Section 14 - Reproduction

Answer Key

14.1	What are **Gametes?**	**Sex Cells**
14.2	What is the difference between **sexual and asexual** reproduction?	Sexual reproduction involves 2 parents and produces genetically different offspring, asexual involves one parent and produces genetically identical offspring
14.3	Give 2 advantages and disadvantages of sexual reproduction.	**Advantages** – variation, increases diversity, species can adapt to a new environment, disease is less likely to have an impact **Disadvantages** – genetic disorders are passed on, no variation
14.4	Give 2 advantaged and 2 disadvantages of asexual reproduction	**Advantages** – product large number off identical offspring, quick, easy, no variation **Disadvantages** – genetic disorders are passed on, no variation
14.5	What organism uses both sexual and asexual reproduction?	Plants
14.6	What type of cell division forms gametes?	**Meiosis**
14.7	Name the gametes in animals.	Sperm and egg
14.8	Name the gametes in plants.	Ovule and pollen
14.9	**What does sexual reproduction lead to that asexual does not?**	**Variation**
14.10	What effect does meiosis have on the chromosome number?	Halves it
14.11	When a new cell is formed by **fertilisation, what type of cell division** takes place?	**Mitosis**
14.12	What is the process by which cells develop into specialised types?	Differentiation

Section 15 - Genetics

Answer Key

15.1	Where is genetic material found?	Nucleus
15.2	Describe the structure of DNA.	Double helix
15.3	What is a gene and what is its function?	A selection of DNA that c**odes for a particular protein**
15.4	What is a human Genome Project?	Mapping of all genes in a human.
15.5	State 3 ways in which understanding the Human Genome Project is important?	1. To search for genes linked to different types of disease 2. To understand and treat inherited disorders 3. To trace early human migration patterns
15.6	**Where does protein synthesis happen in a cell?**	**Ribosome**
15.7	What is the change in the sequence in DNA called?	Mutation
15.8	**What is allele?**	**Different version of the same gene**
15.9	What is the difference between a **dominant and recessive allele**?	**Dominant** – The individual **only needs one copy of this allele** for its phenotype to be seen **Recessive** - The individual **needs two copies of this allele** for its phenotype
15.10	What is the difference between **heterozygous and homozygous**?	Homozygous – The individual **has two identical alleles** for this gene.
15.11	What is the different between genotype and phenotype?	**Genotype** – alleles that determine characteristics **Phenotype** – the observable characteristics for the gene
15.12	What are the genotypes for a a)male and b) female	Male XY, Female XX

Section– DNA (Triple Content)

Answer Key

1.	Name the 3 parts of DNA	A phosphate group, a sugar molecule and a nucleotide base.
2.	Name the **4 nucleotides** found in DNA.	A**denine, Thymine, Cytosine and Guanine.**
3.	How many **bases code** for an amino acid?	Three
4.	What is a set of **3 Nucleotide bases** called?	**A Codon**
5.	Which organelle synthesises new proteins?	Ribosomes.
6.	How is the protein sequence correctly assembled?	Using a template molecule from DNA - **mRNA**
7.	What brings specific amino acids to the ribosome?	Carrier molecule - tRNA
8.	When a protein chain is complete, what process aids it to form its unique shape?	Folding into a 3D shape
9.	Name 3 uses of protein in the body	Enzymes, hormones, structural proteins such as collagen, Antibodies
10.	What is **the change in the DNA Sequence called**?	**Mutation**
11.	Name 3 positional consequences for the protein mutation?	No change, slight change – so no effect on protein Altered protein so it may not function Mutation with non-coding region that may stop the expression of a gene
12.	Name 2 examples of proteins in the body and where you may find them.	Hormones – Glands Antibodies – Produced by white blood cells Enzymes – produced by organs

Section– Cloning (Triple Content)

