SARAWAK MATRICULATION COLLEGE
SCIENCE DEPARTMENT
PHYSICS UNIT

SP015 INDIVIDUAL ASSIGNMENT
SEMESTER 1, SESSION 2021/2022

SUBMISSION DATE: _____

NAME	:	
MIS NO.	:	
TUTORIAL CLASS	:	
LECTURER'S NAME	:	
DATE SUBMITTED	:	

QUESTION NO.	FULL MARKS	MARKS OBTAINED	MODERATOR
1	**12**		
2	**10**		
3	**13**		
4	**8**		
5	**7**		
TOTAL	**60**		

SARAWAK MATRICULATION COLLEGE
PHYSICS SP015 SEMESTER 1, SESSION 2021/2022
INDIVIDUAL ASSIGNMENT RUBRIC

Name :	
MIS No. :	
Tutorial Class :	

Subattribute	1	2	3	4	5	**SCORE**
Allocated mark	$\left(\frac{Mark\ Earned}{Total\ Marks}\right) \times 80$					
Originality	Student's solution has 76% to 99% similarity with other students.	Student's solution has 51% to 75% similarity with other students.	Student's solution has 26% to 50% similarity with other students.	Student's solution has 25% or less similarity with other students.	All the solutions is written in student's own word.	
Solution methods	Less than 25% solutions are written in correct sequence.	25% to 49% solutions are written in correct sequence.	50% to 74% solutions are written in correct sequence.	75% to 99% solutions are written in correct sequence.	All solutions are written in the correct sequence (1a,1b, 1c, 2a, 2b, 2c).	
	Solutions for 3 different questions is written on the same page.	Solution for 1 out of 4 questions are written on a new page.	Solutions for 2 out of 4 questions are written on a new page.	Solutions for 3 out of 4 questions are written on a new page.	The solutions for all 4 questions are written on a new page.	
	Less than 20% of the solution method contains formulas and diagrams.	20% of the solution method contains formulas and diagrams.	40% of the solution method contains formulas and diagrams.	60% of the solution method contains formulas and diagrams.	80% of the solution method contains formulas and diagrams.	
TOTAL MARKS (100)						
CONTINUOUS ASSESSMENT (PB 10 %)						

Evaluated by;

…….

STUDENT'S DECLARATION MATRICULATION PROGRAMME, MINISTRY OF EDUCATION MALAYSIA		
Student's Name:	**Course Code:**	**Matric No.**
Assignment Title:		

STUDENT'S DECLARATION

I hereby declare that this task is my original work except for the citations and summaries of which I acknowledged the source.
Signature: **Date:** **Name:**

Note: This form needs to be attached together with written/printer/model assignment and submitted to the respective lecturer for evaluation.

Instruction: Answer all questions and write the solutions by following the marking rubric provided.

1)

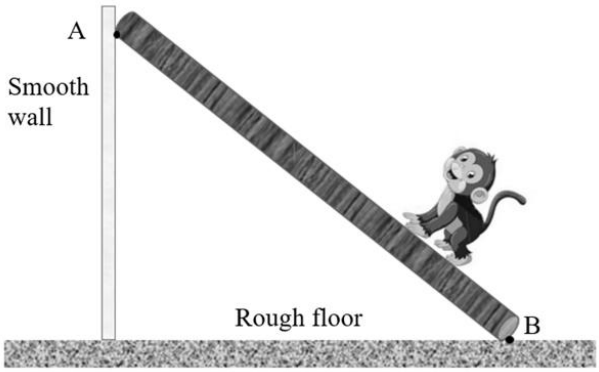


Figure 1

FIGURE 1 shows a uniform coconut tree trunk of length 17 m and mass 40 kg leans against a smooth wall. The height of the end A of the coconut tree is 8.0 m from the rough floor.

a. Determine the horizontal and vertical forces the floor exerts on the end B of the coconut tree when a monkey of mass 7 kg stands $\frac{1}{3}$ of the way from B.

