

SPM BIOLOGY

EXCEL
PAPER 3
MODULE

FORM
4



NAME : _____

FORM : _____

ANALYSIS OF THE 2008 – 2014 SPM PAPERS

CHAPTER	2008	2009	2010	2011	2012	2013	2014
FORM 4							
1. Introduction to Biology							
2. Cell Structure and Cell Organisation							
3. Movement of Substances across the Plasma Membrane	1					1	
4. Chemical Composition of the Cell		1		1			
5. Cell Division							
6. Nutrition		1			1	1	
7. Respiration			1				
8. Dynamic Ecosystem	1		1				
9. Endangered Ecosystem							1
FORM 5							
1. Transport				1			
2. Support & Locomotion							
3. Coordination & Response					1		
4. Reproduction							
5. Inheritance							
6. Variation							1
TOTAL	2						

SPM BIOLOGY (PAPER 3)

CORRECT ANSWERING TECHNIQUES

1. OVERVIEW

- Consist of 2 Questions – 1 ½ Hours
- 50 marks
- Question 1 : 33 marks , Question 2 : 17 marks
- Test on Scientific Skills
- Based on Practical / Experiments / Field Works

2. QUESTION 1 (33 MARKS)

Example of question:

Lemna minor is a species of free-floating aquatic plants from the duckweed family Lemnaceae. The plants grow mainly by vegetative reproduction: two daughter plants bud off from the adult plant.

An experiment is carried out to investigate the effect of abiotic factor such as pH on *Lemna* sp. growth. Experiment is done under controlled conditions: 12 hours a day light exposure and using the same Knop's solution.

Petri dish is filled with 20 ml Knop's solution with different pH value and 5 *Lemna* sp. each. The Knop's solution is treated by adding acid or alkali to achieve the pH value needed.

** Knop's solution is a solution which contains essential nutrient for plants growth.

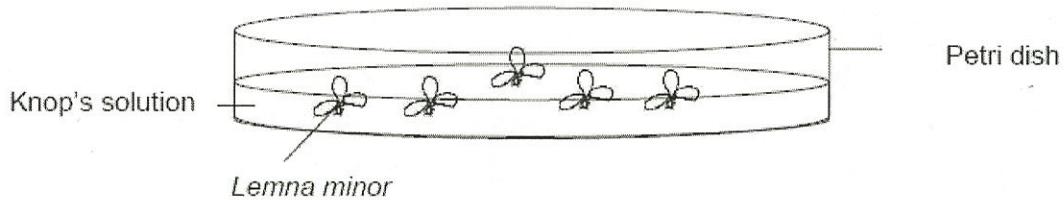
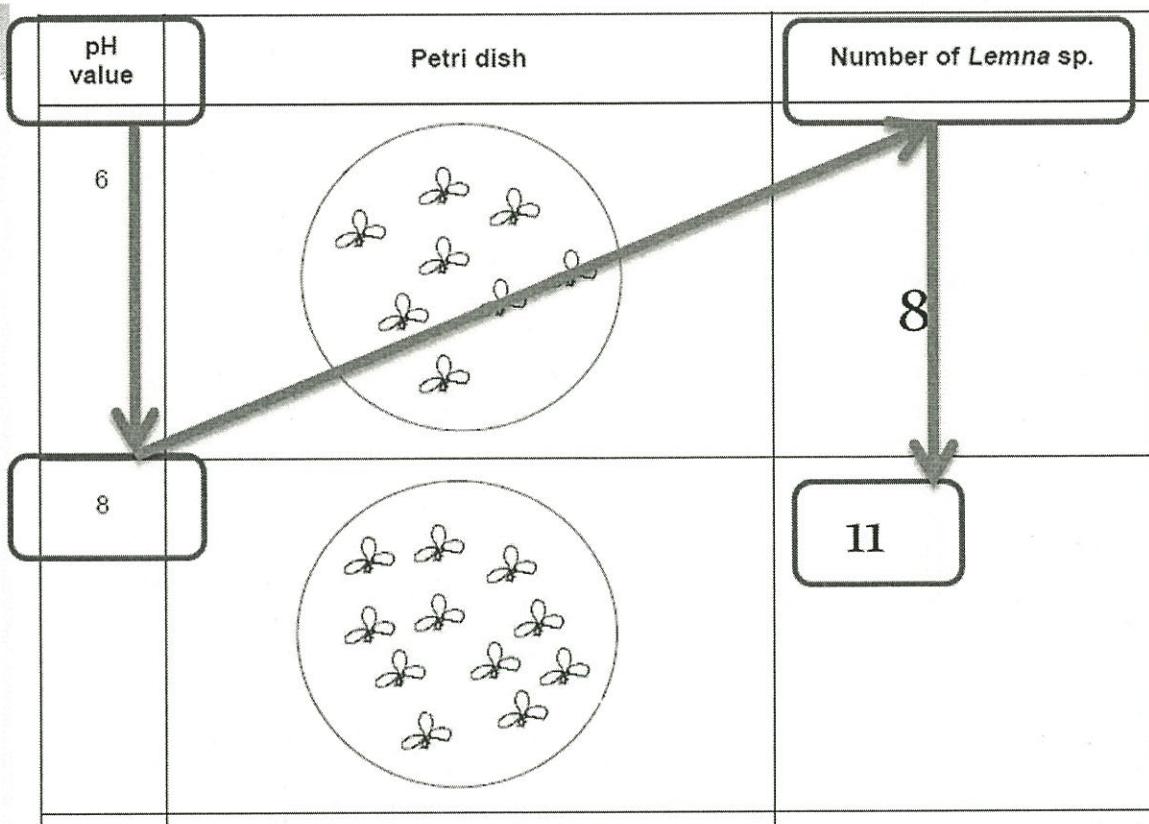


Figure 1

After 7 days, the observation is made and the result shown in Table 1.1

a. Observation

- State two **extreme** observations
- State the meaningful observations
- Consist of MANIPULATED VARIABLES and RESPONDING VARIABLES
- Observations can be in parallel / vertical form
- Preferable : Sentences which state the VALUES read from the given apparatus



Sample answer (HORIZONTAL OBSERVATION)

(b) (i) Based on Table 1.1, state two observations that can be made in this experiment.

Observation 1:

Manipulated Variable Responding Variable

 At pH 12 (Knop solution), the number of *Lemna sp* is 1

Observation 2:

At pH 8(Knop solution), the number of *Lemna sp* is 11

[3 marks]

Sample answer (VERTICAL OBSERVATION)

(b) (i) Based on Table 1.1, state two observations that can be made in this experiment.

Observation 1:

Manipulated Variable

Responding Variable

At pH 12 (Knop solution), the number of *Lemna* sp grow is less than at pH 2/4/6/8/10

Observation 2:

At pH 8 (Knop solution), the number of *Lemna* sp is more than at pH 2/4/6/10/12

[3 marks]

b. Making inference

- Inference 1 is for observation 1
- Inference 2 is for observation 2
- Inference is an early conclusion based on the experimental observations
- Inference may include reasons

Sample answer

(ii) State the inference for each observation made in (b) (i).

Inference for observation 1:

Strong acidic condition is not favorable for *Lemna* growth

.....
.....

Inference for observation 2:

Neutral / Slight alkaline condition is the best / most favorable condition for *Lemna* growth

[3 marks]

c. Measuring and using numbers

- Record the reading of the thermometer , stopwatch, measuring tools, ruler, etc. from the given diagram
- Do not forget the **UNITS**
- Up to 2 decimal points

d. Communicating data

- Table must be completed with UNITS and TITLES for the column and row
- Fill up the complete information given
- Transfer the information correctly
- If there is calculation, show the method with a complete unit / state the formula

Sample answer

pH of water	Number of <i>Lemna sp</i>
2	4
4	5
6	8
8	11
10	5
12	1

e. Interpreting data (Explain / State the Relationship)

- Construct sentence that shows relationship between variables mentioned in a question
- State the details of relationships

Sample answer

In the acidic medium the *Lemna sp.* growth is less, and increase when the medium become neutral but decrease when in alkali condition

f. Controlling variables

- State only ONE Variable for each type
- State how the variables are operated

Variables (STATE)	Method to handle the variables (MUST USE VERB)
Manipulated	Use /state the values or different
Responding	By measuring / calculating and recording using State the apparatus used
Controlled	Use the same / Maintain / Fixstate the values

Sample answer

Variables	Method to handle the variables
Manipulated: pH	Add / Use acid or alkali to the Knop solution to get different pH condition Use pH solution : pH 2, pH 4, pH 6, pH 8, pH 10, pH 12 Change / alter the medium condition
Responding : Number of <i>Lemna sp.</i>	Count and record the number of <i>Lemna sp.</i> plants after 7 days
Controlled Light exposure / Volume of Knop solution	Fix 12 hours light exposure every day Maintain the volume at 20 ml

g. State hypothesis

- Able to state the hypothesis correctly based on the following criteria :
 - P1 : State the MV
 - P2 : State the RV
 - H : Relate P1 & P2
- The sentence that you write must show the relationship between MV and RV
- The more / the less Manipulated Variablesthe more / the less Responding Variables

Sample answer

The higher the pH value, the higher the number of *Lemna sp*

Manipulated variable Relationship Responding variable

h. Predicting

IF THE EXPERIMENT IS REPEATEDPREDICT THE OBSERVATION

- Predict by stating whether the will be an **increase** or a **decrease**? **More?** / **Less?** / **Same?**
- May state the **values** which are suitable and suitable and will be accepted within the range
- And give the **reason** for predicting it so

Sample answer

Less / very small population of *Lemna sp*, because water is contaminated with soap/detergent that contain alkali which is not favourable for *Lemna* to grow

i. Defining operationally

- Answer must be based on experiment not theory
- Consist of the followings :
 - **WHAT IT IS** : State the phrase that is going to define
 - **WHAT IT DOES** : Indicators (apparatus used / Responding Variables)
 - **AFFECTED BY WHAT** : Influenced by Manipulated Variables)

Sample answer

Abiotic factor is the pH of the medium that affect the *Lemna sp.* growth in an ecosystem

j. Classifying

- Complete the given table according to the title
- If the table is not provided, construct the table according to the classification given
- Divide rows and columns according to types / different functions

<i>Abiotic factors</i>	<i>Biotic factors</i>
Humidity	Decomposer
Light intensity	Parasite
Soil texture	Symbiotic organism
Topography	invertebrates

k. Correlating time and space

Able to draw the graph correctly:

- Axis : correct the title with units, uniform scale
- All points plotted correctly
- Able to join points to form smooth graph

3. QUESTION 2 (17 MARKS)

- **Planning / Designing** experiment
- 17 marks
- 9 aspects

a. Problem statement

- What is the effect of MVon RV?
- MUST BE IN QUESTION FORM
- Does / Is / What / How does
.....?

b. Hypothesis

- The moreMV the more / lessRV.....?
- If the
- A statement that shows relationship between the two variables : MV and RV

c. Variables

- Manipulated (MV)
- Responding (RV)
- Fixed (FV)
* State only ONE variable for each

d. List of apparatus and materials

- List ALL functional MATERIALS and APPARATUS

e. Experimental procedure or method

- P1 – Preparation of materials and apparatus
- P2 – Operating Control Variables
- P3 – Operating Responding Variables
- P4 – Operating Manipulated Variables
- P5 – Precautions / Accuracy of experiment

Meaningful sentences:

1. Repeat steps 1 – 5 by using
2. Record result / mass / temperature in a Table

f. Presentation of data (Result)

- Prepare a Table which is complete with :
 - i. Title for column and row
 - ii. Correct units
 - iii. No result / data is required in the table

2.

Cells are basic units of living organism.
They consist of cellular components and organelles that can be seen by using microscope.

Design an experiment to investigate the difference of structures in a plant cell and an animal cell that can be seen under a light microscope.

The planning of your experiment must include the following aspects:

- Problem statement
- Aim of investigation
- Hypothesis
- Variables
- List of apparatus and materials

- Experimental procedure or method
- Presentation of data
- Conclusion

[17 marks]

Answer all questions.

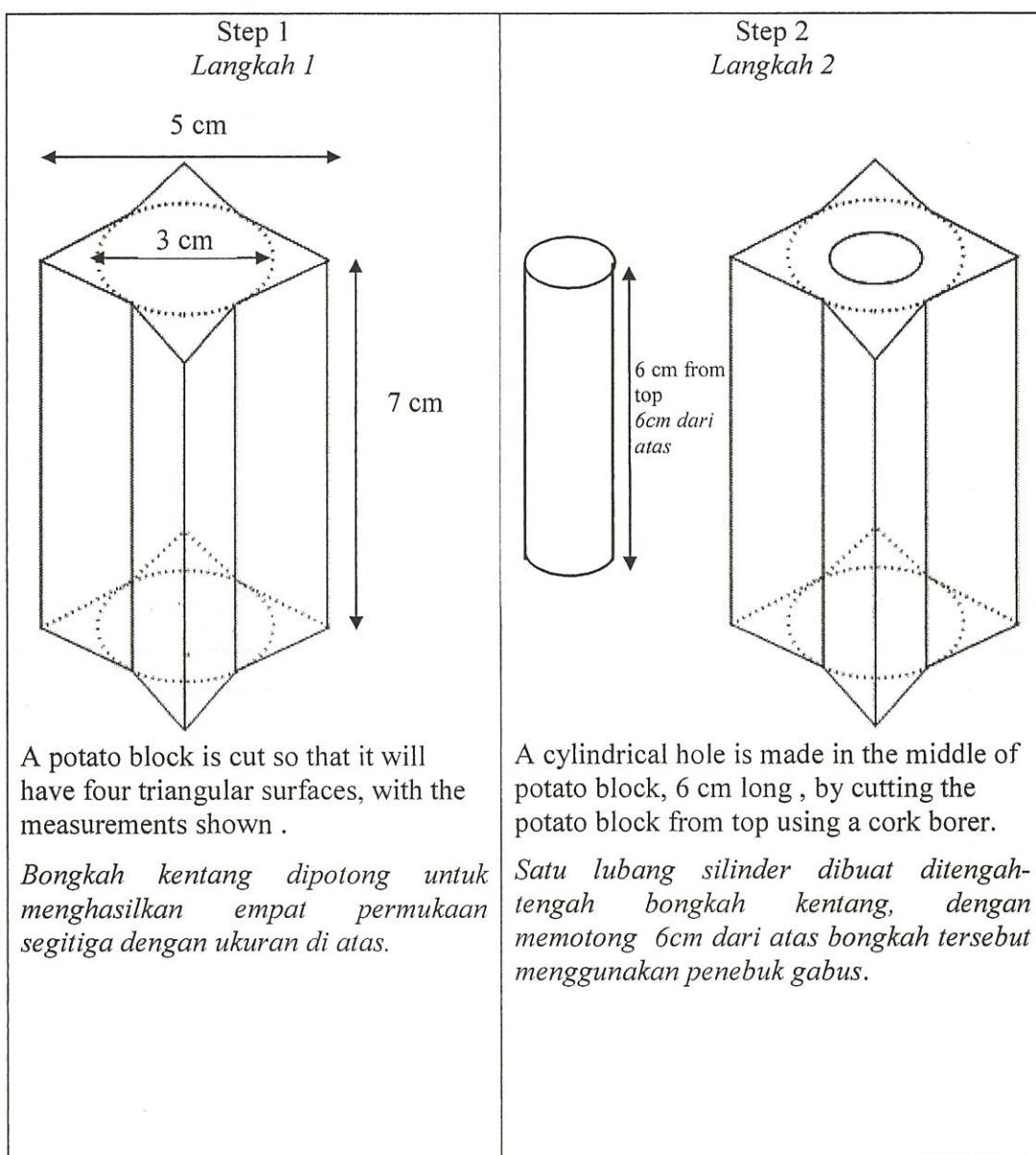
Jawab semua soalan.

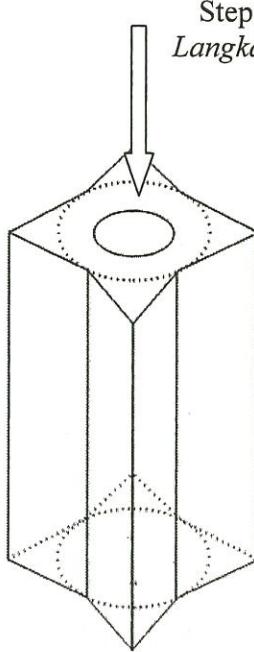
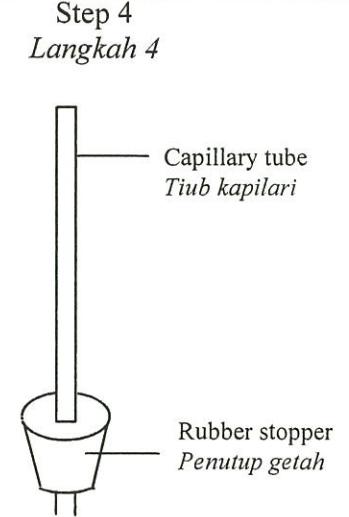
1. An experiment is carried out to investigate the effect of total surface area on the rate of diffusion of substances in an organ.

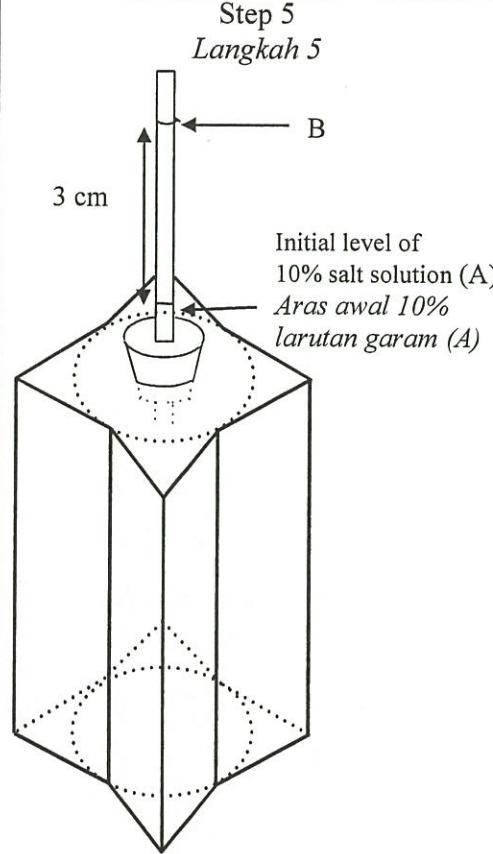
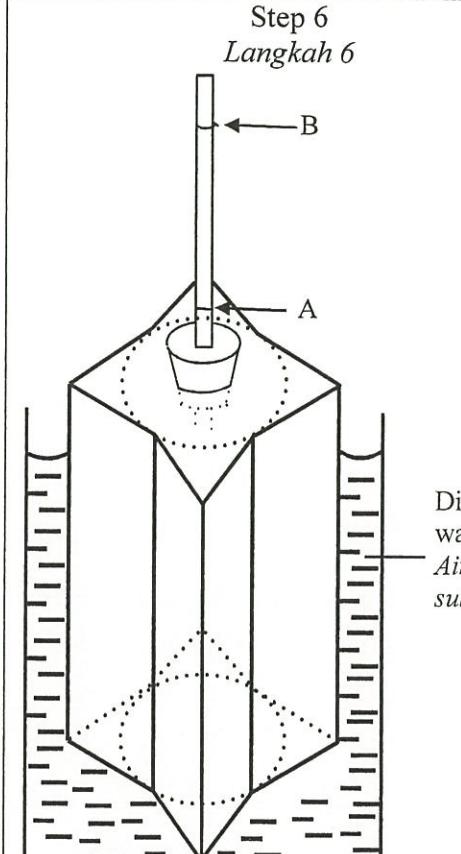
Potato blocks with different number of triangular surfaces are used in the experiment. Preparation of the experiment is shown in the following diagrams.

Satu eksperimen telah dijalankan untuk menyiasat kesan jumlah luas permukaan terhadap kadar resapan bahan dalam organ.

Bongkah kentang dengan bilangan permukaan segitiga yang berbeza digunakan dalam eksperimen. Persediaan eksperimen ditunjukkan dalam rajah di bawah.



<p>Step 3 Langkah 3</p>  <p>A 10% salt solution is poured into the hole in such a way that the height of the solution in the hole is 5 cm.</p> <p><i>10% larutan garam dituangkan ke dalam lubang tadi setinggi 5cm.</i></p>	<p>Step 4 Langkah 4</p>  <p>A rubber stopper with a capillary tube inserted through it is prepared as shown in the figure above. The rubber stopper is used to close the hole containing salt solution.</p> <p><i>Tiub kapilari dimasukkan ke dalam penutup getah seperti yang ditunjukkan dalam gambar persediaan di atas.</i></p> <p><i>Penutup getah digunakan untuk menutup lubang yang mengandungi larutan garam.</i></p>
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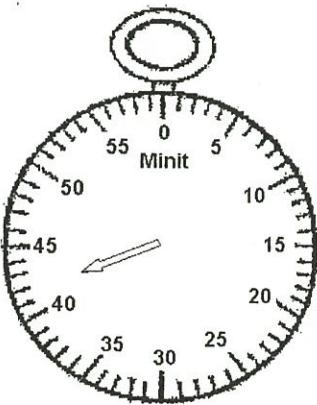
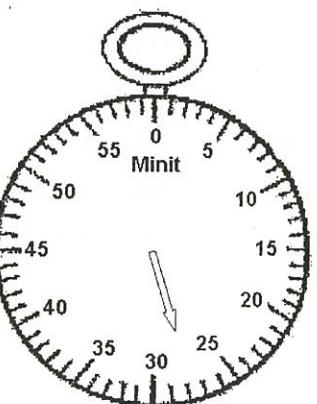
 <p>Step 5 Langkah 5</p> <p>Initial level of 10% salt solution (A) Aras awal 10% larutan garam (A)</p> <p>3 cm</p> <p>B</p>	 <p>Step 6 Langkah 6</p> <p>A</p> <p>Distilled water Air suling</p>
<ul style="list-style-type: none"> The hole in the potato containing salt solution is covered with the stopper prepared in step 4. Salt solution rises up the capillary tube. Initial level of salt solution is marked as A. Another mark is made on the capillary tube at a distance 3 cm above the point A. It is labelled as B. <i>Lubang dalam kentang yang mengandungi larutan garam itu ditutup dengan menggunakan penutup dijalankan dalam langkah 4</i> <i>Larutan garam menaik dalam tiub kapilari. Aras awal larutan garam ditandakan A.</i> <i>Tandaan yang berikutnya dibuat pada tiub kapilari pada jarak 3cm. Ia dilabelkan dengan B.</i> 	<ul style="list-style-type: none"> Place the potato block complete with the rubber stopper and capillary tube in a beaker containing distilled water . Make sure the potato block is not completely immersed in water . Water molecules diffuse across the potato tissue from distilled water to salt solution Record the time taken for the salt solution to travel from A to B. <i>Letakkan bongkah kentang yang dilengkapi dengan penutup getah dan tiub kapilari ke dalam bikar yang mengandungi air suling.</i> <i>Pastikan bongkah kentang tidak tenggelam sepenuhnya di dalam air.</i> <i>Molekul air akan meresap merentasi tisu kentang dari air suling ke larutan garam.</i> <i>Rekod masa untuk larutan garam bergerak dari A ke B</i>

Steps 1 to 6 is repeated using potato blocks of the same size, but different number of triangular surfaces, that is potato block with 8 and 16 triangular surface.

