12 ATAR Biology 2016 Sem 2 Exam Marking key

Section 1: MC

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

(note, change for Q9; also Helen re-organised MC order to fit on pages: old order for Q24 – 28 on second line)

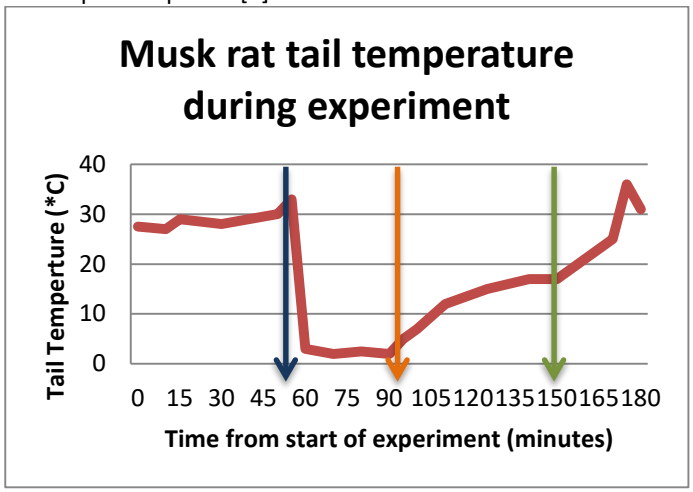
Section 2: SA

Question 31 [19 marks]

a. Musk rat is endothermic [1] because maintains a relatively stable temperature despite environmental change. [1] NOTE ; FROM DATA

b. Expect naked tail to greatly increase heat loss [1] due to hi S/A:vol ratio and lack of insulation to reduce heat loss [1]

c. Title -must include Tail Temp & time or conditions[1]; IV Musk rat Time from start of exp (mins)[1] ,DV: tail temperature (^{0}C) [1], check correct intervals & line graph, labels for change in activity (need all 3) [1], for correct plotted points [1] = **5**



Key : Blue line – entered water; Brown line – left water; Green line – started exercising

d. Air → ice : effect is immediate sharp decrease in tail temperature [1] to just above freezing [1/2]
Ice → Air : effect is gradual increase in tail temperature [1] to about 17 ^{0}C. [1/2]

e. Reduces rate of heat loss [1] by decreasing difference in temp between tail and ice-cold water [1] OR shunts blood away from periphery to core (NOT: puts heat into internal organs)

f. Tail temp increases to 36^0 C as exercise occurs [1] This allows excess heat to radiate [1] when musk rat is generating large amounts of metabolic heat during exercise [1] due to large S/A without insulation [1] OR prevents overheating w/o active means

g. Reliability improvements: 2 of:
Multiple trials, ie Repeat experiment with same rat [1] use large sample – ie 30 + musk rats (only ½ for' >1') [1]OR use control rat not moving in and out of icewater and exercising.

Question 32 15 [marks] (NOTE HJL question order Δ)

a. USE DATA i) sharp decrease [1/2] to 20% of original population OR from 5 → 1000 mosquitos [1/2]
ii) steady increase [1/2] to 60% of original population OR from 1 → 3000 mosquitos over 30 days [1/2] then remains at 3000 mosquito [1/2] for next 60 days [1]

b. IV: Parathion spray

c. Hypothesis : During spray program (days), mosquito numbers decrease. (use both IV and DV) OR Spraying with Parathion will decrease mosquito numbers

d. Not a separate set-up, but the control was the initial 25 days of experiment [1]

e. increased frequency of allele for Parathion resistance, decrease in the non-resistant allele [1]

f. i) (chemical) resistance [1]
ii) natural selection [1]

g. **ANY 2 IDEAS: beneficial** – decrease in mosquito population decreases the vectors for some diseases [1] so decreases the infection rate for humans [1]
detrimental – increase in chemical load of soil and water [1] for 15 years which would accumulate with each spray program causing ill-health in humans[1]
OR reduction in all insects due to non-specific insecticide[1] could reduce pollination and therefore crop yield,[1] OR
May get many resistant pest insects increasing in population [1] due to predator species having long-term decrease in population due to biological magnification of pesticide [1] in environment.

