Carrick Academy

Higher Biology Essays

Biology Department

Unit 1 Essays

Topic	Essay Topic
Enzymes	Write notes on enzymes under the following headings. (i) enzyme activity (ii) enzyme inhibitors
Respiration	Give an account of respiration under the following headings (i) glycolysis (ii) citric acid cycle Write notes on (i) electron transport chain (ii) transfer of energy by ATP
Oxygen Delivery & Thermoregulation	Compare and contrast the circulatory systems of f (i) fish (ii) amphibians (iii) mammals Write notes on (i) endotherms and ectotherms (ii) temperature regulation in mammals Give an account of (i) mechanism of temperature regulation in endotherms (ii) importance of thermoregulation
Surviving & Avoiding Adverse conditions	Give an account of the adaptations of organisms to (i) survive adverse environmental conditions. (ii) avoid adverse environmental conditions Give an account of metabolism in confomers.
Microbe Growth/ Recombinant DNA Technology	Give an account of the phases of growth of microbes cultured in a fermenter. Give an account of the different cultural requirements and conditions required for the growth of microbes. Write notes on (i) transfer of extra chromosomal genes to microorganismsusing plasmids or artificial chromosomes (ii) give an example of an ethical consideration of carrying out this procedure.

Write notes on enzymes under the following headings.

(i) enzyme activity (5)
(ii) enzyme inhibitors (3)

Enzyme Activity

1	activity depends on flexible / dynamic shape of enzyme molecules	1
2	(there is an) affinity of the substrate for active site	1
3	induced fit	1
4	active site orientates reactants	1
5	activation energy (of transition state) lowered	1
6	products have low affinity for active site	1
7	substrate and product concentration affects direction and rate of reactions **OR** describe the effects of increasing substrate concentration as increasing/speeding up/driving forward the rate of the reaction	1
8	enzymes act in groups / multi-enzyme complex	1

Max 5 (from 8)

Enzyme Inhibition

9	(in) competitive inhibition	1
10	there is a resemblance between the substrate and the inhibitor **OR** inhibition is reduced by increase in substrate concentration	1
11	(in) non-competitive inhibition	1
12	the active site shape is changed **OR** the affinity of substrate for enzyme is lowered	1
13	(there can be) product inhibition / feedback inhibition / eg / description	1

Max 3 (from 5)

Give an account of respiration under the following headings

(i) glycolysis (3)
(ii) citric acid cycle (5)

Glycolysis

1	(glycolysis is the breakdown of) glucose to pyruvate	1
2	(2) ATP used to phosphorylate **intermediates** (in glycolysis)	1
3	this is an energy investment phase	1
4	ATP produced / generated / made in a pay off stage	1
4a	Net gain of ATP **OR** 2 ATP used and 4 gained **Award 4a only if points 3 and 4 not awarded**	1

Max 3 (from 4)

Kreb Cycle

5	if oxygen is available / in aerobic conditions pyruvate progresses to the citric acid cycle	1
6	pyruvate is converted / broken down to an acetyl group	1
7	acetyl group combines with coenzyme A	1
8	acetyl (coenzyme A) combines with oxaloacetate to form citrate	1
9	citric acid cycle is enzyme controlled / used dehydrogenases.	1
10	ATP generated/synthesised/produced/released (at substrate level) in the citric acid cycle	1
11	carbon dioxide released (from the citric acid cycle)	1
12	oxaloacetate is regenerated	1
13	NAD/NADH/$NADH_2$/FAD/FADH/$FADH_2$ transports electrons / transports hydrogen ions (to electron transport chain / next stage)	1

Max 5 (from 9)

Write notes on

(i) electron transport chain (7)
(ii) transfer of energy by ATP (2)

Electron transport Chain

1. The electron transport chain (ELC) occurs on the cristae/inner membrane of the mitochondria
2. The ELC is a collection of proteins attached to a membrane
3. NADH/FADH release high energy electrons to the ELC on the inner mitochondrial membrane
4. Electrons pass along a chain of electron acceptors releasing energy
5. Energy (from electrons) is used to pump hydrogen ions (H^+) across the inner mitochondrial membrane/into the inter-membrane space
6. The return flow of H^+ ions back into the matrix drives/powers/rotates the enzyme ATP Synthase
7. ATP Synthase synthesises ATP from ADP and Pi
8. This stage produces most of the energy generated by cellular respiration
9. The final hydrogen/electron acceptor is oxygen
10. Oxygen combines with hydrogen ions and electrons to form water