Langkah 1 hingga 6 diulang menggunakan saiz bongkah kentang yang sama, tetapi berbeza bilangan permukaan segitiga, iaitu 8 dan 16 permukaan segitiga.

Table 1.1 shows the result of this experiment.

Jadual 1.1 menunjukkan keputusan eksperimen ini.

Shape of potato block <i>Bentuk bongkah kentang</i>	Number of triangular surfaces <i>Bilangan permukaan segitiga</i>	Distance A to B <i>Jarak A ke B</i>	Time taken for salt solution to move from A to B / min. <i>Masa yang diambil untuk larutan garam bergerak dari A ke B / min</i>
	4	3 cm	 Time / masa:
	8	3 cm	 Time / masa:

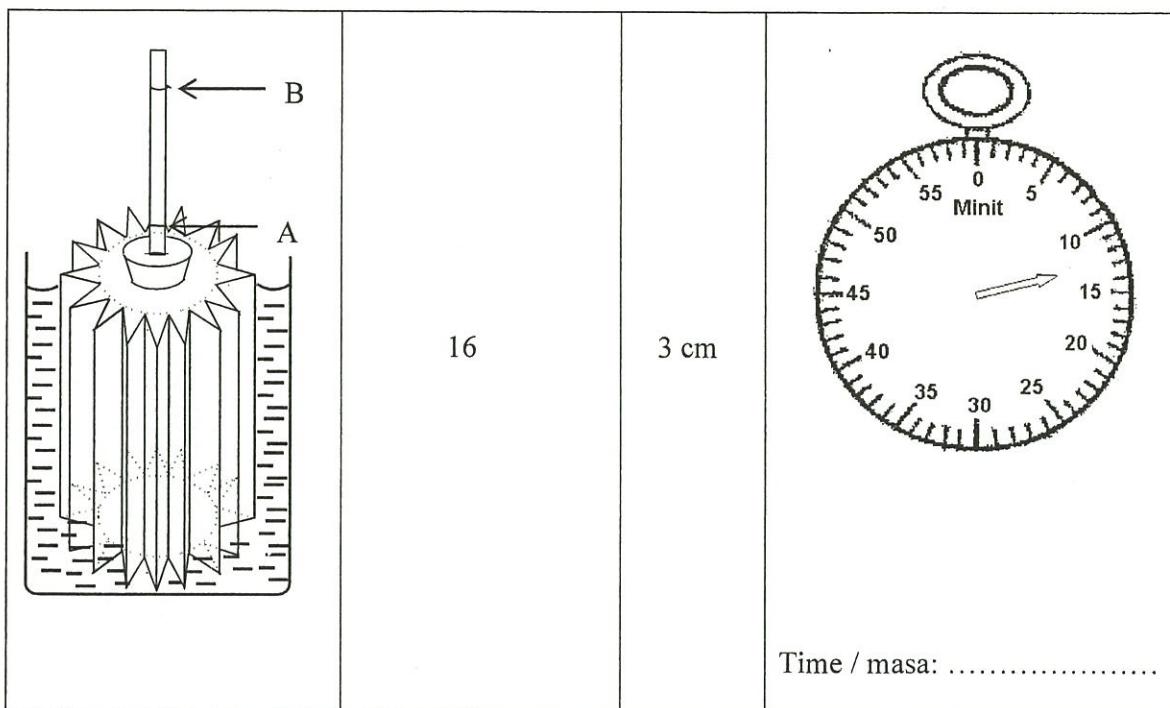


Table 1.1
Jadual 1.1

For
Examiner's
use

- (a) Record the time taken for the salt solution to move from A to B in the spaces provided in Table 1.1.
Rekod masa yang diambil oleh larutan garam untuk bergerak dari A ke B dalam ruangan yang disediakan dalam Jadual 1.1.

1(a)

[3 marks]

- (b) (i) State two different observations Based on Table 1.1.
Nyatakan dua pemerhatian yang berbeza Berdasarkan Jadual 1.1.

Observation 1 :

Pemerhatian 1 :

.....
.....

Observation 2 :

Pemerhatian 2 :

.....
.....

- (ii) State the inferences from the observations in 1(b)(i).

Nyatakan inferens daripada pemerhatian di 1(b)(i)

1(b)(i)

[3 marks]

Inference from observation 1 :

Inferens daripada pemerhatian 1 :

.....
.....

Inference from observation 2 :

Inferens daripada pemerhatian 2 :

.....
.....

1(b)(ii)

[3 marks]

- (c) Complete Table 1.2 based on this experiment.

Lengkapkan Jadual 1.2 berdasarkan eksperimen ini.

For
Examiner's
use

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasi</i>
Responding variable <i>Pembolehubah bergerak balas</i>
Constant variable <i>Pembolehubah dimalarkan</i>

Table 1.2
Jadual 1.2

[3 marks]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....

1(c)(i)

1(d)

- (e) (i) Construct a table and record all the data collected from Table 1.1.
Your table should have the following titles:

For
Examiner's
use

*Bina satu jadual dan rekodkan semua data yang dikumpul dari Jadual 1.1
Jadual anda hendaklah mengandungi tajuk-tajuk berikut:*

- Number of triangular surfaces
Bilangan permukaan segitiga
- Time taken for the salt solution to move from A to B.
Masa yang diambil untuk larutan garam bergerak dari A ke B
- Rate of diffusion.
Kadar resapan

$$\text{Rate of diffusion} = \frac{\text{Distance of salt solution move from A to B}}{\text{Time taken for the salt solution to move from A to B.}}$$

$$\text{Kadar resapan} = \frac{\text{Jarak larutan garam bergerak dari A ke B}}{\text{Masa yang diambil untuk larutan garam bergerak dari A ke B}}$$

- (e) (ii) Use the graph paper provided, draw graph the rate of diffusion against the number of triangular surface.

Dengan menggunakan kertas graf yang disediakan, lukis graf kadar resapan melawan bilangan permukaan segitiga

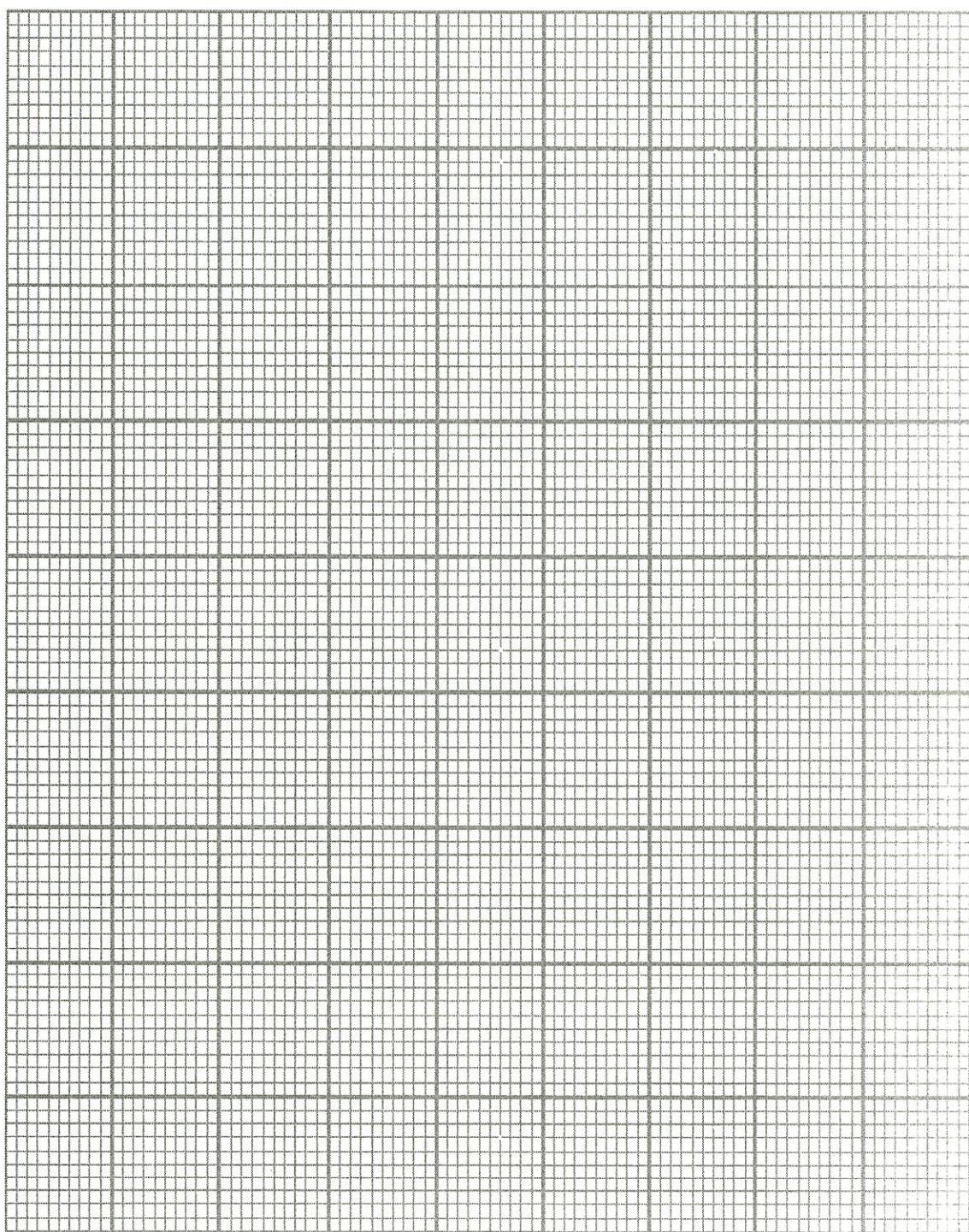
1(e)(i)

[3 marks]

1(e)(ii)

[3 marks]

Graph of the rate of diffusion against the number of triangular surface.
Graf kadar resapan melawan bilangan permukaan segitiga



- (f) Based on graph in 1(e)(ii), explain the relationship between the number of triangular surface and the rate of diffusion.

Berdasarkan graf dalam di 1(e)(ii), terangkan hubungan antara bilangan permukaan segitiga dengan kadar resapan.

.....
.....
.....

1(f)

[3 marks]

- (g) Based on the result of this experiment, state the operational definition for rate of diffusion.

Berdasarkan keputusan eksperiment, nyatakan definisi secara operasi bagi kadar resapan.

.....
.....
.....

1(g)

[3 marks]

(h)

The experiment was repeated by using 30% salt solution instead of 10% salt solution. Predict the outcome of this experiment if the student used number of triangular surface of potato block is 16. Explain your prediction.

Eksperimen diulang dengan menggunakan 30% larutan garam bagi menggantikan 10% larutan garam. Ramalkan hasil eksperimen ini jika pelajar menggunakan bongkah kentang yang mempunyai 16 permukaan segitiga.

Terangkan ramalan anda

.....
.....
.....

1(h)

[3 marks]

- (i) Which of the following organs can be classified as the organs that increase the total surfaces for their effective functions.

Yang manakah organ-organ berikut boleh dikelaskan kepada organ yang meningkatkan jumlah permukaan untuk fungsi yang lebih efektif?

Small intestines <i>Usus kecil</i>	lungs <i>paru-paru</i>	heart <i>jantung</i>
oesophagus <i>esofagus</i>	brain <i>otak</i>	pancrease <i>pancreas</i>

Organs having well adapted surfaces for their effective function <i>Organ-organ yang penyesuaian permukaan untuk fungsi yang efektif</i>	Organs without surfaces well adapted for their effective function <i>Organ-organ tidak mempunyai penyesuaian permukaan untuk fungsi yang efektif</i>

1(i)

Table 1.3
Jadual 1.3

[3 marks]

TOTAL

2. Multicellular organisms are bigger and complex. The cells cannot depend on diffusion alone to obtain its requirements. Multicellular organisms need the transport system to transport respiration gaseous and nutrient to the inner part of the body. Whereas, unicellular organisms get their gaseous and nutrients supply by diffusion through their cell membrane because their total surface area per volume are big.

Based on the above information, plan a laboratory experiment to study the relationship between the size of organisms and the rate of diffusion.

The planning of your experiment must include the following aspects:

Organisma multisel adalah besar dan kompleks. Sel-sel tidak boleh bergantung kepada proses resapan sahaja untuk mendapatkan keperluannya. Organisma multisel memerlukan sistem pengangkutan untuk mengangut gas-gas respirasi dan bahan nutrien ke bahagian dalam seluruh tubuhnya. Manakala, organisme unisel mendapatkan bekalan gas respirasi dan bekalan nutriennya secara resapan menerusi membran sel kerana jumlah luas permukaan per isipadunya yang besar.

Berdasarkan maklumat diatas, reka bentuk satu eksperimen makmal untuk menentukan hubungan antara saiz organism dan kadar resapan.

Perancangan eksperimen anda hendaklah meliputi aspek-aspek berikut:

- Problem statement
Pernyataan masalah
- Hypothesis
Hipotesis
- Variables
Pembolehubah
- List of apparatus and materials
Senarai radas dan bahan
- Experimental procedure
Prosedur eksperimen
- Presentation of data
Persembahan data

[17 marks/markah]

Answer all questions.
Jawab semua soalan.

- An experiment was carried out to study the effect of enzyme concentration on the activity of amylase on starch.
Satu eksperimen telah dijalankan untuk mengkaji kesan kepekatan enzim ke atas aktiviti amilase ke atas kanji.

The following steps were carried out.
Langkah-langkah berikut telah dijalankan.

Step 1: Three test tubes P, Q and R were filled with 2ml of 0.5%, 1.0% and 1.5% of amylase respectively.

Langkah 1: *Tiga tabung uji P, Q dan R diisi dengan 2ml larutan 0.5%, 1.0% dan 1.5% amilase masing-masing.*

Step 2: 2ml of 1% starch suspension was added into each test tube and the contents were stirred.

Langkah 2: *2ml ampaian kanji 1% dimasukkan ke dalam setiap tabung uji dan campuran dikacau.*

Step 3: Every 2 minutes a drop of the mixture from each test tube was mixed with a drop of iodine solution on a white tile.

Langkah 3: *Setiap 2 minit setitik campuran daripada setiap tabung uji dicampurkan ke dalam setitis larutan iordin di atas jubin putih.*

Step 4: All test tubes are immersed in a water bath at temperature of 37°C during the experiment as shown in diagram below.

Langkah 4: *Kesemua tabung didih direndam dalam kukus air pada suhu 37°C sepanjang masa eksperimen seperti yang ditunjukkan dalam rajah di bawah.*

Diagram 1 shows the apparatus set-up used in this experiment.
Rajah 1 menunjukkan bahan-bahan yang digunakan dalam eksperimen tersebut.

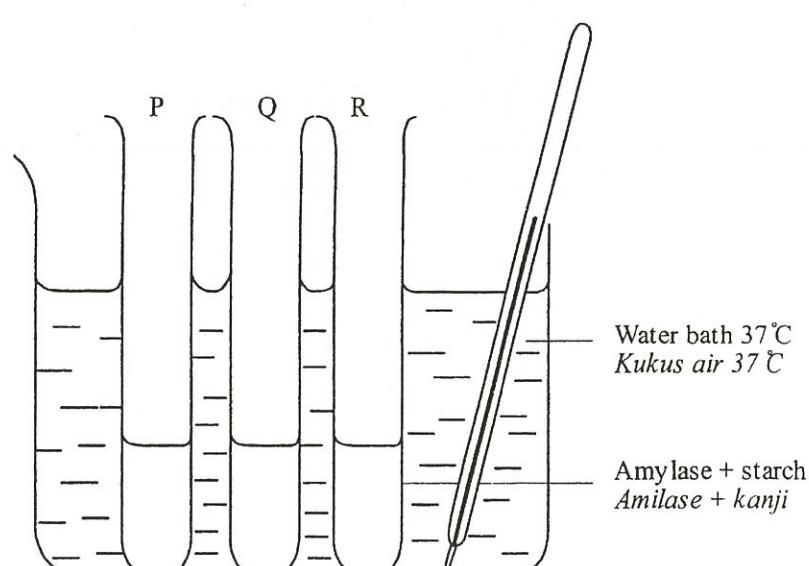


Diagram 1
Rajah 1

Table 1 shows the results of the experiment.
Jadual 1 menunjukkan keputusan eksperimen.

Test tube Tabung uji	The colour of iodine solution starting from minute 0 <i>Warna larutan iordin bermula dari minit 0</i>				Time taken for the starch to be hydrolysed completely(min) <i>Masa diambil bagi kanji dihidrolisiskan dengan lengkap (min)</i>
	Dark blue <i>Biru tua</i>	Yellow (no change) <i>Kuning (tiada perubahan)</i>			
P			Time taken <i>Masa diambil</i> = <input type="text"/> minutes <i>minit</i>		
Q			Time taken <i>Masa diambil</i> = <input type="text"/> minutes <i>minit</i>		
R			Time taken <i>Masa diambil</i> = <input type="text"/> minutes <i>minit</i>		

Table 1
Jadual 1

For
Examiner's
Use

1(a)

(a)

Record the time taken for the starch to be hydrolysed completely in the boxes provided in table above.

Rekod masa yang diambil bagi kanji dihidrolisiskan dengan lengkap di dalam kotak dalam jadual di atas.

3

[3 marks]
[3 markah]

(b) (i) Based on Table 1, state **two** different observations.

*Berdasarkan Jadual 1, nyatakan **dua** pemerhatian yang berbeza.*

Observation 1 :

Pemerhatian 1:

.....
.....

Observation 2 :

Pemerhatian 2:

.....
.....

1(b)(i)

3

[3 marks]
[3 markah]

(ii) State the inference for each observation made in 1(b) (i).
Nyatakan inferensi daripada pemerhatian di 1 (b) (i).

Inference for observation 1 :

Inferensi daripada pemerhatian 1:

.....
.....

Inference for observation 2 :

Inferensi daripada pemerhatian 2:

.....
.....

1(b)(ii)

3

[3 marks]
[3 markah]

- (c) Complete Table 2 to show the variables involved in this experiment and how these variables are operated.

Lengkapkan Jadual 2 untuk menunjukkan pembolehubah-pembolehubah yang terlibat dalam eksperimen ini dan bagaimana pembolehubah-pembolehubah ini dikendalikan.

Variable <i>Pembolehubah</i>	Operating the variable <i>Cara mengendalikan pembolehubah</i>
Manipulated variable: <i>Pembolehubah yang dimanipulasikan :</i>	How to alter the manipulated variable: <i>Bagaimana pembolehubah yang dimanipulasikan diubah :</i>
Responding variable: <i>Pembolehubah yang bergerak balas:</i>	How to determine the responding variable: <i>Bagaimana pembolehubah yang bergerak balas ditentukan :</i>
Constant variable: <i>Pembolehubah yang dimalarkan:</i>	How to maintain the constant variable: <i>Bagaimana pembolehubah dimalarkan ditetapkan:</i>

Table 2
Jadual 2

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....

[3 marks]
[3 markah]

1 (c)

3

[3 marks]
[3 markah]

1(d)

3

For
Examiner's
Use

- (e) (i) Construct a table and record all the data collected in this experiment. Your table should have the following aspects :
Bina satu jadual dan rekodkan semua data yang dikumpul dalam eksperimen ini.
Jadual anda hendaklah mengandungi aspek-aspek berikut :
- Enzyme concentration
Kepekatan enzim
 - The time taken for starch to be hydrolysed completely, t (minute)
Masa yang diambil bagi kanji dihidrolisiskan dengan lengkap, t (minit)
 - The rate of enzyme amylase activity, $1/t$ (minute $^{-1}$)
Kadar aktiviti enzim amilase, $1/t$ (minit $^{-1}$)

1(e)(i)

3

[3 marks]

[3 markah]

- (ii) Based on the data in 1 (e) (i), draw a graph to show the relationship between the enzyme concentration and the rate of amylase activity. Explain your answer.
(Use the graph paper provided on page 7 to answer this question.)

