Mark schemes

1

(a) (i) 4;

1

(ii) 1. Change in amino acid / (sequence of) amino acids / primary structure;

1. Reject = different amino acids are 'formed'

2. Change in hydrogen / ionic / disulphide bonds alters tertiary structure / active site (of enzyme);

2. Alters 3D structure on its own is not enough for this marking point.

3. Substrate not complementary / cannot bind (to enzyme / active site) / no enzyme- substrate complexes form;

3

(b) 1. Lack of skin pigment / pale / light skin / albino;

2. Lack of coordination / muscles action affected;

2 max

(c) Founder effect / colonies split off / migration / interbreeding;

Allow description of interbreeding e.g. reproduction between individuals from different populations

1

[7]

2

(a) 1. Closer the (amino acid) sequence the closer the relationship;

2. (Protein structure) related to (DNA) base / triplet sequence;

Amino acid sequence is related to (DNA) base / triplet sequence = two marks;

2

(b) 1. Reference to base triplets / triplet code / more bases than amino acids / longer base sequence than amino acid sequence;

Different (base) triplets code for same amino acids = 2 marks;

Degeneracy of triplet code = 2 marks

2. Introns / non-coding DNA / degeneracy of code / more than one code for each amino acid;

Ignore reference to codon.

2

[4]

3

(a) (i) 1. Sex;

2. Lifestyle;

Stress, smoking, diet etc are examples of lifestyle.

3. Body mass;

3. Allow weight for mark point 3.

4. Health;

Reject: height.

5. Ethnicity;

6. Genetic factors / family history;

2 max

(ii) 1. Large sample / number / 410 000;

Reject: random

2. Long time period / 8.5 / many years;

3. Different countries / more than one country;

2

(b) Correct answer of 209 / 209.1 = 2 marks;

Answer of 210 = one mark

Incorrect answer but multiplies by 8.5 = 1 mark;

2

(c) Age affects risk of cancer;

Must relate to cancer not just to illness

1

(d) 1. Correlation does not mean causal relationship;

1. Reject casual for point 1.

Reference to 'due to other factors' on its own is not enough for a mark

2. Tea / coffee contains other substances / different amounts of caffeine / estimated intake (of tea / coffee);

3. No control group;

4. Only one type of cancer studied / further studies required / only one investigation / study / group;

4

(e) (i) 1. Treated the same;
2. Accept decaffeinated

2. No caffeine;
2. Reject placebo.

2

(ii) 1. Absorb different amounts;
Reject: Different body masses

2. Broken down by enzymes / digested;

3. Different blood volumes;

4. Differences in metabolism;

5. Caffeine from a different source;

1 max

(iii) 1. Less oxygen / glucose to (cancer) cells;
'Reduces cell division' on its own should not be credited.

2. Less carcinogens;

3. Reduces spread of cancer (cells);

1 max

[15]

4 (a) In one country where the percentage of fat (in the diet) is 35%, the death rate (from breast cancer) is 20 per 100 000;
Must have reference to country
Accept … 1 per 5 000 / 0.02%

1

(b) 1. No. of deaths from breast cancer divided by total population × 100 000;

2. No. of deaths from breast cancer divided by all deaths × 100 000;

3. Sample and count deaths from breast cancer in 100 000 people;
If sample not 100 000 then must scale appropriately

1 max

(c) 1. Positive correlation;

2. But correlation does not show causation / some other (named) factor may be involved;

3. Evidence against positive correlation e.g. different death rates at same % fat / similar death rates at different % fat / some countries with higher death rate have lower fat intake;

1. Accept description of positive correlation / directly proportional.

Accept positive relationship.

2. Do not accept casual in place of causal.

3. Answer must be consistent with data.

3

[5]

5 (a) (i) Spindle formed / chromosome / centromere / chromatids attaches to spindle;

Chromosomes / chromatids line up / move to middle / equator (of cell);

Do not award second mark for answers referring to chromosomes 'pairing up'.

Ignore reference to homologous chromosomes unless context suggests pairing which negates second mark.

