AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.6.1 REPRODUCTION (PACK 1)

SCORE	PERCENTAGE
/309	%

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Q1.

(a) nucleus

1

(b) gene(s)

allow allele(s)

1

(c) copying of chromosomes

1

(d) mitochondria

1

(e) 60 − 45
or
120 − 105

1

15 (minutes)

1

*an answer of 15 (minutes) scores **2** marks*

(f) C

1

(g) 8

1

(h) to repair tissues

1

[9]

Q2.

(a) diffusion

1

(b) A

1

(c) B

1

(d) (earthworm) can absorb more oxygen (in a given time)
or
increases / more gas exchange

allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food

1

(e) lipase

1

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(f) more oxygen (in soil with earthworms)

allow earthworms bring oxygen to soil

1

(for) more (aerobic) respiration

*do **not** accept anaerobic respiration*

1

(of) bacteria / fungi / microorganisms / microbes / decomposers

1

reference to more is only needed once for the first two marking points

(g) fertilisation

ignore sexual reproduction

1

(h) asexual (reproduction)

allow cloning

1

[10]

Q3.

(a) Gregor Mendel

1

(b) DNA

1

(c) when the dominant allele is not present

1

(d) tt

allow homozygous recessive

1

(e)

	T	t
T	TT	Tt
t	Tt	tt

*all 3 correct = **2** marks*
*2 correct = **1** mark*
*0 or 1 correct = **0** marks*
allow tT for Tt

2

(f) circle drawn around either TT or tt on Figure 2

allow circles drawn round both

1

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(g) correct ratio from part **(e)** e.g. 3 : 1

allow multiples of stated ratio
*allow 3 : 1 if no answer to part **(e)***

1

[8]

Q4.

(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

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(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)*

[8]

Q5.

(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

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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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[16]

Q6.

(a) 46

1

(b) 23

allow ecf from 2.1 – ie half of answer given in 2.1

1

(c) egg

1

sperm

1

ovary

1

meiosis

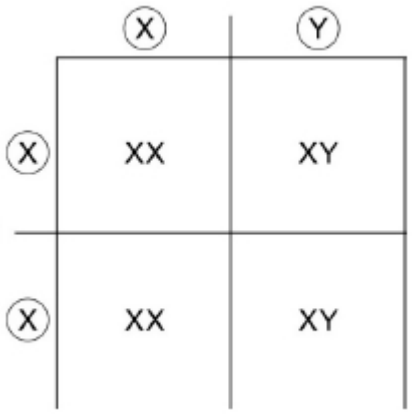
1

fertilisation

1

correct order only
correct spelling only

(d)



*all 4 correct = **2** marks*
*2 or 3 correct = **1** mark*
*0 or 1 correct = **0** marks*
ignore correct / incorrect identification of male and female offspring

2

(e) 1 in 2

1

(f) any **two** from:

- multiple genes determine appearance
  allow several / many genes determine appearance
- different combinations of alleles

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allow description of combinations of alleles' allow genes for alleles

- different environmental effects
  allow example e.g. eat different diets
- from different egg / sperm

2

[12]

Q7.

(a) red blood cell

1

(b) 44

1

(c) retina

1

(d) **7** and **8** / the parents
do not have **A** (allele)
or only have **a** (allele) **or** are **aa**
*allow converse – if parents had an **A** (allele) they would have Stickler syndrome*

1

so children cannot inherit **A**
or can only inherit **a**

or

the parents show the recessive characteristic

so must be homozygous
(recessive)
or must be **aa**
or parents cannot have **A**

1

(e) parental genotypes:
12 = Aa and 18 = aa
or parental gametes:
12 = A + a and 18 = a + a

1

derivation of offspring genotypes
allow ecf

1

identification of **Aa** offspring as Stickler

1

probability = 0.25 / $\frac{1}{4}$ / 1 in 4 / 25% / 1:3
*allow ecf – e.g. 0.5 if **12 = AA***
*do **not** accept 3:1*

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

1

[9]

Q8.