Any 7 for 7 marks

Transfer of energy by ATP

1. Regeneration of ATP from ADP and inorganic phosphate uses the energy released from cellular respiration
2. ATP is used to transfer energy from cellular respiration to synthetic pathways/cellular processes (where energy is required)
3. Breakdown of ATP to ADP and inorganic phosphate/Pi releases energy

Any 2 for 2 Marks

Compare and contrast the circulatory systems of fish, amphibians and mammals (7 marks)

Fish Circulation

1. single circulatory system or diagram showing 1 way in and out
2. Blood flows heart to gills to body and then back to the heart
3. Heart has 1 atrium and 1 ventricle

Amphibian Circulation

4. double incomplete system or diagram showing this
5. Heart has 2 atria and 1 ventricle
6. Oxygenated and deoxygenated blood mixes
7. This reduces the oxygen available for respiration/make ATP
8. Less efficient delivery of oxygen to cells than mammal circulatory system

Mammal Circulation

8. double complete circulatory system
9. Heart has 2 atria and 2 ventricles
10. Blood completely oxygenated to maintain high ATP for high metabolic rate
11. More efficient delivery of oxygen to cells than amphibian/fish circulatory system

DO not award point 6 & 10 - mark awarded just once.

DO not award point 7 & 11 - mark awarded just once.

Any 7 marks

Write notes on:

(i) endotherms and ectotherms;
(ii) temperature regulation in mammals.

(i)	1	endotherms can regulate/control/maintain their (body) temperature (physiologically) **AND** ectotherms cannot/ectotherms temperature is dependent on their environment/behaviour	1
	2	endotherms derive (most body) heat from respiration/metabolism/chemical reactions	1
	3	ectotherms derive/get (body) heat from surroundings/environment **OR** description of behaviour	1
		Max 2 (from 3)	
(ii)	4	temperature monitoring centre/thermoreceptors in hypothalamus **OR** information about temperature detected/received by hypothalamus	1
	5	nerve message/communication/impulse sent to skin/effectors	1
	6	vasodilation/widening of blood vessels to skin in response to increased temperature **OR** vasoconstriction/narrowing of blood vessels to skin in response to decreased temperature	1
	7	more/less blood to skin/extremities **OR** less/more blood in body core	1
	8	increased/more **OR** decreased/less heat radiated from skin/extremities	1
	9	increased temperature/body too hot leads to (increase in) sweat production **OR** converse	1
	10	increase in heat loss due to evaporation of (water in) sweat **OR** converse	1
	11	Decrease in temperature causes hair erector muscles to raise/erect hair	1
	12	traps (warm) air **OR** forms insulating layer	1
	13	Decrease in temperature causes muscle contraction/shivering which generates heat/raises body temperature	1
	14	temperature regulation involves/is an example of negative feedback	1
		Max 8 (from 11)	
		Total	**10**

Give an account of the mechanisms and importance of temperature regulation in endotherms.

Mechanisms:

1 Temperature regulation controlled by negative feedback **(1)**
2 Hypothalamus monitors blood temperature **OR** Hypothalamus is the temperature detecting centre/temperature monitoring centre/temperature control centre **(1)**
3 Hypothalamus sends out nerve messages to effectors/to skin **(1)**
4 Vasodilation (or description) occurs in response to temperature rise/to hot conditions **(1)**
5 Heat lost/Heat radiated from skin [**OR** converse for vasoconstriction – points 4,5] **(1)**
6 Sweating in response to temperature rise/to hot conditions **(1)**
7 Heat lost by evaporation of water/sweat [**OR** converse for cold conditions – points 6, 7] **(1)**
8 In response to drop in temperature/In cold conditions hair erector muscles contract/erector muscles make hairs stand up/erector muscles raise hairs **(1)**
9 Trapped air gives insulation/Trapped air reduces heat loss **(1)**
10 In response to drop in temperature/In cold conditions increase in metabolic rate/increased movement/shivering **(1)**

Maximum (7)

Importance:

11 Chemical reactions/Metabolism controlled by enzymes **(1)**
12 Enzymes have an optimum temperature/have a temperature at which they work best/do not work well at low temperatures/do not work well at high temperatures **(1)**

