

B242 – Question 9, model answer

Marks/25

	AA	Aa	aa	Total	
O		12	11	2	25.0000
a) p(a)=	0.3000				
p(A)=	0.7000				2
Sum(check)	1				
b) Exp Genot freqs	0.4900	0.4200	0.0900	sum(check)	2
E	12.2500	10.5000	2.2500	25.0000	
c) X ²	0.00510	0.0238	0.0278	0.0567 total chi ²	3
	No evidence for deviation from HWE			P approx 0.9 (>0.05)	
d) Figures for C exactly the same as in a-c, so chi-square and P values same					3

Working

	D= 0.146	pA= 0.7 pC= 0.7	qa= 0.3 qc= 0.3		
	Obs	ExpFreq	ExpNos	LnL	pAC= 0.636
AA CC	10	0.404496	10.1124	-9.05113	pAc= 0.064
AA Cc	2	0.081408	2.0352	-5.01656	paC= 0.064
Aa CC	2	0.081408	2.0352	-5.01656	pac= 0.236
					Sum 1
AA cc	0	0.004096	0.1024	0	
Aa Cc	8	0.308384	7.7096	-9.41128	
aa CC	0	0.004096	0.1024	0	
Aa cc	1	0.030208	0.7552	-3.49965	
aa Cc	1	0.030208	0.7552	-3.49965	
aa cc	1	0.055696	1.3924	-2.88785	
	25	1	25	-38.3827	-45.8372
					-7.45452
					-14.909

Marks/25

- e) AC gametes = $0.7 \times 0.7 = 0.49$ 3
- f) With diseq. $0.7 \times 0.7 + D$ 3
- Expected: frequency number = freq x 25
- g) AACc genotypes = $(0.7 \times 0.7 + D) \times (0.7 \times 0.7 + D) = 0.404496 \quad 10.1124$ 3
- h) AaCC genotypes = $(0.7 \times 0.7 + D) \times (0.7 \times 0.3 - D) = 0.040704 \quad 1.0176$ 3
- i) Most likely cause of disequilibrium is movement of genotypes across hybrid zone. 3
 Selection is one of the causes as to why the hybrid zone should be narrow of course.
 I gave one mark for epistasis, provided there was demonstration of a clear understanding of what it is, since this can be a cause for disequilibrium.

People did very variably on this question, varying between 2 marks (this means the student can't even calculate a gene frequency properly! And the change of gene frequencies IS evolution, so clearly there is a fundamental misunderstanding here), all the way to an essentially perfect 23 marks.