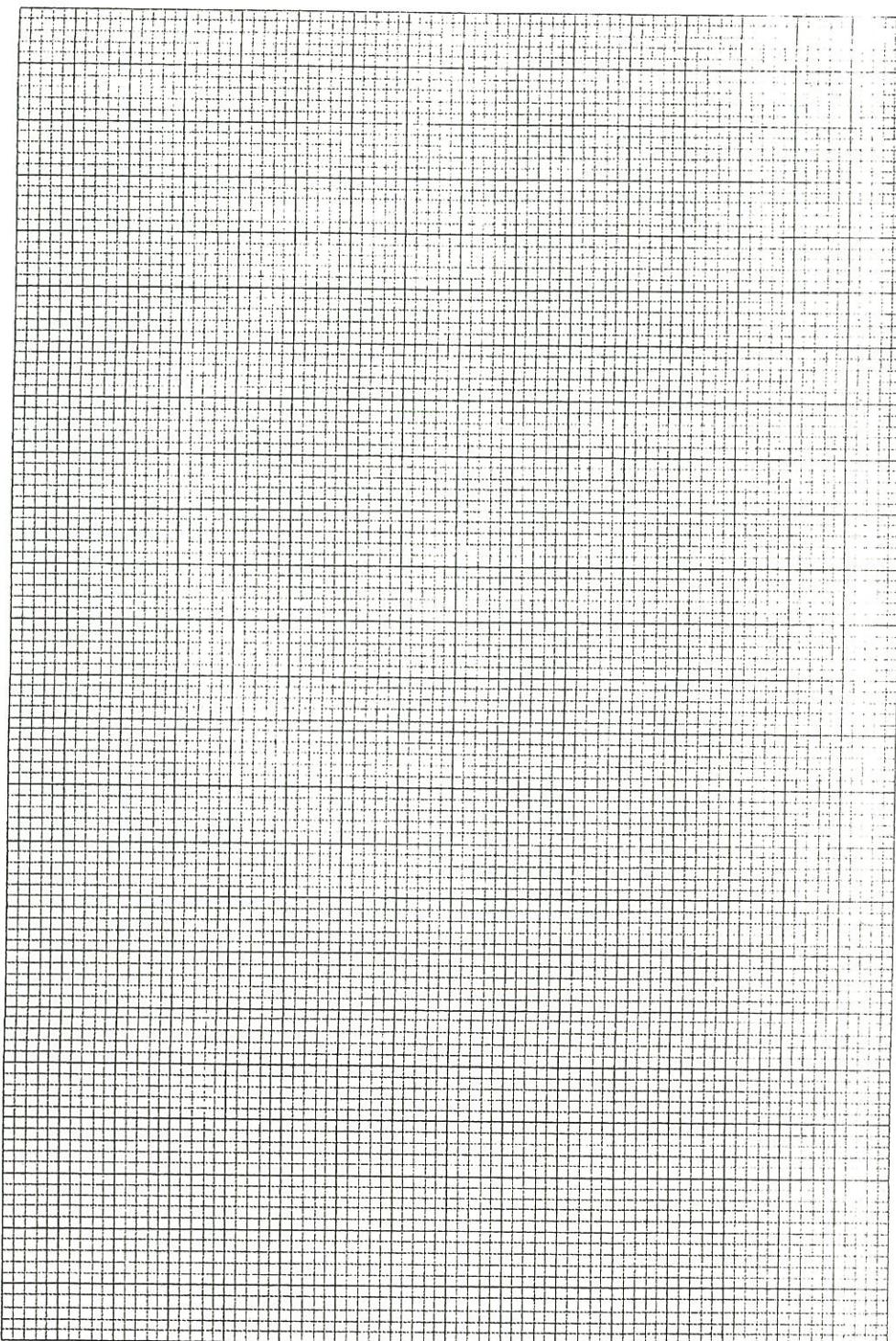
Berdasarkan data di 1 (e) (i), lukis satu graf untuk menunjukkan perhubungan antara kepekatan enzim dengan kadar aktiviti enzim amilase.

*Terangkan jawapan anda.
(Gunakan kertas graf di halaman 7 untuk menjawab soalan ini)*

1(e)(ii)

3

Graph of the rate of enzyme amylase activity against enzyme concentration.
Graf kadar aktiviti enzim amilase melawan kepekatan enzim .



For
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Use

(f)

- Based on the graph in (e) (ii), state the relationship between the enzyme concentration and the rate of amylase activity.
Explain your answer.

*Berdasarkan graf di (e) (ii), nyatakan perhubungan antara kepekatan enzim dengan kadar aktiviti enzim amilase.
Terangkan jawapan anda.*

.....
.....
.....

1(f)

3

[3 marks]
[3 markah]

(g)

- Based on the experiment, define operationally what enzyme is.

Berdasarkan eksperimen, berikan definisi secara operasi bagi enzim.

.....
.....
.....

1(g)

3

[3 marks]
[3 markah]

(h)

- The experiment is repeated with test tube R immersed in water bath with temperature of 65°C during the experiment.

Predict the time taken for starch to be hydrolysed completely in test tube R. Explain your answer.

Eksperimen diulang dengan merendam tabung uji R dalam bekas kukus air bersuhu 65°C semasa eksperimen.

Ramalkan masa yang diambil bagi kanji dihidrolisiskan dengan lengkap dalam tabung uji R. Terangkan jawapan anda.

.....
.....

1(h)

3

[3 marks]
[3 markah]

- (i) The following are some of the materials used in the experiment to study the effect of pH on the enzyme activity.

Yang berikut adalah beberapa bahan yang digunakan dalam eksperimen untuk mengkaji kesan pH ke atas aktiviti enzim.

- Sodium hydroxide solution

Larutan natrium hidroksida

- Hydrochloric acid

Asid hidroklorik

- Distilled water

Air suling

Complete the following table to classify the materials according to the type of medium.

Lengkapkan jadual berikut untuk mengelaskan bahan-bahan tersebut berdasarkan jenis medium.

Material <i>Bahan</i>	Type of medium <i>Jenis medium</i>

1(i)

[3marks]
[3 markah]

3

Answer all questions.
Jawab semua soalan.

- 1 A group of students carried out an experiment to investigate the percentage of vitamin C in different type of fruit juices by using dichlorophenolindophenol (DCPIP) solution. The experiment was carried out by using the samples of fruit juice such as lime juice, lemon juice and orange juice.

Sekumpulan pelajar telah menjalankan satu eksperimen untuk menyiasat peratus vitamin C dalam sampel jus buah yang berbeza dengan menggunakan larutan DCPIP. Eksperimen ini telah dijalankan dengan menggunakan sampel jus buah-buahan seperti jus limau nipis, jus lemon dan jus oren.

The students carried out the following steps:

Pelajar-pelajar tersebut telah menjalankan langkah-langkah yang berikut:

Step 1 : 1ml DCPIP solution was placed in a test tube.

Langkah 1 : 1ml larutan DCPIP telah dimasukkan ke dalam tabung uji.

Step 2 : A few drops of 0.1% ascorbic acid was added to the DCPIP solution until the blue coloured of DCPIP solution turned colourless.

Langkah 2 : Beberapa titik asid askorbik 0.1% telah ditambahkan ke dalam larutan DCPIP sehingga warna biru larutan DCPIP bertukar menjadi tidak berwarna.

Figure 1 shows the method used in the experiment.

Rajah 1 menunjukkan kaedah yang digunakan di dalam eksperimen ini.

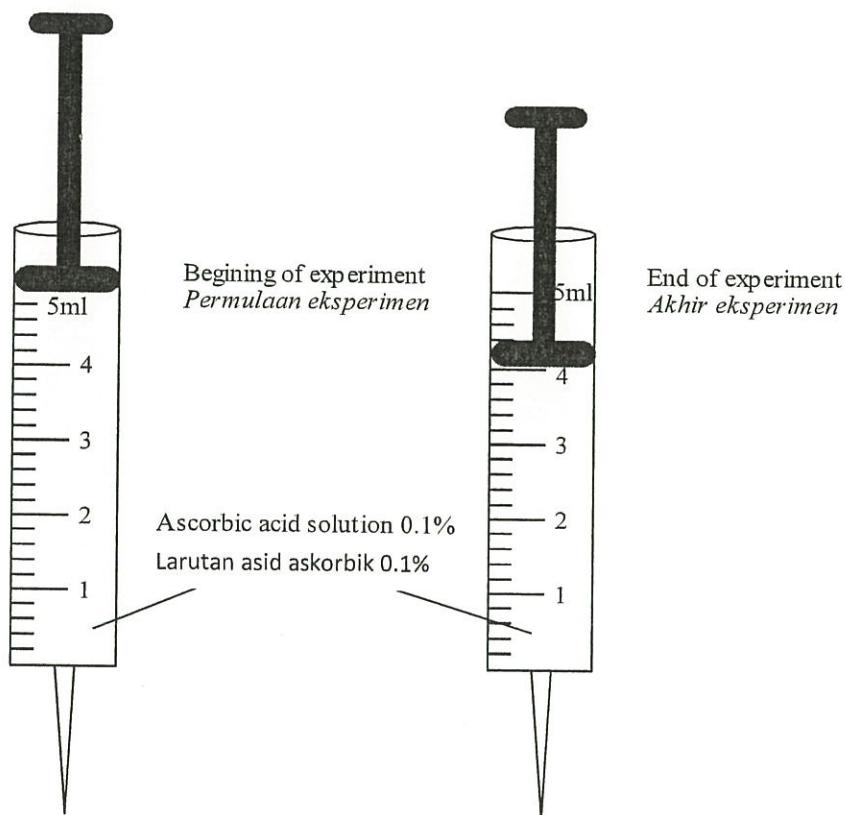


Figure 1
Rajah 1

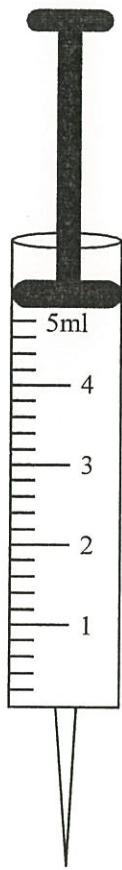
Based on Figure 1, the volume of 0.1% ascorbic solution used to decolourise 1ml DCPIP solution is **1 ml**.

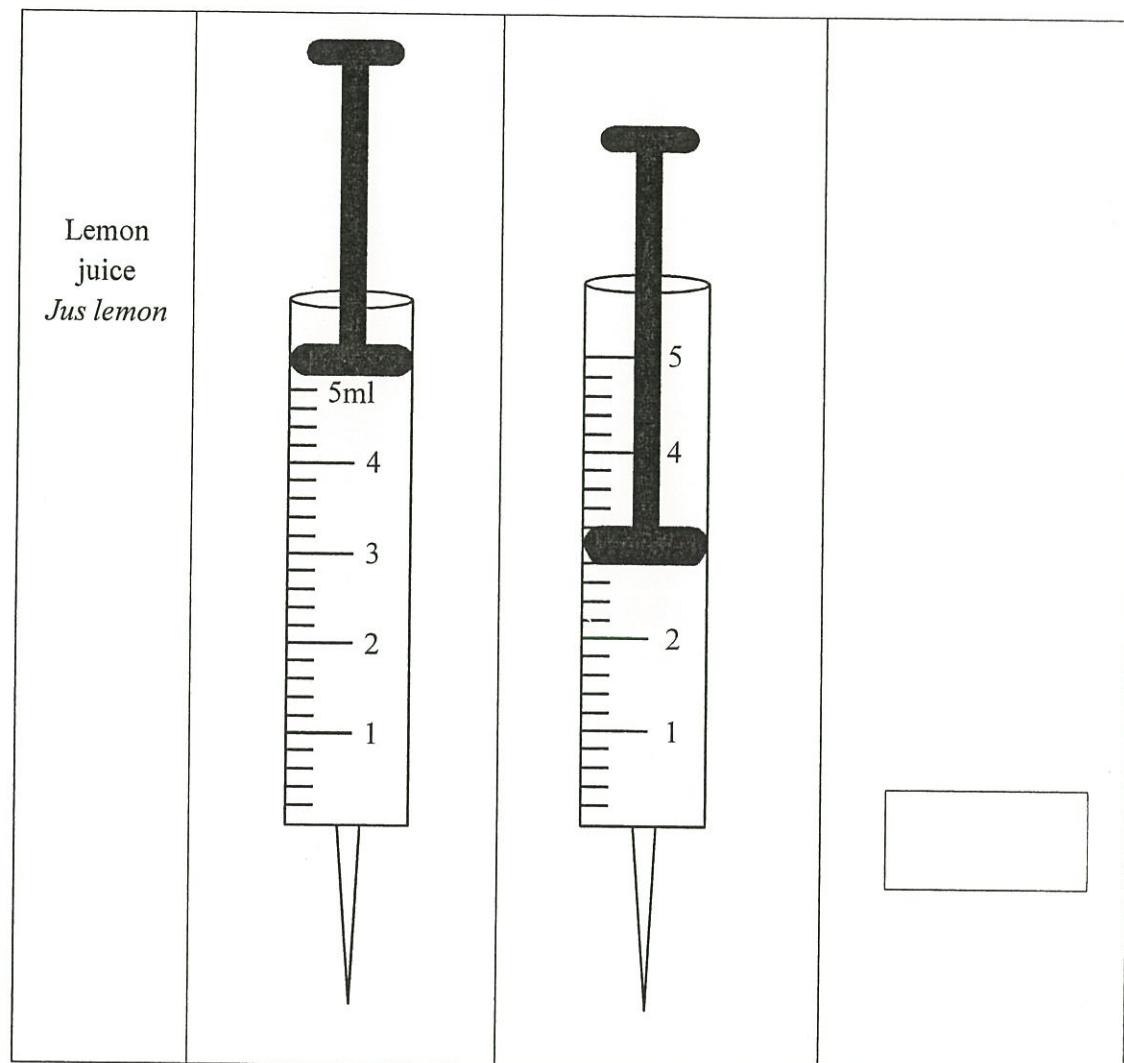
*Berdasarkan Rajah 1, isipadu larutan 0.1% asid askorbik yang digunakan untuk melunturkan warna 1ml larutan DCPIP ialah **1 ml**.*

Step 3 : Step 1 and 2 were repeated by using lime, lemon and orange juices to replace the 0.1% ascorbic acid solution to decolourise 1ml DCPIP solution.

Langkah 3 : *Langkah 1 dan 2 diulang dengan menggunakan jus limau nipis, jus lemon dan jus oren bagi menggantikan larutan 0.1% asid askorbik untuk melunturkan warna 1 ml DCPIP.*

The volume of fruit juices used to decolourise 1ml DCPIP solution is shown in the Table 1. *Isipadu jus buah-buahan yang digunakan untuk melunturkan warna 1 ml larutan DCPIP ditunjukkan di dalam Jadual 1.*

Type of fruit juices <i>Jenis jus buah-buahan</i>	Volume of fruit juice (ml) <i>Isipadu jus buah-buahan (ml)</i>		Volume of fruit juice used to decolourise DCPIP solution (ml) <i>Isipadu jus buah-buahan yang digunakan untuk melunturkan warna larutan DCPIP (ml)</i>
	Initial volume <i>Isipadu awal</i>	Final volume <i>Isipadu akhir</i>	
Lime juice <i>Jus limau nipis</i>			<input type="text"/>



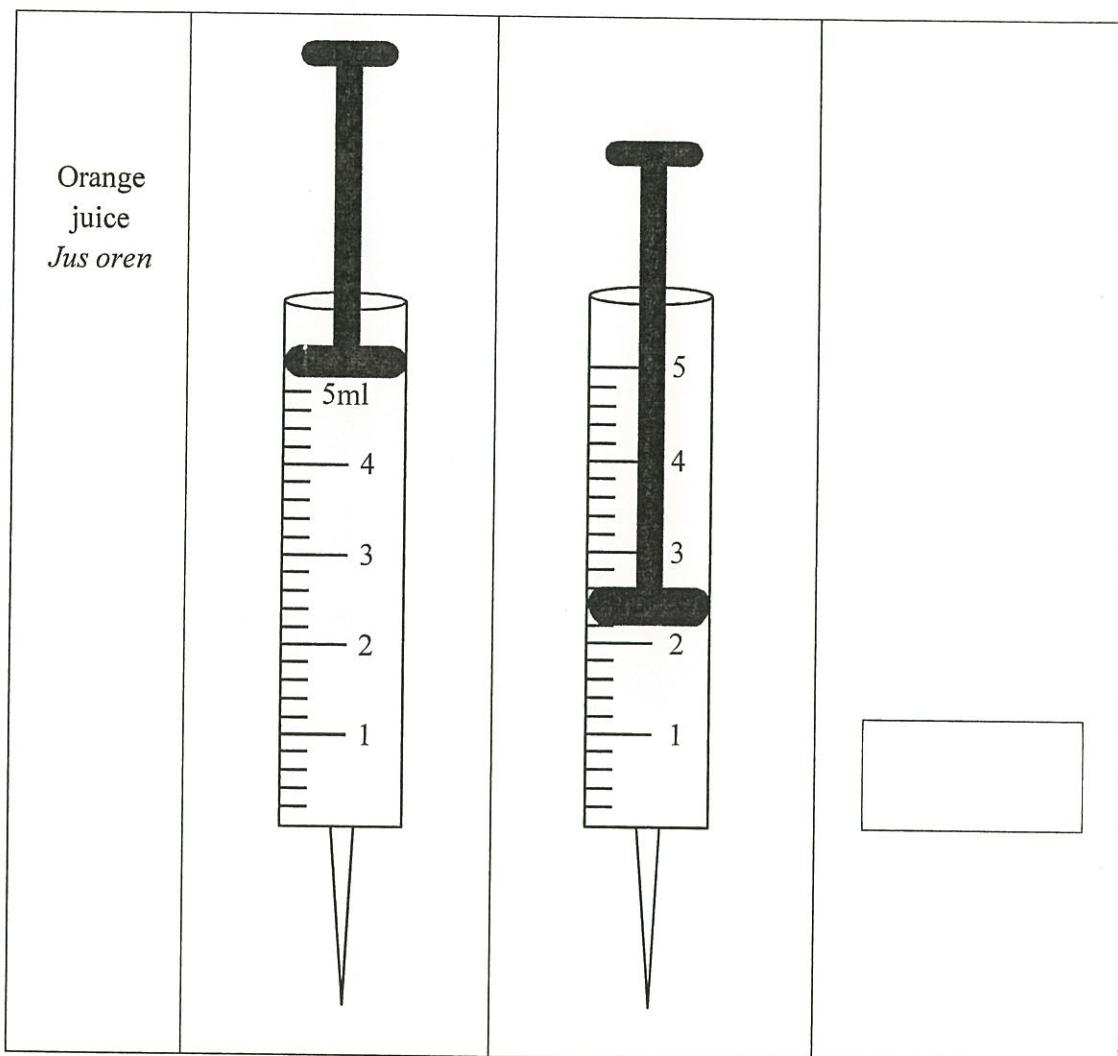


Table 1

Jadual 1

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1 (a)

3

[3 marks]

- (a) Record the volume of fruit juice used to decolourise 1ml of DCPIP solution in the boxes provided in Table 1.

Rekod isipadu jus buah-buahan yang digunakan untuk melunturkan warna larutan 1ml DCPIP dalam kotak yang disediakan dalam Jadual 1.

- (b) (i) Based on Table 1, state **two** different observations .

Berdasarkan Jadual 1, nyatakan dua pemerhatian yang berbeza.

Observation 1 :

Pemerhatian 1 :

.....
.....

Observation 2 :

Pemerhatian 2 :

.....
.....

1 (b) (i)

3

[3 marks]

- (ii) State the inferences which corresponds to the observations in 1(b)(i).

Nyatakan inferens yang sepadan dengan pemerhatian di 1(b)(i).

Inference from observation 1 :

Inferens daripada pemerhatian 1 :

.....
.....

Inference from observation 2 :

Inferens daripada pemerhatian 2 :

.....
.....

1 (b) (ii)

3

[3 marks]

- (c) Complete Table 2 based on this experiment.

Lengkapkan Jadual 2 berdasarkan eksperimen ini.

For Examiner's
use

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasi</i>
Responding variable <i>Pembolehubah bergerak balas</i>
Constant variable <i>Pembolehubah dimalarkan</i>

Table 2

Jadual 2

[3 marks]

- (d) State the hypothesis for this experiment.

Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....

1 (c)

3

1 (d)

3

[3 marks]

- (e) (i) Construct a table and record all the data collected in this experiment. Your table should have the following titles:

Bina satu jadual dan rekodkan semua data yang dikumpulkan dalam eksperimen ini.

Jadual anda hendaklah mengandungi tajuk-tajuk berikut:

- Sample of fruit juice

Sampel jus buah-buahan

- Volume of fruit juice used to decolourise 1 ml DCPIP solution

Isipadu jus buah-buahan yang digunakan untuk melunturkan warna 1ml larutan DCPIP

- Percentage of vitamin C in fruit juice:

Peratus vitamin C di dalam jus buah-buahan:

$$\left[\frac{\text{Volume of } 0.1\% \text{ ascorbic acid solution}}{\text{Volume of fruit juice}} \times 0.1\% \right]$$

$$\left[\frac{\text{Isipadu larutan } 0.1\% \text{ asid askorbik}}{\text{Isipadu jus buah-buahan}} \times 0.1\% \right]$$

1 (e)(i)

3

[3 marks]

- (e) (ii) Use the graph paper provided on page 12 to answer this question. Using the data in 1(e) (i), draw a bar chart to show the percentage of vitamin C in different type of fruit juices.

Guna kertas graf yang disediakan di muka surat 12 untuk menjawab soalan ini.

Menggunakan data di 1 (e)(i), lukis satu carta bar untuk menunjukkan peratus vitamin C dalam jus buah-buahan..

For Examiner's
use

1 (e)(ii)

	3
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[3 marks]

- (f) Based on the bar chart in 1(e) (ii) , explain the relationship between the volume of the fruit juices used to decolourise DCPIP solution with the percentage of vitamin C in the fruit juices.

Berdasarkan carta bar di 1(e) (ii), terangkan hubungan antara isi padu jus buah-buahan yang digunakan untuk melunturkan warna larutan DCPIP dengan peratus vitamin C dalam jus buah-buahan.

.....
.....
.....
.....
.....

1 (f)

	3
--	---

[3 marks]

- (g) Based on the result of this experiment, state the operational definition for vitamin C.

Berdasarkan keputusan eksperimen ini, nyatakan definisi secara operasi bagi vitamin C.

.....
.....
.....
.....
.....

1 (g)

	3
--	---

[3 marks]

- (h) The experiment is repeated using lemon juice that placed in the beaker and prepared 5

hours before the experiment. Predict the outcome of this experiment.

Explain your prediction.

