



Mark schemes

**1**

- (a) **A A a a**  
*Aa allele correctly separated* 1
- B b B b**  
*Bb allele arranged to form four different pairings  
 all four pairings must be correct for the second mark* 1
- (b) **A A**  
*the two cells the same as the parent cell*
- a a**
- B B**
- b b**  
*1 mark for each cell* 2
- (c) (i) 46  
*accept 23 pairs* 1
- (ii) 23  
*accept half if c(i)* 1
- (iii) 46  
*accept save as c(i)* 1

**[7]**

**2**

- (i)
- |   |    |    |
|---|----|----|
| R | r  |    |
|   |    |    |
| R | RR | Rr |
|   |    |    |
| r | rR | rr |
- a cross over diagram is also acceptable 1 mark for the separation of alleles to form the two axes (gametes)*
- 1 mark for the four combinations* 2

- (ii) 25 **or** 1 in 4 **or** 1:3  
*accept ¼ do not credit 1 to 4*

1

**[3]****3**

- (a) (i) to go under teeth **or** mower  
*accept not damaged by grazing animals*  
*accept do not get cut or bitten*  
*accept reduces competition by other plants*  
*do not credit maximum surface of leaves facing Sun*

1

- (ii) any **one** from  
 it can force its way through grass roots  
*accept in competition with grass roots*

it is a store of food (to help the plant recover)  
*do not credit a good store of water*

to reach down to water

to give good anchorage  
*accept it is hard to pull up*

1

- (iii) any **one** from  
 to reach more light  
*accept to get out of the shadow of the hedge **or** tall grass*

to let seeds be caught on animals' coats (more easily)  
*accept improves access **or** visibility **or** ease for pollination*  
*do not credit to help it grow up the hedge*

1

(iv) any one from

(they reach out from hedge) to find  
water

*accept increase surface area*  
*accept to find nutrients **or** minerals*  
*do not award mark if food mentioned*

to give good anchorage

1

(b) (i) gene **or** allele

*do not credit chromosome*

1

(ii) any **one** from

they do not crossbreed **or** interbreed

*accept different species do not breed together **or** do not fertilise*  
*each other*

do not produce fertile offspring

have different numbers or types of chromosomes

*accept genes are incompatible*  
*do not credit have different genes **or** are genetically different*  
*do not credit do not pollinate each other*

1

(c) one mark is for the adaptation and one  
is for an appropriate reason

have white fur

*for camouflage*

are huge

*for large volume to surface area*

thick layer of fat

*for insulation or to reduce heat loss **or** retain heat*  
*do not credit to stop it losing heat **or** withstand the cold **or** keep it*  
*warm*

have thick fur  
*for insulation or to reduce heat loss or retain heat*

hibernate  
*to avoid the coldest part of year*

is a carnivore  
*because animals provide high energy food*

has big paws or claws  
*to be able to walk on snow*

have small ears  
*to reduce heat loss*

have furry feet  
*for insulation from the snow*

2

[8]

4

(a) fertilisation  
*credit conception*

1

(b) (i) sperm  
*do not accept offensive answers or those in the vernacular*

1

testes or testicles

1

(ii) ovum or ova or eggs  
*do not accept ovules*

1

ovary

1

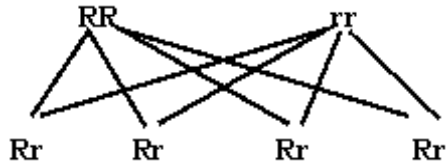
[5]

5

(a) white

1

(b)



or a Punnett square

1 mark for parents and separation of genes  
1 mark correct set of four pairs, **rR**

1

	R	R
r	rR	rR
r	rR	rR

1

all are red or R is red or Rr are red

1 mark for explanation of colour

1

(c) any **two** from

accept allele for gene

to stop cross pollination

credit so they could not breed with other flowers or colours

to control the gene pool or prevent other genes getting in

credit characteristics or factors

do not accept to use the same genes again

to see which genes were present

*credit factors*

to test if F<sub>1</sub> **or** they contained any genes for white **or** recessive genes

