** 5580 **C** 5645 **D** 5700

---

734. 9700_s18_qp_12 Q: 19

The chromosome content of each daughter cell must be identical to that of the mother cell for successful cell replacement when repairing tissues.

Which stages of mitosis make sure that each daughter cell receives one chromatid from each chromatid pair?

A prophase and metaphase

B metaphase and anaphase

C anaphase and telophase

D telophase and interphase

---

735. 9700_s18_qp_12 Q: 20

Which of these statements about cytokinesis is always true?

1 Cell structures replicate.

2 Cell structures are shared between two cells.

3 Nuclear envelope reforms.

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

---

736. 9700_s18_qp_12 Q: 21

Which statement is correct about the number of telomeres present in prophase of a human body cell?

A 46 as there is one telomere at the end of 46 chromosomes

B 92 as there is one telomere at each end of 46 chromosomes

C 92 as there is one telomere at the end of 92 chromatids

D 184 as there is one telomere at each end of 92 chromatids

---

737. 9700_s18_qp_12 Q: 22

Which statement explains why DNA replication is described as semi-conservative?

A Half of each original strand is conserved in each new molecule of DNA.

B Half of the base sequence of each strand is conserved in each new molecule of DNA.

C Only one strand of DNA is used as a template during replication.

D The template for each new molecule of DNA is one strand of the original molecule.

---

738. 9700_s18_qp_13 Q: 19

Which features of an organism are affected by a drug that stops mitosis?

1 cell repair

2 cell replacement

3 number of stem cells

4 tissue repair

5 tumour formation

A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 4 and 5 only

D 2, 3, 4 and 5 only

---

739. 9700_w18_qp_11 Q: 19

How many copies of each DNA molecule will be found in a cell at each stage of the mitotic cell cycle?

	G_1 of interphase	cytokinesis
A	1	1
B	1	2
C	2	1
D	2	2

---

740. 9700_w18_qp_11 Q: 20

Which metabolic processes will be very active in a cell that has just completed cytokinesis?

1 ATP formation

2 DNA replication

3 protein synthesis

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

---

741. 9700_w18_qp_11 Q: 21

A mutation occurs in a gene which prevents the production of telomerase.

What is the effect of this mutation if it occurs in bone marrow stem cells?

A a rapid increase in the production of lymphocytes

B a tumour grows in the bone marrow

C bone marrow stem cells eventually no longer divide

D the total blood cell count will be unchanged

---

742. 9700_w18_qp_11 Q: 22

What are the products when a DNA molecule replicates?

A two molecules of DNA each made of a paired sequence of bases

B two molecules of DNA each made of a paired sequence of nucleotides

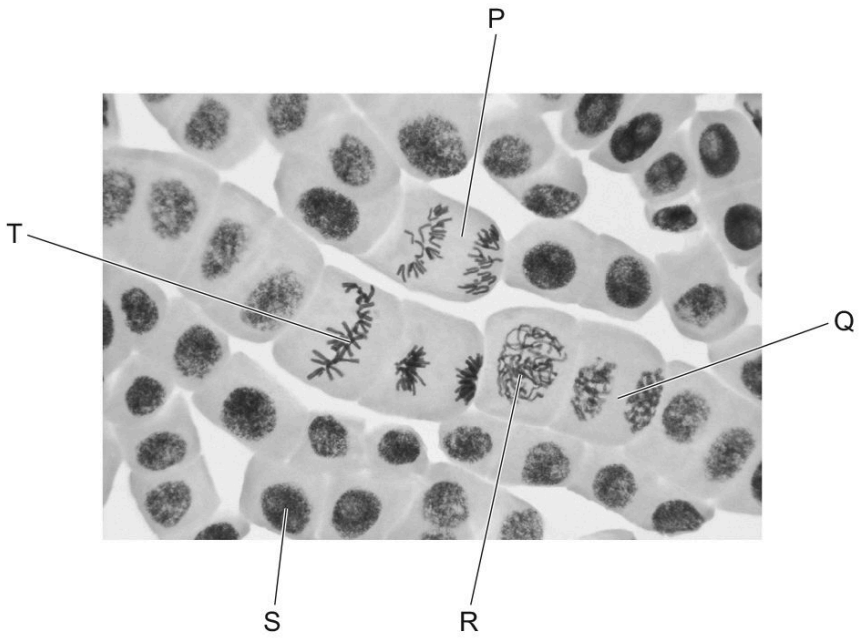
C two strands of DNA each made of a paired sequence of bases

D two strands of DNA each made of a paired sequence of nucleotides

---

743. 9700_w18_qp_12 Q: 20

The photomicrograph shows cells in different stages of mitosis.



Which statements are correct?

1 Cell T shows metaphase.

2 DNA replication occurs in cell R.

3 The amount of DNA in cell P is the same as in cell T.

4 The correct order for the stages is S → R → T → P → Q.

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

---

744. 9700_w18_qp_12 Q: 21

Which changes in a group of mammalian cells, dividing by mitosis, would be necessary for the formation of a tumour?

1 Mitosis is no longer inhibited by cell to cell contact.

2 Cells acquire the ability to migrate and set up new colonies.

3 Cells become able to divide indefinitely.

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

---

745. 9700_w18_qp_13 Q: 20

How many copies of each DNA molecule will be found in a cell at each stage of the mitotic cell cycle?

	G_2 of interphase	metaphase	cytokinesis
A	1	1	1
B	1	2	2
C	2	1	1
D	2	2	2

---

746. 9700_w18_qp_13 Q: 21

Centromere, chromatids and telomeres are parts of a chromosome in a eukaryotic cell.

Which row correctly describes these structures?

	centromere	chromatid	telomere
A	binds the two sister chromatids of a chromosome together	contains histone proteins and a molecule of double-stranded DNA	protects the tips of each chromatid from shortening at each mitotic division
B	site of attachment of spindle microtubules	contains histone proteins and a molecule of single-stranded DNA	prevents the genes nearest the ends of each chromatid from being lost
C	site of production of spindle microtubules	contains a molecule of double-stranded DNA with no associated histone proteins	contains DNA with many repeats of short base sequences
D	splits at metaphase of mitosis	contains a molecule of single-stranded DNA with no associated histone proteins	ensures that when DNA is replicated, the ends of the molecule are included

---

747. 9700_m17_qp_12 Q: 20

Some stem cells divide and give rise to phagocytes.

Where in the human body do these stem cells divide?

1 blood

2 bone marrow

3 lymph nodes

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

---

748. 9700_m17_qp_12 Q: 21

What is the correct sequence of stages in the mitotic cell cycle?

A G1 → G2 → mitosis → S → cytokinesis

B G1 → G2 → S → mitosis → cytokinesis

C G1 → S → G2 → mitosis → cytokinesis

D S → G1 → mitosis → G2 → cytokinesis

---

749. 9700_m17_qp_12 Q: 22

The enzyme telomerase repairs telomeres. It stops the telomeres from getting shorter each time a chromosome is replicated.

Telomerase is not normally active in human body cells, but in some diseases telomerase can be activated.

In which disease is the enzyme telomerase activated?

A cancer

B HIV/AIDS

C malaria

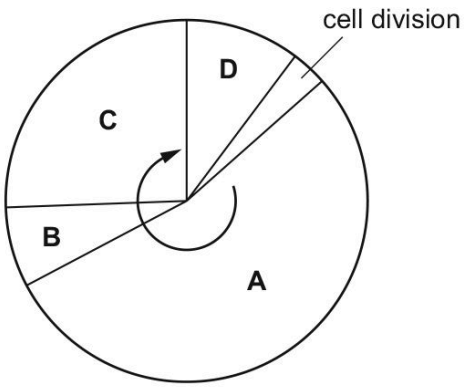
D myasthenia gravis

---

750. 9700_s17_qp_11 Q: 21

The diagram shows the mitotic cell cycle.

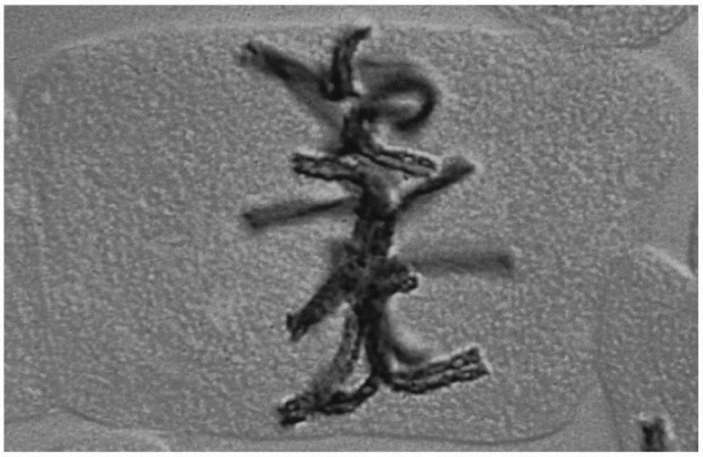
During which phase is DNA replicated?



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751. 9700_s17_qp_12 Q: 16

The photomicrograph shows a stage of mitosis.

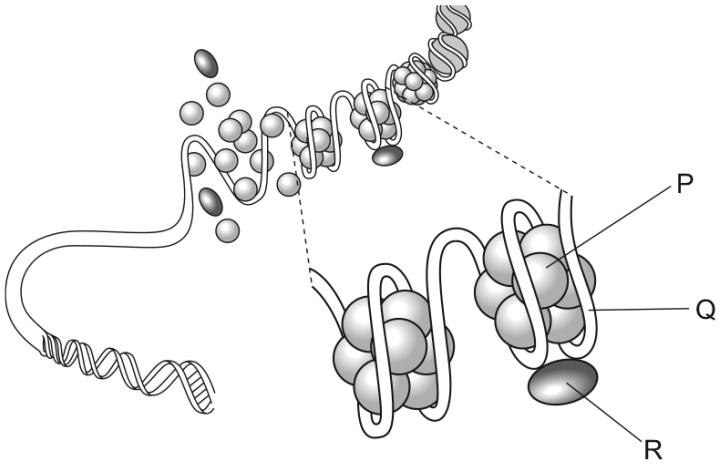


What would be correct for the next stage in mitosis?

	paired chromatids	nuclear membrane
A	absent	absent
B	absent	re-forming
C	present	absent
D	present	breaking down

752. 9700_s17_qp_12 Q: 17

The diagram shows part of the organisation of a DNA molecule and the associated histones.



Which statement about the features labelled P, Q and R during prophase of mitosis is correct?

A The coiled DNA molecule forms Q and wraps around the histones of R to form small clusters held in place by histone P.

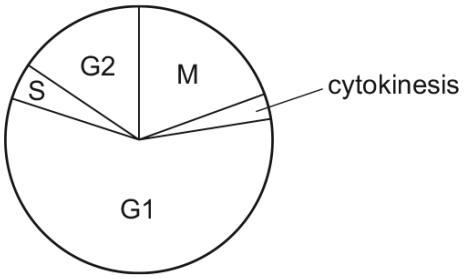
B The groups of histones, P, and its associated DNA, Q, move closer together as the chromosome condenses around R.

C The histones P and R are made of protein around which the DNA molecule, Q, is wrapped so that the DNA molecule can fit inside the nucleus.

D The linked groups of histones P and R and the associated DNA, Q, form strands that fold and twist together to form a chromatid.

753. 9700_s17_qp_13 Q: 16

The diagram shows the cell cycle of a mammalian cell.



Checkpoints in the cell cycle of mammals prevent the cycle from continuing when mistakes are made or DNA is damaged.

Four of the checkpoints are described.

1 Mitosis is blocked if DNA replication is incomplete.

2 Anaphase is blocked if the assembly of chromatids on the spindle is unsuccessful.

3 DNA replication is blocked if DNA is damaged.

4 DNA replication stops if damage to DNA has not been repaired.

In which phases of the cell cycle do these checkpoints occur?

	checkpoint			
	1	2	3	4
A	M	G1	S	G2
B	G2	M	G1	S
C	G2	S	G1	M
D	S	G2	M	G1

---

754. 9700_w17_qp_11 Q: 17

Colchicine is a chemical that stops chromatids from separating during mitosis.

A cell is treated with colchicine.

Which stage of mitosis will this cell reach but not complete?

A anaphase

B metaphase

C prophase

D telophase

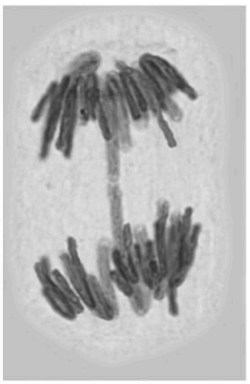
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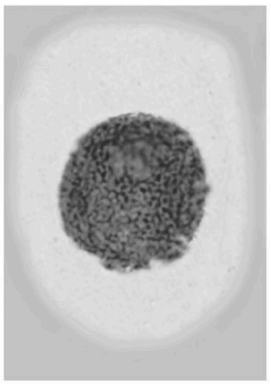
755. 9700_w17_qp_12 Q: 19

The photomicrographs show cells in various stages of the cell cycle.

In which stage does semi-conservative replication of DNA take place?

A 

B 

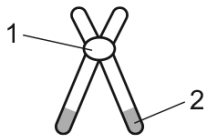
C 

D 

---

756. 9700_w17_qp_12 Q: 20

The diagram shows the structure of one chromosome.



Which row is correct?

	1	2	number of DNA strands
A	centromere	chromatid	2
B	centromere	telomere	4
C	chromatid	telomere	2
D	telomere	chromatid	4

---

757. 9700_w17_qp_12 Q: 21

Cancer cells may divide by far more divisions than other cells found in humans.

Which statement about cancer cells is correct?

A They are able to synthesise the enzyme telomerase.

B They have a mutation in the telomeres so DNA is not hydrolysed.

C They have DNA polymerase so can replicate their DNA without telomere loss.

D They increase the number of copies of repeated DNA sequences in the telomeres.

---

758. 9700_w17_qp_13 Q: 20

What describes a telomere?

A a cell structure composed mainly of protein and involved in cell division

B a protein that associates with DNA to help condense it

C a region of DNA that links two sister chromatids together

D a region of repetitive nucleotide sequences at the end of a chromatid

---

759. 9700_w17_qp_13 Q: 21

Uncontrolled cell division can form tumours.

Which statement is correct for tumour cells **only**?

A Metaphase does not take place.

B Cytokinesis does not occur.

C Interphase takes less time.

D They have mutated DNA.

---

760. 9700_w17_qp_13 Q: 22

Which of these events are part of mitosis?

1 interphase

2 anaphase

3 cytokinesis

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

---

761. 9700_m16_qp_12 Q: 16

Which statements about the cell cycle are correct?

1 The cell cycle consists of both interphase and mitosis.

2 DNA replication takes place in interphase.

3 A cell can remain in interphase for several months.

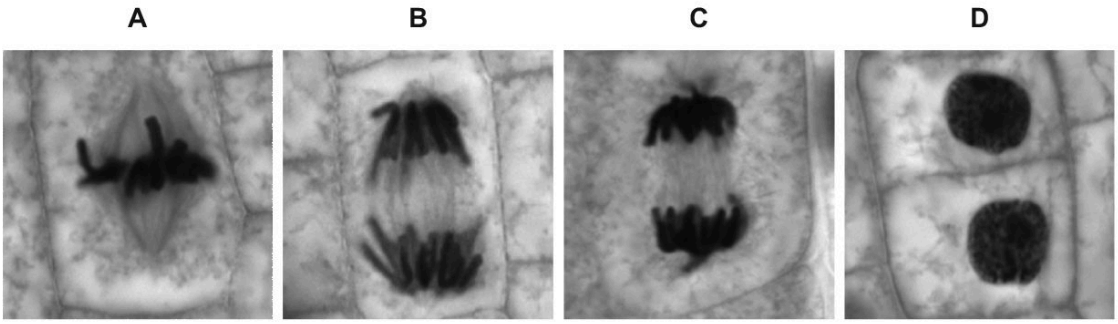
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

---

762. 9700_m16_qp_12 Q: 17

The diagram shows cells in different stages of the cell cycle.

Which is the last stage before cytokinesis?



---

763. 9700_m16_qp_12 Q: 18

How many of the listed structures typically contain genetic material that has telomeres?

- bacterial cell
- chloroplast
- mitochondrion
- nucleus

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

---

764. 9700_s16_qp_11 Q: 18

The protein p53 is produced in a cell in response to DNA damage. This protein stops the cell cycle for a short time just before the DNA is replicated, so that the DNA can be repaired.

At which phase of the cell cycle will this stop occur?

A M **B** G1 **C** S **D** G2

---

765. 9700_s16_qp_11 Q: 19

Which feature of stem cells enables them to replace cells in tissues such as the skin?

A They are undifferentiated cells that are present at birth.

B They differentiate to form skin cells.

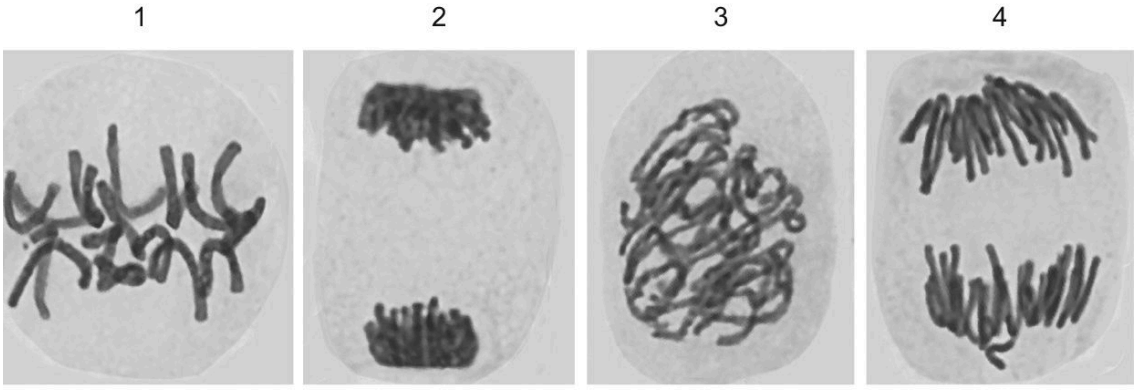
C They divide by mitosis to supply some cells that can differentiate.

D They have the full number of chromosomes.

---

766. 9700_s16_qp_12 Q: 16

The photomicrographs show cells in various stages of the cell cycle.



Which cells contain twice as many DNA molecules as a cell from the same organism after cytokinesis?

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2 and 4 only

---

767. 9700_s16_qp_12 Q: 17

A group of chemicals used to treat cancer prevents the formation of the spindle during mitosis.

Which phase of mitosis is the **first** to be affected?

A anaphase

B metaphase

C prophase

D telophase

---

768. 9700_s16_qp_12 Q: 18

Mitosis is an important process for organisms.

Which features of mitosis are important for single-celled organisms?

1 asexual reproduction

2 growth

3 production of genetically identical cells

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

---

769. 9700_s16_qp_13 Q: 17

Which process occurs during prophase of the mitotic cell cycle in an animal cell?

A division of centromeres

B formation of chromosomes

C replication of DNA

D separation of centrioles

---

770. 9700_s16_qp_13 Q: 18

Which processes occur in bone marrow cells that are in a mitotic cell cycle?

1 phosphate groups bind to ADP molecules to form ATP

2 bonds form between nucleotides in a DNA strand

3 tRNA anticodons hydrogen bond with codons on mRNA

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

---

771. 9700_w16_qp_11 Q: 17

Which row is correct for a human cell just before the cell enters prophase of mitosis?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	46	92	yes	yes
C	92	46	no	yes
D	92	92	no	yes

---

772. 9700_w16_qp_11 Q: 18

Which event is part of the mitotic cell cycle?

A anaphase

B cytokinesis

C DNA replication

D interphase

---

773. 9700_w16_qp_12 Q: 21

Which group of cells can all divide by mitosis?

A bacterial cells, cancer cells, stem cells

B bacterial cells, lymphocytes, stem cells

C cancer cells, lymphocytes, red blood cells

D cancer cells, lymphocytes, stem cells

---

774. 9700_w16_qp_13 Q: 17

Chromosome telomeres are essential for DNA replication and are **not** completely replaced during mitosis.

Substance X completely replaces telomeres during mitosis.

What will be the effect of growing cells with and without substance X?

	with substance X	without substance X
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

---

775. 9700_w16_qp_13 Q: 19

The information describes some events of mitosis.

1 chromosomes undergo condensation and spiralisation

2 centromeres are pulled by shortening of spindle fibres

3 sister chromatids are orientated across the centre of the cell

4 centrioles separate from each other

5 spindle fibres disperse

Which row correctly identifies the stages of mitosis in which these events occur?

	1	2	3	4	5
A	metaphase	telophase	prophase	metaphase	anaphase
B	prophase	anaphase	metaphase	prophase	telophase
C	prophase	metaphase	anaphase	telophase	telophase
D	telophase	metaphase	prophase	anaphase	prophase

---

776. 9700_s15_qp_12 Q: 18

The protein p53 is produced in a cell in response to DNA damage.

A scientist exposed three groups of cells, X, Y and Z, to different conditions.

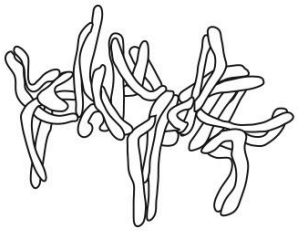
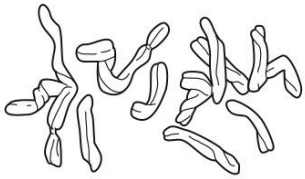
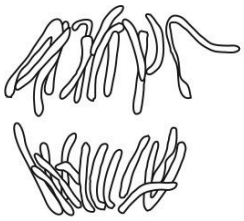
group of cells	conditions cells were exposed to
X	ionising radiation
Y	ultra-violet light
Z	nicotine

In which groups of cells would the scientist find large quantities of p53 mRNA?

A X, Y and Z **B** X and Y only **C** Y and Z only **D** Y only

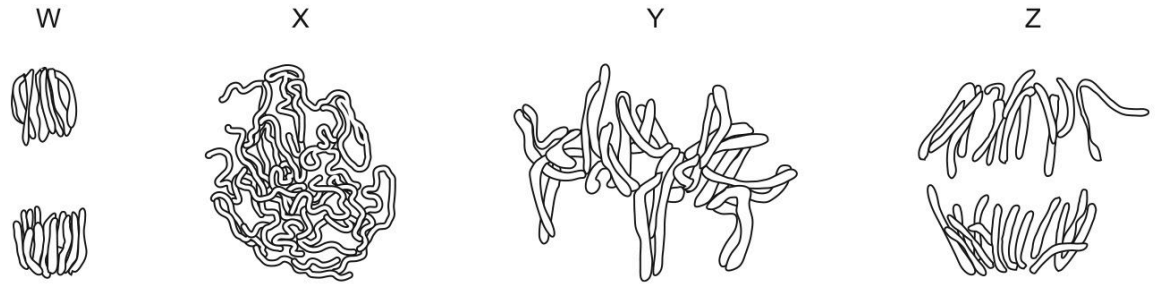
777. 9700_s15_qp_12 Q: 19

Which row is correct?

	diagram	stage
A		interphase
B		metaphase
C		telophase
D		anaphase

778. 9700_s15_qp_13 Q: 18

The diagrams show chromosomes at different stages of mitosis.



Which shows the correct order of the cell cycle?

A W → X → Y → Z

B X → Y → Z → W

C Y → Z → W → X

D Z → W → X → Y

---

779. 9700_w15_qp_12 Q: 18

Which statements about a diploid cell are correct?

1 can divide by mitosis to repair itself

2 has two complete sets of chromosomes

3 can undergo a reduction division to form haploid cells

4 can undergo mitotic division to allow growth to occur

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

5.2 Chromosome behaviour in mitosis

780. 9700_w20_qp_13 Q: 20

Which features of mitosis are important for a single-celled organism?

1 asexual reproduction

2 production of genetically identical cells

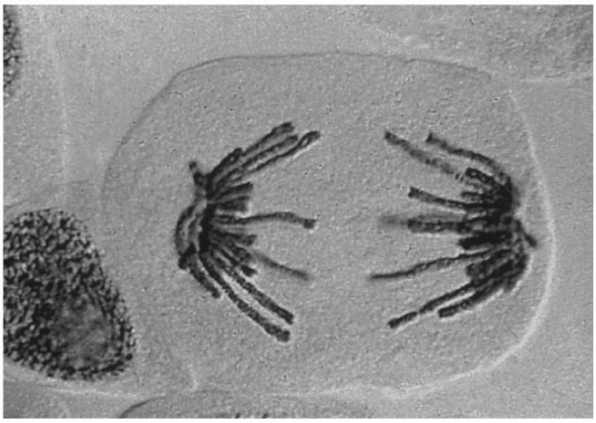
3 growth

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

---

781. 9700_s19_qp_11 Q: 19

The photomicrograph shows a cell during mitosis.



What is happening in this cell?

1 Centrioles are replicating.

2 Spindle microtubules are shortening.

3 Chromatin is condensing.

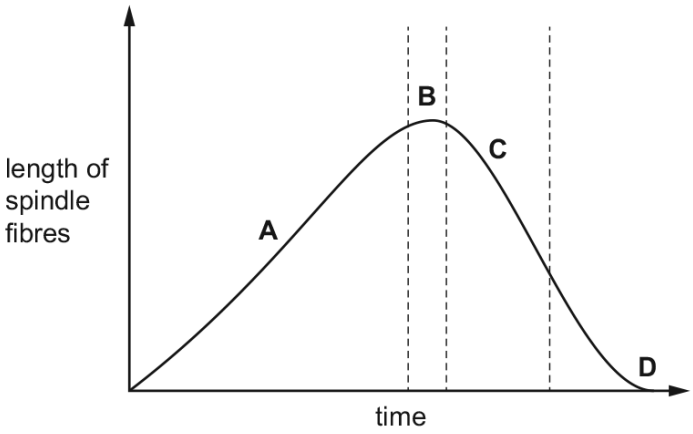
A 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 3 only

---

782. 9700_s19_qp_11 Q: 21

The graph shows the length of the spindle fibres during mitosis.

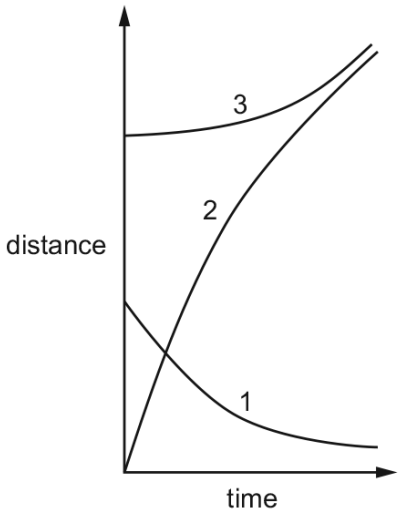
Which region of the graph shows when all the centromeres have detached from the spindle fibres?



---

783. 9700_w19_qp_13 Q: 19

The graph shows three measurements obtained after metaphase of mitosis.

