**HARDY WEINBERG QUESTIONS**

1. **Some humans have a genetic resistance to infection. A recessive allele gives increased resistance to infection by the malarial parasite. In a population, the proportion of babies born who are homozygous for this allele is 0.01. Use the Hardy-Weinberg equation to calculate the expected proportion of heterozygotes in this population.**
2. **Feather colour in one species of chicken is controlled by a pair of codominant alleles which are not sex-linked. The allele CB codes for black feathers and the allele CW codes for white feathers. Heterozygous chickens are blue-feathered. On a farm, 4% of the chickens were black-feathered. Use the Hardy-Weinberg equation to calculate the percentage of this population that you would expect to be blue-feathered.**
3. **Use the Hardy-Weinberg expression to estimate the percentages of red ladybirds and black lady birds in the Autumn 1933 ladybird population.**
4. **Two genes control the type of comb; each gene has a dominant and a recessive allele. The two genes are inherited independently, but interact to produce the four types of comb.**

**Aabb – pea**

**aaBb- rose**

**aabb – single**

**AaBb – walnut**

**Chickens with rose or single combs made up 36% of one population. calculate the frequency of allele a in this population.**

1. **The allele for Tay-Sachs disease t, is recessive to allele T, present in unaffected individuals. In a human population, one in every 1000 children born had Tay-Sachs disease. Use the Hardy-Weinberg equation to calculate the percentage of this population you would expect to be heterozygous for this gene**
2. **The allele for Rhesus positive, R, is dominant to that for Rhesus negative, r. Sixteen percent of the population of Europe is Rhesus negative. Use the Hardy-Weinberg equation to calculate the percentage of this population that you would expect to be heterozygous for the Rhesus gene.**
3. **Snail shells may be unbanded or banded. The absence or presence of bands is controlled by a single gene with two alleles. The allele for unbanded, B, is dominant to the allele for banded, b. A population of snails contained 51% unbanded snails. Use the Hardy-Weinberg equation to calculate the percentage of this population that you would expect to be heterozygous for this gene.**
4. **The dominant allele, T, codes for an enzyme. The other allele, t, is recessive and does not produce a functional enzyme. In a population of sea otters, the allele frequency for the recessive allele, t, was found to be 0.2. Use the Hardy-Weinberg equation to calculate the percentage of homozygous recessive sea otters in this population.**
5. correct answer = 0.18; And three marks for three of: p + q = 1 and p2 + 2pq + q2 = 1; 0.01 = q2 ; q = 0.1; p = 0.9 frequency of heterozygotes = 2pq = 2 × 0.1 × 0.9/ 2 × candidates p × candidates q;
6. Correct answer of 32 (%) = 3 marks. Accept: 0.32 = 2 marks If incorrect answer, allow following points 1. p2 / q2 = 4% / 0.04 / or p / q = 0.2; 2. Shows understanding that 2pq = heterozygotes / carriers; Accept: answer provided attempts to calculate 2pq. This can be shown mathematically i.e. 2 x two different numbers.
7. 49% red and 51% black; One mark for incorrect answer in which p/frequency of black allele/B is Identified as 0.3 and q/frequency of black allele/B as 0.7;
8. 0.6, however derived, scores 2 marks Wrong answer, but evidence of correct working (e.g. p /q = 0.36)
9. range of 5.8 − 6.2% = 3 marks;;; Answers in range of 0.058 - 0.062 = 2 marks If incorrect answer, then 2 max of following points (1) q2 or p2 or tt = 0.001 or 1 divided by 1000 (2.) p or q or T = 0.968 − 0.97 (3) Understanding that heterozygous = 2pq - This can be shown mathematically ie 2 × two different numbers 3. Accept: answer provided attempts to calculate 2pq
10. 48(%) = 3 marks;;; q 2 /p2= 16%/0.16 / p/q = 0.4; Shows that 2pq = heterozygotes/carriers; Final answer of 0.48 = 2 marks Allow mark for identifying heterozygotes if candidate multiplies incorrect p and q values by 2
11. 42% = 3 marks Answer of 0.42 = 2 marks Award one mark maximum for answer of 49.9 / 49.98 / 50% or 0.49 / 0.5 2. q2 = 0.49 / 49% OR q = 0.7 / 70% Award one mark maximum for answer of 40.8 / 41% or 0.41 3. Shows understanding that 2pq = heterozygotes / carriers / shows answer is derived from 2pq; Accept: b2 = 0.49 / 49% or b = 0.7 / 70% for mark point 2
12. 4;; One mark for calculation involving 0.2 × 0.2 or 0.04;