Maximum (1)

Give an account of the adaptations of organisms to

(i) survive adverse environmental conditions.
(ii) avoid adverse environmental conditions

Surviving Adverse Conditions

Some environments vary beyond tolerable limits
The variations can be cyclical or unpredictable
The extremes of conditions do not allow for normal metabolism of organisms
Organisms survive by reducing metabolic rate (dormancy) when conditions would make normal metabolic activity too high
Dormancy can be predictive or consequential
Example of dormancy (hibernation/aestivation)
Daily torpor is a period of reduced metabolic rate on a daily basis for organisms with high metabolic rates
Example of an organism and the adverse conditions which it survives

Any 6

Avoiding Adverse conditions

Migration avoids metabolic adversity by relocation
Method to track migration e.g. electronic tags/GPS/mark and recapture
One example of a vertebrate animal and the adverse condition it avoids e.g. salmon
One example of an invertebrate animal and the adverse condition it avoids e.g. monarch butterfly

Give an account of metabolism in conformers

1. Conformers internal environment varies with the external abiotic factor
2. Abiotic factors include salinity, pH, temperature
3. The metabolic rate of a conformer varies with external abiotic factors
4. Conformers cannot alter their metabolism by homeostasis
5. Conformers live in a narrow range of niches
6. Conformers lack the ability to tolerate changes to the environment/live in stable environments
7. Conformers have low metabolic costs (homeostasis costs lots of ATP)
8. Many conformers manage to maintain their metabolism by behavioural means OR example moving into sun

Any 7 marks

Give an account of the phases of growth of microbes cultured in a fermenter. 7 marks.

Growth measured by measuring increase in cells in a given period of time.
The time taken for the cell to divide in two for unicellular organsims is called the doubling time
The lag phase of growth is where microbes induce the production of enzymes that metabolise substrates
No cell division occurs at the lag phase.
The exponential or log phase of growth is where the population doubles with each cell division
Stationary phase is where the culture medium becomes depleted/nutrients or oxygen run out
Stationary phase is reached when birth rate equals death rate of older cells
Death phase occurs due to lack of substrate/toxic accumulation of metabolites
More cells die than are being produced

OR

Give an account of the different cultural requirements and conditions required for the growth of microbes. 9 marks

Culture Media

Requires an energy source
Energy is derived from carbohydrate/light in photosynthetic bacteria
Supply of raw materials for biosynthesis of proteins/DNA
Many microbes require only simple chemical compounds in growth media
Other microbes require complex compounds that are specific to their growth
Example of complex compound e.g. vitamins, fatty acids or beef extract

Any 5 marks

Culture conditions

Sterility to eliminate any contamination
Control of temperature, oxygen and pH via probes attached to computer monitor
Oxygen controlled by aeration to enable aerobic respiration
pH controlled by buffer solutions/addition of acid or alkali
Temperature controlled by water jacket to prevent enzymes denaturing

Must have reason with factor to award mark

Any 4 marks

Write notes on

(i) transfer of extra chromosomal genes to microorganisms using plasmids or artificial chromosomes

(7)

(ii) give an example of an ethical consideration of carrying out this procedure.

(1)

Recombinant DNA Technology

1. plant/animal genes transferred to microbes to make desired animal/plant protein
2. Microbe yield can be increased by introducing genes which remove inhibitory effect/amplify metabolic steps
3. Vectors contain marker genes and restriction sites/endouclease sites
4. Vectors contain self replicating regulatory sequences
5. Restriction enzymes/endonucleases cut target gene out of chromosome
6. Leaving sticky ends
7. Complementary sticky ends are formed in vectors using the same endonuclease
8. DNA ligase seals gene into plasmid
9. In bacteria the protein may lack post translational modifications/cannot fold properly
10. Yeast vectors avoid this problem and are more successful in recombinant DNA technology

Any 7 marks

Ethical Issues

1. Issue relating to illegal use/abuse of biotech product
2. Issue related to use of technology for unethicial issues e.g. biological weapons