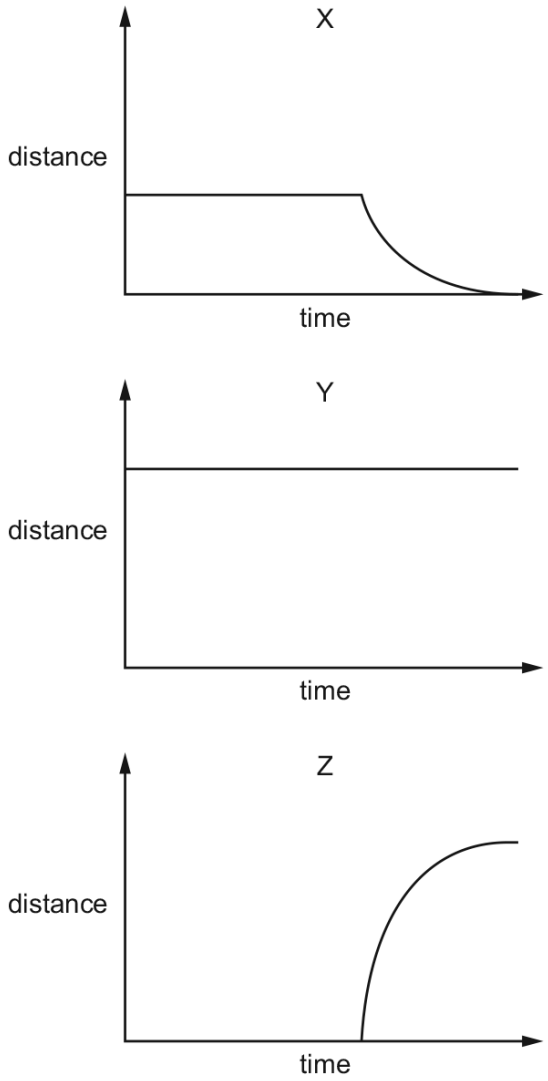


What measurements do the curves represent?

	distance between centromeres and poles of spindle	distance between centromeres of sister chromatids	distance between poles of spindle
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

784. 9700_m18_qp_12 Q: 22

The graphs show various distance measurements taken from metaphase of mitosis onwards. The graphs are to scale when compared to one another.



Which row correctly identifies the distance measurement for each graph?

	X	Y	Z
A	distance between poles of spindle	distance between sister chromatids	distance of centromeres from poles of spindle
B	distance between poles of spindle	distance of centromeres from poles of spindle	distance between sister chromatids
C	distance of centromeres from poles of spindle	distance between poles of spindle	distance between sister chromatids
D	distance of centromeres from poles of spindle	distance between sister chromatids	distance between poles of spindle

785. 9700_s18_qp_11 Q: 18

A student observed the cells in the growing region (meristem) of an onion root and obtained the data shown.

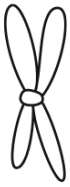
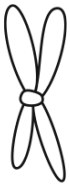
stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

Which percentage of cells contains chromosomes that appear as two chromatids?

A 7.3 **B** 8.9 **C** 95.9 **D** 97.5

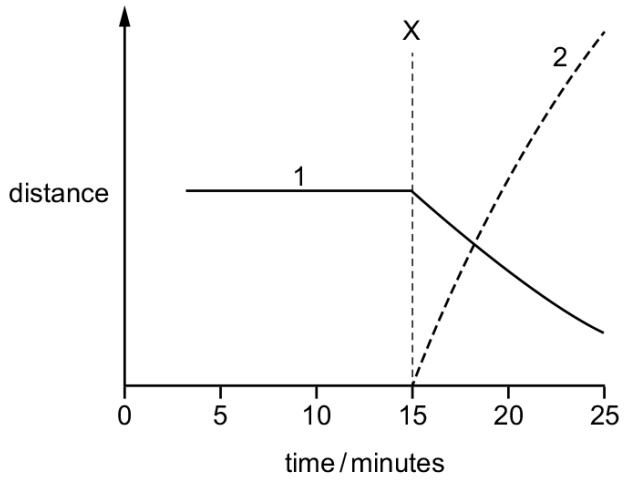
786. 9700_s18_qp_13 Q: 20

Which row shows the appearance of a chromosome at the beginning of prophase of mitosis and the number of DNA strands in the chromosome?

	appearance of one chromosome	number of DNA strands
A		2
B		4
C		1
D		2

787. 9700_s18_qp_13 Q: 21

The graph shows measurements taken during one mitotic cell cycle.



Which stage of mitosis begins at X and which measurements are shown by curves 1 and 2?

	stage beginning at X	distance between centromeres of chromosomes and poles of spindle	distance between centromeres of sister chromatids
A	anaphase	1	2
B	anaphase	2	1
C	metaphase	1	2
D	metaphase	2	1

788. 9700_w18_qp_12 Q: 22

Which row shows some of the events during a mitotic cycle in the correct time sequence?

	time →			
A	centromere of each chromosome splits	nucleoli become visible	nuclear envelope breaks into small vesicles	spindle microtubules produced
B	nuclear envelope breaks into small vesicles	spindle microtubules produced	centromere of each chromosome splits	nucleoli become visible
C	nucleoli become visible	nuclear envelope breaks into small vesicles	spindle microtubules produced	centromere of each chromosome splits
D	spindle microtubules produced	centromere of each chromosome splits	nucleoli become visible	nuclear envelope breaks into small vesicles

---

789. 9700_m17_qp_12 Q: 23

The statements describe events during the mitotic cell cycle.

1 Chromosomes migrate to opposite poles of the spindle.

2 Chromosomes arrange themselves at the equator of the spindle.

3 Chromosomes condense and the nuclear membrane disappears.

4 Centromeres divide.

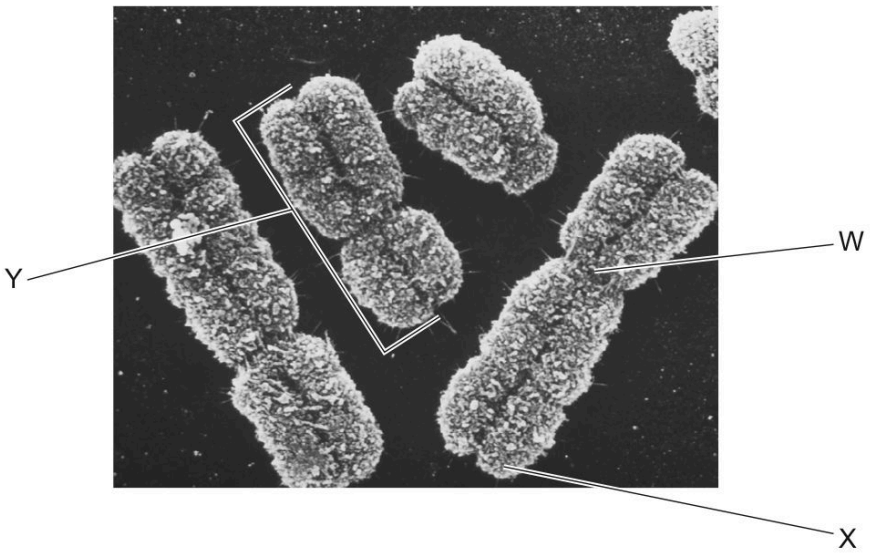
What is the correct order of three of these events in the mitotic cell cycle?

A $2 \rightarrow 3 \rightarrow 4$ **B** $3 \rightarrow 2 \rightarrow 4$ **C** $3 \rightarrow 4 \rightarrow 2$ **D** $4 \rightarrow 2 \rightarrow 1$

---

790. 9700_s17_qp_11 Q: 22

The electron micrograph shows a group of human chromosomes.



Which label is correct for each of the structures labelled W, X and Y?

	W	X	Y
A	centriole	centromere	chromatid
B	centriole	centromere	microtubule
C	centromere	telomere	chromatid
D	centromere	telomere	microtubule

---

791. 9700_s17_qp_11 Q: 23

Which statement about the behaviour of chromosomes during mitosis is correct?

A They attach to the spindle fibres to contain them within the nucleus.

B They condense to prevent further translation of genes.

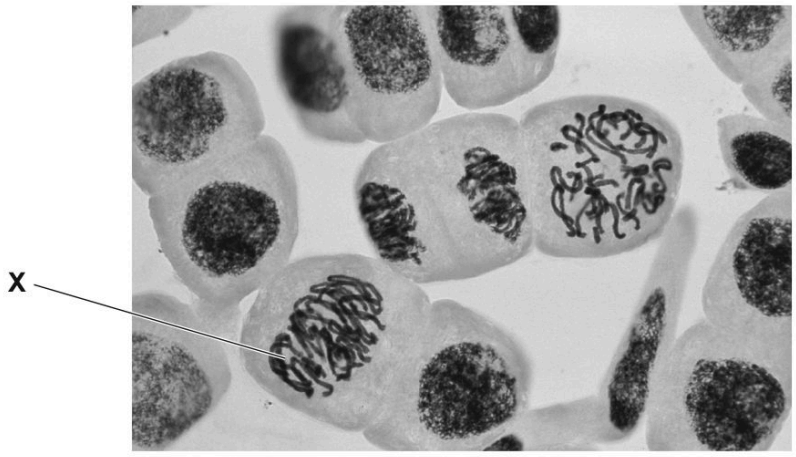
C They reach the poles of the cell and become longer and thinner.

D They replicate to produce sufficient DNA to form two new nuclei.

---

792. 9700_s17_qp_13 Q: 17

The photomicrograph shows cells undergoing mitosis.



Which statement describes what will happen next in cell **X**?

A Chromatin coils up tightly, and the nuclear envelope breaks down.

B Chromosomes line up along the equator of the cell and attach to the spindle.

C Sister chromatids move towards opposite poles, pulled by the spindle fibres.

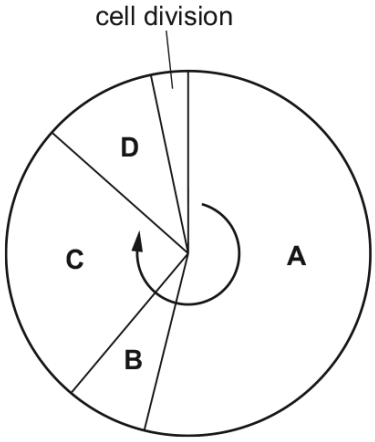
D Spindle fibres break down, and the cell prepares for cytokinesis.

---

793. 9700_w17_qp_11 Q: 16

The diagram shows the cell cycle.

During which phase do chromosomes condense and become visible?



---

794. 9700_s16_qp_11 Q: 17

Which processes occur during prophase of the mitotic cell cycle in an animal cell?

	centrioles replicate	chromosomes condense	spindle fibres form
A	✓	✓	✗
B	✓	✗	✗
C	✗	✓	✓
D	✗	✗	✓

key
✓ = true
✗ = false

---

795. 9700_w16_qp_12 Q: 20

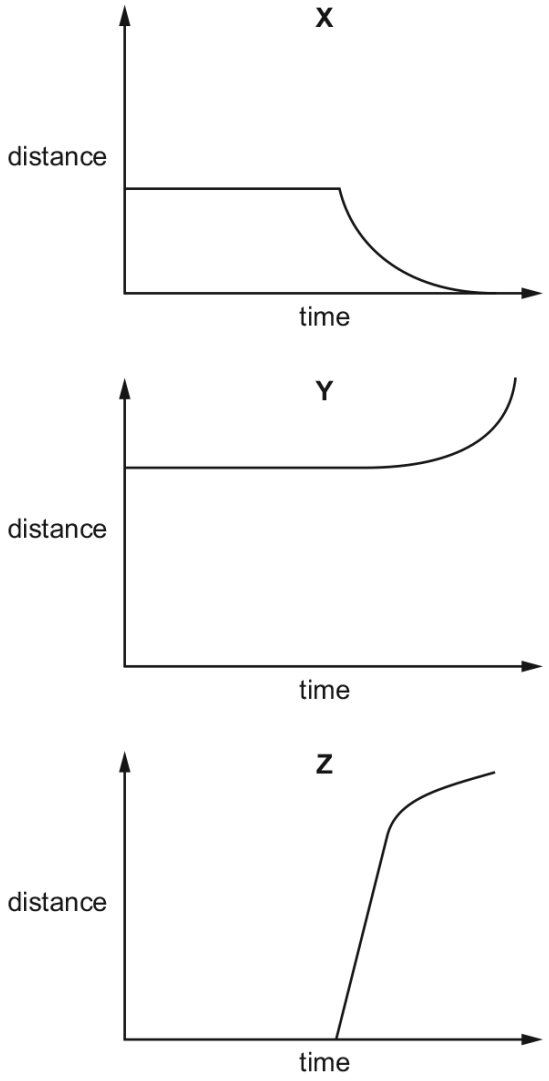
Which row correctly shows the behaviour of the nuclear envelope, the centrioles and the spindle during a stage of mitosis?

	stage of mitosis	behaviour of organelle		
		nuclear envelope	centrioles	spindle
A	prophase	disappears	replicate	spindle microtubules begin to form
B	metaphase	not present	begin to move to poles of cell	spindle microtubules fully formed
C	anaphase	begins to reform	at opposite poles of the cell	some spindle microtubules shorten
D	telophase	reforms	one beside each nucleus	spindle microtubules break down

---

796. 9700_s15_qp_11 Q: 18

The graphs show various measurements taken from metaphase of mitosis onwards. The graphs are to scale when compared to one another.



Which row correctly identifies each graph?

	X	Y	Z
A	distance between poles of spindle	distance between sister chromatids	distance of centromere from pole of spindle
B	distance between poles of spindle	distance of centromere from pole of spindle	distance between sister chromatids
C	distance of centromere from pole of spindle	distance between poles of spindle	distance between sister chromatids
D	distance of centromere from pole of spindle	distance between sister chromatids	distance between poles of spindle

797. 9700_s15_qp_11 Q: 19

A scientist counted 22 chromosomes in each of the root cells of a xerophytic plant.

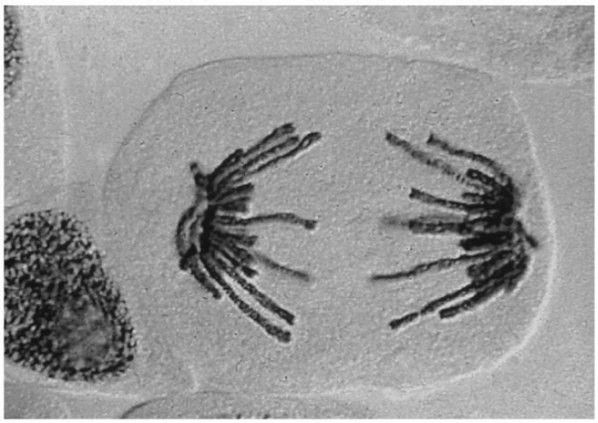
What is the diploid and haploid number of chromosomes for this species?

	diploid number	haploid number
A	11	22
B	22	11
C	22	44
D	44	22

---

798. 9700_w15_qp_11 Q: 18

The photomicrograph shows a cell during mitosis.



What is happening in this cell?

1 Centrioles are replicating.

2 Spindle microtubules are shortening.

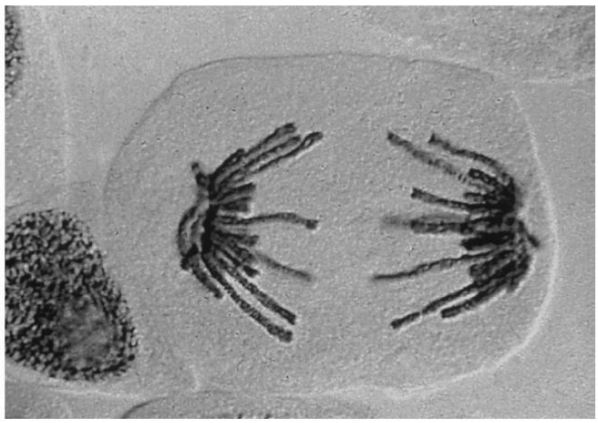
3 Chromatin is condensing.

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

---

799. 9700_w15_qp_13 Q: 18

The photomicrograph shows a cell undergoing mitosis.



What is happening in this cell?

A Centrioles are replicating.

B Chromatin is condensing.

C DNA is replicating.

D Spindle microtubules are shortening.

Chapter 5

The mitotic cell cycle

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5.1 Replication and division of nuclei and cells

46. 9700_s20_qp_21 Q: 2

Fig. 2.1 shows some stages of the cell cycle in the meristematic tissue in the root tip of a plant. Three of these stages, **P**, **Q** and **R**, are identified in Table 2.1.

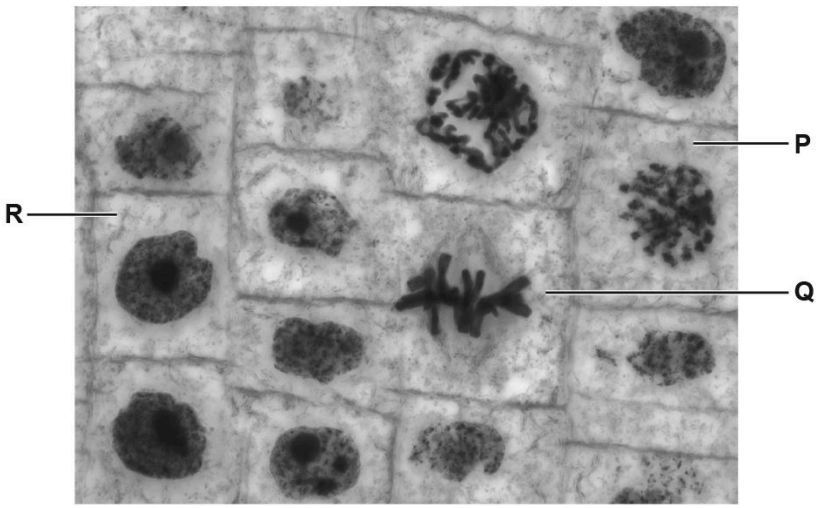


Fig. 2.1

(a) Complete Table 2.1 by stating **one** feature, **visible in Fig. 2.1**, that is used to identify each stage.

Table 2.1

cell	stage of cell cycle	reason
P	prophase of mitosis	
Q	metaphase of mitosis	
R	interphase	

[3]

(b) (i) Draw a labelled diagram to show **one** chromosome at metaphase of mitosis.

On the chromosome you have drawn add labels to show:

- the position of a telomere
- a chromatid
- the centromere.

[4]

(ii) State the type of protein that is associated with DNA in chromosomes.

..... [1]

(iii) Describe how the spindle is involved during the process of mitosis.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 11]

47. 9700_w20_qp_21 Q: 1

(a) Fig. 1.1 is a diagram of a human chromosome at a stage in mitosis.

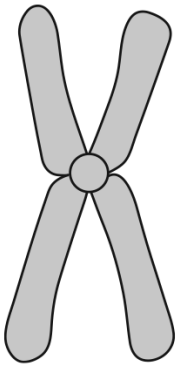


Fig. 1.1

(i) The paragraph describes the structure of the chromosome shown in Fig. 1.1.

Complete the paragraph using the most appropriate term in each space provided.

The chromosome shown in Fig. 1.1 has two genetically identical ..... joined at a ..... . The chromosome is composed of two DNA molecules, each wrapped around proteins known as ..... proteins.

[3]

(ii) State **one** stage during mitosis when the chromosome would appear as shown in Fig. 1.1.

..... [1]

(iii) Suggest the role of ATP in the process of mitosis.

.....

.....

.....

.....

..... [2]

(b) Prokaryotes divide by a process known as binary fission.

Fig. 1.2 shows some of the stages in binary fission.

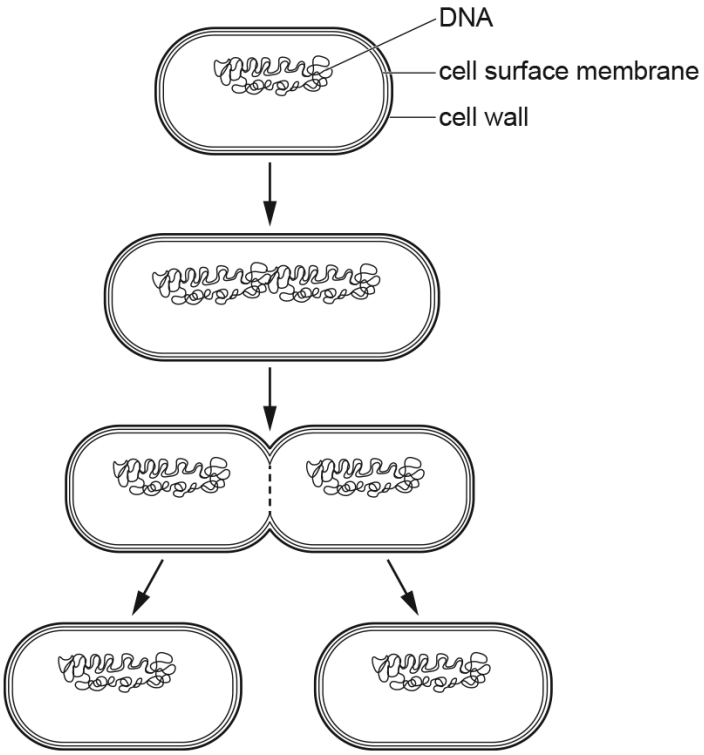


Fig. 1.2

With reference to Fig. 1.2, identify **two** events that occur during binary fission that do **not** occur during mitosis in human cells.

.....

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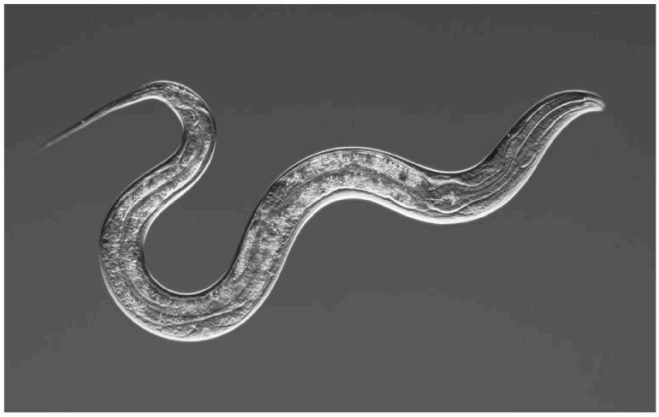
.....

..... [2]

[Total: 8]

48. 9700_w20_qp_23 Q: 3

Fig. 3.1 shows the nematode worm, *Caenorhabditis elegans*.



magnification ×250

Fig. 3.1

Stem cells of *C. elegans* have been studied.

Fig. 3.2 shows the change in mass of DNA per nucleus in a stem cell during one cell cycle.

1 pg = 1×10^{-12} g

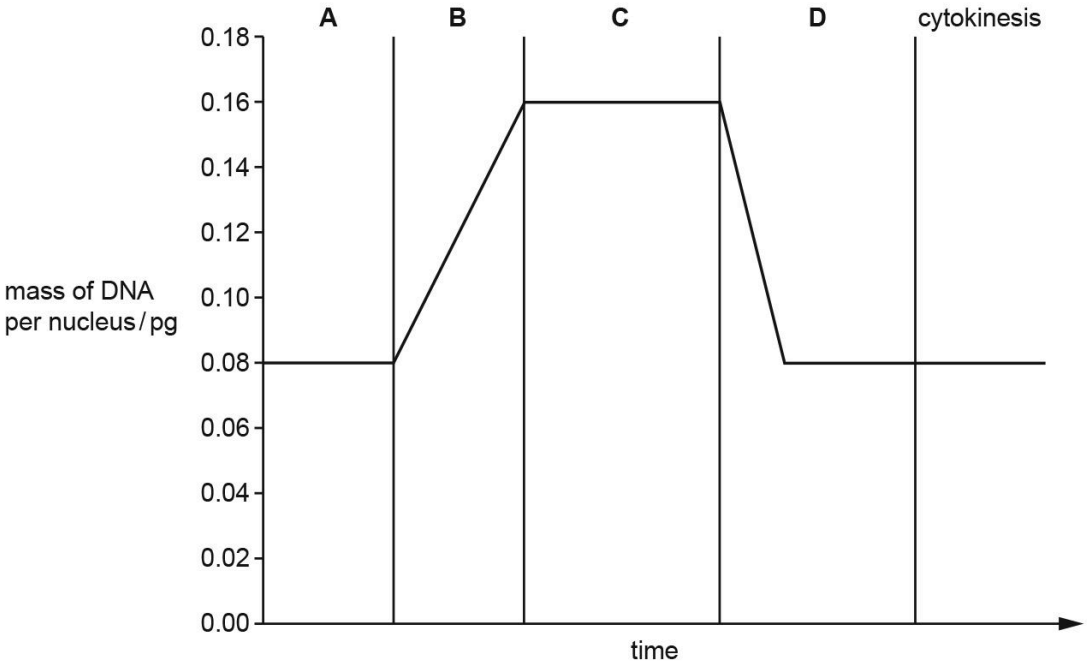


Fig. 3.2

(a) (i) State the phases of interphase shown by **A** and **B** in Fig. 3.2.

A .....

B .....

[2]

(ii) State the stage of mitosis shown by **D** in Fig. 3.2.

..... [1]

(iii) Outline what happens in a cell in preparation for cytokinesis.

.....

.....

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.....

.....

..... [2]

(iv) A stem cell of a female *C. elegans* has 12 chromosomes.

Complete Table 3.1 to show the number of nuclei within the stem cell in stages **A**, **B** and **D** of the cell cycle shown in Fig. 3.2 **and** the number of chromosomes in each nucleus during these stages.

Table 3.1

	stage of the cell cycle		
	A	**B**	**D**
number of nuclei within the stem cell			
number of chromosomes in each nucleus			

[2]

(b) Young nematodes have stem cells throughout the body.

Fig. 3.3 summarises three cell cycles of one of these stem cells.

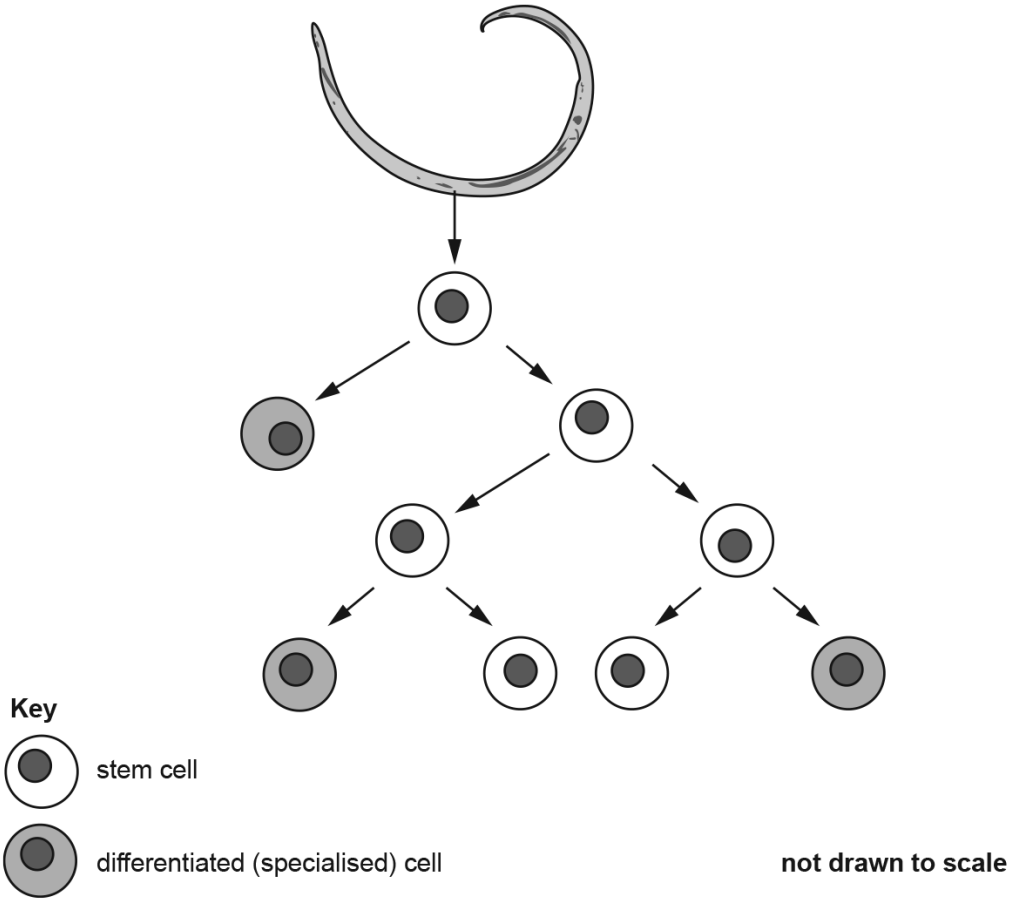


Fig. 3.3

With reference to Fig. 3.3, outline the role of stem cells in animals.