(a) white blood cells have the same DNA / genes / chromosomes
or
have the gene for GH

allow have all the genes
allow all body cells (except RBCs) have all of the genes

1

(b) enzyme has specifically-shaped <u>active site</u>

1

the 2 antibiotic resistance genes have different (sequence of) <u>bases</u>

1

only Tetracycline-resistance gene fits (active site of) enzyme
or
only Tetracycline-resistance gene is complementary to (active site of) enzyme

1

(c)

Ampicillin	Tetracycline
✔	✘
✘	✘
✔	✔

***1** mark for each correct row*
*if no other mark, allow **1** mark for one correct column*

1
1
1

(d) clone produced by asexual reproduction

allow by 'mitosis'

1

all DNA / all genes are copied

allow GH gene copied
allow plasmid copied

1

every cell receives a copy
or
receives every gene
or
receives GH gene
or
receives plasmid
or
genetically-identical cells

1

[10]

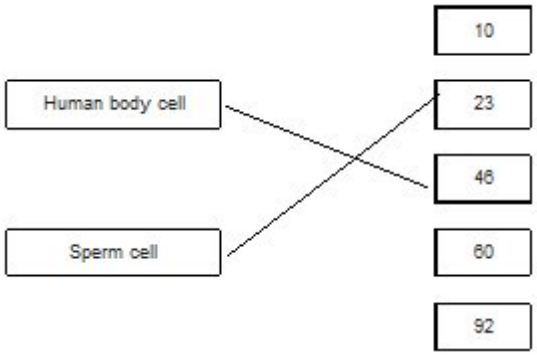
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Q9.

(a) **A**

1

(b)



2

(c) one x circled under mother

accept if clearly indicated choice even if not circled

1

(d) XY

allow YX

1

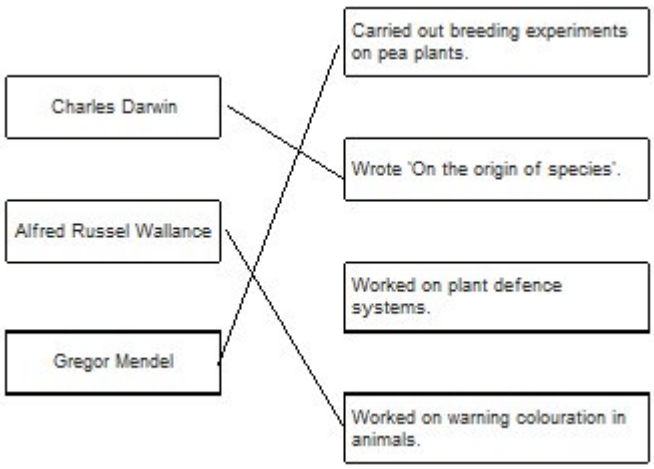
(e) 50 (%)

1

[6]

Q10.

(a)



3

(b) a gene

allow allele

1

(c) 4

1

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(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]

Q11.

(a) phosphate

allow PO_4^{3-}

1

*do **not** allow P*

(b) A / adenine and T / thymine
and
C / cytosine and G / guanine

*do **not** allow U / uracil*

1

(c) (mutation) changes from C to T DNA code
or
there is a change in the three bases / triplet from CAG to TAG

1

(mutation) changes the amino acid

1

(this could) change the protein

1

(so it) forms a different shape / changed active site

accept different tertiary structure

1

(therefore) the enzyme no longer fits the substrate / carbohydrate

1

(d) mother / woman's gametes correct: A a

1

father / man's gametes correct: a a

1

correct derivation of offspring

ecf

1

identification of child with syndrome H or genotype aa

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1

0.5

ecf

allow 50% / 1 / 2 / 1 in 2 / 1:1

1

*do **not** accept 1:2*

[12]

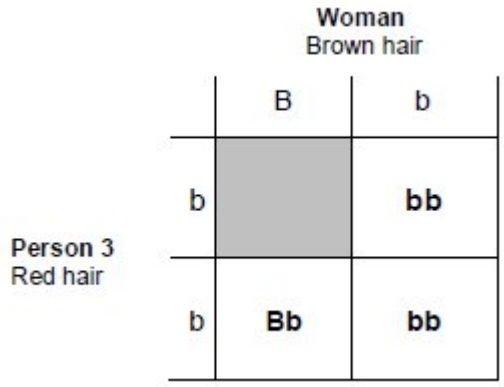
Q12.