Any 1

Unit 2 Essays

Topic	Essay Topic
DNA Replication	Give an account of DNA under the following headings (i) Organisation of DNA (ii) Polymerase Chain Reaction Write notes on DNA under the following headings (i) Replication of DNA (ii) PCR Describe DNA under the following headings. (i) Structure of DNA (ii) Replication of DNA
Stem Cells	Write notes under the following headings: (i) stem cells; (ii) research into stem cells and their therapeutic value. Give an account of stem cells under the following headings. (i) differentiation of stem cells (ii) ,therapeutic use of stem cells & ethical issues surrounding their use.
Bioinformatics	Give an account of bioinformatics under the following headings (i) genomics (i) phylogenetics (ii) personalised medicine Give an account of genomic sequencing under the following headings (i) phylogenetics and molecular clocks (ii) personal genomics and health
Evolution	Write notes on evolution under the following headings: (i) natural selection; (ii) genetic drift. Describe the evolution of a new species under the following headings. (i) Isolation and mutation (ii) Selection
Protein Synthesis	Write notes on (i) transcription (ii) translation (iii) post translational modifications Give an account of (i) structure of RNA (ii) role in protein synthesis
Mutations	Write notes on (i) occurance of mutagenic alleles and mutagenic agents (ii) gene mutations Write notes (i) gene mutations (ii) chromosome structure mutations

Describe DNA under the following headings

(i) DNA Structure (5)
(i) DNA Replication (4)

DNA Structure

1. double strand of nucleotides/double helix
2. Deoxyribose sugar, phosphate and base
3. Sugar phosphate backbone
4. Complementary base pairs OR A-T and C-G
5. Hydrogen bonds between bases
6. Anti parallel structure with deoxyribose at 3' and phosphate at 5' end.
7. Linear DNA wrapped around histone proteins

Any 5 marks

DNA Replication

8. DNA unwinds into 2 strands
9. Primer needed to start replication
10. DNA polymerase adds complementary DNA nucleotides to 3' end of strand
11. DNA polymerase adds nucleotides in one direction/from 5' to 3'
12. Lead strand formed continuously and lag strand replicates in fragments
13. Fragments joined together in lag strand by ligase

Any 4 marks

Write notes on DNA under the following headings

(i) Replication of DNA (4)
(ii) PCR (4)

Replication of DNA

1. Double helix unwinds/hydrogen bonds break between bases
2. Primer anneals to DNA
3. Free complementary DNA nucleotides added to 3' end by DNA polymerase
4. DNA polymerase adds nucleotides from 5' to 3' end
5. Lead strand replication continuous AND lag strand replicated in fragments
6. DNA ligase joins lag fragments together
7. Any two; DNA polymerase/DNA template/free DNA nucleotides/primers & ATP needed for DNA replication

Any 4 marks

PCR

1. PCR amplifies DNA content
2. DNA heated to 90 degrees to denature DNA to separate strands
3. DNA cooled to 55 degrees to allow primer to anneal to DNA to start DNA replication
4. Heated to 70 dedrees to enable DNA polymerase to synthesise DNA
5. DNA polymerase is heat tolerant to prevent enzyme denaturing at high Temperatures
6. Use of PCR is in forensics/paternity tests

Any 4 marks

Give an account of DNA under the following headings

(i) Organisation of DNA (4)
(ii) Polymerase Chain Reaction (5)

Organisation of DNA

1. In prokaryotes cells do not have a nucleus
2. DNA is packaged in circular chromosomes
3. Also have circular plasmids
4. Eukaryotes have a nucleus
5. DNA is packaged in linear chromosomes
6. Circular chromosomes in mitochondria and chloroplasts

Any 4

PCR

7. DNA heated to 90 degrees
8. This denatures the DNA which separates the strands
9. Temperature cooled to 55/60 degrees
10. This allows the primer to anneal to the target DNA sequence
11. Temperature raised to approximately 70 degrees
12. DNA polymerase synthesizes new DNA
13. Adding free DNA nucleotides to the 3' end of the DNA
14. Heat tolerant DNA polymerase is used to prevent DNA denaturing at high temperatures
15. Repeated cycles allows millions of copies to be produced/DNA content amplified

Any 5

Write notes under the following headings.

