Model Answers: Easy

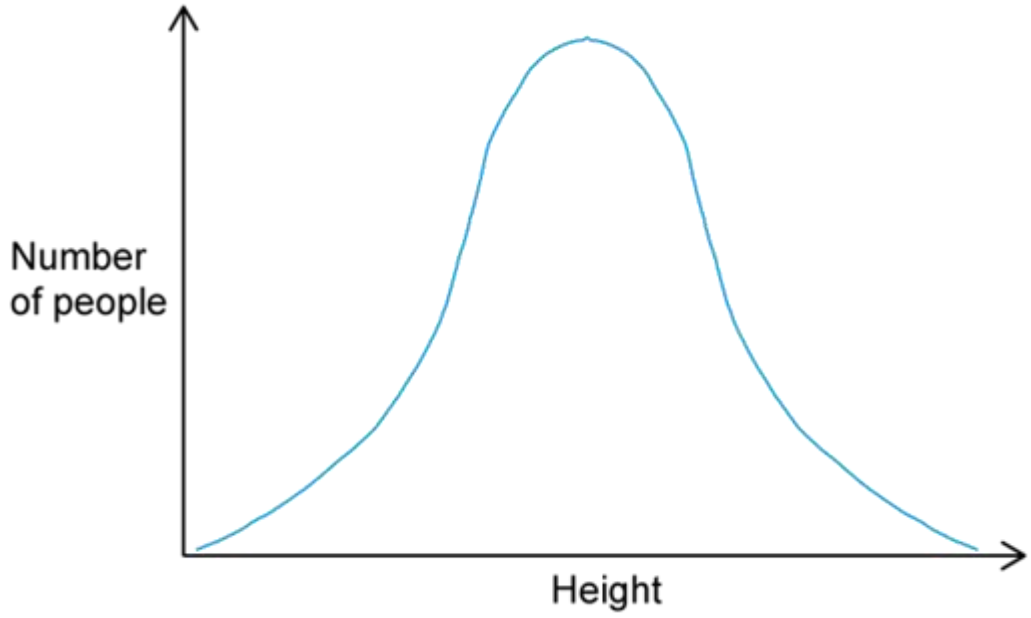
1a

(a) The sketch should appear as follows:

- A line graph (not a bar chart); [1 mark]
- A normal distribution / bell-shaped curve; [1 mark]

[Total: 2 marks]

Most people in the population are 'average height' with a smaller minority existing at the extremes of being tall and short.



1b

(b) The type of variation shown is...

- Continuous variation; [1 mark]

[Total: 1 mark]

Continuous variation can exist in a range of many values and can be plotted on a graph with a normal distribution curve.

1c

(c) The factors that causes variation in hair colour is:

- (Hair colour) can be determined genetically / inherited / coded by DNA/alleles; [1 mark]
- (Hair colour) can be influenced by the environment eg. sunlight exposure / hair dye; [1 mark]

[Total: 2 marks]

1d

(d) The scientific term for when a characteristic is coded for by more than one gene is:

- Polygenic characteristic; [1 mark]

[Total: 1 mark]

2a

(a) The correctly completed Table 1 is as follows...

Organism	Characteristic
human	brown eyes
human	expresses the CFTR protein*
plant	contains gene for two-tone leaves
fungi	red and white spotted fruiting cap (mushrooms)

[Total: 4 marks]

Brown eyes and the spotted mushroom cap are obvious examples of an organism's outward appearance, so are clearly phenotypic traits.

The possession of a gene though, is an organism's genotype. A plant may possess a gene for two-tone leaves but the leaves will only be two-tone if the gene is expressed. Possession of a gene does not make that trait part of the phenotype.

Expression of a gene, like the CFTR gene, is not necessarily visible to a casual observer. However, this still counts as phenotype because the gene is expressed in order for the CFTR protein to be present in a person's airways.

A common misconception is that phenotypes are always visible from the outside of an organism; they are not always!

2b

(b) Environmental factors that can affect an organism's phenotype are:

Animal examples

One from:

- Sunburn / sun tan; [1 mark]
- Artificial hair / eye colour; [1 mark]
- Diet / water intake; [1 mark]
- Temperature; [1 mark]
- Effect of chemicals / drugs; [1 mark]
- Sports / bodybuilding etc; [1 mark]

Allow any plausible environmental factor and its effect on animals

Plant examples:

One from:

