



Solution Pathway

NOTE: This task is sold on condition that it is NOT placed on any school network, student management system or social media site (such as Facebook, Google Docs etc.) at any time.

NOT FOR PRIVATE TUTOR USE.

Below are sample answers. Please consider the merit of alternative responses.

SECTION A: Multiple Choice

Question	Answer	Notes
1	C	A Punnett square is used to calculate the ratio of genotypes and phenotypes in the F ₂ generation.
2	B	With an X-linked recessive trait, an affected mother will pass the trait to all her sons. In all examples bar B, the trait is x-linked dominant.
3	A	Primary data is the kind of data that is collected directly from the data source without going through any existing sources.
4	B	Genetic variation from sexual reproduction can decrease the effect of disease across a population.
5	A	The two alleles together represent a gene.
6	C	This individual is heterozygous for eye colour.
7	A	Continuous variation describes traits that can be represented graphically by a typical bell curve e.g. height, eye colour and skin colour.
8	C	This karyotype is for a female with Trisomy 18.
9	D	People with an extra copy of a chromosome have 47 chromosomes.
10	B	Observable traits are an individual's phenotype.
11	C	Seeds are the result of sexual reproduction in flowering plants. Sexual reproduction increases the genetic diversity in a population.
12	C	The stages represented are 1 - metaphase II, 2 - telophase II, 3 - anaphase II and 4 - prophase II.

13	B	B represents Telophase 1.
14	C	The process is meiosis which results in haploid gametes.
15	C	The red/white flower is an example of codominance.
16	B	This is an example of a test cross. The white-furred Guinea Pig is homozygous recessive for the allele, and the black is shown to be homozygous dominant for the allele.
17	A	All offspring are heterozygous.
18	A	This is a pigeon's karyotype. It has 40 homologous chromosome pairs.
19	D	This process is crossing over, which occurs between non sister chromatids in a homologous chromosome.
20	D	The two genes are most probably linked, and thus too close for crossing over to assort these genes independently.
21	A	This is an example of environmental impact on a phenotype, however the individual's genotype remains unchanged.
22	A	A is an example of a structural adaptation. The others are behavioural.
23	A	Beliefs are opinion and are may or may not be supported by scientific evidence.
24	B	Keystone species are often mutualists - which means that the two species interact for mutual benefit.
25	B	This is an example of a systematic error. A is an example of data analysis and C & D are random errors.

SECTION B – Short Answer

Question 1 (9 marks)

- a) *Asexual reproduction* (1 mark)
- b) *An advantage of asexual reproduction is that it is faster and more energy efficient, (1 mark) whilst a disadvantage is that it results in a population of plants with low genetic diversity (1 mark).*
- c) *Cloning is the process of generating a genetically identical copy of a cell or an organism (1 mark).*
- d) Any two correct answers for 1 mark each including but not limited to
 - *the human interference in the reproduction of other species*
 - *Human induced loss of genetic diversity*
 - *The impact to ecological health of producing a monoculture is such high volume*

- *The commodification of life.*
- e) *The cloning of plants is easy to achieve using asexual reproduction (1 mark). Animal cloning involves inserting the nucleus of a mature body cell into an emptied ovum that is ready for fertilisation in order to form an embryo (1 mark). This gives rise to the question of impact on the wellbeing of both the 'mother' and the embryo (1 mark).*

Question 2 (8 marks)

- a) *The inclusion of First Nations perspectives is integral to a body of research that is not dominated by one perspective, but is challenged, built and enriched by a range of perspectives (1 mark). In an Australian context, this means including the perspectives and knowledges of Aboriginal and Torres Strait Islander peoples (1 mark).*
- b) *This calendar gives a different perspective to the interpretation of the seasons, and we can see that, for example, the eels need to be able to migrate at a particular time of year, and then the bees will be active at a particular time of year (1 mark). If the bees are active, we can look to see what wildflowers are in bloom and then adjust our land management accordingly (1 mark).*
- c) *Eels (1 mark) & bees (1 mark). All species are acceptable answers.*
- d) *A keystone species is the species that helps hold an ecosystem together, whilst a predator is any organism that naturally preys on others (1 mark). Whilst often predators are keystone species, not all keystone species are predators. For example, in a marine ecosystem, phytoplankton can be seen as a keystone species (1 mark).*

Question 3 (8 marks)