Neutral: Details on nuclear membrane.

Accept: Diagram for second marking point.

2

(ii) Chromosome / centromere splits / chromatids / 'chromosomes' separate / pulled apart;

To (opposite) sides / poles / centrioles (of cell);

Reject: Homologous chromosomes separate for first marking point.

Accept: Diagram for second marking point.

Chromatids / 'chromosomes' move to poles / sides / centrioles = 2 marks.

2

(b) (i) Form / replace cells quickly / rapidly / divide / multiply / replicate rapidly;

Neutral: Repair cells.

Answers must convey idea of 'speed'.

1

(Ii) Correct answer = 774 minutes / 12 hours 54mins = 2 marks;;

Incorrect answer but indicates 3 cell cycles involved = one mark;

2

(c) Prevents / slows DNA replication / doubling / prevents / slows mitosis;

New strand not formed / nucleotides (of new strand) not joined together / sugar-phosphate bonds not formed;

First marking point must be in context of DNA replication not cell replication.

Do not negate first marking point if role of DNA polymerase is described incorrectly e.g. Reject: 'joins bases / strands together'.

Role of DNA polymerase must be correct for last marking point.

2

[9]

6

(a) 1. Gives rise to new plants / plantlets;

2. So must be able to develop into different tissues / other specialised cell types / differentiate;

1. Ignore references to leaves / callus

2

(b) Two marks for 5 : 1/50 : 10/1 : 0.2;;

One mark for ratio correctly identified but expressed incorrectly as 1 : 5 / 10 : 50 / 0.2 : 1;

2

(c) (i) 1. Meiosis / independent assortment / crossing over;

2. (Fusion of) genetically different gametes / random fertilisation;

2

(ii) Will be clones / produced by mitosis / will be genetically identical / less variation / all plants will have desired characteristics;

If the reference is to identical must be genetically identical, but allow less variation without the reference to genetical.

1

[7]

7

Essay Using DNA in science and technology

DNA and classification

2.2 Structure of DNA

2.3 Differences in DNA lead to genetic diversity

2.9 Comparison of DNA base sequences

Genetic engineering and making useful substances

2.5 Plasmids

5.8 The use of recombinant DNA to produce transformed organisms that benefit humans

Other uses of DNA

2.5 Cell cycle and treatment of cancer

5.8 Gene therapy;

Medical diagnosis and the treatment of human disease;

The use of DNA probes to screen patients for clinically important genes.

8 (a) Introns;

1

(b) Ile Gly Val Ser;

1

(c) (i) Has no effect / same amino acid (sequence) / same primary structure;

Q *Reject same amino acid formed or produced.*

1

Glycine named as same amino acid;

1

It still codes for glycine = two marks.

(ii) Leu replaces Val / change in amino acid (sequence) / primary structure;

Change in hydrogen / ionic bonds which alters tertiary structure / active site;

Q *Different amino acid formed or produced negates first marking point.*

Substrate cannot bind / no longer complementary / no enzyme-substrate complexes form;

Active site changed must be clear for third marking point but does not need reference to shape.

3

(d) (i) Interphase / S / synthesis (phase);

1

(ii) DNA / gene replication / synthesis occurs / longest stage;

Allow 'genetic information' = DNA.

Allow 'copied' or 'formed' = replication / synthesis

1

[9]

9 (a) RNA polymerase;

DNA polymerase is incorrect
Ignore references to RNA dependent or DNA dependent
Allow phonetic spelling

1

(b) (i) (Receptor / transcription factor) binds to promoter which stimulates RNA polymerase / enzyme X;

Transcribes gene / increase transcription;

2

(ii) Other cells do not have the / oestrogen / ERα receptors;

But do not accept receptors in general.

1

(c) Similar shape to oestrogen;

Binds receptor / prevents oestrogen binding;

Receptor not activated / will not attach to promoter / no transcription;

Accept alternative
Complementary to oestrogen;
Binds to oestrogen;
Will not fit receptor;

2 max

[6]

10 (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]