

Solutions

Each answer shows the steps, then the **result**.

2.1

(a)

- metaphase

(b)

- anaphase

2.2

(a)

- it breaks down / disappears

(b)

- it re-forms around each set of chromosomes

3.1 A

- In anaphase the centromeres split and chromatids move to opposite poles

3.2 C

- Chromosomes lined up across the centre is metaphase

3.3

(a)

- cells in mitosis = $9+4+2+1 = 16$; total = $84+16 = 100$. mitotic index = $\frac{16}{100} = 0.16$

(b)

- the tumour cells divide uncontrollably / continuously, so at any moment a larger fraction are in mitosis

3.4

- metaphase: chromosomes line up at the equator; spindle fibres attach to the centromeres; anaphase: centromeres split; sister chromatids are pulled by the spindle to opposite poles

3.5

(a)

- **Z** prophase, **W** metaphase, **X** anaphase, **Y** telophase; the order is Z, W, X, Y

(b)

- In metaphase (**W**) the spindle fibres attach to the centromere of each chromosome and pull until the chromosomes lie on the equator. In anaphase (**X**) the fibres shorten, the centromeres split, and the sister chromatids are dragged to opposite poles

(c)

- The proportion of cells seen in a stage is proportional to the time spent in it; $\frac{12}{240} = 0.05$; $0.05 \times 20 \text{ h} = 1 \text{ hour}$

(d)

- Growth, repair and asexual reproduction all need daughter cells carrying the same genes as the parent, so they work in the same way; **semi-conservative DNA replication** during interphase makes an exact copy of every chromosome before division