[6 marks]

b. If the coconut tree is just on the verge of slipping when the monkey climbs further until it reaches 15.0 m up the trunk, calculate the coefficient of static friction between coconut tree and floor.

[6 marks]

2)

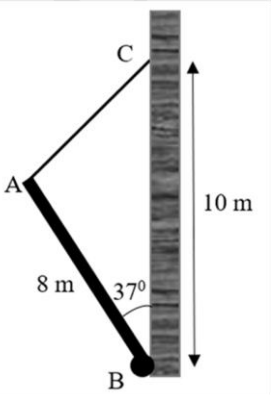


Figure 2

FIGURE 2 shows an 8 m uniform metal rod AB of weight 400 N is hinged to a wall at point B. The end A of the rod is connected with a string of length 6 m to the wall at point C.

Calculate

i. the tension of the string T.

[3 marks]

ii. the reaction force and its direction at the end B.

[7 *marks*]

3a)

Figure 3

A uniform rod AB of length 24 cm is hinged smoothly at a point 4.0 cm from end A. it is maintained in a horizontal position by a 30 N weight suspended 2.0 cm from A and a 5.0 N force applied at B, as shown in **FIGURE 3**. Determine

i. the weight of the rod

[3 marks]

ii. magnitude of the reaction force at the hinge

[4 marks]

3b)

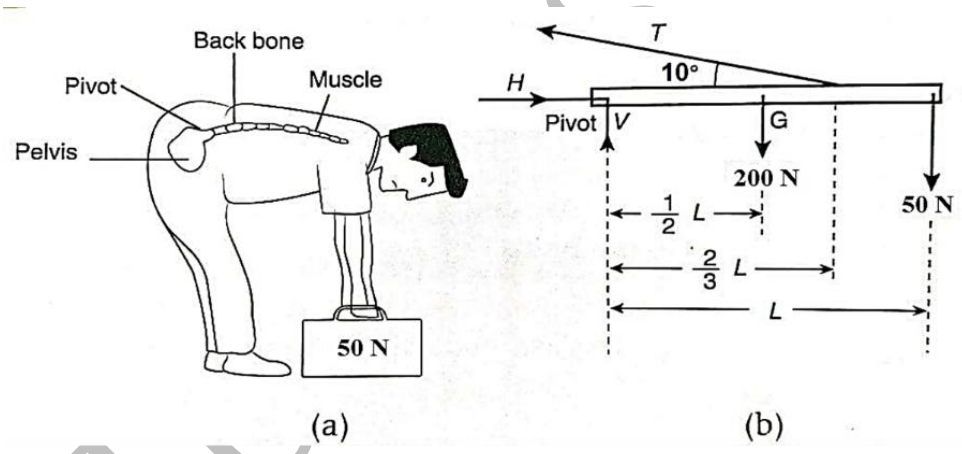


Figure 4

FIGURE 4 shows Aiman bending to lift a load of 50 N. His backbone may be considered as a rod pivoted at the end as shown in **FIGURE 4**. The weight of the upper torso of Aiman is 200 N and acts through the point G. Calculate

i. The tension *T* in the back muscle.

[2 *marks*]

ii. The compression *H* on the backbone.

[2 *marks*]

iii. The vertical reaction *V* on the pivot.

[2 *marks*]

4a)

