About **V Level**

BIOLOGY
ALTERNATIVE TO PRACTICAL
(PAPER 4)   *(YEARLY)*

About **Thinking Process**

When solving problems, we first analyse the questions and then gather relevant information until we are able to determine the answers. But for presentation reason, we need to organise, rearrange and then present ONLY the required workings and solutions.

Thinking process reveals the extra but relevant information which is not required as part of the solutions.

period	**2009 to 2024**	
contents	**June & November, Paper 6, Worked Solutions**	
form	**Yearly**	
compiled for	**O Levels**	
special features	**Thinking Process**	

CONTENTS

Answer **all** questions.

Question 1

A student investigated the structure and nutrient content of a flower.

Fig. 1.1 shows the flower. Some petals have been removed so that the internal structure can be clearly seen.

Fig. 1.1

(a) (i) Make a large drawing of the flower as it appears in Fig. 1.1 in the space below.

[5]

    (ii) On your drawing, draw a line and label it **P** to show where pollen must land when pollination takes place.   [1]

(b) The student tested two parts of the flower, **A** and **B**, for their nutrient content.

The student tested both parts with Benedict's solution, biuret reagent and iodine solution.

(i) Draw a table in which to record the results of the student's tests in the space below.

[4]

(ii) At the end of the tests, the student noted:

- part **A** tested positive with Benedict's solution and negative with biuret reagent and iodine solution
- part **B** tested positive with biuret reagent and iodine solution and negative with Benedict's solution.

In the table you have drawn, record the colours the student would have observed at the end of each test. [3]

(iii) State the nutrients present in:

part **A** ....

part **B** ....   [3]

(c) Fig. 1.2 is a photomicrograph of a pollen grain.
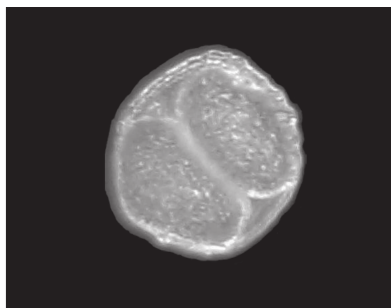
×400

Fig. 1.2

(i) Measure and record the diameter of the pollen grain at its widest point.

diameter ....mm [1]

(ii) Calculate the diameter of the **actual** pollen grain and record your answer to 2 decimal places.
Space for working.

diameter of the actual pollen grain .... [3]

(iii) Fig. 1.3 is a photomicrograph of a pollen grain from a different species of plant.
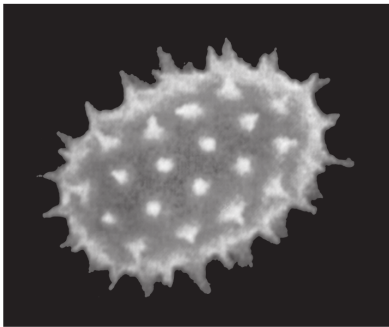
Fig. 1.3

Describe **two visible** differences in the structure of the pollen grains in Fig. 1.2 and Fig. 1.3.

[2]

	Fig. 1.2 pollen grain	**Fig. 1.3 pollen grain**
1		
2		

[Total: 22]

Question 2

A student investigated the number of plants on a school field.

This was done by examining small samples of the field using a square frame measuring 0.5 m × 0.5 m.

Fig. 2.1 (next page), shows the plants in one of these 0.5 m × 0.5 m samples.

(a) The sample contained three different plant species.

The student counted the number of plants of each of these species in this sample.

One plant was **not** fully within the square frame. Suggest and explain what you would do about this plant.

....

.... [1]

(b) Count the number of plants of species **E** in Fig. 2.1, taking into account your answer to **(a)**.

Record your answer in Table 2.1.

