KB0603 – Measuring Using Numbers

Mark Scheme
Able to record all 6 time taken for the methylene blue solution to decolourise i Sample 1 and Sample 2 correctly. Sample Answer:

Location *Lokasi*	Time taken for methylene blue solution to decolourise (minute) *Masa yang diambil untuk larutan metilena biru dilunturkan (minit)*	
	Sample 1 *Sampel 1*	Sample 2 *Sampel 2*
X	66	64
Y	24	26
Z	39	41

Able to list **4-5 readings** correctly .
Able to list **2-3 readings** correctly .
Able to list **1 reading** correctly or no response or incorrect response

(i) [KB0601 - Observation]

Explanation
Able to state two different observations correctly based on the followi criteria: P1 : Manipulated variable (location of water sample / *lokasi sampel air*) P2 : Responding variable (time taken for methylene blue solution to decolourise / *masa yang diambil untuk larutan metilena biru dilunturkan*) ***(Reject: average time / purata masa)*** Sample answers : 1. At location X/Y/Z, the time taken for methylene blue solution to decolourise (Sample 1) is 66/24/39 minutes and (in Sample 2) is 64/26/41 minutes. *Pada lokasi X/Y/Z, masa yang diambil untuk larutan metilena biru dilunturkan (dalam Sampel 1) ialah 66/24/39 minit dan (dalam Sampel 2) ialah 64/26/41 minit.*

7 (b) (ii) [KB0604 – Making inference]

Score	Explanation
2	**Able to make two inferences correctly based on any two aspects** P1 : More / less microorganisms / bacteria *Lebih / kurang mikroorganisma / bakteria* P2 : More / less dissolved oxygen / oxygen content in water // high / low BOD level *Lebih / kurang oksigen terlarut / kandungan oksigen dalam air // tinggi / rendah tahap BOD* P3 : Level of water pollution *Tahap pencemaran air*
3	Sample answers : 1. Water sample in location X has less microorganisms, so the level of water pollution is low // BOD is low. *Sampel air pada lokasi X mengandungi kurang mikroorganisma, maka tahap pencemaran air adalah rendah // tahap BOD rendah.* 2. Water sample in location Y has more microorganisms and the level of water pollution is high // less dissolved oxygen compared to location X and Z. *Sampel air pada lokasi Y mengandungi banyak mikroorganisma dan tahap pencemaran air adalah tinggi // kurang oksigen terlarut berbanding lokasi X dan Z.*

1 (c) [KB0610 – Controlling Variables]

Score	Explanation
3	**Able to state all 3 variables and the methods to handle the variable correctly.** Sample Answer :

Variables	Method to handle the variable correctly
Manipulated variable: Water samples / locations of water samples *Sampel air / lokasi sampel air*	Use **different** water samples / locations of water samples (which are X, Y and Z). *Gunakan sampel air / lokasi sampel air yang **berbeza** (iaitu X, Y dan Z).*
Responding variable : Time taken for methylene blue solution to decolourise *Masa yang diambil untuk larutan metilena biru dilunturkan*	Measure and **record** the time taken for methylene blue solution to decolourise by using a **stopwatch** *Ukur dan **rekod** masa yang diambil untuk larutan metilena biru dilunturkan menggunakan **jam randik***
Average time taken for methylene blue solution to decolourise *Purata masa yang diambil untuk larutan metilena biru dilunturkan*	**Calculate** (and record) the average time taken for methylene blue solution to decolourise by using formula = $\frac{\text{Time taken 1 + Time taken 2}}{2}$ ***Hitung** (dan rekodkan) purata masa yang diambil untuk larutan metilena biru dilunturkan menggunakan formula =* $\frac{\textit{Masa diambil 1 + Masa diambil 2}}{2}$
Level of water pollution *Tahap pencemaran air*	**Calculate** (and record) the level of water pollution by using formula = $\frac{1}{\textbf{Time taken for methylene blue solution to decolourise}}$ ***Hitung** (dan rekodkan) tahap pencemaran air menggunakan formula =* $\frac{1}{\textit{Masa diambil untuk larutan metilena biru dilunturkan}}$