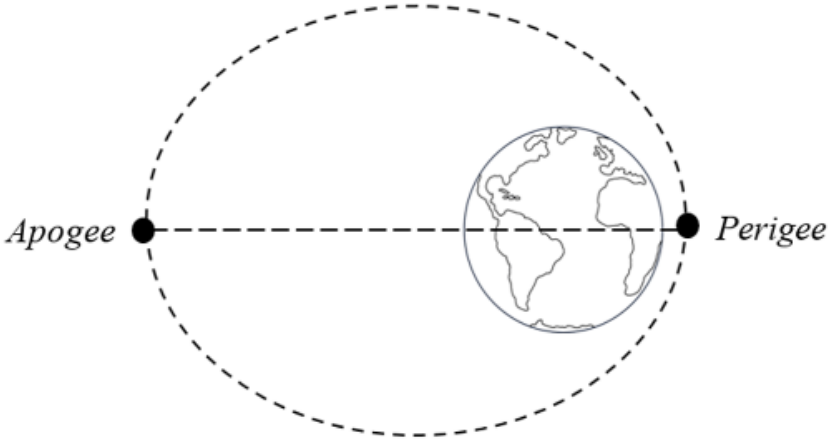


Figure 5

An artificial satellite is placed into an elliptical orbit about the earth, in **FIGURE 5**. Telemetry data indicate that its point of closest approach (called the *perigee*) is $r_P = 8.37 \times 10^6$ m from the center of the earth, and its point of greatest distance (called the *apogee*) is $r_A = 25.1 \times 10^6$ m from the center of earth. The speed of the satellite at the perigee is $v_P = 8450$ m s^{-1}. Find its speed v_A at the apogee.

[3 *marks*]

4b)

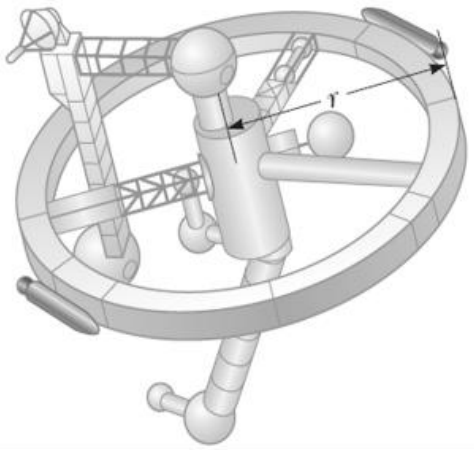


Figure 6

FIGURE 6 shows a space station that is constructed in the shape of a hollow ring of mass 5.0 x 10^4 kg. Members of the crew walk on a deck formed by the inner surface of the outer cylindrical wall of the ring, with radius r = 100 m. At rest when constructed, the ring is set rotating about its axis so that the people inside experience an effective free-fall acceleration equal to g. The rotation is achieved by firing two small rockets attached tangentially to opposite points on the rim of the ring.

i. What angular momentum does the space station acquire?

[2 *marks*]

ii. For what time interval must the rockets be fired if each exerts a thrust of 125 N?

[3 *marks*]

5

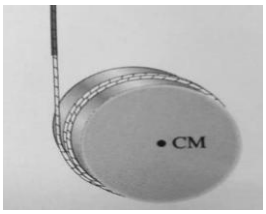


Figure 7

A string is wound around a uniform solid cylinder like a yo-yo of mass 3.0 kg, radius 40 cm, and moment of inertia 0.10 kg m^2 about the axis of rotation. The cylinder starts falling from rest in **FIGURE 7**. As the cylinder falls, find

i. its linear acceleration of the cylinder

[5 marks]

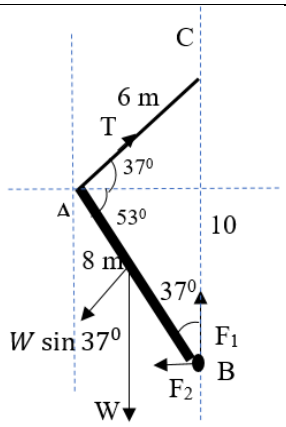
ii. the tension in the string

[2 marks]