Table 2.1

plant species	number of plants in the sample	estimated number of plants in the whole field
C	7	5600
D	4	3200
E		

[1]
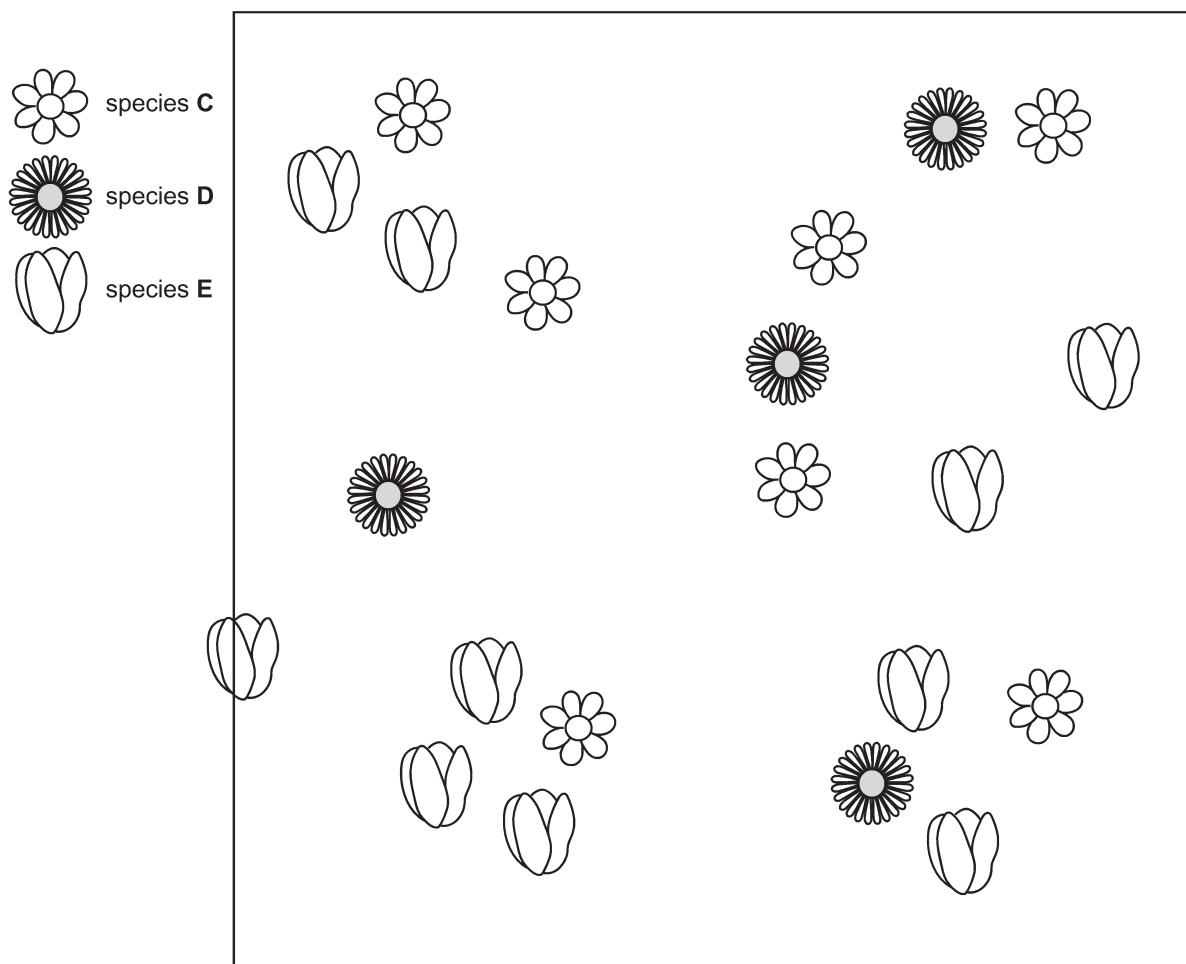
Fig. 2.1

(c) The whole field measured 10 m × 20 m.

Use the sample in Fig. 2.1 to estimate the number of plants of species **E** in the whole field and record this value in Table 2.1.

Show your working.

[2]

(d) Explain why the student counted the numbers of plants in samples of the field instead of counting the number of plants in the whole field.

....

.... [1]

(e) Suggest **two** reasons why taking several samples would improve the accuracy of the estimate for the number of plants in the whole field.

1 ....

....

....

2 ....

....

....