(a) When the dominant allele is not present.

1

(b) (i) Bb

1



(ii)

3 correct = 2 marks

2 correct = 1 mark

1 or 0 correct = 0 marks

allow bB for Bb

2

(iii) 1 in 2

allow ecf from part ii

1

[5]

Q13.

(a) ovary

1

(b) 46

1

(c) (i) does not fit the pattern

or

it is higher than the 3rd value / it should be lower than the 3rd value / it should be between the 3rd and 5th values

*do **not** allow use of incorrect figures*

1

(ii) As age increases % of women (having a baby) decreases

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1

(d) (i) 33

$\frac{66}{2}$

allow 1 mark for

if no answer / wrong answer

2

(ii) low success rate

1

more likely to have a baby with health problems / abnormalities / a faulty chromosome

1

[8]

Q14.

(a) testis / testes

allow testicle(s)

1

(b) (i) **B** = 13.2
C = 6.6
E = 3.3

all 3 correct = 2 marks

2 or 1 correct = 1 mark

*If no marks awarded allow ecf for C **and** E based on answer to B*

ie C = ½ B and E = ½ C for one mark

2

(ii) 6.6

*allow twice answer for cell **E** in part bi*

1

(iii) mitosis

correct spelling only

1

(c) (i) any **two** from:

- cells that are able to divide
- undifferentiated cells / not specialised
- can become other types of cells / tissues **or** become specialised /differentiated

allow pluripotent

2

(ii) 4-day embryo is a (potential) human life

or

destroying/damaging (potential) human life

allow cord would have been discarded anyway

ignore reference to miscarriage

allow cannot give consent

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1

(iii) perfect tissue match **or** hard to find suitable donors

allow same/matching antigens

allow no danger of rejection

allow no need to take immunosuppressant drugs (for life)

*ignore genetically identical **or** same DNA*

1

(iv) stem cells have same faulty gene / allele / DNA / chromosomes

allow genetically identical

ignore cells have the same genetic disorder

1

[10]

Q15.

(a) (i) man has (inherited) polydactyly (PD) allele (from mother)

1

man has (inherited) other / normal / recessive allele from father

1

because father does not have PD allele **or** if father had it father would have had PD **or** father only has normal allele **or** father is homozygous recessive

1

allow gene for allele

(ii) 0.5 / ½ / 1 in 2 / 1:1 / 50%

do not allow 1:2 or 50/50

allow 50:50

1

(b) parental phenotypes: both brown

1

parental genotypes: both **Bb**

1

gametes: **B** **b** and **B** **b**

1

allow only on gametes answer line

allow ecf from genotypes

offspring genotypes: **BB** **(2)Bb** **bb**

allow ecf from gametes

1

offspring phenotypes correctly assigned to genotypes:
BB & **Bb** = brown **bb** = red

do not penalise confusion of 'phenotypes' & 'genotypes' here

1

[9]

Q16.

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(a) salivary gland

1

(b) liver

1

(c) any **four** from:
- merozoites released (from liver) and enter the red blood cells
- (some of these) turn into schizonts
- (which) burst the red blood cells
- releasing (more) merozoites
- coincides with fever attacks.

points credited must be in correct sequence

4

(d) (i) three bases code for one amino acid

1

middle code of CTC is now CAC / T changed to A

1

so will be a different amino acid (in the chain)

1

(and so chain / protein will have a different shape) due to a different sequence of amino acids

1

(ii) correct parental genotypes (both **Aa**)

allow ecf for 2nd and 4th marking points

or correct gametes (**A+a A+a**)

allow alternative symbols if defined

1

correct derivation of offspring genotypes from gametes

1

aa identified (homozygous for) SCA

1

0.25

allow 25% or 1 in 4 or 1:3 or 1 / 4

1

(iii) **(Aa)** less likely to get malaria (than homozygous dominant / **AA**)

allow resistance or protection if correctly qualified eg some protection

***do not accept** 'immune'*

1

[15]

Q17.

