Higher Unit 1 Practise Questions Marker

Key Area 1.1: Structure and organisation of DNA

1) D   Q2) B   Q3) B   Q4) B

Q5)

(a)	(i)	Prokaryotic has circular (chromosome) AND eukaryotic has linear (chromosomes)	1	NOT – eukaryote has linear chromosome and prokaryote has not NOT – prokaryotic has plasmid alone.
	(ii)	Proteins/Histone	1	
(b)		Mitochondrion OR Chloroplast OR plasmid in yeast	1	
(c)	(i)	Nucleotides added to 3′ end OR Polymerase (only) adds to 3′ end OR Polymerase works from 5′ to 3′ OR DNA/it is replicated from 5′ to 3′	1	
	(ii)	(DNA) Nucleotides/primer	1	NOT – bases/helicase/ligase/polymerase
(d)		So that … an exact copy/complete set of… genetic material /genetic instructions /genetic information/genes/DNA/ chromosomes AND is passed to (each)… new cell/daughter cell/the next generation OR during mitosis/cell division OR So new cells have the same…. genetic material/genetic instructions /genetic information/genes/DNA/ chromosomes… as the original cell OR To maintain the… number of chromosomes/chromosome complement… in new/daughter cells	1	NOT – cell replication NOT – so daughter cells can carry out their normal function alone.

Q6) A Q7) C Q8) C

Q9)

A	(i)	
		1. Prokaryotes have circular <u>chromosomes</u> and plasmids.
		2. Yeast has plasmids.
		3. Circular <u>chromosomes</u> in mitochondria/chloroplasts.
		4. Linear <u>chromosomes</u> in nucleus of eukaryotes.
		5. Prokaryotes have circular DNA **AND** eukaryotes have linear DNA (Only if point 1 or 4 not awarded).
		6. Linear/eukaryotic/nuclear chromosome/DNA (tightly) coiled.
		7. Linear/eukaryotic/nuclear chromosome/DNA packaged with/wrapped around (associated) proteins/histones.
		(any 4)

Key Area 1.2: DNA Replication and PCR

Q1)

(a)		0.24	1	
(b)		32	1	
(c)		Inclusive scale and axes labels copied exactly from table headings 1 Points plotted and joined with a ruler 1	2	
(d)		Only donor 2 is suitable OR donor 2 is most suitable	1	
(e)	(i)	TACTGTTTAGC	1	
	(ii)	Separates strands/splits up DNA strands/breaks H bonds between strands/denatures DNA/unzips DNA 1 Any temperature from 50 - 65 1	2	NOT – splits DNA alone

Q2) A   Q3) C Q4) D

Q5)

(a)	(i)	12	1	
	(ii)	1.1 to 2	1	
(b)		Taq- Takes less time to amplify (sequence)/complete a cycle. OR Replicates/cycle/process faster. OR Cheaper as less heat is required/temperature is lower. OR Taq takes 3 minutes and Pfu takes 4 minutes. OR Pfu- Proof reading/corrects errors.	1	Incorrect values negate. NOT- ensures no mistakes are made.
(c)		So it does not denature.	1	NOT- so it can work at high temperatures.

Q6)

(a)	(i)	Any TWO from:	2	**NOT** – Volume of muscle (tissue).
				NOT – Mass/species of fish.
		Size/mass/of muscle (tissue)/ sample.		
		Type of muscle tissue/age of fish.		**NOT** – Same solution.
		Temperature/pH/time.		**NOT** – "Concentration"/"Volume" alone.
		Volume/concentration/type of solution.		Additional incorrect variables (e.g. Light intensity/ oxygen concentration/ CO2 concentration) negates 1 mark.
	(ii)	Hydrogen/ionic/disulphide/Van der Waals/hydrophobic/covalent.	1	**NOT** – Peptide (negates correct answer).
(b)	(i)	Correct scales (0-110 kDa and 0-50 mm) and label. **(1)** Correctly plotted. **(1)**	2	If axes transposed scales and labels mark not awarded.
	(ii)	32 kDa or whatever plotted graph shows.	1	
	(iii)	550	1	
(b)	(iv)	1, 2 and 4 each have three bands/proteins in common/at the same distance **AND** 3 only has one band in common with the other three species. **OR** They/1, 2 and 4 have more bands/proteins in common/the same/similar or converse.	1	**NOT** – Proteins 1, 2 and 4 all have band X.

