

Section A (carries 1/3 of the marks).

Essay. Answer **ONE** of questions 1-3.

1. Assess the key concepts that underpin the parsimony approach to elucidate phylogeny. How does this approach differ from other methods?
2. Discuss how Mendel's mechanism of heredity fits with Darwin's theory of natural selection. Explain why theories of pangenesis ('blending') provide inadequate mechanisms of heredity.
3. Describe the ways in which mimicry and warning colour provide demonstrations of a variety of different evolutionary modes and theories.

Section B (carries 1/3 of the marks).

Short answers. Answer **TWO** of questions 4-8.

4. A farmer estimated the heritability of seed weight in three widely separated populations of corn. In each case, the heritability was 0.60. She concludes that the differences in seed weight were largely due to genetic differences. Do you agree? Explain.
5. Describe the essential steps in a quantitative trait locus (QTL) mapping study. Identify two limitations of this approach.
6. Write a short essay describing ways in which spatial evolution can influence evolution over time, and how knowledge of spatial evolution may inform knowledge of evolution generally.
7. Phenotypic plasticity (PP) is exhibited when the same genotype produces different phenotypes in different environments. Discuss the biological and statistical methods used to analyse the evolution of PP.
8. What is a species? What major ideas about species are used by evolutionary biologists? Explain why evolutionary biologists argue so much over the nature of species.

MORE OVERLEAF

Section C (carries 1/3 of the marks). Attempt **ALL** parts.

9. The scarlet tiger moth *Panaxia dominula* is often polymorphic in UK. There are three phenotypes "dominula" (typical), "medionigra", and the melanic "bimacula," controlled by two alleles at a single autosomal locus, A; "medionigra" is the heterozygote. In an Oxford population, the numbers in 1958-9 were:

<i>dominula</i>	<i>medionigra</i>	<i>bimacula</i>
72	35	11

- Estimate the allele frequencies at the A locus.
- What are the expected genotypic frequencies at the A locus assuming Hardy-Weinberg equilibrium?
- Test whether there is a significant deviation from Hardy-Weinberg for the A locus using a chi-square test, helped by the table below.

Table of χ^2 Degrees of freedom	P values						
	0.99	0.9	0.5	0.1	0.05	0.01	0.001
1	0	0.02	0.46	2.71	3.84	6.63	10.83
2	0.02	0.21	1.39	4.61	5.99	9.21	13.82
3	0.12	0.35	2.37	6.25	7.81	11.34	16.27

- Assuming that any deviation from Hardy-Weinberg is due to inbreeding, what is the inbreeding coefficient?
Twenty male and 20 female "medionigra" from Oxford were allowed to breed together and the following offspring were counted:

<i>dominula</i>	<i>medionigra</i>	<i>bimacula</i>
36	42	21

- Assuming Mendelian inheritance, what would the expected numbers of the offspring be?
- What deviations from expected do you notice? Briefly present hypotheses to explain how this might have come about.
- On the basis of this evidence, what is the predicted future of the A locus polymorphism in Oxford? What are your assumptions?

END OF PAPER