

The National Qualifying Examination (NQE) for Biology is based on the curriculum that all year 10 students will have covered. In this way, we hope to encourage all able students to participate. We do not advocate training programs to teach advanced knowledge of Biology syllabus, neither do we expect schools to prepare students for the NQE using the International Biology Olympiad (IBO) syllabus. Once students qualify for the scholar school in January, we will start to work with them and their teachers to help prepare students using the IBO syllabus.

We will therefore assess scientific enquiry skills and the content knowledge of school curriculum up to Year Ten. So we would expect all students being entered for the NQE to be competent at plotting graphs from data given and interpreting data. Mendelian genetics is included on the science curriculum documents across Australia and we expect students to know, understand and use the principles of determining genetic crosses. Once students can work out simple monohybrid crosses, we think that the more complex genetic crosses can be tackled by the more able students. Generally, we have looked at the curriculum documents and developed / used questions that extend students' reasoning. The answer scheme provided is a guide to how the papers have been marked and where students have provided cogent, plausible alternative responses, they have been credited.

We want students to be passionate about Biology and welcome their participation.

Section A & B (Multiple Choice)

Question	Answer	Question	Answer	Question	Answer	Question	Answer
Q1	A	Q20	A	Q38	200000	Q41j	T
Q2	A	Q21	D	Q39a	3	Q42a	2
Q3	E	Q22	B	Q39b	5	Q42b	9
Q4	C	Q23	C	Q39c	3	Q42c	10
Q5	D	Q24	C	Q39d	F	Q42d	4
Q6	B	Q25	B	Q39e	T	Q42e	7
Q7	D	Q26	C	Q39f	T	Q43	17000
Q8	B	Q27	D	Q40a	05.77	Q44a	F
Q9	D	Q28	E	Q40b	T	Q44b	F
Q10	D	Q29	A	Q40c	F	Q44c	T
Q11	C	Q30	B	Q41a	02.56	Q44d	F
Q12	B	Q31	B	Q41b	00.58	Q44e	F
Q13	B	Q32	C	Q41c	06.10	Q45a	1
Q14	D	Q33	E	Q41d	02.00	Q45b	2
Q15	D	Q34	A	Q41e	04.85	Q45c	7
Q16	A	Q35	B	Q41f	01.09	Q45d	13
Q17	B	Q36	16	Q41g	F	Q45e	10
Q18	D	Q37a	2.23	Q41h	T		
Q19	B	Q37b	N	Q41i	F		

Section C

Q46. Dingos and Kangaroos

a. Draw graph **(5 marks)**

b. _____

(2 marks)

c. _____

(2 marks)

Q47. Osmotic Pressure

Working:

Pressure pushing water from B \square A = 24mmHg

Pressure pushing water from A \square B = pressure generated by solute dissolved

$C = 2 \text{ mmol L}^{-1} = 2 * 10^{-3} \text{ Osms}$

$\pi = CRT$

$\pi = (2 * 10^{-3}) * 62.36367 * (273 + 24)$

$\pi = 37 \text{ mmHg}$

Therefore, pressure pushing water from A \square B = 37mmHg

37mmHg > 24 mmHg thus water will move from A to B (i.e. down the pressure gradient).

Q48. Hominid Evolution

- a. For: tools use – not associated with cognitive disabilities (1)
-
- Skull size to body size ratio differs from *Homo sapiens*, the
-
- only species thought to be around 18000 years ago (1)
-
- Against: Features patterns similar to cretins, iodine deficiency still
-
- occurs on island (1)
-
- Occurs when *Homo sapiens* only known species (1)
-

(4 marks)

- b. Known to be selective drive for small size -see eg island elephants
-

(1 mark)

- c. Volcano activity/ competition with H sapiens may have caused extinction /
-
- lack of food
-

(2 marks)

- d. Thyroid hormone for infant of iodine-deficient mother, Additive to salt or
-
- diet
-

(1 mark)

Q49. Flower genotypes

- a. 7, 8 and 9
- b. 2 and 5
- c. 4 and 9
- d. 6 and 7
- e. 4 and 6

(5 marks)

Q50. Cancer epidemiology

It takes time for mutations to build up within a single cell (1 mark), therefore an older individual is more likely to possess a cell that has collected sufficient and appropriate mutations to proliferate into a tumour/cancerous growth.

(1 mark)

Q51. Rabies vaccines

Inactivated virus (1 mark). The inactivated virus stimulates an immune response in the travellers body resulting in the generation effector cells but more importantly memory cells and hence long term immunity (1 mark) which will increase the speed with which the body can mount a response if challenged by live virus at a later time point (1 mark). Anti-rabies immunoglobulin is inappropriate as it does not prime the traveller's own immune system and immunity is short term, i.e. the lifespan of the antibodies

(1 mark)

52. Galapagos conservation

Any two valid points (examples below):

Snake may eat endemic fauna eg. Eggs and young of nesting birds

Snake may not survive due to absence of correct environment

Snake may compete for a niche occupied by endemic animal

(2 marks)

53. Leaf decomposition

Chemical reactions are effected by temperature; higher temperatures facilitate faster reactions (1 mark). Decomposers such as bacteria and fungi use enzymes to break down organic matter into components they can use, (1 mark). these reactions would be slower at lower temperatures (1 mark). Furthermore the decomposers would grow/proliferate more slowly in the colder climates near Ushuaia due to slower metabolic reactions (1 mark). The combined effect is a much greater time needed for decomposition of equivalent organic matter in the cold climates near Ushuaia compared to more equatorial

(4 marks)

54. Ames Test

a.

