5. The mitotic cell cycle

1.

Which row correctly describes a stage of mitosis?

	stage of mitosis	nuclear envelope	centromeres	spindle
A	prophase	disappears	replicate	spindle microtubules begin to form
B	metaphase	not present	move to the poles of the cell	spindle microtubules fully formed
C	anaphase	begins to reform	split into two	some spindle microtubules shorten
D	telophase	reforms	at maximum distance from cell equator	spindle microtubules break down

Ans: D

2.

What occurs during prophase in animal cells?

1 fragmentation of the nuclear envelope

2 nucleolus disappears

3 stained chromosomes become visible

4 centrioles replicate

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 2 and 3 only

D 1 and 4 only

Ans: B
NOTE: centrioles replicate during the S phase of interphase

3.

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.

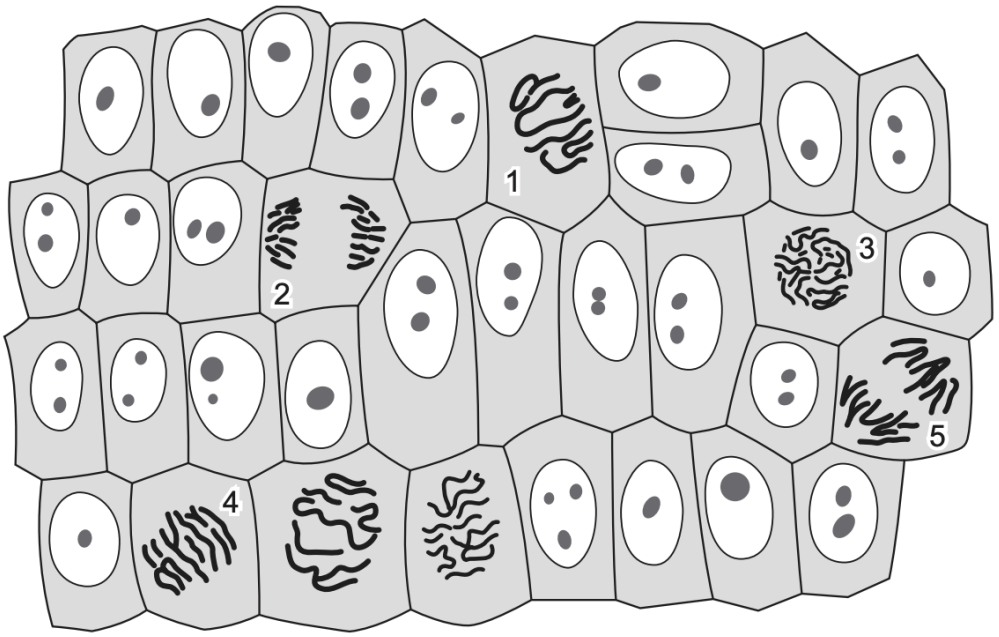
C They are unpaired regions of DNA on the 3′ end of every chromosome.

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

Ans: D

4.

The diagram shows stages of mitosis.



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

A $1 \rightarrow 3 \rightarrow 4 \rightarrow 2 \rightarrow 5$

B $1 \rightarrow 3 \rightarrow 4 \rightarrow 5 \rightarrow 2$

C $3 \rightarrow 1 \rightarrow 4 \rightarrow 5 \rightarrow 2$

D $3 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 5$

Ans: C

- 3 is interphase and 1 is prophase, since the chromosomes appear thicker/condensed in 1
- 4 is metaphase since chromosomes are arranged linearly
- 5 is anaphase as chromatids are separating and 2 is telophase as they have completely moved to opposite poles of the cell

5.

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

Ans: D

6.

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%

Ans: B

- Appear as 2 chromatids during prophase & metaphase
- During anaphase chromatids will separate

7.

Which statements correctly describe features of stem cells that are essential for their role in cell replacement and tissue repair?

1 After mitosis of stem cells, the daughter cells can either remain as stem cells or follow a developmental pathway that leads to the formation of specialised cells.

2 Stem cells are different to all other body cells because they retain all of the genetic information in their DNA throughout the life of the organism.

3 A small population of stem cells is retained in the body of adults throughout their life time.

4 Stem cells have more telomeres than other body cells and this allows them to undergo an unlimited number of mitotic divisions.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 3 only

D 2, 3 and 4 only

Ans: A

8.

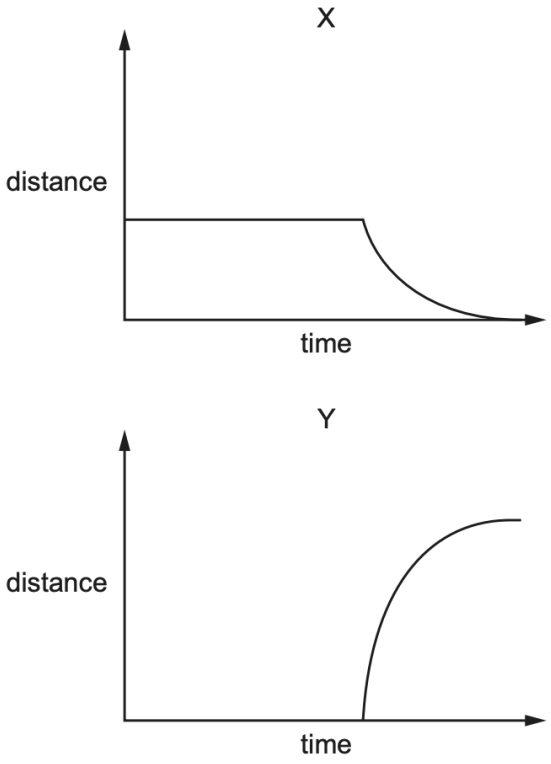
Which row is correct for stem cells?

	can repair cells	can be involved in the formation of phagocytes
A	yes	no
B	yes	yes
C	no	no
D	no	yes

Ans: D

9.