3

	Constant variable: Volume / concentration of methylene blue solution *Isipadu / kepekatan larutan metilena biru* Volume of water sample *Isipadu sampel air* Light intensity *Keamatan cahaya*	**Fix** the volume / concentration of methylene blue solution that is **1 ml / 0.1 %** ***Tetapkan** isipadu / kepekatan larutan metilena biru iaitu **1 ml / 0.1 %*** **Fix** the volume of water sample that is **150 ml** ***Tetapkan** isipadu sampel air iaitu **150 ml*** Place the reagent bottles at the **same** light intensity which is **dark cupboard** *Letakkan botol reagen di tempat yang mempunyai keamatan cahaya **sama** iaitu **almari gelap***
	6 ticks	
2	**3-5** ticks	
1	**1-2** ticks	
0	No response or incorrect response.	

d) **[KB0611 – Making Hypothesis]**

ver.	Mark scheme
	Able to make a hypothesis based on the following aspects. P1 : Manipulated variable (location of water sample / *lokasi sampel air*) P2 : Responding variable (time taken for methylene blue solution to decolourise // level of water pollution // BOD level *masa yang diambil untuk larutan metilena biru dilunturkan // tahap pencemaran air // tahap BOD*) H : Relationship / *Hubungan* Sample answers : 1. Water sample in location Y has the shortest time taken for methylene blue solution to decolourise compared to location X and Z // vice versa. *- Bagi sampel air di lokasi Y, masa yang diambil untuk larutan metilena biru dilunturkan adalah yang paling cepat berbanding lokasi X dan Z // sebaliknya* 2. Water sample in location Y has the highest level of water pollution / BOD level compared to location X and Z // vice versa. *Sampel air di lokasi Y mempunyai tahap pencemaran air / tahap BOD yang paling tinggi berbanding lokasi X dan Z // sebaliknya*
	Able to make a hypothesis based on any two aspects. Sample answers : 1. The higher the time taken for methylene blue solution to decolourise, the lower the level of water pollution. *Semakin panjang masa yang diambil untuk larutan metilena biru dilunturkan semakin rendah tahap pencemaran air*

	2 The level of water pollution is different *Tahap pencemaran air adalah berbeza*
1	**Able to make a hypothesis at idea level.** Sample answers : 1 Water sample in location X/Y/Z is polluted *Sampel air di lokasi X/Y/Z adalah tercemar*
0	No response or incorrect response

1 (e) (i) [KB0606 – Communication]

Score	Mark scheme
3	**Able to construct a table correctly based on the following aspects:** (T) Title with correct units – 1mark (D) Data recorded correctly – 1mark (C) Level of water pollution – 1mark Sample answers :

Location *Lokasi*	Time taken for methylene blue solution to decolourise (minute) *Masa diambil untuk larutan metilena biru dinyahwarnakan (minit)*			Level of water pollution (minute^{-1}) *Tahap pencemaran air (minit^{-1})*
	Sample 1 *Sampel 1*	Sample 2 *Sampel 2*	Average *Purata*	
X	66	64	65	0.02 / 0.015
Y	24	26	25	0.04 / 0.040
Z	39	41	40	0.03 / 0.025

