17.1 Variation

Question Paper

Course	CIE A Level Biology
Section	17. Selection & Evolution
Topic	17.1 Variation
Difficulty	Easy

Time allowed: 30

Score: /25

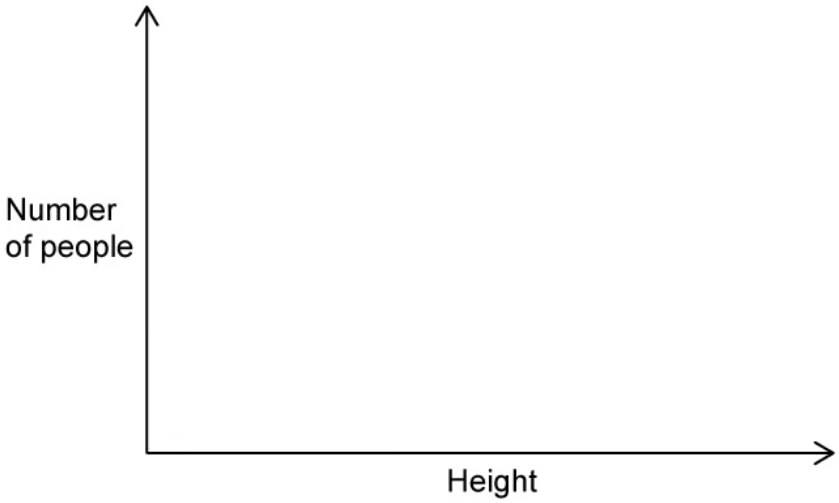
Percentage: /100

Question 1a

A group of 1000 people were chosen at random and surveyed as part of a population study. The participants were asked about their characteristics.

One characteristic that was surveyed was the participant's height measurements.

Sketch a graph in the space below to predict the distribution of individuals height values.



[2 marks]

Question 1b

Name the type of variation shown in the example in part (a).

[1 mark]

Question 1c

Another characteristic that was surveyed was hair colour.

It was found that most individuals had black, brown, blond or ginger hair, but a small number of individuals had hair colours like pink, blue and green.

Describe the factors that can cause variation in hair colour.

[2 marks]

Question 1d

Some characteristics that are more likely to be examples of continuous variation are those that are coded for by several genes that work in combination to produce the phenotype.

State the scientific term used for this type of characteristic.

[1 mark]

Question 2a

Table 1 shows four characteristics displayed by various organisms.

Table 1

Organism	Characteristic	Phenotypic characteristic? (✓/✗)
human	brown eyes	
human	expresses the CFTR protein*	
plant	contains gene for two-tone leaves	
fungi	red and white spotted fruiting bodies (mushrooms)	

* the CFTR protein is an important ion channel protein associated with clearing mucus in the airways; cystic fibrosis sufferers produce a faulty copy of this protein

Place a tick (✓) in the box(es) in the final column that describe **phenotypic** characteristics and a cross (✘) in the other characteristic(s).

[4 marks]

Question 2b

State **two** environmental factors that can affect an organism's phenotype.

Give **one** example from the animal kingdom and **one** from the plant kingdom.

[2 marks]

Question 2c

Fig. 1 lists the four main sources of genetic variation within a population.

Source of genetic variation	Description
Mutation	Random aligment of chromosomes in metaphase I of meiosis
Crossing over	A random copying error in a gene's base sequence during DNA replication
Independent assortment	Any male gamete can meet and fuse with any female gamete
Random fertilisation	Exchange of DNA between non-sister chromatids in prophase I of meiosis

Fig. 1

Link each source of genetic variation to its description with a straight line.

[4 marks]

Question 2d

Explain how a mutation may not necessarily bring about a change in an organism's phenotype.

[1 mark]

Question 3a

Before performing a statistical test such as the t-test, a null hypothesis must be formed.

State what is meant by a null hypothesis.

[2 marks]

Question 3b

Before calculating the t-value between two sets of data, state the **two** statistical calculations that must be performed on each set of raw data.

[2 marks]

Question 3c

State the relationship between the size of the calculated t-value and the probability of a difference between two data sets having occurred by chance.

[2 marks]

Question 3d

Table 1 shows a table of critical values for the t-test which compared the number of leaves of shrubs of the same species growing in different habitats.

The null hypothesis states that the habitat has no significant effect on the number of leaves per shrub.

Table 1

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.

Give a reason for your answer.

[2 marks]