



## Mark schemes

<b>1</b>	(a) (i) characteristic	1	
	(ii) gene	1	
	(iii) gamete	1	
	(b) sexual	1	
	asexual	1	
	clones	1	
			<b>[6]</b>
<b>2</b>	(a) (i) circle		
	<i>mark independently</i>	1	
	unshaded		
	<i>could be in body of script</i>	1	
	(ii) (Harriet) dd		
	<i>in first box</i>	1	
	DD		
	<i>if another letter is chosen it must be used throughout and upper or lower case must be clear</i>	1	
	Dd	1	
	(b) (i) to check for the D allele.	1	

(ii) any **one** from:

- may harm / kill foetus / embryo / baby / mother  
*allow could affect the baby*
- immoral / unethical / religion  
*ignore playing God*  
*ignore references to unnatural*  
*ignore wrong unqualified*  
*ignore expense / prejudice unqualified*  
*ignore lack of permission*  
*ignore results are unreliable*

1

[7]

3

(a) any **one** from

- chromosomes in pairs
- inherited one of each pair from each parent
- one of each pair in egg **and** one of each pair in sperm
- so sex cells / gametes can have half the number  
*allow need to pair during cell division / meiosis*

1

(b) any **two** from:

- code
- combination / sequence of amino acids
- forming specific / particular proteins / examples  
*If **no other mark** gained allow reference to controlling characteristics / appearance for 1 mark*

2

(c) (i) C

1

(ii) 30

1

(d) (i) for growth / repair / replacement / asexual reproduction

*do **not** accept incorrect qualification, eg growth of cells **or** repair of cells*

*they equals cells therefore do not accept they grow etc*

1

(ii) 44 or 22 pairs

1

[7]

4

(a) sexual reproduction

1

(b) any **three** from:

- coat colour inherited / controlled by genes
- it has horse and zebra features
- gets gametes from both parents
- genes / DNA / chromosomes / genetic information in gametes
- zorse receives genes / DNA / chromosomes / genetic information from parents

3

[4]

5

(a) 2 and 3

1

(b) cell **P** has an X chromosome; cell **R** has a Y chromosome

1

(c) any **two** from:

- (formed from) different egg / 2 eggs
- (formed from) different sperm / 2 sperm
- have different genes / alleles / chromosomes / DNA  
*allow genetics*

2

(d) (i) stem cells

1

(ii) the cells divide

1

the cells differentiate

1

(iii) (medical) research / named eg growing organs  
**or**

medical / patient treatment

*allow (embryo) cloning*

*do **not** allow designer babies / more babies*

1

(iv) any **one** from:

- ethical / moral / religious objections

*ignore cruel / not natural / playing God*

- potential harm to embryo

*allow deformed*

*ignore harm to mother*

1

**[9]**

6

- (a) 1 in 4 / 1/4 / 1: 3 / 25% / 0.25  
do **not** accept 3:1 / 1:4 / 2:6

1

- (b) **either** from C **and** D  
*accept synonyms for dominant / recessive eg  
Normal / faulty  
accept genetic diagram if clearly referring to correct individuals or  
genotypes on family tree  
allow 'gene' for 'allele'*

any **three** from:

- C **and** D have disorder  
*ignore 'C & D are carriers'*
- I/J don't have disorder
- C **and** D have dominant **and**  
recessive alleles
- recessive alleles from C **and** D passed to I/J  
**or** I/J have two recessive alleles  
*NB if allele was recessive then all offspring of C **and** D would have  
the disorder = **3** marks*

**or** from A **and** B

*assume response refers to A + B unless contradicted*

- A is homozygous recessive / rr, **and** B is heterozygous / Rr can be shown  
in words or symbols  
*allow any symbol*
- offspring can be rr **or** Rr described  
*allow without key*

3

- (c) (i) (embryos) checked for inherited / genetic disorders / conditions  
*accept diseases for disorders*

1

- (ii) any **three** from:

- C/D have disorder / have dominant allele  
*accept disease / condition*  
*accept 'gene' for 'allele'*  
*ignore reference to 'carriers'*
- chance of embryo / foetus / child having disorder  
**or** may pass on alleles for disorder to their offspring
- C/D might want to decide on termination **or** prepare for child with disorder
- G **and** H don.t have disorder / both homozygous recessive / have no dominant alleles (for this disorder)
- so offspring (of G **and** H) cannot / don.t have disorder

3

**[8]****7**

- (a) characteristics
- (b) genes
- (c) chromosomes
- (d) mitosis
- (e) asexual

1

1

1

1

1

**[5]****8**

- (a) cell membranes

1

- (b) (i) two recessive / cystic fibrosis / faulty / diseased / the allele(s) / genes  
*two can be implied by second marking point*  
*ignore chromosomes* 1
- from Bob **and** Carol / both parents / the parents  
*if no other marks awarded 'Carol is a carrier' gains 1 mark* 1
- (ii) (inherited) dominant / normal allele / gene 1
- from Carol / mother  
*ignore references to recessive allele / gene from father / Bob*  
*if no other marks awarded he has just / only one recessive allele*  
*gains 1 mark* 1
- (c) (i) reduce number of people with cystic fibrosis (in population)  
**or**  
 reduce health-care costs  
**or**  
 expensive to have baby with cystic fibrosis  
*accept to allow decision / emotional argument qualified*  
*eg allows abortion*  
**or**  
*allows people to make choices about termination*  
**or**  
*help to prepare financially / emotionally etc* 1
- (ii) any **one** from:
- possible damage / risk to embryo / fetus / baby  
*allow possible harm / risk to mother*
  - screening / it is expensive
  - (may) have to make ethical / moral / religious decisions  
*ignore not natural / playing God / unethical / immoral / religious*  
*unqualified*
  - right to life
- 1

[7]



9

(a) any **two** from:

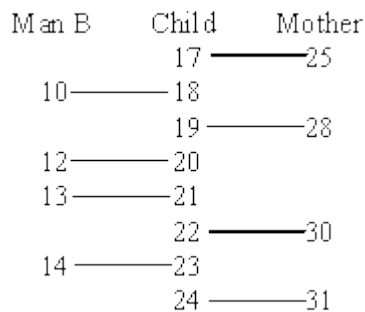
- to combine / use amino acids  
*do not allow to make amino acids*
- in specific / particular / correct / right order
- to manufacture protein / enzymes / hormones  
*allow examples of proteins / enzymes / hormones*

2

(b) (i) (man) B

*no mark for this but max 2 marks if A given*any **three** from:

- child gets DNA / bars / lines from mother and father / parents  
*ignore genes / chromosomes*
- (child has) mother's 25 / 28 / 30 / 31  
**or** child gets 17 / 19 / 22 / 24 from mother
- (child has) man B's 10 / 12 / 13 / 14  
**or** child gets 18 / 20 / 21 / 23 from B



*contradictions disqualify 2<sup>nd</sup> and / or 3<sup>rd</sup> marking points*  
*ignore genes / chromosomes*

- no bars / DNA / lines from man A correspond to child

3

(ii) any **two** from:

- gametes / eggs / sperm
- contain only half of (mother's / father's) DNA / chromosomes / genes / genetic information
- due to meiosis

2

[7]

**10**

(a) have identical genes / chromosomes / genetic material

1

since asexual reproduction

*accept mitosis*

1

(b) mixture of genes / chromosomes / genetic material from two parents

*accept meiosis*

1

sexual reproduction / fusion of gametes

1

(c) public misunderstand technique as cloning **or** worried about large numbers of clones **or** moral / ethical / religious issues **or** unnatural process **or** scientists must not play god **or** technique may lead to embryo death*do **not** allow mark for embryos lost*

