M1.(a) 1. Removes (main / largest) source of oestrogen / (different) mice produce different amounts of oestrogen;

Accept: so oestrogen from ovaries not a confounding variable − idea of.

2. (Allows) oestrogen to be controlled / oestrogen to be made by aromatase only / only oestrogen made in lungs to be involved.

Reject: references to injection of aromatase.

2

(b) 1. (Anastrozole) prevents / reduces oestrogen production;

2. (Fulvestrant) stops remaining oestrogen binding / less oestrogen binds to receptors.

Note: brackets around drug names.

2

(c) (Yes for Group T)

1. Least tumours per animal (from fig. 1);

Accept: 'mean values' for tumour area.

2. Lowest (mean) tumour area / size (from fig. 2);
3. Lowest top of range;

(But)

4. Means (tumour area) are similar;

Where candidates confuse range and standard deviation, do not give credit.

5. Ranges overlap / share values so differences may not be real / treatments may be just effective in reducing tumour;

Ignore significance

6. Range affected by outliers / SD's would be better;
7. Done on mice / not done on women / humans;
8. Only 10 mice used per group / small sample size so may not be representative / reliable;
9. Might be side effects;
10. Only did for 15 weeks so maximum effect of drugs may not have been seen.

5 max

(d) 1. Tumours may be different depths / area does not take depth into

account / tumours are 3-D / are not 2-D;

Neutral: different sizes

Accept: height / thickness for depth

2. (Measure) tumour volume / mass / weight.

2

(e) 1. Allows tumours to grow / develop / form;

Neutral: gives drug more time to work.

2. (So) can investigate treatment rather than prevention (of tumours) / when tumour / cancer is more advanced.

Accept: to see whether it can destroy / treat / stop growth of a tumour (that already exists) / to allow / assess treatment of a tumour

2

(f) 1. Unethical (not to treat patients) / may increase probability of patients dying / getting more ill;

Reject: references to giving people tumours

2. Use normal cancer drugs / treatment.

Accept: named type of cancer treatment, e.g. chemotherapy

2

[15]

M2.(a) (i) 1. (Tumour suppressor) gene inactivated / not able to control / slow down cell division;

Ignore: references to growth

2. Rate of cell division too fast / out of control.

1 and 2 Accept: mitosis

1 and 2 Reject: meiosis

2

(ii) 1. (Genetic) code degenerate;

Accept: codon for triplet

Accept description of degenerate code, e.g. another triplet codes for the same amino acid

2. Mutation in intron.
Accept: mutation in non-coding DNA

1 max

(b) 1. Antibody has specific tertiary structure / binding site / variable region;
Do not accept explanations involving undefined antigen

2. Complementary (shape / fit) to receptor protein / GF / binds to receptor protein / to GF;
Ignore: same shape as receptor protein / GF

3. Prevents GF binding (to receptor).

3

[6]

M3.(a) 1. Methylation prevents transcription of gene;
2. Protein not produced that prevents cell division / causes cell death / apoptosis;
3. No control of mitosis.

3

(b) 1. Scatter graph;
2. Fat on *x* axis and death rate on *y* axis;
3. (Because) looking at relationship between two discrete / independent variables.

3

(c) 1. (Trend) shows positive correlation / shows the more fat in diet, the higher death rate from breast cancer;
2. But number of points off line / anomalies.

2

[8]

M4.(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]

M5.(a) 1. To allow comparison;

2. Because different number of cells in samples / different times for incubation / numbers become easier to manipulate;

2

(b) 203.7(%);;

Allow 1 mark for 21.8 / 10.7

Allow 1 mark for correct answer (203.74) but not correctly to 1 dp

204 = 1 mark

2

(c) (i) 1. (At every concentration) uptake is faster at 37°C / at higher temperature;

2. Due to faster respiration / ATP production;

2

(ii) 1. Uptake at 37°C only small increase / levelling off / almost constant as carrier proteins full;

Accept 'no (significant) change'

Ignore use of numbers

2. Concentration of imatinib is not the limiting factor;

2

[8]