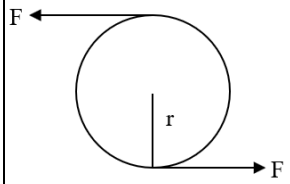
END OF QUESTION

MARKING SCHEME
LECTURER'S ONLY

Question	Solutions	Marks
1a)	$\Sigma\tau_B = 0$ $\boldsymbol{\tau_m + \tau_t + (-\tau_A) = 0}$	K1
	$(7)(9.81)\left(\frac{17}{3}\right)\left(\frac{15}{17}\right) + (40)(9.81)\left(\frac{17}{2}\right)\left(\frac{15}{17}\right) - N_A(17)\left(\frac{8}{17}\right) = 0$ $N_A = 410.81\ N$	G1
	$\Sigma F_x = 0$	K1
	$N_A = f_s = 410.81\ N$	JU1
	$\Sigma F_y = N_B + (-W_m) + (-W_t) = 0$ $N_B = W_m + W_t$ $N_B = g(m_m + m_t)$	
	$N_B = 9.81(7 + 40)$	G1
	$N_B = 461.07\ N$	JU1
1b)	$\Sigma\tau_B = 0$ $\boldsymbol{\tau_m + \tau_t + (-\tau_A) = 0}$	K1
	$(7)(9.81)(15)\left(\frac{15}{17}\right) + (40)(9.81)\left(\frac{17}{2}\right)\left(\frac{15}{17}\right) - N_A(17)\left(\frac{8}{17}\right) = 0$ $N_A = 481.47\ N$	G1
	Vertical force $\Sigma F_y = N_B + (-W_m) + (-W_t) = 0$ $N_B = W_m + W_t$ $N_B = g(m_m + m_t)$	
	$N_B = 9.81(7 + 40)$ $N_B = 461.07N$	G1
	Horizontal force $\Sigma F_x = N_A + (-f_s) = 0$ $N_A + \mu_s N_B = 0$	
	$\mu_s = \frac{N_A}{N_B}$	K1
	$\mu_s = \frac{481.47}{461.07}$	G1
	$\mu_s = 1.044$	JU1
	Total:	**12 Marks**

Question	Solutions		Marks
2		Let F1 and F2 are the horizontal and vertical forces exerted on the rod at B. Taking torque at point B, $\Sigma\tau_B = \tau_1 + (-\tau_2) = 0$ $F_1 d_1 - F_2 d_2 = 0$ $W\ sin\ sin\ 37^0(4) - T(8) = 0$	K1
		$T = \frac{(4)(400)37^0}{8}$	G1
		$T = 120.4\ N$	JU1
		$\Sigma F_y = T_y + F_{1y} + (-W) = 0$ $Tsin\ (37^0) + F_1 - W = 0$	K1
		$(120.4)sin\ (37^0) + F_1 - 400 = 0$ $F_1 = 327.6\ N$	G1
		$\Sigma F_x = T_x + (-F_{2x}) = 0$ $Tcos\ (37^0) - F_2 = 0$	
		$(120.4)cos\ (37^0) - F_2 = 0$	G1
		$F_2 = 96.2\ N$	
	Hence the reaction force,	$F = \sqrt{F_1^2 + F_2^2}$	
		$F = \sqrt{327.6^2 + 96.2^2}$	G1
		$F = 341.4\ N$	JU1
	Direction,	$\theta = tan^{-1}(\frac{F_1}{F_2})$	
		$\theta = tan^{-1}(\frac{327.6}{96.2})$	G1
		$\theta = 73.6^0$	JU1
		Total:	**10 Marks**

Question	Solutions	Marks
3a	$\Sigma\tau = \tau_b + (-\tau_r) + (-\tau_F) = 0$ $W_b(r_b)sin90 - W_r(r_r)sin90 - F(r_F)sin30 = 0$	K1
	$(30)(0.02)sin90 - W_r(0.08)sin90 - 5(0.2)sin30 = 0$	G1
	$W_r = 1.25\ N$	JU1
	$\Sigma F_y = 0$ $R_y + (-W_b) + (-W_r) + (-F_y) = 0$	K1
	$R_y = 30 + 1.25 + 5cos60$	G1
	$R_y = 33.75\ N$	
	$R_x = 5\ sin\ 60^o \approx 4.33N$	
	$R = \sqrt{33.75^2 + 4.33^2}$	G1
	$R = 34.03N$	JU1
3b	$\Sigma\tau = \tau_T + (-\tau_L) + (-\tau_G) = 0$ $T\left(\frac{2}{3}L\right)sin10 - W_L(L)sin90 - W_G\left(\frac{L}{2}\right)sin90 = 0$	
	$T\left(\frac{2}{3}L\right)sin10 - 50(L) - 200\left(\frac{L}{2}\right) = 0$ $T = \frac{(3)150}{(2)sin10}$	G1
	$T = 1295.72\ N$	JU1
	$\Sigma F_x = 0$ $H + (-T_x) = 0$	
	$H = 1295.72\ cos10$	G1
	$H = 1276.04\ N$	JU1
	$\Sigma F_y = 0$ $V + T_y + (-W_L) + (-W_G) = 0$	
	$V = -1295.72\ sin10 + 50 + 200$	G1
	$V = 25\ N$	JU1
	Total	**13 Marks**

