

8(a)	<i>any four from:</i> 1 (Liberty Link soybean / it, is) not harmed by / not killed by / resistant to, herbicide / glufosinate ; 2 herbicide / glufosinate, kills, weeds / unwanted plants ; 3 reduces / removes / less / no, <u>competition</u> (with, weeds / unwanted plants) ; 4 <i>ref. to</i> (sun)light / water / (named) <u>soil</u> minerals ; 5 higher yield or more crop, harvested / produced ; 6 AVP ;
8(b)(i)	restriction, enzyme / endonuclease ;
8(b)(ii)	(DNA) ligase ;
8(c)	<i>any three from:</i> <i>some / other / 21, countries:</i> 1 may, have, unsuitable / described problem in, climate / weather / soil ; 2 no regulatory approval / may have banned (GM / Liberty Link) ; 3 may have, (activist) groups / people, opposed to GM crops ; 4 may not have land space available ; 5 may have banned, herbicide / glufosinate ; 6 AVP ;

5(a)	<i>any four from:</i> <i>mark as pairs</i> <i>Name 1</i> dNTPs / <u>DNA</u> nucleotides ; <i>Explanation 1</i> to, anneal / bind, to complementary bases ; <i>Name 2</i> Taq polymerase ; <i>Explanation 2</i> to make, phosphodiester bonds / the sugar phosphate backbone / double-stranded DNA / a complementary strand of DNA or <i>ref. to</i> functioning at higher temperature / does not denature at the higher temperature / is thermostable ; <i>Name 3</i> buffer ; <i>Explanation 3</i> to provide, optimum / suitable / constant, pH for, polymerase / DNA or prevents, denaturation of polymerase / damage to DNA ;
5(b)(i)	<i>any two from:</i> 1 (DNA ladder) compared to (other fragments) ; 2 <i>ref. to</i> (estimate) length of (DNA) fragment / to identify the fragment number ; 3 <i>ref. to</i> show electrophoresis worked correctly ;

5(b)(ii)	any three from: 1 (PCR) amplifies / makes many copies of, DNA (fragments) ; 2 (PCR) <i>ref. to</i> selecting fragments, small enough / less than 1000 bp / not more than 916 bp (for sequencing) ; 3 (electrophoresis) separate the (DNA) fragments ; 4 (electrophoresis) confirms / identifies, fragment lengths / fragment number / PCR worked correctly ;
5(c)	$(2^{35} =) 3.4 \times 10^{10}$;
5(d)	any four from: 1 child may have disease when, neither parent has the disease / no family history ; 2 early, detection / treatment (for gene therapy to work) ; 3 improve, quality of life / life expectancy ; 4 <i>ref. to</i> informs family planning (for future pregnancies) ; 5 <i>idea that</i> it does not involve additional sampling ; 6 (screening is) expensive ; 7 treatment / gene therapy, expensive ; 8 test may not always be accurate ; 9 long-term effect of treatment, unknown / negative ;

3(a)	any five from: 1 <u>restriction endonuclease</u> ; 2 (RE) cuts, bacterial / herbicide-resistance, gene / DNA ; 3 (RE) cuts a, plasmid / vector ; 4 <u>DNA ligase</u> joins, new / bacterial / foreign, gene to, plasmid / vector ; 5 <i>ref. to</i> joining / adding, of <u>promoter</u> ; 6 (promoter / regulatory sequence) ensures expression of (new / bacterial / foreign / prokaryotic) gene ;
3(b)	73 / 100×123.5 or 90.155 million ; $(90.155 \times 2 =) 180.31$ million ;
3(c)	any four from: <i>positive implications:</i> 1 more food / higher yield (per hectare) ; 2 (farmers) use less, insecticide / pesticide ; 3 cheaper food prices for consumers ; 4 less land needed to grow food leaves more for, biodiversity / conservation ; 5 improved food nutritional value ; <i>negative implications:</i> 6 food allergies ; 7 greater quantity of herbicide residue on food ; 8 (evolution of) resistance in, insects / weeds / fungi / pests ; 9 pollen drift to / cross-breeding with, organic / non-GM / conventional, crops ; 10 GM crops may become invasive weeds ; 11 consumer mistrust / GM food must be clearly labelled ;