**Mark scheme 3.2.2 All cells arise from other cells**

**M1.**          (a)     (i)      Cells are in interphase;

*Accept G phase / S phase.*

**1**

(ii)     Cells undergoing mitosis / in telophase / cytokinesis;

*Accept all named stages but reject prophase, metaphase or anaphase on their own.*

**1**

(b)     1.      3 hours;

2.      Time between beginnings / endings DNA replication / Increases / levelling outs of DNA concentration / for shape (of curve for replication) to be repeated;

3.      (DNA) replication takes place once per cell cycle;

*Allow close approximation where candidate attempts to be more accurate.*

*Principle  
What is shown on the graph*

**3**

**[5]**

**M2.**(a)     1.      Push hard – spread / squash tissue;

2.      Not push sideways – avoid rolling cells together / breaking chromosomes;

*Neutral – to see cells clearly*

**2**

(b)     No (no mark)

Yes (no mark)

1.      Chromosomes / chromatids are (in two groups) at poles of spindle / at ends of spindle;

*Do not accept ‘ends of cell’*

2.      V-shape shows that (sister) chromatids have been pulled apart at their centromeres / that centromeres of (sister) chromatids have been pulled apart;

**2**

(c)     28.8 / 29;

*If incorrect, allow:*

* = 1 mark*

**2**

**[6]**

**M3.**(a)     (D)CBEA;

**1**

(b)

|  |  |  |
| --- | --- | --- |
|  | **Step** | **Reason** |
|  | (Taking cells from the root tip) | Region where mitosis / cell division occurs; |
|  | (Firmly squashing the root tip) | To allow light through /  make tissue layer thin; |

**2**

(c)     (Increase)

1.      Chromosomes / DNA replicates;  
(First decrease)

2.      Homologous chromosomes separate;  
(Second decrease)

3.      Sister chromatids separate;

**3**

(d)     1.      (DNA would) double / go to 2 (arbitrary units);

**1**

**[7]**

**M4.**          (a)     1.      Growth / increase in cell number;

*Ignore growth of cells*

2.      Replace cells / repair tissue / organs / body;

*Ignore repair cells*

*Reject bacteria*

3.      Genetically identical cells;

*‘Produces 2 genetically identical cells’ does not reach MP1 as well as MP3*

4.      Asexual reproduction / cloning;

*Allow example or description*

**2 max**

(b)     (i)     (Ensures) representative (sample);

*Accept find some cells in mitosis / not in interphase.  
Accept ‘more reliable’ only if linked to percentage (of cells).‘Improves reliability’ on its own does not gain this mark*

*Neutral: Large sample*

**1**

(ii)     1.      A = metaphase;

2.      Chromosome / chromatids lie on equator;

*Reject homologous chromosomes Allow centre / middle*

3.      B = anaphase;

4.      Chromatids / chromosomes separating / moving apart / moving to poles;

*Reject homologous chromosomes*

**4**

(c)     2 hours / 120 minutes;

*Allow 1 mark if working shows candidate understood that mitosis would take 10%*

**2**

**[9]**

**M5.**(a)     (i)      Anaphase

**1**

(ii)     1.      Sister / identical chromatids / identical chromosomes;

*Reject: Homologous chromosomes separate.*

*Allow any reference to chromatids / chromosomes being identical e.g. same DNA*

2.      To (opposite) poles / ends / sides;

**2**

(b)     (i)      1.      8.4 / cells with twice DNA content = replicated DNA / late interphase / prophase / metaphase / anaphase;

*Any reference to interphase must suggest towards end of interphase.*

*'Chromosomes replicate' is not enough for DNA replicates.*

2.      4.2 = DNA not replicated / (early) interphase / telophase / cell just divided / finished mitosis;

**2**

(ii)     2.1;

**1**

**[6]**

**M6.**         (a)     Chromosomes:            **C** = 8 *and* **D** = 4;  
DNA:                             **C** = 300 *and* **D** = 150;

**2**

(b)     (i)      testis / ovary;  
*accept anther / carpel / stamen / testicle*

**1**

(ii)     to make chromosomes / chromatids / DNA / genetic material visible;

**1**

**[4]**

**M7.**          (a)     (i)      where mitosis / division / growing / occurs  
*(reject growing cells)*

**1**

(ii)     to distinguish chromosomes / chromosomes not visible  
without stain;

**1**

(iii)     to let light through / thin layer;

**1**

(b)     (i)      74 + 18 / 982;  
= 9.4% / 9%;

**2**

*(allow 1 mark for identifying prophase & metaphase i.e.92 or correct method using wrong figures)*

(ii)     genetic differences / different types of garlic;  
time of day;  
chance;  
age of root tip;  
water availability;  
temperature;  
nutrient availability;

*(environmental factors = 1 but cannot be awarded in addition to a named environmental factor)*

**2 max**

**[7]**

**M8.**          (a)     (i)      Prophase;

**1**

(ii)     Chromosomes / chromatids moved apart;

**1**

(iii)     *A wide range of processes occurs during interphase. This list is by no means exhaustive, but we would expect to see answer such as:*

Increase in volume of cell / volume of cytoplasm / increase in mass / cell bigger; increase in number of organelles;  
synthesis of protein / named protein;  
DNA replication / increase / chromosomes copied;  
ATP synthesis / respiration;

**max 2**

(b)     Divide real length of bar (in mm) / 10 by 0.02;

**1**

(c)     12 / 200 × 24 / single error in otherwise correct method;  
1.44 hours (1 hour 26 min);

**2**

**[7]**