*credit a suitable Punnett square*

*referenced to white*

*credit to see if there was variation in the*

*genes **or** to see if he got any white flowers*

*do not accept for a fair test*

2

(d) white

1

(e)

*the term gene may be in place of allele*

*the situation mark*

red is dominant so masks any white

alleles **or** could be heterozygous

*credit some (may) have both alleles*

*credit you do not know if a white allele is there*

*the consequence marks*

1

### **EITHER**

if a recessive **or** white allele is present

there is a chance of a white flower

*credit if white alleles are there the recessive can show*

### **OR**

chance of white flower could be 1 in 4

if all red flowers contain a dominant and a recessive allele

1

[9]

6

(a) circles round right hand **X** and **Y** gametes

*put two ticks **or** crosses by the circles*

2

(b) 50:50 **or** 1:1 **or** 50% **or** 0.5 **or** ½ equal **or** evens

*credit even*

*do not accept 2:1 **or** 50 / 50*

1

- (c) (i) 23 1
- (ii) 23  
*credit the same as the one above to be marked consequential* 1
- (d) DNA  
*do not accept nucleic acid* 1
- (e) same 1
- [7]**

7

- (a) (i) any **one** from  
mutations  
discontinuous variation 1
- (ii) gene  
*accept any clear indication such as a tick* 1
- (b) any **one** from  
gamma radiation  
*accept radiation*  
X-rays  
ultra violet rays  
chemicals  
*accept mutagens*  
chance 1
- (c) zebras breed (to produce) 1
- fertile offspring  
*do not accept mating* 1
- [5]**



8

(a) 23

1

(b) chromosome    nucleus    gene    cell  
                   2                   3           1       4

1

(c) (i) any **one** from

(cells which are bigger) take up more space

(cells) have to get bigger **or** mature to divide

1

(ii) chromosomes duplicate **or**  
 make exact copies of self*accept forms pairs of chromatids*

1

nuclei divide

*accept chromatids **or**  
 chromosomes separate*

1

identical (daughter) cells formed

*accept for example, skin cells make  
 more skin cells **or** cells are clones*

1

(d) any **two** from*Differentiation mark*babies need **or** are made of different types of cells **or** cells that have  
 different functions*accept different cells are needed  
 for different organs**Division or specialisation mark*

as fertilised egg starts to divide each cell specialises to form a part of the body

*accept specialised cells make  
 different parts of the body**Growth mark*

specialised cells undergo mitosis to grow further cells

*accept cells divide **or** reproduce  
 to form identical cells*

2

**[8]**

9

- (i) vegetative/asexual/cloning  
*for 1 mark*
- (ii) clones/identical copies/all same  
*for 1 mark*

**not** clones if cloning in b(i)

[2]

10

- (a) *idea that*  
thicker/sticky/viscous mucus;  
difficult breathing/trachea blocked;  
digestion difficult/glands blocked

*each for 1 mark*

3

- (b) *idea*  
'normal' gene/allele dominant  
**or**  
cystic fibrosis gene/allele recessive;

*idea that*  
parents heterozygous/carrier;  
children heterozygous, homozygous dominant,  
homozygous recessive (clearly implied by diagram);  
idea one in four chance of cystic fibrosis

*each for 1 mark*

4

[7]

11

- (a) *ideas:*  
frog 2  
nucleus comes from this frog  
DNA/genes/information in nucleus  
this controls development

*for 1 mark each*

4

- (b) *advantages:*  
 large number of identical offspring  
 guaranteed desired features  
 quick  
 economic

*disadvantages:*  
 may all succumb to unexpected disease/change in conditions  
 cut adaptation/reduce gene pool/limits variation

*any 5 for 1 mark each*

5

[9]

12

- (a) idea

- unbanded dominant/plain **or** banded recessive
- because banded appears in young/
- parents heterozygous/Bb
- offspring
 

BB	}	
Bb	}	credit response consistent with parents even if not both heterozygous
Bb	}	
bb	}	

