Mark schemes

1

(a) 1. Binding (of interferon gamma) changes shape/tertiary structure of receptor (protein);

2. This activates/switches on the enzyme;

3. Use of ATP (to phosphorylate STAT1);

1. Accept reference to second messenger mechanism/process3.

Context is important

2 max

(b) 1. Phosphorylated STAT1;

2. IRF (protein);

Accept in either order

1. Must be phosphorylated but accept STAT1P

2. Ignore references to phosphorylated

2

(c) 1. Causes more helper T cells to form;

2. (So) more interferon (gamma) production (by helper T cells);

1. and 2. require idea of more

2

(d) 1. (Tumour suppressor gene) slows cell division/causes death ofdamaged/tumour/cancer cells;

2. *IRF* gene leads to formation of IRF (protein) that binds to gene B;

3. (Gene B protein) causes death of damaged/mutated cells ORslows division;

2. 'It' means IRF gene

3. Context is important

*3. If clearly stated **and** includes the protein, scores 2 marks because it subsumes point 1*

3

[9]

2

(a) Cytosine with Guanine <u>and</u> (Adenine) with Uracil;

Ignore G, C and U

1

(b) Two reasons, with suitable amplification;;

Q

Only infected cells have HIV protein on surface;

So carrier only attaches to / specific to these cells / siRNA can only enter these cells;

OR

siRNA (base sequence) complementary / specific to one mRNA;

Accept idea of specificity

Only infected cells contain mRNA of HIV / this gene / stops translation of this gene / only binds to this mRNA / destroys this mRNA;

Accept could not inhibit other / non-HIV mRNA

4 max

(c) 1. Carrier binds to (protein on) HIV;

1. Accept references to HIV membrane

2. Prevents HIV / it binding to (receptor on human) cell;

2. Reject references to binding to HIV protein on human cell

2

[7]

Essay Using DNA in science and technology

3

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.

(a) RNA polymerase;

4

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 RNApolymerase / 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]

5 (a) No cadmium;

Other conditions same as cadmium-treated group;

2

(b) (i) As a measure of the effect due to cadmium /to make a comparison;

1

(ii) Becoming more methylated;

Ignore later slight decrease/no change

1

(iii) Production of more methyltransferase enzyme /increased activity of transferase;

Extra incorrect relevant information - cancel

1

(c) RNA-polymerase could not bind (to DNA / to promoter);mRNA of p16 could not be made / no transcription of p16 gene;

2

(d) Any **four** from:

1. Cadmium causes expression of methyltransferase gene / increased activity transferase (from 2 to 3 weeks in);
2. Methyl groups on to promoter / p16 gene / suppressor (gene);
3. (p16) normally suppresses tumour growth;
4. p16 protein / p16 expression falls after 4 weeks / after methylation; 5. Tumour formation occurs (after 10 weeks) after p16 falls / after suppressor gene activity falls;

4 max

[11]