Mark schemes

Q1.

(a) 1. Correct answer of 625 = **2 marks**;;

2. Shows 625 but decimal point incorrect = **1 mark**

OR

Working shows 40 = **1 mark**

OR

1600/1.6 = **1 mark**

OR

667/666.6 = **1 mark**;

2

(b) (Cell/membrane has a) phospholipid bilayer

OR

No channel/carrier protein (for uptake)

OR

No need for channel/carrier protein (for uptake);

1

(c) 1. Both are more effective than the control;

Mark points 4 to 10 = 4 max.

Accept both (results) are below the control.

2. Differences in the means not (likely to be) due to chance

OR

Significant difference (in effectiveness between both types);

Reject 'results are significant'.

Accept significantly higher or significantly lower in correct context.

3. (As) SDs do not overlap;

Accept error bars do not overlap.

4. HBsAg (reduced), not zero

OR

Replication (reduced), not zero;

5. Not (investigated in) humans

OR

(Investigated in) mice;

6. shRNA (more effective as) 7.5% (of control) compared with 50% for lhRNA;

Accept 42.5% difference.

Accept (mean) concentration for %.

7. No indication of sample size/number;

8. Long term effects not known

OR

Side effects not known;

Accept 'could be toxic' for side effects not known.

9. No statistical test to determine significance;

10. (Investigated) in vitro

OR

Not (investigated) in vivo;

Accept not done inside an organism or not done in liver (organ) but 'only tested in liver cells' is insufficient unless qualified.

Ignore only 'one study' or 'no repeats'.

5 max

[8]

Q2.

(a) 1. Lipid soluble;

Ignore 'not water soluble' or 'fat soluble'.

2. (Diffuse through) phospholipid (bilayer);

Ignore reference to joining to receptors/channels/carriers but reject passage through protein channels/carriers.

2

(b) 1. Has a (specific) tertiary structure/shape;

Accept in context of AR or testosterone.

Ignore 3D.

2. (Structures are) complementary;

Reject reference to antigen.

Reject reference to active site, enzyme, substrate or induced fit.

2

(c) 1. (AR is) a transcription factor;

Ignore 'binds to bases' or 'binds to gene'.

2. Binds to DNA/promoter;

Reject reference to active site, enzyme, substrate or induced fit.

3. (Stimulates) RNA polymerase;

2 max

(d) 1. With 16 or fewer than 16 (repeats the association) is significant;

If none of the marks is awarded allow principle mark of (prostate) cancer more likely with 16 or less than 16 (repeats) ***or*** *(prostate) cancer less likely with 17 or more than 17 (repeats)*

OR

Alternative principle mark Correctly links significant/not significant to correct probability value/percentage ***or*** *to rejecting/accepting the null hypothesis.*

Reject 'the results are significant'.

Accept 'difference in results is significant'.

2. *With 17 or more than 17 (repeats the association) is **not** significant;

3. *With 16 or fewer than 16 (repeats) there is less than a 5% or less than 0.05 probability of being due to chance

OR

*With 17 or more than 17 (repeats) there is more than a 5% or more than 0.05 probability of being due to chance

OR

*Explanation of a probability value e.g. 0.30 is a 0.30 or 30% probability of being due to chance;

Accept equivalent responses in terms of 95% or 0.95 probability.

4. *With 16 or fewer than 16 (repeats) reject the null hypothesis

OR

*With 17 or more (repeats) accept the null hypothesis;

**Accept reference to any number of repeats (e.g. 18) between 17 to 20 for 17 or more than 17 (repeats).*

3 max

[9]

Q3.

(b) 1. Antisense mRNA is <u>complementary</u> to 'sense' mRNA;

2. Antisense mRNA would bind/base pair to (sense) mRNA;

OR

Double stranded (m)RNA forms;

3. Ribosomes would not be able to bind;

4. Preventing/less translation (of mRNA)

OR

Preventing/less production of SUT1 (protein);

Accept descriptions of translation

4

Q4.

(c) 1. It/DNA is <u>complementary</u> to (m)RNA;

Accept (transcription) results in <u>complementary</u> (m)RNA.

Ignore miRNA/siRNA/transcriptional factors.

2. Binds to mRNA (for huntingtin);

3. Prevents <u>translation</u>;

Ignore transcription.

3

(d) 1. Small sample size
OR
Only 46;

2. Only four-months
OR
short period (of trial);

3. Huntingtin/protein reduced
OR
Huntingtin/protein still produced
OR
Huntingtin/protein not removed;

Accept huntington for huntingtin.

Ignore miRNA/siRNA/transcriptional factors.

4. Allele/gene/mutation/mRNA (for Huntington's) still present
OR
(May be) temporary
OR

Drug treatment repeated;

5. Brain already damaged
OR
Brain damage may continue;

2 max

(e) 1. (Drug/DNA) will directly/quickly reach <u>brain</u>
OR
(Cerebrospinal) fluid bathes the <u>brain</u>;

2. (Drug/DNA) not destroyed by acid
OR
(Drug/DNA) not digested (by enzymes);

Reject protein is digested.

Ignore location of enzymes.

Accept Drug/DNA denatured.

2

(f)

***Mark in pairs** but if no mark credited allow one mark for any reference to transcription or gene expression being affected.*

1. (Increased) methylation of DNA/gene/allele;

Reject acetylation of DNA.

Accept gene expression for transcription but ignore gene switched on/off.

Ignore methylation of histones.

Accept DNA-histone complex as equivalent to <u>histone(s)</u>.

2. Inhibits/prevents transcription;

OR

3. Decreased methylation of DNA/gene/allele;

4. Stimulates/allows transcription;

OR

5. Decreased acetylation of <u>histone(s)</u>;

6. Inhibits transcription;

OR

7. Increased acetylation of <u>histone(s)</u>;

8. Stimulates/allows transcription;

2 max

Q5.

(a) 1. Cell membranes made from phospholipid;

Note: candidates may make both mark points in once statement

2. (Detergent) dissolves membranes / phospholipid (bilayer);

Ignore breaks down

Reject hydrolysis

2

(b) 1. Spin (liquid / supernatant) at (very) high speed / high g;

*Need context of high, **not** just 'faster', 'higher' in context of use of bench centrifuge*

Accept high centrifugal force

Award 1 max if ref. to organelle separation

2. Molecules / CENP-W separates depending on (molecular) mass / size / density;

Accept weight

2

(c) 1. siRNA binds to / destroys mRNA for CENP-W;

Reject if siRNA binds to gene / DNA

*Context is important, siRNA acts on mRNA for CENP-W, **not** tubulin.*

*Ref. to CENP-W required **once** for MP1 and MP2*

2. Prevents translation of CENP-W;

*Context is important, siRNA acts on mRNA for CENP-W, **not** tubulin.*

*Ref. to CENP-W required **once** for MP1 and MP2*

Accept reduces translation of CENP-W

3. (After / as) CENP-W reduces **so** does tubulin production;

3

[7]

Q6.

(a) 1. Heritable changes in gene function;

2. Without changes to the base sequence of DNA;

2

(b)

Control element	Binds with DNA	Binds with protein
Oestrogen		✓

Methyl groups	✓	
Acetyl groups		✓

1 mark for each correct column.

Accept both boxes ticked in oestrogen row.

2

(c) 1. Methyl groups (could be) added to (both copies of) a tumour suppressor gene;

2. The transcription of tumour suppressor genes is inhibited;

3. Leading to uncontrolled cell division.

3