Mark schemes

Q1.

(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]

Q2.

(c) 1. Effective as D has lower protein (than B/C);

Accept descriptions of each group e.g. A = wild type mice. B = AS mice. C = AS mice that received AS stem cells. D = mice that received wild type stem cells.

Accept 'healthy' or 'without AS' for 'wild type'.

2. Not fully effective as D has higher protein than A;

3. Do not know all results for other mice in D

OR

Only shows results for 68% of mice;

4. Some of D mice may have been cured

OR

Some of D may have died;

5. Do not know actual/numerical quantity of protein;

6. (Investigation) only on mice

OR

(Investigation) not on humans;

Accept 'rats' for 'mice'.

7. Rejection may occur;

Accept 'immune response' for rejection.

8. Only shows results for 20 weeks/short-time period

OR

Long-term effects not known;

Ignore answers relating to sample size or statistical test.

4 max

(d) 1. (Transplanted stem cells) differentiate/specialise;

2. Reduce loss of protein at the glomerulus

OR

Prevents protein moving into filtrate;

Accept Bowman's/renal capsule.

2

Q3.

(b) 1. Produce healthy (red blood) cells
OR
Produce (normal) polypeptide/haemoglobin;

Produce only healthy (red blood) cells is only equivalent to mark point 1.

Accept produce 'normal'/non-SCD cells.

Ignore type of stem cell e.g. pluripotent.

2. No sickle/faulty/SCD (red blood) cells (produced)
OR
No defective polypeptide/haemoglobin;

3. Stem/marrow cells (continuously) divide/replicate
OR
Less chance of rejection (from brother/sister);

Differentiate is not equivalent to divide/replicate.

Ignore type of stem cell e.g. pluripotent.

3

(c)

Max 2 marks *for marking points 1, 2 and 3*

(For gene therapy)

1. No destruction of bone marrow
OR
No destruction of stem cells;

Accept no destruction of faulty bone marrow unless context indicates this is against gene therapy.

2. Donors are not required;

Stating 'only own cells used' is ***not*** *equivalent.*

3. Less/no chance of rejection (own stem cells);

(Against gene therapy)

4. Sickle/faulty (red blood) cells still produced

5. Immune response against genetically modified cells/virus
OR
Long-term effect not known (as is new treatment)
OR
Virus could cause side effects;

Accept 'virus could cause problems' or 'risk(s) with virus'.

3 max

Q4.

(e) 1. (iPS cells) divide;

2. (iPS cells) develop/differentiate into (green sensitive) cones;

Accept 'produce'/'specialise' 'turn in to' / 'genes switched on' / 'turned on' for 'develop' but ignore 'grow'

Reject develop into 'green cones'/blue' cones'/'red cones'

Ignore develop/differentiate into (blue/red sensitive) cones;

Reject reference to develop in to 'green pigment'/ 'blue pigment/ 'red pigment

2

(f) 1. (Use of iPS cells) long-term;

Accept 'gene therapy short-term' or 'only two years'

Accept 'permanent'

2. (Use of iPS cells) less chance of rejection/immune response;

3. (Use of iPS cells) single treatment;

Accept 'gene therapy 'regular/frequent treatment''

4. Harm/side effects from using viruses (in gene therapy);

3 max

Q5.

(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

Q6.

(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