Q7)

A	(ii)	a. Amplification/produces multiple copies of (target sequence of) DNA.		NOT - Copy/multiplies/replication of/ magnifies DNA
		b. (Heated to) 90°C - 98°C to separate strands/denature DNA/break hydrogen bonds.		
		c. (Cooled to) 50°C - 65°C for primers to bind/anneal.		
		d. Primers are complementary to/bind to target sequences/DNA.		
		e. (Heated to) 70°C - 80°C so DNA polymerase replicates DNA/ extends new DNA strand/adds nucleotides to new strand/3' end/primer.		
		f. Heat tolerant DNA/Taq polymerase is used.		
		g. Repeated cycles (of heating and cooling).		
		Used in forensic/paternity etc. **(any 5)**		

Q8) A   Q9) D

Q10)

(a)		Histone	1	Not - Protein alone. Not - Associated proteins.
(b)		So DNA polymerase can add nucleotides to the 3' end of the new strand OR To give DNA polymerase a start point for replication	1	 Not - To start/initiate replication alone.
(c)	(i)	DNA <u>polymerase</u> adds nucleotides to the 3' end of the primer/new strand OR DNA <u>polymerase</u> replicates in a 5' to 3' direction.	1	
	(ii)	(DNA) ligase	1	
(d)		Circular chromosomes (1) Plasmids (1) If neither answer above is given then award a maximum 1 mark only for: Circular (DNA)	2	

Key Area 1.3: Gene Expression

Q1)

(i)	1.	RNA polymerase unzips/ unwinds DNA or separates DNA into two strands	1
	2.	Hydrogen bonds between strands/base pairs break	1
	3.	RNA polymerase aligns/brings in/joins/attaches RNA nucleotides with their complementary nucleotides/bases on DNA (template) **OR** A to U and T to A and C to G in diagram	1
	4.	a primary transcript is produced	1
	5.	exons are coding and introns are non-coding (regions of the primary transcript)	1
	6.	introns/non-coding regions are removed OR exons/coding regions are retained	1
	7.	exons are spliced/joined together to form mature mRNA)/transcript	1

(ii)	a.	tRNA has an anticodon and an amino acid attachment site	1
	b.	tRNA binds/joins to/carries/collects specific/correct amino acid	1
	c.	tRNA carries (specific) amino acid to ribosomes	1
	d.	anticodons are complementary/pair with codons on mRNA	1
	e.	there are start and stop codons	1
	f.	peptide bonds form between amino acids **OR** a polypeptide forms	1
			(max 4)

Q2)

(a)		Amino acid	1	
(b)		Protein OR Enzymes	1	
(c)		Cut/cleave AND combine polypeptide chains OR add phosphate/carbohydrate	1	NOT – *post translational modification* NOT – *cleave/cut* alone
(d)		Name: <u>Alternative</u> (RNA) splicing (1) Description: Different (combinations of/variety of) <u>exons</u> are included/ spliced together (in the mature transcript/ RNA) (1)	2	NOT – a description suggesting the order of exons is changed NOT – depends what sections are treated as exons and introns

Q3) A

Q4)

(a)		Introns	1	NOT- non-coding regions.
(b)		1,3,4/2,3,4	1	Must be in correct order and inversions not acceptable.
(c)	(i)	Shorter protein/fewer amino acids.(1) Stop codon is produced earlier (in the sequence) (1)	2	NOT- non-functional protein. NOT- protein is short. NOT- stop codon is produced alone.
	(ii)	Every amino acid after the mutation is changed/affected.	1	NOT- frame shift mutation alone.

