Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(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

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Q2.

(a) 1. Extract DNA and add restriction endonucleases/restriction enzymes;

2. Separate fragments using electrophoresis;

3. (Treat DNA to) form single strands

OR

(Treat DNA to) expose bases;

Ignore method used to separate strands

4. The probe will bind to/hybridise/base pair with the *SUT1*/gene;

5. Use autoradiography (to show the bound probe);

Accept use photographic or X ray film (to show the bound probe)

X rays alone is not sufficient

4 max

(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

(c) $0.4\ (3\dot{1}\dot{8})$**:1;**

Accept any suitable rounding

1

(d) 1. Some ($^{14}CO_2$) used to make cellulose/cell walls;

Accept some becomes lipids/ proteins/DNA/RNA/ nucleotides

2. Some ($^{14}CO_2$) converted into starch (which remains in the leaf);

Accept some ($^{14}CO_2$) converted into glucose

3. Not all ($^{14}CO_2$) fixed/used in photosynthesis;

OR

Not enough RuBP (to combine with all of the $^{14}CO_2$);

Accept descriptions of this

4. Some used to reform RuBP

OR

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Some (is still) in glycerate 3-phosphate/GP/triose phosphate/in the Calvin cycle;

2 max

(e) 1. Reduced *SUT1* expression/less SUT 1 (protein) means less sucrose exported (so concentration increases in leaves);

2. (Increased sucrose in leaves) inhibits rubisco, so less $^{14}CO_2$ fixed into GP;

OR

(Increased sucrose in leaves) inhibits rubisco, so less $^{14}CO_2$ combines with RuBP;

OR

(Increased sucrose in leaves) inhibits rubisco, so less Calvin cycle/light independent reaction/s;

Accept less rubisco or less active rubisco for 'inhibits rubisco'

3. Less sucrose transported to roots, so roots do not develop/grow (as shown by larger shoot to root dry mass ratio);

4. Roots less developed so fewer minerals available for growth

Accept: roots less developed so less water available for photosynthesis

5. Less growth means less dry mass;

Accept: less photosynthesis/light independent reaction/s means less dry mass;

4 max

[15]

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