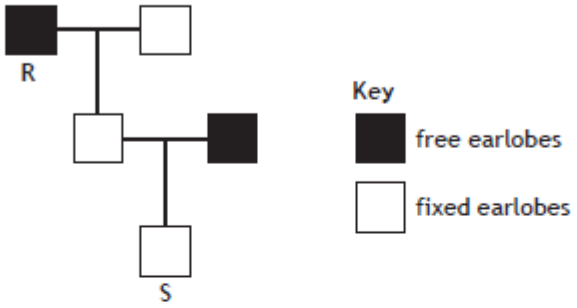
Unit 2 Multicellular Organisms

Key Area 4 Variation and Inheritance

1. In humans the inheritance of earlobe type is an example of discrete variation. The allele for free earlobes (E) is dominant to the allele for fixed earlobes (e). The diagram below shows the inheritance of this characteristic.



Which line in the table below correctly identifies the genotypes of individuals R and S?

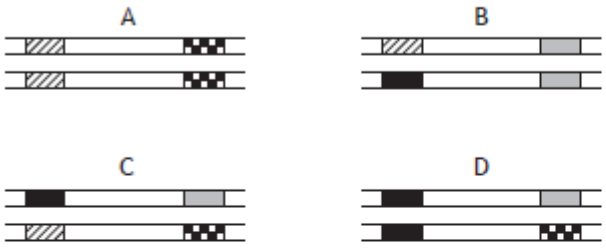
	Genotype	
	R	S
A	EE	ee
B	Ee	ee
C	Ee	Ee
D	ee	EE

2. Variation in a characteristic can either be discrete or continuous. The range of heights and weights for a group of students were measured and recorded. Ear lobe types were also examined and categorised into groups.

Which line in the table below identifies the type of variation shown by each of these human characteristics?

	Height	*Weight*	*Ear lobe types*
A	continuous	continuous	discrete
B	discrete	continuous	continuous
C	discrete	discrete	continuous
D	continuous	discrete	discrete

3. The diagrams below show the same sections of matching chromosomes found in four flies, A, B, C and D.



The alleles shown on the chromosomes can be identified using the following key.

- allele for striped body
- allele for unstriped body
- allele for normal antennae
- allele for abnormal antennae

Which fly is homozygous for body pattern and heterozygous for antennae type?

4. The following diagram shows the inheritance of coat colour in guinea pigs.

P Phenotype Black guinea pig X White guinea pig

P Genotype: BB bb

F1 Genotype: Bb

F2 Genotypes: BB and Bb and bb

Which of the following generations contain heterozygous individuals?

A P and F1

B P and F2

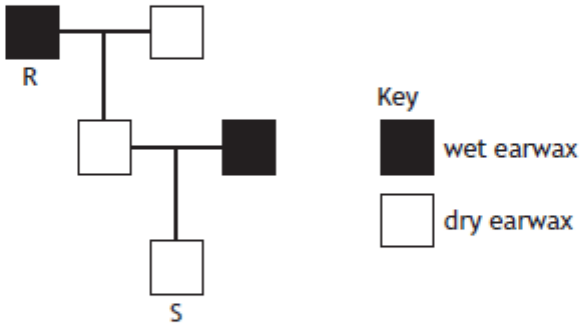
C F1 and F2

D P, F1 and F2

5. An individual who possesses two different alleles for a particular gene would display a

A recessive phenotype
B recessive genotype
C dominant phenotype
D dominant genotype.

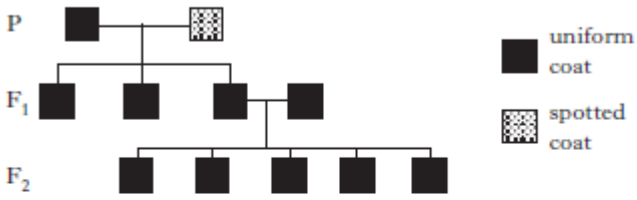
6. In humans the inheritance of wet or dry earwax is an example of discrete variation.
The allele for wet earwax (E) is dominant to the allele for dry earwax (e).
The diagram shows the inheritance of this characteristic.



Which row in the table identifies the genotypes of individuals R and S?

	Genotype	
	Individual R	*Individual* S
A	EE	ee
B	Ee	ee
C	Ee	Ee
D	ee	EE

7. In dogs, uniform coat colour is dominant to spotted coat.



From the family tree above, in which generation(s) are all the dogs heterozygous for coat colour?

