A-Level Biology

Stem Cells

Mark Scheme

Time available: 57 minutes
Marks available: 43 marks

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1.

(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]

2.

(a) 1. (Usually)Type II produce insulin;
2. Cells / receptors less sensitive / responsive (to insulin)
OR
Faulty (insulin) receptors;
3. (Treated / controlled by) diet / exercise;

2. Accept: cells / receptors do not respond.

2. Accept: 'fewer receptors'

3. Accept: (Treated / controlled by) weight loss / medication / drugs.

3. Ignore: diabetes is caused by diet / exercise.

2 max

(b) Tick in box 4

1

(c) 1. Attach to gene / DNA / promoter region;
2. Stimulate / inhibit transcription / RNA polymerase;

Note: Genes being expressed / inhibited or switched on / off is not enough on its own.

2

(d) 1. (Effective as) group A / with iPS / treated lower than group B / with diabetes;
2. (Effective as) group A similar to group C / without diabetes;
3. (Investigation) done on mice not humans;
4. Only shows results for 12 weeks / short-time period / long-term effects not known;

Ignore: Only one study / not repeated / sample size.

2. Accept: 'healthy' or 'normal' or control for group C.

4

[9]

3.

(a) 1. (ESCs) can replace any type of (heart) cell;

Accept named type of cell, e.g. heart muscle cell

1

(b) 1. Might divide out of control;

2. Leading to tumour / cancer;

2

(c) 1. Shows the effects of surgery;

2. Allows effects of transplants / treatment to be seen;

Allow in either order

2

(d) 1. Other cell types cause some increase but most of increase due to cardiomyocytes;

2. Large SD, so some not much increase / no better than control;

3. Overlap of SDs indicates / suggests no significant difference;

3

(e) 1. Greater blood supply (to damaged areas);

2. Bringing more oxygen / glucose for respiration;

3. Brings more amino acids for protein synthesis;

4. For cell repair / mitosis / division;

3 max

(f) 1. Measure diameter of field of view and calculate area;

2. Using micrometer slide and eyepiece graticule;

Accept descriptions

3. Count number of capillaries in large number of fields of view and calculate mean;

4. Select fields of view randomly

4

[15]

4. (a) Will replace themselves / keep dividing / replicate;

Undifferentiated / can differentiate / develop into other cells / totipotent / multipotent / pluripotent;

Accept tissues

2

(b) Reverse transcriptase;

Allow phonetic spelling

1

(c) (i) Alters base / nucleotide sequence / causes frame shift;

Different sequence of amino acids in polypeptide / protein / primary structure alters the tertiary structure;

Accept any reference, such as adding bases, to changing the base sequence of the gene. Reject deletion / substitution.
Idea of sequence essential so not makes different amino acids.
Accept answers involving stop / start codons and effect on protein.

2

(ii) Affects tumour suppressor gene;

Inactivates (tumour suppressor) gene;

Rate of cell division increased / tumour cells continue to divide;

Ignore answers relating to oncogenes. May gain third point.

2 max

(d) Yes
SCID patients unlikely to survive / quality of life poor unless treated;
Cancer that develops is treatable / only affects 25% / five children;

No
Risk of developing cancer is high / 25%;
Cancer may recur / may not be treated successfully in future / only short time scale so more may develop cancer;

No mark for yes or no. Marks are for supporting argument based on biological reasoning.
Accept any points

2 max

[9]