Gold Paper

Question Paper 3

Level	A Level
Subject	Biology
Exam Board	OCR
Paper	Gold Paper
Booklet	Question Paper 3

Time allowed: **59 minutes**

Score: **/44**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

(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.

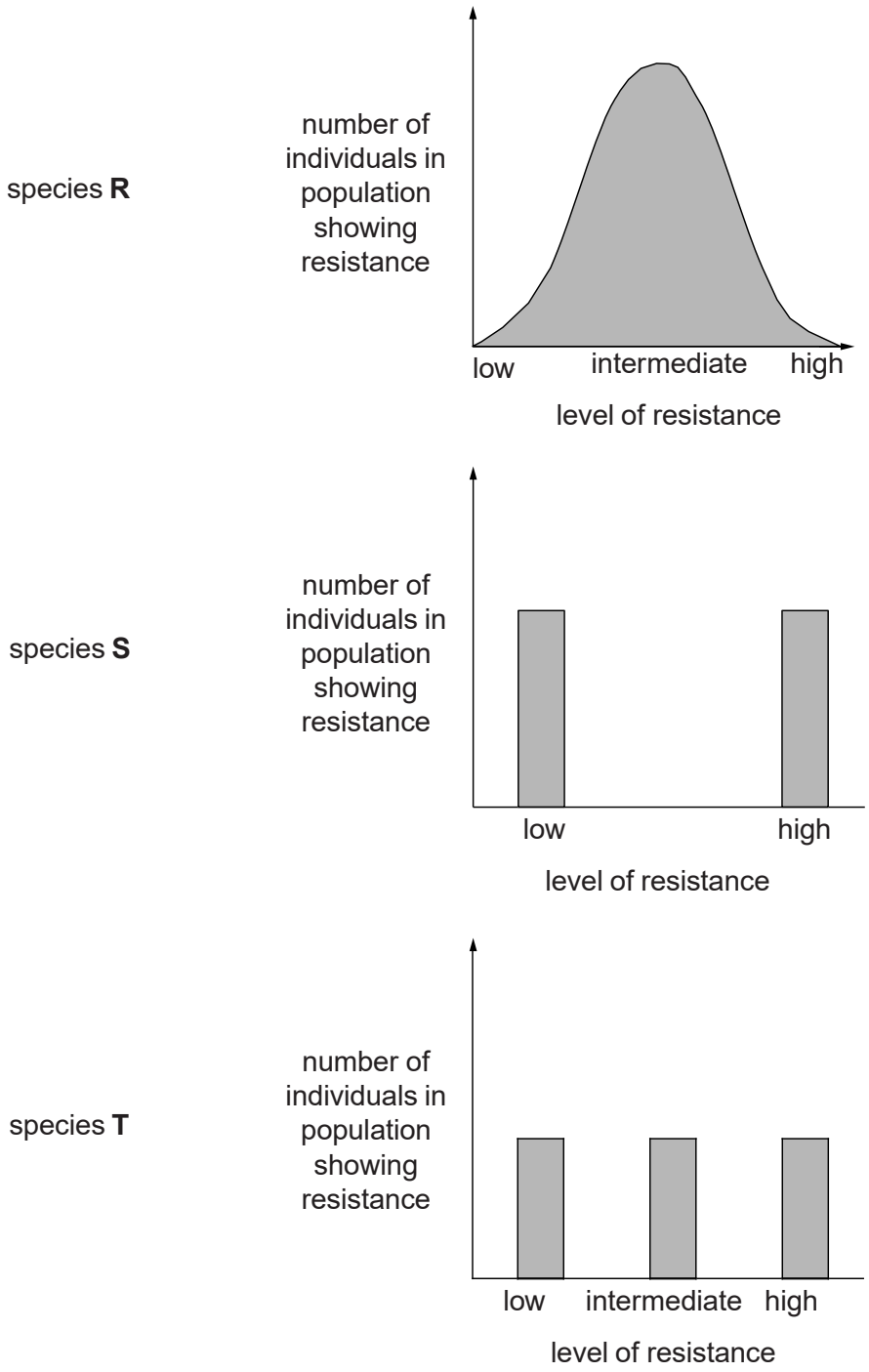

Fig. 6.1

(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.

