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MARK SCHEME

GCSE

BIOLOGY

AQA - TRIPLE SCIENCE

B 6 - TEST 6

GENETICS

Advanced

1. (a)

	statement is true for		
	mitosis only	**meiosis only**	**both mitosis and meiosis**
all cells produced are genetically identical	✓		
in humans, at the end of cell division each cell contains 23 chromosomes		✓	
involves DNA replication			✓

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

2

(b) any **two** from:

ignore references to one parent only

- many offspring produced
- takes less time

allow asexual is faster

- (more) energy efficient
- genetically identical offspring

allow offspring are clones

- successful traits propagated / maintained / passed on (due to offspring being genetically identical)
- no transfer of gametes or seed dispersal

allow no vulnerable embryo stage
allow no need for animals

- not wasteful of flowers / pollen / seeds
- colonisation of local area

must imply local area

2

(c) genetic variation (in offspring)

1

(so) better adapted survive

allow reference to natural selection or survival of the fittest

1

(and) colonise new areas by seed dispersal
or
can escape adverse event in original area (by living in new area)

must imply new area

1

many offspring **so** higher probability some will survive

1

*allow bluebell example described (**max 3** if not bluebell)*

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2. (a) gene / allele

1

(b) (in / on) ribosome(s)

1

(c) any **three** from:

- amino acids make up a protein
- (protein is) particular combination / sequence (of amino acids)
- bases form a <u>code</u>
- the bases work in threes or description

  accept bases work in triplet
- (code / three bases) for one amino acid

  *accept eg (bases) WXZ for amino acid J for **2** marks*

3

(d) (i) different / wrong amino acid (coded for) **or** different / wrong shape

ignore reference to amino acid 'made'
ignore change unqualified
ignore different protein

1

(ii) different / example of different eye colour

allow protein may / would not be made / function (normally)

1

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3. (a) 3.7

1

(b) 2

1

(c) (different combinations of alleles cause) many / 22 values

allow continuous variation

or
in-between values
or
large range of values
or
there are not only two values

*allow there are not only 3 values if 3 is given in part **(b)***

1

(d) different protein made

allow change in shape (of enzyme) or change in 3-D structure
ignore denature

1

active site changed

1

so substrate does not fit / bind

allow description of substrate
allow cannot form E-S complex
ignore lock and key description

1

(e) produces (some) offspring with high-fat milk
or
not all offspring have low-fat milk

ignore reference to alleles

1

(f) takes less time (to obtain results)
or
more offspring at the same time

allow other sensible suggestion − e.g. allows screening
***or** allow cow 7 to continue to produce eggs **o**r avoid injury to cow 7 during mating or giving birth*

1

(g) male gametes correct: d (and d)

1

female gametes correct: D and d

1

*allow **1** mark if gametes are correct but gender not identified*

correct derivation of offspring genotypes from given gametes

*allow 2 × 2 **or** 2 × 1 derivation*

1

Dd identified as low-fat **and** dd identified as high-fat in offspring

if DD offspring are produced, must also identify as low-fat

1

(h) find female with low(est) fat in milk **and** high(est) milk yield

allow choose from 7, 9, 12, 13 which has the highest yield

1

find male whose female offspring have high(est) milk yield **and** low(est) fat in milk

allow choose from 16 or 18 whose female offspring has the highest yield

1

or

find female with lowest fat in milk
or cow 13 (1)*

or
allow female with high(est) milk yield

find male whose female offspring have high(est) milk yield (1)*

or
allow male whose female offspring have lowest fat in milk / male 16

cross the best (for both features) female with the best male

1

select best offspring (for both features) from each generation and repeat for several generations

1

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4. (a)

Ampicillin	Tetracycline
✓	–
–	–
✓	✓

*accept blank **or** cross **or** –*

*1 st: mark by rows to maximum **3** marks*

*2 nd: if no marks by rows, mark by columns to maximum **1** mark*

*table completely blank = **0** marks*

3

(b) 1st: Yes (no mark)