(i) stem cells **(5)**
(ii) therapeutic uses & ethical issues **(3)**

Stem Cells

1	stem cells are unspecialised/undifferentiated cells (in animals)	1
2	capable of cell division/mitosis **OR** can divide	1
3	can become more stem cells	1
4	(products of cell division) can differentiate/specialise	1
5	embryonic stem cells can differentiate into/give rise to/become/ specialise into all cell types **OR** are totipotent/are pluripotent	1
6	adult/tissue stem cells can differentiate into/give rise to/become/ specialise into more limited cell types **OR** are multipotent	1
7	adult/tissue stem cells replenish cells needing to be replaced **OR** cells which are worn out/damaged/diseased/dead cells/tissue	1
7a	if 5,6 or 7 not awarded 1 mark can be awarded for naming adult/tissue and embryonic stem cells	1
8	Differentiated/specialised cells produce protein/express genes characteristic of that cell type **OR** example	1
	Any 5	**Max 5 (from 8)**

Therapeutic Uses & Ethical Issues

9	can be used to repair/replace damaged/diseased/dead organs/tissues	1
10	Example eg bone marrow/corneal transplant **1 or 2**	1
11	ethical issue – requirement to alleviate suffering another ethical issue – requirement to conserve life/living embryos another ethical issue – requirement to obey laws/regulations **Any 1**	1
12	Another one **1 or 2**	1
	Any 3	**Max 3 (from 4)**

Write notes on stem cells under the following headings:

(i) differentiation of stem cells; 7
(ii) research into stem cells and their therapeutic value. 3

Differentiation of Stem Cells

stems cells are unspecialised/undifferentiated cells (in animals)	1
stem cells (continue to) divide	1
differentiate/develop into specialised cells/different cells for different functions OR differentiated cells cannot return to an undifferentiated state/change into other cell types	1
there are adult and embryonic stem cells	1
embryonic stem cells differentiate into all cells types	1
tissue/adult stem cells differentiate into cells which need to be replaced	1
adult stem cells give rise to more limited cell type	1
following differentiation a cell only expresses certain genes	1
that produce proteins characteristic of that cell type	1
example of a stem cell source	

Max 7

Research into stem cells and their therapeutic value. 3

11	stem cell research provides information on cell process	1
12	example of 11 ie cell growth, differentiation, gene regulation	1
13	therapeutic use includes repair of damaged/diseased organs/tissue/cells/eg OR eg of the use eg diabetes, Parkinson's disease, leukemia, skin graft, corneal graft, bone marrow transplant	1
14	stem cell research must be/is often regulated	1
15	example of an ethical issue related to stem cell research embryos could develop into humans OR method of avoiding the issues OR the use of induced pleuripotent stem cells/nuclear transfer techniques	1

Max 3

Give an account of bioinformatics under the following headings

(i) genomics (1)
(i) phylogenetics (5)
(ii) personalised medicine. (2)

Genomics

1	genomics is study of/sequencing of genomes/DNA/bases/nucleotides	1
2	has been undertaken with in disease causing organisms/pest species/ models for research **OR** example	1
	Either	**Max 1 (from 2)**

Phylogenetics

3	phylogenetics is use of DNA/gene sequence data	1
4	to study evolutionary relatedness/relationships of living organisms	1
5	sequence divergence gives estimates of time since lineages/ phylogenetic groups diverged	1
6	eg divergence of the three domains of life/names	1
7	used with fossil evidence to determine the main sequence of events in evolution/construct phylogenetic trees	1
8	example; emergence of cells/last universal ancestor/photosynthesis etc **OR** divergence from common ancestor	1
9	shows genetic/genome/sequence conservation across different lineages/groups	1
	Any 5	**Max 5 (from 7)**

Personal Genomics

10	personal genomics is analysis of an individual human genome	1
11	could lead to/have a role in personalised medicine **OR** medicine suitable for the individual can be worked out **OR** example	1
12	though knowledge of genetic component of susceptibility/likelihood of treatment success **OR** example	1
	Any 2	**Max 2 (from 3)**

Write notes on **evolution** under the following headings:

(i) natural selection;
(ii) genetic drift.

Natural Selection

1	organisms show (genomic) variation (upon which natural selection acts)	1
2	natural/sexual selection is non-random	1
3	(causes) increase in frequency of certain genetic sequences/genes/alleles	1
4	these sequences/alleles increase survival OR survival of the fittest/best suited to their environment	1
5	(survivors) pass on their favourable/beneficial gene sequence/alleles/ characteristics to offspring/next generation	1
6	deleterious/damaging sequences/alleles/genes/characteristics are reduced in frequency/removed from the population	1
7/8	stabilising selection (and explanation) directional selection (and explanation) disruptive selection (and explanation) **(Any 2)**	1 1 1
9	sexual selection	1
10	over many generations/a long time	1
11	individual with favourable/beneficial characteristics/genes/alleles survive to breed/reproduce **Max 7**	1

Genetic Drift

12	genetic drift is random increases and decreases in frequency of sequences/alleles/genes	1
13	particularly in small populations	1
14	results of neutral mutations	1
15	(or as results of the) founder effect/principle	1
16	founders of new populations have gene sequences which are not representative of the whole population/are in abnormal percentages of the whole population **Max 3**	1
	Total	**10**

Describe the evolution of a new species under the following headings.

