12 ATAR Biology 2016 Sem 1 Exam Marking key

Section 1: MC

1D	2A	3C	4B	5B	6B	7C	8D	9C	10B
11D	12D	13C	14D	15A	16D	17A	18A	19C	20B
21B	22C	23A	24A	25C	26A	27B	28D	29A	30C

Section 2: Short Answer

Question 31 [15 marks]

a. Palm trees with the fewest DNA differences will be most closely related to the palm trees of Lee'fee. (or 'The more similar the DNA, the more closely…') [2]

b. i. the 4 different islands (near Lee'fee) [1]
ii. Differences in DNA sequences compared to Lee'fee palm (in the 6 sections of DNA in samples of palm tree (tissue) [1]

c. 2 of: same sections/loci of DNA compared [1]; type of biotechnology used for comparison/ same restriction enzymes used for cutting sections [1] length of sequence in each locus compared [1]same sequence from Lee'fee used for comparison [1]

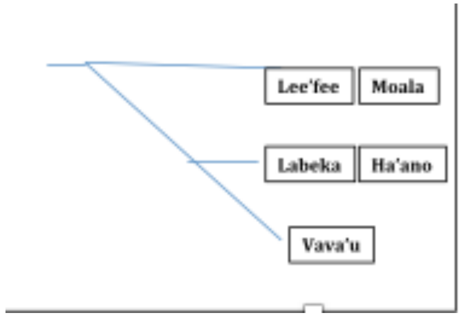
d. *In order down the table*: 0, 2, 3, 2, [1] each

e. Note: the biggest difference is between the first group of Lee'fee & Moala [1](which have no differences, so are the same species) and the other 3 [1]. Then Labeka & Ha'ano are also one species [1], with one difference to Vava'u [1]

Lee'fee and Moala

Labeka and Ha'ano

.OR *Vava'u*



f. Palm trees on Lee'fee and Moala are the closest related (½), and have no differences in DNA sequence, so are the same species. (½).

Question 32 [21 marks]

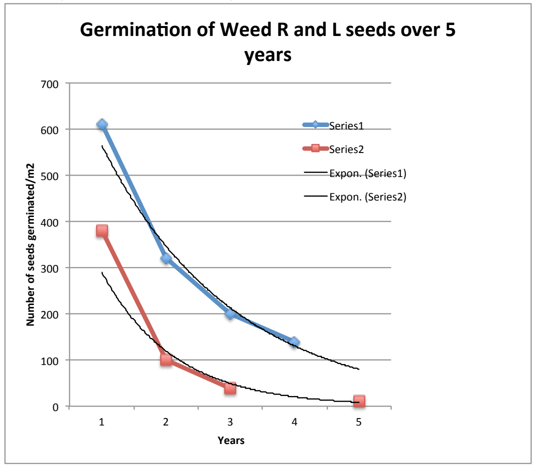
a (i). LINE Reason: both variables are continuous, numerical data (½ each)= [1]

a (ii). COLUMN Reason: marsupials are different species, therefore discontinuous data ((½ each)= [1]

b. DV: number of weeds germinated per m^2 (1 mark)

c. graph: 1 mark ea for following (5 marks)

1. Title; Germination of Weeds R & L over 5 yrs
2. Line graph; Correct orientation; horiz = Time (years)
3. Axis labels – vertical = N^o weeds per m^2
4. Plotted points accurate
5. Key, or lines clearly labelled



d. Seeds of weed R will germinate over more years/lay dormant) than seeds of Weed L (2 marks) OR
If Seed R is more drought resistant after two years **then** more R weeds will germinate (or similar including IV and DV)

e. (allowing for either exponential or linear decline from previous years):
Weed R Year 5: 80 +/- 20 (½) as shown on graph (½)
Weed L Year 4: 20 +/- 4 (½) as shown on graph (½)

f) R remains dormant for longest (1) so can continue to germinate for more years after drought (1) – as in graph.

