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 codes 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 16 – Variation and Evolution

Answer Key

16.1	What is variation?	Variation is **differences between organism within the same species** or between different species
16.2	State 2 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

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?**	**C**hanges 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.

The Arabian oryx (*Oryx leucoryx*) is a mammal that was once extinct in the wild.

The image shows an Arabian oryx.

(a) What is the genus of the Arabian oryx?

Tick **one** box.

leucoryx ☐   *Oryx* ☐   *Oryx leucoryx* ☐

(1)

(b) Give **two** adaptations of the Arabian oryx to living in hot desert environments.

Use information from the image.

1. _____

_____

2. _____

_____

(2)

(c)   The Arabian oryx uses its long horns to fight for territory and mates.

Describe how the long horns could have evolved.

_____

_____

_____

_____

_____

_____

(3)

Arabian oryx from many different zoos were interbred so that they could be reintroduced to the wild.

(d)   What is the name of this method of increasing the population of endangered animals?

Tick **one** box.

Breeding programme   ☐

Genetic modification   ☐

Natural selection   ☐

Selective breeding   ☐

(1)

(e)   Explain why it was important to use Arabian oryx from many different zoos instead of one zoo.

_____

_____

(1)
(Total 8 marks)

Q2.

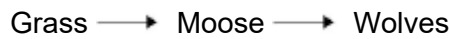Moose are animals that eat grass.

Figure 1 shows a moose.

Figure 1

© Wildnerdpix/iStock/Thinkstock
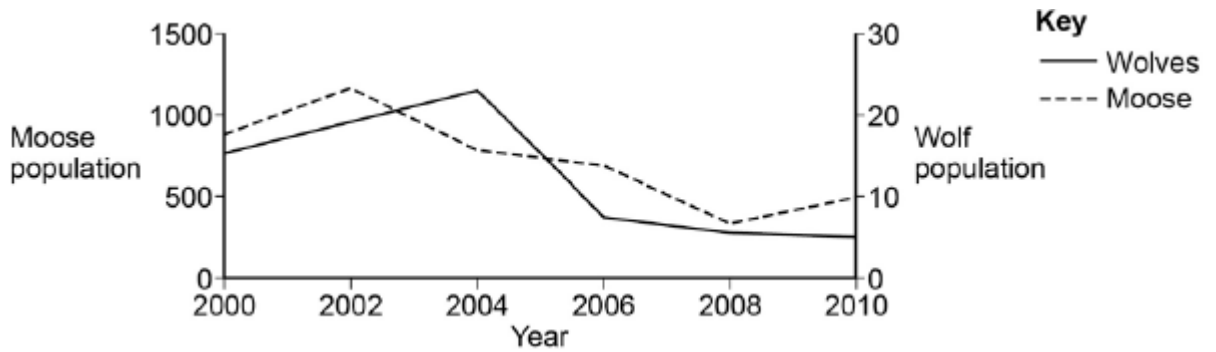
Figure 2 shows a food chain.

Figure 2

Grass ⟶ Moose ⟶ Wolves

(a)   Name the secondary consumer shown in **Figure 2**.

_____

(1)

(b)   **Figure 3** shows how the moose population and wolf population have changed in one area.

This is a predator-prey cycle.

Figure 3

In 2004 the line on **Figure 3** for wolves is above the line for moose.

How does **Figure 3** show that there are more moose than wolves in 2004?

_____

_____

(1)

(c)   Suggest why the moose population decreased between 2002 and 2004.

Use information from **Figure 3**.

_____

_____

(1)

(d)   The number of wolves is one biotic factor that could affect the size of the moose population.

Give **two** other biotic factors that could affect the size of the moose population.

1. _____

_____

2. _____

_____

(2)

(e)   Moose have distinct characteristics such as antlers.

Describe how moose may have evolved to have large antlers.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)
(Total 10 marks)

Higher Tier

Q3.

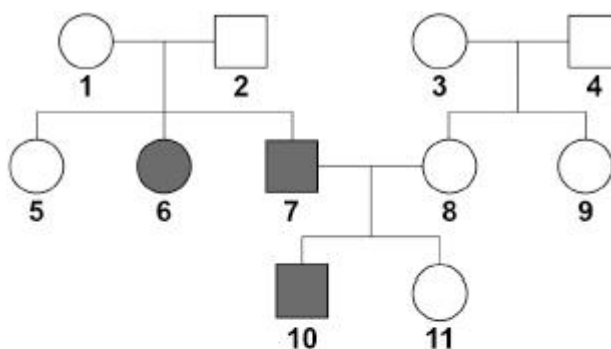This question is about genetic disorders.

(a)   Some people are heterozygous for a genetic disorder.

