

**Model Answers: Medium**

1

The correct answer is **B** because

- Cell 4 shows **metaphase**: chromosomes align at the equator which is where the mitotic spindle will bind to the centromere region
- Cell 1 shows **anaphase**: the chromosomes begin to separate into chromatids, which get pulled to the poles of the cell by the contracting mitotic spindle
- Cell 2 shows **telophase**: the chromatids are at the poles ready for the nuclear envelope to reform
- Cell 3 shows **late telophase**: the uncoiled chromosomes form two nuclei however cytokinesis (division of cytoplasm) has not occurred yet
- Cell 5 shows a single cell with a nucleus and no distinct chromosomes and therefore it is in **interphase**

**A** is incorrect as it suggests the chromosomes have uncoiled before they collected at the poles

**C** is incorrect as it suggests the cell at the interphase stage (with the uncoiled chromosomes within a nuclei)

**D** is incorrect as anaphase is when the chromatid centromeres divide separating the chromatids and the contracting spindle microtubules move the chromatids to the poles

2

The correct answer is **D** because:

- The order of the mitosis stages are **prophase** (two chromatids are joined by a centromere), **metaphase** (chromosomes line up along the equator of the spindle), **anaphase** (centromere divide, chromatids move to opposite poles of the cell) and **telophase** (chromosomes uncoil)
- During telophase the DNA **uncoils**

Answers **A**, **B** and **C** all have the first stage as telophase, anaphase and metaphase respectively which does not follow the correct order (PMAT).

3

The correct answer is **B** because spindle are microtubules. Microtubules are made from the protein tubulin.

Answers **A**, **C** and **D** all represent other organic macromolecules present in organisms.

4

The correct answer is **B** because:

- This diagram is of a cell undergoing mitosis, which will produce two diploid daughter cells (each with the same number of chromosomes)
- There are 10 chromosomes (that have been replicated and therefore there are sister chromatids present, so **each** chromosome is made of **2 chromatids**)
- The haploid number ( $n$ ) is where there is only **one** set of chromosomes present
- Although it is difficult to see the aligning of the chromosomes at the equator the cell has not entered anaphase as the chromatids are still joined at the centromere

**A & C** are incorrect as both indicate the cell is in anaphase, however the chromatids are clearly still joined at the centromere

**D** is incorrect as this is the diploid number of the cell (there are **two** sets of chromosomes present **not** one)

5

The correct answer is **C** because:

- Plant cells do **not** have **centrioles**
- Centrioles are the starting point for the microtubule formation to create the mitotic spindle
- Mitosis is the process of the nucleus dividing and therefore the cell wall is still present
- There are 8 chromosomes ( $n$ ) present (these have been replicated during interphase to produce sister chromatids)

6

The correct answer is **C** because during prophase

- The nuclear envelope breaks up so that the sister chromatids can be separated
- Centrioles begin to migrate to opposite ends of the nucleus (poles)
- The diploid number is the number of chromosomes present in the cell, eukaryotic cells have 2 copies of each chromosome before DNA replication (one from the mother and one from the father) and are therefore diploid
- Spindle microtubules begin to form ready for metaphase

**A** is incorrect as the centrioles have already replicated during prophase, they replicate during interphase.

**B** is incorrect as the nuclear envelope does not reform during metaphase, it reforms during telophase.

**D** is incorrect as the nuclear envelope is not breaking up during telophase, it is reforming. The nuclear envelope breaks up in prophase.

7

The correct answer is **B** because sister chromatids are separated during anaphase, which is after metaphase.

**A** is incorrect as sister chromatids are separated during anaphase

**C** is incorrect as sister chromatids are still joined by the centromere in prophase

**D** is incorrect as telophase occurs after anaphase, the chromatids need to be separated before telophase as this is when the nuclear envelopes reform around the DNA at each pole

8

The correct answer is **C** because if haploid eukaryotic cells were to undergo meiosis then when fertilisation occurs the zygote would have an insufficient number of chromosomes to produce a diploid cell.

**A** is incorrect as although mutagens cause mutations not all mutations result in uncontrolled division (cancer), they can be beneficial or have no effect

**B** is incorrect as although the chromatids have separated to separate ends of the cell during anaphase they are still in the **same cell** so the mass has not changed yet

**D** is incorrect as mitosis is not involved in cell repair **but** cell replacement

9

The correct answer is **D** because during prophase the centrioles (the proteins from which the mitotic spindle is formed) separate to opposite poles of the cell.

**A** is incorrect as the chromosomes condense and **nuclear envelope** breaks down in **prophase**. The chromosomes align at the **equator** during **metaphase**.

**B** is incorrect as the chromosomes separate during anaphase, **not** telophase.

**C** is incorrect as during anaphase it is the **centromeres** that divide.

10

The correct answer is **A** because:

- A **cell plate** forms between the two new nuclei during **cytokinesis** in **plant cells** not in animal cells
- Animal daughter cells are formed during cytokinesis by the process of **cleavage furrowing**

**B** is incorrect as DNA is expressed during interphase (G1 phase) when proteins are synthesised

**C** is incorrect as the spindle is formed from microtubules in metaphase, to allow the sister chromatids to be separated

**D** is incorrect as DNA is expressed and spindle is formed from microtubules in animal cells