Question	Solutions	Marks
4a)	$L_A = L_P$	K1
	$I_A\omega_A = I_P\omega_P \Rightarrow (mr_A{}^2)\left(\frac{v_A}{r_A}\right) = (mr_P{}^2)\left(\frac{v_P}{r_P}\right) \Rightarrow r_A v_A = r_P v_P$ $v_A = \frac{r_P v_P}{r_A}$	
	$v_A = \frac{(8.37 \times 10^6)(8450)}{25.1 \times 10^6}$	G1
	$v_A = 2817.79\ ms^{-1}$	JU1
4b)	$a_c = g = \frac{v^2}{r} = r\omega^2$ $\omega = \sqrt{\frac{g}{r}}; I = Mr^2; L = I\omega$ $L = (Mr^2)\left(\sqrt{\frac{g}{r}}\right)$	
	$L = (5 \times 10^4)(100^2)\left(\sqrt{\frac{9.81}{100}}\right)$	G1
	$L = 1.566 \times 10^8\ kgm^2s^{-1}$	JU1
	 $\Sigma\tau = I\alpha = 2Fr \Rightarrow \alpha = \frac{2Fr}{I} - - - [1]$ $\alpha = \frac{\omega_f - \omega_i}{\Delta t} \Rightarrow as\ \omega_i = 0, \alpha = \frac{\omega}{\Delta t} - - - [2]$ $[1] = [2] \Rightarrow \frac{2Fr}{I} = \frac{\omega}{\Delta t}$	
	$\Delta t = \frac{I\omega}{2Fr}$	K1
	$\Delta t = \frac{1.566 \times 10^8}{2(125)(100)}$	G1
	$\Delta t = 6264\ s$	JU1
	Total:	**8 marks**

Question	Solutions	Marks
5	$\Sigma\tau = I\alpha$	K1
	$Tr = I\alpha = I\left(\frac{a}{r}\right)$ $T = \frac{Ia}{r^2} - - - [1]$	
	$\Sigma F_y = ma$	K1
	$W + (-T) = ma \Rightarrow mg - T = ma$ $T = mg - ma$	
	$1 = 2$ $a = \frac{mg}{\left(\frac{I}{r^2}\right) + m}$	K1
	$a = \frac{(3)(9.81)}{\left(\frac{0.1}{0.4^2}\right) + 3}$	G1
	$a = 8.12\ ms^{-2}$	JU1
	$T = \frac{Ia}{r^2}$	
	$T = \frac{(0.10)(8.12)}{(0.4)^2}$	G1
	$T = 5.08\ N$	JU1
	Total:	**7 marks**

SULIT

SP015

Physics 1

Continuous Assessment

Semester 1 Session

2021/2022

2 hours

SP015

Fizik 1

Penilaian Berterusan

Semester 1

Sesi 2021/2022

2 jam

KEMENTERIAN PENDIDIKAN MALAYSIA

BAHAGIAN MATRIKULASI

MATRICULATION DIVISION

UJIAN AMALI

PRACTICAL TEST

FIZIK 1

Penilaian

Berterusan 2 jam

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

Kertas soalan ini mengandungi **6** halaman bercetak.

