QUESTION 1:

1.   A group of students carried out an experiment to study the effect of intraspecific competition on the growth of maize seedlings.
Sekumpulan pelajar menjalankan satu eksperimen untuk mengkaji kesan persaingan intraspesifik ke atas pertumbuhan biji benih jagung.

Diagram 1 shows the apparatus set-up of the experiment
Rajah 1 menunjukkan susunan radas untuk eksperimen tersebut

O 0 0	0 0 0 0	0 0 0 0 0 0
O 0 0	0 0 0 0	0 0 0 0 0 0
0 0 0	0 0 0 0	0 0 0 0 0 0
0 0 0	0 0 0 0	0 0 0 0 0 0
0 0 0	0 0 0 0	0 0 0 0 0 0
Tray P/kotak P	**Tray Q /kotak Q**	**Tray R/kotak R**

Diagram 1/rajah 1

Step 1   : Three seedlinging trays are filled with 4 kg of garden soil.
Langkah 1   : Tiga kotak semaian diisikan dengan 4 kg tanah kebun.

Step 2   : The trays are labeled as P, Q and R.
Langkah 2   : Kotak-kotak semaian dilabelkan P, Q dan R.

Step 3   : In tray P, 50 maize seedlings are seedlinged at a distance of 15 cm intervals.
In tray Q, 50 maize seedlings are seedlinged at a distance of 10 cm intervals.
In tray R, 50 maize seedlings are seedlinged at a distance of 5 cm intervals.
Langkah 3   : Dalam kotak P, 50 anak benih jagung ditanam pada jarak 15 cm berselang seli.
Dalam kotak Q, 50 anak benih jagung ditanam pada jarak 10 cm berselang seli.
Dalam kotak R, 50 anak benih jagung ditanam pada jarak 5 cm berselang seli.

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

Step 5   : After 30 days, remove 30 maize seedlings randomly from tray P, tray Q and tray R. The root of seedlings are washed and wipedry.
Langkah 5   : Selepas 30 hari, 30 anak benih jagung secara rawak dari kotak P, kotak Q dan kotak R. Akar anak benih dibersihkan dan dilapkan sehingga kering.

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

Distance between maize seedlings / jarak antara anak benih jagung (cm)	Dry weight of 30 maize seedlings (g) / berat kering 30 anak benih jagung (g)
15	**200**
10	**150**

5	
	100

Table 1/Jadual 1

(a) Record the dry weight of the maize seedlings in the boxes provided in Table 1
Rekodkan berat kering anak benih jagung di dalam kotak yang disediakan dalam jadual 1.

(b) (i) Based on the results in Table 1 , state **two** observations that can be made from this experiment.
Berdasarkan keputusan di dalam Jadual 1, nyatakan dua pemerhatian yang dapat dibuat daripada eksperimen ini

Observation 1/*pemerhatian 1*:

At distance 15 cm, the dry weight of 30 paddy seedlings is 200g

Observation 2/*pemerhatian 2*:

At distance 5 cm, the dry weight of 30 paddy seedlings is 100g

[3 *marks*]

(ii) State the inference from the observations in (b) (i).
Nyatakan inferens berdasarkan pemerhatian di (b) (i)

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

(At distance 15 cm), there is low intraspecific competition so the growth rate of maize plant is high

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

(At distance 5 cm), there is highintraspecific competition so the growth rate of maize plant is low

[3 *marks*]

(c)   Complete table 2 based on the experiment.
Berdasarkan eksperimen, lengkapkan jadual 2 di bawah

Variable *Pembolehubah*	Particulars to be implemented *Cara mengendalikan pembolehubah*
Manipulated/ *manipulasi:* **Distance between maize seedlings**	**Used different distance between maize seedling//used the distances at 15cm, 10cm and 5cm**
Responding / *bergerakbalas:* **Dry weight of maize seedlings//** **growth rate**	**Record dry weight of maize seedlings by using a weight balance // calculate the growth rate using formula** **Growth = Dry weight of 30 maize plant** **30 days**
Controlled/ *dimalarkan* **Volume garden soil // type of maize plant // size of tray**	**Fix the volume of garden soil at 4kg // fix the same type of maize plant // fix the same size of tray**