Q5)

B	(i)	1. Single strand of nucleotides. 2. (nucleotide) contains ribose sugar, phosphate and base. 3. Adenine, cytosine, guanine and uracil. 4. mRNA takes copy of DNA code from nucleus to ribosome. 5. 3 bases on mRNA codes for an amino acid/is a codon. 6. tRNA picks up specific/one type of amino acid. 7. tRNA carries amino acid to a ribosome. 8. tRNA has anticodon (complementary to codon) AND an amino acid attachment site. 9. rRNA (combined) with protein forms a ribosome. 10. If points 4 -9 not awarded, award point for stating mRNA, tRNA and rRNA. (any 6)	9	NOT – Letter of bases alone. NOT – "DNA has thymine and RNA has uracil" alone.

(ii)	a.	Introns removed from primary transcript.	
	b.	Exons joined/spliced together to produce mature transcript.	
	c.	Exons coding/expressed AND introns non coding/not expressed.	
	d.	Alternative (RNA)splicing produces different mature transcripts.	
	e.	(Different mature transcripts produced) depending on which (combinations of) exons are retained/spliced together/ removed.	
		(any 3)	

Q6) C

Q7)

(a)		3:5:30	1	
(b)		Protein	1	Not - Amino acids
(c)		Change in the sequence may change the structure/function/shape of the ribosome OR Ribosome is not made/formed/ usable (1) Translation can no longer occur OR mRNA cannot join to ribosome OR tRNA cannot join to mRNA (1)	2	
(d)		DNA double strand, (r)RNA single strand OR DNA has thymine, (r)RNA has uracil OR DNA has deoxyribose sugar, (r)RNA has ribose	1	Not - T and U.

Q8)

(a)	(i)	Prokaryotes have a smaller genome OR Eukaryotes have a larger genome	1	If figures quoted they must be correct to award the mark.
	(ii)	800	1	
	(iii)	4100	1	
(b)		$2{\cdot}52/2{\cdot}5 \times 10^7$ OR 25 200 000	1	
(c)		Regulates transcription OR Transcribed to tRNA/rRNA	1	 Not - Transcribed but not translated alone
(d)		There are different combinations of exons in the mature transcript OR Different exons are removed from the primary transcript	1	Not - any reference to a change in sequence of exons: eg different order of exons Not - Depends on which exons are treated as introns

Key Area 1.4: Cellular Differentiation

Q1)

(a)		Increase in stroke volume/volume of blood pumped out of heart per heartbeat (in patients given the treatment)　　　1 No effect on heart rate (of patients given the treatment) **1**	2	
(b)		1190	1	
(c)	(i)	Embryonic stem cells differentiate/develop into all/many types of cell **AND** adult/tissue stem cells differentiate/develop into less/narrower range of/limited cell types **OR** Adult stem cells are more differentiated/specialised than embryonic stem cells	1	
	(ii)	They express/switch on the genes characteristic of that type of cell **OR** Certain genes/some genes are expressed/switched on (and other genes are switched off)	1	NOT - genes are switched on and off
(d)		Provide information on gene regulation/cell growth/cell differentiation/cell division/cell ageing/disease development **OR** Use as model cells to study how diseases develop **OR** For drug testing	1	

Q2)

| (a) | | It differentiates into/specialises into/ becomes...

many/lots of/all/wide range of cell types/tissue types

OR

It is pluripotent/totipotent | 1 | NOT – multipotent |
| (b) | | Different proteins will be produced/ synthesised/made (resulting in different cell types)

OR

Only proteins characteristic of that cell type are produced/synthesised/ made | 1 | **NB** : Protein coded for ≠ synthesised |
| (c) | | Repair of damaged/diseased... organs/cells/tissues