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



Which row correctly identifies the distance measurement for each graph?

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

Ans: C

10.

Which row is correct for the start of anaphase of mitosis?

	form of DNA	DNA is associated with histone proteins	state of the cell surface membrane
A	chromosomes	always	broken apart
B	chromosomes	sometimes	intact
C	separated sister chromatids	always	intact
D	separated sister chromatids	sometimes	broken apart

Ans: C

11.

The contents of a daughter cell are compared to the parent cell after one cell cycle.

Which row is correct?

	number of chromosomes	volume of cytoplasm	length of telomeres
A	increases	remains the same	decreases
B	increases	decreases	remains the same
C	remains the same	remains the same	remains the same
D	remains the same	decreases	decreases

Ans: D

12.

Which statements about the cell cycle are correct?

1 The cell cycle includes 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

Ans: A

13.

A scientist stains the chromosomes of a 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

Ans: B

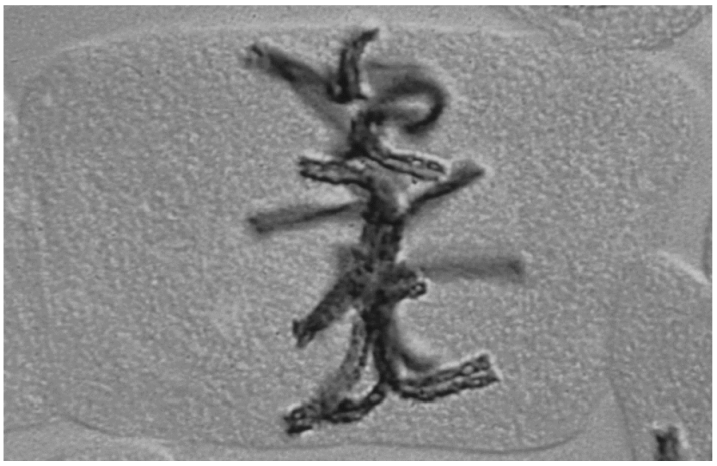
- Number of chromosomes per nucleus during telophase = 38
- Number of telomeres = 38 x 2 = 76

NOTE:

- Each chromosome has 2 telomeres!!
- After replication, each chromosome will have 4 telomeres, due to identical sister chromatids.
- At telophase, each nucleus will not have identical sister chromatids, hence only 2 telomeres at both ends of the chromatid

14.

The photomicrograph shows a stage of mitosis.



What would be correct for the next stage in mitosis?

	two sister chromatids remain attached	nuclear membrane
A	no	**not** present
B	no	re-forming
C	yes	**not** present
D	yes	breaking down

Ans: A

15.

What are the correct roles of mitosis?

	stem cell growth	replacing lost skin cells
A	✓	✗
B	✓	✓
C	✗	✗
D	✗	✓

key

✓ = correct

✗ = **not** correct

Ans: D

NOTE: mitosis helps in the <u>division</u> of stem cells NOT growth!!

16.

Which row about the stages of the mitotic cell cycle is correct?

	DNA ligase used in the nucleus	RNA polymerase used in the nucleus
A	G_1 phase	S phase
B	G_2 phase	mitosis
C	mitosis	G_2 phase
D	S phase	G_1 phase

Ans: D

17.

There are 64 chromosomes in the muscle cells of a particular mammal.

How many DNA molecules are present in a cell during early prophase and telophase of mitosis?

	early prophase	telophase
A	64	32
B	64	64
C	128	128
D	128	64

Ans: C

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 Hydrogen bonds form between tRNA anticodons and mRNA codons.

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

Ans: A

19.

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

Ans: B

20.

Which process does **not** involve mitosis?

A asexual reproduction

B growth of unicellular organisms

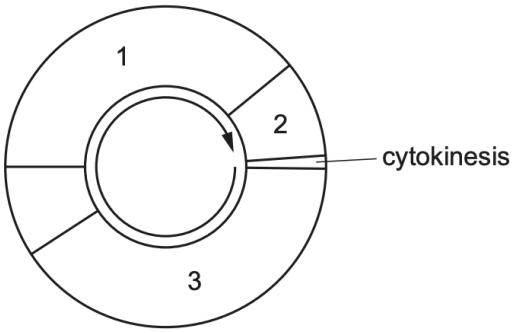
C repair of tissues by cell replacement

D replacement of damaged or dead cells

Ans: B

21.

The diagram shows an outline of the mitotic cell cycle.



Which numbered stages of the cell cycle include a period of time when each chromosome consists of sister chromatids joined by a centromere?

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

Ans: A

22.

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

Ans: B