Answer Key

1.	What is **plant tissue culture**?	Using **small groups of cells from part of a plant to grow identical new plants.**
2.	What are plant cuttings?	An older, but simple method used by gardeners to produce many identical new plants from a parent plant.
3.	Why is plant cloning useful?	Horticulture and agriculture. To produce lots of plants with the same desirable characteristics and increase yield for profit.
4.	Describe the stages in embryo transplant	Splitting apart cells from a developing animal embryo before they become specialised transplanting the identical embryos into their host mothers.
5.	Describe the **stages of adult cell cloning**.	**1.** The nucleus removed from the **unfertilised egg cell** 2. The **nucleus from an adult body cell**, such as a skin cell, is inserted into the egg cell 3. An **electric shock** stimulates the egg cell to divide to form an embryo 4. These embryo cells contain the same genetic information as an adult skin cell 5. When the embryo has **developed into a ball of cells, it is in inserted into the womb of an adult female** to continue its development
6.	State 2 advantages of cloning in plants and animal.	Organisms have the desired characteristics, slow breeding organisms can be produced quickly
7.	State 2 disadvantages of animal cloning in plants and animals.	Reduces genetic variation, so make populations more susceptible to disease, ethical concerns.
8.	Compare the offspring as a result of embryo transplants	All are genetically identical to each other – but not to parents
9.	In adult cell cloning what is removed from the cloning target cell?	Nucleus
10.	What type of cell is taken from the target clone in adult cell cloning?	Any adult cell with a nucleus containing all chromosomes. (Not a gamete)
11.	What has to done to the egg in adult cell cloning?	Remove the nucleus.
12.	What has to be done to stimulate the new egg to start diving in adult cell cloning?	Electric shock.

Section 16 – Variation and Evolution

16.1	What is variation?	**Variation is differences between organism within the same species or between different species**
16.2	State causes of variation	**Environmental, genetic, can be a combination of both**
16.3	What is evolution?	The gradual **changing of an inherited characteristic of a population over time**.
16.4	What is a **species?**	**Organisms that can interbreed to produce fertile offspring**
16.5	What is **natural selection**?	The process by which evolution takes place – those **with favourable characteristics (best suited to environment) are more likely to survive and reproduce, passing on their genes.**
16.6	What is **selective breeding**?	The process by which humans breed plants and animals for particular genetic characteristics.
16.7	State 2 **advantages of selective breeding.**	• Desired **characteristics can be inherited,** • Increased profit for items that you can increase yield
16.8	State 2 disadvantages of selective breeding.	• Inbreeding – some breeds are prone to disease • inherited defects may not get the characteristics you desire
16.9	What is **genetic engineering?**	The process involves **modifying the genome of an organism by introducing a gene from another organism to give a desired characteristics**
16.10	What structures are present in a prokaryote are used in genetic engineering	**Plasmids**
16.11	What are used to 'cut out' and 'stick' and inserted section of DNA?	**Cut – restriction enzymes** **Stick – ligase enzymes**
16.12	State 2 advantages and 2 disadvantages of genetic engineering.	Improved growth/rates/Increased yield/Increased food quality/produce human proteins/enzymes as medicine Unknown effects on populations of wild flowers Unknown effects on populations of insects Some people feel the effects of eating GM crops on human health have not been fully explored
16.13	State **3 uses of genetic engineering**	Insulin production, disease resistant crops, monoclonal antibodies

Section 17 – Inheritance and Classification

Answer Key

17.1	Who is credited with the theory of natural selection and evolution?	Charles Darwin
17.2	State **3 stages of natural selection**	**1. Individual organism within a particular species show a wide range of variation and characteristic** **2. Individuals with characteristics most suited to the environment are more likely to survive to breed successfully** 3. **The characteristics have enabled these individuals to survive are then passed on to the next generation**.
17.3	What is speciation	The formation of new and distinct species in the course of evolution
17.4	What are fossils?	The remains of organisms from millions of years ago, found in rocks
17.5	Why are fossils important?	Can be used to determine how much or how little has changes as life developed on Earth.
17.6	What is an evolutionary tree?	Evolutionary trees are used to represent the relationships between organisms
17.7	What do the junctions between lines on an evolutionary tree mean?	A common ancestor of two species
17.8	What is extinction?	When there are no remaining individuals of a species still alive
17.9	State 3 ways that **extinction** could occur?	Changes to the environment over geological time; **lack of food/prey; new predators; new diseases**; new, more successful competitors; a single catastrophic event/natural disaster
17.10	State the title at each classification level.	**Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species**
17.11	Which 2 levels are used in the binomial naming system?	**Genus and Species**
17.12	What are the 3 domains?	Archaea, Bacteria, Eukarya

Foundation Tier

Q1.