*Accept any clear and consistently used notation*

- identify BB, Bb as plain
- identify bb as banded
- ratio 3:1 unbanded/banded (stated or clearly implied)
- matches 35:12 results e.g. all the outcomes clearly identified as banded/unbanded)

*for 1 mark each*

7

(b) *idea*

- many genes control [accept “continuous variation”]
- many alleles for a gene/large genepool
- snails can inherit lots of different combinations
- mutation (gives rise to many alleles)  
*allow* selection allows alleles to be passed on unless [very]disadvantageous or if advantageous

*any 4 for 1 mark each*

[Also credit, for 1 mark each, up to 2 causes of mutation, e.g. mistakes in cell division, radiation]

4

**[11]****13**(a) *idea*  
advantages

- large scale
- cheaper
- easy to grow/produce or quick to produce
- non-seasonal

disadvantages

- loss of farmers' income
- loss of foreign exchange
- less work in Kenya/developing country
- mass use of a of particular pyrethrin
- can allow insect populations to become resistant

*any 6 for 1 mark each**maximum of 4 in**advantages/disadvantages*

6

- (b) *idea*  
 chromosomes /DNA carry genes  
 cut off gene/part of chromosome/DNA  
 insert into yeast chromosome/DNA/plasmid/nuclear  
 Accept DNA answers  
*for 1 mark each*

3

[9]

14

(a) alleles in parents	$Bb$		$Bb$	
alleles in sperms/eggs (*)	B	b	B	b
alleles in children (*)	$BB$	$Bb$	$bB$	$bb$
hair colour	black	black	black	red

(\*) NB ecf  
 Allow other letters if a clear key  
*each line correct for 1 mark each*

4

- (b) evens/50:50/equal/half (e.c.f. from cross below)  
*for 1 mark*

parents	J Smart	M Jones
	Bb	bb
children	Bb Bb	bb bb
	black	red

*each line correct for 1 mark each*

3

J Smart must be BB or Bb  
 M Jones must be bb or from (a)

*Credit cross shown in a matrix:*

	$B$	$b$
$b$	$Bb$	$bb$
$b$	$Bb$	$bb$

*for 2 marks*

*Bb identified as black hair*

*bb identified as red hair*

**or**

*2 red : 2 black*

*for 1 mark*

1

[8]

15

(a) *idea*

identical (do not allow simply "the same number")

*for 1 mark*

1

(b) *idea*

chromosomes double/duplicate/copies made

*for 1 mark*

separate into 2 sets/divide\*

*gains 1 mark*

**but**

separate into 4 sets/divide twice\*

*gains 2 marks*

number halved compared to bodycell

**or**

single set (only) 16

accept in terms of cells but only if chromosomes referred to in first and/or last items)

*for 1 mark*

4

[5]

**16***idea*

- (gene) in DNA (i.e. mention of DNA)
- (DNA) contains bases
- (bases) code for amino acids (in protein)
- (amino acids) in correct order
- to make the (spider) protein  
*any four for 1 mark each*

(No credit for double helix, **pairs** of bases - but no penalty)