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..... [3]

[Total: 10]

49. 9700_s18_qp_23 Q: 1

Fig. 1.1 is a photomicrograph of root tip meristem. Different stages of the cell cycle are visible. Some cells are in the same stage of the cell cycle and some are in the same stage of mitosis.

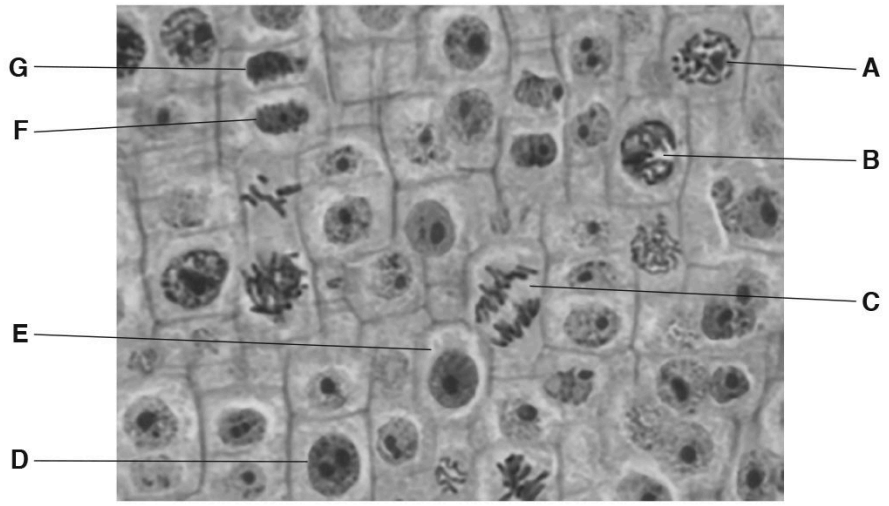


Fig. 1.1

(a) Cell **D** and cell **E** are in the same stage of the cell cycle.

State the difference between the nucleus of cell **D** and cell **E**.

.....

.....[1]

(b) Name the stage of mitosis occurring in each of cells **A**, **B** and **C**.

cell **A** .....

cell **B** .....

cell **C** .....[3]

(c) Cells **F** and **G** are newly formed cells. Cytokinesis has occurred with the formation of a cell plate.

Describe the events that have occurred in the stage of mitosis immediately **before** cytokinesis.

.....

.....

.....

.....[2]

[Total: 6]

50. 9700_w18_qp_22 Q: 3

The response of the human body to tissue damage depends on the types of tissues involved. Epithelial tissue, liver tissue and cardiac muscle tissue each respond differently to damage.

- Epithelial tissue of the gas exchange system contains stem cells.
- Liver tissue contains cells in a non-dividing state that can enter a cell cycle when stimulated.
- Cardiac muscle tissue contains cells that cannot divide at all. Damage is permanent and is associated with scar tissue formation.

(a) Explain the importance of mitosis in the repair of damaged tissue.

.....

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..... [2]

(b) Explain why stem cells are important in tissue repair.

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..... [2]

(c) Following liver tissue damage, chemicals are produced and released into the circulation. These chemicals are able to stimulate the liver cells to help tissue repair.

Explain how this is an example of cell signalling.

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.....

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.....

.....

..... [3]

[Total: 7]

51. 9700_m17_qp_22 Q: 3

Catalase is an enzyme that catalyses the breakdown of hydrogen peroxide, a toxic waste product of metabolism.

$$2H_2O_2 \xrightarrow{\text{catalase}} 2H_2O + O_2$$

Fig. 3.1 shows the results of an investigation into the effect of hydrogen peroxide concentration on the rate of the catalase-controlled reaction, with and without the presence of two different inhibitors.

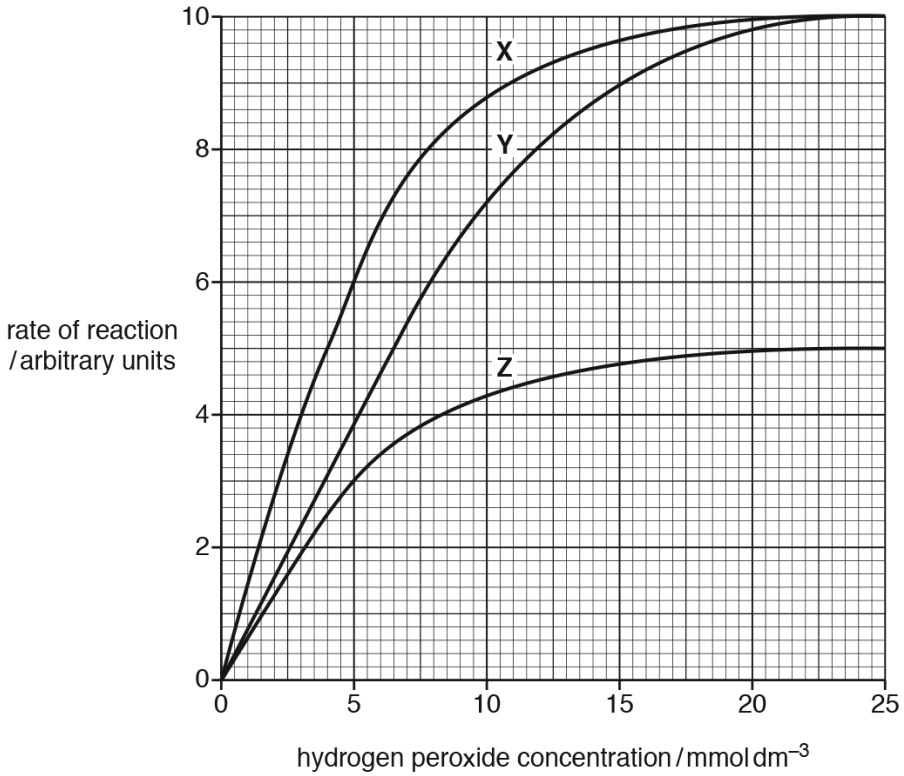


Fig. 3.1

(a) The inhibitors used in the investigation have different modes of action.

Identify which of curves **X**, **Y** and **Z** are the results for:

- the reaction with the non-competitive inhibitor
- the reaction with the competitive inhibitor
- the reaction without any inhibitor.

non-competitive inhibitor .....

competitive inhibitor .....

without any inhibitor .....

[1]

(b) With reference to Fig. 3.1, compare the maximum rate of reaction, V_{max}, and the Michaelis-Menten constant, K_m, for curves **X**, **Y** and **Z**.

V_{max} .....

.....

.....

.....

K_m .....

.....

.....

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.....

[4]

Hydrogen peroxide has a harmful effect on cells. One effect is to damage DNA.

(c) Describe the structure of DNA.

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..... [4]

(d) The cell has mechanisms to repair the damage to DNA caused by hydrogen peroxide. Errors in repair may cause a change to the structure of DNA.

Studies have investigated possible risks associated with foods and drinks that contain hydrogen peroxide. This is because the compound can be considered a mutagen. Mutagens cause mutations.

Explain why hydrogen peroxide can be considered a mutagen.

.....

.....

.....

.....

..... [2]

[Total: 11]

52. 9700_w17_qp_21 Q: 1

Fig. 1.1 is a photomicrograph of plant cells showing stages in cell division.

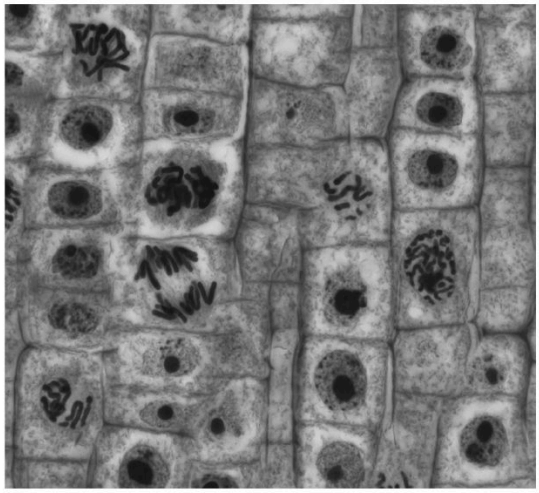


Fig. 1.1

(a) On Fig. 1.1, draw a circle around a cell in anaphase. [1]

(b) Suggest the advantages of using a light microscope, rather than an electron microscope, to study cell division.

.....

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.....

.....

..... [2]

(c) Mitosis is important in producing more cells for plant growth.

Describe **three other** ways in which mitosis is important in plants.

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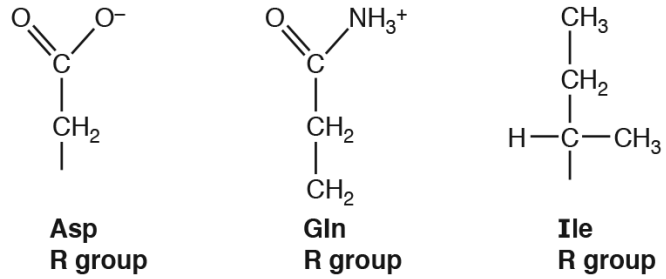
.....

..... [3]

[Total: 6]

53. 9700_w17_qp_21 Q: 4

Fig. 4.1 shows the structure of the R groups of three amino acids, aspartate (Asp), glutamine (Gln) and isoleucine (Ile).



Asp R group **Gln R group** **Ile R group**

Fig. 4.1

(a) One of the mRNA codons for the amino acid Gln is CAA.
A mutation could change this codon from CAA to UAA.

UAA is a STOP codon.

State what is meant by a STOP codon.

.....

.....

.....[1]

(b) Many proteins that contain the amino acids shown in Fig. 4.1 are globular.

Describe how the three R groups in Fig. 4.1 can contribute to the globular structure of a protein.

.....

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.....[4]

(c) An example of a globular protein is the enzyme starch phosphorylase. This enzyme catalyses the conversion of starch to glucose-1-phosphate.

Name the type of bond that is broken when starch is converted to glucose-1-phosphate.

.....[1]

An investigation was carried out to find out how the activity of starch phosphorylase varied with temperature, when free in solution and when immobilised in alginate.

The results are shown in Fig. 4.2.

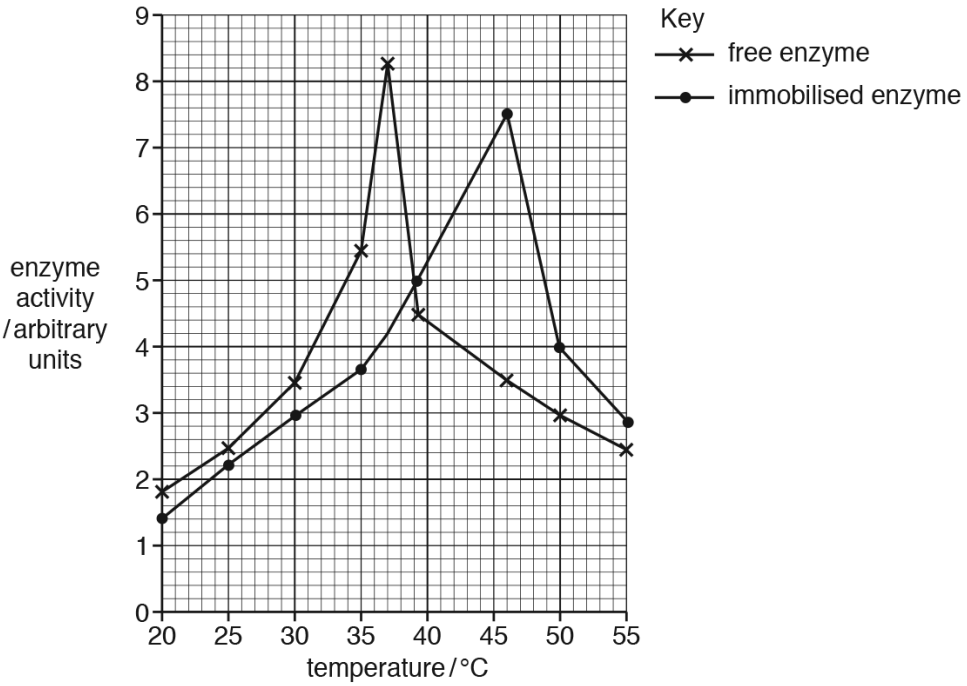


Fig. 4.2

(d) With reference to Fig. 4.2, compare the results for the enzyme activity when free in solution and when immobilised.

.....

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.....

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.....

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.....

.....

.....[4]

(e) State how the Michaelis–Menten constant (K_m) is derived from V_{max} for an enzyme.

.....

.....

.....[1]

(f) The K_m values for starch phosphorylase were determined when free in solution and when immobilised.

The K_m values were:

- free in solution, $K_m = 0.34\,\text{mmol}\,\text{dm}^{-3}$
- immobilised, $K_m = 0.84\,\text{mmol}\,\text{dm}^{-3}$.

Suggest an explanation for the difference between the two values.

.....

.....

.....

.....

.....

.....[2]

[Total: 13]

54. 9700_w16_qp_21 Q: 1

Fig. 1.1 is a transmission electron micrograph of part of an animal cell.

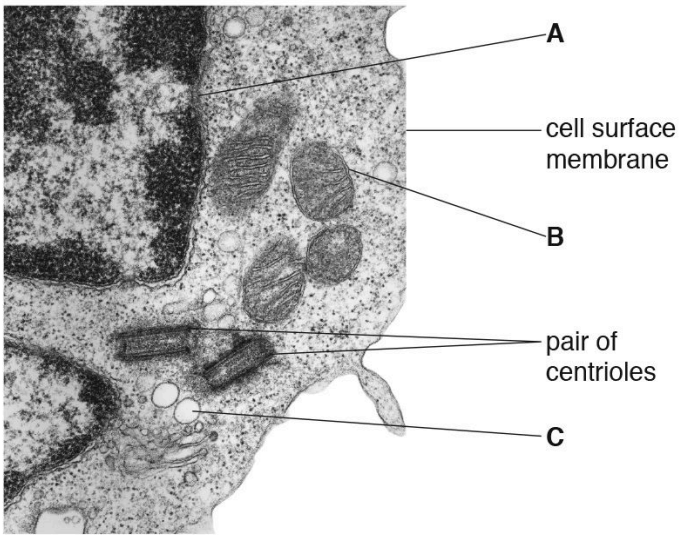


Fig. 1.1

(a) Name the structures **A**, **B** and **C**.

A .....

B .....

C .....[3]

(b) Name **one** structure, visible in Fig. 1.1, that would also be present in a prokaryotic cell.

.....[1]

(c) Cells such as that in Fig. 1.1 can divide by mitosis.

Describe the role of centrioles in mitosis.

.....

.....

.....

.....

.....[2]

(d) Sodium ions cross cell surface membranes using facilitated diffusion or active transport.

Explain why sodium ions cross cell surface membranes by these mechanisms and **not** by simple diffusion.

.....

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 9]

5.2 Chromosome behaviour in mitosis

55. 9700_w19_qp_22 Q: 6

Telomerase is an enzyme that is important in maintaining the telomeres that are located at the ends of chromosomes.

(a) Explain the importance of telomeres.

.....

.....

.....

.....

..... [2]

(b) Suggest why telomerase is present in much higher quantities in stem cells and cancer cells than in other cell types.

.....

.....

..... [1]

(c) Studies suggest that telomerase is a flexible molecule when binding its substrate. The active site changes its shape slightly to allow the formation of the enzyme-substrate complex.

Name the theory that describes this mode of enzyme action.

..... [1]

(d) An investigation was carried out into the effect of substrate concentration on the activity of telomerase.

The results are shown in Fig. 6.1.

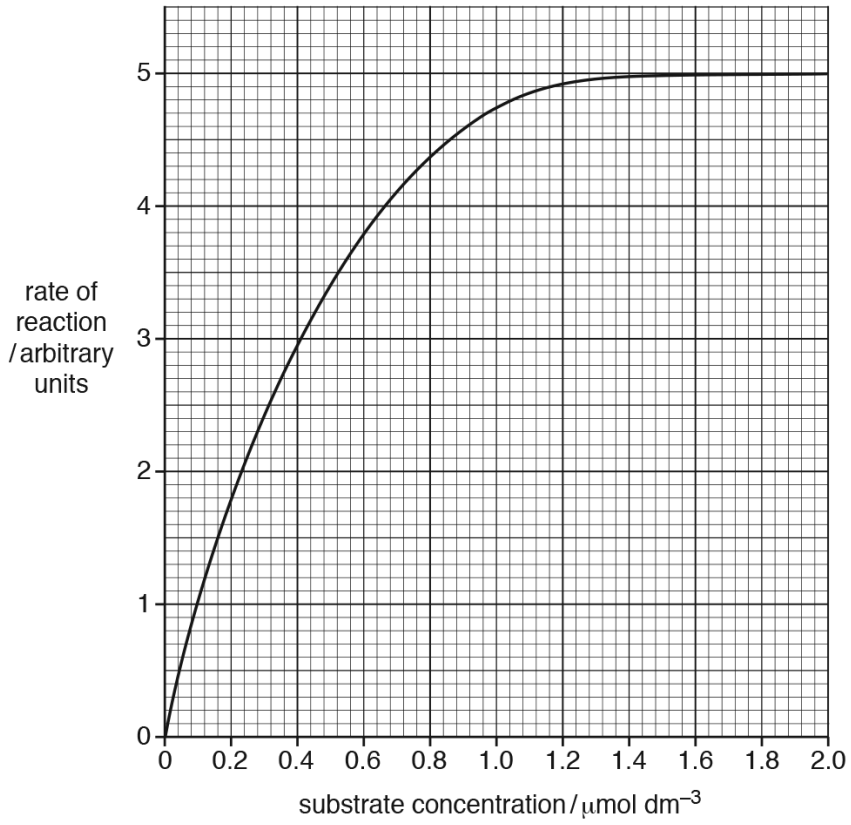


Fig. 6.1

With reference to Fig. 6.1, explain the difference in the rates of reaction obtained for telomerase at a substrate concentration of 0.2 μmol dm^{-3} compared with a substrate concentration of 1.6 μmol dm^{-3}.

.....

.....

.....

.....

..... [2]

[Total: 6]

56. 9700_w19_qp_23 Q: 2

Meristematic tissue is found in the growing region of plants, such as root tips.

Fig. 2.1 shows a section through the meristematic region of a root tip of onion, *Allium cepa*.

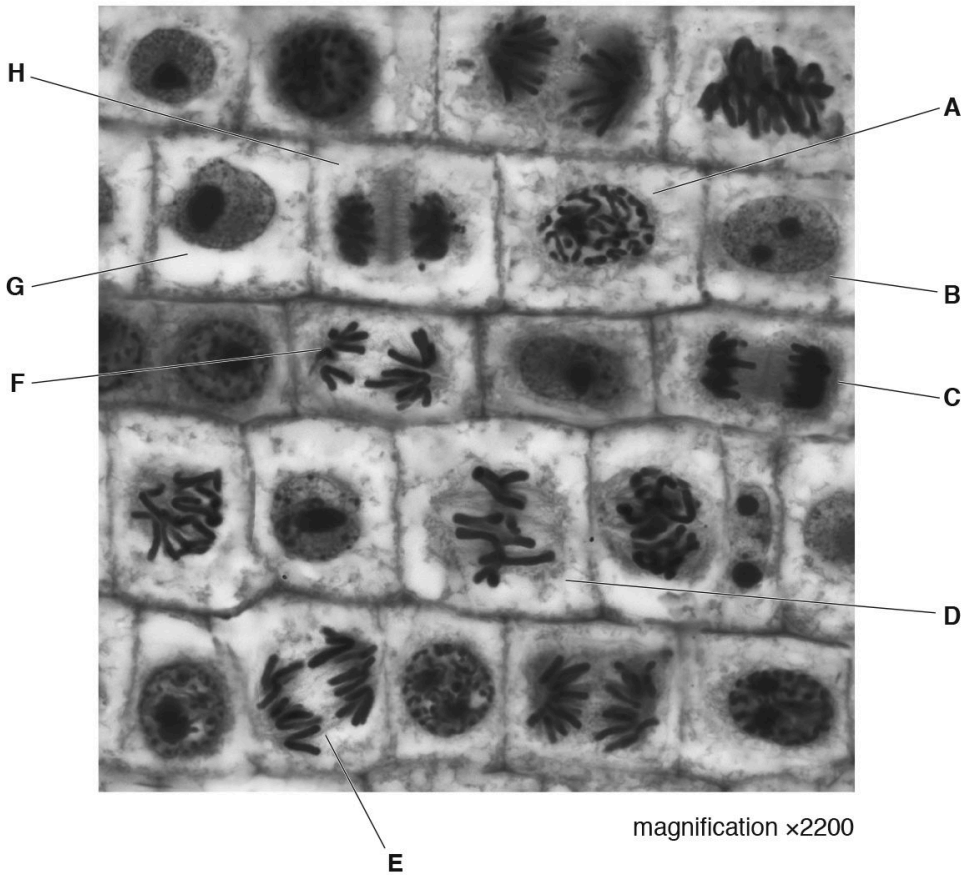


Fig. 2.1

Table 2.1 shows the numbers of cells in different stages of the cell cycle that were observed in sections of the meristematic regions of root tips of *A. cepa*.

Table 2.1

stage of cell cycle	one example of cell from Fig. 2.1	number of cells counted in each stage			
		replicate 1	replicate 2	replicate 3	mean
interphase		4686	4709	4808	4734
prophase		148	159	155	154
metaphase		38	47	40	42
anaphase		25	33	28	29
telophase		38	47	39	41
				total	5000

(a) Complete Table 2.1 by using the letters **A** to **H** from Fig. 2.1 to identify **one** cell in each stage of the cell cycle. [3]

(b) The total length of time taken for meristematic cells of *A. cepa* to complete one cell cycle at 25 °C is 12 hours.

Using sections similar to the one in Fig. 2.1, the length of time spent in each stage of the cell cycle can be estimated. To obtain the estimate, the percentage of cells in that stage is calculated.

Using the data in Table 2.1, calculate:

- the percentage of cells in anaphase
- the mean length of time in **minutes** for anaphase.

Show your working.

percentage of cells in anaphase = ... %

mean length of time in anaphase = ... min
[2]

(c) State **one** event that occurs during cytokinesis in the cell cycle of plant cells, such as those shown in Fig. 2.1.

.....

..... [1]

[Total: 6]

57. 9700_s18_qp_21 Q: 1

Fig. 1.1 is a transmission electron micrograph of a cell from the root of thale cress, *Arabidopsis thaliana*.

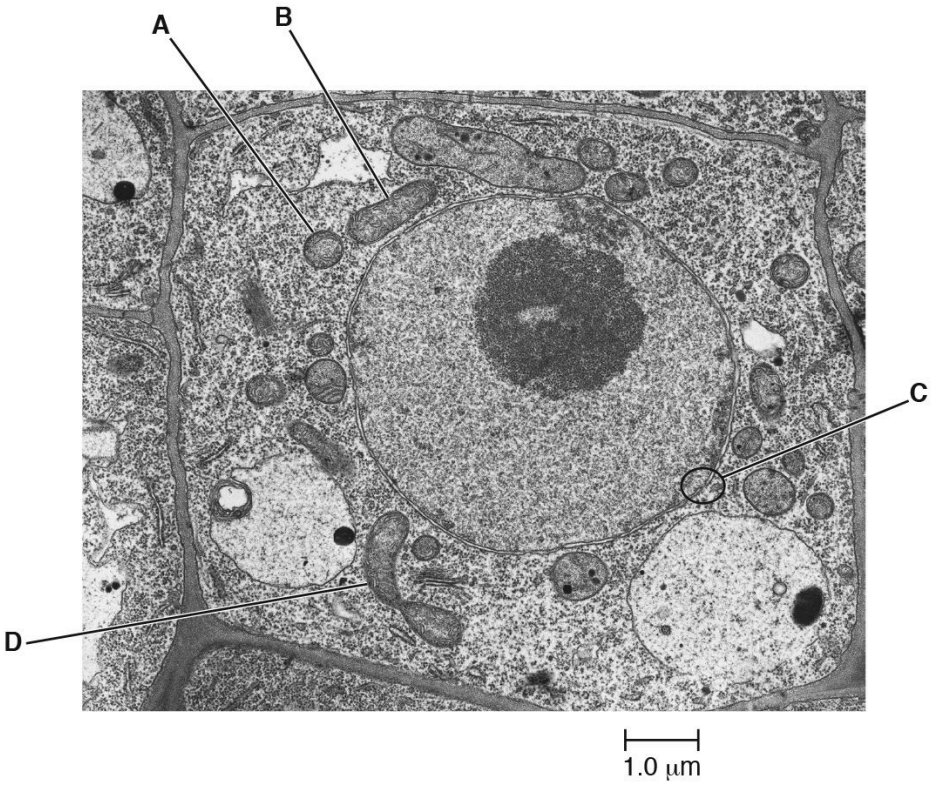


Fig. 1.1

(a) (i) The structures labelled **A** and **B** on Fig. 1.1 are sections of two mitochondria.

Suggest why **A** and **B** are different shapes.

.....

.....

.....[1]

(ii) The structure labelled **D** on Fig. 1.1 is a mitochondrion about to divide.

Explain the importance of the division of mitochondria for the cell shown in Fig. 1.1 **and** for cells in the root tips of thale cress.

.....

.....

.....

.....

.....[2]

(b) Within a cell, substances move between the nucleus and the cytoplasm. The area labelled **C** in Fig. 1.1 shows an area where this communication occurs.

Make a large, labelled drawing of area **C** to show where this communication occurs.

[2]

(c) Outline the functions of the nucleus in non-dividing cells, such as the cell in Fig. 1.1.

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.....[4]

[Total: 9]

58. 9700_s18_qp_22 Q: 4

Fig. 4.1 is a photomicrograph showing some cells in interphase and some cells in stages of mitosis.

