**M1.**(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:*

$\frac{6}{200} \times 960$ *= 1 mark*

**2**

**[6]**

**M2.**(a) (D)CBEA.

**1**

(b)

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

| | |
|---|---|
| the root tip) | 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]

**M3.**(a) 1. Rank all STs in ascending order;
2. Find value with same number (of people) above and below.
*Accept find middle value*

2

(b) Not ethical to fail to treat cancer.

1

(c) Yes since with ipilimumab:

1. Median ST increased by 2.1 months;
2. Percentage of patients showing reduction in tumours increased from 10.3% to 15.2%;

No because:
3. No standard errors shown / no (Student) t- test / no statistical test carried out;
4. (So) not able to tell if differences are (statistically) significant / due to chance (alone);
5. Improvement might only be evident in some patients / no improvement in some patients;

6. Quality of (extra) time alive not reported;

*If answers relate only to 'Yes' or □No', award 2 marks max*

**4 max**

(d) 1. Faulty protein recognised as an antigen / as a 'foreign' protein;
2. T cells will bind to faulty protein / to (this) 'foreign' protein;
3. (Sensitised) T cells will stimulate clonal selection of B cells;
4. (Resulting in) release of antibodies against faulty protein.

**3 max**

**[10]**

**M4.**(a) Variable that is changed;

*Reject 'the variable that changes'.*

**1**

(b) 1. Idea of a confounding variable;

2. (So) genetically similar;

*2. Do not accept 'genetically identical / same DNA'.*

3. (So) have similar salt tolerance / response to salt water / response to watering treatment;

4. (So) have similar yield / mass of seeds;

*Do not accept 'amount / number of seeds' or 'growth rate'.*

**2 max**

(c) Mitosis;

*Ignore cell division*

**1**

(d) 1. Irrigation with sea water / **C** / **D** increased yield compared with no irrigation / **A**;

*For 'yield' accept 'mass of seed' throughout.*

2. Yield was lower when irrigated with sea water / **C** / **D** compared with fresh water / **B**;

*Only penalise once for use of 'amount / number of seeds'.*

3. Yield was lower when watered with sea water throughout growth and seed formation / **C** than when watered with sea water just at seed formation / **D**;

*Accept use of figures from table.*

*'It' refers to watering with seawater / mixture.*

**2 max**

(e) 1. Irrigation with sea water / **C** / **D** increases concentration of salt in soil;

*Ignore reference to standard deviation / quality of the data.*

2. Lower water potential in the soil linked to reduced uptake of water;

3. Salt concentration in the soil might / might not increase in the future;

*Mark point 3 includes the principle for mark point 1 so mp3 gains 2 marks (for mp1 and mp3)*

4. Might decrease plant growth / yield in the future;

5. Less food / fewer seeds for future planting;

*Mp 3 and 4. Allow 'further' for the idea of 'in the future'.*

**3 max**

**[9]**