Table 2// *Jadual 2*

[3 *marks*]

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

The further the distance between the maize seedlings, the higher the growth rate of/dry weight of maize plant//vice versa

[3 *marks*]

(e) Construct a table and record all your data collected in the experiment which include the following aspects :
  Bina satu jadual untuk merekodkan semua keputusan eksperimen meliputi aspek berikut :

- Distance between maize seedlings/jarak antara anak benih jagung
- Dry weight of 30 maize seedlings/berat kering 30 anak benih jagung
- Growth rate of maize seedling/kadar pertumbuhan anak benih jagung

  Growth rate = Dry weight of maize seedlings
                        Number of days

  Kadar pertumbuhan = Berat kering anak benih jagung
                                  Bilangan hari

Distance between maize seedlings (cm)	Dry weght of 30 maize seedlings (g)	Growth rate (g/days)
15	200	6.67
10	150	5.00
5	100	3.33

[3 *marks*]

(f) Use the graph paper provided on page 55 to answer this question. Using the data in 1 (e)draw a graph of the growth rate of maize seedlings against the distance between the maize seedlings.
Dengan menggunakan kertas graf yang dibekalkan pada muka surat 55 untuk menjawab soalan ini. Dengan menggunakan data di dalam 1 (e), lukiskan graf kadar pertumbuhan anak benih jagung melawan jarak di antara anak benih jagung

[3 *marks*]

(g) Based on graph in 1 (f), explain the relationship between the growth rate of maize seedlings and distance between seedling
Berdasarkan graf di 1 (f), terangkan hubungan di antara kadar pertumbuhan anak benih jagung dan jarak antara anak benih.

P1: As the distance between maize increases, the growth rate of maize seedlings increases.
P2: This is because there is lower intraspecific competition
P3: causes the dry weight of maize seedlings increase

[3 *marks*]

(h) If the experiment is repeated by increasing the distance between the maize seedlings to 20 cm, **predict** the observation . **Explain** your prediction..
Jika eksperimen diulang dengan meningkatkan jarak di antara anak benih jagung pada 20 cm,ramalkanpemerhatian. Terangkan ramalan anda.

P1: The dry weight more than 200g
P2: because longer distance give more water/ nutrient / space to the maize seedling,
P3: so the growth rate of maize seedlings increases

[3 *marks*]

(i) Based on this experiment, what can you deduce about intraspecific competition?
Berdasarkan eksperimen ini, apakah yang dapat anda rumuskan tentang persaingan intraspesifik?

P1: Intraspecific competition is the growth maize plants when it compete between themselves
P2: and shown by the dry weight of maize seedling.
P3: The growth rate of maize is affected by the distance between the seedlings

[3 *marks*]

(j) When resources are 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/*makanan* Space/*ruang* Breedingmate/*pasangan mengawan* |
| Nutrient/*nutrien* Water/*air* Light/*cahaya* |

