



Inheritance: practice questions

5 questions · 16 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name

Total / 16

1 PAPER 1A STYLE [1 mark]

Pink-flowered four o'clock plants (*Mirabilis jalapa*) are self-pollinated. Which ratio of offspring phenotypes is expected?

- A. ☐ 3 red : 1 white
- B. ☐ 1 red : 2 pink : 1 white
- C. ☐ All pink
- D. ☐ 9 red : 3 pink : 3 white : 1 other

2 PAPER 1A STYLE [1 mark]

A woman who is a carrier of haemophilia has children with a man who does not have haemophilia. What is the probability that their first child is a son with haemophilia?

- A. ☐ 0
- B. ☐ 0.25
- C. ☐ 0.5
- D. ☐ 1.0

3 PAPER 2A STYLE

[3 marks]

The table describes part of a family pedigree for a rare genetic condition. Deduce, with reasons, whether the allele causing the condition is dominant or recessive, and whether it is autosomal or sex-linked.

Individuals in the pedigree			
Individual	Sex	Affected?	Parents
I-1	Male	No	Not shown
I-2	Female	No	Not shown
II-1	Female	Yes	I-1 and I-2
II-2	Male	No	I-1 and I-2
II-3	Male	Yes	I-1 and I-2

4 PAPER 1B STYLE

[5 marks]

Students measured the heights of two groups of 16-year-olds. The table summarises the results (data for practice). (a) Calculate the interquartile range for group X. [1] (b) Determine whether a student of 188 cm in group X would be an outlier. Show your working. [2] (c) Compare the two groups. [1] (d) Suggest why height shows continuous variation. [1]

Height (cm)					
Group	Minimum	Q1	Median	Q3	Maximum
X	151	162	168	172	188
Y	149	155	160	166	176

Answer =

Explain how phenylketonuria (PKU) is inherited, and why a heterozygous person does not have the condition.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B [1]

2. [1]

B B [1]

3. [3]

- recessive because II-1 / II-3 is affected but neither parent (I-1, I-2) is [1]
- so both parents must be carriers / heterozygous [1]
- autosomal because a daughter (II-1) is affected while her father (I-1) is not [1]
- if X-linked recessive, an affected daughter's father would have to be affected [1]
- [max 3]

4. [5]

- (a) $172 - 162 = 10$ cm [1]
- (b) $1.5 \times 10 = 15$; $172 + 15 = 187$ cm (ECF) [1]
- (b) $188 > 187$ so it is an outlier [1]
- (c) group X has a higher median (168 vs 160 cm) OR group Y has a larger IQR / spread (11 vs 10 cm) [1]
- (d) polygenic / controlled by many genes [1]
- (d) and environmental factors such as nutrition [1]
- [max 5]

5. [6]

- PKU is caused by a recessive allele [1]
- of an autosomal gene / gene not on a sex chromosome [1]
- gene codes for the enzyme that converts phenylalanine to tyrosine [1]
- affected individuals are homozygous recessive / pp [1]
- two carrier / heterozygous parents have a 0.25 / 1 in 4 chance of an affected child [1]
- shown with a Punnett grid: Pp $\times$ Pp gives PP, Pp, Pp, pp [1]
- heterozygote has one dominant allele coding for functional enzyme [1]
- one allele produces enough enzyme to convert phenylalanine [1]
- so heterozygote has the same phenotype as homozygous dominant / is a carrier [1]
- phenylalanine builds up in affected individuals damaging the brain unless a low-phenylalanine diet is followed [1]
- [max 6]