

Mark schemes

Q1.

- (a) 665 (people per month);;

Allow one mark for 7980/7981 in working (number of deaths from throat cancer per year)

Accept answers not rounded

2

- (b) 1. (EGCG) binds to active site of DNMT;
Ignore active site changes shape
Ignore 'forms enzyme-substrate' complex
2. (DNMT) cannot methylate (promoter region of tumour suppressor gene);
3. Transcription(al) factor(s) can bind (to promoter region);
4. RNA polymerase (stimulated/activated);
Accept less methylation (of promoter region/tumour suppressor gene)

3 max

- (c) 1. Only investigated in throat cancer

OR

Might not work for other types of cancer;

2. Not all cancers are caused by (increased) methylation (of a tumour suppressor gene)

OR

There are other causes of cancer;

3. Only a significant reduction with 20/50/above 10 (μmol)
Allow converse, ie no significant effect with 5/10 (μmol)

4. Do not know how much EGCG is in green tea;

5. Only reduces growth rate (of cancer cells)

OR

No evidence of cancer being cured;

6. *In vivo* cells/cells in the body might respond (to EGCG) differently (from those grown *in vitro*);

3 max

[8]

Q2.

(a) Box 2.

An inversion will result in a change in the number of DNA bases.

Reject if more than one box with tick. Ignore crossed-out ticks

1

- (b) 1. (Increased) methylation (of tumour suppressor genes);
Accept abnormal methylation or hypermethylation
Ignore decreased acetylation of histones
2. Mutation (in tumour suppressor genes);
3. Tumour suppressor genes are not transcribed/expressed
OR
Amino acid sequence/primary structure altered;
Accept mRNA for transcription/transcribed
Accept tertiary structure altered
Accept different amino acid
Ignore reference to protein not being formed
4. (Results in) rapid/uncontrollable cell division;
Accept cell division cannot be regulated
Ignore growth

3 max

- (c) 1. Correct answer of $1.9/1.93 \times 10^{25} = 2$ marks;;
Accept $2 \times 10^{25} = 2$ marks
Ignore any numbers after 1.93
2. Incorrect answer but shows $84 = 1$ mark
OR
 $28 \times 3 = 1$ mark
OR
Incorrect answer but shows 672 divided by 8 = 1 mark;

2

[6]**Q3.**

- (d) 1. ATM will not bind to (broken) DNA;
2. DNA not repaired / cell still has broken DNA;
3. Cell division continues / tumour forms;
4. Tumour suppressor (gene) not effective / not activated;
5. May have no effect in diploid / heterozygous (organism);
6. (Which) still has a functional ATM / ATM gene;

3 max

Q4.

- (a) 1. Heritable changes in gene function;
2. Without changes to the base sequence of DNA;

2

(b)

Control element	Binds with DNA	Binds with protein
Oestrogen		✓
Methyl groups	✓	
Acetyl groups		✓

1 mark for each correct column.

Accept both boxes ticked in oestrogen row.

2

- (c) 1. Methyl groups (could be) added to (both copies of) a tumour suppressor gene;
2. The transcription of tumour suppressor genes is inhibited;
3. Leading to uncontrolled cell division.

3

- (d) Cells of benign tumours cannot spread to other parts of the body / metastasise;

OR

Cells of benign tumours cannot invade neighbouring tissues.

Accept answers clearly in the context of malignant tumours.

1

[8]**Q5.**

- (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]

Q6.

- (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]