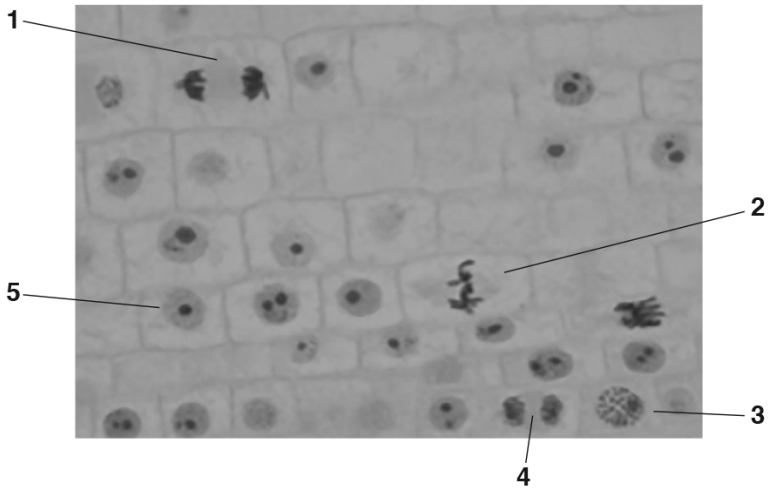


Fig. 4.1

(a) Choose from the cells labelled **1** to **5** in Fig. 4.1 to identify the cell in which:

- the nuclear envelope is reassembling .....
- the spindle begins to form .....
- there is a high rate of transcription and translation .....

[3]

(b) Cell **2** is in a stage of mitosis that occurs before the stage of mitosis shown in cell **1**.

Outline the changes that would occur from the stage of mitosis shown in cell **2** to the stage shown in cell **1**.

.....

.....

.....

.....

.....

.....[2]

(c) Suggest why some cells in Fig. 4.1 appear empty, with no nucleus or chromosomes.

.....

.....

.....[1]

[Total: 6]

59. 9700_m17_qp_22 Q: 1

A diagram of a chromosome from a dividing cell is shown in Fig. 1.1.



Fig. 1.1

(a) A dividing cell is at risk of losing genetic material each time DNA replication occurs.

On Fig. 1.1, add a label line and the letter **G** to show the location on the chromosome of an area that helps to prevent the loss of genes. [1]

(b) The chromosome shown in Fig. 1.1 consists of one long DNA molecule associated with histone proteins.

Name **one** stage of mitosis in which a chromosome would have the same general structure as the chromosome shown in Fig. 1.1.

..... [1]

(c) Name the stage in the mitotic cell cycle during which the cytoplasm and the cell divide to produce two genetically identical daughter cells.

..... [1]

(d) The control of the cell cycle can be affected by extracellular chemical messengers that bind to proteins and glycoproteins in the cell surface membrane. The overall mechanism is known as cell signalling.

State the term used to describe the proteins and glycoproteins that function in this way.

..... [1]

[Total: 4]

60. 9700_w17_qp_22 Q: 1

The root apical meristem is a region of undifferentiated cells in the root tips of plants. Mitosis occurs in this region.

(a) Fig. 1.1 is an image of the root tip of *Allium* as observed using a microscope with a low-power objective lens.

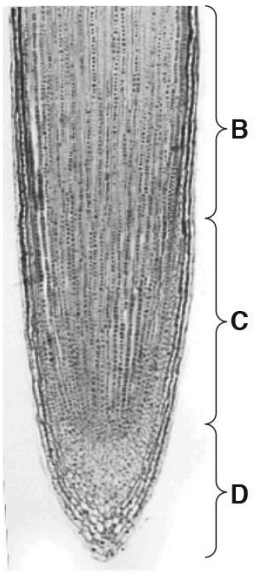


Fig. 1.1

State which region, **B**, **C**, or **D**, should be chosen in order to observe the highest proportion of cells in stages of mitosis.

.....[1]

(b) (i) Draw a labelled diagram to show the structure of a chromosome at late prophase of mitosis.

[3]

(ii) Describe the behaviour of the nuclear envelope during mitosis.

.....

.....

.....

.....

.....[2]

[Total: 6]

---

61. 9700_w17_qp_23 Q: 6

Extracellular growth factors are involved in the control of cell cycles in some mammalian cells. One of these growth factors is epidermal growth factor (EGF).

Fig. 6.1 shows the events that occur when EGF is present at the surfaces of two cells, **A** and **B**.

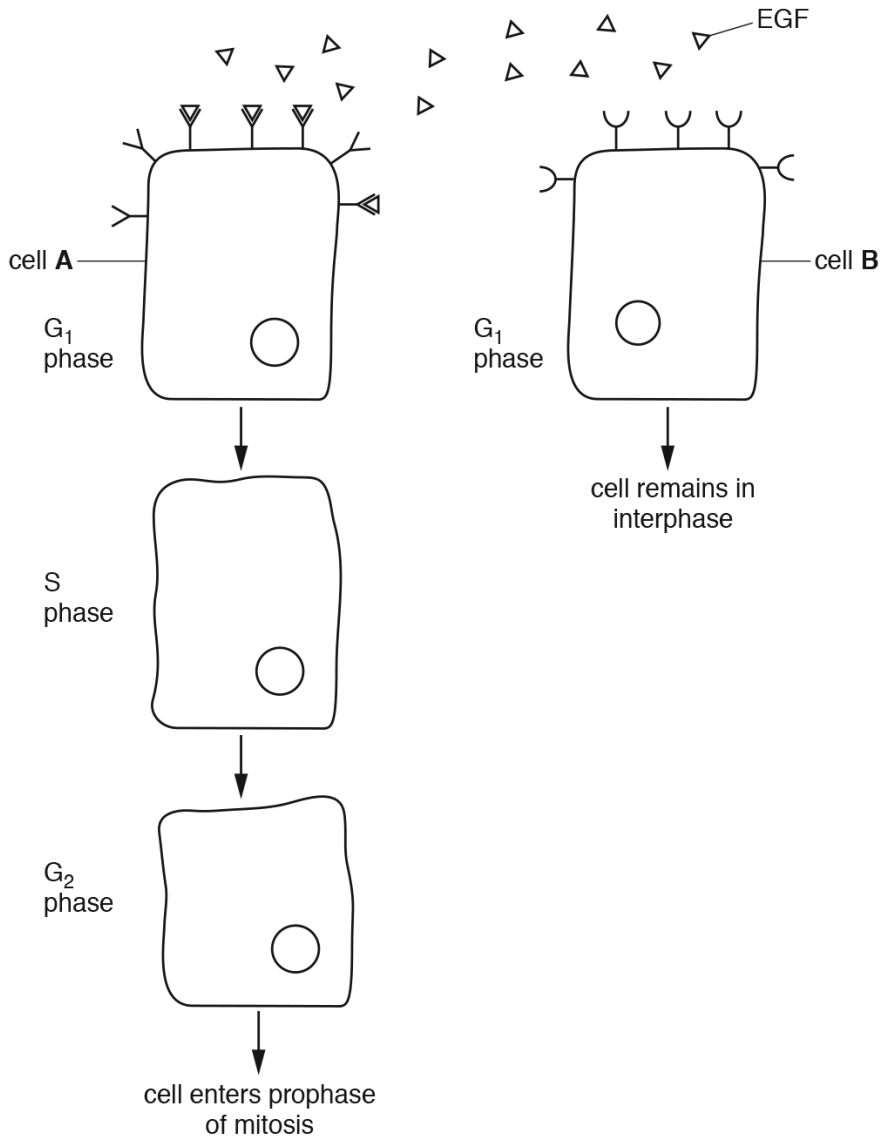


Fig. 6.1

(a) Explain why cell **A** in Fig. 6.1 responds to EGF, but cell **B** does not.

.....

.....

.....

.....

.....[2]

(b) In the cell cycle, more mRNA is produced in the G_1 phase than during mitosis.

Suggest why this is so.

.....

.....

.....

.....[1]

(c) DNA is replicated during the S phase of the cell cycle. EGF is one of many factors that stimulate the change from the G_1 phase to the S phase.

State the substances used to synthesise DNA during the S phase.

.....

.....

.....

.....

.....[3]

(d) Fig. 6.2 is a drawing of chromosome 1 from rice, *Oryza sativa*, during metaphase of mitosis.

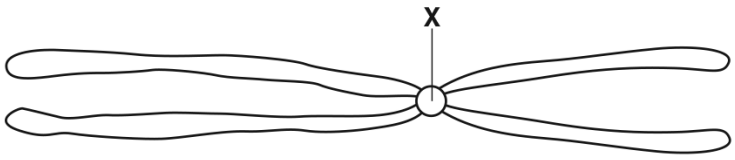


Fig. 6.2

(i) State the name and function of the region of the chromosome labelled **X**.

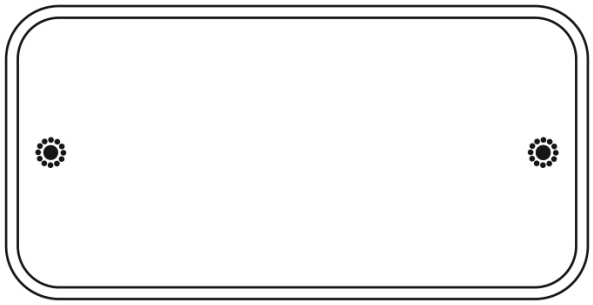
name .....

function .....

.....

.....[2]

(ii) In the outline of the cell below, draw the chromosome from Fig. 6.2 as it would appear in anaphase of mitosis.



[2]

[Total: 10]

62. 9700_s16_qp_22 Q: 5

Fig. 5.1 shows plant cells in stages of mitosis.

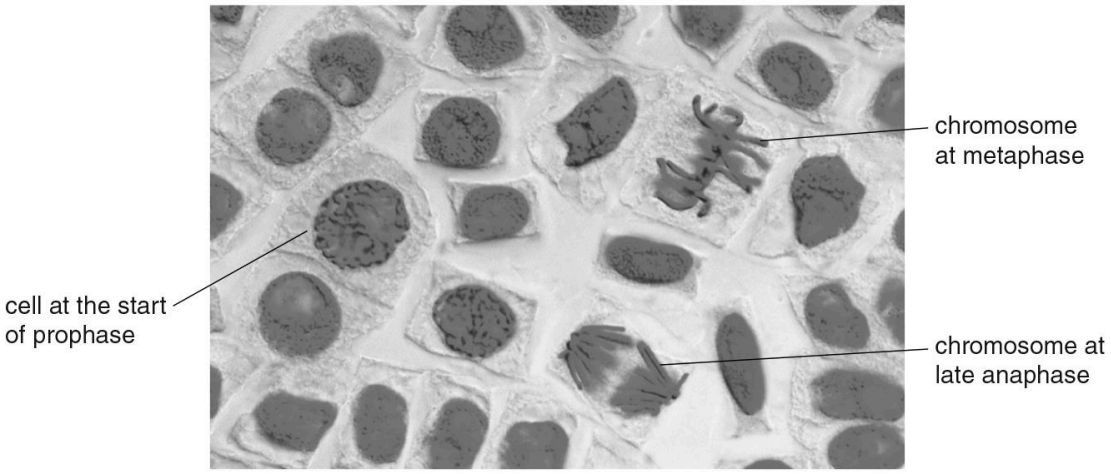


Fig. 5.1

(a) Individual chromosomes cannot be seen in the cell at the start of prophase. Changes to the chromatin occur so that by late prophase chromosomes are clearly visible.

(i) Outline what occurs during early prophase so that chromosomes become visible in late prophase.

.....

.....

.....[1]

(ii) Describe the structure of the chromosome in late prophase.

.....

.....

.....

.....

.....

.....

.....[3]

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(b) State **two** differences between the chromosome at metaphase and the chromosome at late anaphase.

.....

.....

.....

.....

.....

.....[2]

(c) One of the functions of a plant hormone known as cytokinin is to act as a cell signalling molecule and promote cytokinesis.

Suggest how cytokinin acts as a cell signalling molecule.

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.....

.....

.....

.....

.....[3]

[Total: 9]

63. 9700_w16_qp_22 Q: 1

Match the description for each of statements **A** to **E** to a correct cell structure.

A Double membrane-bound organelle, absent in animal cells, that produces ATP.

.....

B Partially permeable membrane surrounding the large permanent vacuole of plant cells.

.....

C Formed from microtubules during mitosis.

.....

D Has peptidoglycan as one of its major components.

.....

E Site of assembly of 80S ribosomes.

.....

[5]

[Total: 5]

64. 9700_s15_qp_21 Q: 1

A student investigated growth in the roots of broad bean, *Vicia faba*. The student cut sections of the root tip of this plant and viewed them with a light microscope.

Fig. 1.1 is a photomicrograph of one of the sections. The cell labelled **D** is in interphase.

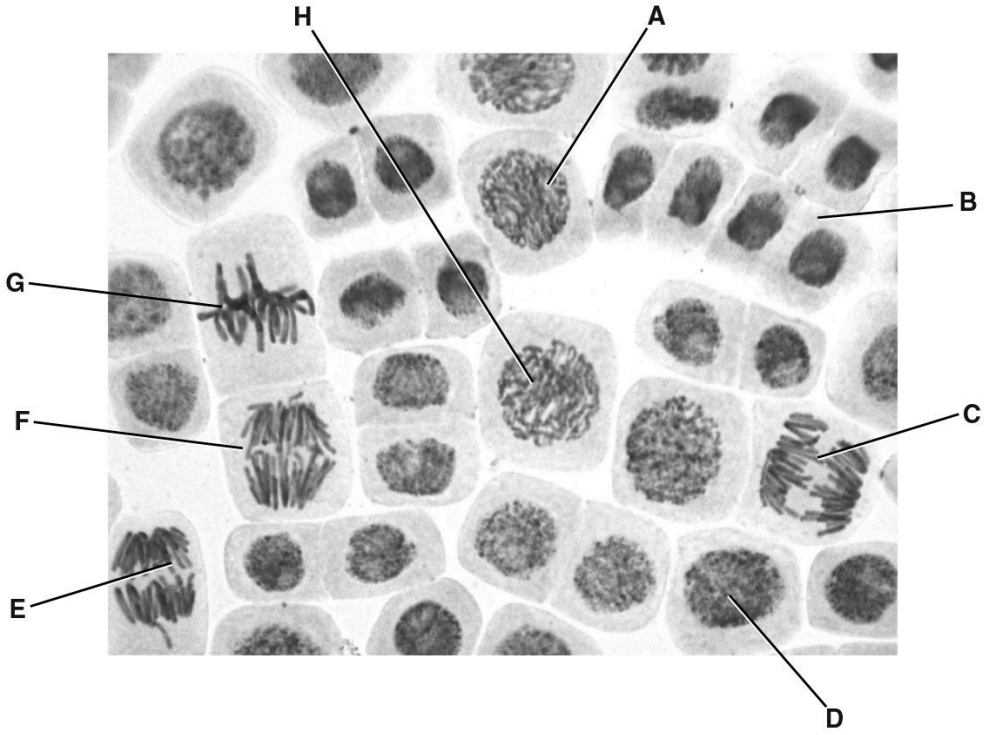


Fig. 1.1

(a) Complete the table below by:

- naming the stages of mitosis in the correct sequence following interphase
- identifying **one** example from the cells labelled **A** to **H** that is in each stage of mitosis that you have named.

stage of mitosis	label from Fig. 1.1

[5]

(b) In animal cells, centrioles are responsible for assembling microtubules to make the spindle at the beginning of mitosis.

Describe the role of the spindle during mitosis.

.....

.....

.....

.....

.....

.....[2]

(c) State two roles of mitosis in plants and animals **other than growth**.

1 .....

2 .....[2]

(d) *V. faba* is a legume. Roots of legumes often have swellings at intervals known as nodules. Cells within the nodules contain nitrogen-fixing bacteria.

(i) Explain the role of nitrogen fixation in the nitrogen cycle.

.....

.....

.....

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.....

.....[2]

(ii) Farmers in some parts of the world grow legume crops together with cereal crops in the same field. This is known as intercropping.

Explain how intercropping results in an increase in the yield of the cereals when the legumes die.

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.....[3]

[Total: 14]

65. 9700_w15_qp_22 Q: 3

The photomicrographs in Fig. 3.1 show stages of the mitotic cell cycle occurring in the root tip of the onion, *Allium sp*. They are all of the same magnification. Stages **A** to **C** are in the correct sequence and stages **K** to **N** are **not** in the correct sequence.

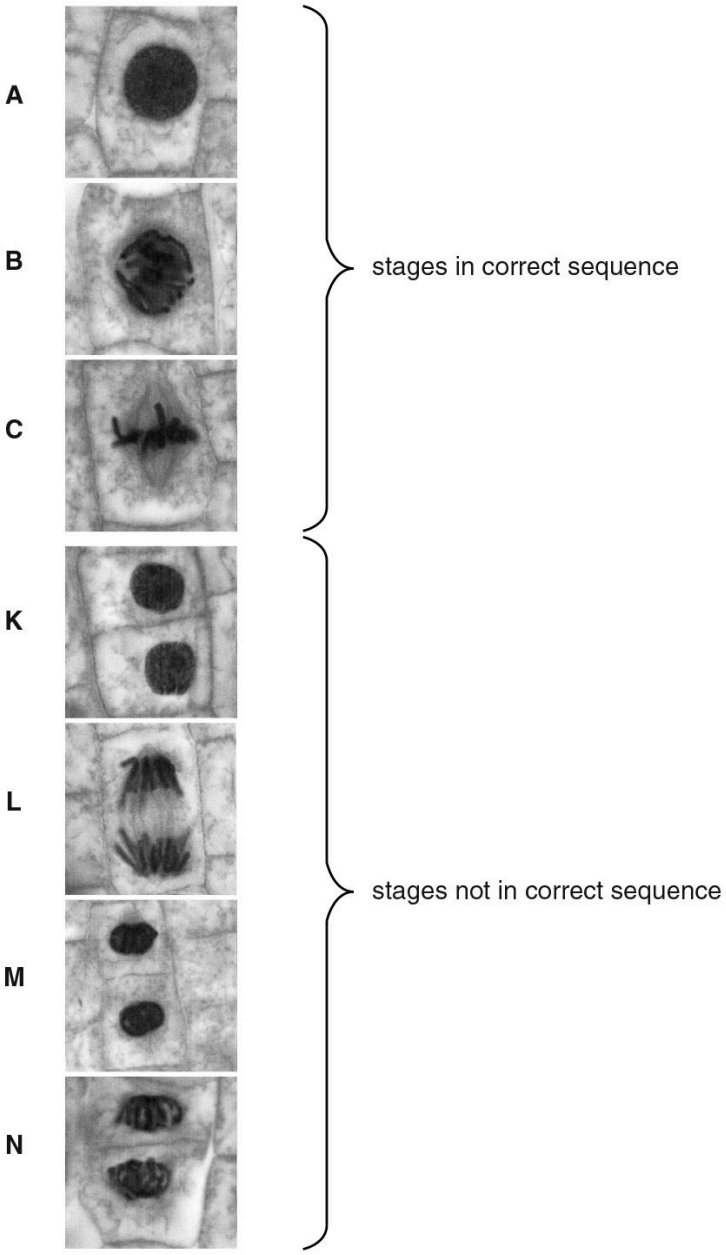


Fig. 3.1

(a) Name stages **A** and **C**.

A .....

C ..... [1]

(b) Put stages **K** to **N** in the correct sequence, starting with the stage that immediately follows stage **C**.

C ⟶ ..... ⟶ ..... ⟶ ..... ⟶ ..... [1]

(c) Explain how the behaviour of the chromosomes and spindle during stage **L** in Fig. 3.1 ensures that the two daughter cells will be genetically identical.

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[Total: 5]

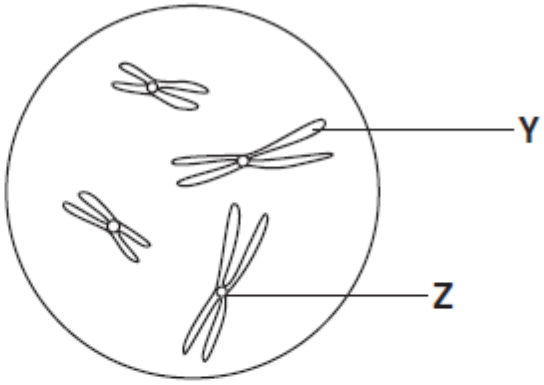
1.

16 What occurs in mitosis?

	homologous chromosomes pair	chromosome number remains the same
A	✗	✓
B	✓	✗
C	✗	✗
D	✓	✓

2.

The diagram shows chromosomes in a nucleus.



What are **Y** and **Z**?

	Y	Z
A	centromere	centriole
B	centromere	chromatid
C	chromatid	centriole
D	chromatid	centromere

3. Colchicine is a chemical that stops chromatids from separating during mitosis.

Which phase will the cell reach and then stop dividing?

A anaphase

B interphase

C metaphase

D telophase

4. Which statement describes events during interphase of mitosis?

A Chromosomes start to coil, becoming shorter and fatter.

B Chromosomes line up on the equator of the spindle.

C Chromatids are pulled apart by spindle fibres.

D Chromosomes are replicated ready for the next division.

5. Which statement about the strands of a newly replicated DNA molecule is correct?

A Both strands are made up of newly assembled nucleotides.

B Both strands contain some nucleotides from the original molecule.

C One strand is new and the other is part of the original molecule.

D The sugar-phosphate chains are conserved and new bases are inserted between them.

6. During which process does mitosis occur?

A the production of antibodies from B-lymphocyte memory cells

B the production of cancerous tissue in alveoli

C the production of mucus from goblet cells

D the production of plaques in atherosclerosis

7. What happens to chromosomes in prophase of mitosis?

A They are formed by replication of DNA.

B They attach to the spindle fibres.

C They divide to form chromatids.

D They shorten and become visible.

8. The diagram shows the chromosomes of one cell which has been squashed during mitosis.



Which stage of mitosis is shown and what is the haploid chromosome number in this species?

	stage of mitosis	haploid chromosome number
A	anaphase	5
B	anaphase	10
C	metaphase	5
D	metaphase	10

9. Which cell activity must occur before prophase of mitosis can begin?

A breakdown of the nuclear envelope

B increased production of mRNA

C migration of centrioles to opposite poles

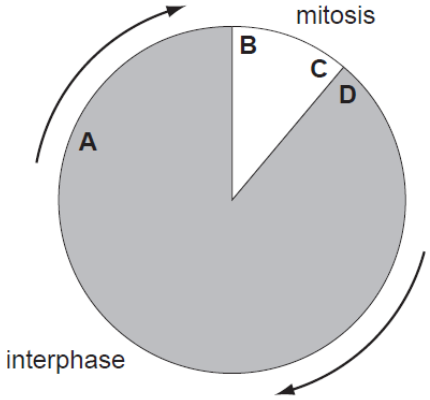
D replication of DNA

10. What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

11. The diagram shows the mitotic cell cycle.

When radioactive nucleotides are supplied to dividing cells, at which point will they be incorporated into the chromosomes?



12. Which processes involve mitosis?

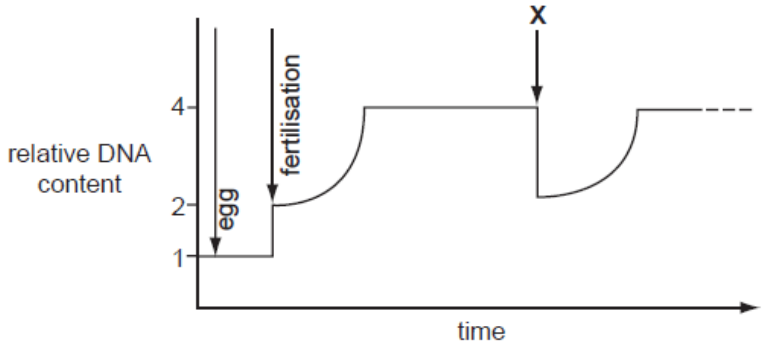
A growth, reduction division and asexual reproduction

B growth, repair and asexual reproduction

C growth, repair and semi-conservative replication

D repair, reduction division and asexual reproduction

13. The graph represents the changes in the quantity of DNA present in one nucleus at different stages in the life cycle.



Which stage takes place at **X**?

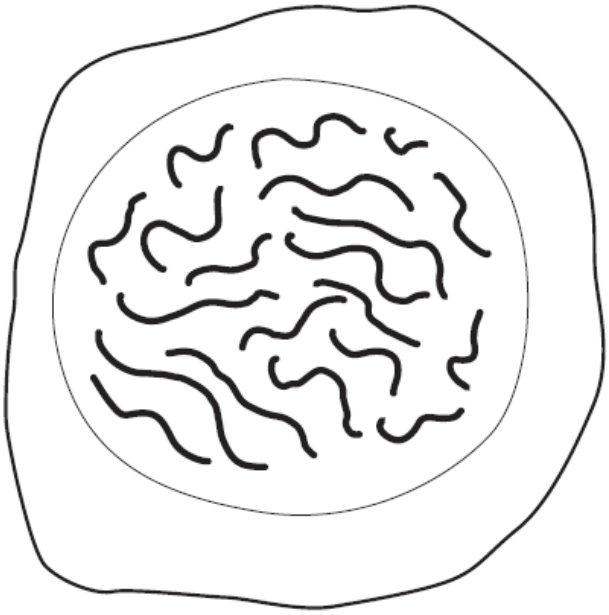
A interphase

B metaphase

C prophase

D telophase

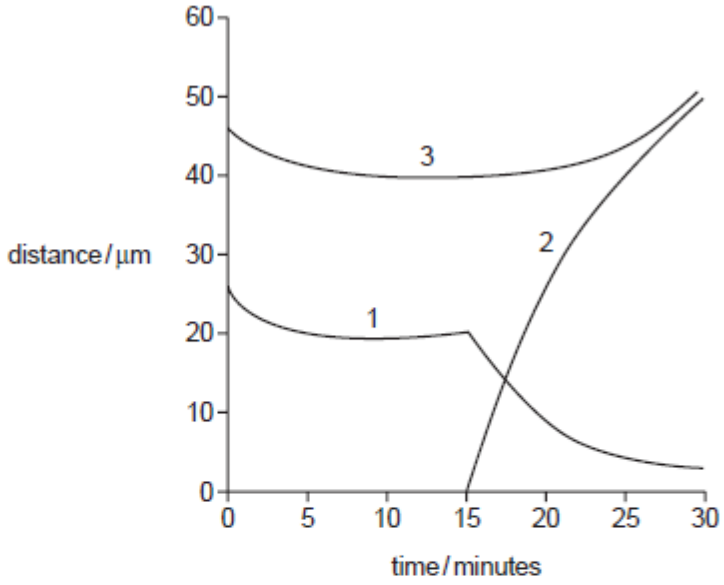
14. The diagram shows a cell of an organism formed by reduction division.



What is the diploid number for this organism?

