

**M1.(a)** Cytosine with Guanine and (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]

**M2.(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 / ER $\alpha$  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]

**M3.** (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]

#### **M4. 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.