Define the term 'heterozygous'.

_____

_____

(1)

(b)   The figure below shows the inheritance of a genetic disorder in a family.

Key

◯ Female who does **not** have the disorder

▢ Male who does **not** have the disorder

⬤ Female who has the disorder

⬛ Male who has the disorder

Person **7** and person **8** plan to have another child.

Determine the probability that the child will be a **male** who has the disorder.

You should:

·   draw a Punnett square diagram

·   identify the genotype of person **7** and the genotype of person **8**

·   identify the phenotype of each offspring genotype

·   use the symbols:

H = dominant allele

h = recessive allele

Probability of having a male child with the disorder = _____

(6)

(c) Polydactyly is a different inherited disorder.

Two parents do **not** have any alleles for polydactyly in their ordinary body cells.

These parents produced a child with polydactyly.

Explain how polydactyly suddenly occurred in this family.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)
(Total 11 marks)

Q4.

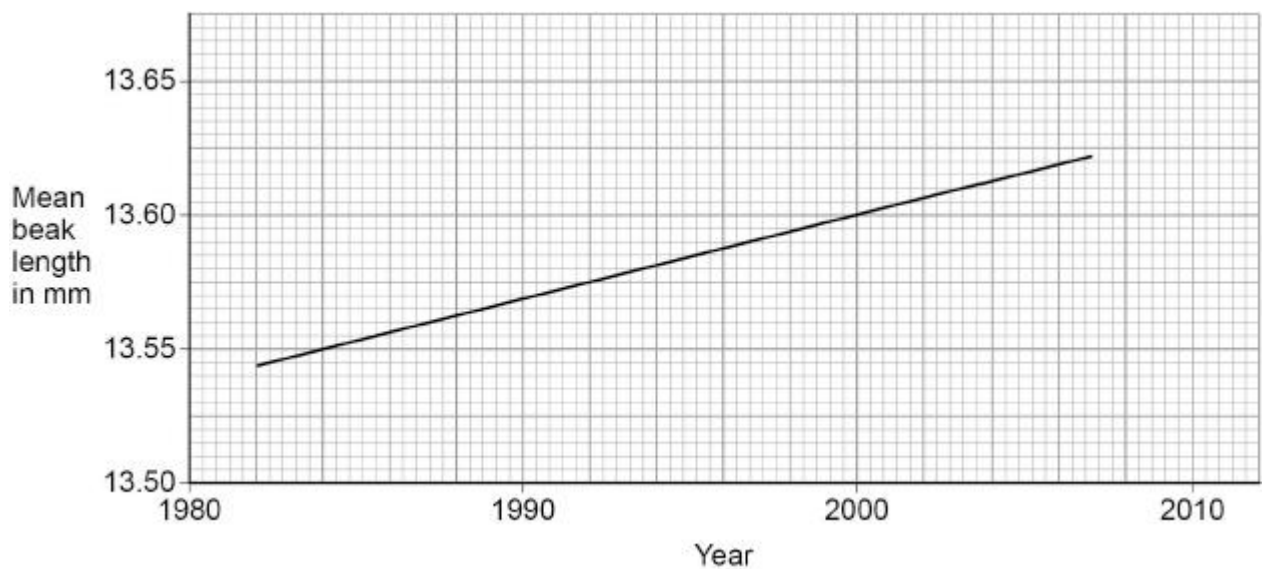**Figure 1** shows one species of bird on a bird feeder.

Figure 1

The birds use their beaks to reach nuts inside the bird feeder.

Figure 2 shows the mean beak length of this species of bird in the UK.

This species of bird often visits bird feeders.

Figure 2

(a)   Determine the rate of change in beak length from 1984 to 2000.

Use **Figure 2**.

_____

_____

_____

_____

_____

_____

Rate of change = _____ mm/year

(3)

(b)   Explain the process of evolution that could cause the trend in **Figure 2**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(c)   Birds of this species:
  •   live for about 3 years

- produce up to 24 eggs every year.

Explain why evolution is easier to study in this species of bird than in humans.

_____

_____

_____

_____

_____

_____

_____

(3)

(d)   Birds of this species are found in different parts of the world.

Describe evidence that would show two individual birds are the same species.

_____

_____

_____

_____

_____

_____

_____

(3)
(Total 15 marks)

Mark schemes

Q1.

(a) *Oryx*

1

(b) any **two** from:
- white / light colour (to reduce thermal gain)
- short fur (to reduce thermal insulation)
- little body fat
- large hooves (to walk in sand)
- camouflaged (against sand by light colour)

2

(c) any **three** from:
- variation in population
- animals with longest horns more likely to survive / reproduce
- passing on alleles for long horns
- repeated over many generations

3

(d) breeding programme

1

(e) any **one** from:
- to increase genetic diversity

    *do **not** accept to increase biodiversity*
- species may be unable to cope if environment changes
- all susceptible to same diseases / inbreeding problems

    allow otherwise all offspring would have similar genes or a decreased gene pool
- prevents inbreeding

1

[8]

Q2.