A 10 **B** 20 **C** 40 **D** 46

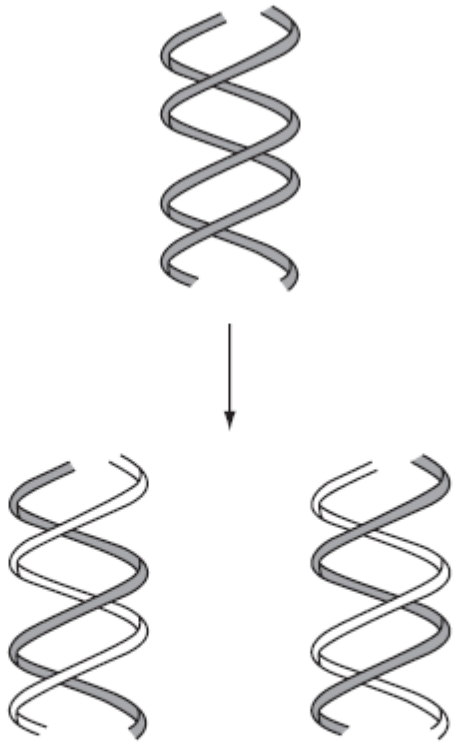
15. The graph shows three measurements obtained following metaphase of mitosis



What measurements do the curves represent?

	distance between centromeres and poles of spindle	distance between centromeres of sister chromatids	distance between poles of spindle
A	1	2	3
B	1	3	2
C	3	1	2
D	3	2	1

16. The diagram shows a process involving DNA.



What is the name of the process and the stage in the cell cycle at which it occurs?

	process	stage
A	replication	interphase
B	replication	prophase
C	transcription	interphase
D	transcription	prophase

17. What occurs in anaphase of mitosis?

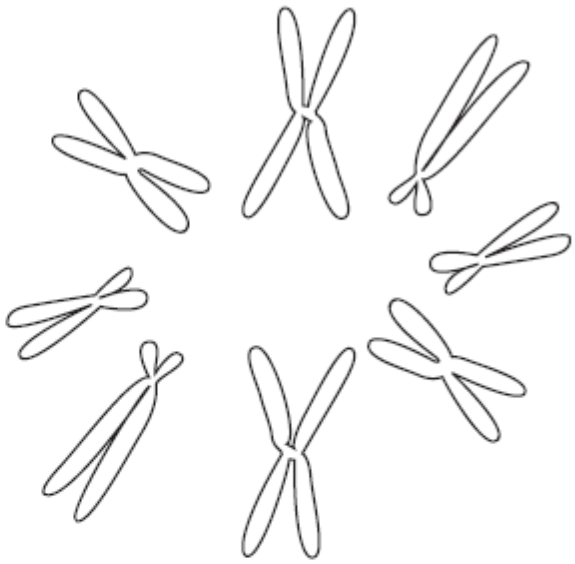
A chromatids line up on the equator of the cell

B chromatids reach the poles of the spindle

C chromatids separate and move to opposite poles

D chromatids start to coil up and become visible

18. The diagram shows chromosomes at metaphase of mitosis.



What are the diploid and haploid numbers for this species?

	diploid	haploid
A	4	8
B	8	4
C	8	16
D	16	8

19. Which process occurs during prophase of the mitotic cell cycle in an animal cell?

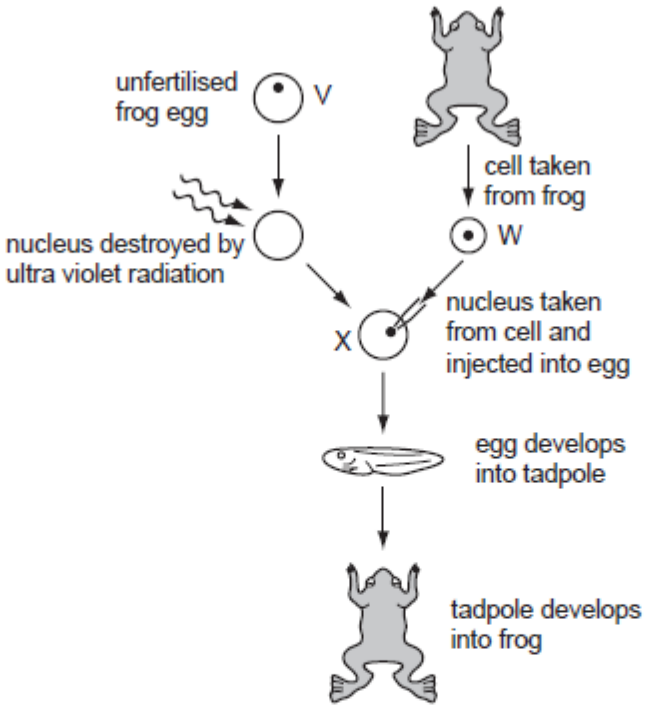
A division of centromeres

B formation of chromosomes

C replication of DNA

D separation of centrioles

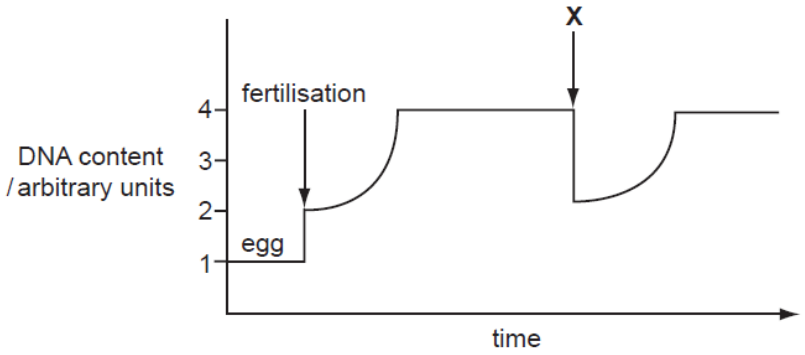
20. The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs. The diploid number (2n) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the types of cell in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

21. The graph represents the changes in the quantity of DNA present in one nucleus at different stages in the life cycle of a mammal.



Which stage takes place at **X**?

A interphase

B metaphase

C prophase

D telophase

22. At which stage of mitosis do these events occur?

	centromeres separate	spiralisation and condensation of DNA
A	anaphase	interphase
B	anaphase	prophase
C	metaphase	interphase
D	metaphase	telophase

23. During which process does only mitosis occur?

A the production of antibodies from B-lymphocyte memory cells

B the production of cancerous tissue in alveoli

C the production of gametes

D the production of root hairs

24. At which stage of mitosis do these events occur?

	centromeres separate	spiralisation and condensation of DNA
A	anaphase	interphase
B	anaphase	prophase
C	metaphase	interphase
D	metaphase	telophase

25. During which process does only mitosis occur?

A the production of antibodies from B-lymphocyte memory cells

B the production of cancerous tissue in alveoli

C the production of gametes

D the production of root hairs

26. Which is always true of cytokinesis?

1 Cell organelles replicate.

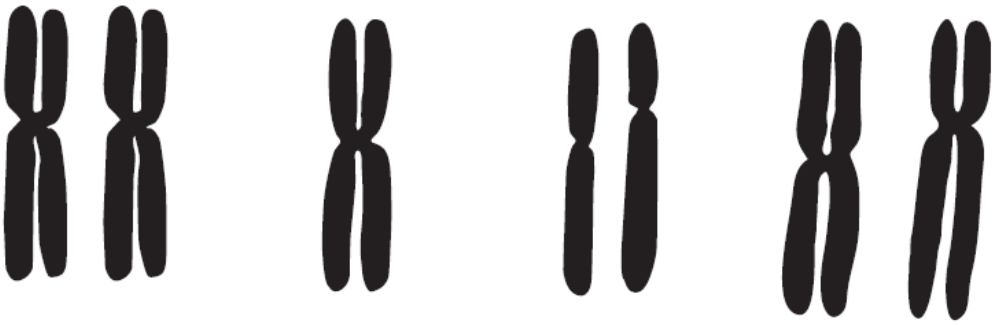
2 Cell organelles are divided between two cells.

3 Nuclear envelope reforms.

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

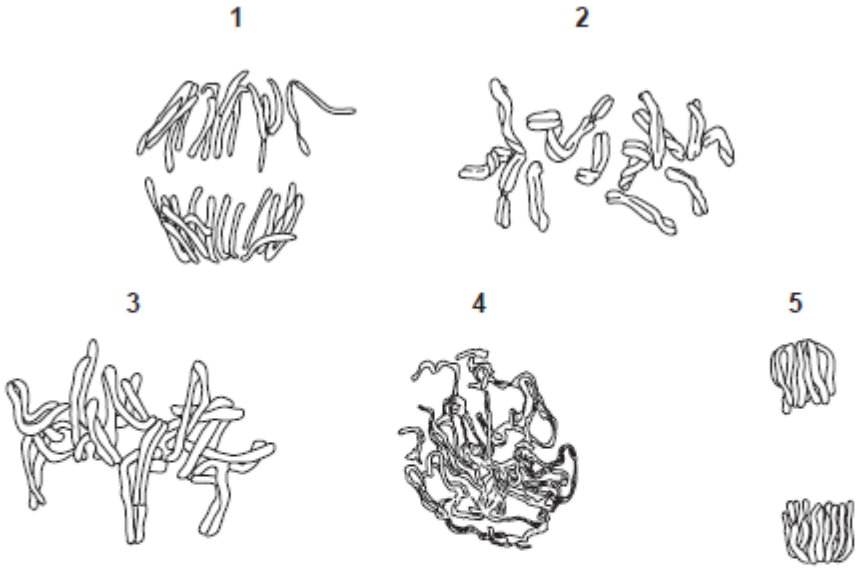
27. The diagram shows chromosomes taken from the nucleus of a cell.

Which diagram represents a pair of homologous chromosomes?



A **B** **C** **D**

28. The drawings show stages of the mitotic cell cycle.



In which order do the stages occur?

	first → last				
A	2	1	3	5	4
B	2	4	1	5	3
C	4	2	1	3	5
D	4	2	3	1	5

29. Immediately after which stage in mitosis in an animal cell does the cytoplasm start to divide?

A anaphase

B metaphase

C prophase

D telophase

30. The diagram shows a diploid cell during mitosis.



Which stage of mitosis is shown?

A anaphase

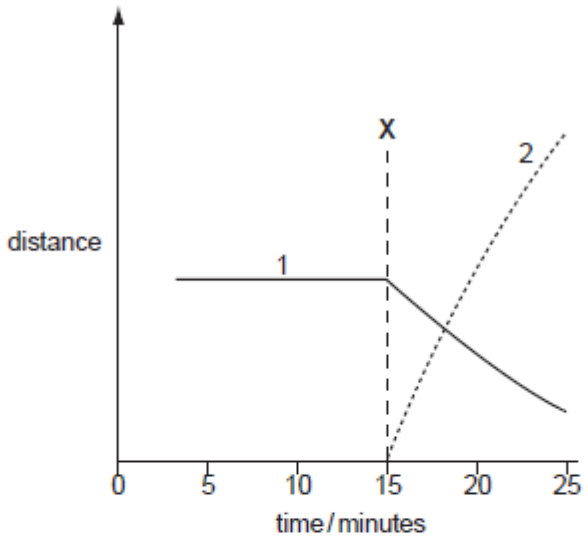
B metaphase

C prophase

D telophase

31.

The graph shows measurements taken during one mitotic cell cycle.

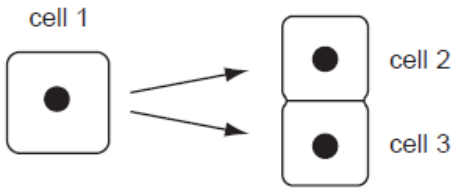


Which stage of mitosis begins at **X** and which measurements are shown by curves 1 and 2?

	stage beginning at **X**	distance between centromeres of chromosomes and poles of spindle	distance between centromeres of sister chromatids
A	anaphase	1	2
B	anaphase	2	1
C	metaphase	1	2
D	metaphase	2	1

32. Human cells contain 46 chromosomes.

The diagram shows a human cell in prophase of mitosis (cell 1) and the daughter cells just after telophase (cells 2 and 3).



How many DNA molecules are there in the nucleus of cell 1 and cell 2?

	cell 1	cell 2
A	46	23
B	46	46
C	92	23
D	92	46

33. Which process occurs during prophase of mitosis in an animal cell?

A division of centromeres

B formation of chromosomes

C replication of DNA

D separation of centrioles

34. The diagram shows an animal cell which is undergoing mitotic division.



Which stage of mitosis has been reached?

A anaphase

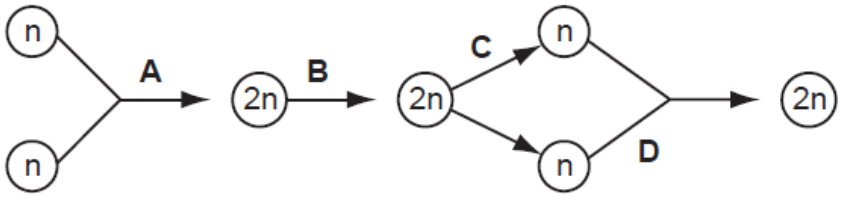
B metaphase

C prophase

D telophase

35. The diagram represents the life cycle of an animal.

At which stage in the life cycle does mitosis occur?



36. To which of the processes shown does mitosis make a contribution?

	genetic variation	increase in cell number	replacement of damaged cells
A	✗	✓	✓
B	✓	✗	✗
C	✓	✓	✗
D	✗	✗	✓

key

✓ contributes to process

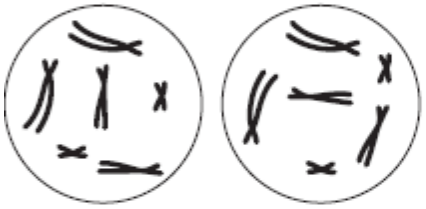
✗ does not contribute to process

37. The diagram shows the chromosomes of a cell at late prophase of mitosis.

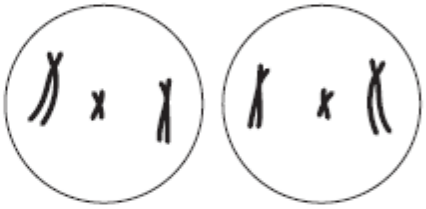


What will be the appearance of the products of this cell division as they enter prophase of their next division?

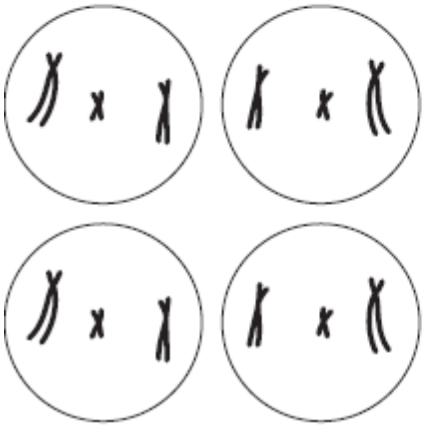
A



B



C



D



38. A diploid nucleus in a species of fruit fly has 8 chromosomes.

How many DNA molecules are present in the nucleus at the end of interphase?

A 4 **B** 8 **C** 16 **D** 32

39. Mammalian skin cells in tissue culture were supplied with a source of radioactive thymine.

At which stage in the cell cycle will the thymine be used in the nuclei?

A interphase

B metaphase

C prophase

D telophase

40. Which of the following is true of cancer?

A Each mitotic division produces more than two daughter cells.

B Mitosis has stopped.

C Mitosis is uncontrolled.

D Mitosis results in cells with variable numbers of chromosomes.

41. Each of the following events takes place during mitosis.

1 centromeres divide

2 chromatids move to opposite poles of the cell

3 chromosomes line up along the equator of the spindle

4 chromosomes uncoil

5 two chromatids are joined by a centromere

In which order do the events take place?

	first →				last
A	1	2	4	5	3
B	3	1	2	4	5
C	4	5	3	1	2
D	5	3	1	2	4

42. Which statement describes events during interphase of the mitotic cell cycle?

A Chromatids are pulled apart by spindle fibres.

B Chromosomes are replicated ready for the next division.

C Chromosomes line up on the equator of the spindle.

D Chromosomes start to coil, becoming shorter and fatter.

43. Chromosome telomeres promote DNA replication and are not completely replaced during mitosis. A substance **X** is known that completely replaces telomeres during mitosis.

What will be the effect of growing a cell culture with and without substance **X**?

	with substance **X**	without substance **X**
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

44. What is a correct description of the centrioles, nuclear envelope and spindle during mitosis in animal cells?

	phase	centrioles	nuclear envelope	spindle
A	anaphase	replicate	absent	present
B	metaphase	present	reforms	present
C	prophase	move apart	breaks up	forms
D	telophase	replicate	breaks up	breaks up

45. Which statement describes a cell that is capable of reproduction and belonging to a haploid organism?

A It has chromosomes that contain one polynucleotide chain.

B It is capable of carrying out a reduction division to form gametes.

C It possesses two copies of each gene as a result of fertilisation.

D It will undergo cell division by mitosis during asexual reproduction.

46. During which stage of the mitotic cell cycle is DNA replicated?

A anaphase

B interphase

C prophase

D telophase

47. Cancer cells divide out of control, forming tumours.

Which statement describes the difference between a cancer cell and a normal cell?

A Cancer cells do not undergo cytokinesis.

B Cancer cells have a shorter interphase.

C Cancer cells do not have metaphase.

D Only cancer cells have mutated DNA.

48. Male bees are haploid. They develop from unfertilised eggs. Female bees are diploid.

Which statements are correct?

1 All male bees are genetically identical.

2 Male bee sperm cells are produced by mitosis.

3 New combinations of genes only occur in female bees.

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

49. What describes the behaviour of the nuclear envelope and the cell membrane during mitosis?

	nuclear envelope	cell membrane
A	breaks down	breaks down
B	breaks down	remains intact
C	remains intact	breaks down
D	remains intact	remains intact

50. The cell cycle includes mitosis.

Which are features of **nuclear** division?

1 forms cells of equal size to the parent cell

2 forms genetically identical cells

3 semi-conservative replication of DNA

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

51. In which process does mitosis **not** have an important role in living things?

A asexual reproduction

B growth of cells

C increase in size

D repair to damaged tissues

52. The diagram shows the chromosomes of a typical plant cell at the metaphase stage of mitosis.



Which row describes this cell during metaphase?

	diploid number (2n) for the plant	structures present at metaphase		
		cell wall	centriole	spindle
A	4	✓	✗	✓
B	8	✗	✓	✓
C	8	✓	✗	✓
D	16	✓	✓	✗

53. The table shows the percentages of bases in DNA from various types of cell.

source of DNA	percentage of bases in DNA			
	adenine	guanine	thymine	cytosine
calf thymus	28.2	21.5	27.8	22.5
bull spleen	27.9	22.7	27.3	22.1
bull sperm	28.6	22.2	27.2	22.0
rat bone marrow	28.7	21.4	28.4	21.5
yeast	31.3	18.7	32.9	17.1

What is a valid deduction from these data?

A All cells from the same species have approximately the same content of DNA.

B Small differences in DNA from different cells have large effects.

C The four bases show complementary base pairing.

D The structure of DNA is different in yeast and animal cells.

54. What describes the behaviour of the nuclear envelope and the cell membrane during mitosis?

	nuclear envelope	cell membrane
A	breaks down	breaks down
B	breaks down	remains intact
C	remains intact	breaks down
D	remains intact	remains intact

55. Which statement about a diploid cell is **not** correct?

A It can undergo a mitotic division to allow growth to occur.

B It can undergo a mitotic division to repair a cell.

C It can undergo a reduction division to form haploid cells.

D It is one that possesses two complete sets of chromosomes.

56. Meiosis and mitosis are two types of cell division.

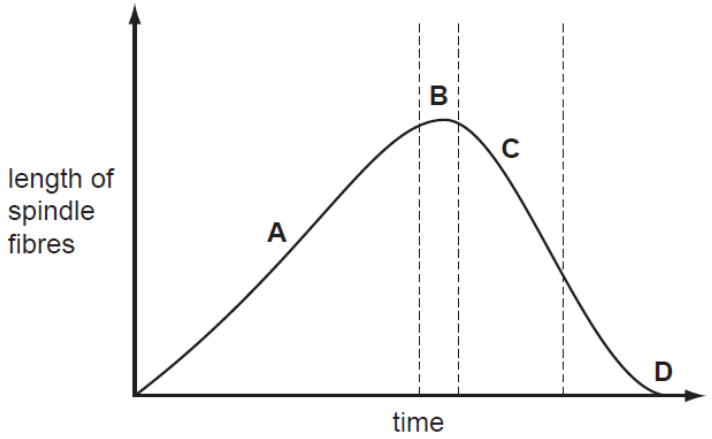
A cell has 10 chromosomes before it divides.

How many chromosomes will it have after dividing by meiosis or mitosis?

	meiosis	mitosis
A	5	10
B	5	20
C	10	5
D	20	5

57. The graph shows the length of the spindle fibres during mitosis.

Which region of the graph shows when the centromeres detach from the spindle fibres?



Q.1.

1 Fig. 1.1 shows drawings of a cell at various stages in the mitotic cell cycle.

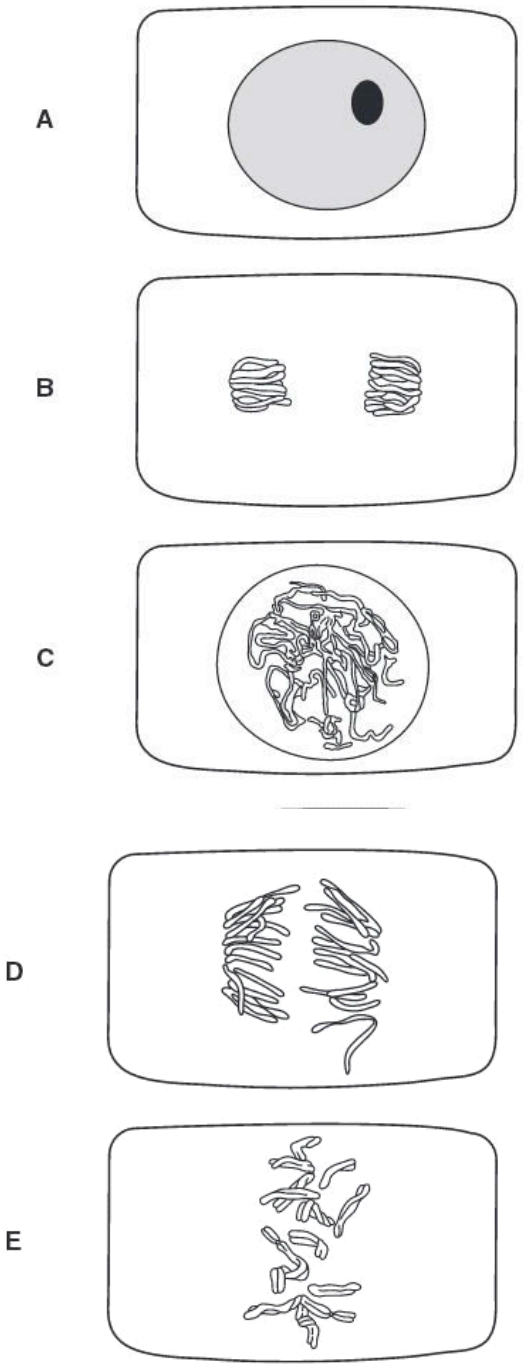


Fig. 1.1

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(a) List the letters shown in Fig. 1.1 in the order in which these stages occur during a mitotic cell cycle. The first stage has been entered for you.

A .... [1]

(b) Explain what is happening in stage **D** in Fig. 1.1.

.....

.....

.....

.....[2]

(c) Describe in outline what happens to the DNA in the nucleus during stage **A** in Fig. 1.1.

.....

.....

.....

.....

.....

.....[3]

(d) State the importance of mitosis in the growth of a multicellular organism, such as a flowering plant or a mammal.

.....[1]

[Total : 7]

Q.2.

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3 Muntjac are small deer found throughout Asia. Cells at the base of the epidermis in the skin continually divide by mitosis. Fig. 3.1 shows the chromosomes from a skin cell of a female Indian muntjac deer at metaphase of mitosis.

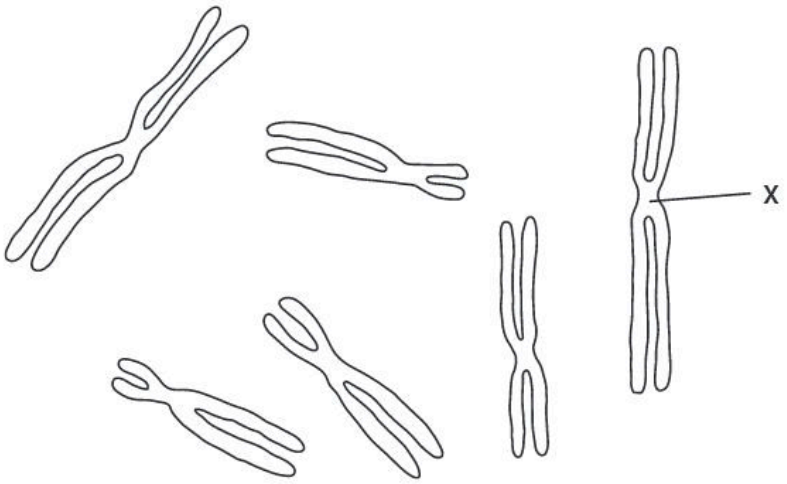


Fig. 3.1

(a) (i) State the diploid chromosome number of the female Indian muntjac deer.

.....[1]

(ii) Name X and state its role in mitosis.

name .....

role .....

.....[2]

(iii) On Fig. 3.1, **shade in** a pair of homologous chromosomes. [1]

(iv) In the space below, draw one of the chromosomes shown in Fig. 3.1 as it would appear during **anaphase** of mitosis.

[2]

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(b) Outline what happens to **a chromosome** between the end of anaphase and the start of the next mitosis.

.....

.....

.....

.....

.....

.....[3]

(c) During the formation of eggs in the ovary of the female Indian muntjac deer, the chromosome number changes.

State what happens to the chromosome number and explain why this change is necessary.

.....

.....

.....

.....[2]

[Total: 11]

Q.3.

(b) Describe the roles of centrioles in animal cells.

.....

.....

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.....

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..... [3]

Q.4.

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6 Fig. 6.1 is an electron micrograph of a cancer cell in the process of dividing by mitosis.

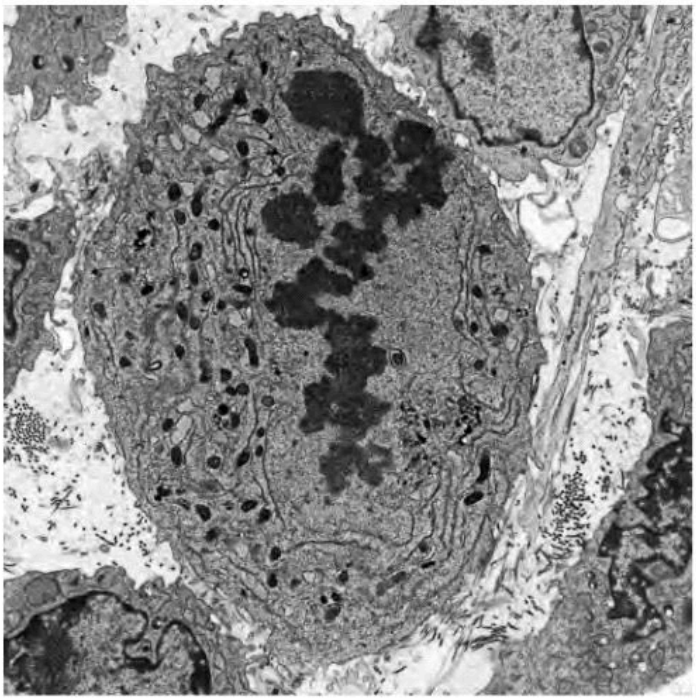


Fig. 6.1

(a) The stage of mitosis visible in Fig. 6.1 is metaphase.

State which features of the cell shown in Fig. 6.1 indicate that it is at metaphase and not at anaphase.

.....

.....

.....

.....[2]

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(b) People who have smoked cigarettes for many years are at risk of developing lung cancer.

Describe how cigarette smoke is responsible for the development of lung cancer.

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.....

.....

.....

.....[4]

(c) Fig. 6.2 shows the change in the percentage of smokers in the male population of the UK between 1950 and 2005.

Fig. 6.3 shows the change in mortality rate in the UK in men aged 75 to 84 between 1950 and 2005.

