Question Number	Answer	Additional guidance	Mark
1(a)(i)	1. reference to {polymerase chain reaction / PCR} ; 2. polymerase (enzyme) {added / eq } ; 3. idea of need for primers and nucleotides ; 4. {90-98} (^{o}C) → {50-65} (^{o}C) → {70-75} (^{o}C) ; 5. idea that cycle needs to be repeated {several times / to make several copies of DNA / eq} ;	**1. Acce** as a ref to PCR machine	**(4)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	(DNA) {profiling / fingerprinting / (gel) electrophoresis} ;	**Ignore** Southern blotting, PCR **Accept** DNA profile / DNA fingerprint	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)	1. idea of work appearing in a (Scientific) journal or being presented at a conference ; 2. idea that validity or reliability is considered ; 3. by other scientists / ref to peer review ;	**1. Accep** publishing a paper, scientific meeting	**(2)**

Question Number	Answer	Additional guidance	Mark
1(c)(i)	1. reference to different {conditions / environments /eq} (in each region) ; 2. idea of different selection pressures ; 3. idea of {restricted gene flow / separate gene pools} ; 4. reference to reproductive isolation;	**1. Acce** appropriate named factor e.g. temperature **3. Igno** different allele frequency	**(2)**

Question Number	Answer	Additional guidance	Mark
1(c)(ii)	1. idea of different {alleles/ gene pool} ; 2. idea that this leads to {new / different} phenotypes ; 3. idea of new {allele / gene} can be {advantage / disadvantage} ; 4. reference to (advantageous) {(mutated) gene / (new) allele} passed onto offspring ;	**1. Ignor** allele frequency **2. Acce** traits / characteristics / features	**(2)**

Question Number	Answer	Mark
2 (a)(i)	all the {DNA / genes / eq} of (the human species) ;	**(1)**

Question Number	Answer	Mark
2 (a)(ii)	Any **one** from: 1. idea of discrimination e.g. insurers might have access to a person's DNA / 2. idea of who decides whether a person is tested / 3. idea of need for confidentiality / 4. expensive medical treatments might be restricted / eq ;	**(1)**

Question Number	Answer	Mark
2 (b)(i)	1. idea that (Human Genome Project) identifies allele related to melanoma e.g. mutant allele, aberrant allele ; 2. idea that drug targets this allele ; 3. (mutant) allele can no longer express itself / eq ; 4. idea of drug preventing translation ; 5. idea that such a drug is more effective ;	**(3)**

Question Number	Answer	Mark
2 (b)(ii)	1. idea that drug affects expression of the allele ; 2. idea that protein not produced ; 3. idea that (melanoma) cells killed ; 4. idea that (melanoma) cells do not divide ; 5. idea that they are replaced with normal body cells ; 6. through mitosis / eq ; 7. description of specific part of mitosis affected e.g. no spindle fibres ;	**(4)**

Question Number	Answer	Mark
2 (b)(iii)	1. randomised trial / eq ; 2. {large number / eq} of patients ; 3. double blind / eq ; 4. idea of {use of placebo / use of current treatment} ; 5. testing how effective the drug is on patients / eq ;	**(2)**

Question Number	Answer	Mark
2 (c)	1. yeast cells have human collagen {gene / allele / DNA / eq} ; 2. idea that new collagen is recognised as 'self' e.g. has no non-self antigens ; 3. does not trigger immune response / eq ;	**(2)**

Question Number	Answer	Mark
3(a)	Substance X = (DNA)primer(s) ; Substance Y = (mono)nucleotide(s) ; Substance Z = DNA strand(s) ;	**(3)**

Question Number	Answer	Mark
3(b)(i)	A ;	**(1)**

Question Number	Answer	Mark
3(b)(ii)	C ;	**(1)**

Question Number	Answer	Mark
3(b)(iii)	B ;	**(1)**

Question Number	Answer	Mark
3(c)(i)	1. Idea that human enzymes will not work at {high / these/ above 37^{o}C eq} ; 2. reference to {denaturation /change in shape of active site}(at temperatures in PCR) ;	**(2)**

Question Number	Answer	Mark
3(c)(ii)	1. (xylem / wood) made of dead material / has no {living material / cytoplasm / cell contents / nuclei / mitochondria} / eq ; 2. no {DNA / nucleic acid} present / eq ;	**(2)**

Question Number	Answer	Mark
4(a)(i)	C ;	**(1)**

Question Number	Answer	Mark
4(a)(ii)	B ;	**(1)**

Question Number	Answer	Mark
4(a)(iii)	1. (S/ suspect) 3 ; 2. (S3) matches {all / 9 / eq} of the bands in the sample ; 3. DNA profiling assumes every individual's DNA is {unique / different} / eq ; 4. apart from identical twins / eq ; 5. ref to DNA profiling analyses the {introns / non-coding blocks / STR / short tandem repeats / eq} ; 6. non-coding DNA {very variable / hypervariable / eq} ; 7. large number of {introns / non-coding blocks / eq} ; 8. idea of many {combinations / eq} (at each locus) ;	**maximum (5)**

Question Number	Answer	Mark
4(b)	1. ref to DNA profiling has several stages ; 2. ref to {artefacts / contamination / eq} can arise at any stage ; 3. only {a few sequences / small portion } of DNA analysed / eq ; 4. ref to possibility of two identical profiles from unrelated individuals ; 5. {identical twins / closely-related individuals / eq} may show same profile / eq ;	**maximum (2)**

Question Number	Answer	Mark
4(c)	1. comparisons made between DNA from fossils and other organisms ; 2. to find genetic relationships / how closely related / eq ; 3. ref to used in {taxonomy / classification / eq} ; 4. to understand evolutionary lines / to determine common ancestor / eq ;	**maximum (2)**

Question Number	Answer	Additional Guidance	Mark
*5(a)(i)	(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. multiple copies of DNA made / eq ; 2. using {PCR / *polymerase chain reaction*} ; 3. credit any correct detail of PCR ; 4. reference to *restriction* {*enzymes / endonucleases*} to produce DNA {*fragments* / eq} ; 5. reference to (*gel) electrophoresis* ; 6. idea of {loading / eq} the DNA onto the {*gel* / named *gel*} ; 7. idea that an {*electric current* / charge} is applied ; 8. reference to use of {*dye / fluorescent tag / UV light / Southern blotting / gene probes / radioactive labelling* / eq};	QWC emphasis on spelling 1. IGNORE refs to amplification, large amounts 3. .g. step 1: 90 to 95 ^{o}C, step 2: 50 to 65 ^{o}C, step 3: 70 to 80 ^{o}C, use of {*primers* / DNA *polymerase / nucleotides*}, many repetitions 6. e.g. *agarose, agar* 7. ACCEPT apply *potential difference*	**(6)**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	1. idea of comparing total number of {bands / eq} ; 2. idea of comparing position of {bands / eq} ; 3. idea of comparing {size / width} of {bands / eq} ;	ACCEPT idea of comparing bands for 1 mark if mps 1, 2 or 3 cannot be awarded ACCEPT bars / blocks	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)	1. {scientific / peer reviewed} {papers / journals / magazines / article} ; 2. (scientific) {conferences / lecture / forums} ; 3. media reports ;	3. e.g. TV, radio, newspaper, internet	**(2)**