[2]

(f) Use the data in Table 2.1 to construct a bar chart to show the estimated number of plants of species **C**, **D** and **E** in the whole field.
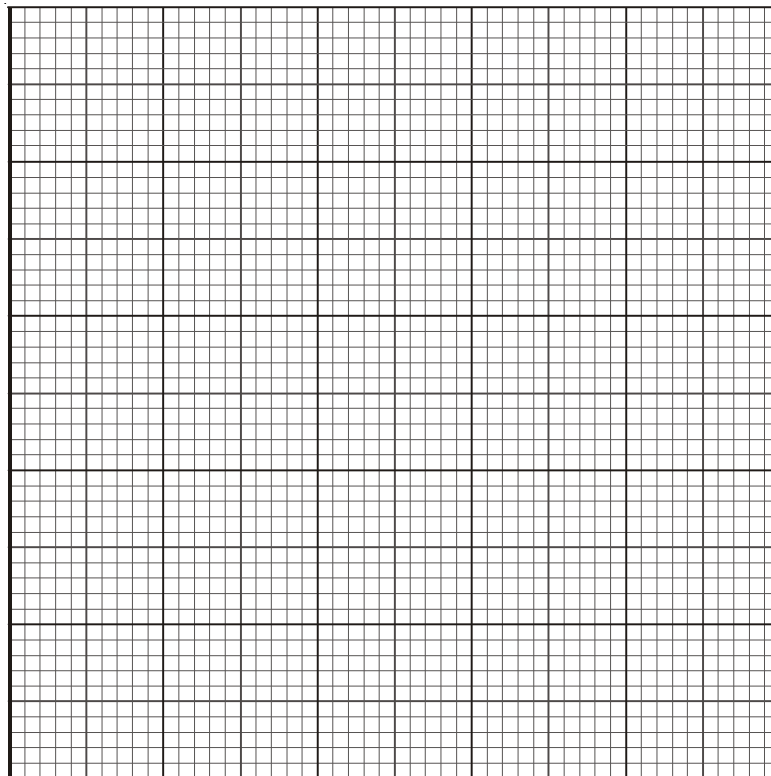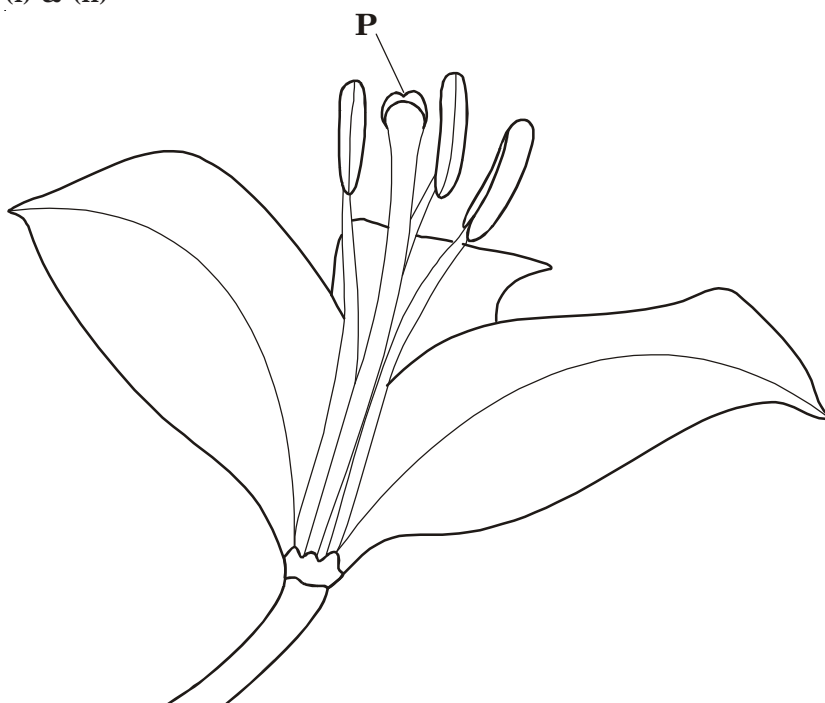
[4]

[Total: 11]

SOLUTIONS - JUNE 2024

Q1 - Solution

(a) (i) & (ii)

P

(b) (i) & (ii)

test solution or reagent	colour / observations	
	A	**B**
benedict's	green / yellow / orange / red	blue
biuret	blue	purple / lilac / violet
iodine	brown / yellow	blue-black / black

(iii) part **A**: Contains reducing sugar or glucose

   part **B**: Contains proteins and starch

(c) (i) Diameter = 25 mm

   (ii) Actual diameter = $\dfrac{\text{diameter of pollen grain in photomicrograph}}{\text{magnification}}$

   $= \dfrac{25 \text{ mm}}{400} = 0.06 \text{ mm}$

25 mm

   (iii)