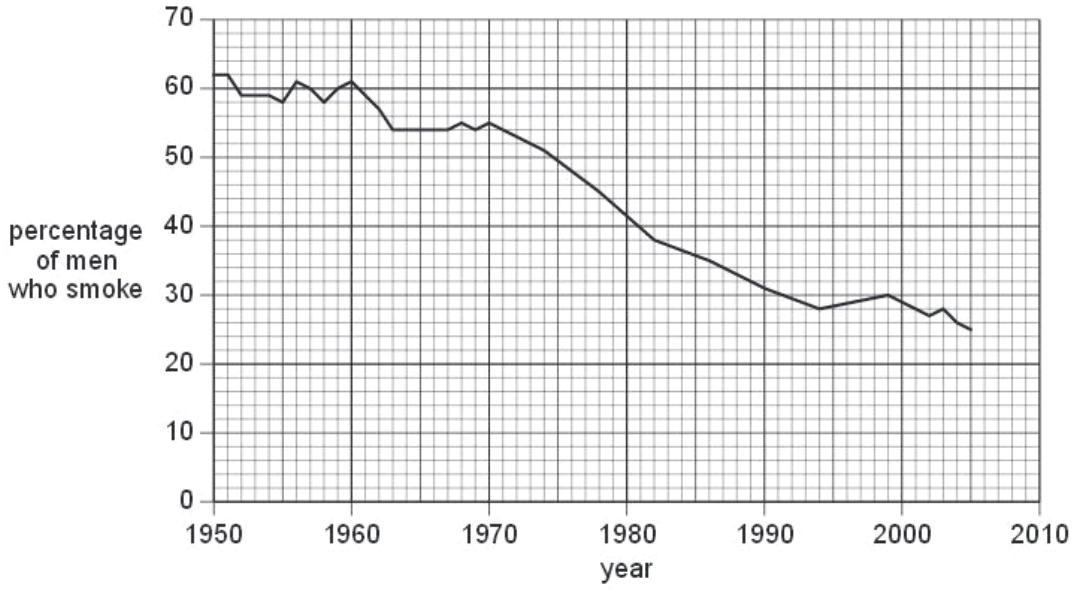


Fig. 6.2

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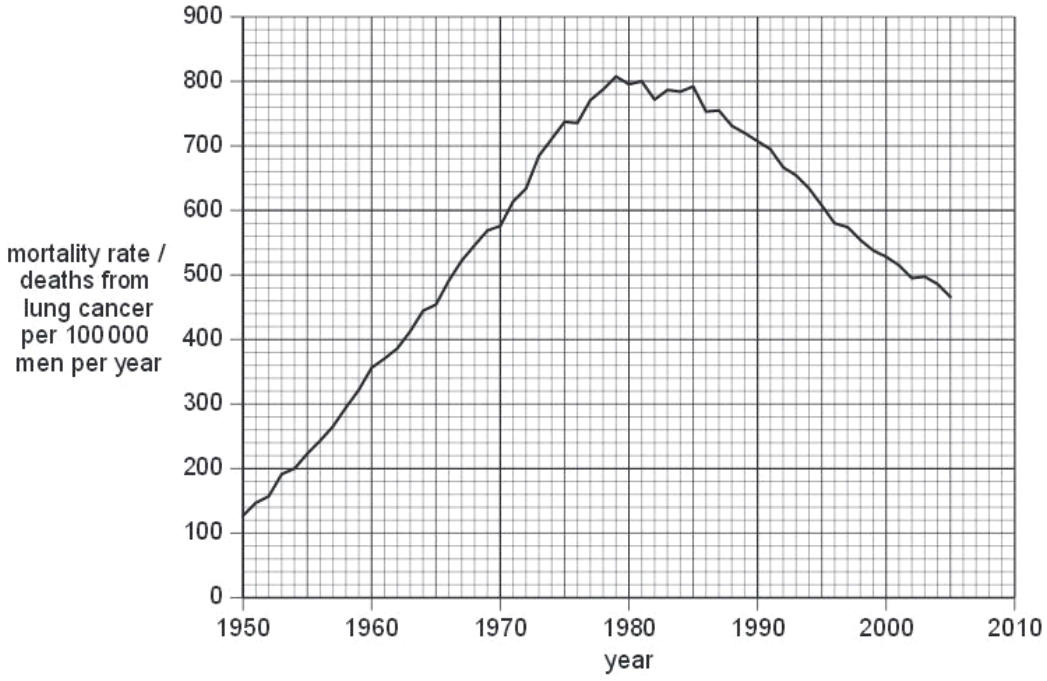


Fig. 6.3

Fig. 6.2 and Fig. 6.3 appear to show that there is no link between the percentage of the population that smoke and the death rate from lung cancer.

Explain why the mortality rate from lung cancer among men increased and then decreased over the period shown in Fig. 6.3, even though the percentage of smokers decreased over the same period of time.

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 9]

STEMUP.CO.UK

Q.5.

1 Fig. 1.1 is a photomicrograph of a root tip of onion, *Allium cepa*, showing cells in interphase and in stages of mitosis.

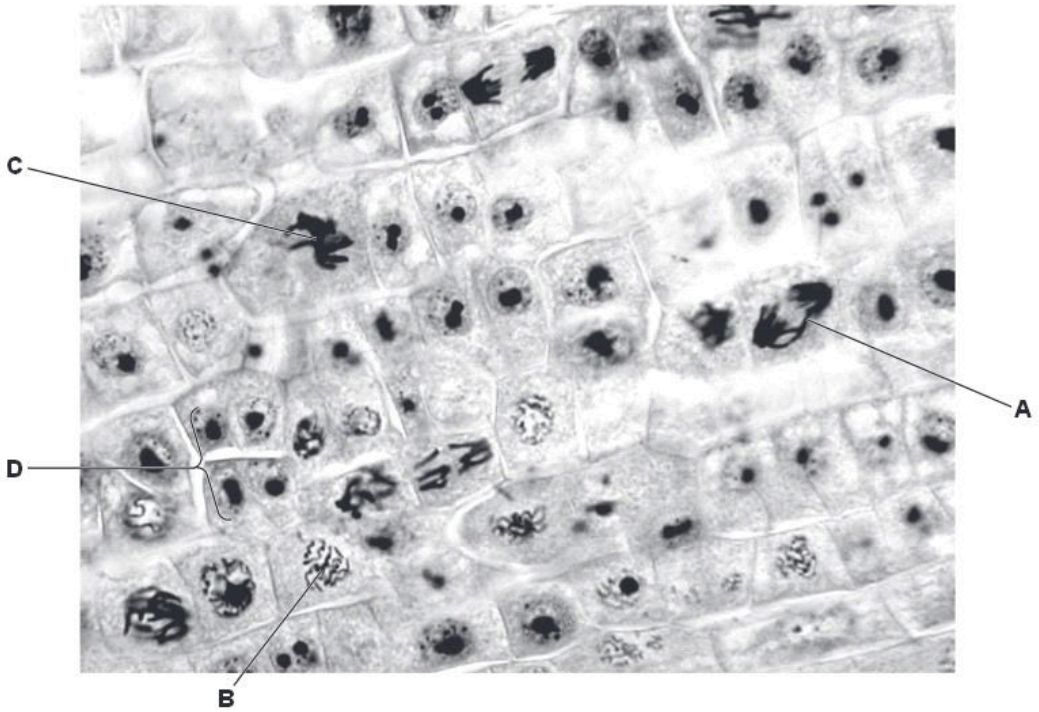


Fig. 1.1

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(a) Name the stages of mitosis shown in cells **A**, **B** and **C**.

A .....

B .....

C .....[3]

(b) Suggest why the cells labelled **D** are smaller than most of the other cells in Fig. 1.1.

.....

.....

.....[1]

(c) Interphase is often described as a 'resting stage'.

Explain why the term 'resting stage' is not an appropriate description for cells in interphase.

.....

.....

.....[2]

[Total: 6]

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Q.6.

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1 Fig. 1.1 shows a stage in the mitotic cell cycle in an animal cell.

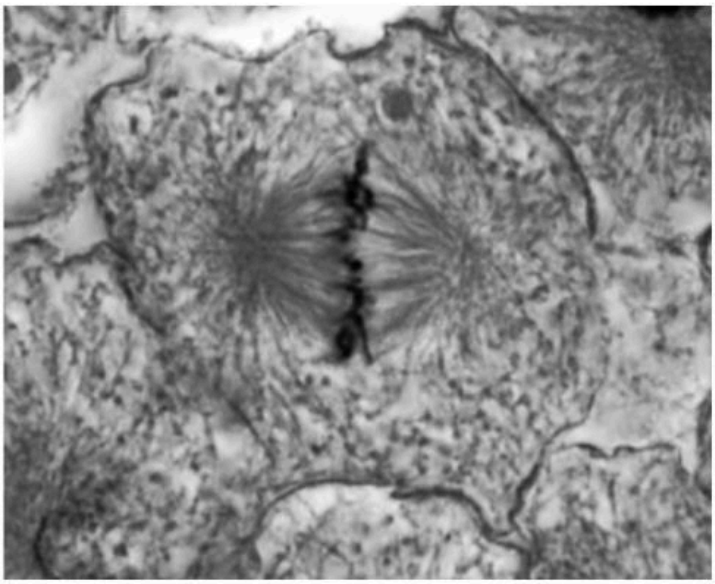


Fig. 1.1

(a) (i) Name the stage of mitosis shown in Fig. 1.1.

..... [1]

(ii) State three features which are characteristic of the stage of mitosis shown in Fig. 1.1.

1. .....

.....

2. .....

.....

3. .....

..... [3]

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(b) Explain the importance of mitosis in organisms.

.....

.....

.....

.....

.....

..... [3]

(c) In many multicellular organisms, such as mammals, the time taken for the mitotic cell cycle varies considerably between different tissues, but is very carefully controlled in each cell.

Suggest the importance of this control in mammals.

.....

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.....

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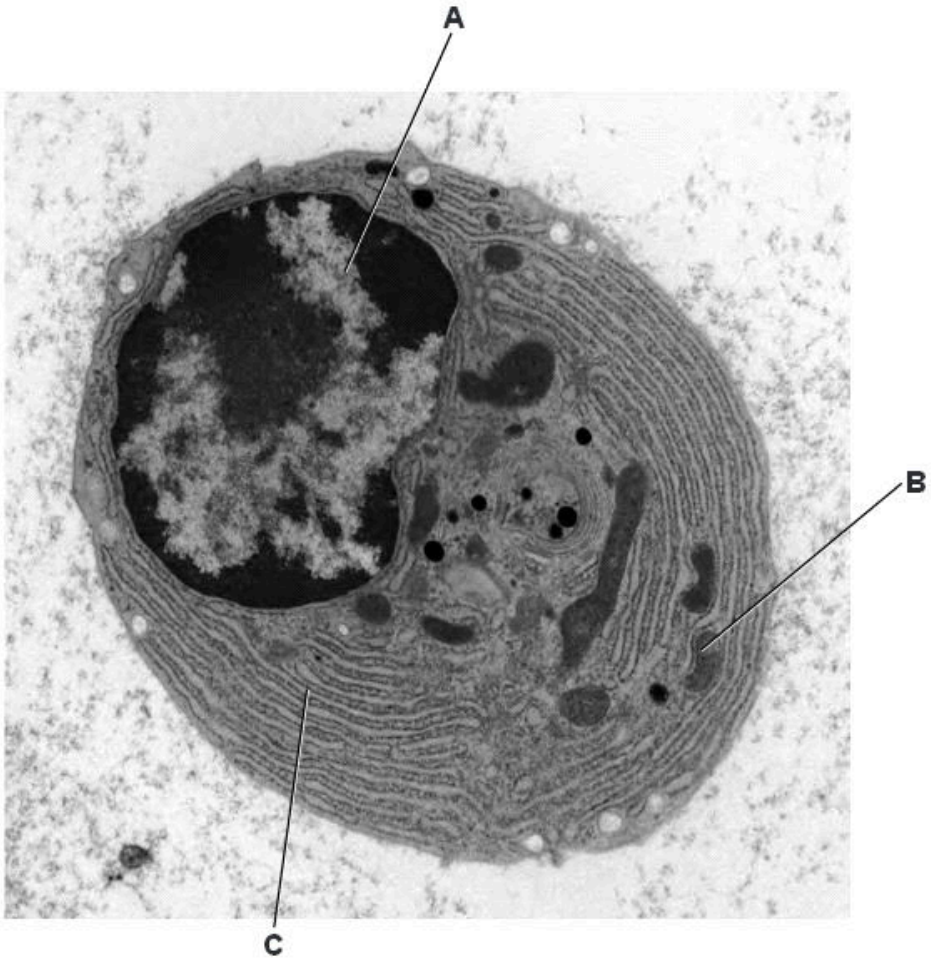
..... [2]

[Total: 9]

Q.7.

2 Fig. 2.1 is a transmission electron micrograph of a plasma cell. Plasma cells are antibody-secreting cells that are formed from B-lymphocytes.

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(b) An activated B-lymphocyte divides repeatedly by mitosis to produce many identical plasma cells.

(i) Explain why it is important that many identical plasma cells are produced.

.....

.....

.....

.....

.....

..... [3]

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(ii) B-lymphocytes have centrioles and a spindle that can be observed during mitosis.

Describe and explain how the behaviour of the centrioles and spindle of a cell dividing by mitosis is associated with the behaviour of the chromosomes.

You may use the space below for labelled diagrams.

.....

.....

.....

.....

.....

..... [4]

[Total: 13]

Q.8.

STEMUP.CO.UK

6 **(a)** Explain how uncontrolled cell division can result in cancer.

.....

.....

.....

.....

.....

.....

..... [3]

(b) Describe the experimental evidence that shows that smoking causes lung cancer.

.....

.....

.....

.....

.....

.....

..... [3]

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(c) Fig. 6.1 shows the changes in mortality rates for lung cancer in five countries between 1950 and 2006 for males.

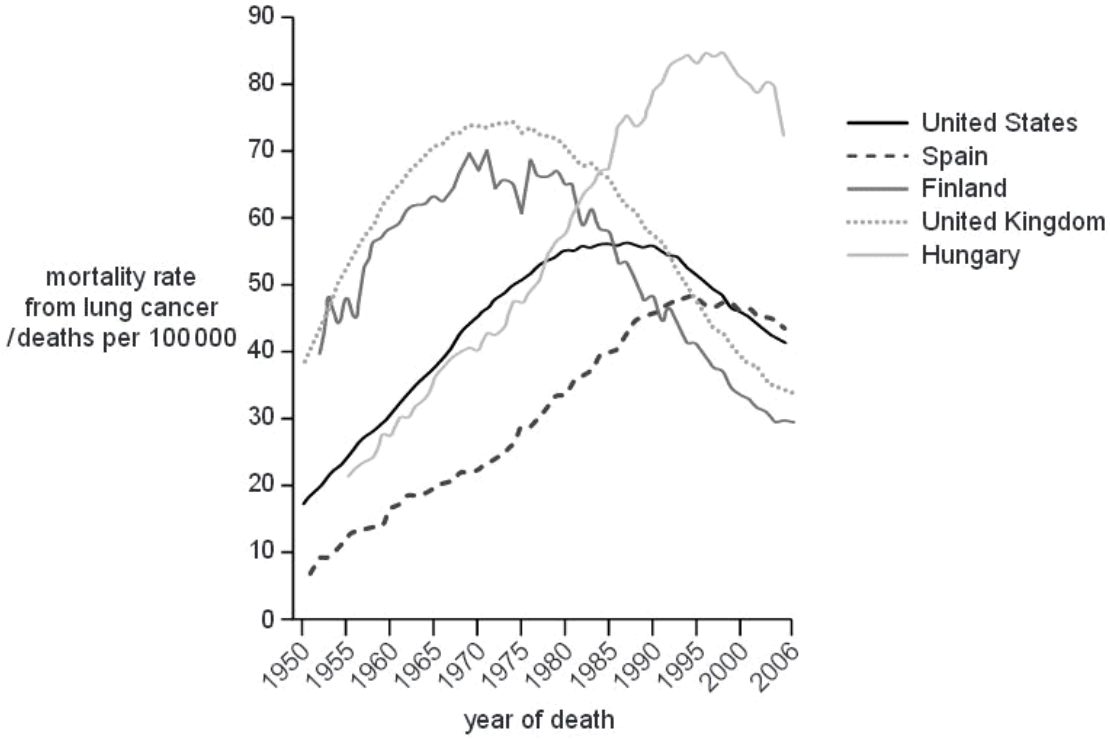


Fig. 6.1

With reference to Fig. 6.1, describe the similarities **and** differences in the trends in mortality rates in the countries shown.

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 9]

Q.9.

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1 **(a)** The cells in Fig. 1.1 are from the same organism and look the same. The cells in Fig. 1.1(a) have been produced by mitosis and the cells in Fig. 1.1(b) have been produced by meiosis.

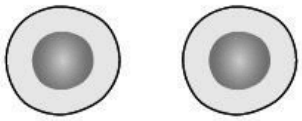


Fig. 1.1(a)

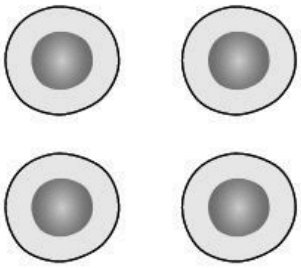


Fig. 1.1(b)

(i) Complete the table to show two differences between cells that have been produced by mitosis compared to cells that have been produced by meiosis.

mitosis	meiosis

[2]

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(ii) Explain why the organism produces cells by meiosis.

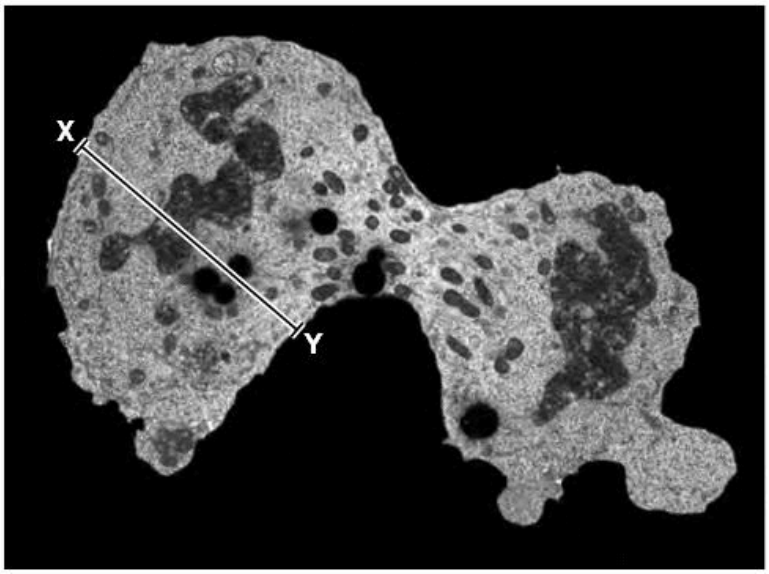
.....

.....

.....

..... [2]

(b) Fig. 1.2 is a transmission electron micrograph of a dividing cancer cell.



magnification x 3000

Fig. 1.2

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(i) Calculate the actual width of the cell shown in Fig. 1.2 at **X-Y**.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

(ii) The cancer cell shown in Fig. 1.2 has more mitochondria and rough endoplasmic reticula (RER) compared to the non-cancerous cell from which it originated.

Suggest why this is so.

.....

.....

.....

..... [2]

[Total: 8]

Q.10.

5 **(a)** Explain the importance of mitosis in multicellular organisms.

.....

.....

.....

.....

.....

..... [3]

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A protein, mitosis-promoting factor (MPF), has been identified in cells. MPF is a globular protein made from two polypeptide chains.

(b) Place a tick (✓) in the box next to the type, or types, of protein structure shown by MPF.

primary	☐
secondary	☐
tertiary	☐
quaternary	☐

[1]

The presence of MPF is known to cause prophase to start.

(c) Describe the changes that occur during prophase in an animal cell.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(d) MPF normally begins to break down and stops functioning during anaphase.

Suggest the possible consequences of MPF **not** breaking down.

.....

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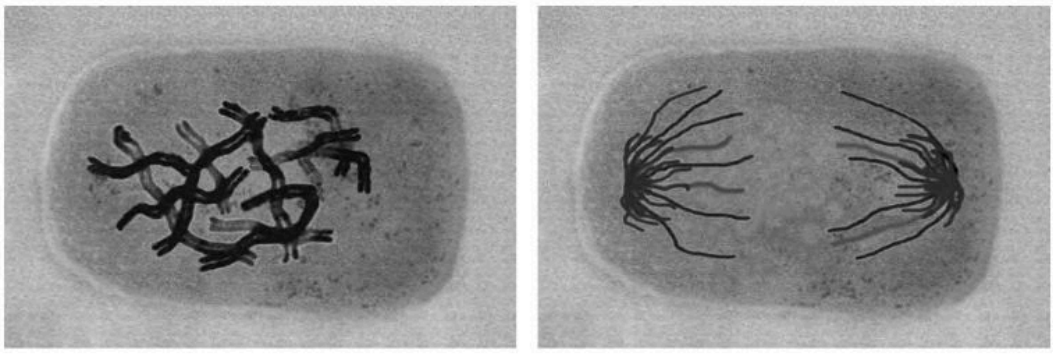
.....

..... [3]

[Total: 11]

Q.11.

4 Fig. 4.1 shows two stages of mitosis in a cell from a root tip of *Allium cepa*.



D **E**

Fig. 4.1

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(a) Describe what happens to the chromosomes during mitosis between the stage shown in **D** and the stage shown in **E**.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) Describe the events that occur within a cell after the stage shown in Fig. 4.1 **E** to allow the formation of two cells.

.....

.....

.....

.....

.....

.....[3]

(c) A root was cut into ten transverse sections at different distances from the tip. The sections were stained and viewed under the microscope. The number of cells in mitosis were counted in each section and the results were used to determine the mitotic index. This is calculated as follows:

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}}$$

Fig. 4.2 shows the mitotic index for the ten sections.

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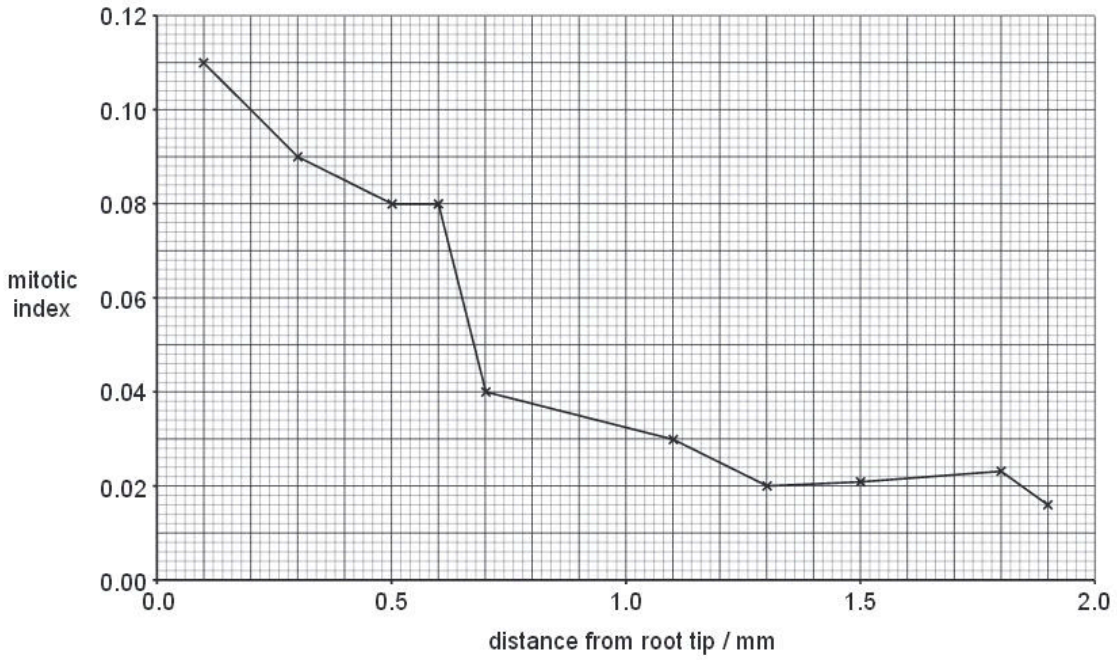


Fig. 4.2

Using the information in Fig. 4.2, describe how the mitotic index changes along the length of the root.

.....

.....

.....

.....

.....

.....[3]

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(d) Explain how the events in the mitotic cell cycle ensure that all the cells in the root are genetically identical.

.....

.....

.....

.....

.....

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.....

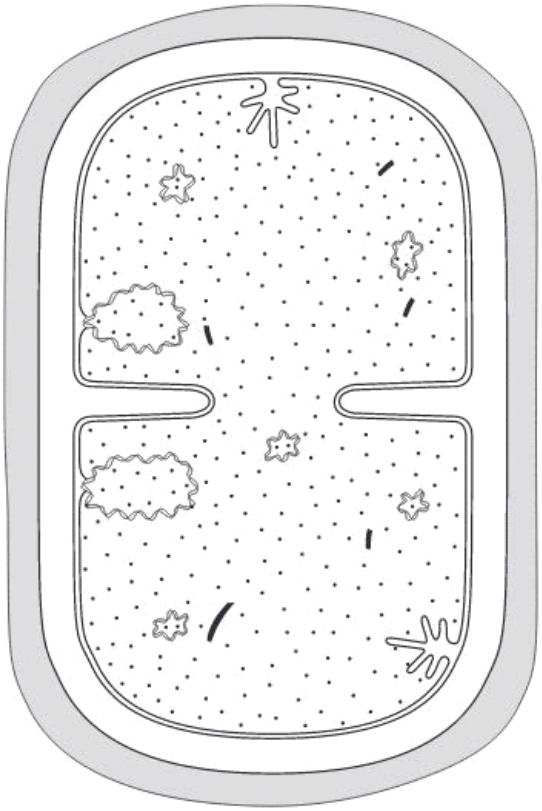
.....[3]

[Total: 13]

Q.12.

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1 Fig. 1.1 shows a bacterial cell dividing by binary fission.



magnification = x 37 500

(a) With reference to Fig. 1.1, state three structural features of prokaryotic cells that are **not** shown by eukaryotic cells.

1 .....

2 .....

3 .....[3]

(b) Plant cells divide by mitosis, not by binary fission.

(i) State three roles of mitosis in plants.

1 .....

2 .....

3 .....[3]

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(ii) Explain why cells that are produced as a result of mitosis are genetically identical.

.....

.....

.....

.....

.....