(a) any **two** from:

- right amount of nutrients **or** different / all foods
- right amount of energy
- for (individual) needs

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'right amount' only needed once for both marks to be awarded

2

(b) (i) ovaries / ovary

allow placenta

1

(ii) any **one** from:

- inhibits follicle stimulating hormone / FSH production
- inhibits maturation of eggs

ignore ref to site of production of FSH

*allow stimulates LH production **or** stimulates preparation of womb lining*

1

(iii) any **one** from:

- stimulate muscle growth
- used in (oral) contraceptives

1

(c) small (rate of) decrease then bigger (rate of) decrease

1

idea that change of rate (of decrease) at 900 (mg per day)

*If no other mark awarded allow **1** mark for decrease*

1

(d) (i) gene(s) / nucleus / chromosome(s) / DNA

allow ribosome

1

(ii) reduces production of cholesterol (by liver)

allow idea of switching off gene for reductase (production)

allow switch off / reduce / inhibit reductase (production)

allow reduces absorption of cholesterol (by intestine)

allow statins (might) breakdown / destroy cholesterol

1

[9]

Q18.

(a) (i) (female) has XX / only X's / no Y

allow has X chromosomes

ignore ref to genes / cells

1

(ii) extra chromosome / has 47 chromosomes / one set has 3 copies

ignore reference to chromosome numbers other than 47 or no. 18

1

no. 18

1

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(b) (i) 14

allow in range of 13.5 to 14.5

1

(ii) 7

allow in range of 6.75 to 7.25

accept ecf from 5bi

1

(c) Advantages:

any **two** from:

- more than 1 embryo (so more chance of success)

  allow method 2 may cause a miscarriage
- tested at 3 days cf 10 weeks **or** tested earlier

  tested when only 3 days old
- tested before pregnancy
- no termination / abortion
- spare embryos have a potential use.

2

Disadvantages:

any **one** from:

- needs an operation

  accept described hazard of operation
- (spare) embryos / human life destroyed / harmed

  must be comparative
- higher cost
- embryos might not implant / might not develop.

1

[8]

Q19.

(a) (i) in the chromosome(s)

ignore genes / alleles

1

in the nucleus

allow nuclei

allow mitochondria

1

(ii) the DNA / chromosomes / genes are replicated / copied / multiplied / doubled / duplicated

allow DNA is cloned

ignore same DNA / chromosomes / genes if unqualified

1

(b) (i) 1 / one

1

(ii) 2 / two

1

(c) **B**

1

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[6]

Q20.

(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 F_2 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

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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 cf other species

  allow he only worked on pea plants
- Mendel's results were not corroborated until later / 1900

2

[10]

Q21.

(a) (different / alternative) forms of a gene

*do **not** accept types of genes*

1

(b) DNA isolated from embryo

1

(fluorescent) probe mixed with embryo DNA

1

probe (then) <u>binds</u> with embryo DNA

1

(UV light) <u>to show</u> alleles / gene for disorder

1

(c) genotypes of parents and gametes correct (Man **D** and **d**, Wife **d** and **d**)

*allow half-size genetic diagram with only one **d** from wife*

1

offspring genotypes correct (½ = **Dd** and ½ = **dd**)

allow ecf if parental genotypes are wrong

1

offspring phenotypes correctly assigned to genotypes

1

(d) genotypes of parents and gametes correct (**N** and **n**)

allow ecf if parental genotypes are wrong

1

offspring genotypes correct (**NN**, 2 × **Nn**, and **nn**)

1

offspring phenotypes correctly assigned to genotypes;

1

correct probability = 0.25 / ¼ / 25% / 1 in 4 / 1:3, <u>only</u>;

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*do **not** allow '3:1' / '1:4'*

1

[12]

Q22.

(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 <u>three</u> 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 <u>mitosis</u>

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

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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]

Q23.