OR

Production of tissues for grafting/ transplant

OR

Correct examples eg bone marrow transplants/(make) skin grafts/ to treat a named disease/treat burns | 1 | NOT – cure/treat diseases alone

NOT – research diseases |
| (d) | | Embryo/it/baby/foetus/a potential life... is... destroyed/killed/not allowed to develop

OR

Embryos which would have been destroyed are being put to good use

OR

Use of stem cells for drug testing rather than animals

OR

Diseases could be cured | 1 | NOT – religious reasons alone |

Q3)

(a)	(i)	From.... start/0 – 5 weeks/over first 5 weeks it increased from **0** – 9·2 **(1)** From 5 (– 7) weeks it remained constant/levelled off **(1)** **Correct values for 2 statements but no units (weeks) = 1 mark**	2
	(ii)	200	1
	(iii)	B	1
(b)		**B** It/number of shoots is highest/greatest (at 7 weeks) **(1)** **and** this is (still) increasing **(1)** **OR** **C** It/number of shoots... is increasing more/most rapidly **(1)** **and** B is slowing down/levelling off **(1)**	2
(c)		Greatest (average) <u>**root**</u> length/ Longer <u>**roots**</u> **(1)** More water absorbed for photolysis/photosynthesis **OR** More nutrients absorbed for named process eg protein synthesis/ATP production etc. **(1)**	2

Q4)

(a)	(i)	Can only differentiate/specialise/change into- a few types of cell/myoblasts/muscle cells/limited variety of cells/cells of the tissue that it came from (or converse). **(1)**	1	NOT- can only differentiate into a limited number of cells without reference to type. NOT- multipotent alone.
	(ii)	Growth/repair/renewal of <u>muscle</u> (tissue). **OR** Increase number of muscle cells for growth/repair (of muscles). **OR** Become muscle cells for growth/repair (of muscles).	1	NOT- repair of muscle cells. NOT- growth of muscle cells. NOT- increase number of muscle cells alone.
	(iii)	Does not involve destruction/killing of a (potential) life/embryo.	1	
(b)		Testing/development of drugs/medicines. **OR** Study how diseases develop (or description of development of a named disease). **OR** Study cell growth/cell division/ cell differentiation/gene regulation.	1	NOT- descriptions of therapeutic uses. NOT- researching diseases. NOT- study cell processes.

Q5) A   Q6) B   7) D

Key Area 1.5 and 1.6: Structure of the Genome and Mutations
Q1)

(i)	1.	(single gene) mutations are random changes in DNA sequences/genes/alleles/the genome	1
	2.	single gene mutation name AND description	1
		substitution – base/base pair/nucleotide is replaced/substituted by another	
		insertion – base/base pair/nucleotide is added/inserted	
		deletion – base/base pair/nucleotide is removed/deleted	
	3.	another single gene mutation name AND description	1
	4.	If 2 or 3 not awarded – all 3 mutation names	1
	5.	Insertion/deletion results in a frameshift mutation/expansion of a nucleic acid sequence	1
	6.	(single nucleotide) substitutions include missense, nonsense and splice site mutations	1
	7.	splice site mutations can alter the mature mRNA OR result in exon removal OR result in introns remaining present	1
			(max 4)

(ii)	a.	chromosome mutation can involve changes to chromosome number/structure	1
	b.	chromosome mutation name AND description;	1
		Translocation: genes/sections of chromosome from one chromosome become attached to another chromosome	
		Deletion: genes/sections of chromosome deleted from chromosome	
		Inversion: genes/sections of chromosome/rotate through $180°$/flipped	
		Duplication: genes/sections of chromosome/pieces of chromosome are duplicated/repeated	
	c.	another chromosome mutation name AND description	1
	d.	If b or c not awarded – all 4 names but no descriptions	1

Q2) B

Q3)