We can now produce organisms with the characteristics we want the organisms to have.

List A gives the names of four ways of producing organisms.

List B gives information about the ways of producing organisms.

Draw **one** line from each way of producing organisms in **List A** to the correct information in **List B**.

List A **Ways of producing organisms**	**List B** **Information**
	Taking part of the stem from a plant, then putting this part of the stem in wet soil in a plant pot.
Embryo transplantation	
	Growing groups of cells from a plant on special jelly.
Genetic engineering	
	Transferring genes from one organism to a different organism.
Taking cuttings	
	Growing plants from seeds in a garden.
Tissue culture	
	Separating groups of cells from a very young developing animal then putting the groups of cells into host mothers.

(Total 4 marks)

Q2.

The photograph shows an *Anolis* lizard. This lizard lives on a tiny island.

By Paul Hirst (Phirst) (Own work) [CC-BY-SA-2.5], via Wikimedia Commons

Scientists investigated how the leg length of the *Anolis* lizards affected their survival. At the start of the investigation the *Anolis* lizards had a large range of leg lengths.

- The scientists placed six *Curly-tailed* lizards onto the island.
- The *Curly-tail* lizard is a predator of the *Anolis* lizard.
- After one year the population of *Anolis* lizards had halved.
- Nearly all the remaining *Anolis* lizards had long legs.

(a) Why did the population of *Anolis* lizards halve?

_____

_____

(1)

(b) The remaining *Anolis* lizards had long legs.

Suggest an explanation for this.

_____

_____

_____

_____

_____

(2)

(c) Answer each of these questions by placing a tick (✓) in the correct box.

(i) Which theory is supported by evidence from this investigation?

Global warming ☐

Natural selection ☐

Sustainability ☐

(1)

(ii) Which scientist proposed this theory?