(i) Isolation and mutation
(ii) Selection

Isolating Mechanism

1. Isolating mechanisms prevent gene flow/interbreeding between sub-populations
2. Geographical isolation leads to allopatric speciation
3. Behavioural isolation leads to sympatric speciation
4. Ecological isolation leads to sympatric speciation
5. Different mutations occur either side of barrier/mutations only occur on 1 side of barrier
6. Some mutations are favourable conferring a selective advantage

Selection

7. Natural selection is a non random increase in frequence of alleles that increase survival
8. Sexual selection is a non random increase in frequency of alleles that increase reproductive success
9. 2 Selection pressures described (stabilizing/directional/disruptive)
10. Third type of selection pressure award second mark
11. After a very long period of time
12. New species formed
13. The two species cannot interbreed to produce fertile offspring

Give an account of gene expression in eukaryotic cells under the following headings:

A) transcription of DNA 4
B) translation of mature mRNA 4
C) Post translational modifications 2

Transcription of DNA

Occurs in the nucleus
RNA polymerase unwinds and breaks hydrogen bonds between the bases in the two DNA strands.
RNA polymerase adds complementary RNA nucleotides to make a primary transcript
Introns removed and exons spliced together to make mature mRNA (in a process called RNA splicing)
Alternative splicing produces different mature mRNA by splicing different exons together
Depends on what is classified as an exon or intron

Translation of mature mRNA

mRNA carries code from nucleus to ribosome
tRNA carries specific amino acids
Anticodons on tRNA align with codons on mRNA
Amino acids aligned in specific sequence dependent on mRNA code
Amino acids form a polypeptide bond by forming peptide bonds.

Post Translational Modifications

Only occurs in eukaryoates to enable protein to fold correctly
Named example e.g. add phosphate/add carbohydrate/cut and combine protein
Second named example

Give an account of the structure of RNA and its role in protein synthesis. **(10)**

Note: Marks may be awarded for information given in a diagram. The relevant piece of information must be clearly shown in a carefully drawn and labelled diagram.

Structure of RNA

1. single stranded
2. made of nucleotides
3. has a base, ribose (sugar) and a phosphate
4. bases are guanine, cytosine, adenine and uracil. (not letters A,U,G,C)

Max 3 marks

Role in protein synthesis

5. mRNA carries information/code (for protein) from nucleus/from DNA
6. mRNA attaches to ribosome
7. three bases on mRNA is a codon
8. tRNA transport amino acids to ribosome
9. tRNA transports specific amino acids
10. three bases on tRNA is an anticodon
11. codons match/pair with their anticodons
12. joins/adds correct amino acid onto growing protein/polypeptide.
13. sequence of bases/codons on mRNA gives sequence of amino acids

Max 5 marks

Give an account of mutation under the following headings:

(i) occurrence of mutant alleles and effects of mutagenic agents; **3**

(ii) gene mutations and their effects on protein structure. **7**

(10)

