1 (a) Many species of insects have evolved resistance to chemical

insecticides. Three different patterns of resistance in insect species **R**, **S** and **T** are shown in Fig. 6.1.

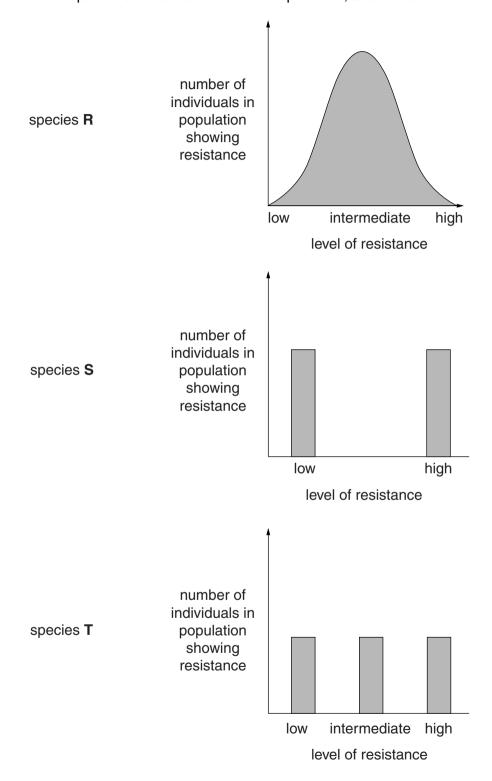


Fig. 6.1

(i)	Complete the table below with the letter(s), R, S and T, to indicate which species show a
	continuous pattern of variation and which species show a discontinuous pattern.

	Discontinuous	Continuous
Species identified by letter		

[2]

(ii) A student noted a number of statements on his revision card that referred to the patterns of resistance shown in species **R**, **S** and **T** in Fig. 6.1.

Revision card - patterns of resistance

- 1. It's controlled by a single gene
- 2. There is an additive effect
- 3. May involve multiple alleles
- 4. Heterozygote shows a distinct phenotype
- 5. It's controlled by many genes (polygenic)
- 6. Involves a dominant and a recessive allele
- 7. Shows co-dominance or incomplete dominance
- 8. Involves just two alleles

Complete Table 6.1 below, by selecting the correct numbered statement(s) that explain the genetic basis of each pattern of resistance for each species.

You may select a number more than once.

Species	Statement number(s)
R	
S	
Т	

Table 6.1

[6]

(b) Dog fleas are small parasitic insects that live in the fur of dogs and feed on their blood. Dogs are routinely treated with sprays or powders to kill fleas.

A vet believes that dog fleas may have become resistant to a popular flea-killer product.

He asks an A-level work experience student to plan an experiment to test this hypothesis.

The student needs to sample fleas from dogs visiting the surgery and also fleas from long grass in fields visited by dog-walkers. The fleas then need to be tested for resistance to the flea-killer.

Describe the methods the student could use to:

- collect both samples of fleas
- find out the proportion of fleas that are resistant
- process the data.

Ø	∌ II	n your rocess	answ	ver yo a logi	ou sh cal se	nould eries d	desc of ste _l	ribe os.	the	metho	ds fo	or cc	llectio	n, te	esting	and	data
															•••••		
															•••••		
																	[7]

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- 2 Living organisms can be classified into five kingdoms, based on certain key characteristics.
 - (a) Table 2.1 shows some of the characteristics of the five kingdoms.

Complete the table.