g (i) same mass were sown for each experiment (1), but this means only ½ as many L seeds. (1) OR germination rate is actually x2 what it appears for Weed L(1)
(ii) count out seed numbers OR 2x mass for Weed L (1)
(iii) *name (1)*: replication, larger sample size, control light/soil/moisture
explanation(1): by controlling for either individual variation & random error (first 2), or controlling extraneous variables

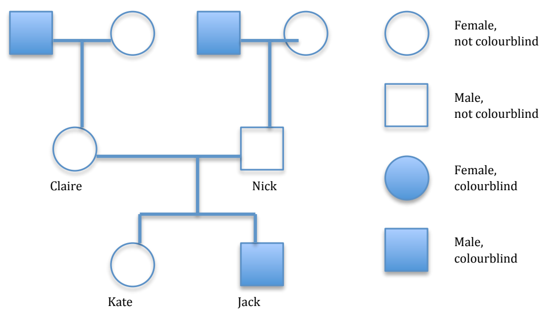
Question 33 [19 marks]

a **Allele** different form of a gene, different in base sequence
Gene section of DNA that codes for an instruction, usually a protein (need both compared clearly, 1 mark each)

b (i) line up in homologous pairs (1)
crossing over between homologous pairs (1) *NB: Indep assortment not apparent from THIS picture.*

(ii). ABED, AbeD, aBed, abed (2)

(iii) variation in gametes (½) leads to variation in offspring (½), species more likely to survive in changing environment (1) c.



Key (1)

Generations numbered, order and sex correct (2)

3 individuals shaded (I1, I3, II2) (1 mark)

(i) Nick: X^BY (1) as Nick has normal vision (1) Claire: X^BX^b (1) as she has normal vision but father is colourblind (1) OR Jack must have inherited the recessive allele from his mother (1)

(ii)

	X^B	X^b
X^B	X^BX^B	X^BX^b
Y	X^BY	X^bY

- punnet square (1 mark), including Genotypes : ¼ X^BX^B ¼ X^BX^b ¼X^BY ¼X^bY
- Phenotypes: ½ normal female: ¼ normal male ¼ colour blind male (1)
- colour blind next child: 25% (and will be a boy) (1)

Question 34 [12 marks]

a. green, [1] since AxD gives all green (simple explan^n) [1]

b. (MUST have eg for full marks)

- depends on homo vs heterozygote
- eg AxD gives all green [1], suggests homozygous [1]
- eg BxD [1]gives 50% green, 50% yellow, suggests heterozygous [1]

c. heterozygous (Gg) [1] must have dominant allele since phenotype is green; must contain recessive allele to produce yellow offspring [1] (BxC)

d. Environment conditions- give eg such as light or shade, nitrogen in soil, amount of water etc [1]

e. Vary: specify clearly the variable said in d. [1]
measure: height/ internode length –[½] specific
Control: 3 other environ'tal conditions eg light or shade, fertiliser, amount of water [½ ea] *NOT IV or DV*

Question 35 [14 marks]

a. Mountain is hard to cross or live in [1] because it is high/ cold/ rainforest vegetation won't survive in climate [1] (MUST have eg for full marks)

b. i. prickly skink [1]
ii. Divergent evolution OR allopatric speciation [1]

c. The more easily an animal can move over a geographical barrier (such as a mountain), the less % allele difference between populations on either side of the barrier. [1 for reason, 1 for hypothesis form]

d. *6 points – either of the ones in brackets OK, as long as others all present.*

- Variation in original population due to mutations
- Isolation of gene pools
- Diff selection pressures in each separated pop^n
- (+ Diff mutations in each gene pool)
- selection/survival of fittest, which reproduce leads to
- (over enough generations)
- sufficient accumulat^n of diff's betwn pop^n/ changed allele frequencies

e. to become diff species

f. 2 species [1]: A and B interbreed so same; C is different.[1]