(a)	(i)	Deletion/insertion	1	
	(ii)	Effect on lactase gene: All the codons/base sequences nucleotide sequences/ triplets/ bases/nucleotides after the mutation will change/will move along. OR All the following codons/base sequences nucleotide sequences/triplets will change. (1) Effect on structure of lactase: All the amino acids after the mutation may change (1)	2	**NOT** – Amino acids produced/made.
(b)	(i)	Gene is permanently switched on. OR More transcription occurred. OR Repressor molecule not produced so operator permanently switches on gene/gene not switched off.	1	

Q4) C

Q5)

(a)	(i)	Hydrogen	1	
	(ii)	Introns/non-coding sequences are removed from the primary transcript OR Gene/primary transcript has introns and exons, mature transcript has (only) exons. OR RNA splicing	1	
(b)	(i)	Section of a chromosome/gene(s) is added to its homologous partner OR A gene moves from a chromosome to its homologous partner	1	
	(ii)	Beneficial mutations can occur in one of the copies of the gene/DNA (1) The other gene can still be expressed to produce its protein (1)	2	Must be clear mutation is occurring in one copy of the gene

Q6)

(a)	To show the effect of the mutations OR To show the effect of the drugs/ each drug OR To prove the drugs affect/increase chloride transport OR To compare with and without drugs	1	Not - To compare alone
(b)	Treatment - P (1) Mutation - B (1)	2	
(c)	An average was calculated OR Results are averaged	1	
(d)	Personalised medicine OR Pharmacogenetics	1	

Key Area 1.7: Evolution

Q1) B

Q2)

(a)	(i)	Sympatric	1	
	(ii)	Prevents/interrupts/stops/blocks... gene flow/gene exchange/breeding/ mating... between populations **OR** Prevents interbreeding	1	NOT – stops populations from mating/ breeding alone
	(iii)	(DNA) sequence data/genome analysis would be similar **OR** They/the two populations... can **inter**breed/breed together... to produce fertile offspring (or converse statement)	1	NOT – they can **breed** to produce fertile offspring NOT – answers referring to 2 species instead of 2 populations

Q3) B

Q4)

(a)		From 2009/from the start it increases from 10% to 66% in 2015. **OR** Over the first 6 years it increases from 10% to 66%. (1) Then stays constant (until 2016). (1)	2	Cannot access any marks if 66 and 2015 not mentioned. Must state % unit at least once to gain full marks. **All** correct values but no % unit = 1. If additional points are correctly described do not negate.
(b)		Resistant plants survive. **OR** Non-resistant die. (1) Pass resistance- • genes/alleles/sequences • to next generation/to offspring/vertically. **OR** Reproduce/breed • and pass on resistance • genes/alleles/sequences. (1)	2	NOT- pass on characteristic/ traits/resistance.
(c)		Bacteria can exchange- • genetic material/plasmids • horizontally/in same generation • and charlock cannot/charlock transfers vertically. **OR** Horizontal gene transfer is faster (or converse).	1	NOT- horizontal gene transfer is fast.

Q5) D   Q6) A   Q7) B   Q8) A   Q9) B

Q10)

(a)		Geographical (1) Prevents gene flow between populations/groups OR Prevents populations/groups interbreeding (1)	2	Not - Prevents gene flow/exchange between species Not - Prevents gene flow alone
(b)	(i)	5	1	
	(ii)	Behavioural isolation/barrier OR Ecological isolation/barrier OR Sympatric speciation	1	

Key Area 1.8: Genomic Sequencing

Q1) C   Q2) B

Q3)

(a)	(i)	550	1
	(ii)	260	1
	(iii)	Last common ancestor (of rats and humans) was more recent (than rats and frogs). OR Last/most recent common ancestor of rats and humans was 90 million years ago while rats and frogs was 420 million years ago. OR Rats diverged more recently from humans than from frogs.	1
(b)	(i)	28	1
	(ii)	Any value from 27 to 28	1
(c)		21	1

Q4) D

Q5)

| DNA sequence data

OR

Fossils/fossil records

OR

Mutation rate | 1 |

Q6) A
Q7) A