Darwin ☐

Lamarck ☐

Semmelweiss ☐

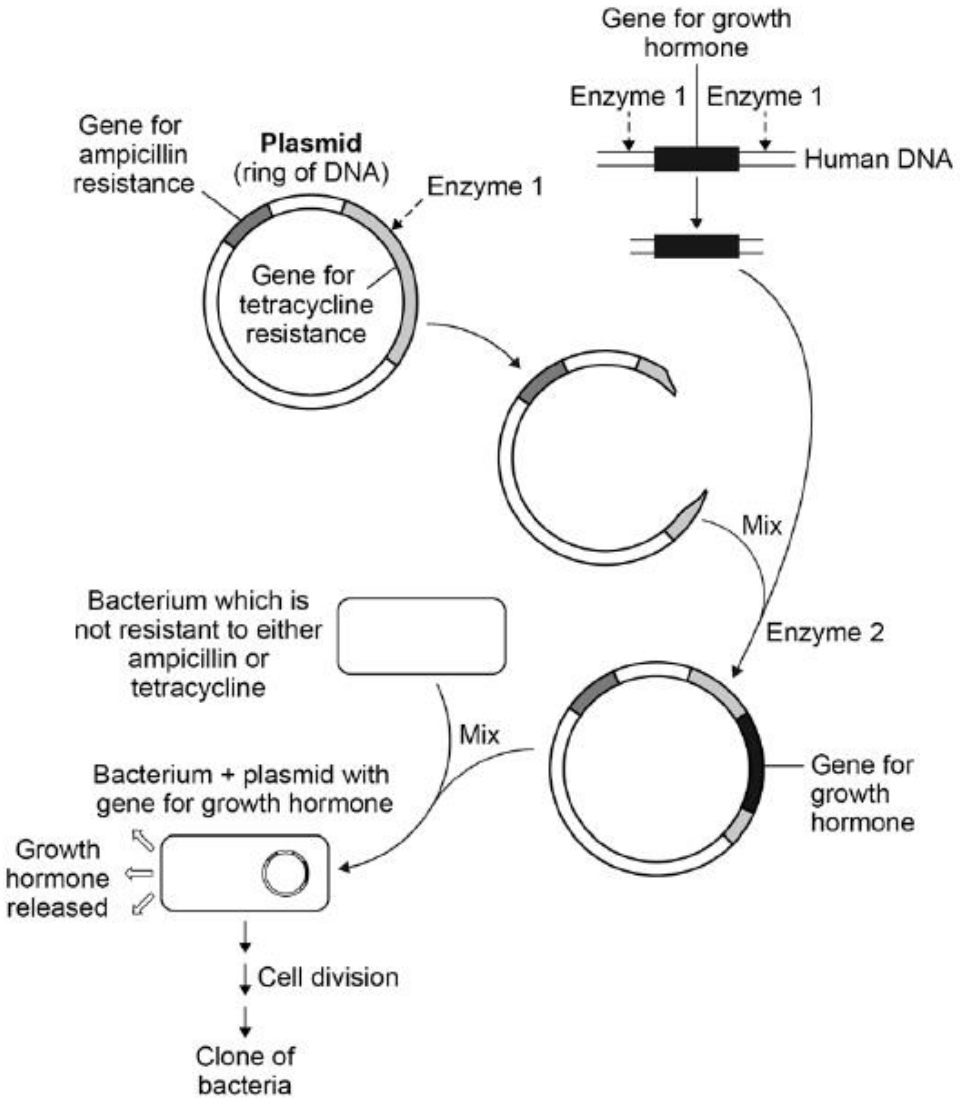
(1)

(Total 5 marks)

Higher Tier

Q3.

The diagram shows how scientists can use genetic engineering to produce human growth hormone.



(a) Human growth hormone is made by the pituitary gland.

The human DNA containing the gene for growth hormone can be taken from a white blood cell.

Give the reason why the gene does **not** have to be taken from cells in the pituitary gland.

_____

_____

(1)

The figure above shows that the plasmid contains two genes for antibiotic resistance:

- a gene for resistance to the antibiotic ampicillin
- a gene for resistance to the antibiotic tetracycline.

(b) Explain how the structure of **Enzyme 1** allows it to cut the gene for tetracycline resistance, but **not** the gene for ampicillin resistance.

(3)

(c) In the final step of the diagram above, very few bacteria take up a plasmid containing the gene for growth hormone.

Some bacteria take up an unmodified plasmid.

Most bacteria do **not** take up a plasmid.

Complete the table below.

- Put a tick in the box if the bacterium **can** multiply in the presence of the given antibiotic.
- Put a cross in the box if the bacterium **cannot** multiply in the presence of the given antibiotic.

	Bacterium can multiply in the presence of	
	Ampicillin	**Tetracycline**
Bacterium + plasmid with growth hormone gene		
Bacterium without a plasmid		
Bacterium with an unmodified plasmid		

(d) The figure above shows that the bacterium containing the gene for human growth

hormone multiplies by cell division.

This produces a clone of bacteria.

Explain why **all** the bacteria in this clone are able to produce growth hormone.

(3)

(Total 10 marks)

Q4.

There are two types of cell division: mitosis and meiosis.

(a) Describe **three** differences between the processes of mitosis and meiosis.