Question 36. [19 marks]

a. . i. Patient #2 (1 mark)

- Band in common with Darrell (1/2 mark)
- That was not in mother's DNA (1/2 mark)

ii.
Must have one match to each of mother and Patient #3 [1 ea, = 2]

iii. gel electrophoresis [1] (NB this is the process; DNA profiling is what results from the process)

b. Any 2 of: Substitution, addition, deletion, inversion, with correct alteration to given DNA sequence. [1 ea]

iii. 2 of: DNA replication/ mitosis/ meiosis [1 ea, =2]
NB not DNA transcription as DNA unlikely to be altered.

c. i. DNA probes: Single-stranded lengths of DNA engineered to be complementary to sections of genes of interest. *(NB NOT fluorescent)* [1]
ii. Bonding together (through hydrogen bonds between nitrogen bases) of single stranded DNA sections – single stranded cDNA from patients to probes.
iii. **Green** fields: shows normal DNA has bonded, so this section of gene is normal
Red field shows Breast cancer DNA has bonded, so mutant section of this type is present
Black field – nothing has bonded, so different mutation is present for this section.

d. i. universal, so the triplet code specifies the same amino acids in sea coral and in glofish [1]
ii. The gene must be transcribed into mRNA [1], and then translated in to proteins in ribosomes. [1]
iii. Probably low, as it would no longer be black and white but red, and glow in UV light [1] so more easily seen by predators [1]

Question 37. [10 marks]

Structure enables exact replication because (any 5):

- DNA strands are complementary, according to base pairing rule
- Adenine pairs only with thymine; Cytosine pairs only with guanine
- So when DNA unwinds, free nucleotides pair up with exposed bases
- on each free parent strand ie semi-conservative replication
- Forming 2 new identical double helices
- There are enzyme mechanisms to correct mistakes in replication

Structure enables storage of genetic info because (any 5): up to 5 marks

- Genetic information is stored as a sequence of bases/nucleotides
- nucleotides are read in groups of 3
- This is a codon, specific codons code for specific amino acids
- So sequence gives an instruction to make a protein
- The double helix is a very stable structure with strong sugar-phosphate backbone, so the code is preserved

Question 38. . [10 marks]

Need at least 1 point under each heading of molecular, fossil and anatomical.
Each point must then have a related example to explain.

Molecular up to 6 marks total if include examples

- Protein sequencing - ie comparing amino acid sequences of the same proteins between organisms [1] eg Cytochrome C [1]
- DNA sequencing ie comparing DNA base sequences of the same genes between organisms [1] eg Homeo box gene
- Number of Variations/mutations indicates time since divergence [1] since it is assumed that mutations happen at a relatively constant rate [1]

Fossils up to 4 marks

- – progression over time shows evolution of more and more complex forms. [1] eg fossil progression of horses/ sea urchins [1]
- Intermediate forms can show relationships, inferring pathway of evolution between different species [1] eg feathered *Archaeopteryx* suggests a connection between dinosaurs and birds [1]

Anatomical evidence ANY 3
– 2 marks per concept =up to 6 marks total

- Homologous Structures – Comparing structures of animals that are related will show similarities, even if function different [1] eg pentadactyl limb suggests relationship between vertebrates [1]
- Vestigial Structures - Structures or organs that are the same but serve no useful purpose [1] eg appendix or tailbone in humans [1] that indicates descent from a common ancestor [1]
- Embryology – closely related organisms show similarity of embryos indicating that there is a common ancestor [1] eg high degree of similarity amongst early vertebrate embryos with gill slits/ pharangeal arches [1]

Question 39. . [10 marks]
Diagram should correctly illustrate the following, as indicated:

Transcription (any 4 for 4 marks) • DNA unwinds (NB RNA polymerase does this) • RNA polymerase attaches to DNA • DNA code is used as a template / mRNA forms complementary strand to DNA • {only one strand of DNA is transcribed (antisense strand) } • free nucleotides used to form mRNA
mRNA transported/moves (from nucleus) to bind to ribosome in cytoplasm (1 mark)
Translation (any 4) • Bases read in groups of 3 per codon • tRNA recognizes codon on mRNA, binds with its anti-codon • tRNA brings a specific amino acid with it • a peptide bond forms between the amino acids • amino acid chain forms a polypeptide/ protein
b. proteins necessary as enzymes to regulate cell processes [1], and as structural components, eg cell membrane structural or carrier proteins, muscle fibres [1]

Question 40. [10 marks]

Can give each one only to 4 marks; term must be explained and needs to be applied to correct example.

Natural selection - up to 4 marks, if applied

Seen in the change in characteristics of a population over time, leading to better adaptation to the environment [1]

Eg Palmer finches were probably many shades of brown/ variation [1], but those most suited to survive predators were the best camouflaged against the dark volcanic rocks[1] , so they bred and over time [1] the population became dark in colour.[1]

Sexual Selection up to 4 marks, if applied – choice by mate leads to attractive characteristics [1]
eg female finches probably preferred males who danced elaborately [1] mated with them by preference, so passing on genes[1] for dancing and red throat [1] so now this is evident in population [1]

Genetic drift – up to 4 marks if applied
Change in characteristics due to random events , especially seen in small populations [1] eg eye rings are now all yellow, and does not appear to be any reason for this [1] (as similar islands have both yellow and white).

So probably by chance the birds that bred had yellow eye rings [1] and over many generations this became fixed due to random events [1] The gene for white eye rings was lost from the population.[1]

Question 41. [10 marks]

a. *up to 4 marks*

Polygene –
a number of different genes are responsible for a characteristic, [1] here it is colour.

Multiple alleles
– one gene has more than 2 forms – 3 or more [1]

Dominant/recessive inheritance;
a dominant allele affects the phenotype when only one allele is present [1] a recessive allele only controls the phenotype when homozygous [1]

b. *up to 6 marks*
must explain each one to get full marks overall

Polygene
there would be a range of phenotypes from white, through palest red, medium red, deep red and very dark red.[1] On a graph of colour vs frequency in population this would be like a normal curve. [up to 2 is graph with correct axes]

Multiple alleles
There would be somewhere between 3 and 6 different phenotypes depending on number of alleles.[1] The graph would have columns for each phenotype, say white, pale pink, red and dark red. [1 for any attempt at an approp graph, or a suitable punnet square explaining genotype and phenotype)

Dominant/recessive inheritance
Just 2 colours, white and red.[1] The frequency of each would depend on which were dominant. [1] a suitable column graph could get 1 mark. [Punnet square ½ only as not really informative of population, just shows genotype and phenotype]

Question 42. [10 marks]

Positive: (must have 3 , can get to 4 Marks)

- engineer GM plants and animals to grow despite salinity, aridity, other problems due to climate change
- include higher vitamin content or specific characteristics egFlavr Savr tomatoes, golden rice
- Get higher yields
- Faster change than with artificial selection
- Need less insecticide and herbicide

Negative: (must have 3 , can get to 4 Marks)

- Permanent change to DNA may lead to unforeseen consequences
- Eg change in function of other genes
- Allergenic products
- Leads to loss of different varieties and therefore biodiversity when one transgenic or GM variety is predominant, so crops may fail if a new disease infects this variety
- Genetic change could spread to wild populations, creating super weeds (or other)

Applications [up to 4 marks, MUST have at least 2 marks]

Agriculture*: current applications for up to 2 marks each*

Eg use of BT cotton where gene from the naturally occurring soil bacterium *Bacillus thuringiensis* causes the cotton to produce a pesticide that kills the cotton boll worm [2]

'Round up ready' crops (eg canola) with genes from the soil bacterium called *Agrobacterium tumefaciens* that make crop resistant to herbicide sprays such as Round up [2]