1

**[5]****11**

joining

1

sexual

1

identical

1

asexual

1

clones

1

**[5]**

**12**

in the correct order

DNA

1

23

1

XX

1

XY

1

recessive

1

dominant

1

**[6]****13**

(a) A = meiosis

*accept 'mieosis'**do **not** accept 'miosis'*

1

B = mitosis

*do **not** accept 'meitosis' etc*

1

(b) fertilisation allow conception

1

(c) (i) 23

1

(ii) 46

1

**[5]**

**14**

- (a) chromosome  
*accept chromosomes*

1

- (b) drawing shows:

1

just 2 chromosomes

one long + one short

1

**[3]****15**

- (a)

<u>Ampicillin</u>	<u>Tetracycline</u>
✓	–
–	–
✓	✓

*accept blank **or** cross **or** –*

*1<sup>st</sup>: mark by rows to maximum **3** marks*

*2<sup>nd</sup>: if no marks by rows, mark by columns to maximum **1** mark  
table completely blank = **0** marks*

3

- (b) 1<sup>st</sup>: Yes (no mark)

*if 'no' - read on for logical argument e.g. loss of plasmid **or** gene mutation*

2<sup>nd</sup>: all formed from same original cell

*must be one cell i.e. bacterium*

1

by asexual reproduction / no fusion / not sexual

*allow reference to 'mitosis'*

1

offspring cells are genetically identical **or**

all have a copy of the insulin gene / of the plasmid

1

**[6]**

**16**

(i) clones

*accept other positive indications*

1

(ii) same genes / alleles / DNA

*accept same genetics / genetic information do **not** accept same chromosomes*

1

grown in same (environmental) conditions **or** correct eg – same amount of water / same temperature / same amount of light

1

**[3]****17**

(a) one from each parent / one from egg and one from sperm

*do **not** accept egg and sperm join / fertilisation unqualified*

1

(b) (i) nn

*accept a ring around printed nn*

1

(ii) Nn Nn

1

**[3]****18**(a) (i) **Aa** or **aA**

1

(ii) allele / gene for vestigial wings / **a** is recessive **or** vestigial is recessive **or A** is dominant **or A** would override the effect of **a or A** present gives long wings

1

(b) parental genotypes correct – both **Aa**

*NB can pick up chain of logic at any point correctly  
derived from candidate's previous point*

1

gametes correctly derived from **P** genotypes

1

offspring genotypes correctly derived from gametes

1

**3:1** ratio recognised

*wrong cross and not 3:1 ratio = max 2*

1

**[6]****19**

eggs

*accept gamete once*

1

ovaries

1

sperms

*accept gamete once*

1

testes

1

sexual

1

gametes

*allow egg **and** sperm once*

1

fertilisation

1

asexual

1

**[8]**

20

(a) genes/DNA

1

female/girl/woman/ *both required in the correct place for this last mark*male/boy/man/ *do not accept homo/heterogametic, homo/heterozygous*

1

(b) parents correct

*n.b if parents are wrong, candidates can score a maximum of 3 marks*

1

gametes correct

*allow just 1 mark for female*

1

combinations correct

1

correct analysis of the 50:50 ratio of what is written

1

**[6]**

21

(a) (i) gametes i.e. B b and B b

1

correct combination of genotypes i.e. BB, Bb, Bb, bb

1

correct analysis of phenotypes i.e. 3 black fur 1 with brown fur

1

(ii) award one mark for the recognition that it is down to chance (which two gametes fuse) and not simply 'because it's a prediction'

*do not accept mutation*

1

(b) (i) **B** is dominant/ an allele is dominant if it is expressed in the heterozygous phenotype  
*candidates are likely to use a variety of ways of expressing their ideas*

1

b is recessive/ a recessive allele is not expressed in the presence of its contrasting allele

*do not accept powerful*

*do not accept stronger*

1

- (ii) alleles are different forms of a gene controlling a characteristic and occupying the same site on homologous chromosomes (e.g. B or b)

1

genes are the units of DNA/sites on chromosomes carrying the information that determines characteristics (e.g. bB)

1

- (c) homozygous: BB / bb / possessing a pair of identical alleles for a character/true breeding