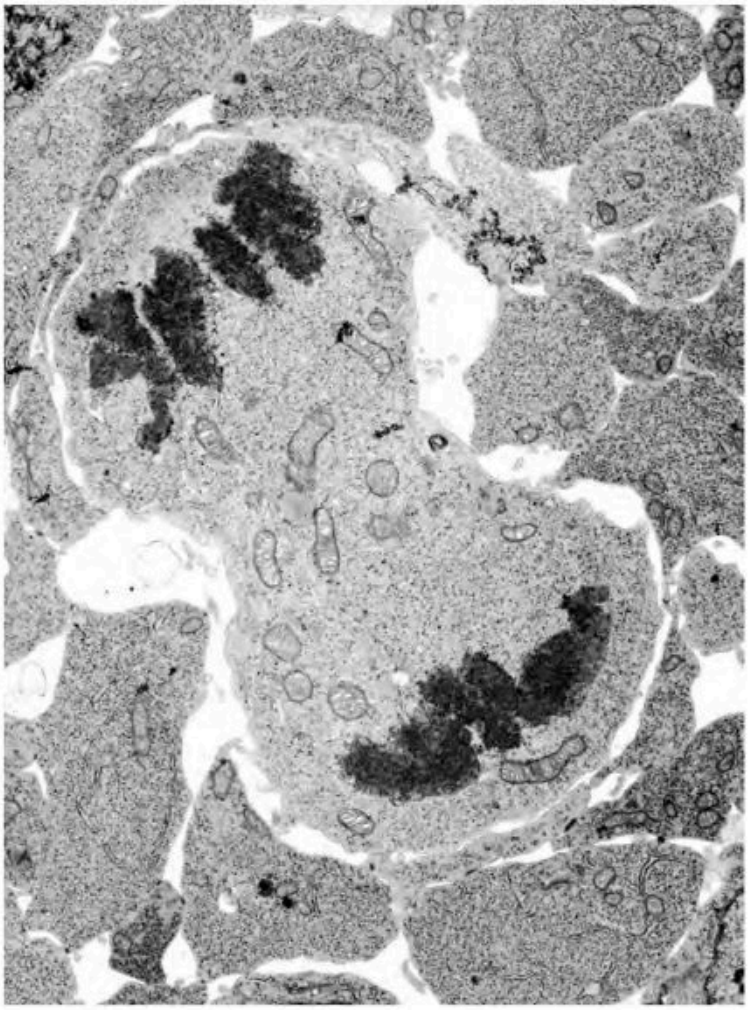
.....[3]

[Total: 9]

Q.13.

3 Fig. 3.1 is an electron micrograph of a lymphocyte in the process of cell division during an immune response.

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(a) With reference to Fig. 3.1,

(i) name the stage of mitosis shown;

.....[1]

(ii) describe what is happening during this stage of mitosis;

.....

.....

.....

.....

.....[2]

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(iii) suggest the **disadvantages** of using an electron microscope to study mitosis.

.....

.....

.....

.....

.....[2]

(b) Tumours may form inside the lungs of long-term smokers.

(i) Describe how a tumour develops in the lungs.

.....

.....

.....

.....

.....

.....

.....[3]

(ii) Describe two signs or symptoms of lung cancer.

1 .....

.....

2 .....

.....[2]

[Total: 10]

Q.14.

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3 **(a)** Explain why it is important that the daughter cells produced during a mitotic cell cycle in humans are genetically identical.

.....

.....

.....

.....[2]

(b) Name two factors that increase the chance that a cancer cell will develop.

1 .....

2 .....[2]

(c) Fig. 3.1 shows a cancer cell in the process of cell division.

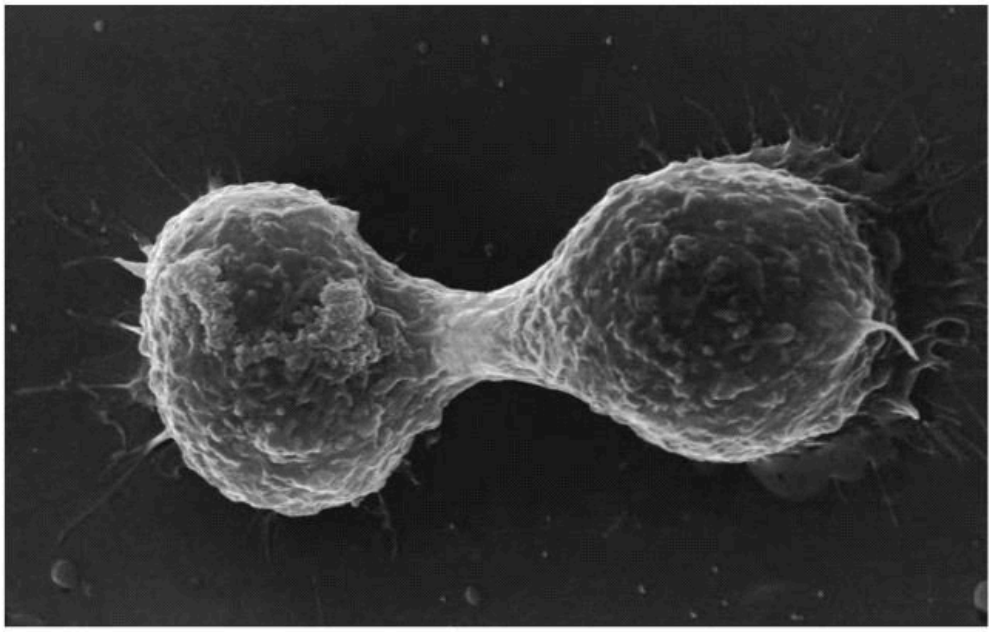


Fig. 3.1

With reference to Fig. 3.1,

(i) state the stage of cell division;

.....[1]

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(ii) describe what is happening to the cell during this stage of cell division;

.....

.....

.....

.....

.....

.....

.....[3]

(iii) describe how these cells develop into a tumour.

.....

.....

.....

.....

.....[2]

[Total: 10]

Q.15.

4 (a) (i) Name two factors that increase the chances that cancer will develop.

1. .....

2. .....[2]

(ii) State why lung cancer is categorised as a non-infectious disease.

.....

.....[1]

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The effectiveness of anti-cancer drugs may be determined by growing different tumours in culture.

The effectiveness of two drugs on two human tumours (**A** and **B**) from different tissues was assessed. The two drugs, T138067 and vinblastine, were added to the tumours in culture on days 5, 12 and 19. The volumes of the tumours were compared with the volumes of tumours that were not treated with any drugs.

The results are shown in Fig. 4.1.

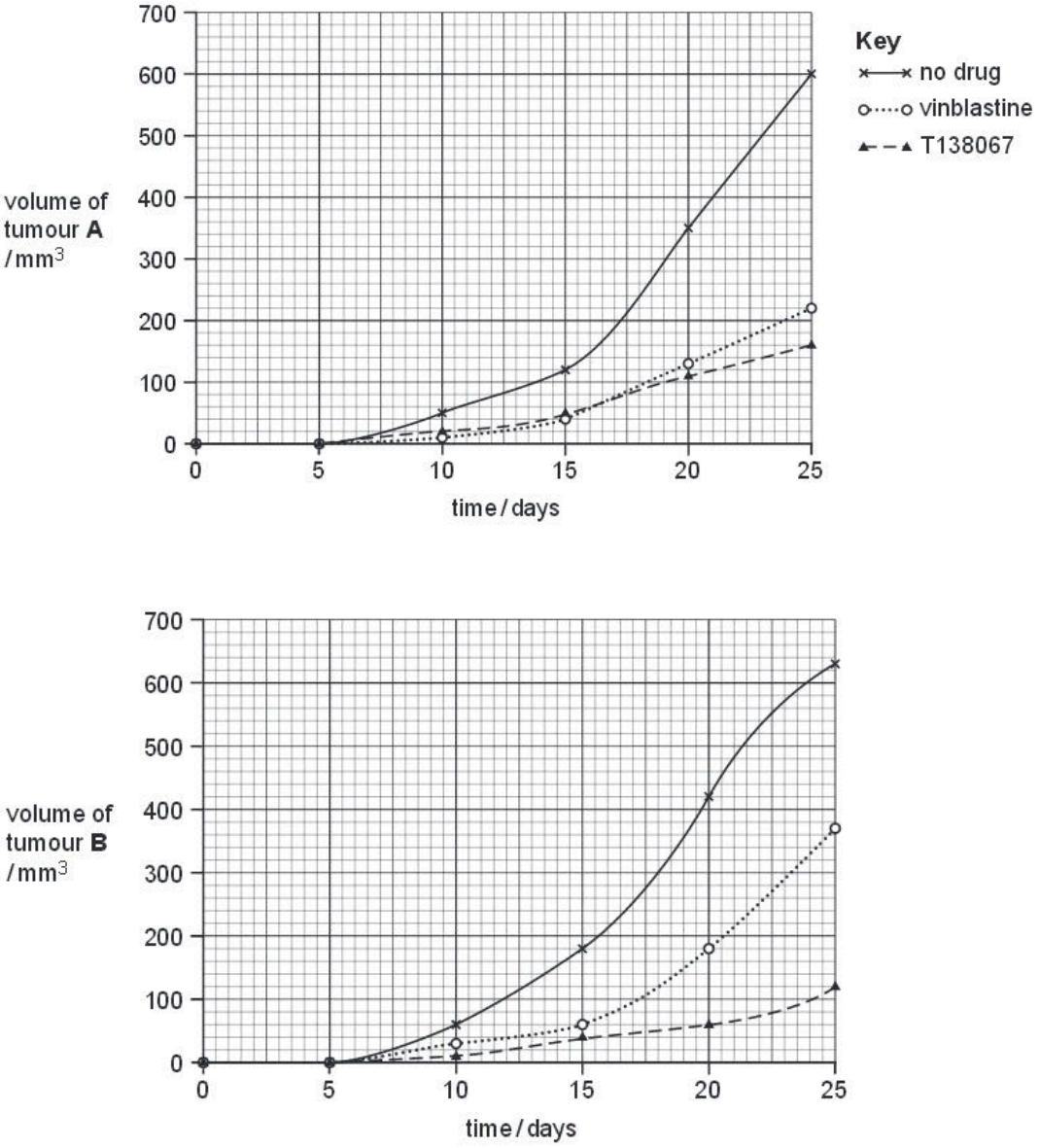


Fig. 4.1

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(b) Use the data in Fig. 4.1 to compare the effectiveness of the two drugs used to treat the tumours.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(c) Vinblastine disrupts the formation of the spindle apparatus during mitosis.

Explain how vinblastine has its effect as an anti-cancer drug.

.....

.....

.....

.....

.....

.....[3]

[Total: 10]

Q.16.

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3 Bone marrow contains stem cells that divide by mitosis to form blood cells. Each time a stem cell divides it forms a replacement stem cell and a cell that develops into a blood cell.

Fig. 3.1 shows changes in the mass of DNA in a human stem cell from the bone marrow during three cell cycles.

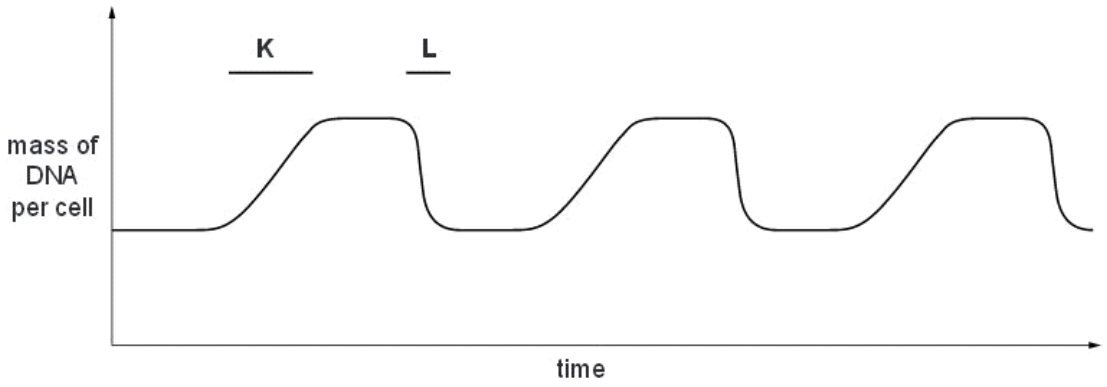


Fig. 3.1

(a) With reference to Fig. 3.1, state:

(i) what happens to bring about the changes in the mass of DNA per cell at **K** and at **L**

K .....

.....

L .....

.....[2]

(ii) how many blood cells are formed from the stem cell in the time shown

.....[1]

(iii) what happens to the number of chromosomes in the stem cell.

.....[1]

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Stem cells in bone marrow give rise to phagocytes, B-lymphocytes and T-lymphocytes.

(b) Describe how a red blood cell develops from a stem cell.

.....

.....

.....

.....

.....

.....[3]

(c) During an immune response, cells divide by mitosis.

Describe how mitosis is involved in an immune response.

.....

.....

.....

.....

.....

.....[3]

Q.17.

STEMUP.CO.UK

1 Fig. 1.1 shows a cell of a female fruit fly, *Drosophila melanogaster*, during a stage of mitosis.

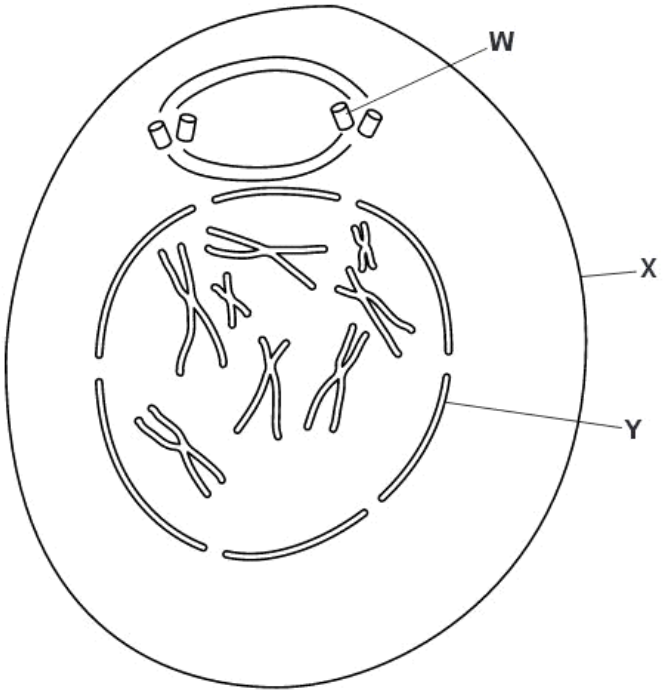


Fig. 1.1

(a) (i) Name the stage of mitosis shown in Fig. 1.1.

.....[1]

(ii) Shade a pair of homologous chromosomes. [1]

(iii) Name the structure labelled **W** and state its function.

.....

.....

.....[2]

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(b) State what happens to structure **X** and to structure **Y** between the stage shown in Fig. 1.1 and the end of cell division.

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 7]

Q.18.

(d) The inner lining of arteries and veins is composed of a layer of epithelial cells supported by a layer of elastic and connective tissue. The epithelial cells are capable of cell division by mitosis.

(i) State the role of mitosis in cell division of epithelial cells.

.....

.....

.....

.....[2]

(ii) Explain why the epithelial cells undergo mitosis and **not** meiosis.

.....

.....

.....

.....[2]

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(e) Fig. 1.2 is a diagram of a cell in late prophase of mitosis.

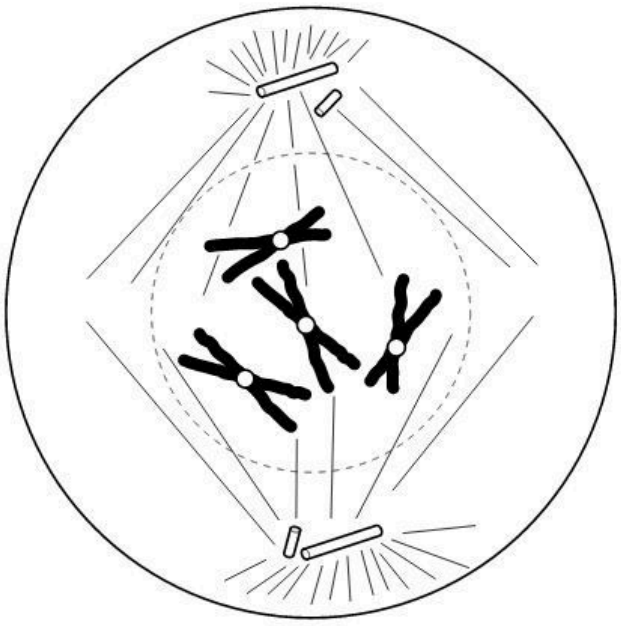


Fig. 1.2

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Complete Fig. 1.3 to show the **same cell** in the **anaphase** stage of mitosis.

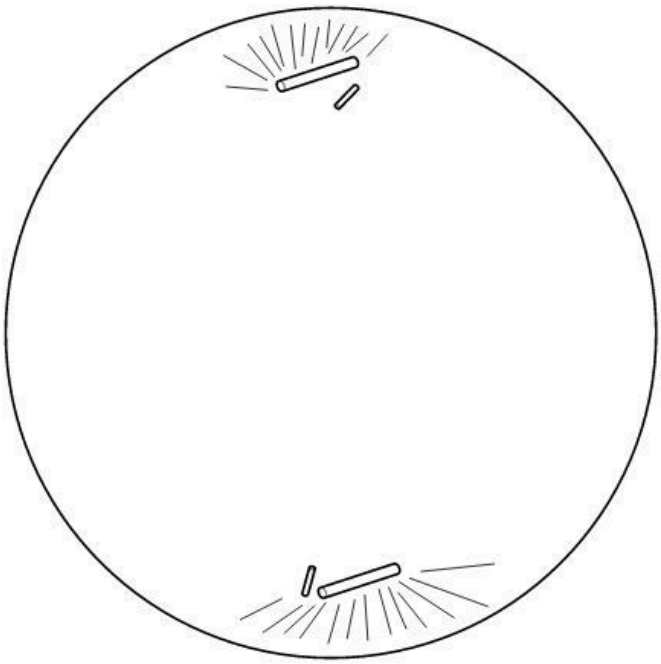


Fig. 1.3

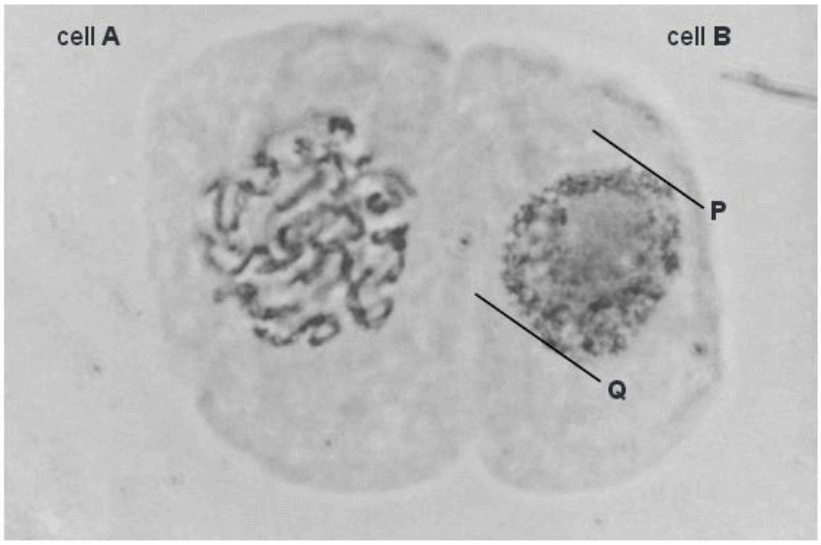
[2]

[Total: 13]

Q.19

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3 Fig. 3.1 is a photomicrograph of two animal cells, **A** and **B**, at different stages of the mitotic cell cycle.



magnification × 5000

Fig. 3.1

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(a) **(i)** For each cell, state the name of the stage of the cell cycle shown in Fig. 3.1.

cell **A** .....

cell **B** .....
[2]

(ii) Describe the events that occur during the stage of the cell cycle named for cell **A** in **(a)(i)**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The magnification of Fig. 3.1 is × 5000.

Calculate the diameter of the nucleus of cell **B** between lines **P** and **Q**.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

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(c) State the advantages of light microscopy, rather than electron microscopy, for studies of the cell cycle.

.....

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 11]

Q.20.

(c) Cells, such as **C**, at the base of the epithelium of the trachea divide by mitosis.

Describe the changes that occur within the cell between the beginning of prophase and the end of metaphase.

.....

.....

.....

.....

.....

.....

.....

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.....

.....[5]

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The mitotic cell cycle – AS 9700 Biology June 2022

1. June/2022/Paper_11/No.18

Which processes require mitosis?

1 the cloning of T-lymphocytes

2 the repair of cell structures by protein synthesis

3 the growth of multicellular organisms from a single cell

4 the reproduction of a unicellular eukaryote

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

2. June/2022/Paper_11/No.19

Which events listed are part of the cell cycle?

1 interphase

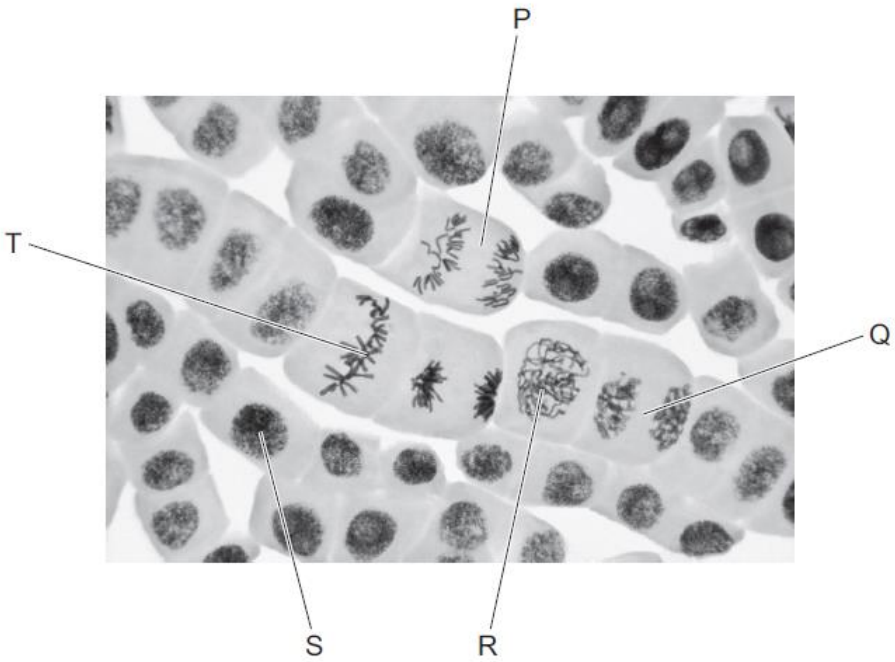
2 prophase

3 cytokinesis

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

3. June/2022/Paper_11/No.21

The photomicrograph shows cells at different stages of mitosis.



A student wrote four statements about the photomicrograph.

1 Cell P shows anaphase.

2 Spindle formation is occurring in cell Q.

3 The amount of DNA in cell R is the same as in cell T.

4 The correct order for the stages is S → R → T → P → Q.

Which statements are correct?

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

4. June/2022/Paper_12/No.17

What is a role of mitosis?

A growth of organisms

B production of genetically different cells

C repair of cells

D replacement of cancerous tissue

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5. June/2022/Paper_12/No.18

Telomeres prevent the loss of genes from the ends of chromosomes during DNA replication, but they become shorter each time they are copied.

In cancer cells and stem cells, the telomeres remain the same length.

Which statement is correct for **all** human cells?

A If telomeres become too short, a cell may stop dividing.

B Adding telomeres could increase the rate of ageing of cells.

C Telomeres are repaired by the enzyme RNA polymerase.

D Telomeres prevent all damage occurring to DNA molecules.

6. June/2022/Paper_12/No.19

The nucleus of a mouse body cell in G_1 phase of the cell cycle has 1.2×10^{-12} g of DNA.

What will be the mass of DNA in the nucleus of the cell at the end of S phase and at the end of G_2 phase of the cell cycle?

	end of S phase	end of G_2 phase
A	1.2×10^{-12} g	1.2×10^{-12} g
B	1.2×10^{-12} g	2.4×10^{-12} g
C	2.4×10^{-12} g	1.2×10^{-12} g
D	2.4×10^{-12} g	2.4×10^{-12} g

7. June/2022/Paper_12/No.20

Which statement about telomeres is correct?

A They allow cells in culture from any age of donor to divide a fixed number of times.

B They are genes which are present on the 5′ end of every chromosome.

C They are unpaired regions of DNA on the 3′ end of every chromosome.

D They prevent introns and exons being lost from genes during cell division.

8. June/2022/Paper_13/No.18

Some cells are listed.

1 bacterial cells

2 cancer cells

3 lymphocytes

4 mature red blood cells

5 stem cells

Which cells can divide by mitosis?

A 1, 2, 4 and 5

B 1, 2 and 3

C 2, 3 and 5

D 3, 4 and 5

9. June/2022/Paper_13/No.19

Which statements about mitosis are correct?

1 At the end of telophase, two nuclei are formed.

2 Centrioles attach chromosomes to the spindle during metaphase.

3 Chromatids are pulled apart during anaphase.

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

10. June/2022/Paper_13/No.20

Which statement about telomeres is correct?

A They allow cells in culture from any age of donor to divide a fixed number of times.

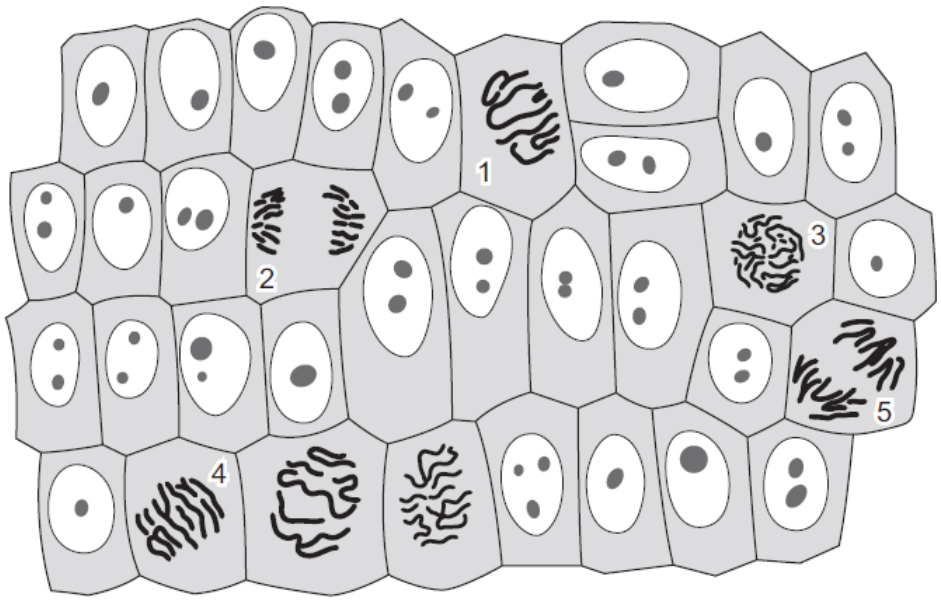
B They are genes which are present on the 5′ end of every chromosome.

C They are unpaired regions of DNA on the 3′ end of every chromosome.

D They prevent introns and exons being lost from genes during cell division.

11. June/2022/Paper_13/No.21

The diagram shows stages of mitosis.



What is the correct sequence of the stages of mitosis numbered on the diagram?

A 1 → 3 → 4 → 2 → 5

B 1 → 3 → 4 → 5 → 2

C 3 → 1 → 4 → 5 → 2

D 3 → 4 → 1 → 2 → 5

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The mitotic cell cycle – AS 9700 Biology Nov 2022

1. Nov/2022/Paper_11/No.18

How many of these processes produce genetically identical cells?