A P only
B F_1 only
C F_2 only
D P and F_1

8. Hair type in humans is controlled by a single gene. The dominant form is curly hair (H). The recessive form (h) produces straight hair.

Both parents of this curly-haired child have the genotype Hh.

(a) What term is used to describe the genotype of both parents? 1

_____

(b) Complete the Punnet square to show the possible genotypes of their offspring. 1

		Male gametes	
		H	h
Female gametes	H		
	h		

(c) State the possible genotype(s) of the girl in the picture. 1

_____

Total marks 3

9.

Coat colour in Labrador dogs is an inherited characteristic. Black coat (B) colour is dominant to chocolate coat colour (b).

(a) A homozygous black Labrador was crossed with a Labrador with a chocolate coloured coat.

Complete the diagram below to show the genotypes of each of the parents and the F_1 phenotype. 2

Parents:	black coat	X	chocolate coat
Genotypes:			
F_1 genotype:		All Bb	
F_1 phenotype:			

(b) (i) Explain what is meant by polygenic inheritance. 1

_____

_____

(ii) State the type of variation shown by polygenic inheritance. 1

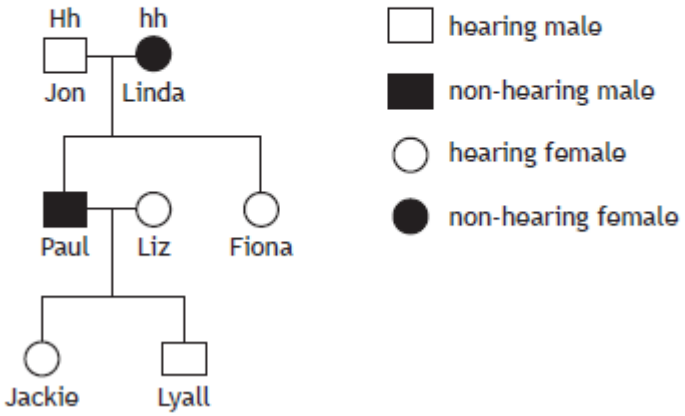
_____

Total marks 4

10. (a) One type of deafness in humans is caused by a single gene.

The diagram below shows the pattern of inheritance in one family.

H represents the hearing form of the gene.
h represents the non-hearing form of the gene.



(i) Using Jon as an example, explain how it is known that the hearing form of the gene is dominant. 1

_____

_____

(ii) Use information in the family tree to complete the following table to show the genotype and phenotype of each individual. 2

Individual	*Genotype*	*Phenotype*
Paul		
Lyall		

(iii) Fiona has a child with a man who has the same genotype as her. State the chance of their child being able to hear. 1

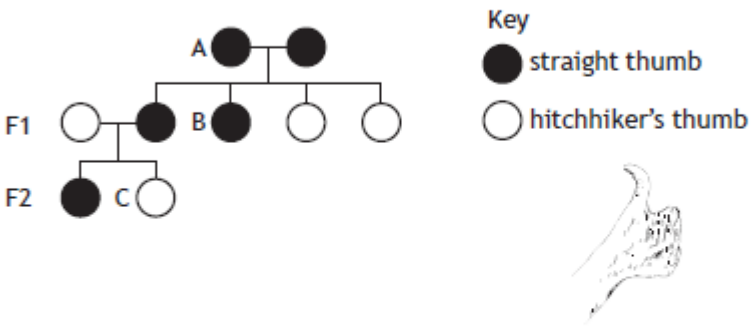
(b) Most features of an individual's phenotype are controlled by more than one gene.

Name this type of inheritance. 1

_____

11.

The following diagram represents part of a family tree showing the inheritance of hitchhiker's thumb, where the thumb can bend back as shown below.



(a) Complete the table below for individuals A and C. 2

Individual	*Possible Genotype(s)*	*Phenotype*
A		straight thumb
B	TT or Tt	straight thumb
C	tt	

(b) In a survey of 90 students it was found that 25 of them had hitchhiker's thumb.

(i) Calculate the number of students with straight thumb to hitchhiker's thumb as a simple, whole number ratio. 1

Space for calculation

_____ : _____

straight thumb : hitchhiker's thumb

(ii) The predicted ratio was 3 straight thumb : 1 hitchhiker's thumb.