*give credit to an explanation using a diagram*

1

heterozygous: Bb / carrying a pair of contrasting/different alleles for a characteristic

*do not accept references to xx, xy*

*do not accept gene by itself*

1

[10]

22

- (i) (sweet) peas

1

- (ii) homozygous parents crossed [1]

heterozygous (F1) offspring crossed [1]

recognition of yellow dominant over green [1]

recognition that results support 3:1 **or**

0.75 to 0.25 ratio

*up to 4 marks awarded for an understanding of the monohybrid cross and the expected outcome*

4

[5]



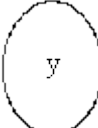
**23**

**one** mark for each of the following comparisons to a maximum of **6**

candidates **must** make a clear comparison

<b>meiosis</b>	<b>mitosis</b>
sexual	asexual
gametes	growth
ovary <b>or</b> testes <b>or</b> gonads	all other cells
half number of chromosomes	same number of chromosomes
haploid <b>or</b> 23 chromosomes	diploid <b>or</b> 46 chromosomes
reassortment <b>or</b> variation possible <b>or</b> not identical	no reassortment <b>or</b> no variation <b>or</b> identical
4 cells produced	2 cells produced
2 divisions	1 division

**[6]****24**

(a)  clearly labelled 'y'

1

mark the offspring in two horizontal rows

**1** mark for each fully correct row

**allow** transferred error if parent 2 is incorrect

XX Xx

1

XY XY

*accept YX*

1

(b) parent 1

*accept XX*

1

- (c) 50:50  
**or**  
 equal **or** even  
**or**  
 1:1 **or** 50%

*accept 1/2 **or** 2/4*

1

[5]

25

- (a) **award one mark for each key idea**

energy released **or** energy transferred **or** respiration

*allow provides **or** gives*

*do **not** allow produces **or** makes*

3

near to the site of movement **or**  
 energy available quickly **or** more  
 energy

*accept allows more mitochondria to fit in*

(mitochondria) packed (around  
 filament) **or** efficient arrangement **or**  
 spiral arrangement

- (b) contains chromosomes **or** genes **or**  
 DNA

***not** genetic material*

1

(which) contribute half (the genes) to  
 the fetus **or** offspring

*23 chromosomes **or** half the genes*

***or** reference to X,Y chromosome determining sex (if the notion of  
 halfness is there)*

*nucleus contains half genes for the offspring = 2 marks*

1

[5]

26

- (a) breed (together)  
*accept have same number of chromosomes*  
*do **not** accept have the same number of genes*  
 1
- to produce fertile offspring  
 1
- (b) male **or** testes  
*accept dog*  
 1
- testes **or** male  
*accept testis*  
*do **not** accept testicles*  
 1
- ovary **or** ovaries  
 1
- gametes  
 1
- fertilisation  
*do **not** accept conception*  
 1
- fetus **or** zygote **or** embryo  
*do **not** accept baby **or** puppy*  
 1
- (c) genetic information **or** genes **or**  
 chromosomes **or** DNA  
*do **not** accept characteristics by itself*  
 1
- (comes) **from** two parents  
*accept **from** both parents*  
 1

[10]

27

(a) (i)

*if two nuclei drawn then maximum two marks*

1

6 chromosomes

1

same 3 homologous pairs

1

nuclear membrane drawn

1

(ii) 3 chromosomes

1

1 from each homologous pair

1

(b) (i)

*parent line must be separate*

heterozygous parents Tt × Tt

*maximum of 2 marks if parental genotype is wrong*

gametes correct T t T t

1

genotypes TT Tt Tt tt

1

(ii) correct analysis of chance i.e. 1 in 4  
**or** 25%

1

(iii) 50% **or** 1 in 2

1

**[10]**

28

- (a) (i) gametes correct  
allow by implication from line diagram  
only need on X from female

1

offspring genotype correctly derived  
on suitable diagram

	<b>X</b>	<b>X</b>
X	XX	XX
Y	XY	XY

or

	<b>X</b>
X	XX
Y	XY

1

- (ii) 1:1 **or** 50% **or** ½ **or** 0.5 **or** 1 in 2  
**or** 1 out of 2 **or** 50 : 50  
do **not** accept 50/50  
accept 'equal' (probability)