Eksperimen ini diulang menggunakan jus lemon yang disimpan dalam bikar dan disediakan 5 jam sebelum eksperimen. Ramalkan hasil eksperimen ini.

Terangkan ramalan anda.

For Examiner's
use

.....
.....
.....
.....
.....

1 (h)

	3
--	---

[3 marks]

- (i) Another group of students carried out the experiment to determine the percentage of vitamin C but was provided with the following materials :

Apple juice <i>Jus epal</i>	Ascorbic acid solution 1.0% <i>Larutan asid askorbik 1.0%</i>
DCPIP solution 0.1% <i>Larutan DCPIP 0.1%</i>	Pineapple juice <i>Jus nanas</i>

Classify the above list into materials to be tested and reagents based on their functions in the experiment in Table 3.

Kelaskan senarai bahan di atas kepada bahan yang diuji dan reagen berdasarkan fungsi dalam eksperimen ini dalam Jadual 3.

1 (i)

	3
--	---

Materials to be tested <i>Bahan yang diuji</i>	Reagent <i>Reagen</i>

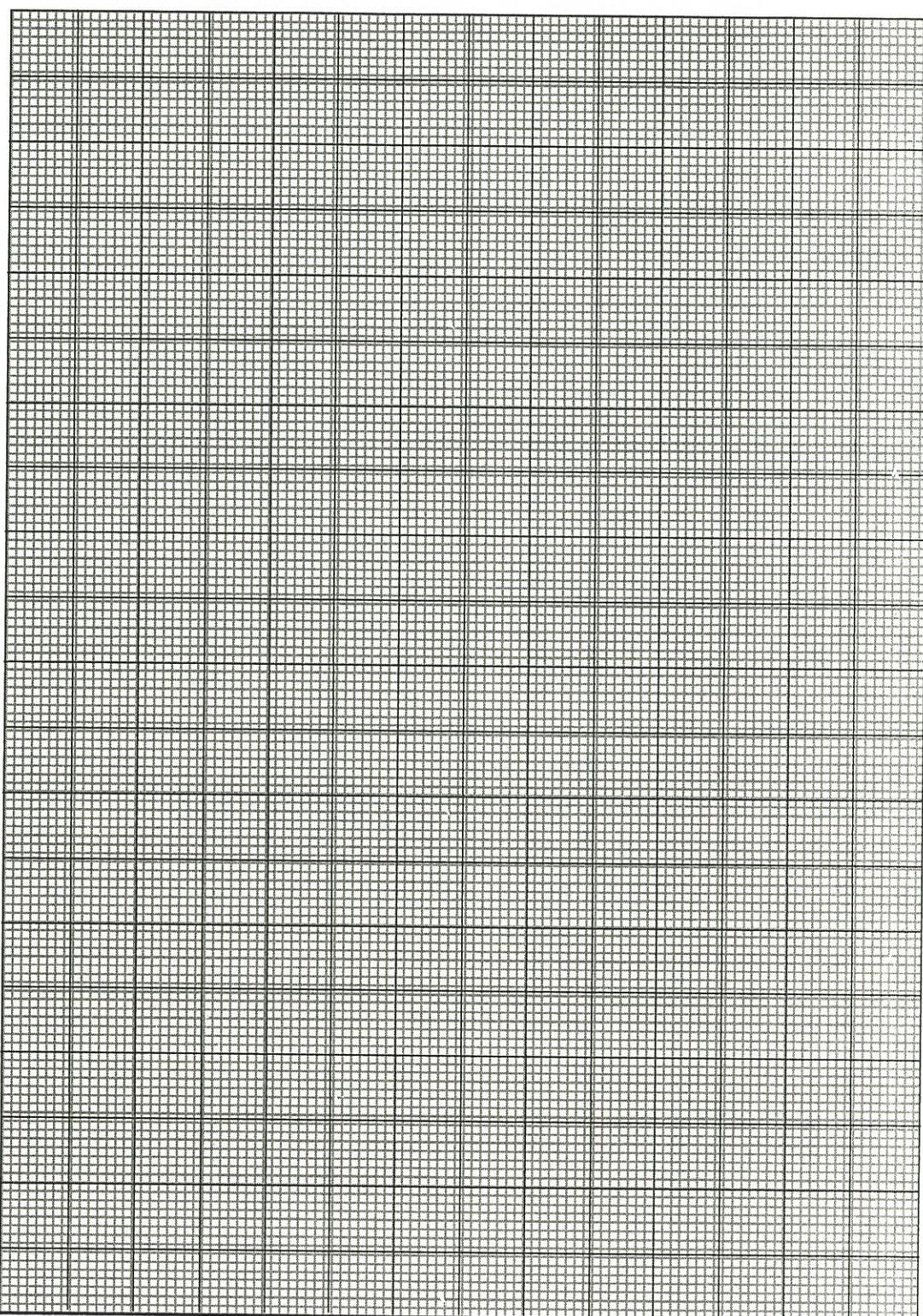
Jadual 3
Jadual 3

Total

	33
--	----

[3 marks]

Bar chart of percentage of vitamin C in different fruit juices
Carta bar peratus vitamin C dalam jus buah-buahan yang berbeza



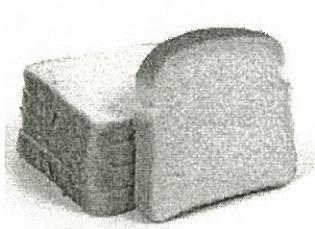
Soalan 2

Human beings need energy to do their daily activities and to maintain their body temperature at 37°C . Cellular respiration produce energy in our body. Energy is measured in the unit of Joule per gram.

Design an experiment to calculate the energy value in the food samples below:

Manusia memerlukan tenaga untuk melakukan aktiviti harian dan mengekalkan suhu badan pada 37°C . Respirasi sel menghasilkan tenaga di dalam badan kita. Tenaga disukat dengan unit Joule per gram.

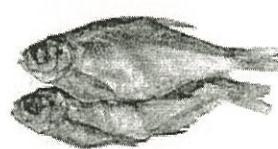
Rekabentuk satu eksperimen untuk menghitung nilai tenaga di dalam sampel-sampel makanan di bawah.



Bread,
roti



groundnut
kacang tanah



dried fish
ikan kering

The planning of your experiment must include the following aspects:

Perancangan eksperimen anda hendaklah meliputi aspek-aspek berikut:

- Problem statement
Pernyataan masalah
- Hypothesis
Hipotesis
- Variables
Pembolehubah
- List of apparatus and materials
Senarai radas dan bahan
- Experimental procedure
Prosedur eksperimen
- Presentation of data
Persembahan data

[17 markah]

2 Plants can grow well if the needs of macronutrients and micronutrients are fulfilled in correct proportions. Plants which lack of nitrogen will lead to stunted growth and leaves becomes yellow . Table 1 shows the content of nutrient in a correct proportion for the plants to grow well which known as Knop's Solutions.

Tumbuh - tumbuhan boleh tumbuh dengan baik sekiranya keperluan makronutrien dan mikronutriennya dipenuhi dalam nisbah yang betul. Tumbuhan yang kekurangan nitrogen akan menyebabkan pertumbuhannya terbantut dan daunnya bertukar kuning. Jadual 1 menunjukkan nutrien dalam nisbah yang betul bagi tumbesaran yang baik dan dikenali sebagai Larutan Knop's .

Knop's Solution Larutan Knop's	
Distilled water	1000ml
Calcium nitrate	0.8g
Potassium nitrate	0.2g
Potassium dihydrogen phosphate	0.2g
Magnesium sulphate	0.2g
Ferum (II) phosphate	0.05g

Table 1

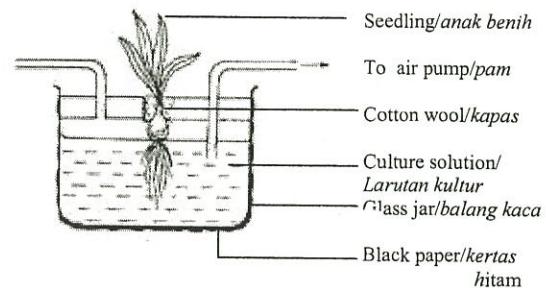


Figure 1

By using a suitable plant that can absorb nutrient from culture solution as in Figure 1, design an experiment to show the effect of nitrogen deficiency on the growth of seedling. Your experimental planning need to include the following aspects:

Dengan menggunakan tumbuhan yang boleh menyerap nutrien daripada larutan kultur seperti Rajah 1, rekabentuk satu eksperimen untuk menunjukkan kesan kekurangan nitrogen ke atas kadar tumbesaran anak benih. Perancangan eksperimen anda hendaklah meliputi aspek-aspek berikut:

- Problem Statement
Penyataan Masalah
- Objective of investigation
Tujuan eksperimen
- Hypothesis
Hipotesis
- Variables
Pembolehubah
- List of apparatus and materials
Senarai alat radas
- Technique used
Teknik
- Experimental procedure
Prosedur eksperimen
- Presentation of data
Persembahan data
- Conclusion
Kesimpulan

Answer all questions.

Jawab semua soalan

1. Goldfish is a cold-blooded organism. The body temperature varies with the surrounding temperature as well as the rate of respiration.

Ikan emas ialah sejenis haiwan berdarah sejuk. Suhu badannya berupaya berubah mengikut suhu persekitaran, begitu juga kadar respirasinya.

An experiment was carried out to investigate the effect of water temperature on the rate at which a goldfish opens and closes its mouth.

Satu eksperimen telah dijalankan untuk mengkaji kesan suhu air ke atas kadar seekor ikan emas membuka dan menutup mulutnya.

The following steps were carried out.

Langkah-langkah berikut telah dijalankan.

Step 1. In the experiment, the temperature of the water in an aquarium is fixed at 6°C.

A goldfish is placed in the aquarium.

Langkah 1. Dalam eksperimen ini, suhu air dalam sebuah akuarium telah diubah dan ditetapkan pada 6°C. Seekor ikan emas dimasukkan ke dalam akuarium itu.

Step 2. The goldfish is left in the water for 30 minutes to adapt to the water temperature.

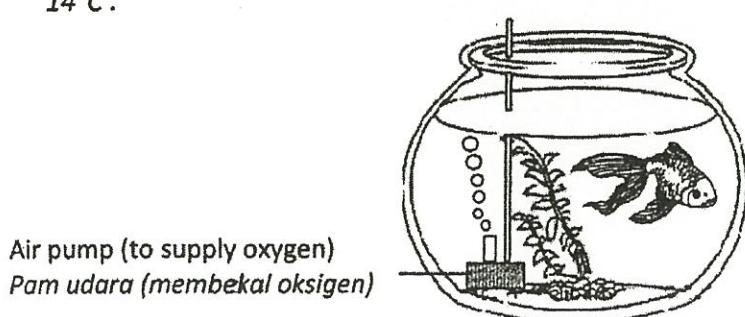
Langkah 2. Ikan emas itu dibiarkan berada dalam air selama 30 minit supaya ia dapat menyesuaikan diri dengan suhu air.

Step 3. After 30 minutes, start the stop watch, measure and record the time taken for the goldfish to open and close the mouth for 50 times.

Langkah 3. Selepas 30 minit, mulakan jam randik, ukur dan rekodkan masa yang diambil oleh ikan emas untuk membuka dan menutup mulutnya sebanyak 50 kali.

Step 4. Repeat step 1 to step 3 by fixing the temperature at 10°C and 14°C.

Langkah 4. Ulangi langkah 1 sehingga langkah 3 dengan menetapkan suhu pada 10°C and 14°C.



The results of the experiment are shown in Table 1
Keputusan eksperimen ditunjukkan dalam Jadual 1.

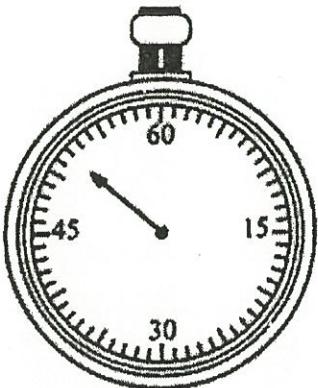
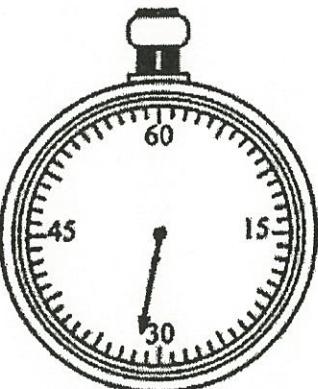
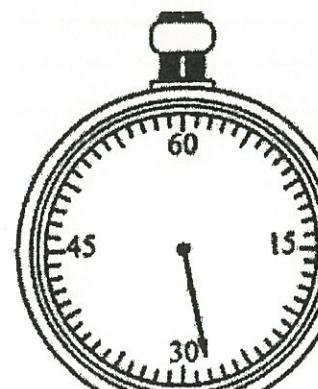
Temperature of the water. <i>Suhu air</i>	Observation <i>Pemerhatian</i>	Time taken for the goldfish to open and close the mouth for 50 times. <i>Masa yang diambil oleh ikan emas untuk membuka dan menutup mulutnya sebanyak 50 kali.</i>
6°C		_____ seconds saat
10°C		_____ seconds saat
14°C		_____ seconds saat

Table 1
Jadual 1

- (a) Record the time taken for the goldfish to open and close the mouth for 50 times in Table 1.
Rekod masa yang diambil oleh ikan emas untuk membuka dan menutup mulutnya sebanyak 50 kali dalam Jadual 1.

[3 marks / markah]

- (b) (i) State two different observations made from Table 1.
Nyatakan dua pemerhatian yang berbeza yang dibuat daripada Jadual 2.

Observation 1 / Pemerhatian 1 :

.....
.....
.....

Observation 2 / Pemerhatian 2 :

.....
.....
.....

[3 marks / markah]

- (ii) State the inferences from the observations in 1(b)(i)
Nyatakan inferens daripada pemerhatian di 1(b)(i)

Inference from observation 1 / Inferens daripada pemerhatian 1 :

.....
.....
.....

Inference from observation 2 / Inferens daripada pemerhatian 2 :

.....
.....
.....

[3 marks / markah]

- (c) Complete Table 2 based on this experiment.
Lengkapkan Jadual 2 berdasarkan eksperimen ini.

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasikan</i>
Responding variable <i>Pembolehubah bergerak balas</i>
Constant variable <i>Pembolehubah dimalarkan</i>

Table 2 / Jadual 2

[3 marks / markah]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....
.....

[3 marks / markah]

- (e) (i) Construct a table and record all the data collected in this experiment.

Your table should have the following titles :

Bina satu jadual dan rekodkan semua data yang dikumpul dalam eksperimen ini.

Jadual anda hendaklah mengandungi tajuk-tajuk berikut :

- Water temperature
suhu air
- Time taken for the goldfish to open and close the mouth for 50 times.
Masa yang diambil oleh ikan emas membuka dan menutup mulut 50 kali.
- Rate of respiration of the goldfish (numbers of mouth openings / minute)
Kadar respirasi ikan emas (bilangan kali membuka mulut / minit)

[3 marks / markah]

- (ii) Use the data from 1(e)(i), draw a graph of the rate of respiration against the temperature of the water.

Gunakan data dari 1(e)(i), lukiskan graf kadar respirasi melawan suhu air.

[3 marks / markah]

- (f) Based on the graph in 1(e)(ii), explain the relationship between the rate of respiration of the goldfish and the water temperature.
Berdasarkan graf di 1(e)(ii), terangkan hubungan antara kadar respirasi ikan emas dengan suhu air.

.....
.....
.....
.....
.....
.....

[3 marks / markah]

- (g) State the operational definition for the rate of respiration of the goldfish.
Nyatakan definisi secara operasi bagi kadar respirasi ikan emas.

.....
.....
.....
.....
.....
.....

[3 marks / markah]

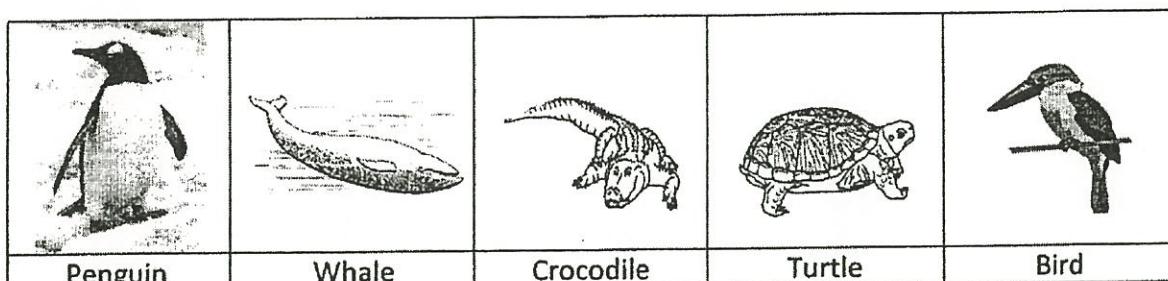
- (h) The experiment is repeated at 10°C by removing the air pump from the aquarium.
Predict the outcome of this experiment.
Explain your prediction.
*Eksperimen ini diulangi pada suhu 10°C dengan mengeluarkan pam udara dari akuarium.
Ramalkan hasil eksperimen ini.
Terangkan ramalan anda.*

.....
.....
.....
.....
.....
.....

[3 marks / markah]

- (i) Using the list provided below, classify the warm-blooded animals and cold-blooded animals in Table 3.

Menggunakan senarai yang disediakan di bawah, klasifikasikan haiwan berdarah panas dan haiwan berdarah sejuk dalam Jadual 3.



Warm-blooded animals <i>Haiwan berdarah panas</i>	Cold-blooded animals <i>Haiwan berdarah sejuk</i>

Table 3
Jadual 3

[3 marks / markah]

Answer all questions.

Jawab semua soalan.

1. A group of students conducted an experiment to investigate the content of carbon dioxide in exhaled air for an athlete after doing three different levels of vigorous activity which lasted for 20 minutes. The athlete rested 15 minutes between each activity. The exhaled air was analysed immediately to determine the amount of carbon dioxide produced with a J-tube.

Sekumpulan pelajar telah menjalankan eksperimen untuk mengkaji kandungan karbon dioksida dalam udara hembusan oleh seorang atlet selepas menjalankan tiga jenis aktiviti yang berbeza tahap kecergasan selama 20 minit. Atlet tersebut berehat selama 15 minit sebelum aktiviti berikutnya. Udara hembusannya dianalisa dengan segera untuk menentukan kandungan karbon dioksida yang dihasilkan menggunakan tiub-J.

Diagram 1 shows the length of air column in the J-tube before treatment using 0.1% potassium hydroxide solution (KOH).

Rajah 1 menunjukkan panjang turus udara di dalam tiub-J sebelum dirawat dengan larutan kalium hidroksida (KOH) 0.1%.

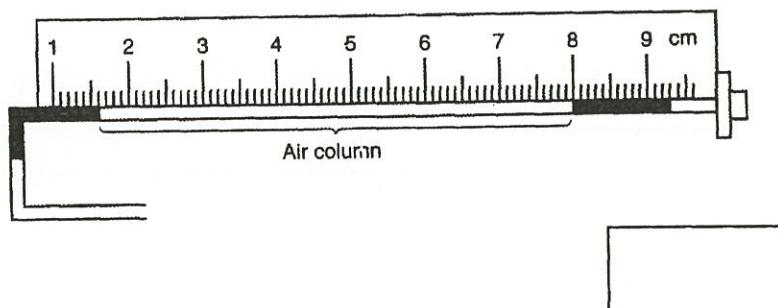


Diagram 1

Rajah 1

Table 1 shows the lengths of air column in the J-tube after treatment with potassium hydroxide solution (KOH).

Jadual 1 menunjukkan panjang turus udara di dalam tiub-J selepas dirawat dengan larutan kalium hidroksida (KOH).

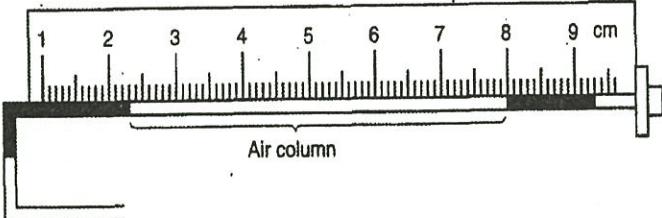
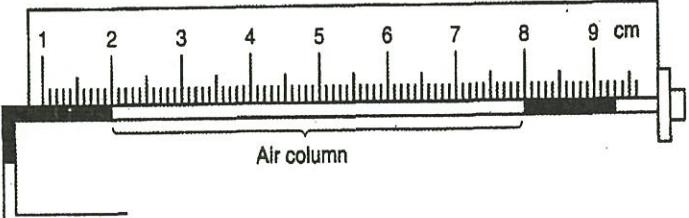
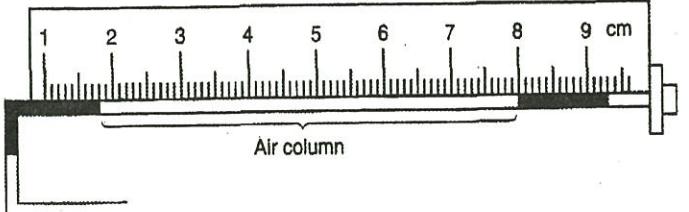
Levels of vigorous activity <i>Tahap kecergasan aktiviti</i>	Length of air column after treatment with potassium hydroxide / cm <i>Panjang turus udara selepas dirawat dengan kalium hidroksida / cm</i>	Length of air column / cm <i>Panjang turus udara / cm</i>
P	 <p>Air column</p>	<input type="text"/>
Q	 <p>Air column</p>	<input type="text"/>
R	 <p>Air column</p>	<input type="text"/>

Table 1
Jadual 1

- (a) Record the lengths of the air column in the spaces provided in Diagram 1 and Table 1.

Catatkan panjang turus udara pada ruang yang disediakan dalam Rajah 1 dan Jadual 1.

[3 marks / 3 markah]

- (b)(i) State **two** observations that can be made from this experiment based on Table 1.

Nyatakan **dua** pemerhatian yang boleh dibuat daripada eksperimen berdasarkan Jadual 1

Observation 1:

Pemerhatian 1:

.....
.....

