D3.2 Inheritance (HL)

What the Cell · DP Biology · worksheet · HL statements D3.2.16–21

Name _____ **Date** _____ **Total** _____ / 40

About 40 minutes, or one section at a time. The number of marks shows how many separate points to make. A chi-squared table is not needed: use 7.81 as the critical value for 3 degrees of freedom at p = 0.05.

Section A: Recall

8 marks

1 **Define** linked genes. D3.2.19 **[1]**

2 **List** the gametes made by a plant with genotype TtRr, where the genes are unlinked. D3.2.16 **[1]**

3 **State** the expected phenotype ratio of a test cross between AaBb and aabb, where the genes are unlinked. D3.2.17 **[1]**

4 **Define** recombinant. D3.2.20 **[1]**

5 **State** the stage of meiosis in which independent assortment happens. D3.2.16 **[1]**

6 **State** how the degrees of freedom are calculated in a chi-squared test. D3.2.21 **[1]**

7 **Draw** the notation for an individual heterozygous for two linked genes, with A and B on the same chromosome. D3.2.19 **[2]**

Section B: Understanding

14 marks

8 **Explain** how the behaviour of chromosomes in meiosis produces a 9:3:3:1 ratio in a dihybrid cross. D3.2.16, D3.2.17 **[4]**

9 In tomatoes, red fruit (R) is dominant to yellow (r) and tall (T) is dominant to dwarf (t). The genes are unlinked. **Predict**, using a Punnett grid, the phenotype ratio from RrTt × Rrtt. D3.2.17 **[3]**

10 **Explain** why linked genes do not assort independently. D3.2.19 **[2]**

11 **Explain** how recombinants can arise from linked genes. D3.2.20 **[3]**

12 The human genes HBB and HBD lie next to each other on chromosome 11. **Predict** how often their alleles would be separated by crossing over, and explain. D3.2.18 **[2]**

Section C: Working with evidence

12 marks

All data in this section are invented for practice. The patterns are realistic.

13 D3.2.20, D3.2.21

In maize, coloured seeds (C) are dominant to colourless (c) and smooth seeds (S) are dominant to wrinkled (s). A plant heterozygous for both genes was crossed with a plant homozygous recessive for both. The offspring were:

Phenotype	Coloured, smooth	Colourless, wrinkled	Coloured, wrinkled	Colourless, smooth	Total
Observed	168	162	36	34	400

a **State** the expected number in each class if the genes were unlinked. **[1]**

b **State** a null hypothesis for this test. **[1]**

c **Calculate** the chi-squared value. Show your working. **[3]**

d **Deduce**, with a reason, whether the null hypothesis should be rejected. **[2]**

e **Identify** the recombinant classes and calculate the percentage of recombinants. **[2]**

f **Draw** the genotype of the heterozygous parent using linkage notation. **[1]**

g **Explain** why the recombinant classes are small. **[2]**

Section D: Longer answer

6 marks

14 **Distinguish** between the results of test crosses involving two unlinked genes and two linked genes, explaining the differences. D3.2.16, D3.2.19, D3.2.20 **[6]**

What the Cell. Original questions written for this course.