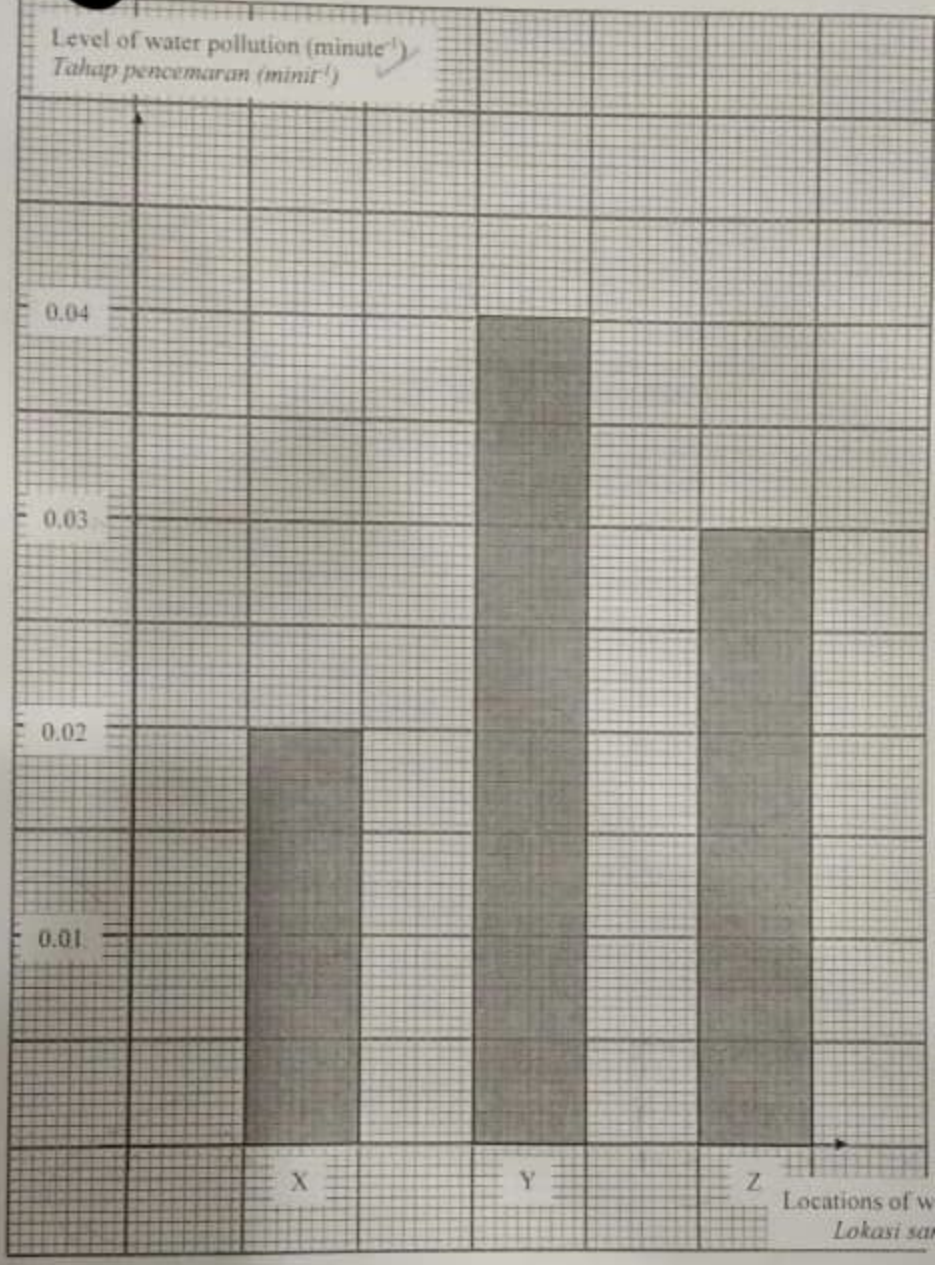
2	Able to state any **two** correct aspects.
1	Able to state any **one** correct aspect.
0	No response or incorrect response

1 (e)(ii) [KB0612 – Plotting a graph]

Score	Explanation
3	**Able to draw the bar graph to show the level of water pollution against the locations of water samples** Axis/ *Paksi* (P) : Both axis with uniform scales – 1 mark Points/ *Titik* (T) : Correct height – 1 mark Shape/ *Bentuk* (B) : Correct bar chart – 1 mark **All three aspects plotted**
2	Any **two aspects**
1	Any **one aspect**
0	**No response** or **incorrect response**

6

Level of water pollution against the locations of water samples
Tahap pencemaran air melawan lokasi sampel air