Observation 2:

Pemerhatian 2:

.....
.....

[3 marks / 3 markah]

- (ii) State the inferences from the observations in 1 (b) (i)

Nyatakan inferens daripada pemerhatian di 1 (b) (i)

Inference from observation 1:

Inferens daripada pemerhatian 1:

.....
.....

Inference from observation 2:

Inferens daripada pemerhatian 2:

.....
.....

[3 marks / 3 markah]

(c) Complete Table 2 based on this experiment.

Lengkapkan Jadual 2 berdasarkan eksperimen ini.

Variable <i>Pembolehubah</i>	Method to handle variable <i>Cara mengendali pembolehubah</i>
Manipulated variable: <i>Pembolehubah dimanipulasi</i>
Responding variable: <i>Pembolehubah bergerakbalas</i>
Constant variable: <i>Pembolehubah dimalarkan</i>

Table 2

Jadual 2

[3 marks / 3 markah]

(d) State the hypothesis for this experiment.

Nyatakan hipotesis bagi eksperimen ini.

.....
.....

[3 marks / 3 markah]



(e) (i) Construct a table and record all the data collected in this experiment.

Bina satu jadual dan rekodkan semua data yang dikumpul dalam eksperimen ini.

Your table should have the following aspect.

Jadual anda hendaklah mengandungi aspek-aspek berikut:

- Title with correct unit

Tajuk dengan unit yang betul

- Initial length and final length of air column

Panjang awal dan panjang akhir turus udara

- Change in the length of air column

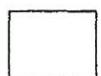
Perubahan panjang turus udara

- Percentage of carbon dioxide released

Peratus karbon dioksida yang dibebaskan

$$\begin{array}{lcl} \text{Percentage of carbon} & = & \frac{\text{Change in length of air column}}{\text{Initial length of air column}} \times 100\% \\ \text{dioxide released} & & \\ \text{Peratus karbon dioksida} & = & \frac{\text{Perubahan panjang turus udara}}{\text{Panjang awal turus udara}} \times 100\% \\ \text{yang dibebaskan} & & \end{array}$$

[3 marks / 3 markah]



- (ii) Use the graph paper provided on page 8 to answer this question. Using the data in 1(e) (i) draw a bar chart to show the relationships between percentage of carbon dioxide released and levels of vigorous activity.

Guna kertas graf yang disediakan di halaman 8 untuk menjawab soalan ini. Dengan menggunakan data di 1(e) (i) lukis satu carta bar untuk menunjukkan hubungan antara peratusan karbon dioksida yang dibebaskan dengan tahap kecergasan aktiviti yang dilakukan.

[3 marks / 3 markah]

- (f) Based on the bar chart in 1 (e) (ii), explain the relationship between the levels of vigorous activity and the percentage of carbon dioxide released.

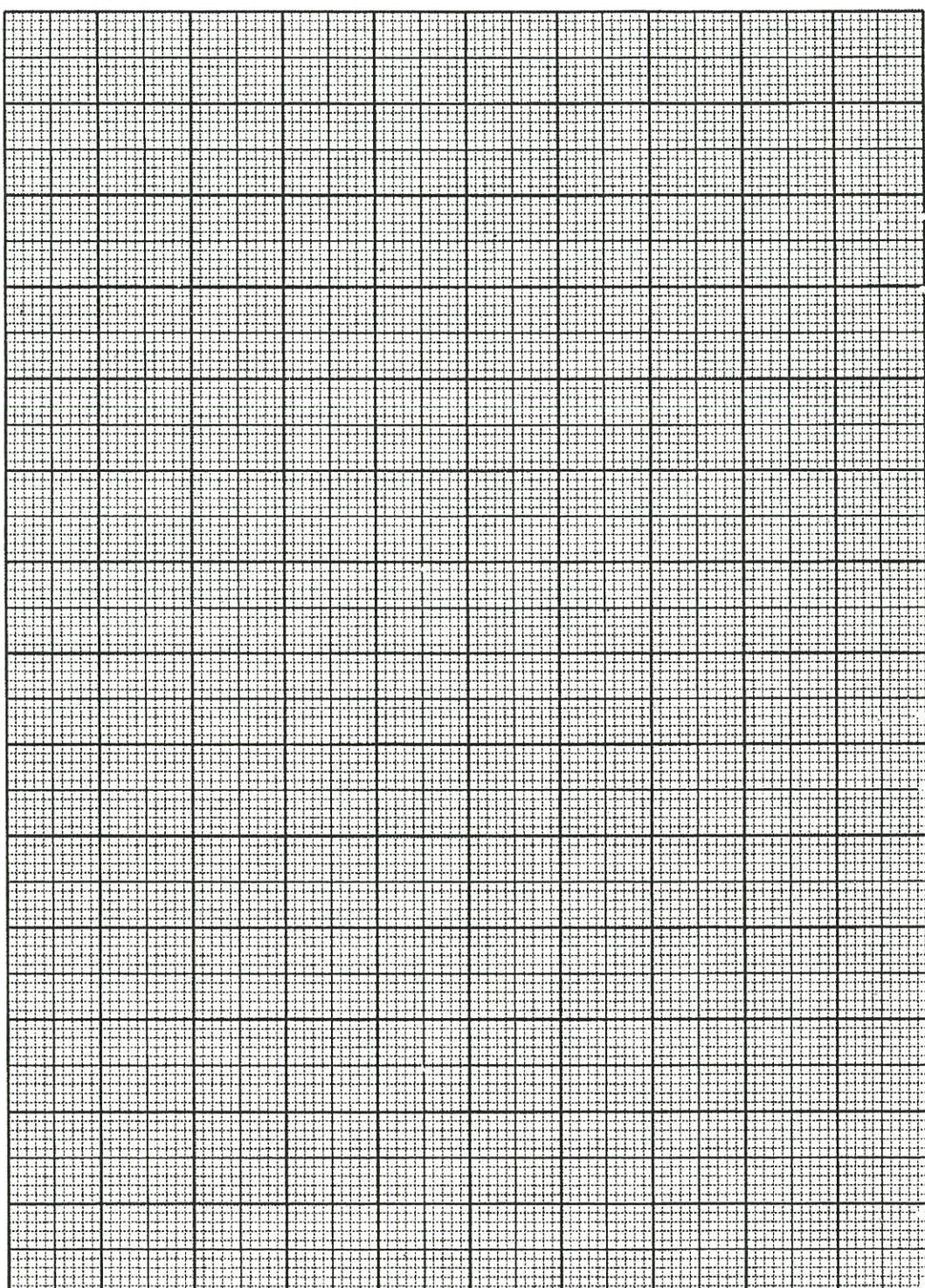
Berdasarkan carta bar dalam 1(e) (ii), terangkan perkaitan antara tahap kecergasan aktiviti dan peratusan karbon dioksida yang dibebaskan.

[3 marks / 3 markah]

- (g) State the operational definition of exhaled air based on this experiment.

Nyatakan definisi secara operasi bagi udara hembusan berdasarkan eksperimen ini.

[3 marks / 3 markah]



- (h) If the duration of activity P is extended to 40 minutes, predict the length of air column after treatment with potassium hydroxide. Explain your prediction.

Jika tempoh masa menjalankan eksperimen ini diperpanjang kepada 40 minit, ramalkan panjang turus udara selepas dirawat dengan larutan kalium hidroksida. Terangkan ramalan anda.

.....
.....
.....

[3 marks / 3 markah]

- (i) Categorize the types of activity P, Q and R based on high, medium and low rate of respiration.

Kategorikan jenis aktiviti P, Q dan R berdasarkan kepada kadar respirasi paling tinggi, sederhana dan rendah.

Levels of vigorous activity <i>Tahap kecergasan aktiviti</i>	Rate of respiration <i>Kadar respirasi</i>

[3 marks / 3 markah]

Question 2
Soalan 2

Diagram 2 shows an apparatus used in determining the amount of certain gas in an air sample.
Rajah 2 menunjukkan satu radas yang digunakan dalam menentukan kandungan gas tertentu di dalam satu sampel udara.

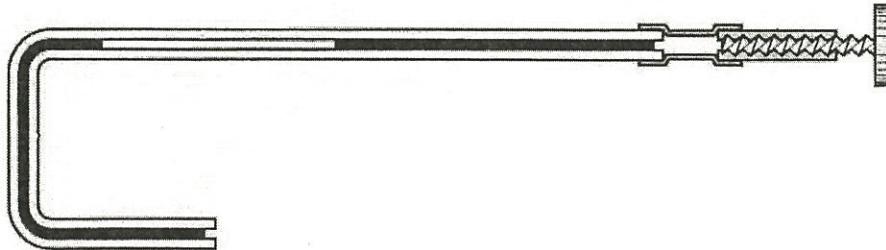


Diagram 2
Rajah 2

By using the apparatus shown, design a laboratory experiment to investigate the percentage of carbon dioxide in exhaled air collected after conducting different types of activity.

Dengan menggunakan radas yang ditunjukkan, rancangkan satu eksperimen makmal mengkaji peratus gas karbon dioksida di dalam udara hembusan nafas yang dikumpulkan selepas menjalankan jenis aktiviti yang berbeza.

Your experimental planning need to include the following aspects:
Perancangan eksperimen anda perlu meliputi aspek-aspek berikut:

- Problem Statement
Pernyataan masalah
- Variables
Pembolehubah
- Hypothesis
Hipotesis
- List of materials and apparatus
Senarai bahan dan radas
- Experimental procedures
Prosedur eksperimen
- Presentation of data
Persembahan data

[17 marks]
[17 markah]

2. The soft texture of bread results from yeast. Carbon dioxide trapped in the dough makes it rise. Fermentation is a process which yeast is used to produce carbon dioxide. The yeast carries out fermentation through anaerobic respiration. The rate of fermentation can be influenced by several factors such as temperature, pH and the presence of nutrient.

Tekstur roti yang lembut adalah disebabkan oleh yis. Semasa membuat roti, karbon dioksida yang terperangkap di dalam doh menyebabkan roti itu naik. Proses penghasilan karbon dioksida oleh yis dikenali sebagai fermentasi. Yis menjalankan fermentasi melalui respirasi anaerob. Terdapat pelbagai faktor yang mempengaruhi kadar fermentasi, misalnya suhu, pH dan kehadiran nutrien.

Based on the information, plan a laboratory experiment to investigate the effects of nutrient on the rate of anaerobic respiration of yeast.

The planning of your experiment must include the following aspects:

Berdasarkan maklumat di atas, rancang satu eksperimen dalam makmal untuk mengkaji kesan nutrien ke atas kadar respirasi anaerob yis.

Perancangan eksperimen anda hendaklah meliputi aspek-aspek berikut:

- Problem statement
Pernyataan masalah
- Hypothesis
Hipotesis
- Variables
Pembolehubah
- List of apparatus and materials
Senarai radas dan bahan
- Experiment procedure
Prosedur eksperimen
- Presentation of data
Persembahan data

[17 marks]
[17 markah]

Question 1

Lemna minor is a species of free-floating aquatic plants from the duckweed family Lemnaceae. The plants grow mainly by vegetative reproduction: two daughter plants bud off from the adult plant.

An experiment is carried out to investigate the effect of abiotic factor such as pH on *Lemna* sp. growth. Experiment is done under controlled conditions: 12 hours a day light exposure and using the same Knop's solution.

Petri dish is filled with 20 ml Knop's solution with different pH value and 5 *Lemna* sp. each. The Knop's solution is treated by adding acid or alkali to achieve the pH value needed.

** Knop's solution is a solution which contains essential nutrient for plants growth.

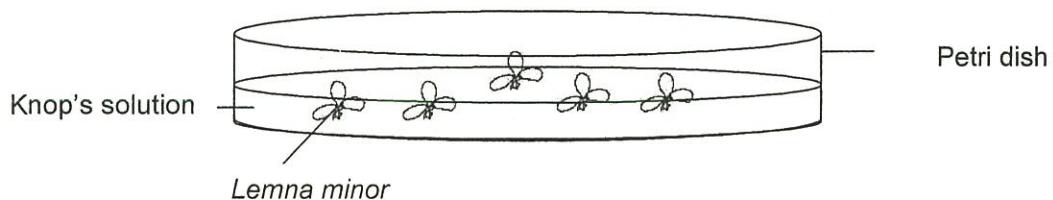
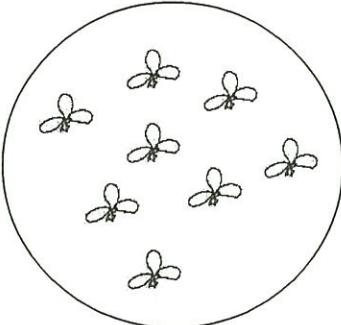
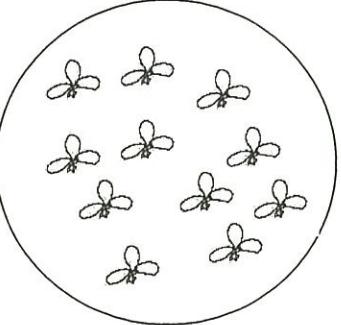
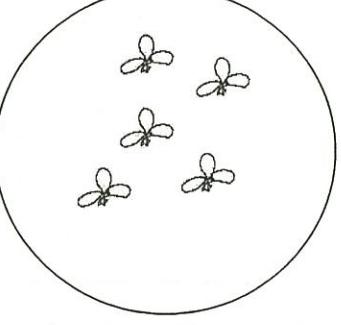
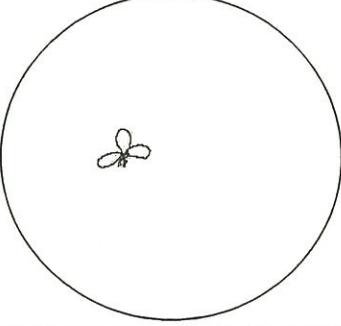


Figure 1

After 7 days, the observation is made and the result shown in Table 1.1

Table 1.1

pH value	Petri dish	Number of <i>Lemna</i> sp.
2		
4		

pH value	Petri dish	Number of <i>Lemna</i> sp.
6		
8		
10		
12		

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examiner's
use

Base on the experiment, answer all questions below.

- (a) State the number of *Lemna* sp. in the spaces provided in Table 1.1

[3 marks]

1 (a)

- (b) (i) Based on Table 1.1, state two observations that can be made in this experiment.

Observation 1:

.....
.....
.....

Observation 2:

.....
.....
.....

1 (b) (i)

[3 marks]

- (ii) State the inference for each observation made in (b) (i).

Inference for observation 1:

.....
.....
.....

Inference for observation 2:

.....
.....
.....

1 (b) (ii)

[3 marks]

- (c) Complete Table 1.4 to show the variables involved in the experiment and how the variables are operated.

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Variables	Operating the variables
Manipulated variable:	How to alter the manipulated variable:
Responding variable:	How to determine the responding variable:
Controlled variable:	How to maintain the controlled variable:

Table 1.2

[3 marks]

1 (c)

- (d) State the hypothesis for this experiment.

.....
.....
.....

1 (d)

[3 marks]

- (e) (i) Construct a table and record the results of the experiment.

Your table should contain the following title.

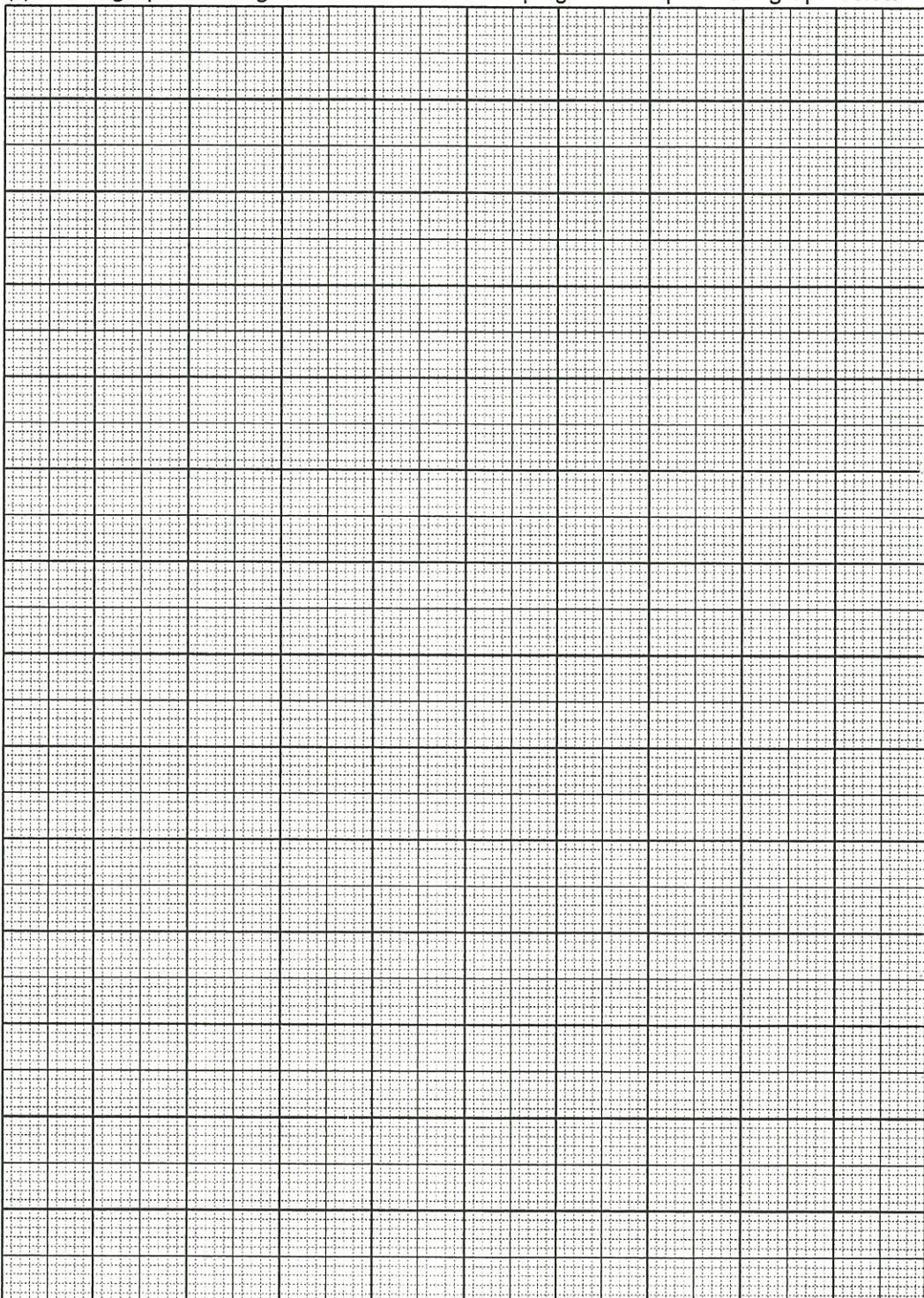
- pH of water
- Number of *Lemna* sp.

1 (e) (i)

[3 marks]

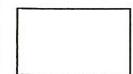
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(ii) Plot a graph showing the number of *Lemna* sp against the pH in the graph below



[3 marks]

1 (e) (ii)



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use

- (iii) Referring to the graph in (e) (ii), describe the relationship between the *Lemna* sp growth and the condition of the medium.

.....
.....
.....

1 (e) (iii)

[3 marks]

- (f) Based on the experiment, define operationally the abiotic factor in an ecosystem.

.....
.....
.....

1 (f)

[3 marks]

- (g) The effluent from laundry shop flows into a pond nearby, predict the population of *Lemna* sp in the pond. Explain your answer.

.....
.....

1 (g)

[3 marks]

- (h) Classify the biotic and abiotic factors from the list provided below.

Humidity, light intensity, decomposer, parasites, symbiotic organism, soil texture, invertebrates, topography

1 (h)

[3 marks]

Answer all questions.
Jawab semua soalan.

1. A group of students carried out an experiment to study the effect of intraspesific competition on the growth of paddy seedlings.

Sekumpulan pelajar menjalankan eksperimen untuk mengkaji kesan persaingan intraspesifik terhadap pertumbuhan anak benih padi.

Diagram 1 shows the apparatus set-up of the experiment.

Rajah 1 menunjukkan susunan radas untuk eksperimen tersebut.

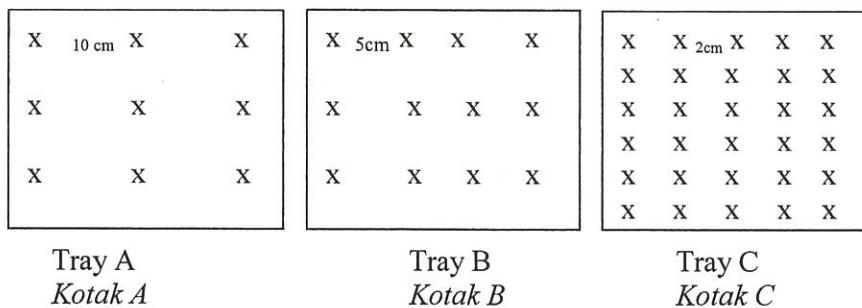


Diagram 1
Rajah 1

Step 1 : Three seedling trays are filled with 4 kg of garden soil.
Langkah 1 : Tiga kotak semaihan diisi dengan 4 kg tanah kebun.

Step 2 : The trays are labeled as A, B and C.
Langkah 2 : Kotak-kotak semaihan dilabelkan A, B dan C.

Step 3 : In tray A, 30 paddy seedlings are seedlinged at a distance of 10 cm intervals.
 In tray B, 30 paddy seedlings are seedlinged at a distance of 5cm intervals.
 In tray C, 30 paddy seedlings are seedlinged at a distance of 2cm intervals.
*Langkah 3 : Dalam kotak A, 30 anak benih padi ditanam pada jarak 10cm berselang seli
 Dalam kotak B, 30 anak benih padi ditanam pada jarak 5 cm berselang seli,
 Dalam kotak C, 30 anak benih padi ditanam pada jarak 2 cm berselang seli*

Step 4 : Each tray is watered daily with the same amount of water for 30 days.
Langkah 4 : Setiap kotak semaihan disiram tiap-tiap hari dengan jumlah air yang sama banyak untuk 30 hari.