(a) (i) alternative / different / one form of a gene

or

a mutation of a gene

do not allow a type of gene

(For info: CRAM = Childhood Recurrent Acute Myoglobinuria)

1

(ii) not expressed if dominant / other allele is present or it is heterozygous

or

only expressed if dominant allele not present / no other allele present or it is homozygous

need two copies to be expressed / not expressed if only one copy

allow 'gene' for allele

1

(iii) unaffected parents have an affected child

*allow **7** and **8** have **10***

allow skips a generation

1

(b) (i) has two alleles that are the same

*accept (person is) **nn** / **NN** or has two recessive / dominant alleles*

1

(ii) (all) inherit **N** / normal / dominant allele from **1** / from father

ignore they are carriers

1

all are **Nn** / none are **nn** / all are heterozygous

1

(c) (i) genetic diagram including:

1 gametes correct **or** parental genotypes correct:

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N and **n** + **N** and **n** **or** **Nn** + **Nn**

accept alternative symbols, if defined

1

2 derivation of offspring genotypes:
NN + **Nn** + **Nn** + **nn**

allow alternative if correct for parental gametes

1

3 **nn** identified as CRAM

accept ¼ / 25% / 1 in 4 / 1 out of 4 / 1:3

1

4 correct probability: 0.25

*do **not** accept 3:1 / 1:4*

1

(ii) any **four** points + conclusion:

pro PGD:

detected at earlier stage / at 3 days c.f. several weeks / before becoming pregnant

no / less chance of miscarriage c.f. CVS

does not involve abortion / less trauma / less pain / ethical comparison

higher chance of having unaffected child – eg ref to use of spare embryos

provides embryos for research

4

pro CVS:

PGD may destroy some embryos

ethical implications of research on embryos (with PGD)

lower incidence of false positives / false results

low(er) financial cost

conclusion:

must relate to candidate's argument

must have at least one point from each technique for max marks

1

[15]

Q24.

(a) (i) Chromosomes

1

(ii) Characteristics

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1

(iii) Classify

1

(b) Plants

ignore algae

1

[4]

Q25.

(a) (i) gamete(s)

ignore reproductive cells

1

(ii) womb / uterus

allow phonetic spellings

1

(b) (i) are formed from the same original embryo

1

(ii) embryo transplantation

1

(iii) any **one** from:

- (calves will have some) genes / DNA from bull / sperm
  allow not all genes from the cow
- idea that sexual reproduction produces variation
  allow may be male
  allow idea that gene for low fat milk may not be passed on

1

[5]

Q26.

(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

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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]

Q27.

(a) (i) fertilisation

1

(ii) in sequence:

accept 1 next to gene, 2 next to chromosome and 3 next to nucleus in box

1 gene
2 chromosome
3 nucleus

*allow 1 mark for smallest **or** largest in correct position*

2

(iii) DNA

1

(b) (i) On diagram:

tick drawn next to **X** and / or **Y** from Parent 1

tick(s) must be totally outside grid squares
allow ticks around "parent "
extra ticks elsewhere cancel

1

(ii) 0.5 / ½ / 50% / 1:1 / 50:50 / 1 in 2

allow 2/4 / 2 in 4 / 2 out of 4 / 'even(s)' / 'fifty – fifty'
*do **not** allow 1:2 or '50 / 50' or '50 – 50'*

1

2 (out of 4) boxes are **XX**

or

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half of the sperm contain an **X**-chromosome

*allow **XY** is male and 2 (out of 4) boxes are **XY***

1

[7]

Q28.

(a) (i) one form of a / one gene

*do **not** allow 'a type of gene'*

allow a mutation of a gene

1

(ii) not expressed if dominant / other allele is present / if heterozygous

or

only expressed if dominant allele not present / or no other allele present

allow need two copies to be expressed / not expressed if only one copy / only expressed if homozygous

1

(b) (i) two parents without PKU produce a child with PKU / **6** and **7** → **10**

allow 'it skips a generation'

1

(ii) genetic diagram including:

accept alternative symbols if defined

Parental gametes:

6: **N** and **n**
and 7: **N** and **n**

1

derivation of offspring genotypes:

NN Nn Nn nn

allow genotypes correctly derived from student's parental gametes

1

identification: **NN** and **Nn** as non-PKU

OR nn as PKU

allow correct identification of student's offspring genotypes

1

correct probability only: 0.25 / ¼ / 1 in 4 / 25% / 1 : 3

*do **not** allow 3 : 1 / 1 : 4*

*do **not** allow if extra incorrect probabilities given*

1

(c) (i) mitosis

correct spelling only

1

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(ii) 8

1

(iii) DNA

allow deoxyribonucleic acid

*do **not** allow RNA / ribonucleic acid*

1

(d) (i) may lead to damage to embryo / may destroy embryos / embryo cannot give consent

allow avoid abortion

allow emotive terms – eg murder religious argument must be qualified

allow ref to miscarriage

allow idea of avoiding prejudice against disabled people

allow idea of not producing designer babies

1

(ii) any **one** from:

- prevent having child with the disorder / prevent future suffering / reduce incidence of the disease

  ignore ref to having a healthy child

  ignore ref to selection of gender
- embryo cells could be used in stem cell treatment

  allow ref to long term cost of treating a child (with a disorder)

  allow ref to time for parents to become prepared

1

[12]

Q29.

(a) DNA

1

(b) X and Y

1

(c) (i) 46 chromosomes

1

(ii) half the number

1

(d) meiosis

1

[5]

Q30.

(a) Mendel

1

(b) (i) **TT**

1

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(ii) a dominant allele

1

(c) 1 : 1

1

(d) 100 short plants

1

[5]

Q31.

(a) (i) mitochondrion / mitochondria

must be phonetically correct

1

(ii) carbon dioxide / CO_2

1

water / H_2O

1

in either order
*accept CO2 but **not** CO^2*
*accept H2O **or** HOH but not H^2O*

(iii) diffusion

1

high to low concentration

allow down a concentration gradient

1

through (cell) membrane **or** through cytoplasm

*do **not** accept cell wall*

1

(b) ribosomes make proteins / enzymes

1

using amino acids

1

part A / mitochondria provide the energy for the process

allow ATP
*do **not** accept produce or make energy*

1

[9]

Q32.

(a) (i) meiosis

allow mieosis

1

(ii) testis / testes

allow testicle

1

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(b) (i) 23

1

(ii) fuses / joins with cell D / with egg cell **or** used in fertilisation

allow fuse with another cell

1

prevents doubling of chromosome number / restores original no. / 46 / diploid no. / normal no. / full no.

accept 23 from each parent / from each gamete

1

[5]

Q33.

(a) (i) allele expressed even when other allele present **or** expressed if just one copy of allele is present **or** expressed if heterozygous

if present other allele not expressed

1

(ii) 2 affected parents have unaffected child **or 1** and **2** → **5** / **6**

or if recessive all of **1** and **2**'s children would have CADASIL

1

(iii) heterozygous – has unaffected children **or** because if homozygous all children would have CADASIL

1

(b) genetic diagram including:

accept alternative symbols, if defined

1

correct gametes:

D and **d**
and d (and **d**)

ignore 7 / 8 or male / female

1

derivation of offspring genotypes:

Dd Dd dd dd

*allow just **Dd dd** if ½-diagram*
allow ecf if correct for student's gametes

1

identification **of Dd** as CADASIL
or dd as unaffected

allow ecf if correct for student's gametes

1

correct probability: 0.5 / ½ / 1 in 2 / 50% / 1 : 1

1

(c) (i) stem cells can differentiate **or** are undifferentiated / unspecialised

1

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can form blood <u>vessel</u> cells / brain cells

or

stem cells can divide

1

(ii) ethical argument - eg no risk of damage to embryo or adult can give consent for removal of cells **or** adult can re-grow skin

more ethical qualified

ignore religion unqualified

or
if from a relative then less chance of rejection **or** if from self then no chance of rejection
or
skin cells more accessible

1

[10]

Q34.

(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

[5]

Q35.

(a) (i) gametes

apply list principle

1

(ii) chromosomes

apply list principle

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1

(b) (i) The allele is recessive

no mark if more than one box is ticked

1

(ii) two

apply list principle

1

(c) (i) **A**

apply list principle

1

(ii) **B**

apply list principle

1

[6]

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