(f) [KB0608 – Interpreting Data]

Score	Mark Scheme
3	**Able to explain the relationship between level of water pollution and location of water samples based on all three aspects :** R : Relationship E1 : More / less microorganisms / bacteria *Lebih / kurang mikroorganisma / bakteria* E2 : More / less dissolved oxygen / oxygen content in water / BOD level *Lebih / kurang oksigen terlarut / kandungan oksigen dalam air / tahap BOD* Sample answers : 1. Water sample in location Y has the highest level of water pollution compared to location X and Z. This is because water sample in location Y has the highest amount of microorganisms, thus has the least amount of dissolved oxygen. *Sampel air di lokasi Y mengandungi tahap pencemaran air yang paling tinggi berbanding lokasi X dan Z. Ini kerana sampel air di lokasi Y mengandungi bilangan mikroorganisma yang paling banyak, maka ia mengandungi kandungan oksigen terlarut yang paling rendah.*
2	Able to state the relationship based on **R** and **P1/ P2.**
1	Able to state an idea of the relationship **R // idea + P1/P2**
0	No response or incorrect response / no R or incorrect R

1 (g) [KB0605 – Predicting]

Score	Explanation
3	**Able to predict the average time taken for methylene blue solution to decolourise based on the following aspects**: P : Prediction of average time taken (more than 65 minutes) *Ramalan purata masa diambil (lebih daripada 65 minit)* E1 : shaking introduces oxygen into the solution / increases dissolved oxygen content in the solution *menggoncang menyebabkan kemasukan oksigen ke dalam larutan/ menambahkan kandungan oksigen terlarut di dalam larutan* E2 : inaccurate results *keputusan tidak tepat* Sample answers: The average time taken for methylene blue solution to decolourise is more than 65 minutes. This is because shaking introduces oxygen into the solution / increases dissolved oxygen content in the solution, therefore produces inaccurate results. *Purata masa diambil untuk larutan metilena biru dilunturkan adalah lebih daripada 65 minit. Ini kerana menggoncang menyebabkan oksigen terlarut ke dalam larutan / menambahkan kandungan oksigen terlarut di dalam larutan, maka memberikan keputusan yang tidak tepat.* **P + E1 + E2**
2	**P+E1 // P + E2 // idea + E1 + E2**
1	**P only // idea + E1 // idea + E2**
0	No response or incorrect response / No P or wrong P

66

(h) [KB0609 –Defining by Operation]

ore	Mark scheme
	Able to define operationally water pollution based on the result of this experiment. P1 : Water sample (from river P) that has low dissolved oxygen content / high BOD level *Sampel air (dari sungai P) yang mengandungi kandungan oksigen terlarut rendah / tahap BOD yang tinggi* P2 : Shown by the time taken / average time taken / change // difference in time taken for methylene blue solution to decolourise *ditunjukkan oleh masa diambil / purata masa diambil / pertukaran // perbezaan masa yang diambil untuk larutan metilena biru dilunturkan* P3 : Affected by location of water sample *Dipengaruhi oleh lokasi sampel air* Sample answers : Water pollution is the water sample (from river P) that has low dissolved oxygen content. This is shown by the time taken / average time taken / change // difference in time taken for methylene blue solution to decolourise and affected by the location of water sample. *Pencemaran air adalah sampel air (dari sungai P) yang mengandungi kandungan oksigen terlarut rendah. Ini ditunjukkan oleh masa diambil / purata masa diambil / pertukaran // perbezaan masa diambil untuk larutan metilena biru dilunturkan yang dipengaruhi oleh lokasi sampel air*
3	
2	Able to define operationally based on **two** aspects.
1	Able to define operationally based on **one** aspect.
0	No response or incorrect response.