1

- (b) Y chromosome needed for male child

1

only male has the Y **or** wives had only X (chromosomes)  
or sex determined by the sperm

1

[5]

29

- (a) on chromosomes/DNA within the nucleus  
each for 1 mark

2

- (b) parental genotypes correct i.e. Aa Aa;  
gamete genotypes correct i.e. A or a A or a/correct lines;  
F1 genotypes correct i.e. AA Aa Aa aa;  
aa recognised as child with cystic fibrosis  
each for 1 mark

4

- (d) (i) molecule has two long strands/double helix;  
 idea of held together by (weak) bonds;  
 each strand has 4 different types of base; )  
 which pair with specific bases in opposite strand; )  
 when strands separate; ) OWTTE  
 each strand acts as a 'complementary' template; )  
 makes 2 identical strands )  
*each for 1 mark*

6

- (ii) order of bases acts as a code;  
 which controls the order;  
 in which amino acids are assembled into protein;  
 read in triplet

*each for 1 mark*

3

**[15]****30**

- (a) select for breeding;  
 the plants with the sweetest taste

*each for 1 mark*

2

- (b) natural population has a wide range of variations;  
 because it has a large number of alleles;  
 selective breeding reduces the number of alleles;  
 cloning perpetuates this reduced number of alleles

*each for 1 mark*

4

- (c) 3 of:  
reference to cuttings;  
reference to tissue culture;  
reference to hormones;  
cloning

*each for 1 mark*

3

- (d) 4 of:  
cut genes for disease resistance;  
from chromosomes of 'cooking banana';  
introduce into chromosomes of 'ordinary banana';  
tissue culture to produce disease resistant plants/clone;  
enzymes cut chromosomes

*each for 1 mark*

4

**[13]**

**31**

- (a) Stan BB  
Sharon bb  
all offspring Bb

3

- (b) Tom Bb  
black offspring Bb  
white offspring bb

3

**[6]**

**32**

- (a) (i) e.g. B and b  
*for 1 mark*

1

- (ii) e.g. bb  
*for 1 mark*

1

- (b) no black genes in flock  
all double recessive  
*for 1 mark each*

2

**[4]****33**

- (a) grow from parents,  
by vegetative reproduction/asexual reproduction/  
no sexual reproduction  
*for 1 mark each*

2

- (b) e.g. different environmental conditions/named condition  
*for 1 mark*

1

**[3]****34**

- (a) mutation  
*for 1 mark*

1

- (b) fall,  
idea that resistant beetles more likely to survive to breed,  
∴ their offspring more likely to appear in the next generation  
*for 1 mark each*

3

- (c) inbreeding between resistant brothers and sister,  
will produce some individuals with 2 copies of the resistance allele,  
if 2 of these individuals breed all their offspring will be resistant  
*for 1 mark each*

3

**[7]****35**

- (i) DNA  
*for 1 mark*

1



- (ii) contains the code for manufacturing the protein,  
as order of bases,  
which determine the order in which amino acids are  
assembled into protein

*for 1 mark each*

3

[4]

36

D

*idea that twins have come from one (fertilised) egg*

*idea that Y sperm / Y chromosome produces boys*

*each for 1 mark*

*allow 1 mark if candidate selects **A and** states that Y sperm / Y chromosome produce boys (reject Y gene unqualified) OR allow 1 mark if candidate selects **C and** states that twins must have come from one (fertilised) egg*

[3]

37

- (a) (i) mitosis

*for 1 mark*

1

- (ii) 1

fertilised egg cell has 1 albino gene from father splits to produce identical cells / produced by mitosis

*each for 1 mark*

3

- (b) (i) less protection from UV light / UV radiation

*for 1 mark*

1

- (ii) ideas of uncontrolled multiplication of mutated cells reject fast / rapid cell division cells invade of other parts / cells transported in blood