(a) wolves

1

(b) moose and wolves are on different scales

1

(c) wolf population has increased so more moose are eaten

    *do **not** accept there are more wolves than moose*

1

(d) any **two** from:

- (other) predators

    allow correct examples

    allow 'humans hunting moose'
- (new) pathogens

allow diseases
- competition

2

(e)   any **four** from:

- variation (within species) of antler size
  allow description relating to antlers
- (caused by) different genes
- as a result of sexual reproduction / process of meiosis / mutation
- (phenotype) most suited to environment most likely to survive and breed
  ignore natural selection unqualified
- genes for large antlers (more likely to be) passed on to next generation

4

reference to mate selection
or
fighting
or
gaining territory
or
competition for mates
or
avoiding predation

1

[10]

Q3.

(a)   any **one** from:
- (having two) different alleles for a gene / trait / characteristic / disorder
  ignore examples such as Hh
  ignore having two different alleles unqualified
- (having) the dominant **and** recessive allele for a gene / trait / characteristic / disorder

1

(b)   father / person 7 **hh**

1

mother / person 8 **Hh**
  *allow **hh** and **Hh** parental genotypes with each parent unidentified **or** reversed for **1** mark*

1

(possible offspring correctly derived)
hh (× 2)
Hh (× 2)
  allow correctly derived offspring from

incorrect parental genotype(s)

1

(each different phenotype identified)
hh = has the disorder
Hh = does not have the disorder

> *allow from incorrectly derived offspring*
>
> *if incorrectly have **HH** = does not have the disorder*

1

0.5

> *allow 50% **or** ½ **or** 1:1 **or***
>
> *1 out of 2 **or** 1 in 2*
>
> *do **not** accept 1:2*
>
> *allow probability of having disorder correctly derived from incorrect parental genotypes*

1

(probability of male with disorder)
0.25

> *allow 25% **or** ¼ **or** 1:3 **or***
>
> *1 out of 4 **or** 1 in 4*
>
> *do **not** accept 1:4*
>
> *allow probability of male with disorder correctly derived from incorrect probability of having the disorder*

1

(c) caused by mutation

> *allow description, for example change in the genetic code **or** change in base sequence*

1

during meiosis

> *allow in (germ) cells prior to meiosis*
>
> *allow in (the formation of) gametes / egg / sperm*
>
> *allow during mitosis between fertilisation and birth*

1

causing a change in amino acid sequence

1

causing a different (specific) protein to be produced
or
causing none of a (specific) protein to be produced

> *causing a different (specific) enzyme to be produced*
>
> *or*

causing none of a (specific) enzyme to be produced

allow polydactyly is caused by a dominant allele so if child has one / the allele (with the mutation) they will have the disorder

*if no other mark awarded allow parents used donated egg / sperm for **1** mark*

1

[11]

Q4.

(a) 13.55 (mm) **and** 13.60 (mm)

1

$$\frac{13.60 \text{ (mm)} - 13.55 \text{ (mm)}}{2000 - 1984}$$

allow

$$\frac{0.05}{16}$$

allow correct working from other pairs of readings

1

0.003125 (mm/year)
or
3.125×10^{-3} (mm/year)

allow correct answer from other pairs of readings

allow a correct answer given to any number of significant figures

1

(b) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5−6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3−4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1−2

No relevant content

0

Indicative content

- there is variation in beak length (in this bird population)
- variation is due to mutations

- beak length is controlled by gene(s)

- birds with longer beaks can reach more nuts / food **or** birds with longer beaks can fight with **or** outcompete birds with shorter beaks
- therefore have more energy from food
- so can produce more offspring **or** reproduce more

- those offspring that inherit the long beak allele more likely to survive
- which is natural selection
- pass allele *l* gene (for long beak) on
- repeated over many generations

- birds are evolving to have longer beaks

For **Level 3** detail of process of evolution must be linked to beak length **and** implication of several generations is required.

(c)   shorter life cycle / span

        allow converse if clearly referring to human evolution

        ignore shorter life

1

    more offspring

1

    (so) the genetics of the population changes faster

        allow effect of mutations seen sooner / faster **or** *humans can see evolution in birds during the course of a human life(time)*

        allow more fossil evidence

1

(d)   similar / same phenotype

1

    similar genotype / DNA (profile)

1

    (can reproduce / breed and) produce fertile offspring

1

[15]