	Fig. 1.2 pollen grain	**Fig. 1.3 pollen grain**
1	round / circular shape	oval shape
2	smooth surface without spikes	rough surface due to spikes
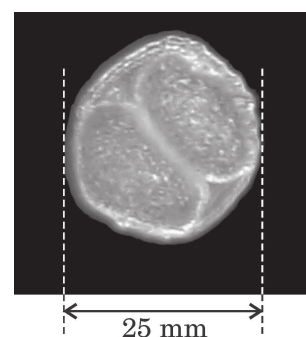
COMMENT on **ANSWER**

❝ **(c) (iii)** Pollen in fig. 1.2 has internal division while in fig. 1.3 shows no division. ❞

Q2 - Solution

(a) It can be included as more than half of it is in the square.

(b)

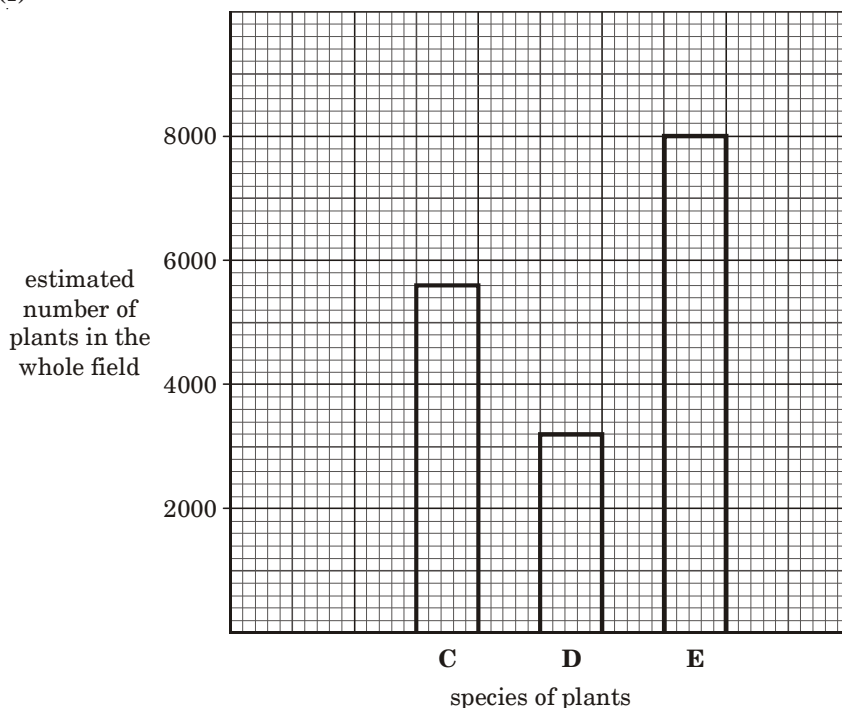| plant species	number of plants in the sample	estimated number of plants in the whole field
C	7	5600
D	4	3200
E	10	8000

(c) Total No. of samples $= \dfrac{10 \times 20}{0.5 \times 0.5} = 800$

∴ No. plants of species E in the whole field $= 10 \times 800$

$= 8000$ plants

(d) It is too difficult and time consuming to count them all in the field.

(e) 1. As plants are not evenly distributed, so larger proportion of field is sampled.

2. Larger sample means the results are more representative of actual population in the field.

(f)

COMMENT on **ANSWER**

❝**(a)** Plant can be excluded as it is not fully in the square.

(d) It is not possible to keep an accurate tally and more likely to make an error during counting.

(e) larger sample is more likely to include every type or number of plant species. ❞

Q3 - Solution

(a) Students can measure growth of plants either by taking height or mass at start and then at end. They can use less than 10% of atleast three concentration of all fertilisers used. Same volume of each fertiliser solution is provided to plants. After applying fertilisers, leave for the same time. Different variables or factors affecting plant growth are kept constant like light intensity, concentration of CO_2, volume of water supplied. Experiment is repeated at same fertiliser concentration and average or mean is calculated. Data for height or mass is compared for each fertiliser concentration.

(b) Fertiliser concentration.

COMMENT on **ANSWER**

❝**(a)** Different factors affect plant growth, so methods to control them should be same, e.g. a room with thermostatically controlled temperature can be used. For light intensity, bulbs of certain wattage may be used. ❞