Table 2.1

kingdom	membrane-bound organelles	cell wall	type(s) of nutrition
prokaryote	absent	present – made of peptidoglycan	
	present	sometimes present – composition varies	heterotrophic and autotrophic
fungi		present – made of chitin	heterotrophic
	present		autotrophic
animal		absent	heterotrophic

		'						[6]
(b)		own species is discovered of thread-like structure		contain ma	ny nuclei	scattered	throughout	the
	Suggest to	he kingdom to which this	s species belo	ongs.				
								[1]

(c)	Living organisms can also be classified into three groups called domains .
	Outline the features of this system of classification compared with the five kingdom system.
	[3]
	[10tal. 10]

		nammals that car and waves (echol				
a)	Suggest how that abilit	he ability to use y.	echolocation ma	ay have evolved	from an ancesto	r that did not
						[4]
	pipistrelles bel was decided th	is the most com longed to the sai nat there were tw pistrelle, <i>Pipistre</i>	me species, <i>Pip</i> o species: the c	istrellus pipistrell	lus. However, in	the 1990s, it
	Data for both s	species are provi	ded in Table 3.1.			
			Table 3.1			
	species	mean body mass (g)	mean wingspan (m)	range of echolocation call (kHz)	colour	

species	mean body mass (g)	mean wingspan (m)	range of echolocation call (kHz)	colour
common pipistrelle	5.5	0.22	42–47	medium to dark brown
soprano pipistrelle	5.5	0.21	52–60	medium to dark brown

(b) (i)	Name the genus to which the soprano pipistrelle belongs.
	[1]
(ii)	Using the data in Table 3.1, suggest why pipistrelles were originally classified as one species.
	[1]
(iii)	State two pieces of molecular evidence that can be used to identify organisms as belonging to different species.
	[2]
(iv)	Describe how it is possible to confirm, over a longer period of time, whether two organisms belong to different species or the same species.
	[2]

(c)	The soprano pipistrelle has an echolocation call that is 'high pitched' (between 52 and $60\mathrm{kHz}$). The common pipistrelle has an echolocation call that is 'low pitched' (between 42 and $47\mathrm{kHz}$).
	Variation within and between species can be as a result of genetic or environmental factors. Whatever the causes of variation, the type of variation displayed can occur in two different forms .
	Using the pipistrelle as an example, describe the key features of both forms of variation.
	In your answer you should make it clear how genes and environment relate to each form of variation.
Physi	icsAndMathsTutor.com [7]

[Total: 17]



kaka (Nestor meridionalis)



kea (*Nestor notabilis*)



kakapo (Strigops habroptila)

Fig. 4.1

	•	stem used by scientists for classifying living things has developed from the original ation system proposed by Carl Linnaeus around 250 years ago.
(a)	Cor	nplete the following paragraph by using the most appropriate term(s).
	The	system of classifying organisms according to their observable features or genetic
	cha	racteristics is called Organisms are classified into
	larg	e groups which are then subdivided into increasingly smaller groups. A system such as
	this	is called a
	rela	tionship between organisms is[3]
(b)		v Zealand is made up of two large and many smaller islands and is situated a long distance n any other land mass.
	In N	lew Zealand there is a large variety of birds not found elsewhere in the world.
	Am	ong its many species of the parrot family, Psittacidae, are:
		 kaka (Nestor meridionalis) kea (Nestor notabilis) kakapo (Strigops habroptila)
	The	se birds are shown in Fig. 4.1 on the insert.
	(i)	State two characteristics that birds, such as parrots, share with other members of the animal kingdom.
		1
		2 [2]
	(ii)	Name the domain to which the parrot belongs.
		[1]

4

(iii)	Species that are more closely related in evolutionary terms have more genes in common than species that are less closely related.
	Using the information provided, suggest the likely genetic relationship between the three parrot species.
	[4]

(c)		kakapo is one of the world's largest and rarest parrot species. The variation in mass of lt birds in the kakapo population has been reported to be between 950 g and 4000 g.
	(i)	Define the term <i>variation</i> .
		[2]
	(ii)	Suggest two reasons why the kakapo varies in size.
		1
		2[2]
	(iii)	Suggest two reasons why the reported mass range for the adult kakapo may not be accurate.
		1
		2
		[2]
(d)		some point in the past, distinct species of New Zealand parrot are likely to have arisen an original ancestral population.
		te the name of the process by which new species arise and suggest the mechanisms essary for this process to occur.
	nan	ne of process
	med	chanisms necessary for this process to occur
		ra-