1

2

3

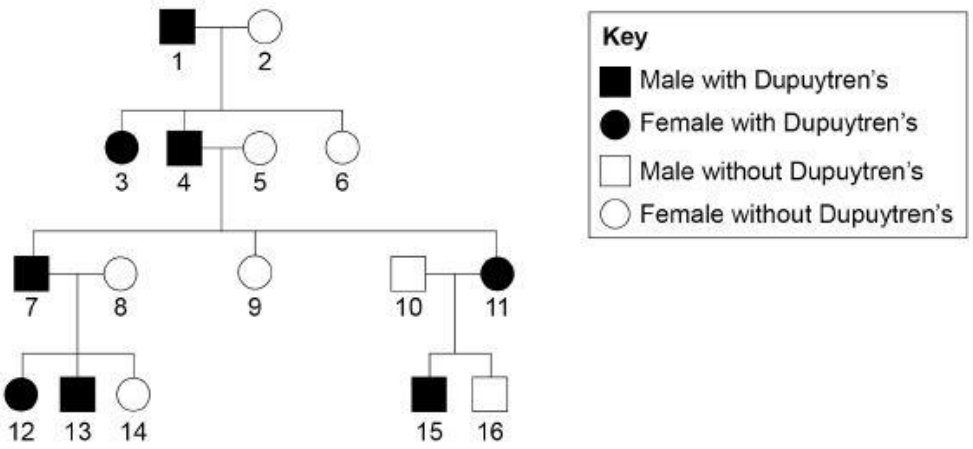
(3)

(b) Describe **one** similarity between the processes of mitosis and meiosis.

(1)

Dupuytren's is a disorder that affects the hands.

The diagram below shows the inheritance of Dupuytren's in one family.



Dupuytren's is caused by a dominant allele in this family.

D = dominant allele

d = recessive allele

(c) Give the genotype of person **1**.

Explain your answer.

Genotype _____

_____

_____

(2)

(d) Person **7** and person **8** in the diagram above are expecting a fourth child.

What is the probability of the child having Dupuytren's?

You should:

- draw a Punnett square diagram
- identify which offspring have Dupuytren's

Probability = _____

(5)

(e) Explain how the diagram above shows the allele for Dupuytren's is **not** on the Y chromosome.

_____

_____

_____

_____

(2)

(Total 13 marks)

Q5.

Figure 1 shows a ring-tailed lemur.

Figure 1

The table below shows part of the classification of the ring-tailed lemur.

Classification group	**Name**
Kingdom	*Animalia*
Phylum	*Chordata*
	Mammalia
	Primates
	Lemuroidea
Genus	*Lemur*
	catta

(a) Complete the table above to give the names of the missing classification groups.

(2)

(b) Give the binomial name of the ring-tailed lemur.

Use information from the table above.

_____

(1)

Lemurs are only found on the island of Madagascar.

Madagascar is off the coast of Africa.

Scientists think that ancestors of modern lemurs evolved in Africa and reached Madagascar about 50-60 million years ago.

Today there are many species of lemur living on Madagascar.

Figure 2 shows information about water currents.

Figure 3 shows the distribution of three species of lemur on Madagascar.

