

**Model Answers: Medium**

1

The correct answer is **C** as the purpose of **mitosis** is to:

- **repair damaged tissue**
- produce **cloned immune cells**
- increasing the number of cells (**growth**)
- **asexual reproduction.**

**A & B** are incorrect as mitosis is required for producing cloned plasma cells AND replacing damaged cells.

**D** is incorrect as gametes are produced during **meiosis**.

2

The correct answer is **A** because the positioning of the chromosomes on the equator of the spindle could occur in homologous pairs which occurs during meiosis and results in haploid cells. Hence, the genetic constitution will not be maintained.

**B, C & D** are incorrect as they all include the option 4 where the homologous chromosomes could orientate themselves randomly at the equator.

3

The correct answer is **C** because cancer cells result from uncontrolled cell division and thus have a shorter interphase (when the cell carries out protein synthesis and grows). Mitosis takes a specific length of time whereas the length of interphase varies depending on when the cell receives a signal to divide.

**A** is incorrect as although mutations are rare, they can occur in any cell

**B** is incorrect as new cells, including cancer cells, are created when the cytoplasm divides during cytokinesis

**D** is incorrect as cancer cells undergo the mitosis phases to produce new cancer cells

4

The correct answer is **D** because **D** is located towards the end of Interphase which suggests the cell is in **G<sub>2</sub> phase** and thus has gone through S phase (or **Synthesis of DNA** where nucleotides would be incorporated).

**A & B** are incorrect as both are located where the cell will be undergoing mitosis, which is when the replicated chromosomes (sister chromatids) are being separated.

**C** is incorrect as immediately after mitosis and cytokinesis the cell enters the **G<sub>1</sub> phase** where the cell grows, and organelles are synthesised.

5

The correct answer is **B**

- As **prophase** is the first stage of mitosis and so the **nuclear envelope** is still present
- During the **S phase** of interphase DNA is **replicated** producing a copy of the 46 chromosomes

**A** is incorrect as during prophase the **nuclear envelope** gets broken down and the **spindle fibres** form and when the nucleus divides there would only be **23** chromosomes in the daughter cells

**C** is incorrect as there are **no** spindle fibres before prophase and when the **46** chromatids were separated during **anaphase** this would result in only **23** chromosomes in the daughter cells

**D** is incorrect as there are too few molecules of DNA to produce two **diploid** cells that were genetically identical to the parent cell

6

The correct answer is **D** if both genes are mutated (inactive) then the cancer cells are able to **continually divide** which is more likely to result in breast cancer. This is because if there are no **brac1** or **p53** proteins then there is nothing to stop the growth of breast cancer cells (**brac1**) or to suppress the tumour (**p53**).

All other options would not result in cancer cells being able to continually divide as they would be stops by the proteins produced by the normal genes.

7

The correct answer is **B** because **telomeres** are short repeated sequences of DNA and proteins, which **reduce** in length each time DNA replicates because **DNA polymerase** cannot function all the way to the end of the DNA molecule. The shortening of telomeres is thought to contribute to **aging** (as cell division slows then stops)

With substance **X** replacing the telomeres, the cell **won't** age and die and instead will continually divide.

8

The correct answer is **A** as **S phase** of **interphase** is when DNA is replicated via **semi-conservative replication** and hence is when thymine (a nucleotide) will be incorporated into new strands of DNA.

All other options mention phases that occur during mitosis which is the process of the nucleus dividing and occurs **after** DNA replication.

9

The correct answer is **A** as ultraviolet light, viruses and x-rays are examples of **carcinogens** (agents that cause cancer)

All other options include carbon monoxide which is **not** a carcinogen but does displace oxygen from **haemoglobin**.

10

The correct answer is **A**

- When the *p53* gene is expressed (switched on) the tumour cells no longer divided whereas when the gene was not being expressed (switched off) the tumour cells were dividing.
- Therefore, *p53* acts to suppress the formation and growth of tumours.

**B** is incorrect as when the *p53* gene was switched on only the tumour cells died whereas the healthy cells were unaffected

**C & D** are incorrect as when the *p53* gene was switched on the tumour cells died