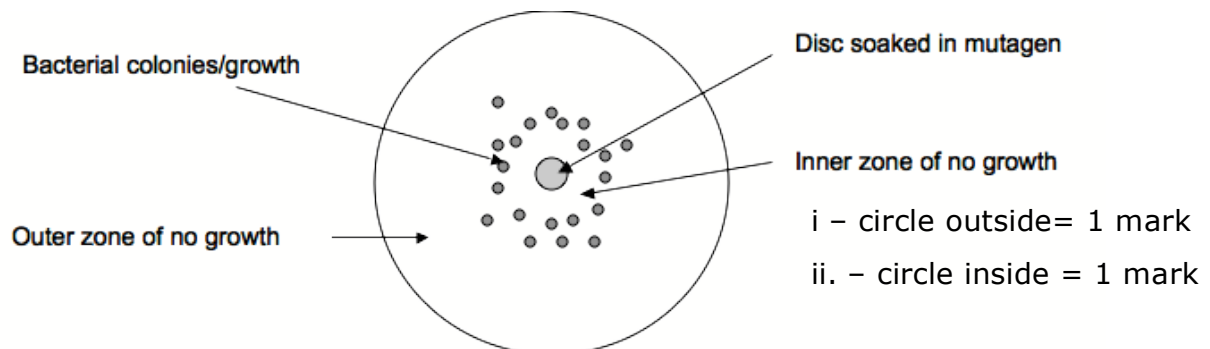
i. Mutagen concentration is so high it causes too many mutations in the bacterial DNA for them to remain viable.

(1 mark)

ii. Mutagen concentration is too low to cause mutation of the gene in the pathway of histidine synthesis, hence the bacteria can't produce histidine and can't grow

(1 mark)

b. Draw lines



(2 marks)

55. Kangaroo Rat

a. The temperature of expired air in kangaroo rats is lower than air temperature whereas in humans the temperature of expired air is significantly higher than air temperature.

(2 marks)

b. The cooling of expired air allows for condensation of water in the nose, and prevents this water being lost as vapour.

(2 marks)

c. Metabolic water. Explain that metabolisation of carbohydrates produces water as a byproduct.

(2 marks)

d. Any of: burrows underground, nocturnal or another reasonable answer

(1 mark)

56. Polypeptide alignment

a.

	a10	c9	d9	d10
c9	22			
d9	22	5		
d10	7	23	22	
abdB	35	30	31	35

(3 marks)

b. C9 and d9 (1 mark), will also except the inclusion of a10 and d10

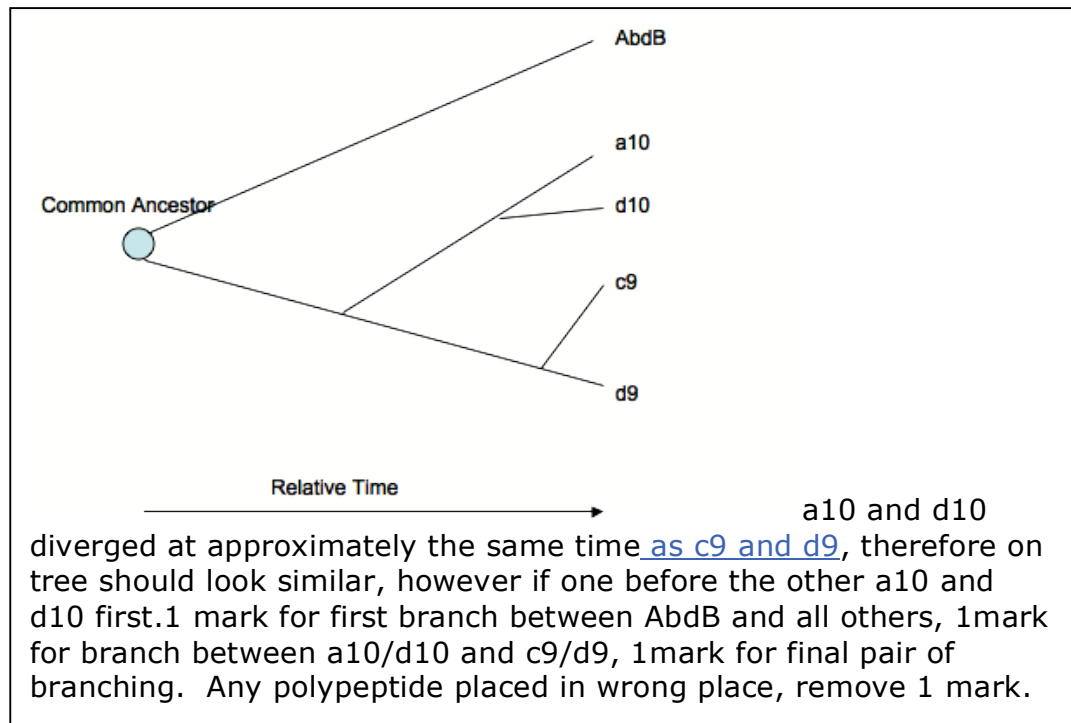
(1 mark)

c. abdB

(1 mark)



d.



(3 marks)

- e. Less similar (1 mark). Degenerate nature of the genetic code means that changes to the gene sequence may not result in changes to the polypeptide sequence, therefore the gene sequence changes more rapidly over time than the polypeptide sequence (1 mark). Bonus mark if they mention introns changing even more rapidly due to less selection pressure to maintain

(2 marks)

- f. Those regions that change the least are those that are most functionally/structurally important (1 mark), there is a selective pressure acting to maintain these regions. (1 mark)

(2 marks)