Step 5 : After 30 days, remove 10 paddy seedlings randomly from tray A, tray B and tray C. The roots of seedlings are washed and wipe dry.
Langkah 5 : Selepas 30 hari, 10 anak benih padi dikeluarkan secara rawak dari kotak A, kotak B dan kotak C. Akar anak benih dibersih dan dilapkan sehingga kering.

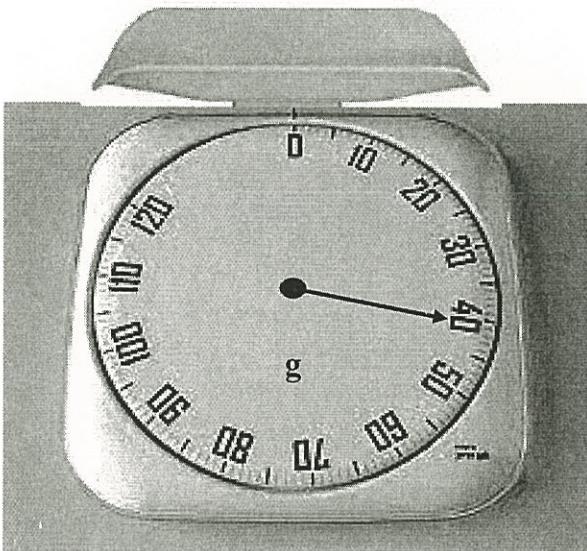
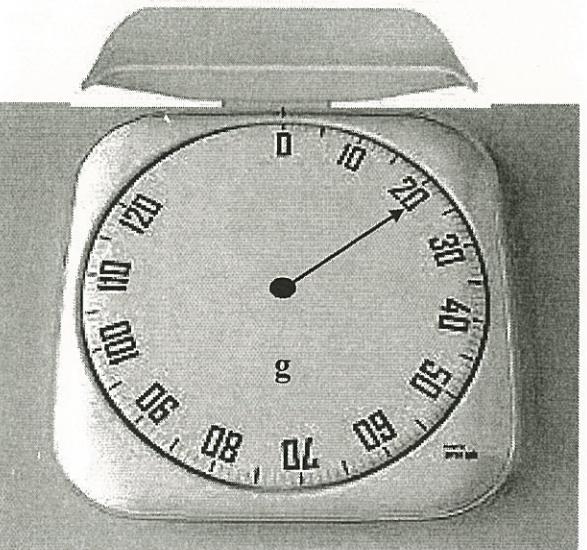
Step 6 : The dry weight of the paddy seedlings is recorded in Table 1.
Langkah 6 : Berat kering anak benih dicatatkan dalam Jadual 1.

(a) Record the dry weight of the paddy seedlings in the boxes provided in Table 1.

Rekodkan berat kering anak benih padi di dalam kotak yang disediakan dalam Jadual 1.

[3 marks]

[3 markah]

Distance between paddy seedlings <i>Jarak antara anak benih padi (cm)</i>	Dry weight of 10 paddy seedlings / (g) <i>Berat kering 10 anak benih padi / (g)</i>
10	 <input type="text"/>
5	 <input type="text"/>

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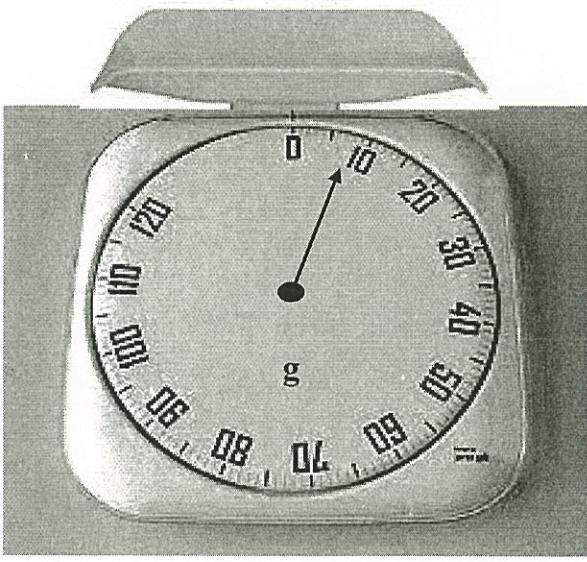
Distance between paddy seedlings <i>Jarak antara anak benih padi (cm)</i>	Dry weight of 10 paddy seedlings / (g) <i>Berat kering 10 anak benih padi / (g)</i>
2	<p>1(a)</p>  <p>3</p>

Table 1
Jadual 1

- (b) (i) State two different observations made from Table 1.
Nyatakan dua pemerhatian yang berbeza yang dibuat daripada Jadual 1.

Observation 1 :

Pemerhatian 1 :

Observation 2 :

Pemerhatian 2 :

1(b)(i)

[3 marks]
[3 markah]

3

- (ii) State the inference which corresponds to the observations in 1 (b) (i).
Nyatakan inferens yang sepadan dengan pemerhatian di 1 (b) (i).

Inference from observation 1 :

Inferens daripada pemerhatian 1 :

Inference from observation 2 :

Inferens daripada pemerhatian 2 :

1(b)(ii)

[3 marks]
[3 markah]

3

For
Examiner's
Use

- (c) Complete Table 2 based on this experiment
Lengkapkan Jadual 2 berdasarkan eksperimen ini

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasi</i>	_____
Responding variable <i>Pembolehubah bergerakbalas</i>	_____
Constant variable <i>Pembolehubah dimalarkan</i>	_____

1(c)

3

Table 2
Jadual 2

[3 marks]
[3 markah]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

1(d)

3

[3 marks]
[3 markah]

For
Examiner's
Use

- (e) (i) Construct a table and record all the data collected in this experiment.

Bina satu jadual dan rekodkan semua data yang dikumpul dalam eksperimen ini.

Your table should have the following title.

Jadual anda hendaklah mengandungi tajuk-tajuk berikut.

➤ *Distance between paddy seedlings*
Jarak antara anak benih padi

➤ Dry weight of 10 paddy seedlings
Berat kering 10 anak benih padi

➤ Growth rate of paddy seedling
Kadar pertumbuhan anak benih padi

$$\text{Growth rate} = \frac{\text{Dry weight of paddy seedling}}{\text{Number of days}}$$

$$\text{Kadar pertumbuhan} = \frac{\text{Berat kering anak benih padi}}{\text{Bilangan hari}}$$

1(e)(i)

[3 marks]
[3 markah]

3

For
Examiner's
Use

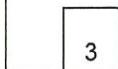
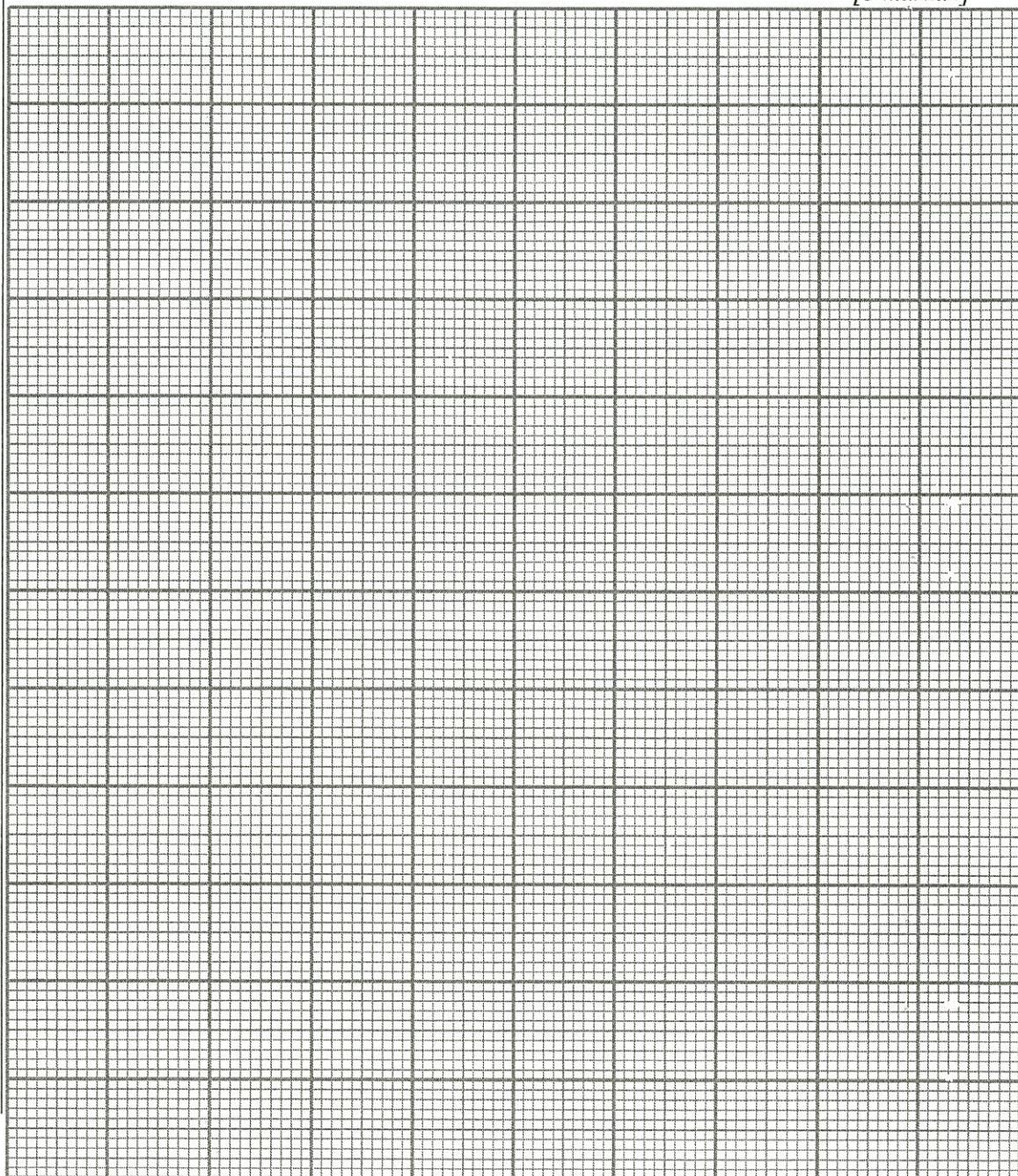
- (ii) Use the graph paper provided on page 7 to answer this part of question.
Using the data in 1(e)(i), draw the graph of the growth rate of paddy seedlings against the distance between paddy seedling

Gunakan kertas graf yang disediakan dalam di muka surat 7 untuk menjawab soalan bahagian ini.

Menggunakan data 1(e)(i), lukiskan graf kadar pertumbuhan anak benih padi melawan jarak antara anak benih padi.

[3 marks]

[3 markah]



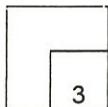
For
Examiner's
Use

- (f) Based on the graph in 1 (e) (ii) , explain the relationship between the growth rate of paddy seedling and distance between seedling.

Berdasarkan kepada graf di 1 (e) (ii), terangkan hubungan antara kadar perumbuhan anak benih padi dengan jarak antara anak benih.

1(f)

[3 marks]
[3 markah]



- (g) This experiment is repeated by increasing the distance between the paddy seedlings to 20 cm.

Predict the observation.

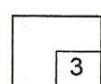
Explain your prediction.

Eksperimen ini diulang dengan menambah jarak antara anak benih padi pada 20cm. Ramalkan pemerhatian.

Terangkan ramalan anda.

1(g)

[3 marks]
[3 markah]

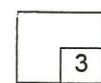


- (h) Based on the result from the experiment, what is the operational definition of intraspecific competition?

Berdasarkan keputusan daripada eksperimen ini, apakah definisi secara operasi persaingan intraspesifik?

1(h)

[3 marks]
[3 markah]



For
Examiner's
Use

- (i) When resources are in limited supply, organisms living in the same habitat will compete for the same resources.

The following is a list of the resources.

Apabila sumber-sumber menjadi terhad, organisma hidup di habitat yang sama akan bersaing untuk sumber yang sama.

Berikut ialah senarai sumber-sumber tersebut.

Food <i>Makanan</i>	Space <i>Ruang</i>	Light <i>Cahaya</i>
Water <i>Air</i>		Breeding mate <i>Pasangan mengawan</i>

In Table 3, classify the resources given, according to what are the resources competed by animals and resources competed by plants.

Dalam Jadual 3, klasifikasikan sumber-sumber yang diberi, mengikut apakah sumber-sumber yang disaingi oleh haiwan dan sumber-sumber yang disaingi oleh tumbuhan.

Resources competed by animal <i>Sumber-sumber yang disaingi oleh haiwan</i>	Resources competed by plant <i>Sumber-sumber yang disaingi oleh tumbuhan</i>

Table 3
Jadual 3

1(i)

3

[3 marks]
[3 markah]

Answer all questions.

Jawab semua soalan.

Question 1

Soalan 1

An experiment was carried out to investigate the effect of light intensity on the growth rate of *Mucor* sp. on white bread. *Mucor* sp. is a bread mould.

The growth of *Mucor* sp. on white bread is determined by using quadrat sampling technique. Three pieces of white breads labelled as R, S and T, are damped with 10 ml of distilled water each. The breads are placed in separate transparent plastic bags and are sealed tightly. The breads are placed in three cabinets with different lightings as follows.

R : Lighted by one 40 watt florescence bulb

S : Lighted by two 40 watt florescence bulbs

T : Lighted by three 40 watt florescence bulbs

Diagram 1 shows the calculation on the total area covered by *Mucor* sp. on a sample white bread.

*Satu eksperimen telah dijalankan untuk mengkaji kesan keamatan cahaya ke atas kadar pertumbuhan *Mucor* sp. di atas roti putih. *Mucor* sp. adalah sejenis kulapuk roti.*

*Pertumbuhan *Mucor* sp. di atas roti putih ditentukan dengan menggunakan teknik persampelan kuadrat. Tiga keping roti putih dilabelkan sebagai R, S dan T, dilembabkan dengan 10 ml air suling setiap satu. Roti-roti ini diletakkan ke dalam beg plastik lutsinar yang berasingan dan ditutup rapat. Roti-roti ini disimpan di dalam tiga kabinet dengan pencahayaan berbeza seperti berikut:*

R : Pencahayaan oleh satu mentol floresen 40 watt

S : Pencahayaan oleh dua mentol floresen 40 watt

T : Pencahayaan oleh tiga mentol floresen 40 watt

Rajah 1 menunjukkan pengiraan jumlah luas yang dilitupi oleh *Mucor* sp. di atas sekeping sampel roti putih.

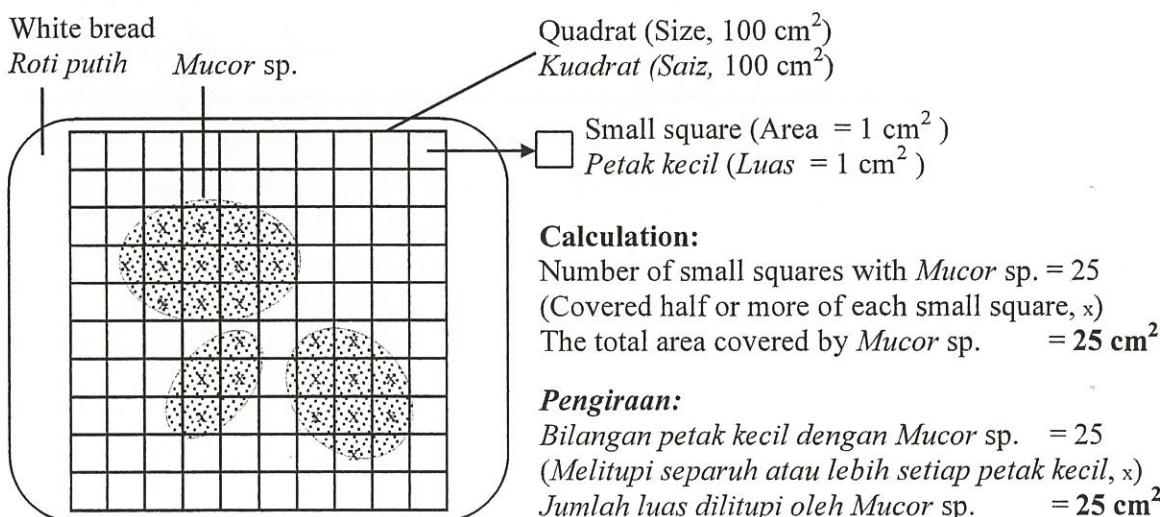


Diagram 1

Rajah 1

Table 1.1 shows the results of the experiment after two weeks of growing period.

Jadual 1.1 menunjukkan keputusan eksperimen selepas dua minggu tempoh pertumbuhan.

Bread Roti	Number of 40 watt florescence bulb <i>Bilangan mentol floresen 40 watt</i>	<i>Mucor sp. on white bread after 2 weeks Mucor sp. di atas roti putih selepas 2 minggu</i>	The total area covered by <i>Mucor sp.</i> <i>/ cm²</i> <i>Jumlah luas dilitupi oleh Mucor sp. / cm²</i>
R	1	
S	2	
T	3	

Table 1.1

Jadual 1.1

- (a) Record the total area covered by *Mucor* sp. on each bread, in the spaces provided in Table 1.1.

*Rekodkan jumlah luas yang dilitupi oleh *Mucor* sp. di atas setiap roti, di dalam ruangan yang disediakan dalam Jadual 1.1.*

1(a)

[3 marks]

[3 markah]

- (b) (i) State **two** different observations made on Table 1.1.

*Nyatakan **dua** pemerhatian yang berbeza yang dibuat ke atas Jadual 1.1.*

Observation 1 :

Pemerhatian 1 :

.....
.....

Observation 2 :

Pemerhatian 2 :

.....
.....

1(b)(i)

[3 marks]

[3 markah]

- (ii) State the inference for each observation made in (b) (i).

Nyatakan inferens bagi setiap pemerhatian yang dibuat dalam (b) (i).

Inference for observation 1 :

Inferens bagi pemerhatian 1 :

.....
.....
.....

Inference for observation 2 :

Inferens bagi pemerhatian 2 :

.....
.....
.....

1(b)(ii)

[3 marks]

[3 markah]

- (c) Complete Table 1.2 based on the experiment.

Lengkapkan Jadual 1.2 berdasarkan eksperimen ini.

1(c)

[3 marks]

[3 markah]

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasikan</i>
Responding variable <i>Pembolehubah bergerak balas</i>
Controlled variable <i>Pembolehubah dimalarkan</i>

Table 1.2

Jadual 1.2

- (d) State the hypothesis for this experiment.

Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....

1(d)

[3 marks]

[3 markah]

- (e) (i) Construct a table and record all the data collected in the experiment which include the following aspects:

- Light intensity
- The total area covered by *Mucor* sp.
- The growth rate of *Mucor* sp. ($\text{cm}^2 \text{ day}^{-1}$)

$$\text{Growth rate of } Mucor \text{ sp.} = \frac{\text{Total area covered by } Mucor \text{ sp.} (\text{cm}^2)}{\text{Growing period (day)}}$$

Bina satu jadual dan rekodkan semua data yang dikumpul dalam eksperimen ini yang meliputi aspek-aspek berikut:

- Keamatan cahaya
- Jumlah luas dilitupi oleh *Mucor* sp.
- Kadar pertumbuhan *Mucor* sp. ($\text{cm}^2 \text{ hari}^{-1}$)

$$\text{Kadar pertumbuhan } Mucor \text{ sp.} = \frac{\text{Jumlah luas dilitupi oleh } Mucor \text{ sp.} (\text{cm}^2)}{\text{Tempoh pertumbuhan (hari)}}$$

1(e)(i)

[3 marks]

[3 markah]

- (ii) Draw a graph of the growth rate of *Mucor* sp. against light intensity, on the graph paper provided.

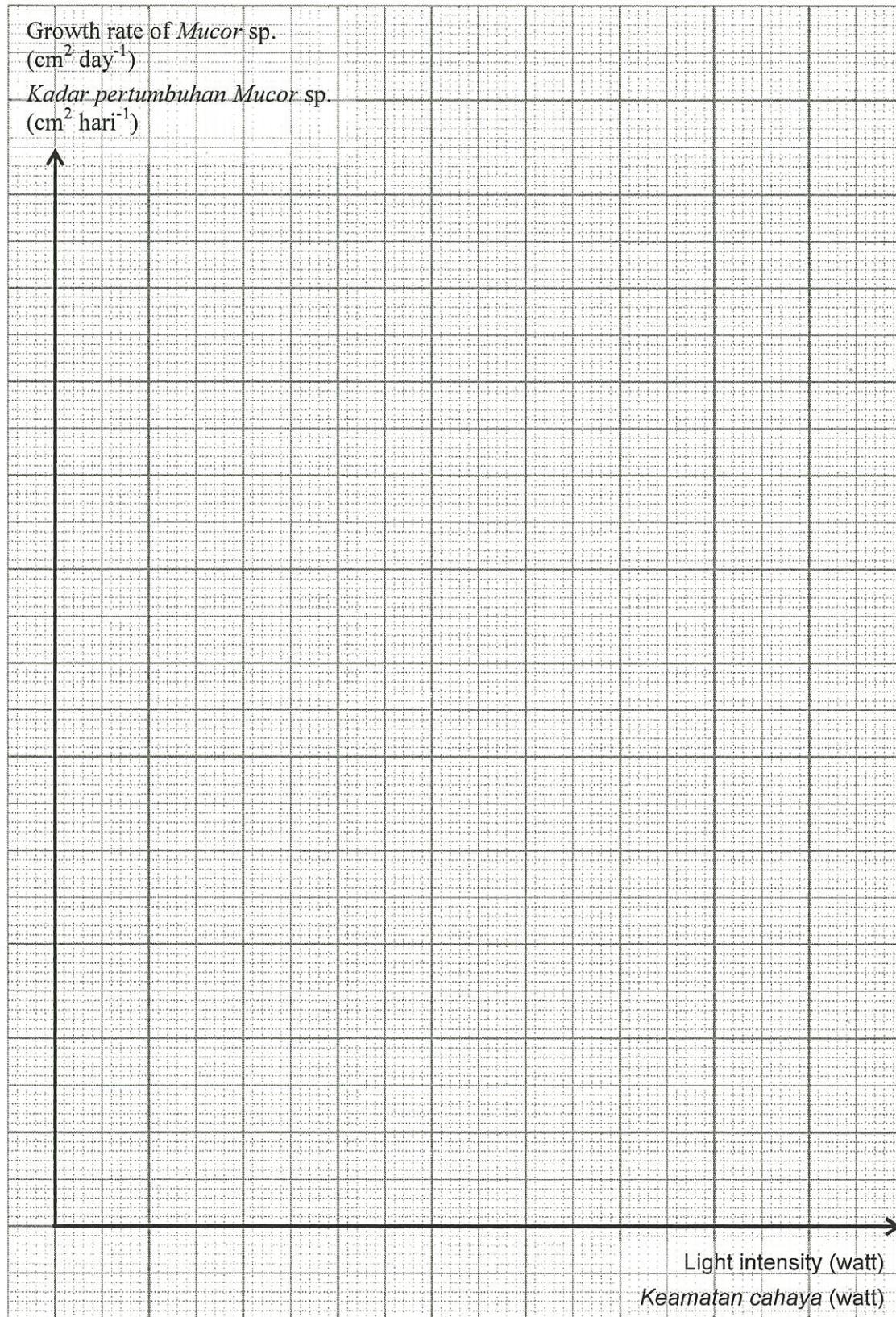
*Lukiskan satu graf kadar pertumbuhan *Mucor* sp. melawan keamatan cahaya, di atas kertas graf yang disediakan.*

1(e)(ii)

[3 marks]

[3 markah]

The graph of the growth rate of *Mucor* sp. against light intensity
Graf kadar pertumbuhan Mucor sp. melawan keamatan cahaya



- (f) Based on the graph drawn in 1 (e) (ii), explain the relationship between the growth rate of *Mucor* sp. and light intensity.