[2]

	Discontinuous	Continuous
Species identified by letter		

(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. **[6]**

Species	Statement number(s)
R	
S	
T	

Table 6.1

(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.

In your answer you should describe the methods for collection, testing and data processing in a logical series of steps.

[7]

[Total: 15]

Question 2

The potato plant, *Solanum tuberosum*, is a staple food plant in many parts of the world.

Potatoes are susceptible to infection by a pathogen called *Phytophthora infestans*, which causes a disease known as potato late blight. The most visible sign of the disease is a brown discolouration of the leaves.

Some varieties of potato are resistant to infection by *P. infestans*

(a) State **two** ways in which an individual *S. tuberosum* plant could respond to infection by *P. infestans*

[2]

(b) The resistance of different varieties of *S. tuberosum* to infection by *P. Infestans* was investigated.

- Three different clones, A, B and C, of *S. tuberosum* were used.
- The clones were grown in adjacent fields over the same time period.
- The percentage of leaf area affected by the disease was estimated at regular intervals.

The results are shown in Fig. 18.

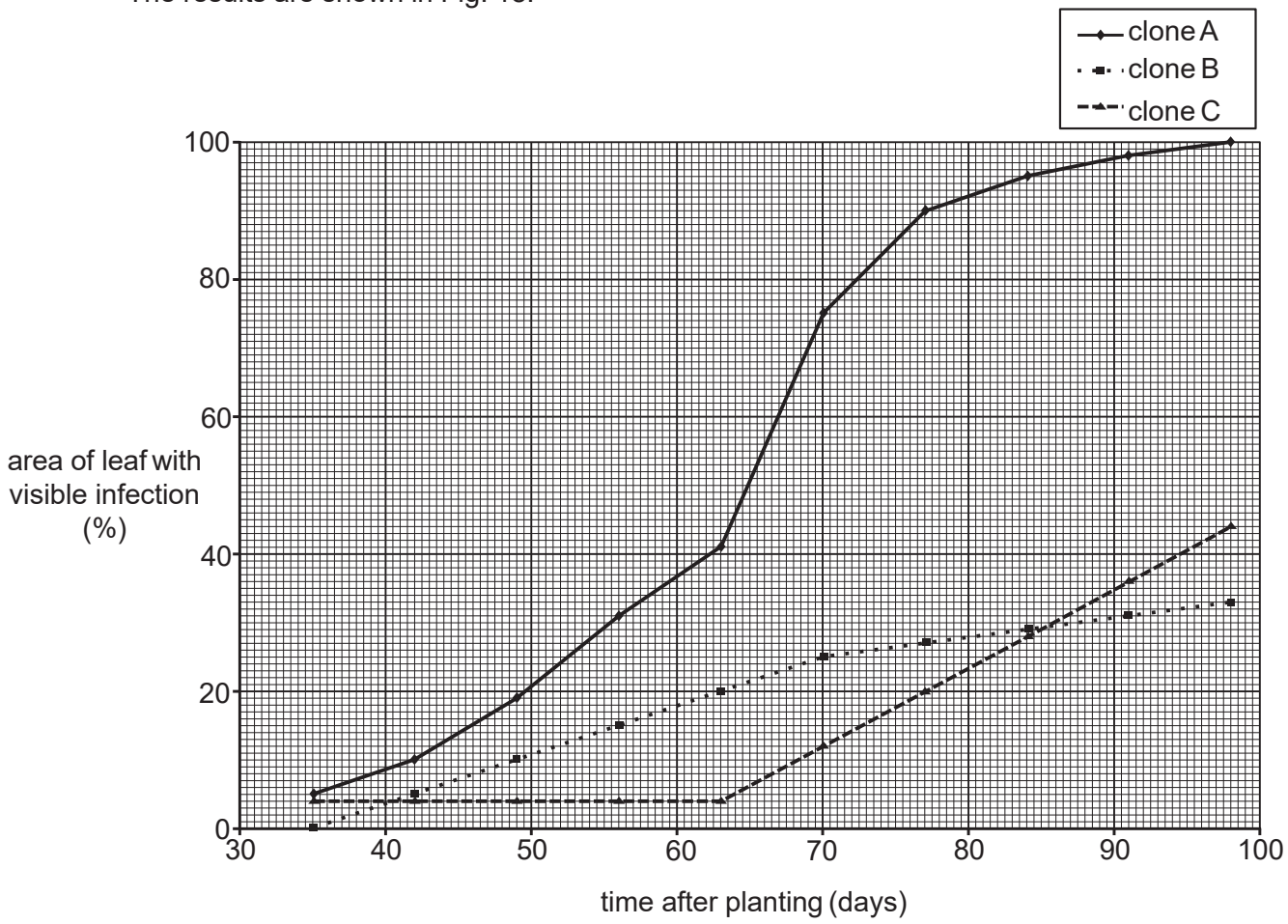

Fig. 18

(i) Suggest why it is important to use clones in an investigation such as this. **[2]**

(ii) State how a clone of potatoes could be produced for this investigation and explain why it is important to carry out this procedure under aseptic conditions.

Procedure

asepsis is important because.

[2]

(iii) The extent of infection is estimated by comparing the area under the curve from the graph. The area under the curve for clone **B** is 1250. (Units can be ignored in this instance.)

Using Fig. 18, calculate the approximate area under the curve, between day 35 and day 98, for clone **C**.

[3]

(iv) Calculate the area under the curve for clone **C** as a proportion of the area under the curve for clone **B**. . **[1]**

(v) **Using Fig. 18**, suggest why the area under the curve is used as a measure of infection rather than the area of leaf that is visibly affected on a given day. **[2]**

(vi) The clones were planted in adjacent fields in order to control variables such as temperature, wind speed and rainfall.

Suggest two other abiotic variables that this precaution was intended to control. **[2]**