- growth of plant roots
- replacement of dead human skin cells
- repair of damaged muscle tissue
- asexual reproduction of coral

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

2. Nov/2022/Paper_11/No.19

Which row shows the correct number of each component of a single chromosome at the end of prophase of mitosis?

	centromeres	chromatids	polynucleotide strands	telomeres
A	1	0	2	2
B	1	2	4	4
C	2	0	4	2
D	2	2	2	4

3. Nov/2022/Paper_11/No.20

Which processes occur during interphase?

1 DNA replication

2 microtubule organisation

3 synthesis of ribosomes

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

4. Nov/2022/Paper_11/No.21

Embryonic stem cells are able to replicate continuously.

What happens to the telomeres during repeated mitotic cell cycles of embryonic stem cells?

A Their lengths increase.

B Their lengths decrease.

C They are completely lost.

D They stay the same length.

5. Nov/2022/Paper_12/No.18

The enzyme telomerase prevents loss of telomeres after many mitotic cell cycles.

Which cells need to transcribe telomerase enzyme?

1 cancer cells

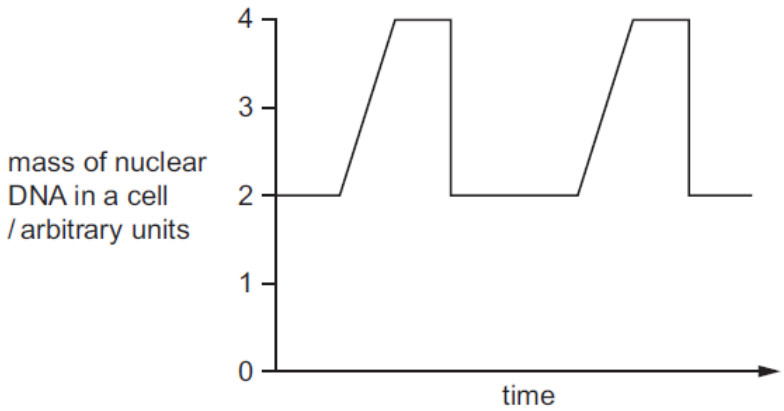
2 stem cells

3 activated memory B-lymphocytes

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

6. Nov/2022/Paper_12/No.19

Which processes that occur in the cell cycle are represented in the diagram?



A DNA replication and nuclear division only

B DNA replication, nuclear division and cytokinesis

C mitosis and cytokinesis

D mitosis only

7. Nov/2022/Paper_12/No.20

A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates the gene coding for the p53 protein, preventing production of the protein.

Which statement explains why this mutation may cause cancer?

A Cells with no p53 are able to undergo mitosis.

B Cells with no p53 replicate their damaged DNA.

C The carcinogen in cigarette smoke increases the rate of cell division.

D The mutated p53 causes uncontrolled cell division.

8. Nov/2022/Paper_12/No.21

Stained onion cells undergoing mitosis were observed using a microscope.

Which row is correct for mitosis in plant cells?

	prophase	metaphase	anaphase	telophase
A	centrioles visible	chromosomes pair up at the equator	two telomeres are visible on each chromatid	two nuclear membranes form
B	centromeres present	chromosomes align at the equator	chromosomes replicate to form chromatids	centrioles disappear
C	each chromosome is visible as two chromatids	centromeres attach to spindle fibres	chromatids separate and migrate to opposite poles	chromosomes decondense
D	spindle fibres formed by centrioles	centromeres attach to spindle fibres	chromatids are pulled apart by centrioles	spindle fibres form new nuclear membranes

9. Nov/2022/Paper_12/No.22

How many statements about semi-conservative replication of DNA in a eukaryotic cell are correct?

1 The process takes place in the cytoplasm.

2 An adenine nucleotide will line up against uracil on the template strand.

3 Each daughter molecule will contain half of the original DNA molecule.

4 If the DNA molecule contained 40% guanine nucleotides, each daughter molecule will contain 20% guanine nucleotides.

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

10. Nov/2022/Paper_13/No.18

Which row shows the correct number of each component in a single chromosome at the start of telophase of mitosis?

	centromeres	polynucleotide strands	telomeres
A	1	2	2
B	1	4	4
C	2	4	2
D	2	2	4

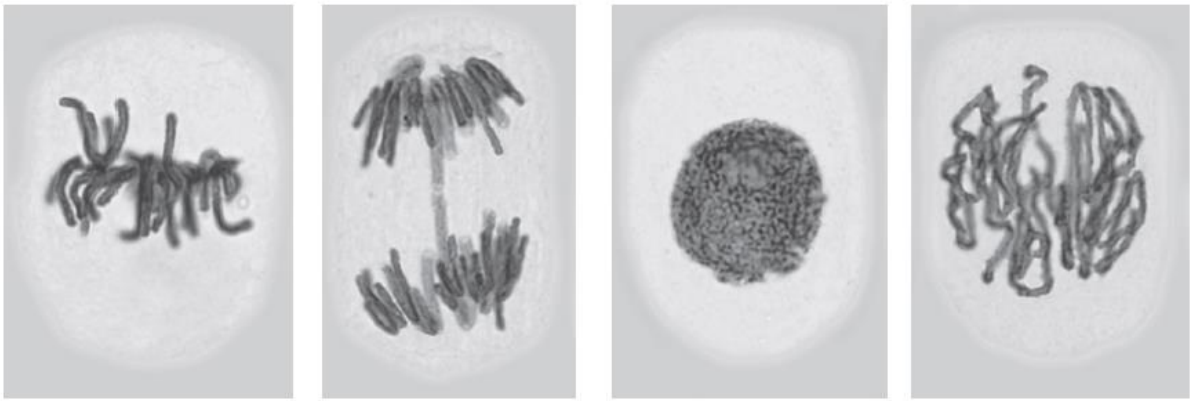
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11. Nov/2022/Paper_13/No.19

The photomicrographs show cells in various stages of the cell cycle.

In which stage does semi-conservative replication of DNA take place?

A **B** **C** **D**



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12. Nov/2022/Paper_21/No.6(a_ b)

(a) Fig. 6.1 is a photomicrograph of plant cells in stages of the mitotic cell cycle.

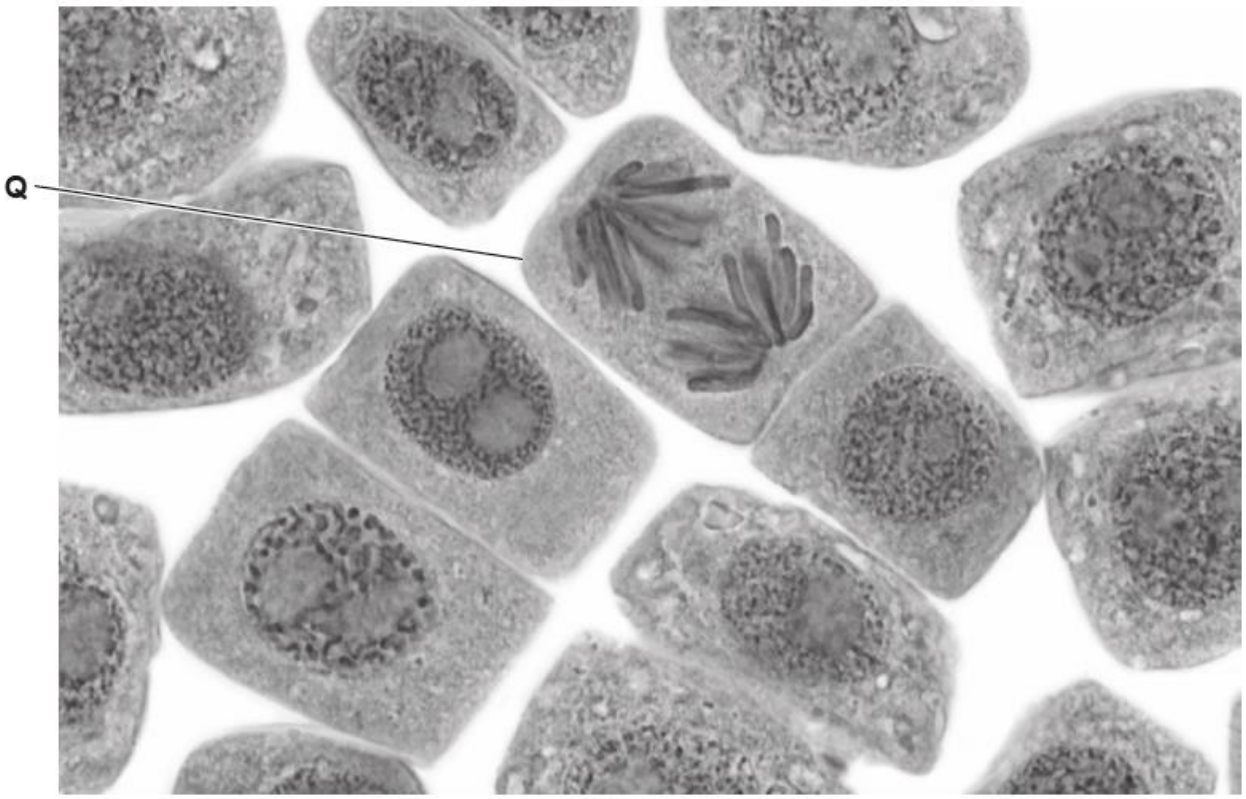


Fig. 6.1

(i) Name the stage of mitosis shown in cell **Q**.

..... [1]

(ii) Outline the roles of mitosis in a healthy plant.

.....

.....

.....

..... [2]

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(b) Uncontrolled mitosis can cause cancer in humans.
Paclitaxel is a drug used in the treatment of some forms of cancer.

Researchers investigated the effect of Paclitaxel on the mitotic cell cycle of cancer cells.

- The cancer cells were grown for two days and then divided into groups.
- Each group was treated with a different concentration of Paclitaxel.

After 28 hours (one cell cycle):

- the percentage of cells in stages of mitosis was calculated
- the ratio of the number of cells in anaphase to the number of cells in metaphase was determined.

The results of the investigation are shown in Fig. 6.2.

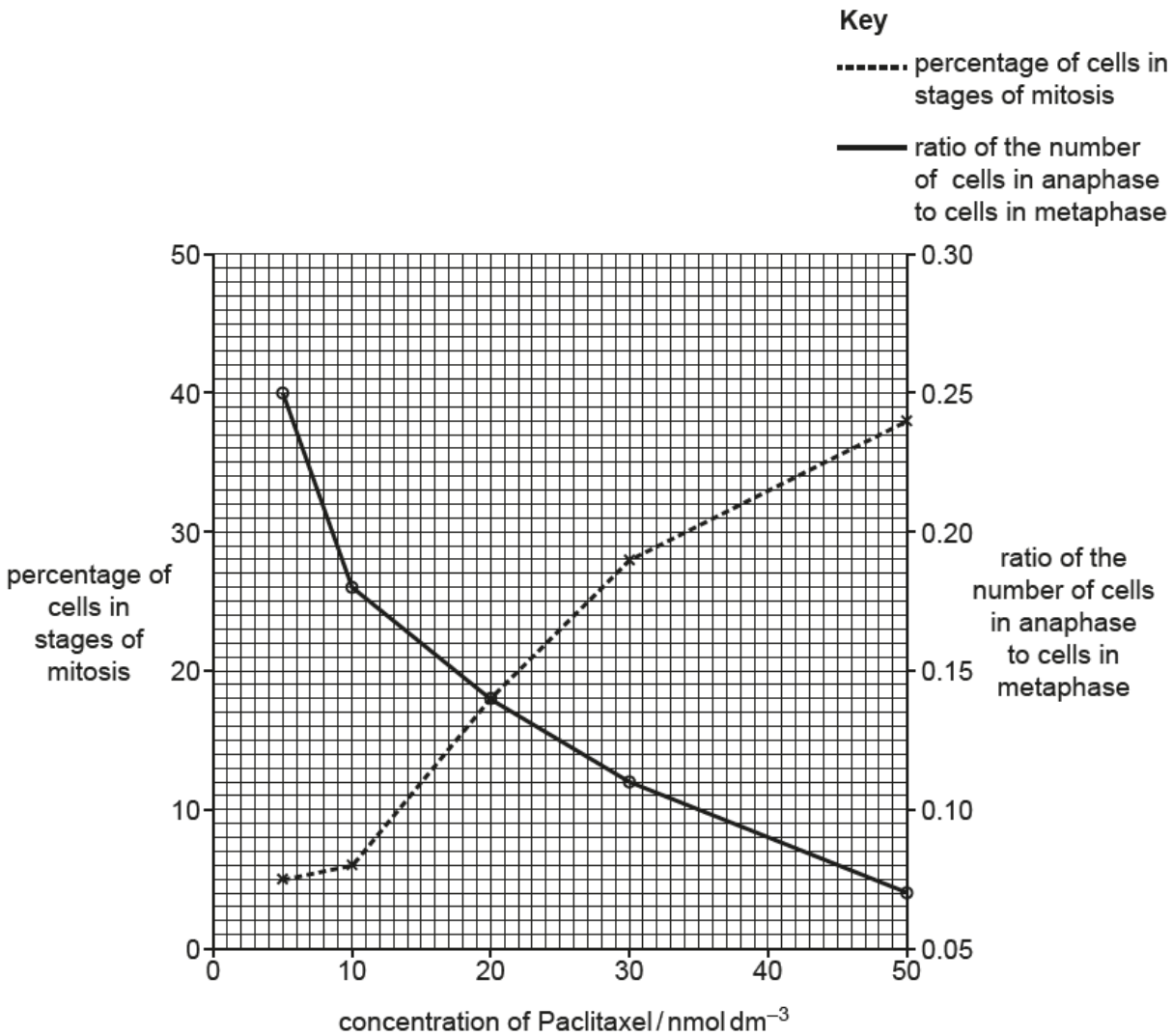


Fig. 6.2

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With reference to Fig. 6.2, describe the results and suggest an explanation for the effect of Paclitaxel on the mitotic cell cycle.

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..... [4]

[Total: 7]

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13. Nov/2022/Paper_23/No.4(a_ b)

The early development of an animal involves divisions of the zygote and daughter cells by mitosis to form an embryo consisting of genetically identical cells.

Fig. 4.1 shows several cells at various stages of the cell cycle in an embryo of whitefish, *Coregonus artedi*.

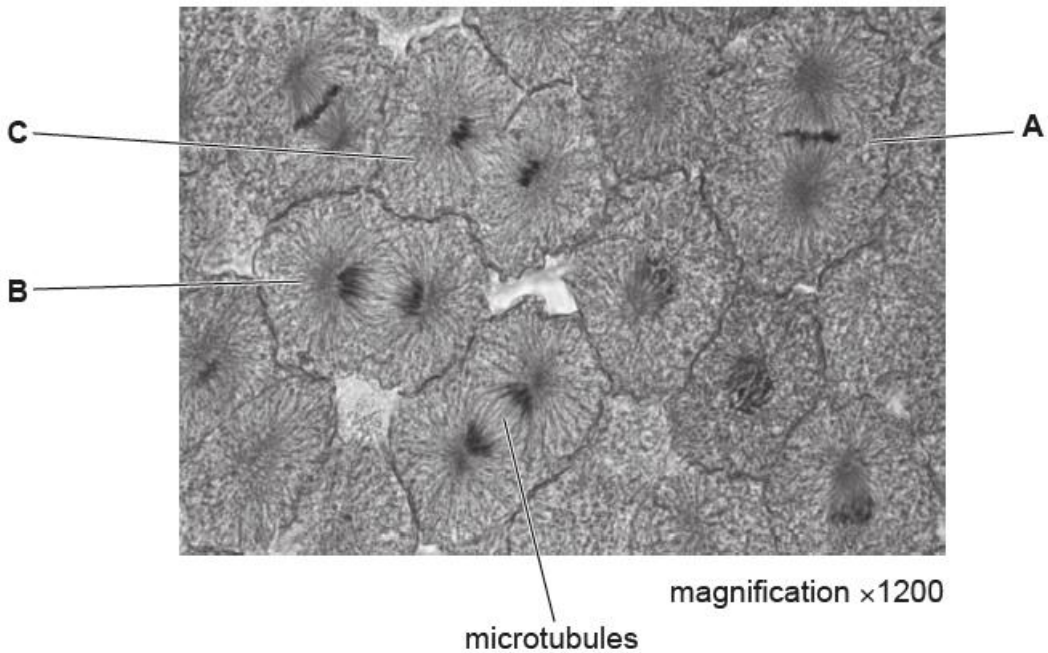


Fig. 4.1

(a) (i) Name the stage of mitosis in cell **A** and in cell **B**, shown in Fig. 4.1.

A .....

B .....

[2]

(ii) Fig. 4.1 shows microtubules in the cells that are dividing.

Describe the role of microtubules in mitosis.

.....

.....

.....

.....

.....

.....

..... [3]

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(iii) State what happens in cell **C**, shown in Fig. 4.1, until two new cells are formed.

.....

.....

.....

.....

.....

.....

..... [3]

(b) The cells produced in the developing whitefish are genetically identical.

Identify **and** explain **two** events that occur during the cell cycle that lead to daughter cells being genetically identical.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 11]

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The mitotic cell cycle – AS 9700 June 2022

1. June/2023/Paper_9700/11/No.17

The cell cycle includes mitosis.

What are features of this type of nuclear division?

1 forms cells of equal size to the parent cell

2 forms genetically identical nuclei

3 semi-conservative replication of DNA

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

2. June/2023/Paper_9700/11/No.18

A student observed the cells in the growing region (meristem) of an onion root and obtained the data shown.

stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

Which percentage of cells contains chromosomes that appear as two chromatids?

A 7.3% **B** 8.9% **C** 95.9% **D** 97.5%

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3. June/2023/Paper_9700/12/No.21

How many copies of each DNA molecule will be found in a cell at the **start** of the stages of the mitotic cell cycle shown?

	G_1 of interphase	cytokinesis
A	1	1
B	1	2
C	2	1
D	2	2

4. June/2023/Paper_9700/12/No.22

One characteristic of DNA is that it is a universal genetic code.

What is meant by a universal genetic code?

A All living organisms use the same triplet code for amino acids.

B All DNA triplets code for a different amino acid.

C Not all DNA triplets code for an amino acid.

D All living organisms contain the same four nucleic acids.

5. June/2023/Paper_9700/13/No.21

Which row describes some properties of stem cells?

	able to divide by mitosis to produce more stem cells	able to differentiate into specialised cells	able to repair damaged cells
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✗	✓

key

✓ = is a property

✗ = is not a property

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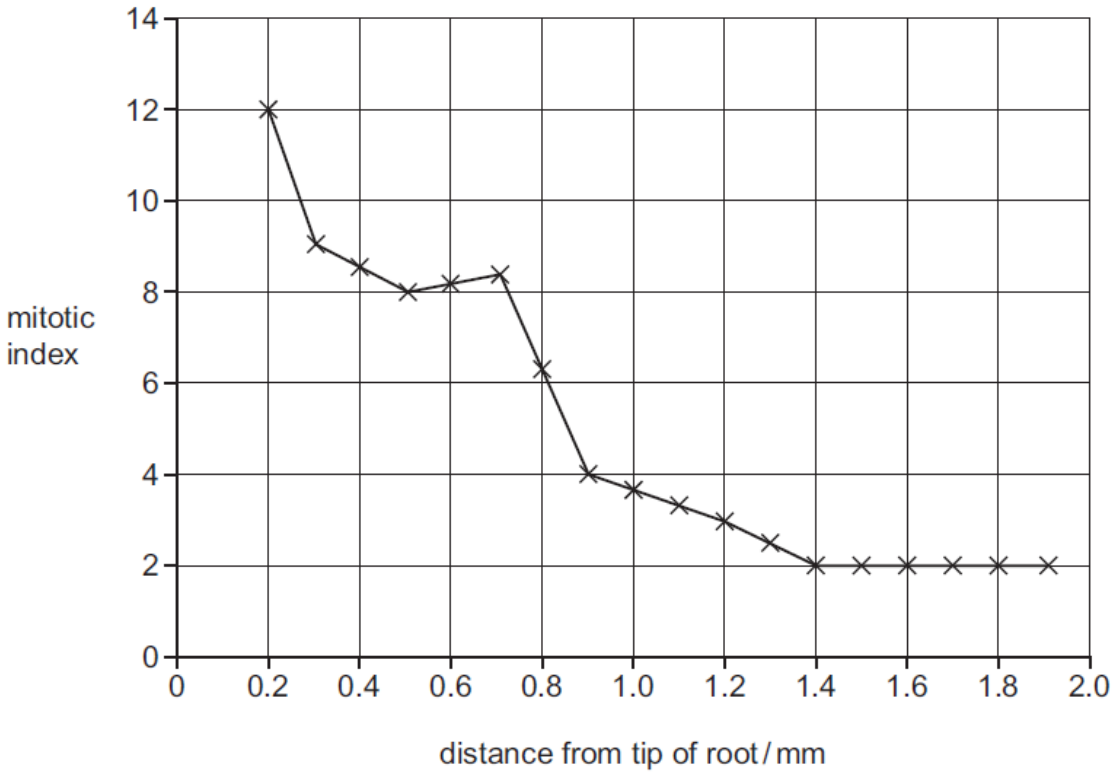
6. June/2023/Paper_9700/13/No.22

The mitotic index is a measure of the proportion of cells that are undergoing mitosis in an area of tissue. It is calculated using the formula shown.

$$\text{mitotic index} = (\text{number of cells undergoing mitosis} \div \text{total number of cells}) \times 100$$

A scientist calculated the mitotic index of areas of onion root at different distances from the tip of the root.

The results are shown.



Which statement is correct?

A No cell division occurs further than 1.4 mm from the tip of the root.

B The rate of cell division decreases as the distance from the root tip decreases.

C Most of the cells undergoing cell division are closer to the tip of the root.

D For a sample of 200 cells 0.2 mm from the tip of the root, 6 would be undergoing mitosis.

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7. March/2023/Paper_9700/12/No.19

Which events are part of the mitotic cell cycle?

1 interphase

2 telophase

3 cytokinesis

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

8. March/2023/Paper_9700/22/No.1(c)

(c) Mitogens are short chains of amino acids that function as cell-signalling molecules. Mitogens are released from secretory cells and travel in the blood to target cells, where the mitogens bind to cell surface receptors. The target cells respond by progressing from the G_1 phase to the S phase of the mitotic cell cycle.

(i) Outline what happens in the G_1 phase and S phase of the mitotic cell cycle.

G_1 phase .....

.....

.....

S phase .....

.....

.....

[2]

(ii) As a result of mutation, the production and release of mitogens into the blood can be greatly increased.

Suggest a possible consequence for target cells of increased concentrations of mitogens in the blood.

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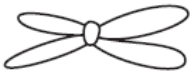
..... [1]

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The mitotic cell cycle – AS 9700 November 2023

1. Nov/2023/Paper_ 9700/11/No.18

Which row is a representation of one chromosome at the beginning of prophase of mitosis and the number of DNA strands in the chromosome?

	appearance of one chromosome	number of DNA strands
A		2
B		4
C		1
D		2

2. Nov/2023/Paper_ 9700/11/No.19

Which events are part of mitosis?

1 interphase

2 telophase

3 cytokinesis

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

3. Nov/2023/Paper_ 9700/11/No.20

The statements are about genes and proteins involved in breast cancer.

- The protein coded by the *BRAC1* gene inhibits the growth of breast cancer cells.
- The protein coded by the *p53* gene suppresses tumours.

Which combination of genes is **most likely** to result in breast cancer?

	BRAC1	*p53*
A	✗	✗
B	✗	✓
C	✓	✗
D	✓	✓

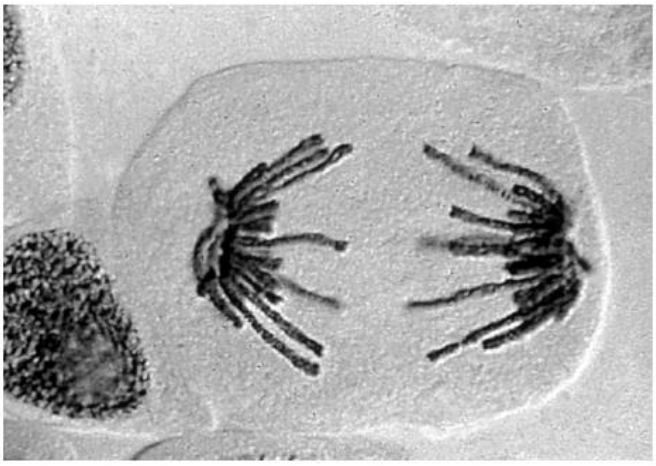
key

✓ = normal active gene

✗ = mutated gene

4. Nov/2023/Paper_ 9700/11/No.21

The photomicrograph shows a cell during mitosis.



What is happening in this cell?

1 Chromosomes are condensing.

2 Centromeres are moving to opposite poles.

3 Spindle microtubules are shortening.

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

5. Nov/2023/Paper_ 9700/12/No.18

A human embryo consists of 12 cells at the start of day 1. The cells divide by mitosis for 4 complete days at a rate of 1 division every 32 hours.

What is the maximum number of cells in the embryo at the end of day 4?

A 48 cells

B 96 cells

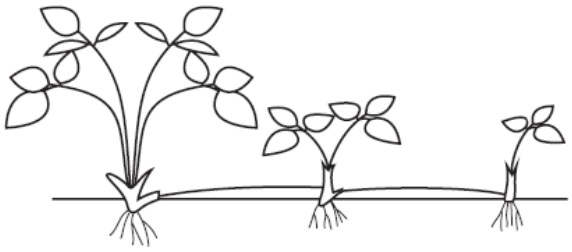
C 192 cells

D 384 cells

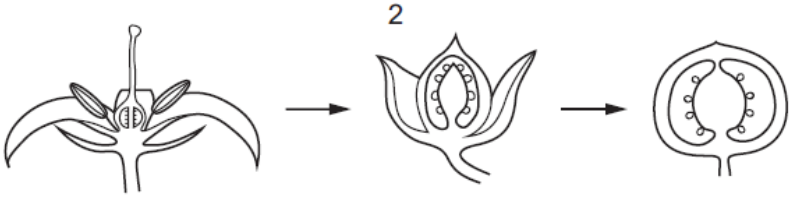
6. Nov/2023/Paper_ 9700/12/No.19

Which diagrams show roles of mitosis?

1



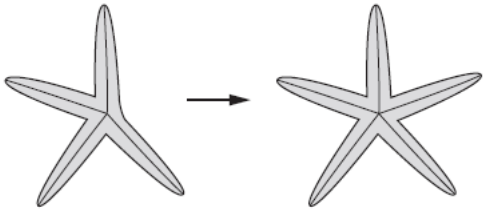
2



3



4



A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 2 only

D 3 and 4 only

7. Nov/2023/Paper_ 9700/12/No.20

Which events are part of the mitotic cell cycle?

1 interphase

2 anaphase

3 cytokinesis

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

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

Which statement about the behaviour of chromosomes during telophase is correct?

A Chromosomes attach to the spindle fibres at the equator.

B Chromosomes start to uncoil inside the newly formed nucleus.

C Chromosomes move towards the opposite poles of the cell.

D Chromosomes condense into compact structures in the cytoplasm.

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

The transmission electron micrograph shows a cell in a stage of the mitotic cell cycle.



Which statement explains why it is difficult to identify the stage of the mitotic cell cycle shown?

A Chromosomes have supercoiled and are visible, but centrioles are not visible.

B Anaphase may be continuing, or telophase may be starting.

C It is unclear whether the electron micrograph shows two cells in metaphase.

D Some people may consider interphase to have started.