*Berdasarkan kepada graf yang dilukiskan dalam 1 (e) (ii), terangkan hubungan antara kadar pertumbuhan *Mucor* sp. dengan keamatan cahaya.*

.....
.....
.....
.....

1(f)

[3 marks]
[3 markah]

- (g) Based on the result of the experiment, state the meaning of growth operationally.
Berdasarkan keputusan eksperimen ini, nyatakan pengertian pertumbuhan secara operasi.

.....
.....
.....

1(g)

[3 marks]
[3 markah]

- (h) The experiment is repeated by using a white bread labelled X. The bread is damped with 5 ml of distilled water, wrapped in a transparent plastic bag, and kept in a cabinet lighted by one 40 watt florescence bulb for two weeks.

Predict the total area covered by *Mucor* sp. on the white bread X by using the same sampling technique. Explain your prediction.

Eksperimen ini diulang dengan menggunakan satu roti putih berlabel X. Roti ini dilembabkan dengan 5 ml air suling, dibungkus dengan beg plastik lutsinar, dan disimpan di dalam kabinet dengan pencahayaan oleh satu mentol floresen 40 watt selama dua minggu.

*Ramalkan jumlah luas yang dilitupi oleh *Mucor* sp. di atas roti putih X dengan menggunakan teknik persampelan yang sama. Terangkan ramalan anda.*

.....
.....
.....
.....
.....

1(h)

[3 marks]

[3 markah]

- (i) Classify the following list into biotic and abiotic factors in Table 1.3.

Kelaskan senarai berikut kepada faktor-faktor biotik dan abiotik dalam Jadual 1.3.

Light intensity <i>Keamatan cahaya</i>	Humidity <i>Kelembapan</i>	Parasites <i>Parasit</i>
Decomposer <i>Pengurai</i>	Temperature <i>Suhu</i>	Nutrient <i>Nutrien</i>

Biotic factor <i>Faktor biotik</i>	Abiotic factor <i>Faktor abiotik</i>

Table 1.3

Jadual 1.3

1(i)

[3 marks]

[3 markah]

1. Diagram 1.1 shows dark winged moth and light winged moth live in a forest habitat. The wing colour of the insects provides effective camouflage against the tree trunk.

Rajah 1.1 menunjukkan kupu-kupu berkepak gelap dan kupu-kupu berkepak cerah yang hidup dalam suatu habitat belukar.

Warna sayap serangga ini dapat memberi kesan penyamaran di atas batang pokok..



Unpolluted tree trunk
Batang pokok tidak tercemar

Polluted tree trunk
Batang pokok tercemar

Diagram 1.1 / Rajah 1.1

Diagram 1.2 shows an industrial which area has been set up near to the forest. Plants which are near to the industrial area are badly affected. Leaves and trunk are covered by the smoke and soot released by the factories.

The population of the moths are also affected.

Rajah 1.2 menunjukkan satu kawasan perindustrian telah dibina berdekatan dengan belukar itu. Tumbuhan yang berdekatan dengan kawasan perindustrian telah teruk terjejas. Daun dan batang pokok dilitupi oleh asap dan jelaga yang dibebaskan oleh kilang-kilang. Populasi kupu-kupu juga turut terjejas.

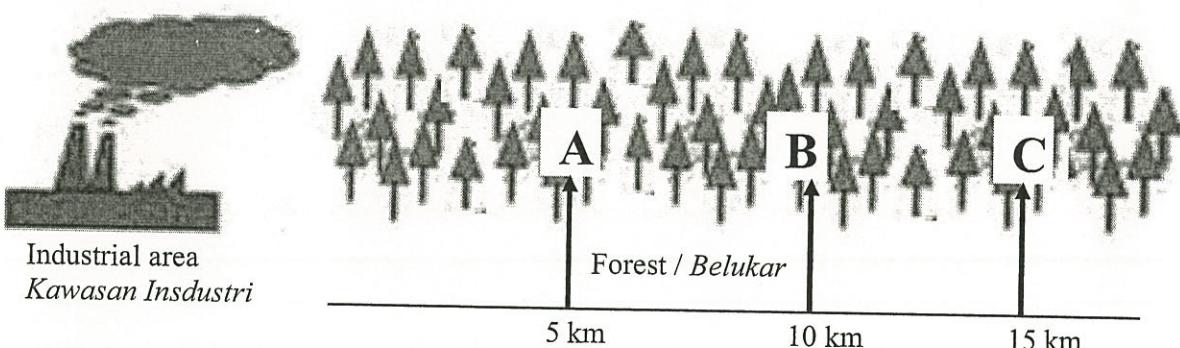


Diagram 1.2 / Rajah 1.2

A group of students carried out an experiment to investigate the effect of air pollution on the population of light winged moth in the forest.

The population of the light winged moth is estimated in three different sites, A, B and C by using 'Capture-mark-release and recapture' method. The results of the experiment are shown in Table 1.

Sekumpulan pelajar telah menjalankan satu eksperimen untuk mengkaji kesan pencemaran udara ke atas populasi kupu-kupu bersayap cerah yang hidup dalam belukar. Populasi kupu-kupu berkepak cerah dianggar dalam tiga tapak berbeza, iaitu A, B dan C dengan menggunakan kaedah 'tangkap-tanda-lepas dan tangkap semula'. Keputusan eksperimen ditunjukkan dalam Jadual 1.

Site Tapak	Number of Light Winged Moth Captured <i>Bilangan Kupu-kupu Bersayap Cerah yang Ditangkap</i>		Number of moth captured <i>Bilangan kupu-kupu yang ditangkap</i>
	First Capture (X) <i>Tangkapan Pertama (X)</i>	Second Capture / Recapture (Y) <i>Tangkapan Kedua / Semula (Y)</i>	
A	   	   	X = Y =
B	    	    	X = Y =
C	       	       	X = Y =



Unmarked light winged moth
*Kupu-kupu bersayap cerah
yang tak bertanda*



Marked light winged moth
*Kupu-kupu bersayap cerah
yang bertanda*

Table 1 / Jadual 1

- (a) Record the number of moth captured, X and Y in Table 1.
Kira bilangan kupu-kupu yang ditangkap, X dan Y dalam Jadual 1.

[3 marks / markah]

- (b)(i) State two different observation from Table 1.
Nyatakan dua pemerhatian yang berbeza dari Jadual 1.

Observation 1 / *Pemerhatian 1 :*

.....
.....
.....

Observation 2 / *Pemerhatian 2 :*

.....
.....
.....

[3 marks / markah]

- (ii) State the inferences from the observations in 1(b)(i)
Nyatakan inferensi dari pemerhatian di 1(b)(i)

Inference from observation 1 / *Inferensi dari pemerhatian 1:*

.....
.....
.....

Inference from observation 2 / *Inferensi dari pemerhatian 2:*

.....
.....
.....

[3 marks / markah]

- (c) Complete Table 2 based on the experiment.
Lengkapkan Jadual 2 berdasarkan eksperimen ini.

Variable <i>Pembolehubah</i>	Method to handle the variable <i>Cara mengendalikan pembolehubah</i>
Manipulated Variable <i>Pembolehubah Dimanipulasikan</i>
Responding Variable <i>Pembolehubah Bergerak Balas</i>
Constant Variable <i>Pembolehubah Dimalarkan</i>

Table 2 / Jadual 2

[3 marks / markah]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

.....
.....
.....

[3 marks / markah]

- (e)(i) Construct a table to record all the data collected in this experiment.

Your table should have the following data.

Bina satu jadual untuk merekodkan semua data yang dikutip dalam eksperimen ini.

Jadual anda hendaklah mengandungi data-data berikut ;

- Name of the site

Nama tapak

- Distance from the industrial area

Jarak dari kawasan industri

- Number of moth in the first capture

Bilangan kupu-kupu dalam tangkapan pertama

- Number of moth in the second capture (recapture)

Bilangan kupu-kupu dalam tangkapan kedua (semula)

- Number of marked moth in second capture

Bilangan kupu-kupu bertanda dalam tangkapan kedua

- Estimated population of the moth

Populasi anggaran kupu-kupu

$$\text{Estimated population} = \frac{(\text{Number in the first captured}) \times (\text{Number in the recaptured})}{(\text{Number marked in the recapture})}$$

$$\text{Populasi Anggaran} = \frac{(\text{Bilangan dalam tangkapan pertama}) \times (\text{Bilangan dalam tangkapan semula})}{(\text{Bilangan yang bertanda dalam tangkapan semula})}$$

[3 marks / markah]

- (ii) Use the data in (e)(i), draw the graph of the estimated population of the light winged moth against the distance from the Industrial zone.
Gunakan data dari (e)(i), lukiskan graf populasi anggaran kupu-kupu bersayap cerah terhadap jarak dari kawasan industri.

[3 marks / markah]

Use the graph paper provided by school

- (f) Based on the graph in (e)(ii), explain the relationship between the estimated population of the light winged moth and the distance from the industrial area.

Berdasarkan graf di (e)(ii), terangkan perhubungan antara populasi anggaran kupu-kupu bersayap cerah dengan jarak dari kawasan industri.

.....
.....
.....
.....

[3 marks / markah]

- (g) State the operational definition for estimated population of light winged moth.

Nyatakan definisi secara operasi bagi populasi anggaran kupu-kupu bersayap cerah.

.....
.....
.....
.....

[3 marks / markah]

- (h) Another group of students repeat the above experiment to investigate the effect of air pollution on the estimated population of the dark winged moth.

Results show that at Site B, the estimated population of dark winged moth is 68.

Predict the estimated population of dark winged moth at Site A.

Explain your prediction.

Sekumpulan pelajar lain mengulangi eksperimen di atas untuk mengkaji kesan pencemaran udara ke atas populasi anggaran bagi kupu-kupu bersayap gelap.

Keputusan menunjukkan di Tapak B, populasi anggaran kupu-kupu bersayap hitam ialah 68.

Ramalkan populasi anggaran kupu-kupu bersayap hitam di Tapak A.

Terangkan ramalan anda.

.....
.....
.....
.....

[3 marks / markah]

- (i) The following is a list of biotic and abiotic factors affecting the population of moths.
Berikut ialah senarai faktor-faktor biosis dan abiosis yang mempengaruhi populasi kupu-kupu.

Smoke, Bird, temperature, tree, ant, light intensity.
Asap, burung, suhu, pokok, semut, keamatan cahaya

Classify these factors in Table 3.
Klasifikasikan faktor-faktor ini dalam Jadual 3.

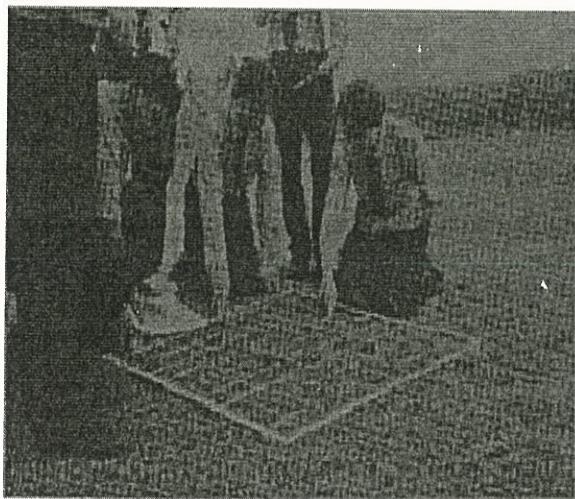
Biotic Factors <i>Faktor biosis</i>	Abiotic Factors <i>Faktor abiosis</i>

[3 marks / markah]

QUESTION 2

A group of students carried out a field work study to determine the population size of plants species by using the quadrat sampling technique. Figure below shows how the technique was used using a quadrat of 1m x 1m.

Sekumpulan pelajar telah menjalankan suatu projek kajian luar untuk menentukan saiz populasi spesies tumbuhan menggunakan teknik persampelan kuadrat. Rajah di bawah menunjukkan bagaimana teknik tersebut digunakan dengan kuadrat beukuran 1m x 1m .



Based on the above diagram, design an experiment to study how the percentage coverage of certain plant species can be determined. Your experimental planning should include the following aspects:
Berdasarkan rajah di atas, reka bentuk suatu eksperiment untuk mengkaji bagaimana peratus taburan sesuatu spesies tumbuhan dapat ditentukan. Perancangan eksperiment anda hendaklah mengandungi aspek-aspek berikut:

- Statement of the identified problem
Pernyataan Masalah dinyatakan
- Objective of the study.
Objektif kajian atau tujuan
- Variables.
Pembolehubah.
- Statement of the Hypothesis.
Pernyataan Hypothesis
- List of materials and apparatus.
Senarai Radas dan bahan
- Technique used.
Teknik digunakan
- Experimental procedure.
Prosedur eksperiment.
- Presentation of data.
Data dikomunikasikan
- Conclusion
Kesimpulan..

[17 marks]

2. Diagram 1 shows a garden snail (*Cornu aspersum*) which becomes the main pest in vegetable farm.

*Rajah 1 menunjukkan sejenis spesies siput kebun (*Cornu aspersum*) yang menjadi haiwan perosak utama di kebun sayuran .*

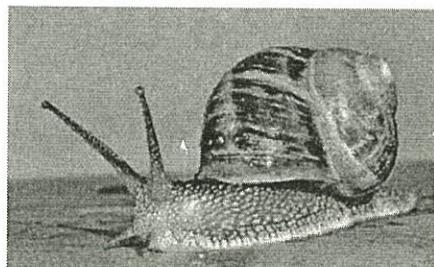


Diagram 1
Rajah 1

A research shows that humidity is one of the factor that affects the population size of the garden snail.

Based on the above information, design an experiment to study the effect of humidity on the population size of garden snail in your school.

The planning of your experiment must include the following aspects:

Satu kajian menunjukkan bahawa kelembapan ialah salah satu faktor yang mempengaruhi saiz populasi siput kebun.

Berdasarkan pernyataan di atas, jalankan satu eksperimen untuk mengkaji kesan kelembapan terhadap saiz populasi siput kebun di sekolah anda.

Perancangan eksperimen anda hendaklah meliputi aspek-aspek berikut:

- Problem statement
Pernyataan masalah
- Hypothesis
Hipotesis
- Variables
Pemboleh ubah
- List of apparatus and material
Senarai radas dan bahan
- Experimental procedure
Prosedur eksperimen
- Presentation of data
Persembahan data

[17 marks]
[17 markah]

Answer all questions.

- 1 Air pollution occurs when there are increasing in numbers of pollutants such as gases, smoke, dust and dirt in the atmosphere. This condition will affect the safety and health of living things.

Base on the above information, a group of students had carried out an experiment to determine the number of solid pollutants in the air of different environments. The light microscope is used to help the students in their experiment.

Pencemaran udara berlaku apabila terdapat penambahan dari segi jumlah bahan cemar seperti gas, asap, habuk dan kotoran di dalam atmosfera. Keadaan ini akan memberi kesan kepada keselamatan dan kesihatan organisme hidup.

Berdasarkan maklumat di atas, sekumpulan pelajar telah menjalankan satu eksperimen untuk menentukan jumlah bilangan bahan cemar pepejal di dalam persekitaran udara bagi tempat yang berbeza. Sebuah mikroskop cahaya telah digunakan untuk membantu pelajar tersebut menjalankan eksperimen berkenaan.



Diagram 1/ Rajah 1

Four set of glass slides A, B, C and D are prepared. Each of it is put in a particular place for two days as shown in Table 1. The results are recorded in the table.

Sebanyak empat set slaid kaca A, B, C dan D telah disediakan. Setiap satu daripadanya diletakkan di tempat yang tertentu selama dua hari seperti ditunjukkan pada Jadual 1. Keputusan eksperimen tersebut telah dicatatkan di dalam jadual tersebut.

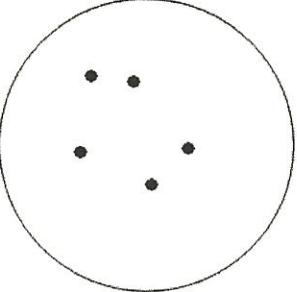
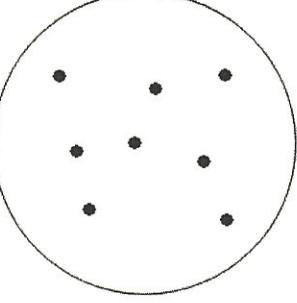
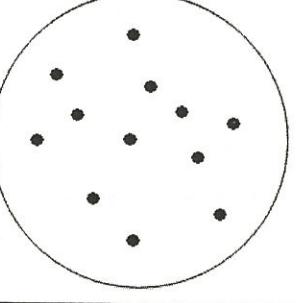
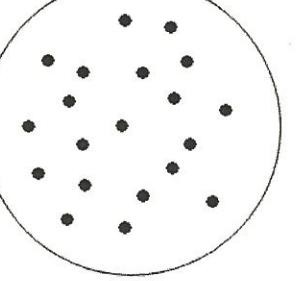
Glass slide Slaid kaca	Location of glass slide being placed <i>Lokasi slaid kaca diletakkan</i>	Solid particles as seen under light microscope (magnify:10 x10) <i>Partikel pepejal yang dilihat di bawah mikroskop cahaya (kuasa pembesaran : 10 x10)</i>	Number of solid particles as seen under light microscope (magnify :10 x10) <i>Bilangan partikel pepejal yang dilihat di bawah mikroskop cahaya (kuasa pembesaran :10 x10)</i>
A	Air-conditioned room <i>Bilik berhawa dingin</i>		
B	Class room <i>Bilik darjah</i>		
C	School canteen <i>Kantin sekolah</i>		
D	School car park <i>Tempat meletak kendaraan di sekolah</i>		

Table 1 / Jadual 1

For
examiner's
use

- (a) Complete Table 1 by filling in the number of solid particles shown in the field view of the light microscope (magnify:10 x10).

Lengkapkan Jadual 1 dengan mencatatkan bilangan zarah pepejal yang diperhatikan di dalam medan penglihatan mikroskop cahaya tersebut (kuasa pembesaran : 10 x 10) .

[3 marks]

1 (a)

- (b)(i) State **two** observations which can be made from this experiment.

Nyatakan dua pemerhatian yang boleh dibuat daripada eksperimen ini.

Observation 1 / Pemerhatian 1:.....

.....

Observation 2 / Pemerhatian 2:.....

.....

[3 marks]

1 (b)(i)

- (ii) State **two** inferences from the observations in (a)(i).

Nyatakan dua inferensi daripada pemerhatian di (a)(i)

Inference 1 / Inferensi 1:.....

.....

Inference 2 / Inferensi 2:.....

.....

[3 marks]

1 (b)(ii)

For
examiner's
use

- (c) Complete Table 2 based on the experiment.
Lengkapkan Jadual 2 berdasarkan eksperimen ini.

Variables <i>Pembolehubah</i>	Method to handle the variables <i>Cara mengendali pembolehubah</i>
Manipulated variable <i>Pembolehubah dimanipulasikan</i>
Responding variable <i>Pembolehubah bergerakbalas</i>
Constant variable <i>Pembolehubah dimalarkan</i>

Table 2 / Jadual 2

1 (c)

[3 marks]

- (d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

.....

.....

[3 marks]

1 (d)

For
examiner's
use

- (e) (i) Construct a table and record the result of the eksperiment.
Binakan satu jadual dan rekodkan keputusan eksperimen tersebut.