Question 33 [14 marks]

a) any three of the following – just say what would be seen in xerophyte

A - Cuticle [1/2] xerophyte thick waxy cuticle reflects sunlight → reduces heat → reduces water loss [1] OR hairs observable outside cuticle

B - Epidermis [1/2] xerophyte multiple cells layer [1/2] increased cell layers reduces water loss for xerophytes [1] (could also put hairs in here)

D – stomata [1/2] xerophyte may be few, sunken [1/2] for xerophytes this decreases the ability for water to be loss through transpiration [1] (could also include compound hairs here found in stomata)

E – guard cells [1/2] can have heavy cuticle in xerophytes [1/2] when plant is wilting, cuticle assists in keeping stomata closed [1]

b) CAM or C4 plants [1] open stomata to take in CO_2 at night when water loss is less [1] store this as intermediate

compound so photosynthesis happens during the day from this stored CO_2 [1]

c) Jarrah/ *Phytophthora* dieback [1] protist

d) NOT A FUNGUS. Show a protist – single cell organism [1] with nucleus [1] and flagellum [1] [= 3]

e) 1. zoospores with flagellum [1] can be spread through water currents / can move to roots[1] of susceptible plants

2. chlamydospores [1] can survive harsh dry conditions and be carried through soil movement [1]

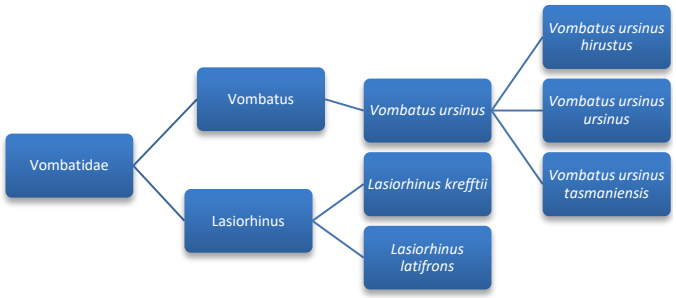
Question 34 [marks]

a) 2 of: divergent evolution [1] , adaptive radiation [1] or allopatric speciation [1]

b) 2 of: fossil record – tracking / comparing development of related species over time [1]
homologous structures – comparing uses and function of similar structures.
comparative embryology – similarities of the embryos of different sub-classes[1*] ??useful at this level?*
comparative biochemistry – comparing amino acid sequence of comparable proteins (eg Cytochrome C)

c) will look for number of similarities and differences in DNA sequence[1] to estimate time since divergence from common ancestor [1/2], and which species and families are most closely related [1/2]

d)



1 mark for each 'column' correct : family to genus to species to subspecies position [4]NB should have genus and species in italics/ underlined but not penalised

Question 35 [20 marks]

a) i) II3 is 100% heterozygous [1] must have received d from father and D from mother as does NOT have the disease [1]
ii) II5 is 100% heterozygous [1] must have given d to III4 and must have a D as does NOT have the disease [1]

b) i) false [1], 2 heterozygous parents (Dd) may have a homozygous offspring (dd)
parents and diseased son. [1]
ii) FALSE [1] chance of 2 in 3 of Dd,[1] from punnet square, as rule out the dd option (doesn't have disease)[1]

c) if a carrier then heterozygous. [1] Determined by crossing with homozygous recessive female ie diseased [1] if any offspring are normal – then III5 is heterozygous. [1]

d) heterozygous punnet square [1]
probability normal – ¾ or 75% [1]
probability of male ½, [1]
so Probability of both is ½ x ¾ = 3/8 (37.5%) [1]

e) yes [1] but only if II 5 is a carrier (X^NX^n) of rare disease. individual I2 would be X^nY therefore showing the disease, but not passing the allele to sons. Daughters would be carriers of X^n. [1] OR punnet squ
individual II 5 would be X^NX^n , carrier [1], giving X^n to son therefore giving disease to son [1]

Question 36. [19 marks]

a) selective breeding/ artificial selection [1]
select most resistant plants in crop [1] (save seed for next season) and breed/ cross-pollinate together [1] for many generations

b) use restriction enzymes to cut out CryAb gene [1]
cut plasmid with same enzyme, join with ligase [1]
put plasmid into vector - bacterium (such as *Agrobacterium*) [1]
bacterium is vector to insert gene in plasmid into crop cells' nuclei [1]

c) 2 ADV: much quicker change in crop genes than through many seasons of breeding, as don't have to wait for mutations to occur [1]
Can get specifically just the desired gene without undesirable associated traits [1] no compromise of taste, growth, disease resistance etc to breed in desired qualities
Can get genes that are not available in just that crop species – use transgenes [1]

