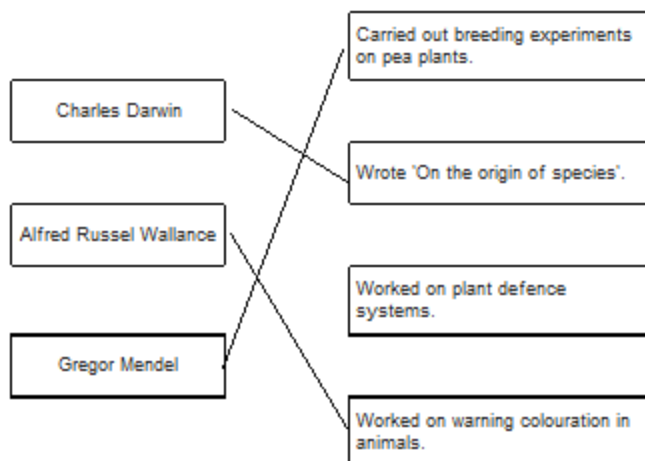


1.

(a)



3

(b) a gene

allow allele

1

(c) 4

1

(d) correct derivation of children's genotypes

1

identification of children with cystic fibrosis (dd)

1

0.25

allow ecf

allow ¼ / 25% / 1 in 4 / 1:3

1

*do **not** accept 1:4*

(e) heterozygous

1

[9]

2.

(a) any **two** from:

- larger / longer / thicker
*allow examples eg fewer toes **or** bones fused*
- fewer (bones in total)
allow smaller surface area touching the ground
- fewer bones touching the ground

2

- (b) (i) large(r) surface / area in contact with the ground

or

low / less pressure on ground

1

(so) less likely to sink into mud / ground

or

(so) could run fast(er)

allow easy / easier to escape predators

1

- (ii) variation (in size / number / arrangement of bones)

allow mutation(s) (in size / number / arrangement of bones)

1

(and) those with large(r) / few(er) bones more suited to running **or** run faster (on harder / drier ground)

1

these survive **and** breed

allow ref to offspring for breed

1

(so) genes / DNA (for larger / fewer bones) passed on

allow alleles passed on

1

[8]

3.

- (a) reference to interbreeding

1

successfully between Island types

allow ref. to production of fertile offspring

allow ref. to DNA analysis / comparison for 1 mark

ignore ref. to grey fox

1

- (b) (i) (two ancestral populations) separated / isolated (by geographical barrier / sea)

1

and genetic variation (in each population) **or** different / new alleles **or** mutations occur

1

under different environment / conditions

allow abiotic or biotic example

allow different selection pressures

1

natural selection occurs **or** better adapted survived to reproduce

1

so (favourable) alleles / genes / mutations passed on (in each population)

ignore they adapt to their environment

1

- (ii) any **one** from:
- continued to mate with one another
 - few beneficial mutations (between island varieties)
 - similar conditions on each island so similar adaptations/features fit

1

[8]

4.

- (a) (i) nucleus

correct spelling only

accept mitochondrion

ignore genes / genetic material / chromosomes

1

- (ii) base(s)

Accept all four correct names of bases

ignore nucleotides and refs to organic / N-containing

1

- (iii) 4

1

- (iv) codes for sequence / order of amino acids

ignore references to characteristics

1

codes for a (specific) protein / enzyme

or

the sequence / order of three bases / compounds / letters

codes for a specific amino acid

or

the sequence / order of 3 bases / compounds / letters

codes for the order / sequence of amino acids

1

- (b) (i) DNA

1

circular / a ring **or** a vector / described

1

- (ii) kills any cells not having **kan^r** gene / so only cells with **kan^r** gene survive

1

hence surviving cells will also contain **Bt** gene / plasmid

1

- (iii) cells divide by mitosis
ignore ref to asexual reproduction
correct spelling only

1

genetic information is copied / each cell receives a copy of (all) the gene(s) / all
 cells produced are genetically identical / form a clone

1

- (iv) any **two** from:

- gene may be passed to pathogenic bacteria
- cannot then kill these pathogens with kanamycin
- or**
- cannot treat disease with kanamycin
- may need to develop new antibiotics
- gene may get into other organisms
- outcome unpredictable

2

[13]

5.