(i)	1	occurrence is random **and** at low frequency/rare/not frequent	1
	2	mutagenic agents increase/speed up the rate/frequency/likelihood of/chance of/ occurrence of mutation **NOT** cause/induce mutation alone	1
	3	they include chemical (agent)s/colchicine/mustard gas/benzene **NOT** tars/petrochemicals/cigarette smoke etc	1
	4	Radiation **OR** X-rays **OR** UV light/radiation	1
		Any 3 **Max 3 (from 4)**	
(ii)	5	include inversion/substitution/deletion/insertion **(any 2)** **NOTE** - accept phonetic endings eg sion for tion	1
	6	the other two	1
	7	description of **one** named mutation in terms of bases/nucleotides eg inversion – bases/nucleotides rotate through 180°/swivel/flip round eg substitution – base/nucleotide/named bases substituted/ swapped/replaced by another eg – insertion base/nucleotide/named base inserted/placed into sequence eg – deletion base/nucleotide/named base deleted/removed **NOTE** - could be shown in diagrams but note that bases/nucleotides must be labelled as such or named	1
	8	another description	1
	9	inversion **and** substitution change/affect one/two/a few bases/nucleotides **OR** one/two codons/triplets **OR** are point mutations	1
	10	deletion **and** insertion change/affect all/every/each codon/triplet after mutation/from the mutation on **OR** are frame-shift mutations	1
	11	point mutations/inversion/substitution change one/two amino acids	1
	12	point mutations/inversion/substitution cause minor changes to the protein structure/function	1
	13	frame shift/deletion/ insertion change all amino acids after the mutation	1
	14	frame shift/deletion/insertion cause major changes to protein structure/function	1
		Any 7 **Max 7 (from 10)**	
		Total	**10**

Describe mutations under the following headings

(i) gene mutations (6)

(ii) chromosome structure mutations (3)

Gene mutations

1. Changes in DNA base sequence
2. Substitution is when 1 base is swapped with another OR example
3. Subsitution mutations leads to a change in 1 amino acid/point mutations
4. Only time substitution mutations are significant are when it affects the start/stop codon affecting protein
   significantly as it is shorter/longer
5. Deletion removes a nucleotide or example
6. Insertions adds in a nucleotide or example
7. Deletion/insertion are frame shift mutations/affect all amino acids after the mutations (only award either point 3 or 7)
8. Insertion mutations can lead to a sequence repeat which can cause genetic disease

Chromosome Mutations

1. Deletion removes a <u>GENE</u> ore example (must mention term gene not just letters ABC etc)
2. Duplication leads to a replication of the same gene sequence or example
3. Translocation leads to a gene being inserted from a different chromosome
4. Inversion leads to the order of genes beting reversed

Unit 3 Essays

Symbiosis

Give an account of symbiosis under the following headings

(i) parasitism (5)
(ii) mutualism (3)

Social Behaviour

Write notes on social behaviour under the following headings:

(i) altruism and kin selection;
(ii) primate behaviour.

Give an account of parasitism and mutualism as types of symbiosis.

Parasitism

1	symbiosis relationship/association between two different species		1
2	coevolution/coevolved		1
3	parasites gain energy/resources/nutrients		1
4	host is harmed by/made weaker by these losses OR one benefits and the other is harmed		1
5	parasites can have limited metabolism		1
6	often cannot survive outside host/reproduction requires host OR obligate		1
7	transmission/transfer method to new host or vector eg direct contact/resistant stage		1
8	secondary hosts as vector		1
9	eg of parasite and host		1
		Max 5	

Mutualism

10	mutualism involves benefit for both species		1
11	interdependent relationship OR one cannot live without the other		1
12	example of mutualism		1
13	benefits to one described		1
14	benefits to other described		1
		Max 3	

Write notes on social behaviour under the following headings:

(i) altruism and kin selection (5)
(ii) primate behaviour (3)

Altruism and kin selection

1	in context of altruism use of donor **and** recipient	1
2	altruistic behaviour harms **and** benefits / increased survival or descriptions of examples	1
3	reciprocal altruism involves reversal of roles at a later stage / favour returned or a description of reversed roles	1
4	reciprocal altruism often occurs in social animals/social insects **OR** mention of the prisoner's dilemma	1
5	altruism is (more) common between kin / related individuals / kin selection is altruism between kin	1
6	donor can benefit indirectly (through shared genes)	1
7	increased chance of shared / their genes surviving / being passed on (in recipient's offspring)	1
	Max 5 (from 7)	

Primate behaviour

8	primates have a long period of parental care / spend a long time with their parent(s)/ look after young for a long time	1
9	this gives opportunity to learn complex social skills	1
10	(social) primates use ritualistic display / appeasement (behaviour) to reduce conflict/aggression / ease tension	1
11	any one example of appeasement / alliance forming / ritualistic behaviour e.g. grooming / facial expression / body posture / sexual presentation	1
12	second example of appeasement / alliance forming / ritualistic behaviour	1
13	individuals form alliances which increase social status **OR** Social hierarchy exists	1
14	complexity of social structure is related to ecological niche / resource distribution / taxonomic group	1
	Max 5 (from 7)	
	Total	**10**