d) I OF: if transgenes are introduced, there is a permanent change in the species genome which cannot be reversed once the crop has been planted [1] gene insertion may unexpectedly change expression of other genes [1] May crossbreed with nearby non-recombinant crops/related native species to contaminate them – eg create resistant superweeds [1] Complicated/specialised process/expensive – can't be done by farmers themselves [1] Effects/consequences not fully understood/ethical issues/ allergic reactions/ may be unintended effects on ecosystem that cannot be undone once new gene is introduced into species - permanent alteration of biodiversity [1]

e) 3 marks for each row of table, as follows:

mRNA, single strand of nucleic acid showing A, C, G U nucleotides (NO T)[1] STATE: carries a copy of a gene [1] to ribosome for translation into protein [1]

t RNA cloverleaf simple diagram showing anticodon of 3 nucleotides [1] and amino acid at opp end [1] STATE: transfers specific amino acid by matching its anticodon with codon on mRNA [1]

rRNA – circular diagram or similar representing the ribosome [1] place for protein synthesis [1] where mRNA code is translated into a polypeptide chain/ series of amino acids [1]

Question 37. [10 marks]

a.

Structure of DNA:UP TO 5M

1. **Replication accuracy and stability [1]**

Diagram showing double helix : phosphate-sugar backbone (stability) [1] with complementary base pairs of nucleotides Adenine- Thymine; Cytosine- Guanine: [1]

These enable accurate replication when strands separate and new complementary strands form [1] semi-conservative replication for accuracy [1] can also say H bonds enable to break & re-form

2. **Carries the genetic code**: [1]**UP TO 5M**

Gene = sequence of nucleotides [1]

along 1 side of the double helix, strands are anti-parallel so enzymes can read the correct side for the code [1] OR can unwind to allow enzymes to produce mRNA

each set of 3 nucleotides is a codon [1]

coding for a specific amino acid [1]

the set of codons that make up a gene give the instruction to the cell to make a protein.[1]

b.

Natural selection: (**UP TO 8 MARKS** – must include application of at least one characteristic)

VARIATION There was variation in the colour and wing size of beetles [1]

SURVIVAL as there is an overproduction of offspring there is a struggle for survival, those beetles best camouflaged against the colours of the island (plants/ rocks/ trees etc) will survive predators the best [1]

APPLICn OF WHO SURVIVES eg bright green may hide beetles more effectively than brown and yellow/green [1]

REPRODUCE & PASS ON ALLELES over time these individuals survive and reproduce, passing on their alleles [1]

APPLIC^{N} OF CHANGE TO POPn so the population becomes bright green in colour as frequency of these alleles increases[1]

OVER MANY GENERATIONS [1]

Also, wingless beetles may survive best as not blown into the ocean [1] , therefor over time the alleles for winglessness become more frequent [1]

Genetic drift UP TO 3 M: effect due to random events – NOT due to survival advantage.[1 for clear explanation]

So may be by chance that only bright green beetles survived a natural disaster or flood, or found mates, leading to predominance of bright green colour in population. [1]

Size may also have become large due to random mating events, that by chance only the large beetles mated [1]

Question 38. [10 marks]

a.

i.DNA Sequencing UP TO 3 M- this is the determination of the exact sequence of the nucleotides in the genome of a species (all the DNA) [1] carried out by Sanger sequencing where a series of syntheses are carried out with radioactive or fluorescently labelled nucleotides [1] which terminate a section of replication at different lengths, enabling the sequence to be determined. [1]

(JUST FYI In detail, Sanger sequencing involves:

- (PCR a sample of DNA to provide millions of copies)
- Divide the sample of DNA into four lots. Add 1% Adenosine Dideoxynucleotide to one quarter of DNA sample and PCR again (with 99% regular nucleotides and Taq1 DNA Polymerase). Repeat with thymine, cytosine and guanine dideoxynuclotides
- Run each of the dideoxynucleotide PCR'd DNA through separate wells
- Read the DNA code from the bottom up (shortest lengths travel greatest distance)

DNA profiling- UP TO 3 M finding the unique make-up of an individual of a particular species [1] compare the number of replications(lengths of specific sequences) of STRs that vary greatly between individuals.[1]

These sections are compared by cutting out with restriction enzymes, then using electrophoresis to compare the lengths of corresponding segments in different individuals.[1]

Longer segments are heavier and travel shorter distances than smaller sections with fewer repeats.

ii. **EXAMPLES – 1 M EACH**

DNA SEQU: can have up to 3 marks for 3 examples, as long as have 1 for DNA profiling

- check if a species is the particular one needing to be conserved OR correct one for determining population size/distribution for conservation management. Can be difficult to distinguish highly similar species except by DNA sequencing
- Is the meat being served in the restaurant from an endangered species of tuna?
- Checking if fur/bone etc is from endangered sp with prohibited trafficking

DNA profiling: can have up to 3 marks for 3 examples, as long as have 1 for DNA SEQU

- Are birds/animals from sale from captive bred pair or taken from the wild?
- Checking relatedness between individuals for captive breeding purposes to maintain diversity in the population
- Any other suitable

38b.

