

# GCSE BIOLOGY

Topic Paper: 6.2 Variation and evolution: Section 1  
Part 1 & 2 Mark Scheme

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## MARK SCHEME



**63 Marks**



**M1.** (a) any **three** from:

- (gene) cut out
- (gene / cut out) from (bacterial) chromosome / DNA
  - accept (gene / cut out) from (bacterial) plasmid*
- ref to enzymes (at any point)
- (gene spliced) into maize chromosome / DNA
- (gene added) at an early stage of development

3

(b) any **four** from:

- justification based on comparison of the relative merits of at least one advantage and one disadvantage
  - max 3 marks if only advantages or disadvantages given*

**Advantages:**

- less effort for farmer **or** less likely to harm farmer
  - ignore ref to cost*
- (pesticide) always there **or** doesn't wash away
  - allow examples eg no need to spray*
- less insects to eat crop / maize **or** carry disease
  - allow pesticide doesn't contaminate water courses*
- so greater crop production / yield

**Disadvantages:**

- (toxin) kills other insects
  - ignore ref to cost*
- so (some) crops don't get pollinated / (sexually) reproduce
  - allow maize not pollinated*
- possible harm when eaten by humans / animals
  - allow may have unpleasant taste*
- damage to food chains
  - allow reduced biodiversity*
- gene may spread to other species

4

[7]

**M2.** (a) two species / types involved

1



(b) *full marks only if at least **one** pro, **one** con and an attempt at a conclusion*

any **three** from:

pros (max **two** pros)

useful if species difficult to breed

prevents extinction / continues genetic line

cons (max **two** cons)

*ignore reference to ethical issues / cruelty*

low success rate **or** figures given

development problems

diverts attention from habitat conservation / poaching / pollution / climate change

cloning reduces gene pool

3

conclusion

argued conclusion

*must include references to **both** pros and cons and must be at end of answer*

1

[5]

**M3.** (a) there was no mixing of genes / genetic material

1

because the nucleus was removed from the egg cell before fusion

1

(b) (i) male **and**

white-faced

***both** required*

1

(ii) because the genetic material / genes

1

comes from the white-faced male only

1

[5]

**M4.** (a) chromosomes

*ignore gene / DNA*

1



- (b) *to obtain 3 marks candidates must give **one** reasonable pro **and one** reasonable con*

**pros eg**

any **two** from:

overcomes shortage of human eggs / rabbits produce lots of eggs

*ignore all embryos identical*

ethical / religious issues with using human embryos

reduces tests on (adult) humans

may provide cure for / cause of disease

embryo not allowed to develop beyond 14 days

no harm to rabbit

99.5 % human genetic information so very similar to human or will react in the same way

max 2

**cons eg**

any **two** from:

ethical / religious objections to mixture of human and rabbit genes

ethical issues with experimenting with rabbits

*allow some people object to using rabbits / cruel to rabbits*

ethical / religious objections to killing embryos

0.5% of rabbit genetic information might affect results

14 days too short a time to get results

max 2

**plus**

**conclusion eg**

possibility of cure does / does not outweigh ethical / religious objections

**Note:** *the conclusion mark cannot be given unless both an advantage and a disadvantage have (already) been given*

cure does not justify mixing human and animal genes / killing embryos

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

1

[5]



- M5.** (a) genetically identical / same DNA / same chromosomes  
**gains 2 marks**  
*accept identical without reference to genetic material for 1 mark* 2
- (b) remove nucleus from egg  
*allow use empty egg cell* 1
- insert genetic material / nucleus /DNA / chromosomes from frozen mouse  
*do not allow if reference to sperm* 1
- electric shock **or** allow to divide **or** insert into womb / uterus 1
- (c) ethical / religious / emotional reasons  
**or**  
not known if it is safe / long term effects not known  
*ignore playing God / unnatural / immoral* 1

[6]



**M6.** (a) any **two** from:

*assume it refers to asexual*

no fusion in asexual **or** sexual involves fusion

*accept no fertilisation in asexual **or** fertilisation in sexual*

**or** no mixing of genetic information in asexual **or** mixing of genetic information in sexual

*accept genes / alleles / chromosomes / genetics for genetic information*

**or** asexual involves splitting (of one individual)

no gametes in asexual **or**

sexual involves gametes

*accept named gametes*

only one parent in asexual **or**

sexual involves two parents

no variation in asexual

**or** asexual produces clones

**or** sexual leads to variations

*allow offspring of sexual have characteristics of both parents for this point*

*ignore sexual intercourse*

*ignore external / internal*

*ignore plants / animals*

*ignore mitosis / meiosis*

2

(b) nucleus of egg removed **or**  
involves empty egg cell

1

so only one nucleus **or** one set of genetic information / genes / chromosomes

**or**

so genetic information / genes / chromosomes from one parent only

1

[4]

**M7.** (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

[5]

- M8.**
- (a) (jellyfish) gene(s) cut out
 

1
  
  - ref to enzymes (at any stage)
 

1
  
  - (gene) transferred to zebra fish at early stage of development / embryo / egg
    - ignore removal of zebra fish genes*

1
  
  - (b) any **two** from:
    - ignore unethical / religious / unnatural*
    - could transfer gene to other (fish) species
    - effects on food chains
      - accept effects on other species / humans who eat them*
    - effects on zebra fish themselves, eg may out compete non GM zebra fish

2

[5]

- M9.**
- (a) fusion of gametes / named gametes
    - allow meet / join / fertilise*

1
  
  - results in mixing of genetic information / DNA / chromosomes
    - accept genetic information / DNA / chromosomes from two parents*

1
  
  - (b) (i) use enzyme
 

1



to cut gene from pout chromosome / DNA 1

insert gene into salmon chromosome / DNA / egg / embryo / nucleus  
*accept use of plasmid as carrier*  
*ignore salmon / cell* 1

(ii) eg fear of gene transfer to wild salmon / extinction of wild salmon /  
fear of harmful effect on consumers / unsure of long term effects  
*ignore cruel / ethics / morals / religion / unnatural / economics* 1

[6]

**M10.** (a) auxin  
*accept other named plant hormones* 1

(b) (i) any **three** from:  
no (fusion of) gametes / fertilisation  
*allow no meiosis or new cells only produced by mitosis*  
only one parent  
*allow not two parents*  
no mixing of genetic material  
no genetic variation or genetically identical offspring  
*allow clones* 3

(ii) more / many offspring / plants (produced from one parent plant)  
*allow less damage to parent plant*  
*ignore speed / cost* 1

[5]

**M11.** (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 – only weeds 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

[5]

**M12.** (a) wing pattern similar to *Amauris*

*allow looks similar to Amauris*

1

birds assume it will have an unpleasant taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*

*do not accept breeds with Amauris*

*do not accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]