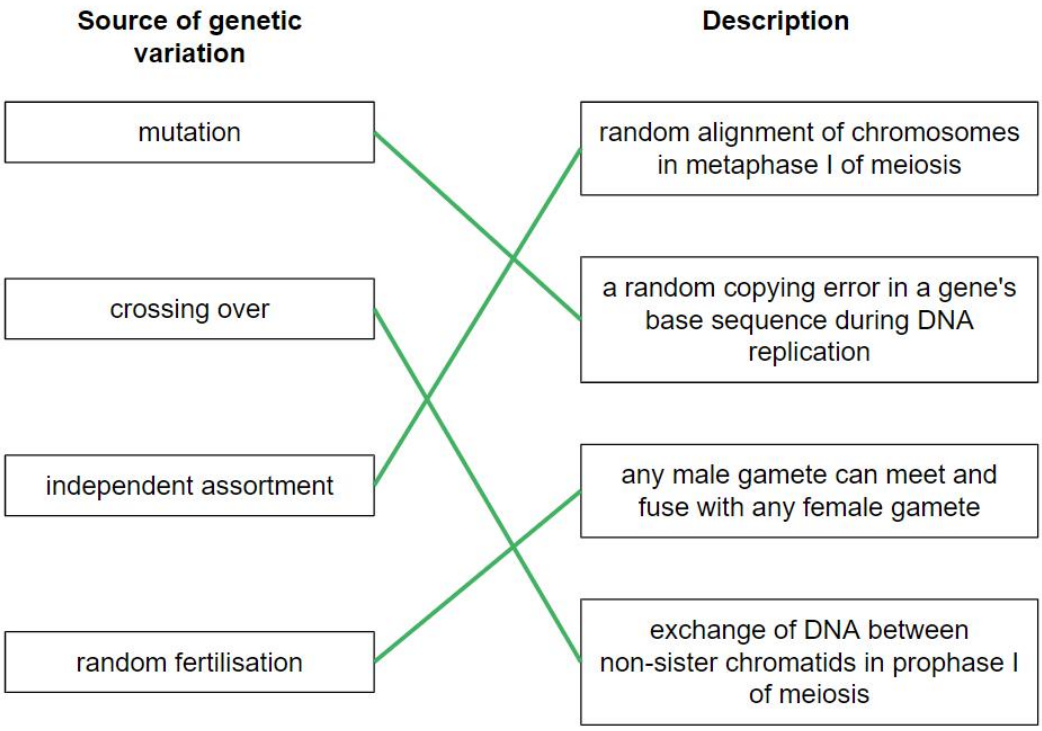
- Temperature; [1 mark]
- pH / mineral content (of soil); [1 mark]
- Light intensity; [1 mark]
- Wind direction / speed; [1 mark]
- Availability of water; [1 mark]

Allow any plausible environmental factor and its effect on plants

[Total: 2 marks]

2c

(c) The correct linking of the boxes is shown below:



[1 mark] for each correct line

[Total: 4 marks]

This is a synoptic question which links to Topic 16.1.4 Meiosis in Animal & Plant Cells.

2d

(d) A mutation may not necessarily bring about a change in an organism's phenotype because:

Any **one** of the following:

- The mutation is not expressed / occurs in a region of non-coding DNA / an intron; [1 mark]
- The mutation does not code for a different amino acid / so the same protein is synthesised; [1 mark]
- The mutation causes an unimportant/insignificant change to the protein's structure (and does not affect its function); [1 mark]
- The organism may possess an unmutated, dominant allele that is still expressed in the phenotype / the organism may become heterozygous dominant; [1 mark]

[Total: 1 mark]

3a

(a) A null hypothesis is a statement...

- That the expected result will show no significant difference between two means; [1 mark]
- That any differences seen are due to chance; [1 mark]

[Total: 2 marks]

3b

(b) Before calculating the t-value between two sets of data, the two statistical calculations that must be performed on each set of raw data are:

- Mean / $\bar{x}$; [1 mark]

- Standard deviation / S / s.d.; [1 mark]

[Total: 2 marks]

3c

(c) The relationship between the size of the calculated t-value and the probability of a difference between two data sets having occurred by chance is:

- The greater the t-value calculated (for any degree of freedom)...; [1 mark]
- ...the lower the probability of chance (causing any significant difference between the two sample means); [1 mark]

Allow converse argument, inverse relationship/correlation

[Total: 2 marks]

3d

(d) The null hypothesis would be:

- Rejected; [1 mark]
- Because the t value is **greater/higher** than the 5% confidence level critical value (of 2.26); [1 mark]

[Total: 2 marks]

Degrees of freedom	Value of t			
1	6.31	12.7	63.7	63.6
2	2.92	4.30	9.93	31.6
3	2.35	3.18	5.84	12.9
4	2.13	2.78	4.60	8.61
5	2.02	2.57	4.03	6.87
6	1.94	2.45	3.71	5.96
7	1.90	2.37	3.50	5.41
8	1.86	2.31	3.36	5.04
9	1.83	2.26	3.25	4.78
10	1.81	2.23	3.17	4.59
Probability that chance could have produced this value of t	0.10	0.05	0.01	0.001
Confidence level	10%	5%	1%	0.1%

For a value of t calculated to be 3.15 at 9 degrees of freedom, state whether you would accept or reject the null hypothesis at a 5% confidence level.

Step 1: look for the 5% critical value at 9 degrees of freedom = 2.26 [1 mark]

Step 2: is our calculated t value higher than 2.26?

Yes: 3.15 > 2.26, therefore Reject the null hypothesis [1 mark]