Explain why the predicted ratio was different to the actual ratio. 1

_____

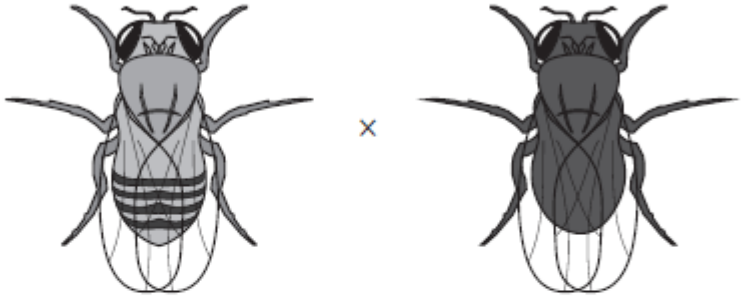
_____

12.

Chromosomes contain the genetic information responsible for variation amongst members of a species.

Fruit flies can have either a grey or black body colour.

The parent flies used in a cross are shown in the diagram.



Genotype:	GG	×	gg
Phenotype:	Grey body		Black body

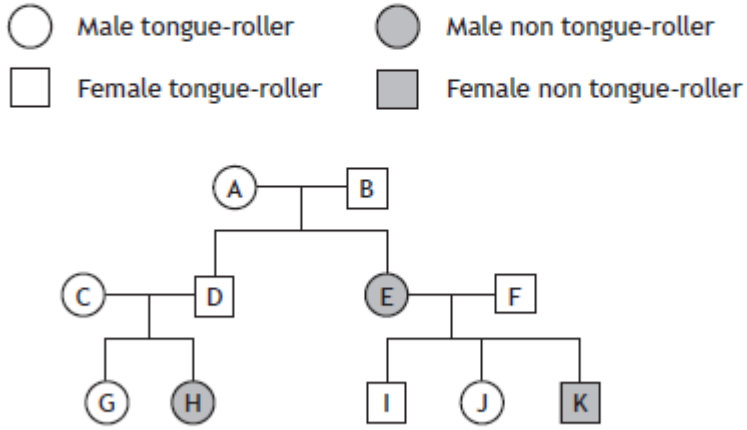
(a) Using the information given, underline one option in each bracket to complete the following sentences. 2

Body colour in fruit flies is an example of { discrete / continuous } variation.

The F_1 flies produced from this cross will be { homozygous / heterozygous }.

13. (a) Tongue-rolling is an inherited characteristic controlled by different forms of a gene. T (roller) represents the dominant form of the gene, and t (non-roller) represents the recessive form.

The family tree diagram shows a pattern of inheritance of the characteristic.



(i) Use letters from the diagram to identify all the individuals in the F_2 generation. 1

_____

(ii) Give the genotypes of individuals E and F. 2

E _____ F _____

(iii) Complete the Punnett square to show the gametes and expected genotypes of the offspring of E and F. 2

		Genotype of gametes from F	
Genotype of gametes from E			

(b) State the type of variation shown by tongue-rolling. 1

_____

14.

Border collie dogs can have "stand up" ears, "flop down" ears or "mid way" ears. Ear type is controlled by a single gene which has two alleles.

A true breeding "stand up" ears Border collie was crossed with a true breeding "flop down" ears Border collie.

Patch
"stand up" ears

Flossie
"flop down" ears

All the Border collies in the F_1 generation had "mid way" ears.

(*a*) Using the letter **S** for "stand up" ears and the letter **D** for "flop down" ears, give the genotypes of Patch, shown above, and a Border collie from the F_1 generation.

Patch's genotype _____ **1**

F_1 genotype _____ **1**

(*b*) Calculate the expected phenotype ratio if two Border collies from the F_1 generation were crossed.

Space for working

Phenotype ratio _____ (mid way) : _____ (stand up) : _____ (flop down) **1**

15.

Sorghum is an important food crop in some parts of the world.

The colour of the seed husk (coat) is controlled by a single gene.

Purple husk colour (H) is dominant to tan husk colour (h).

(*a*) A true breeding purple husk plant is crossed with a true breeding tan husk plant.

(i) What other term is used in genetics to indicate true breeding?

Circle the correct term below.

heterozygous polygenic homozygous recessive **1**

(ii) Complete the genotypes of the parental (P) generation below:

P purple X tan

P genotypes _____ _____ **1**

(iii) State the phenotype(s) of the F_1 plants.

F_1 phenotype(s) _____ **1**

(*b*) An individual from the F_1 generation is crossed with a true breeding tan husk plant.

(i) Complete the Punnett square to show the expected results of this cross.

	Genotypes of gametes from F_1 plant	
Genotype of gametes from tan husk plant		

2

(ii) State the expected phenotype ratio for the offspring of this cross.

_____ : _____

purple tan **1**