*each for 1 mark*

2

[7]

38

- (a) *ideas that*  
 embryos develop from cells with sheep nuclei / chromosomes / DNA  
 which contains genetic information / information for development  
 OR placental cells (from goat) provide only e.g. nutrition  
*any two for mark each*

2

- (b) *Max. 3 pros e.g. ideas that* avoids extinction of rare breeds  
 rapid method for plants large numbers with same features can be produced  
 preserves features produced by genetic engineering *e.g. Tracey*  
 maintains particular genetic strains *e.g. produced by*  
*extensive selective breeding*  
***reject simple idea of identical offspring unless qualified as above***  
*any three each for one mark*

3

*Max. 3 cons e.g. ideas that* moral / ethical objections animal 'rights'  
 identical individuals less adaptable to change or changing needs  
 reduced gene pool

*any three each for one mark*

3

[8]

39

- (a) chromosomes  
 genes (reject alleles)  
 alleles  
*for 1 mark each*

3

- (b) (i) sexual / sex  
*for one mark*

1

- (ii) egg / gamete / sex cell / ovum (reject ovule)  
*for one mark*

1

- (c) (i) information / genes / DNA passed from parents (reject chromosomes)  
*for one mark*

1

- (ii) genes / genetic information / chromosomes from two parents  
 alleles may be different  
 environmental effect / named may have been mutation  
*any two for 1 mark each*

2

**[8]****40**

- (a) woman XX  
 man XY

*for 1 mark each*

2

- (b) 50% / 1 in 2 / evens / 0.5 / 50:50  
*for 1 mark*

mark scheme for genetic diagram

gametes all correct  
 genotypes of offspring all correct in relation to gametes  
*for 1 mark each*

1

mark scheme for written explanation

half sperm have X chromosome, half have Y  
 and  
 all eggs have X chromosome

50% / 1 in 2 / evens / 0.5 chance of egg being fertilised  
 by X or Y sperm  
*for 1 mark each*

2

**[5]****41**

- (a) (i) sexual / sex  
 (ii) egg / gamete / sex cell / ovum (*reject ovule*)  
*for 1 mark each*

2

- (b) (i) meiosis / reduction  
 (ii) mitosis / somatic  
*for 1 mark each*

2

(c) twice as many (*reject* answers based on 23 / 46 chromosomes)

*for one mark*

1

(d) (i) information / genes / DNA passed from parents  
(chromosomes neutral)

*for one mark*

1

(ii) genes / genetic information / chromosomes from two parents  
alleles may be different  
environmental effect / named may have been mutation

*any two for 1 mark each*

2

**[8]**

**42**

parental genotypes both correct – both Bb  
gamete genotypes all correct B and b B and b  
genotype of bb offspring correctly related to gametes  
bb offspring identified as small bolls

*for 1 mark each*

**[4]**

**43**

(i) DNA (*accept* RNA)

*for one mark*

1

(ii) DNA carries coded information  
which controls the order of amino acids  
in proteins

*for 1 mark each*

3

**[4]**

<b>44</b>	dominant	1	
	recessive	1	
	genes	1	
	gametes	1	
	environmental	1	<b>[5]</b>

<b>45</b>	(a) asexual		
	<i>mitosis is neutral</i>	1	
	(b) (body cell)		
	nucleus <i>is</i> from body cell		
	<i>no mark for just body cell – mark the explanation</i>		
	<i>allow converse nucleus from egg cell is removed</i>	1	
	nucleus contains (genetic) information / instructions / chromosomes / genes / DNA / allele		
	<i>do <b>not</b> credit 'contains characteristics'</i>	1	
	(c) splitting apart (cells from clonal) embryo		
	<i>do <b>not</b> credit 'repeat process'</i>	1	<b>[4]</b>