[Total: 14]

Domesticated pigs are descended from *Sus scrofa,* sometimes called the 'wild boar'.

(a) (i) In **Table 17.1**

- number the levels in the correct sequence and
- complete the name column.

[4]

Sequence of levels	Level	Name
.....	Order	Artiodactyla
.....	Species	.....
.....	Family	Suidae
1	Kingdom	.....
.....	Genus	.....
.....	Phylum	Chordata
.....	Class	Mammalia

Table 17.1

(ii) We now have DNA evidence of how organisms are related to each other. This evidence has helped biologists to construct a second classification viewpoint: the Domain system.

Explain what such developments show about the nature of scientific knowledge. **[1]**

(b) In domesticated, farmed pigs, the following two traits have been studied:

- The allele for curly tail, **T**, is dominant to the allele for straight tail, **t**.
- The allele for pink skin (dermis), **D**, is dominant to the allele for black skin, **d**.

(i) Draw a genetic diagram to show the results of crossing pigs that are heterozygous for both traits, tail and skin. Use the letters given above.

[5]

parental genotypes …… ……..

gametes …… ……..

F_1 offspring genotypes

……...

offspring phenotypes

……...

phenotype ratio

……...

(ii) Describe in words how this phenotypic ratio might be different if the two genes were autosomally linked. **[1]**

(c) A pig farmer crossed one group of pigs, heterozygous for both traits, with another group homozygous recessive for both traits. The farmer expected to get roughly equal numbers of each of the four possible mixtures of tail and skin phenotype.
The results that actually occurred are shown in **Table 17.2**.

Phenotype	**Observed, *O***	**Expected, *E***			
curly pink	20	26			
curly black	30	26			
straight pink	21	26			
straight black	33	26			

Table 17.2

(i) The farmer thought from these results that the two genes might be autosomally linked.

Calculate χ^2. (You may wish to use **Table 17.2** to write figures for steps in your calculation process.)

$$x^2 \sum = \frac{(O-E)^2}{E}$$

[3]

(ii) The farmer had concluded that the genes are linked.

Use your calculation and **Table 17.3** to justify whether the farmer's conclusion can be supported or not.

[1]

Degrees of freedom	**Probability**							
	0.95	**0.90**	**0.75**	**0.50**	**0.25**	**0.10**	**0.05**	**0.01**
1	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09

Table 17.3

[Total: 15]