**[4]****17**

- (a) (i) nucleus  
(ii) chromosome  
(iii) gene  
*each for 1 mark*

3

- (b) a body cell  
*for 1 mark*

1

**[4]****18**

- (a) (i) asexual / non-sexual / cloning *[not artificial]*  
*for 1 mark*

1

- (ii) gene / allele / chromosome / DNA  
*for 1 mark*

1

- (iii) A) same / look alike / similar  
*gains 1 mark*

**but** same sex / all female / all black / identical / clones  
*gains 2 marks*

- B) same as the black (female)  
*for 1 mark*

3

(b) (i) ovaries [not reproductive organs]  
for 1 mark

1

(ii) hormones / fertility drugs / FSH  
for 1 mark

Allow LH

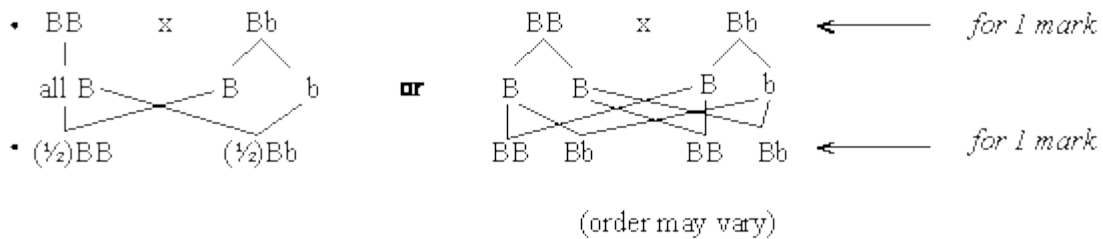
[Do not allow oestrogen / fertility treatment]

1

[7]

19

(a) First Generation

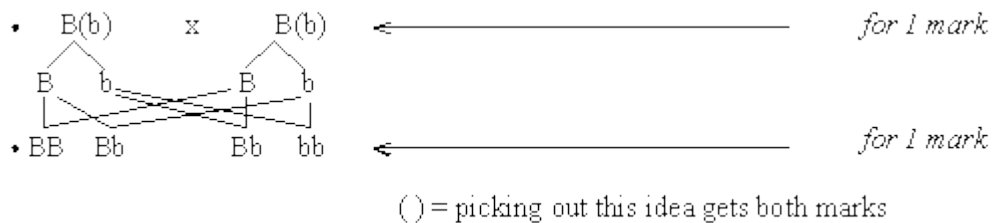


**or** as matrix

	B	B	
B	BB	BB	1 mark for correct column and row headings
b	Bb	Bb	1 mark for correct outcomes

**allow** one mark for being able to produce a correct genetic cross (even if from an incorrect starting point)

Second generation



or as a matrix

	B	b	
B	BB	Bb	1 mark for correct column and row headings
b	Bb	bb	1 mark for correct outcomes

4



(b)

- green colour gives an advantage/camouflage
- more green flies than black flies survive to breed\*
- pass on their genes to the next generation
- (\* but implied by 3<sup>rd</sup> bullet point)

*for 1 mark each*

3

**[7]****20**

sex  
genes  
chromosomes  
nucleus

*in order**for 1 mark each***[4]****21**

(a) sexual / sex

*for 1 mark*

1

(b) *idea that*

sexual reproduction brings about a mixture of genes  
or similar / different genes / parents / gametes / DNA /  
characteristics / chromosomes (*not* features)

*for 1 mark*

1

(c) (i) asexual / cloning (*allow* vegetative)*for 1 mark*

1

(ii) (A) *idea that* (they are exactly the same). *Do not allow*  
similar or just one named feature.*for 1 mark*

2

(b) different (*allow* similar but *do not allow* same).  
*Allow* any one named difference*for 1 mark*

- (d) (i) greater the X-ray dose, greater the % of mutations  
**or** % of mutations increases steadily / in proportion to X-ray dose  
*for 1 mark*

1

- (ii) ionising radiations / ultra-violet light / alpha particles / beta particles  
 / gamma rays / radio activity / chemicals / drugs / smoking / natural  
 in meiosis / spontaneous / cell replication / toxic waste / pollution

1

*Accept radioactivity but not radiations alone.*

*for 1 mark*

[7]

22

(a)

- caused by a recessive\* gene / allele  
*(allow non / not dominant)*
- both parents heterozygous / carry the gene / allele  
*for 1 mark each*

offspring needs two recessive genes to have / inherit disease

*for 2 marks*

**or**

- $Nn \times Nn$
- $NN \quad Nn \quad Nn \quad nn$   
*for 1 mark each*

$nn$  identified as having the disease\*

*for 2 marks*

4

(b) any reference to DNA  
*gains 1 mark*

**but**  
different genes means difference in DNA  
*gains 2 marks*

*idea of*  
different codes / instructions for making proteins  
**or**  
different (order of) amino acids (in proteins)  
*for 1 mark*

3

[7]