(i) [KB0602 – Classifying]

core	Mark scheme
	Able to classify the elements that cause water pollution into heavy metals and non-heavy metals correctly. Sample answer
3	<table><tr><th>Heavy metals *Logam berat*</th><th>Non-heavy metals *Bukan logam berat*</th></tr><tr><td>Lead / *plumbum* Mercury / *merkuri* Cadmium / *kadmium* Copper / *kuprum*</td><td>Magnesium / *magnesium* Sodium / *natrium*</td></tr></table> All **6** ticks correctly
2	All **4 – 5** ticks correctly
1	All **1 – 3** ticks correctly
0	No response or incorrect response

No.	Mark Scheme	Score
2(i)	**Able to state problem statement relating the manipulated variable with the responding variables correctly based on the following aspects :** P1 : Manipulated variable (number of leaves / *bilangan daun*) P2 : Responding variable (rate of transpiration in hibiscus plants / *kadar transpirasi pokok bunga raya*) P3 : Relationship (Question form) Sample answer: 1. Does the number of leaves affect the rate of transpiration in hibiscus plants? *Adakah bilangan daun mempengaruhi kadar transpirasi pokok bunga raya?* 2. What is the effect of the number of leaves on the rate of transpiration in hibiscus plants? *Apakah kesan bilangan daun ke atas kadar transpirasi pokok bunga raya?* **P1 + P2 + P3**	3
	Able to state a problem statement inaccurately Sample answers: 1. What is the effect of number of leaves on hibiscus plants? *Apakah kesan bilangan daun ke atas pokok bunga raya?* 2. Does number of leaves affect the transpiration process? *Adakah bilangan daun mempengaruhi proses transpirasi?* 3. What factor affects the rate of transpiration? *Apakah faktor yang mempengaruhi kadar transpirasi?* **Any 2P**	2
	Able to state a of problem statement at idea level Sample answers: 1. The hibiscus plant undergoes transpiration process. *Pokok bunga raya menjalani proses transpirasi.* 2. The number of leaves affects the transpiration in plants. *Bilangan daun mempengaruhi transpirasi dalam pokok* **Any 1P**	1
	No response or incorrect response	0

No.	Mark Scheme	

2(d)	**Able to state the hypothesis based on the following aspects :**
	
	P1 : Number of leaves / *bilangan daun*
	P2 : Rate of transpiration (in hibiscus plants) / *kadar transpirasi (dalam pokok bunga raya)*
	P3 : Relationship of the variables / *hubungkait pemboleh ubah*
	
	Sample answers:
	1. The higher the number of leaves, the higher the rate of transpiration (in hibiscus plant) //vice versa.
	Semakin tinggi bilangan daun, semakin tinggi kadar transpirasi (dalam pokok bunga raya) // sebaliknya
	
	2. The rate of transpiration increases as the number of leaves increases //vice versa.
	Kadar transpirasi meningkat apabila bilangan daun meningkat // sebaliknya	

	Able to state a hypothesis inaccurately based on any two aspects Sample answers: 1. Different number of leaves cause different rate of transpiration. *Bilangan daun berbeza menyebabkan kadar transpirasi berbeza.* 2. Number of leaves affects the rate of transpiration. *Bilangan daun mempengaruhi kadar transpirasi.*	
	Able to state an idea of the hypothesis based on any one aspect Sample answers: 1. Hibiscus plants show different transpiration process. *Pokok bunga raya menunjukkan proses transpirasi berbeza*	
	No response or incorrect response	0

	Mark Scheme	Score
(i)	**Able to state all the three variables correctly** Sample answers: 1. Manipulated variable: Number of leaves *Bilangan daun* 2. Responding variable: Rate of transpiration // time taken for air bubbles to travel in 10cm distance // distance travelled by air bubbles in 5 minutes *Kadar transpirasi // masa diambil untuk gelembung udara bergerak sejauh 10cm // jarak yang dilalui oleh gelembung udara dalam masa 5 minit* 3. Controlled variable: Temperature // air movement // light intensity // humidity // type of plant // distance travelled by air bubbles in 5 minutes // time taken for air bubbles to move along 10 cm *Suhu // pergerakan udara // keamatan cahaya // kelembapan // jenis pokok // jarak yang dilalui oleh gelembung udara dalam masa 5 minit // masa diambil untuk gelembung udara bergerak sejauh 10cm*	3
	Able to state any **two variables** correctly	2
	Able to state any **one variable** correctly	1
	No response or **incorrect response**	0

