# A-Level Biology

## Cancer

## Mark Scheme

**Time available: 67 minutes**
**Marks available: 51 marks**

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**1.**

(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 <u>active site</u> 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 <u>significant</u> reduction with 20/50/above 10 (µmol)

*Allow converse, ie no <u>significant</u> 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]**

**2.**

(a) 1. Produce healthy (blood) cells;

*Accept produce 'normal' /non-MDS cells.*

2. No MDS/faulty/cancerous (blood) cells;

*Produce only healthy/normal (blood) cells =* ***two marks.***

*Accept no (cancerous) tumour.*

3. Stem cells divide/replicate;

*Ignore reference to totipotent/pluripotent/ multipotent/unipotent*

*Accept 'clone' for divide.*

**3**

(b) 1. (AZA) reduces methylation (of DNA/cytosine/gene);

*Reject any reference to mutation.*

2. (Tumour suppressor) gene is transcribed/expressed;

*Accept mRNA produced for transcription/transcribed.*

*Ignore gene is 'switched on' or activated but allow protein is formed.*

3. Prevents rapid/uncontrollable cell division

**OR**

Cell division can be controlled/stopped/slowed;

*Ignore growth.*

**3**

(c) 1. Effect of AZA can be compared;

*Comparison on its own is not enough for a mark.*

2. Unethical not to treat (control group);

**2**

(d) 1. Correct answer of 29/28.8 = **2 marks**;;

2. Working shows 0.74 **and** 0.58 = **1 mark**

**OR**

58/57.6 = **1 mark**

**OR**

28 = **1 mark**;

**2**

**[10]**

**3.**

(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]**

**4.**

(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]**

**5.**

(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]**