Figure 2

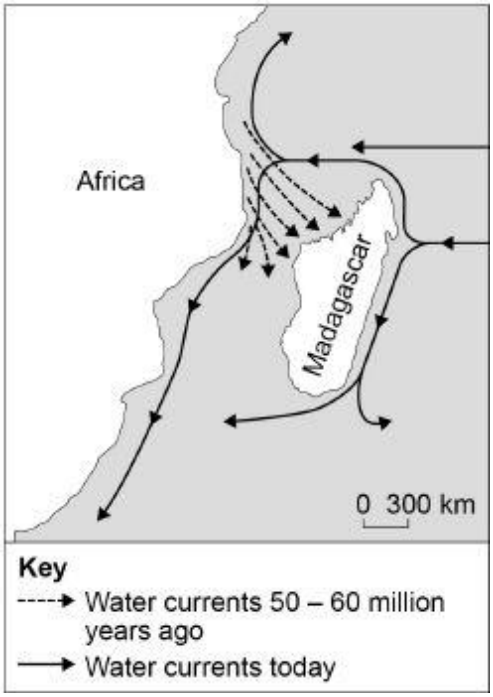
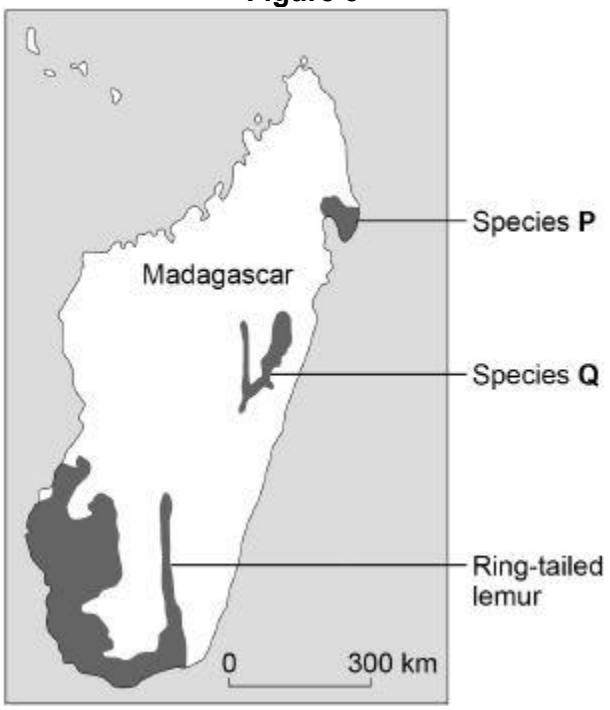


Figure 3



(c) Suggest how ancestors of modern lemurs reached Madagascar.

_____

_____

(1)

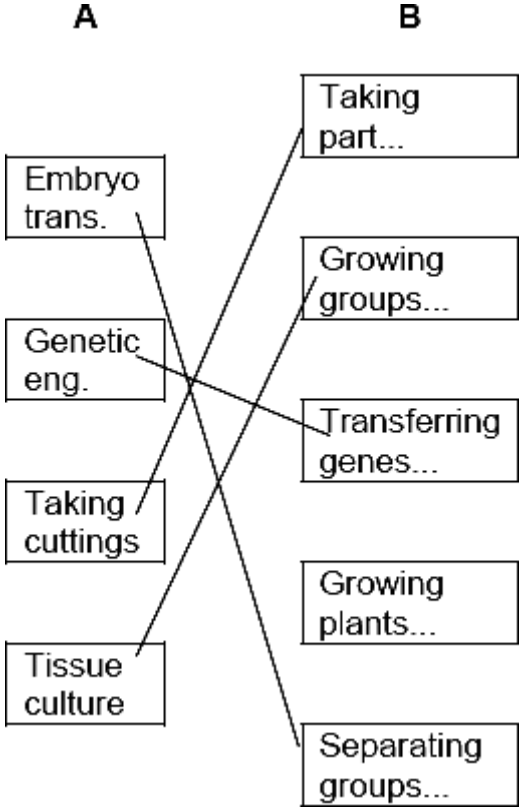
(d) Describe how the ancestors of modern lemurs may have evolved into the species shown in **Figure 3**.

(5)

(Total 9 marks)

Mark schemes

Q1.



1 *mark for each correct line*

mark each line from left hand box

two lines from left hand box cancels mark for that box

[4]

Q2.

(a) predation / eaten

ignore competition

1

(b) could run faster / jump higher /climb better

1

to escape / or escape describe

1

(c) (i) natural selection

1

(ii) Darwin

1

[5]

Q3.

(a) white blood cells have the same DNA / genes / chromosomes
or
have the gene for GH

allow have all the genes

allow all body cells (except RBCs) have all of the genes

1

(b) enzyme has specifically-shaped <u>active site</u>

1

the 2 antibiotic resistance genes have different (sequence of) <u>bases</u>

1

only Tetracycline-resistance gene fits (active site of) enzyme
or
only Tetracycline-resistance gene is complementary to (active site of) enzyme

1

(c)

Ampicillin	Tetracycline
✓	×
×	×
✓	✓

1 *mark for each correct row*

if no other mark, allow ***1*** *mark for one correct column*

1
1
1

(d) clone produced by asexual reproduction

allow by 'mitosis'

1

all DNA / all genes are copied

allow GH gene copied

allow plasmid copied

1

every cell receives a copy
or
receives every gene
or
receives GH gene
or
receives plasmid
or
genetically-identical cells

1

[10]

Q4.

