

Biology

Written examination 2



2005 Trial Examination

SOLUTIONS

SECTION A – Multiple-choice questions (1 mark each)

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

SECTION B – Short answer questions (Total 50 Marks)

Question 1

- a. i. A nucleus containing two complete sets of chromosomes.
- ii. 16
- iii. any of the chromosomes which makes up a homologous pair/any chromosome which is not a sex chromosome
- b. i. Queen has genotype **DdRr**. Drone has genotype **dr**.

ii.

Worker group	Phenotype of worker	Genotype	Expected phenotype ratio
1	Cannot open compartments and cannot remove carcasses	DdRr	1
2	Opens compartments but cannot remove carcasses	ddRr	1
3	Cannot open compartments but does remove carcasses	Ddrr	1
4	Opens compartments and removes carcasses	ddrr	1

- c. 1 hygienic ; 3 non-hygienic

Question 2

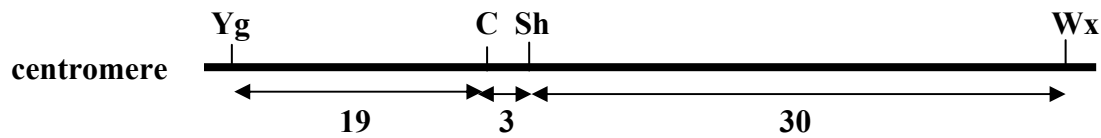
- a. i. Autosomal linkage.
- ii. C and Wx

b.

F2 Phenotype	Genotype	Number of offspring
Coloured, non-waxy	CW _x /cw _x	1542
Coloured, waxy	Cw _x /cw _x	747
Colourless, non-waxy	CW _x /cw _x	739
Colourless, waxy	Cw _x /cw _x	1510

c. i. Cross-over value = $\frac{\text{number of individuals with recombinant phenotypes}}{\text{total number of offspring}} \times 100$

ii.



Question 3

a. i Hard parts as compared with soft tissue are not subject to decomposition, and are more likely to be replaced by minerals or form casts or moulds.

ii **Method 1**

By relative dating of the age of the rocks in which they are found, as judged by the position of these rocks in the sequence of sediments.

Method 2

By using the half-life of radioactive elements in the fossil teeth to determine their absolute age **OR** by using the half-life of radioactive elements to determine the absolute age of the rocks in which they are found

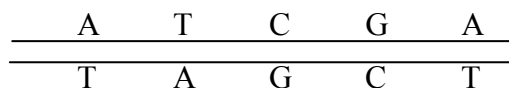
b. i Continental drift

ii Teeth found in sediments 120 million years old means the platypus was present in Australia prior to the separation of the continents.

Fossils more than 38 million years old found in South America indicate the platypus was present in South America prior to the separation of the continents.

Question 4

a. i Strands contain the nucleotides A, T, C and G; A pairs with T and C pairs with G
Bases that pair are complementary – e.g.



ii Mutation

b. i Sequence One

From Figure 1, the raccoon is most closely related to the red panda **OR** there is a difference of only one base between Sequence One and the sequence for the red panda

ii Sequence Three

From Figure 1, other bears are more closely related to the spectacled bear than the giant panda is **OR** there are only 2 base differences between Sequence Three and the common ancestor, compared with 3 in Sequence Two and the spectacled bear

- iii Polymerase chain reaction.
DNA sample is heated to separate the strands and then incubated with DNA polymerase to amplify/produce many copies of ancestral DNA
 - iv The match would not be exact; individuals of the same species can have different alleles.
Different alleles means different sequences of DNA for the same gene.
- c. i Organisms from different ancestral lines evolve similar features because of similar selection pressures/ways of life
- ii The giant panda and red panda have evolved from a common ancestor, therefore their evolution has been divergent.
 - iii These are analogous structures.
They have a similar function but have evolved from different structures/bones.

Question 5

- a. Infant mortality is at a minimum at 3.5kg, but increases steeply as birth weights get larger than 4.5kg or smaller than 2.5kg.
- b. i Frees up front feet and digits (hands and fingers) for tool use/weapon use/carrying food/babies to safe location
- OR**
- Improves surveillance of surrounding plain/habitat for spotting landmarks/prey/food/predators
- OR**
- More efficient thermoregulation – upright posture reduces surface area presented to the sun/increases air flow across the body/elevates body into cooler, less humid air
- OR**
- More energy-efficient method of locomotion for covering long distances at low speed
- ii Foramen magnum will be positioned in the centre of the base of the skull so the skull is balanced on a vertical spine
- OR**

Femur will be angled outwards from the knee/neck of femur will be angled upwards

OR

Arms (forelimbs) are relatively long compared to the legs (hindlimbs)

OR

Arched feet with forward-pointing, non-opposable big toe

iii Genetic variation means some hominids have bigger brains than others;

Increased intelligence results in better tool use/communication/co-operation OR leads to more successful hunting/gathering of food/getting mates;

Larger brained individuals have greater chance of survival and produce more offspring than smaller brained individuals;

Alleles for larger brains are passed on to the next generation and become more frequent in the population.

- c.** Evolution of increased brain volume leads to bigger-headed babies/larger birth weight;
Births are more difficult as diameter of birth canal has not increased;
Mortality of bigger-headed babies is higher;
Fewer bigger-headed babies survive to reproduce and pass on alleles for larger brains.

END