(iv)	**Able to list all apparatus and materials correctly** Sample answers: **Set A**	3

Apparatus / *Radas*	Materials / *Bahan*
• Beakers / *bikar* (√)* • Capillary tube / *tiub kapilari* (√) • Rubber tubing / *tiub getah* (√) • Retort stand / *kaki retort* (√)* • Ruler / *pembaris* (√) • Stopwatch / *jam randik* (√)* • Knife / cutter / scissors / *pisau / pemotong / gunting* (√)* • Marker pen / *pen penanda* (√)* • * potometer / *potometer* (√) (√) compulsory for 8A (√) compulsory for 4A (with potometer)	• Hibiscus shoot / *pucuk bunga raya* (√) • Vaseline / grease / petroleum jelly / *gris / jeli petroleum* (√) • Distilled water / *air suling* (√) • Dry cloth / tissue paper / *kain yang kering / kertas tisu* (√) : compulsory for 3M

(√) Compulsory. If not stated here, look for it in the procedure.
(√) Wajib. Jika tidak dinyatakan di sini, cari ia di dalam prosedur.
*** beaker + retort stand + capillary tube + rubber tubing = potometer = 1 Apparatus**

8A + 3M

5A + 3M

Set B

Apparatus / *Radas*	Materials / *Bahan*
• Conical flask / *kelalang kon* (√) • Weighing balance / *penimbang* (√) • One hole rubber stopper / *penutup getah satu lubang* (√) (√) compulsory for 3A	• Hibiscus shoot / *pucuk bunga raya* (√) • Paraffin oil / *minyak parafin* (√) • Distilled water / *air suling* (√) (√) : compulsory for 3M

3A + 3M

4-7A+ 2M / 2A + 2M	2
1-3 A + 1M / 1A + 1M	1
No response or incorrect response	0

2(v)	**Mark Scheme**	Score
	Able to describe the steps of the experimental procedure or method correctly based on the following aspects : K1 : Preparation of materials & apparatus K2 : Operating fix variable K3 : Operating responding variable K4 : Operating manipulated variable K5 : Precaution step Sample answer : Procedures: **Set A** 1. **Cut** a fresh leafy shoot of a **hibiscus plant** with 10 leaves in a basin of water. K1, K2 ***Potong** pucuk **pokok bunga raya** berdaun dengan 10 helai daun di dalam air.* 2. **Fit** the shoot into the rubber tube of the potometer **tightly** to make sure its air tight. K1, K5 ***Masukkan** batang pucuk ke dalam tiub getah potometer dengan **ketat** untuk memastikan ia kedap udara.* 3. **Hold** the shoot and the potometer upright using a retort stand. K1 ***Tegakkan** pucuk dan potometer menggunakan kaki retort.* 4. **Dry** the leaves and the stem of the shoot with a piece of cloth. K5 ***Keringkan** daun-daun dan batang pucuk dengan sehelai kain.* 5. **Apply** Vaseline to all the connections to **prevent** any leakage. K1, K5	3

