Mark schemes

Q1.

(a) 1. Restriction endonucleases/enzymes cuts plasmid;

OR

Restriction endonucleases/enzymes produces 'sticky ends';
Ignore restriction enzymes cuts out the gene.
*Reject restriction enzymes **cuts** the **gene**.*

2. Ligase joins gene/DNA and plasmid

OR

Ligase joins 'sticky ends';

2

(b) 1. Cell division has occurred (before gene added);
Accept mitosis but reject meiosis.

2. (Cells producing) gametes do not receive the gene;
Accept DNA replication has occurred.

2

(c) 1. No overlap in SDs;

2. Significant increase/difference (in growth/mass)

OR

Increase/difference (in growth/mass) is **not** due to chance;
Reject 'the results are significant or not due to chance'.

2

(d) 1. Large sample size **so** representative;

2. 12 months **so** can assess/allow growth;
Accept long time for 12 months.
Accept increase in mass for growth.

3. Control (present) for comparison;
Accept description of the control.

2 max

[8]

Q2.

(d) Binds to P34 gene/DNA/mRNA
OR

Binds to transcription factor gene/DNA
OR
Binds to promoter;

Reject binds to transcription factor

1

(e) 1. Restriction (endonuclease/enzyme) to cut plasmid/vector;

2. Ligase joins gene/DNA to plasmid/vector;

2

(f) 1. Mass/number of amino acids/polypeptides;

Accept weight for mass
Ignore density/size
Accept length of polypeptide/amino acid chain
Accept primary structure /sequence of amino acids.
Accept tertiary structure

2. Charge;

3. R groups (differ);

2 max

Q3.

(a) Produces (c)DNA using (m)RNA;

Accept: 'converts' (m)RNA to (c)DNA.
Reject: tRNA

1

(b) Joins <u>nucleotides</u> to produce (complementary strand/s of) <u>DNA</u>;

Accept: 'joins <u>DNA nucleotides</u>'.

1

(c) 1. To remove any DNA present;
2. As this DNA would be amplified / replicated;

1. Must be idea of removal / destruction.
2. Accept: idea of DNA not being used as template.

2

(d) 1. Ratio in range of 1.4 :1 to 1.5 :1 = **2 marks**;
2. One mark for answers which shows incorrect ratio but
Shows 0.24 as a number or line on the graph
OR
Ratio in correct range, but the wrong way round
OR
Ratio in correct range but not expressed to 1
OR
Ratio shown the other way round in range
1: 0.67 to 1:0.71;

Note: ratio not expressed to 1 in correct range may be shown in different ways, for example as:

3:2 or simply as 1.5 for one mark.

2

(e) Limited number of primers / nucleotides;

Accept: DNA polymerase (eventually) denatures

Accept: primers / nucleotides 'used up'.

1

(f) 1. Base sequences differ;
2. (Different) complementary primers required;

1. Accept: reference to either RNA or DNA base sequences but reject reference to DNA base sequence in viruses.

2

[9]

Q4.

(a) 1. Human DNA / human gene / HGH gene contains introns
OR
Methods 2 and 3 produce DNA / *HGH* without introns;

2. *E. coli* cannot remove introns / cannot splice mRNA / cannot splice pre-mRNA;

2

(b) Faster to use gene machine than all the enzyme-catalysed reactions (involving reverse transcriptase);

Accept extra step / more steps involved in isolating mRNA

1

(c) 1. Cut the plasmid with a restriction endonuclease;

Allow 'add base sequences to blunt ends of plasmid and HGH gene'

2. (So that) both have complementary / sticky ends;

3. (Mix together) and add ligase to join the complementary / sticky ends;

3

(d) Can quickly identify transformed bacteria using UV light;

1

(e) 1. Arabinose alters structure of araC protein / reduces effect of araC protein;

2. So stops / reduces inhibition of promoter gene and GFP gene is transcribed;
OR
So stops / reduces inhibition of promoter gene and GFP is produced;

2

[9]

Q5.

(a) 1. (If injected into egg), gene gets into all / most of cells of silkworm;
2. So gets into cells that make silk.

2

(b) 1. Not all eggs will successfully take up the plasmid;
2. Silkworms that have taken up gene will glow.

2

(c) Promoter (region / gene).

1

(d) 1. So that protein can be harvested;
2. Fibres in other cells might cause harm.

2

[7]

Q6.

(a) 1. (Requires DNA fragment) DNA polymerase, (DNA) nucleotides and primers;

2. Heat to 95 °C to break hydrogen bonds (and separate strands);
Accept temperature in range 90 to 95 °C.

3. Reduce temperature so primers bind to DNA/strands;
Accept temperature in range 40 to 65 °C.

4. Increase temperature, DNA polymerase joins nucleotides (and repeat method);
Accept Taq polymerase for DNA polymerase.
Accept temperature in range 70 to 75 °C.

4

(b) 1. (Initially) number (of molecules) doubling is low

OR

Doubles each cycle to produce exponential increase;
First alternative relates to idea of low numbers i.e., 2, 4, 8, 16, 32 etc.

2. Plateaus as no more nucleotides/primers;
Accept 'levels out' or 'flattens' for plateaus.
Accept enzyme/polymerase (eventually) denatures.

2

[6]