- (a) sexual

1

characteristic

1

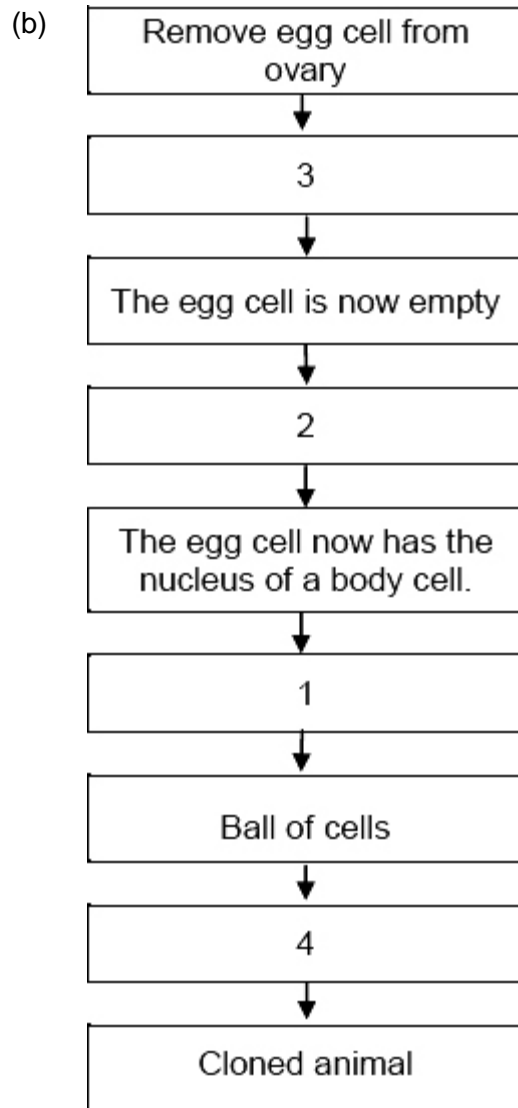
mutation

1

chromosome

this order only

1



four correct gains 3 marks

two or three correct gains 2 marks

one correct gains 1 mark

accept correct connection between statement and box

3

[7]

6.

(a) (i) 3.15 : 1

accept 3.147:1 or 3.1 : 1 or 3 : 1

do not accept 3.14 : 1

Ignore 705:224

1

(ii) any **two** from:

- fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes)
- more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number
allow ref. to more representative / reliable
*do **not** allow more accurate **or** precise*
ignore fair / repeatable
- anomalies have limited effect / anomalies can be identified
accept example of an anomaly

2

(b) (i) in sequence:

Homozygous

Homozygous

Heterozygous

All 3 correct = 2 marks

2 correct = 1 mark

1 or 0 correct = 0 marks

2

(ii) genetic diagram including:

Parental genotypes: **Nn** and **Nn**

allow other characters / symbols only if clearly defined

1

or

Gametes: **N** and **n** + **N** and **n** derivation of offspring genotypes: **NN** **Nn** **Nn**
nn

allow genotypes correctly derived from candidate's P gametes

1

identification: **NN** and **Nn** as purple **and** **nn** as white

allow correct identification of candidate's offspring genotypes but only if some F₂ are purple and some are white

1

(c) any **two** from:

- did not know about chromosomes / genes / DNA
or did not know chromosomes occurred in pairs
ignore genetics
- had pre-conceived theories
eg blending of inherited characters
ignore religious ideas unless qualified
- Mendel's (mathematical) approach was novel concept
allow his work was not understood or no other scientist had similar ideas
- Mendel was not part of academic establishment
allow he was not considered to be a scientist / not well known / he was only a monk
- work published in obscure journal / work lost for many years
- peas gave unusual results of other species
allow he only worked on pea plants
- Mendel's results were not corroborated until later / 1900

2

[10]