	*Sapukan Vaseline pada semua sambungan untuk **mengelakkan** kebocoran.*	
6.	**Allow** an air bubble to enter the capillary tube of potometer and trapped it. ***Wujudkan** gelembung udara di dalam tiub kapilari.*	K1
7.	**Mark** the initial position of air bubble as X. Mark another point, Y, which distance of 10 cm from X. ***Tandakan** kedudukan awal gelembung udara sebagai X. Tandakan satu lagi titik Y, sejarak 10cm dari X.*	K1
8.	**Leave** the potometer on the laboratory table. ***Letakkan** potometer di atas meja makmal.*	K1
9.	**Record** the time taken for the air bubble to move from X to Y using **stopwatch**. ***Rekodkan** masa diambil untuk gelembung udara bergerak dari X ke Y menggunakan **jam randik.***	K3
10.	**Calculate** the rate of transpiration by using a formula: **Rate of transpiration** = $\frac{\mathbf{1}}{\textbf{Time taken for air bubble to travel}}$ ***Hitung** kadar transpirasi menggunakan formula:* ***Kadar transpirasi** = $\frac{1}{\textbf{Masa diambil untuk gelembung udara bergerak}}$*	K3
11.	Repeat step 1 to 10, by using the same plant shoot but reduce the leaves number to **6** and then with **4** leaves. *Ulang langkah 1 hingga 10 menggunakan pucuk bunga raya yg sama tetapi mengurangkan bilangan daun kepada 6 helai dan kemudian **4** helai.*	K4
12.	Experiment is repeated twice to get **average** reading. *Eksperimen diulang dua kali **untuk** mendapatkan bacaan **purata**.*	K5
13.	Record the data in a **table**. *Rekodkan data di dalam **jadual***	K1
	Note: *i. At least 5K1* *ii. K2,K3,K4 and K5 at least one*	
	12	K1, K2

	Set B 1. **Cut** a fresh leafy shoot of a **hibiscus plant** with 10 leaves in a basin of water. ***Potong** pucuk **pokok bunga raya** berdaun dengan 10 helai daun di dalam air.*	K1
	2. **Fit** the shoot into a one hole rubber stopper at a conical flask which was filled with 100ml of distilled water. ***Masukkan** batang pucuk ke dalam penutup getah pada kelalang kon yang telah diisi dengan 100ml air suling.*	K1
	3. **Place** a few drops of paraffin oil on the surface of the distilled water in the conical flask. ***Letakkan** beberapa titik minyak parafin di atas permukaan air suling dalam kelalang kon.*	K1
	4. Record the initial mass of the potometer. *Rekodkan jisim awal potometer.*	K1
	5. **Leave** the potometer on the laboratory table. ***Biarkan** potometer di atas meja makmal.*	K1
	6. After **30 minutes**, measure and **record** the final mass of potometer by using **weighing balance**. *Selepas **30 minit**, ukur dan **rekodkan** jisim akhir potometer menggunakan **penimbang**.*	K2, K3
	7. Repeat step 1 to 6, by using the same plant shoot but reduce the leaves number to **6** and then with **4** leaves. *Ulang langkah 1 hingga 6 menggunakan pucuk bunga raya yg sama tetapi mengurangkan bilangan daun kepada **6** helai dan kemudian **4** helai.*	K4
	8. Repeat the experiment twice to get **average** reading. *Ulang **eksperimen dua kali untuk** mendapatkan bacaan **purata**.*	K5
	9. Record the data in a **table**. *Rekodkan data di dalam **jadual**.*	K1
	Note: *i. At least 5K1* *ii. K2,K3,K4 and K5 at least one* 13	
	All the 5K	
	Able to state 3- 4 K	2
	Able to state 1-2 K	1
	No response or incorrect response	0

Mark Scheme

Score

No.

(vi) **Able to construct a table to record data based on the following criteria:**
C1 : Manipulated variables with parameter and unit
C2 : Operating responding variables and responding variables with unit

Sample answers :

Set A

(C1) (C2)

Number of leaves *Bilangan daun*	Time taken for air bubbles to travel from X to Y (minute) *Masa diambil untuk gelembung udara bergerak dari X ke Y (minit)*	Rate of transpiration (cm/minute) *Kadar transpirasi (cm/minit)*
10		
6		
4		

Set B

(C1) (C2)

Number of leaves *Bilangan daun*	Mass of potometer (g) *Jisim potometer (g)*			Rate of transpiration (g/minute) *Kadar transpirasi (g/minit)*
	Initial *Awal*	Final *Akhir*	Mass of water absorbed by roots *Jisim air diserap oleh akar*	
10				
6				
4				

13