In Table 3, classify the resources given according to what are the resources competed by animals and resources compete by plants.
Dalam Jadual 3, klasifikasikan sumber-sumber yang diberi mengikut apakah sumber-sumber yang dsaingi oleh haiwan dan sumber-sumber yang disaingi oleh tumbuhan.
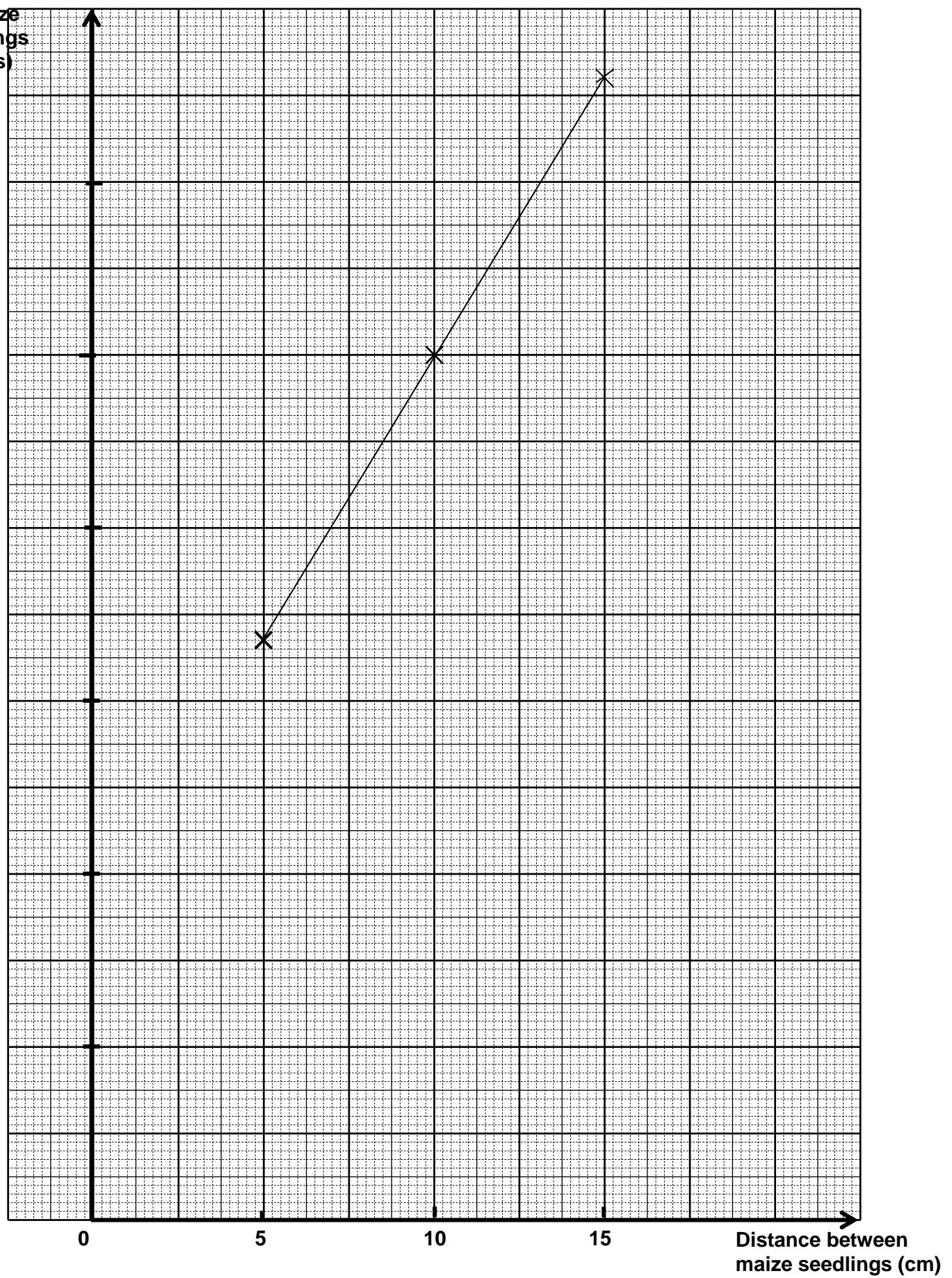
The resources competed by animals/ *Sumber-sumber yang dsaingi oleh haiwan*	Resources compete by plants/ *Sumber-sumber yang disaingi oleh tumbuhan*
Food **Space** **Breedingmate**	**Nutrien** **Water** **Light**

Table 3/Jadual 3

[3 *marks*]

Growth rate
Of maize
seedlings
(g/days)

0   5   10   15   Distance between
                                              maize seedlings (cm)