(a) any **three** from:

- mitosis produces two (daughter) cells but meiosis produces four (daughter) cells

  answers must be comparative

- one cell division in mitosis but two cell divisions in meiosis

- mitosis produces cells with two of each chromosome, but meiosis produces cells with one of each chromosome

  allow mitosis produces diploid cells but meiosis produces haploid cells
  *allow mitosis maintains the number of chromosomes **or** mass of DNA **or** mass of genetic material but meiosis halves the number / mass*
  *allow mitosis produces cells with 23 pairs **or** 46 chromosomes but meiosis produces cells with 23 chromosomes*

- mitosis produces genetically identical cells, but meiosis produced genetically different cells

  allow other correct differences between the processes of mitosis and meiosis

3

(b) any **one** from:

- DNA doubles / copies / replicates (once)

  *allow chromosomes **or** genetic material **or** genetic information double / replicate / are copied*

- increase in the number of mitochondria / ribosomes / sub-cellular structures

  ignore mitochondria / ribosomes are copied / duplicated

  allow chromosomes / chromatids pulled to side (of cell)
  allow other correct similarities between the processes of mitosis and meiosis

1

(c) Dd / dD

allow heterozygous

1

has **D** because has Dupuytren's **and** has **d** because child / person 6 is homozygous recessive **or** does not have Dupuytren's **or** is **dd**

*allow has **D** because has Dupuytren's **and** person 1 and person 2 both passed **d** to child / person 6*

*allow has **D** because has Dupuytren's*
*__and__ cannot be homozygous / **DD** or all the children would have Dupuytren's*

1

(d) male / person 7 gametes correct: **D** and **d**

1

female / person 8 gametes correct: **d** and **d**

*allow **1** mark for both sets of gametes correct if parents not identified*

1

correct derivation of offspring genotypes:
Dd Dd dd dd

allow correct derivation of offspring genotypes from incorrect gametes

1

offspring with Dupuytren's identified

allow correct for genotypes stated in mp3

1

probability correct from the correct identification given

allow probability correct from offspring genotypes if identification not given

1

(e) female(s) / person(s) 3 / 11 / 12 have Dupuytren's

allow some females have Dupuytren's

1

females don't have Y chromosome
or
Dupuytren's is passed from fathers / 1 / 7 to daughters / 3 / 12, (so is not on the Y chromosome)

allow only males have Y chromosomes
allow females are XX
allow Dupuytren's is passed from mothers / 11 to children / 15, (so is not on the Y chromosome)

1

[13]

Q5.

(a)

Classification group	**Name**
Class	*Mammalia*
Order	*Primates*

Family	*Lemuroidea*
Species	*catta*

*all 4 correct = **2** marks*
*2 or 3 correct = **1** mark*
*0 or 1 correct = **0** marks*

2

(b) Lemur catta

ignore capitalisation / non-capitalisation of initial letters

ignore italics / non-italics
ignore underlining / non-underlining

1

(c) carried by (favourable) currents on masses of vegetation

allow description of currents from Figure 2
ignore swimming

1

(d) isolation of different populations

1

habitat variation between lemur populations

allow examples − biotic (e.g. food / predators) or abiotic (e.g. temperature)

1

genetic variation or mutation (in each population)

1

better adapted survive (reproduce) **and** pass on (favourable) allele(s) to offspring

*allow natural selection **or** survival of the fittest **and** pass on (favourable) allele(s) to offspring*
allow gene(s) / mutation as an alternative to allele(s)

1

(eventually) cannot produce fertile offspring with other populations

allow cannot reproduce 'successfully' with other populations

ignore cannot reproduce unqualified

1

[9]