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

2nd: all formed from same original cell

must be <u>one</u> 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

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5. (a) (use of) enzymes

1

(b) asexual reproduction / no gametes / no fusion / only one parent

ignore clones

1

cells all contain same genetic information / same genes (as parent) / same DNA

1

(c) can spray crop with herbicide – <u>only weeds</u> killed

crop survives herbicide insufficient

1

(d) any **one** from:

allow 'think that GM food is bad for health'

- fears / lack of knowledge about effects of GM food on health

  ignore not natural or against religion

- crop plants may pass on gene to wild plants

- encourages use of herbicides

1

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6. (a) changes code /sequences of bases
or
sequence of amino acids is different

1

the enzyme has different / wrong shape / structure

allow the active site is changed

1

so substrate will not fit into enzyme / will not join to enzyme

1

(b) (i) 46

allow 23 pairs

1

(ii) also inherited (from mother) normal chromosome 15 / normal allele / normal gene / boy is heterozygous / **Hh**

allow the boy is a carrier

1

(allele for) this disorder is recessive
or
the normal allele would give a working enzyme

ignore converse

1

(iii) genetic diagram including:

Parental gametes:

H and **h** from both parents

accept alternative symbols, if defined

1

derivation of offspring genotypes:

HH Hh Hh hh

allow alternative if correct for student's parental genotypes / gametes

1

identification of **hh** (having the disorder) if 1 in 4

1

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7. (a) both parents **Aa**

*accept other upper and lower case letter without key **or** symbols with a key*

allow as gametes shown in Punnett square

1

aa in offspring correctly derived from parents
or
aa correctly derived from the parents given

ignore other offspring / gametes

for this mark parents do not have to be correct

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted / described*

1

(b) (i) any **one** from:

accept converse if clear, eg if you (only) took one it might have cystic fibrosis / might not be fertilised

- (more) sure / greater chance of healthy / non-cystic fibrosis egg / embryo / child

  accept some may have the allele

  reference to 'suitable / good embryo' is insufficient

- greater chance of fertilisation

1

(ii) **advantages**

to gain 3 marks both advantage(s) <u>and</u> disadvantage(s) must be given

max 3

any **two** from:

ignore references to abortion unless qualified by later screening

- greater / certain chance of having child / embryo without cystic fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection
  ignore risk unqualified
- ethical or religious issues linked with killing embryos
  accept wrong / cruel to embryos accept right to life argument
  ignore embryos are destroyed
- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive
or
eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note**: the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

(c) any **three** from:

- osmosis / diffusion

  *do **not** accept movement of ions / solution by osmosis / diffusion*

- more concentrated solution outside cell / in mucus

  assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'

- water moves from dilute to more concentrated solution

  allow correct references to movement of water in relation to concentration gradient

- partially permeable membrane (of cell)

  allow semi / selectively permeable

3

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8. (a) seeds produced by sexual reproduction / fusion of gametes / fertilisation

allow produced by pollination / crossing

1

mixture of genes / genetic information / chromosomes / DNA
or from two parents / apple trees

*if no other mark obtained allow **1** mark for apples had different genes / genetic information / chromosomes / DNA*

or

mutation occurred

ignore environmental effects / cloned

1

(b) (i) cuttings / tissue culture

accept grafting

allow adult cell cloning

ignore cloning unqualified

ignore genetic engineering

ignore asexual reproduction

1

(ii) asexual reproduction

allow produced by cloning / mitosis

1

have identical genes / genetic information / chromosomes / DNA

or no mixing of genes / genetic information /chromosomes /DNA

1

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9. (a) Aa

*allow dominant **and** recessive*

allow heterozygous

1

(b) (i) gametes A, a **and** A, a

*max **1** if gametes are incorrect (eg in punnet square)*

1

correctly derived offspring from cross

allow ecf from their gametes

1

identification of round **and** wrinkled offspring

for this mark the phenotype of each different offspring genotype must be indicated

1

(ii) (due to) chance **or** expected ratio is only a probability

accept the idea of small numbers not representative

ignore anomaly / random / coincidence

*do **not** accept error*

1

(c) any **one** idea from:

- genes / chromosomes / alleles / DNA not discovered / known about

  *do **not** accept religious theme (ie confusion with Darwin's difficulties with the church)*

- published in obscure journal / few scientists read his work

1

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