Your table should have the following titles :
Jadual anda sepatutnya mengandungi tajuk-tajuk berikut:

- Places where glass slide is located
Tempat di mana slaid kaca telah diletakkan
- Number of solid particles as seen under the light microscope
(magnify : 10x10)
*Bilangan zarah pepejal yang diperhatikan di bawah mikroskop cahaya
(kuasa pembesaran : 10X10)*

1 (e)(i)

[3marks]

For
examiner's
use

- ii) Use the graph paper provided to answer this question.
 Using the data in 1(e)(i), draw a bar chart to show the relationship between the places where glass slide is located and the number of solid particles as seen under a light microscope (magnify :10X10).
Gunakan kertas graf yang telah disediakan bagi menjawab soalan ini.
Dengan menggunakan data di 1(e)(i) lukiskan carta bar untuk menunjukkan perkaitan di antara tempat di mana slaid kaca di letakkan dan bilangan zarah yang diperhatikan di bawah mikroskop cahaya (kuasa pembesaran : 10X10).
- [3 marks]

1 (e)(ii)

- (f) Based on the graph in 1 (e) (ii). Explain the relationship between the number of solid particles as seen under the light microscope (magnify : 10 x 10) and places where the glass slide is located.
Berdasarkan graf di 1 (e) (ii), terangkan perkaitan di antara bilangan zarah pepejal yang diperhatikan di bawah mikroskop cahaya (kuasa pembesaran : 10X10) dan tempat di mana slaid kaca di letakkan.
-

1 (f)

[3 marks]

- (g) State the operational definition for air pollution.
Nyatakan definisi secara operasi bagi pencemaran udara.
-

1 (g)

[3 marks]

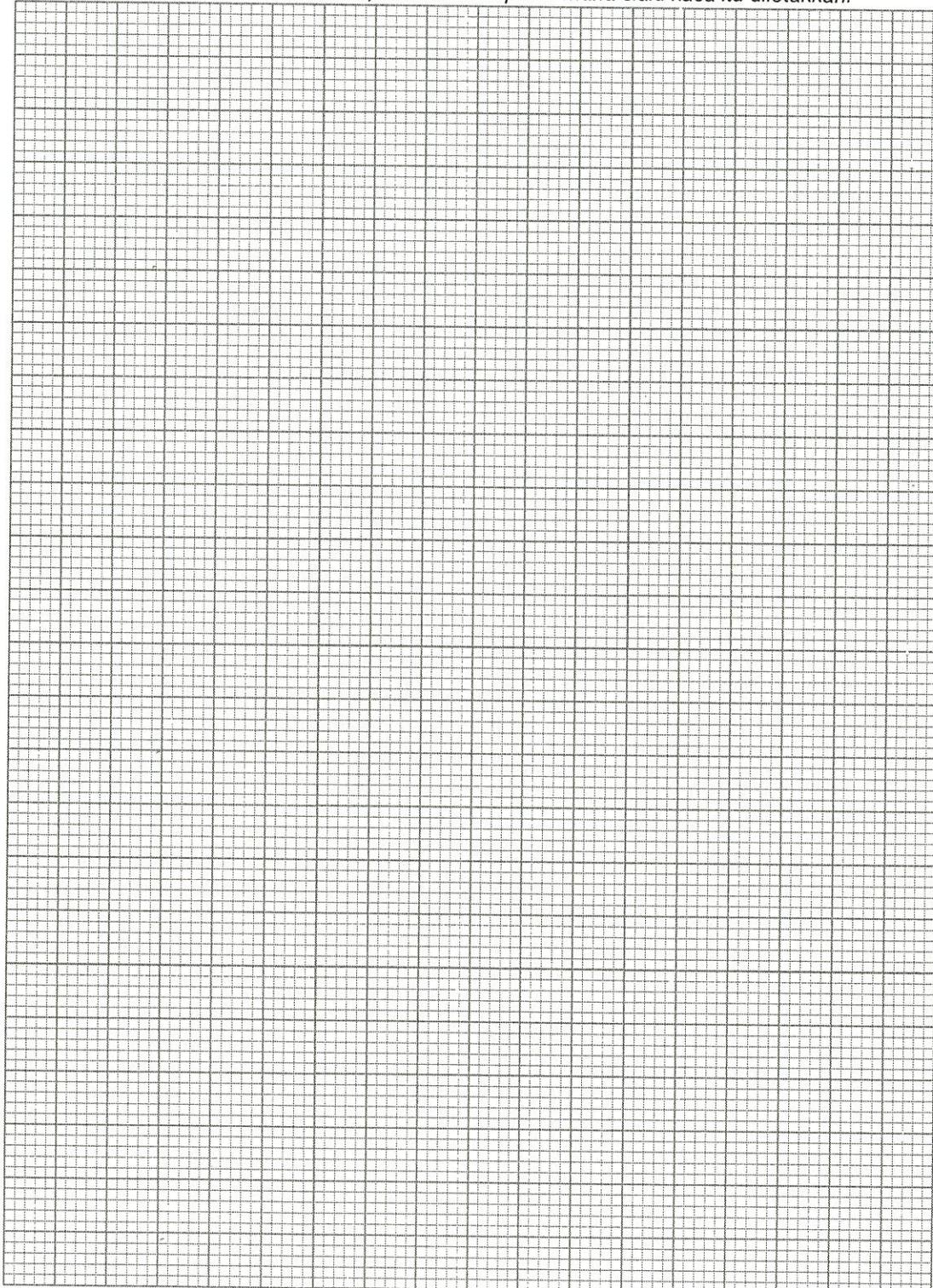
- (h) This experiment is repeated by placing the glass slide at a construction area. Predict the number of solid particles observed under the light microscope (magnify : 10 x10). Explain your prediction.
Eksperimen ini diulangi dengan meletakkan slaid kaca tersebut di satu kawasan pembinaan. Ramalkan bilangan zarah pepejal yang dapat diperhatikan di bawah mikroskop cahaya (kuasa pembesaran : 10 x10) . Terangkan ramalan anda.
-

1 (h)

[3 marks]

Bar chart of the number of solid particles as seen under light microscope
(magnify : 10x 10) against the places where the glass slide is located.

*Carta bar bilangan zarah pepejal yang diperhatikan di bawah mikroskop cahaya
(kuasa pembesaran : 10 x10) melawan tempat di mana slaid kaca itu diletakkan.*



For
examiner's
use

- (i) Another group of students carried out another experiment to determine the level of water pollution of given water samples. Below are the materials and apparatus used in the experiment.

Sekumpulan pelajar yang lain telah menjalankan satu eksperimen untuk menentukan tahap pencemaran air bagi sampel air yang diberikan.

Berikut adalah bahan dan radas yang telah digunakan di dalam eksperimen tersebut.

Distilled water, reagent bottles, syringe, 0.1% methylene blue solution <i>Air suling , Botol Reagen , Picagari, Larutan Metilena Biru 0.1%</i> Stopwatch, pond water, river water and drain water. <i>Jam Randik, air kolam, air sungai, air longkang.</i>
--

Material
Bahan

Apparatus
Radas

1 (i)

Table 3 / Jadual 3

[3 marks]

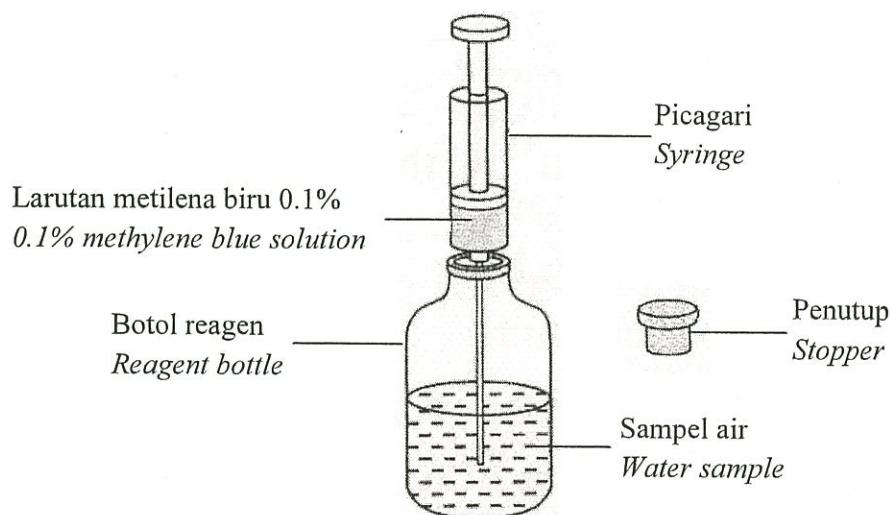
TOTAL

Jawab semua soalan.

Answer all questions.

1. Rajah 1 menunjukkan eksperimen yang dijalankan untuk menentukan tahap pencemaran sampel air dari sumber-sumber yang berbeza di sebuah kampung.

Diagram 1 shows an experiment carried out to determine the level of pollution in water samples from different sources in a village.



Rajah 1 / Diagram 1

Langkah-langkah berikut dijalankan; / The following steps were carried out;

Langkah 1 / Step 1

Sampel air dari lima sumber berbeza dikumpulkan di dalam lima botol reagen seperti berikut;
Water samples from five different sources were collected in five reagent bottles as follows;

Botol reagen / Reagent bottle	Sumber sampel air / Source of water sample
A	Air perigi / Well water
B	Air sungai / River water
C	Air kolam / Pond water
D	Air longkang / Drain water
E	Air tasik / Lake water

Langkah 2 / Step 2

1 ml larutan metilena biru 0.1% ditambahkan ke dalam setiap sampel air dengan menggunakan picagari.

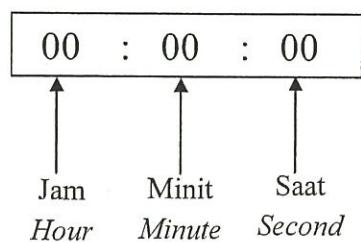
1 ml of 0.1 % methylene blue solution was added to each water sample using a syringe.

Langkah 3 / Step 3

Botol reagen ditutup dan diletakkan ke dalam almari gelap. Masa yang diambil untuk larutan metilena biru luntur direkod.

The reagent bottles were closed and kept in a dark cupboard. The time taken for methylene blue solution to decolourise was recorded.

Rajah 2 menunjukkan masa pada permulaan eksperimen.
Diagram 2 shows the time at the beginning of the experiment.



Rajah 2 / Diagram 2

Jadual 1 menunjukkan keputusan eksperimen ini.

Table 1 shows the results of this experiment.

Botol reagen <i>Reagent bottle</i>	Bacaan jam randik <i>Stopwatch reading</i>	Masa yang diambil untuk larutan metilena biru luntur (jam) <i>Time taken for methylene blue solution to decolourise (hour)</i>
A	04 : 00 : 00	
B	00 : 30 : 00	
C	03 : 00 : 00	
D	02 : 00 : 00	
E	01 : 00 : 00	

Jadual 1 / Table 1

- (a) Rekod masa yang diambil untuk warna larutan metilena biru luntur dalam ruang yang disediakan dalam Jadual 1.

Record the time taken for methylene blue solution to decolourise in the spaces provided in Table 1.

[3 markah / marks]

1(a)

	3
--	---

- (b) (i) Nyatakan **dua** pemerhatian yang berbeza yang dibuat daripada Jadual 1.

State two different observations made from Table 1.

Pemerhatian 1 / *Observation 1* :

.....

Pemerhatian 2 / *Observation 2* :

.....

[3 markah / marks]

1 (b)(i)

	3
--	---

- (ii) Nyatakan inferens daripada pemerhatian di 1(b) (i).

State the inferences from the observations in 1 (b) (i).

Inferens daripada pemerhatian 1 / *Inference from observation 1* :

.....

Inferens daripada pemerhatian 2 / *Inference from observation 2* :

.....

[3 markah / marks]

1(b)(ii)

	3
--	---

- (c) Lengkapkan Jadual 2 berdasarkan eksperimen ini.
Complete Table 2 based on this experiment.

Pembolehubah <i>Variable</i>	Cara mengendali pembolehubah <i>Method to handle the variable</i>
Pembolehubah dimanipulasikan <i>Manipulated variable</i>
Pembolehubah dimanipulasikan <i>Responding variable</i>
Pembolehubah dimalarkan <i>Constant variable</i>

1(c)

3

Jadual 2 / *Table 2*[3 markah / *marks*]

- (d) Nyatakan hipotesis bagi eksperimen ini.
State the hypothesis for this experiment.

.....
.....
.....

[3 markah / *marks*]

1(d)

3

- (e)(i) Bina satu jadual dan rekod semua data yang dikumpul dalam eksperimen ini.
Construct a table and record all the data collected in this experiment.

Jadual anda hendaklah mengandungi tajuk-tajuk berikut:
Your table should have the following titles:

- Sumber sampel air
Source of water sample
- Masa yang diambil untuk larutan metilena biru luntur
Time taken for the methylene blue solution to decolourise
- Tahap pencemaran air menggunakan skala 1(paling kurang tercemar) hingga 5 (paling tercemar)
Level of water pollution using the scale 1 (least polluted) to 5 (most polluted)

1(e)(i)

3

[3 markah / marks]

- (ii) Guna kertas graf yang disediakan di halaman 8 untuk menjawab soalan ini.

Menggunakan data di 1(e) (i), lukis satu carta bar untuk menunjukkan hubungan antara tahap pencemaran air dengan sumber sampel air.

Use the graph paper on page 8 to answer this question.

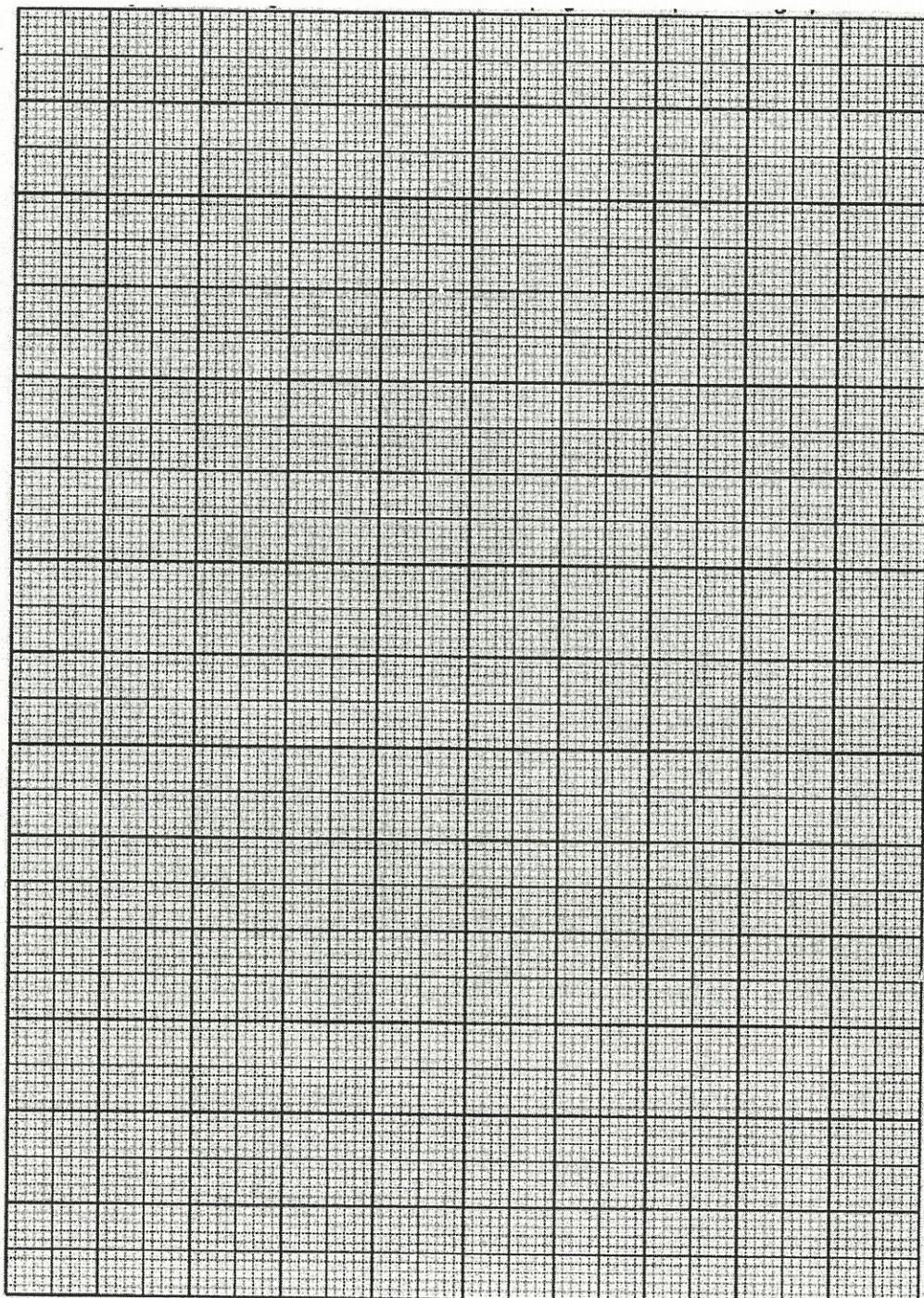
Using the data in 1 (e)(i), draw a bar chart to show the relationship between the level of water pollution and the source of water samples.

1(e)(ii)

3

[3 markah / marks]

Carta bar tahap pencemaran air melawan sumber sampel air
Bar chart of level of water pollution against the source of water samples



- (f) Terangkan hubungan antara masa yang diambil untuk larutan metilena biru luntur dengan tahap pencemaran sampel air.

Explain the relationship between the time taken for decolourisation of methylene blue solution with the level of pollution of the water samples.

1 (f)

3

.....
.....
.....

[3 markah / marks]

- (g) Nyatakan definisi secara operasi bagi pencemaran air.

State the operational definition for water pollution.

1 (g)

3

.....
.....
.....

[3 markah / marks]

- (h) Jika eksperimen ini diulangi ke atas sampel air berhampiran ladang ternakan haiwan, ramalkan masa yang diambil untuk warna larutan metilena biru luntur. Terangkan ramalan anda.

If the experiment is repeated on a water sample near an animal farm, predict the time taken for the decolourisation of methylene blue solution. Explain your prediction.

1 (h)

3

.....
.....
.....

[3 markah / marks]

- (i) Lengkapkan Jadual 3 berdasarkan bahan dan radas dalam Rajah 1 dan Rajah 2.
Complete Table 3 based on the material and apparatus in Diagram 1 and Diagram 2.

Bahan <i>Materials</i>	Radas <i>Apparatus</i>

1(i)

Jadual 3 / *Table 3*

[3 marks /markah]

3

Jumlah

33

Question 2**Soalan 2**

The level of water pollution can be tested by using the Biochemical Oxygen Demand (BOD) value. At high BOD value the dissolved oxygen in the water is less, more anaerobic bacteria are present and the water is polluted.

Aras pencemaran air boleh diuji menggunakan nilai Keperluan Oksigen Biokimia (BOD).

Pada nilai BOD yang tinggi oksigen terlarut dalam air adalah rendah, banyak bakteria anaerobik dan air adalah tercemar.

A group of student carried out an experiment to study the level of water pollution at a river stream. The river was used by the village for their daily activities. Water samples from station A, B and C are tested for this experiment.

Sekumpulan pelajar telah menjalankan satu eksperiment untuk mengkaji aras pencemaran air di suatu aliran sungai. Sungai tersebut telah digunakan oleh penduduk kampung untuk kegiatan harian mereka. Sampel-sampel air dari stesen A, B dan C telah diuji dalam eksperimen ini.

Design an experiment in the laboratory to study the level of water pollution at the different stations of river stream as shown in Diagram 2.

Rekabentuk satu eksperimen di dalam makmal untuk mengkaji aras pencemaran air di stesen –stesen yang berlainan pada aliran sungai seperti yang ditunjukkan dalam Rajah 2.

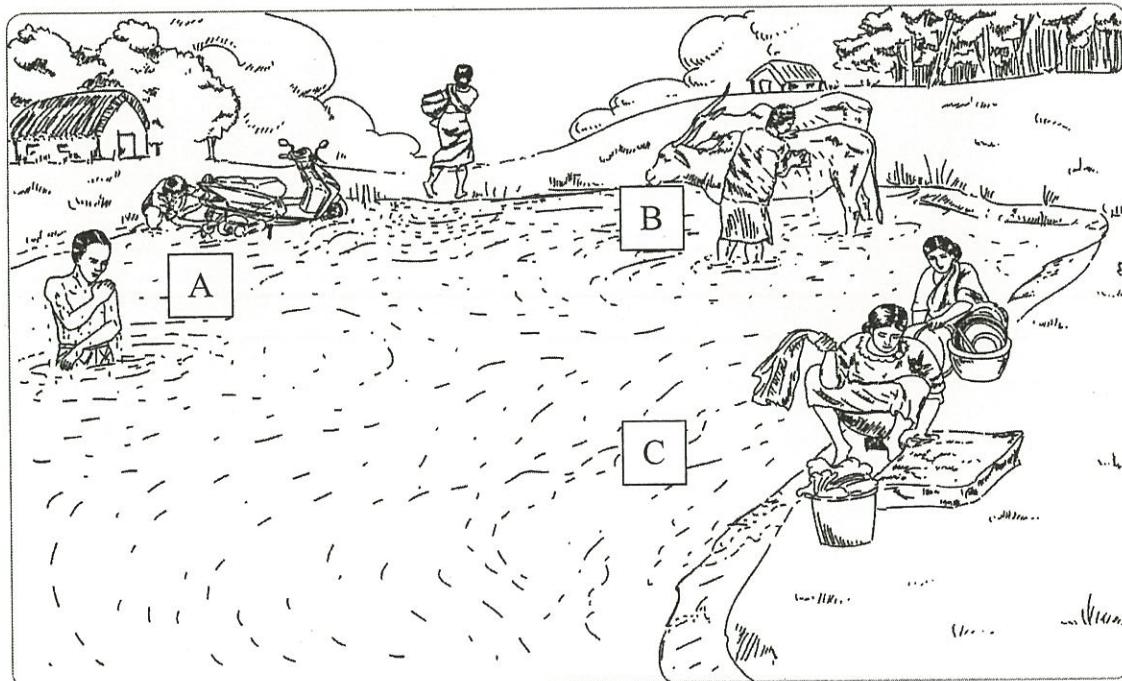


Diagram 2
Rajah 2

The planning of your experiment should include the following aspect:
Rancangan eksperimen anda hendaklah mengandungi aspek berikut:

- Problem statement
Pernyataan Masalah
- Hypothesis
Hipotesis
- Variables
Pembolehubah
- List of apparatus and materials
Senarai radas dan bahan
- Experimental procedure
Prosedur Eksperimen
- Presentation of Data
Penyampaian Data

[17 marks]