- a) *The clearing of the area will lead to a decrease in food sources available to the potoroo (1 mark). This in turn would lead to a reduction in overall numbers, and the potential extinction of the potoroo (1 mark).*
- b) *The fungi species have evolved to depend on the potoroo for dispersing its spores (1 mark). A decline in the number of potoroo would ultimately lead to a decline in the number of fungi (1 mark).*
- c) *The distribution of a species describes the spread of that species over a particular area (1 mark), whilst the density describes the number of individuals per land unit (e.g. per sqkm) (1 mark)*
- d) *Adaptations for protection against predation are a result of evolution (1 mark). Australian animals have not had the opportunity to evolve alongside introduced predators and as such are more vulnerable to predation by these species (1 mark).*

Question 4 (7 marks)

a)

1 mark for using a Punnett square

1 mark for assigning correct allele symbols

1 mark for correct percentage prediction.

The percentage chance the baby has the disorder is 25%

	<i>D</i>	<i>d</i>
<i>D</i>	<i>DD</i>	<i>Dd</i>
<i>d</i>	<i>Dd</i>	<i>dd</i>

b) Autosomal recessive inheritance

c) As this disorder is not sex linked, the children's sex would not influence the percentage chance that they inherited the disorder (1 mark). Therefore the girls would have a 25% chance of being unaffected (1 mark) and a 50% chance of being a carrier, like their parents (1 mark).

Question 5 (7 marks)

- a)** An ethical consideration is a collection of principles and values that should be followed when engaging in scientific investigation (1 mark). The ethical considerations should minimise the harm that is done to individuals and society in the pursuit of scientific understanding (1 mark).
- b)** Any reasonable suggestion including but not limited to
- Do participants understand what they are consenting to?
 - Is any minority group marginalised or exploited as a result of this research?
 - Will this do harm to any individual?
- c)** Any correct primary data and secondary data source identified for 1 mark each.
E.g. Primary data: designing and implementing a survey (1 mark); secondary data: an analysis of existing journal articles (1 mark).
- d)** Any reasonable suggestion (1 mark) written as a question (1 mark).
E.g., If a person is paid to participate in genomic research, is that adequate compensation for their genetic information?

Question 6 (5 marks)

a)

Type of adaptation	Example

Structural	<i>Koalas have rough skin on the bottom of their feet for gripping tree trunks and branches.</i>
Behavioural	<i>Koalas are active at night to conserve energy loss.</i>
Physiological	<i>The koala's digestive tract has evolved to detoxify the eucalyptus upon which they subsist.</i>

- b) *A physiological adaptation is any adaptation to an organism's internal processes that helps them survive (1 mark), whilst a structural adaptation is any feature on an organism's body that aids survival (1 mark).*

Question 7 (6 marks)

- a) 1 mark each for each correct phase



- b) *Crossing over occurs during prophase I of meiosis before tetrads are aligned along the equator in metaphase I (1 mark). Crossing over increases genetic diversity, as recombination results in new allele combinations in the gametes (1 mark).*
- c) *Homologous chromosomes are chromosomes that share the same structural features (1 mark) AND the same genes at the same loci (1 mark).*

References

Multiple Choice

Question 2:

<https://www.cracksat.net/sat/reading/test-38.html>

https://www.researchgate.net/figure/X-linked-dominant-trait-pedigree-By-Diana-B-Pylypiv_fig1_327666985

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<https://epomedicine.com/medical-students/solving-pedigree-analysis-3-steps/>

https://commons.wikimedia.org/wiki/File:Wiki_Drawing_-_X-Linked_Dominant_%281%29.svg

Figure 1: <https://www.nagwa.com/en/explainers/153127372129/>

Figure 2: <https://translational-medicine.biomedcentral.com/articles/10.1186/s12967-015-0569-y>

Table 1: http://cyberbridge.mcb.harvard.edu/mitosis_7.html

Question 13:

http://cyberbridge.mcb.harvard.edu/mitosis_6.html

Question 15:

<https://www.genome.gov/genetics-glossary/Codominance>

Question 21:

<https://www.gregrutherforddds.com/what-you-need-to-know-about-gaps-between-teeth>

Short Answer

Question 4

<https://sites.google.com/site/pedigreesforpredictingtraits/volunteer-information>

Question 6

Image: <https://sciencing.com/physical-adaptations-koala-bear-8078241.html>