Environ effect on Variation [up to 3 marks]

comes about through effect of factors such as light, food, water, chemicals on phenotype, changing the expression of genes. [1] Can be temporary eg pale-skinned humans tan in sunlight, plants flower when daylight hours are at a certain length and/or temp, or can be permanent eg epigenetic change. [1] Mutagens can cause permanent change in DNA that can be passed to offspring if involves gametes. [1] Environment selection pressures can decrease variation in a species.

UP TO 2M genetic processes leading to variation : crossing over in meiosis [1] leads to exchange of genetic material between homologous chromosomes, enabling more variation in gametes produced, [1]

UP TO 2M independent/random assortment of chromosomes: [1] when homologous chromosomes pair up in metaphase I of meiosis, they pair up in an order independent of other pairs. This leads to variety in the gametes [1], as each meiotic division can create a different set of alleles as chromosomes separate.

UP TO 2M Fertilisation:[1] random fertilisation of diverse gametes creates diversity in the offspring of sexually reproducing organisms [1]
Significance: UP TO 2M Greater diversity in resulting offspring means greater resilience in the face of changes to the environment [1] as greater diversity in individuals of a species means more likelihood that some will carry the alleles to cope with changed conditions [1]

Question 39. [10 marks]
a.: (can use annotated diagrams)
In Freshwater, UP TO 5 M these fish gain water by osmosis across gills (and body surface) [1] And lose salt from gill surface [1] can also gain salt from food (½)
To maintain salt & water balance, they excrete large volumes of dilute urine [1] , do not drink [1] , actively take up (ie active transport) salt thru gills [1]
In moving to salt water, they must change their physiology:
IN SALT WATER, UP TO 5 M:
They lose water across gills (and body surface) **[1]** And gain salt from gill surface [1]
To maintain salt & water balance, they have to drink large amounts of salt water [1], excrete salt actively via gills [1]
Excrete highly conc urine full of salt, low vol of water [1]
So need a change in kidney function and active transport across gills [1]
b.

Tetanus bacteria [1]	**Malaria protist [1]**
Structure showing cell wall and circle of DNA [1]	Structure showing single cell with nucleus and flagellum[1]
Infect : present in soil contaminated by feces, present in spores [1]	Warm and wet conditions in tropics where mosquitos breed
Infect through open wound[1] Not contagious to other humans	Infect through mosquito bite – vector is *Anopheles* mosquito Can infect others via vector
Impact: toxins lead to muscle stiffness, lockjaw [1]	Impact: toxins from merozoities & burst RBCs lead to fever, chills, aches

Question 40. [10 marks]
a. Table format:

animal	N waste product [1]	Survival advantages (must be in correct row to get marks)
Freshwater fish	ammonia	Low E cost to produce [1] Ammonia is highly soluble[1] f/water fish have an abundance of water to remove ammonia in high vol of dilute urine before toxic build-up in body [1]
magpie	Uric acid	Non-toxic, so can be stored in egg [1] Insoluble : Little water for removal, [1] so can survive where water is scarce [1]
kangaroo	urea	Less E to produce than uric acid [1] Less toxic than ammonia [1] So can be stored for short time in some water [1] Soluble, but can be concentrated in urine [1] Can pass across placenta from removal from embryo as it grows [1]

40b.
Each of 5 strategies @ 2 M each for explain, example:

- Quarantine – isolate infected individuals and prevent mosquito contact to pre, example
- Immunization – if antigen for virus is isolated, create a vaccine so immune systems of people can be 'trained' to recognize and attack virus particle
- Disruption of pathogen lifecycle eg spray vector – mosquito, prevent larva hatching by ridding country of pools of stagnant water
- Medication: antivirals to prevent virus replication
- Physical preventative measures eg wear masks, disinfect surfaces, public health advice to avoid crowds where virus particles may be transmitted eg public transport, concerts, large parties, prevent mosquito bites by wearing long-sleeved/long-legged clothing

Give 1 for public awareness campaign, but cannot score again for points apready given.