| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(a)(i) | 1. chromatids separated / chromosomes decondensed / eq ;<br><br>2. nucleus divided / two nuclei present /eq ; | | (2) |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(a)(ii) | 1. DNA plicated / (identical) copies of DNA produced / eq ;<br><br>2. i a that { quantity of DNA / number of chromosomes } is doubled / cell is 4n ; | 1. IG RE DNA synthesis<br><br>2. ACCE two sets of DNA | (2) |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(b)(i) | C 64 ; | | (1) |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(b)(ii) | 1. time in G1 or G2 phase / usually a cell spends { several hours / more time / 14 hours } in G1 and G2 phase ;<br><br>2. ess protein synthesis / fewer organelles ;<br><br>3. i a of { cytoplasm / organelles / cell membrane } { shared / divided / halved } with each cell division ; | 2. ACCE less cytoplasm or cell membranes produced<br>ACCEPT no organelles produced | (2) |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(c) | 1. genes would be { activated / deactivated } / eq ;<br><br>2. active genes transcribed / mRNA produced ;<br><br>3. translation (of mRNA) to produce proteins / eq ;<br><br>4. idea that proteins { modify cell / determine function of cell } / structure of cell altered permanently ; | 1. ACCE switching on or off of genes, NOT turned on or off<br><br>DO NOT ACCEPT translation of proteins | (4) |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 1(d) | 1. tiss s made of cells and organs made of tissues /eq ;<br><br>2. tissues made of { one type / similar types } of cells AND organs made of different tissues / eq ;<br><br>3. organ have more functions than tissues ; | Piece together the answer if necessary | (2) |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(a)** | 1. idea of increasing cell number ;<br><br>2. idea of replacing {damaged / dead } cells<br><br>OR<br><br>idea of repairing (damaged) tissue ;<br><br>3. to produce genetically identical cells ; | 1. ACCEPT 'production of new cells' and cells divide multiply or replicate<br><br>2. NOT growth or repair of cells | **(2)** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(b)(i)** | Stage 2. { hydrochloric / acetic / ethanoic } AND { macerate / soften / separate / break up / eq } ;<br><br>Stage 3. Toluidine (blue) / orcein / Feulgen / Schiff's (reagent) ;<br><br>Stage 4. Slide AND { coverslip / cover slide } ; | Stage 2. ACCEPT HCl, ACCEPT break down<br><br>Stage 3. ACCEPT ethanoic /acetic / proprionic orcein. ACCEPT unambiguous spellings that couldn't be anything other than the name of a stain | **(3)** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| **2(b)(ii)** | 1. { safety goggles / safety glasses / gloves } when handling { acid / stain }<br><br>2. care (with scalpel) when cutting root tip<br><br>3. care with slide when squashing root tip ; | IGNORE lab coats protecting clothes | **(1)** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(c) | **(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence)**<br><br>1. idea of chemical stimulus e.g. signal protein, growth substance ;<br><br>2. idea of some genes {active / inactive / eq} ;<br><br>3. idea of transcription of active genes ;<br><br>4. mRNA translated / { polypeptide / protein } made / eq ;<br><br>5. idea of cell {structure / function} determined / cell modified e.g. lignin synthesised ; | **QWC emphasis is logical sequence**<br><br>1. A EPT hormone<br><br>2. ACCEPT ge s switched on / off<br><br>3. A EPT mRNA synthesised | **(4)** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(d)(i) | chiasmata<br>/ pairing of homologous chromosomes<br>/ synapsis<br>/ formation of bivalents ; | IGNORE non-observable processes that are different<br>ACCEPT crossing over<br>ACCEPT spelling of chiasmata as chaismata or phonetically correct | **(1)** |

| Question Number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 2(d)(ii) | 1. crossing over and { independent/ random} assortment ;<br><br>2. description of crossing over as swapping over sections of { chromatid / DNA } ;<br><br>3. description of independent assortment of maternal and paternal chromosomes ;<br><br>4. consequence described e.g. produces recombinants or new combinations of alleles ; | 1. t s mark can be awarded if there are no correct details provided for either process | **(2)** |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| **3(a)** | X – metaphase ;<br><br>Y – anaphase ; | | **(2)** |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| **3 (b)** | 1. { chromatin / DNA } condenses / eq ;<br><br>2. chromosomes { condense /become visible /eq } ;<br><br>3. idea of nuclear { membrane /envelope } breaking down ;<br><br>4. nucleolus {disappears /eq} ;<br><br>5. reference to centrioles moving to poles or opposite ends of cell ;<br><br>6. reference to formation of spindle (fibres) ; | 1. ACCEPT coiling of DNA, not supercoiling<br><br>2. ACCEP shorten or thicken<br><br>5. NB part (b) does not specify plant cells, therefore reference to centrioles is acceptable | **(4)** |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| **3 (c)** | 1. interphase;<br><br>2. chromosomes not visible / nucleus is visible / eq ; | 1.ACCEPT/ G1 / G2 / S<br><br>2. Must be a detail seen in the photograph<br>ACCEPT converse e.g. not mitosis as chromosomes not visible | **(2)** |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| 4 (a)(i) | ☒ B metaphase ; | | (1) |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| 4 (a)(ii) | 1. refere e to {chromosomes / chromatids} ;<br><br>2. a {centre/middle/equator} (of cell) / on the metaphase plate ; | | (2) |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| 4 (b) | ☒ B interphase ; | | (1) |

| Question Number | Answer | Additional Comments | Mark |
|---|---|---|---|
| 4 (c) | QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)<br><br>1. *telophase* ;<br><br>2. *chromosomes* {*decondense* / eq } ;<br><br>3. *spindle* (fibres) break down / eq ;<br><br>4. *nuclear* { *membrane* / *envelope* } reforms / eq ;<br><br>5. two *nuclei* present /eq ;<br><br>6. *nucleoli* reform / eq ;<br><br>7. each cell will have *centrioles* ;<br><br>8. idea of *cytokinesis* ; | QWC emphasis is spelling<br><br>2. N chromatids<br><br>8. NOT '2 new cells' (it is in the stem of the Question) ACCEPT forms cleavage furrow | (4) |