QUESTION 2

Score	Explanation
01 √	***Identified the problem***
3	*Able to state problem statement correctly* P1 – light intensity P2 – rate of transpiration *Sample answer:* Is the light intensity increase the rate of transpiration of plant?
2	*Able to state problem statement but slightly incorrect*
1	*Able to state idea only (not in question)//Hypothesis form.*
0	No response or wrong response.
√	**Objective of study/Aim** *Able to state the objective of study correctly* *Sample answer:* To investigate the effects of light intensity on the rate of transpiration of a balsam plant.
√	**Variables** *Able to state any one item for each variable given.* Manipulated Variable : distance light sources// ligh intensity Responding Variable : Time taken for the air bubble move// rate of transpiration Fixed / Controlled Variable: temperature//type of plant
02 √	***Statement of hypothesis*** P1 – light intensity P2 – rate of transpiration P3 – The rate transpiration / air bubble movement / is influence by light intensity
3	*Able to state the hypothesis correctly by relating two variable correctly.* *Sample answer:* The higher the light intensity, the rate of transpiration of a balsam plant increase.
2	*Able to state hypothesis but slightly incorrect.*
1	*Able to state idea only.*
0	No response or wrong response.
05 √	**List of apparatus** Photometer, stopwatch, cutter (knife), beaker, fluorescent lamp, meter ruler **List of materials** Balsam plant, Vaseline, water, tissue
3	*Able to list down 4 apparatus and 3 material.*
2	*Able to list down 2 apparatus and 2 material.*
1	*Able to list down 1 apparatus and 1 material.*
0	*No response or wrong response.*
B1 – 1 √	**Technique used** Measure and record the time taken for the air bubble to move in a distance for 10 cm by (B1-1).
04 √	**Experimental procedure** 1. A suitable balsam plant is selected **(K1)** and is cut using a sharp knife **(K1)**. The cut end is immediately immersed in a beaker filled

	with distilled water**. (K1)**
	2. The cut plant is then fixed onto a photometer **(K1)** and the joints between the plant and the photometer are sealed using Vaseline to make them airtight **(K5).**
	3. The laboratory curtains and doors are pulled and closed so that outside lightning will not affect the outcome of the experiment **(K1).**
	4. A 40W**(K2)** fluorescent lamp is set 30 cm **(K3)** away from the edge of the **(K3)** photometer with a meter rule placed to measure the distance.
	5. The air bubble in the photometer is set to 0 cm **(K4).** The lamp is switched on and the stopwatch is started **(K4)** when the air bubble cross the X mark .
	6. The movement of air bubble is observed and the stopwatch is stopped when the bubble reaches Y mark, that is 10 cm **(K2).**
	7. Record the time taken into a table**(K4)** .
	8. Steps 4 to 7 are repeated, with the distance of the lamp are put at 40 cm**(K3)**, 50 cm**(K3)**, 60 cm **(K3)** away from the photometer.
	9. All the findings are recorded into the table**(K4).**
3	*All* **5K***criteria correct* K1 – any **three** criteria K2 – any **one** criteria K3 – any **three** criteria K4 – any **two** criteria K5 – any **one** criteria
2	**3K – 4K***criteria correct.*
1	**At least 2K***criteria correct.*
0	*No response or wrong response.*
B2 – 1 √	**Presentation of data** Data is present in a table with right unit for rate of transpiraton (for B2 – 1 ***cm/second*** or ***cm second*** *-1*)

Distance of lamp from the edge of the photometer (cm)	Time taken for the air bubble to travel for X to Y (s)	Rate of Transpiration (cm/second)

	If without the unit for the rate of transpiration, give no an idea (x) and B2 - 0.
√	**Conclusion** *Write the hypothesis or another hypothesis.* *Sample answer:* The higher the light intensity the higher the rate of transpiration. Hypothesis is accepted.
03	**Report writing**
3	**Score 3 = 7-9**
2	**Score 2 = 4-6** √

1	**Score 1 = 1-3 √**
0	**No response or wrong response.**

Question 1: 33 Marks
Question 2: 17 Marks

(Total   = 50 marks)

END OF THE SCHEME MARKING