46

(a) gametes A **or** a A **or** a

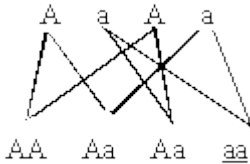
1

F<sub>1</sub> genotypes correctly derived

1

albino identified

**OR**



*gametes – 1*

*F<sub>1</sub> genotypes corresponding to 'lines' – 1*

*lines must be correct*

*Albino (aa) identified – 1 (lower case)*

1

**OR**

	A	a
A	AA	Aa
a	Aa	aa

*gametes –1*

*boxes all correct –1*

*albino (aa) identified –1*

(b)  $\frac{1}{2}$  / half / 50% evens/ 1 in 2

*do **not** credit 1 to 2 or 50/50*

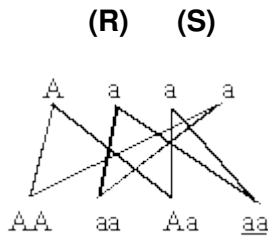
1

gametes A **or** a a **or** a or one  
parent heterozygous, one parent  
homozygous recessive

1

F<sub>1</sub> genotypes correctly derived

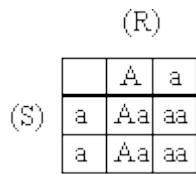
OR



*gametes correctly identified – 1*

*F<sub>1</sub> genotypes correctly derived – 1*

OR



*gametes correctly derived – 1*

*F<sub>1</sub> genotypes correctly derived – 1*

1

[6]

47

man XY

*allow (chromosomes) different*

1

woman XX

*allow (chromosomes) same  
genes and alleles are neutral  
allow 1 mark for one is XX and one is XY*

1

[2]

48

(a) any **two** from

- copies of chromosomes made
- cell divides twice **or** 4 cells formed
- each gamete / cell now has single set of chromosomes  
*allow chromosome number halved /  
cells haploid / cells n*

2

(b) any **two** from

- sex cells / gametes fuse / fertilisation
- offspring receive genes or chromosomes or alleles from both parents / DNA
- alleles in a pair may vary

2

(c) (i) new form of gene

*allow change in genetic material / DNA / chromosomes / gene*

1

(ii) (no)

any **two** from

- some neutral
- exemplified  
*e.g. extra digit*
- some increase chances of survival / reference to natural selection or evolution
- exemplified  
*e.g. example of disease resistance*

2

[7]



- 49** (a) any **three** from:
- factor for colour has two forms  
*accept gene for factor and allele for form*
- yellow dominant since all first generation yellow  
*accept F1 for first generation*
- green recessive since reappears in second generation  
*accept F2 for second generation*
- 3
- (b) (i) genes  
*accept alleles / genetic*
- 1
- (ii) nucleus  
*accept chromosomes / DNA*
- 1
- [5]**
- 
- 50** (a) (i) meiosis
- 1
- (ii) mitosis
- 1
- (c) (i) **X** pituitary
- 1
- Y** FSH
- 1
- (ii) stimulates LH production
- 1
- inhibits FSH production / production of **Y**
- 1
- [6]**

- 51** (a) (i) testis 1  
ovary 1
- (b) fertilisation **or** fertilise(d) / (ing)  
*accept fusion*  
*do not credit conception **or** intercourse* 1
- (c) (i) the same, identical  
*do not credit very similar make clear*  
*their genetic material is the same*  
*do not credit the same number of chromosomes or genes* 1
- (ii) the same, identical  
*make clear their genetic material is the same*  
*do not credit the same number of chromosomes or genes* 1
- [5]**

- 52** (a) (i) XX XY XY XX  
female male male female  
*the four correct genotypes and sex are required they may be in any order* 1
- (ii) meiosis  
*correct spelling required but*  
*accept meisosis not miosis or meosis* 1
- (iii) 23 1
- (iv) 23 1

(b) (i) any **two** from

(introduces) variation

*accept can crossbreed **or** offspring may gain beneficial characteristics*

prevents the risk of all being the same  
and a disease wiping out population  
**or** prevent monoculture

two parents to raise offspring

2

(ii) both parents carry a recessive allele  
**or** gene **or** are heterozygous

*accept both parents are carriers*

1

**[7]**