*This question paper consists of **6** printed pages.*

Section A

Conduct the experiment on Simple Harmonic Motion (SHM) by referring the given procedure carefully. Answer **all** the questions that follows.

Objective: To determine the acceleration due to gravity using a simple pendulum

Theory:

Accoring to the theory of SHM, the period of oscillation of a simple pendulum, *T* is given by

$$T = 2\pi\sqrt{\frac{l}{g}} - - - [1]$$

Where l is the length of the pendulum and g is the acceleration due to gravity.

Apparatus:

i. A piece of string (≈ 100 cm)
ii. A small pendulum bob
iii. A cork
iv. A retort stand with a clamp
v. A stop watch
vi. A metre rule
vii. A protractor with a hole at the centre of the semicircle
viii. An optical pin
ix. A pair of scissors or a cutter
x. A G-clamp

Procedure:

1.1 Set up a simple pendulum as in **Figure 1**

1.2 Set the length, l of the pendulum for 70 cm.

1.3 Swing the pendulum at 9^o from the vertical in one plane and measure the time for 10 oscillations, t_{10}. Repeat the operation and calculate the average value.

1.4 Using the same string, repeat step 1.3 with length of the pendulum l = 60 cm, 50 cm, 40 cm, 30 cm, and 20 cm.

1.5 Tabulate the values for l and t_{10} in the blank paper given.

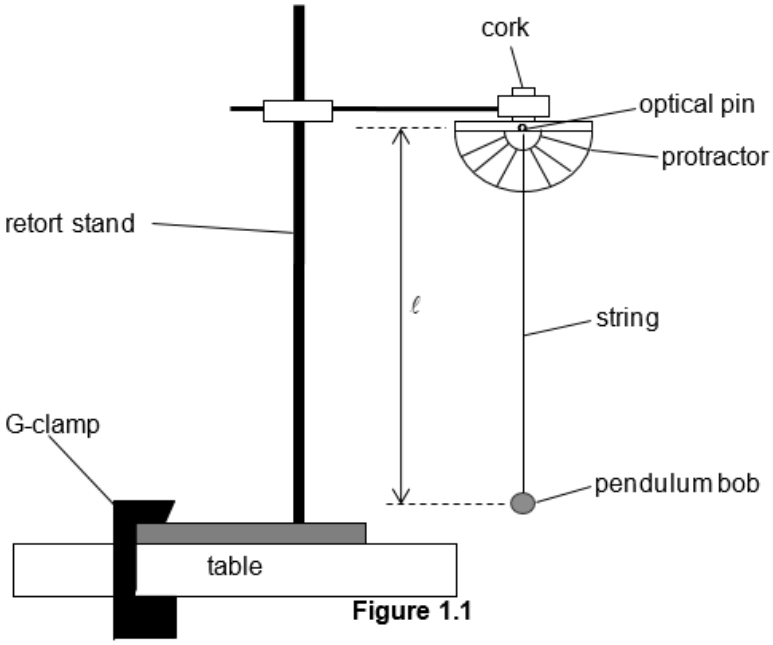


Figure 1.1

Section B – Answer all the question based on data provided in the table below.

a) Based on the experiment in Section A, state:

i. the manipulated variable

Length of Pendulum, l

ii. the responding variable

Time for 10 oscillations, t_{10}

iii. the constant variable

Mass of pendulum, m OR amplitude of oscillations, θ

[3 marks]

b) Complete the table based on the data provided below.

No. of reading	Length of pendulum, l $(\pm 0.1\ cm)$	Time taken for 10 oscillations, t $(\pm 0.01\ s)$			$T = \frac{t_{ave}}{10}$ (s)	T^2 (s^2)
		t_1	t_2	t_{ave}		
1	20.0	9.17	8.63	8.90	0.89	0.79
2	30.0	11.88	9.92	10.90	1.09	1.19
3	40.0	12.70	12.47	12.59	1.26	1.59
4	70.0	16.13	18.14	17.14	1.71	2.92
5	80.0	19.15	16.04	17.60	1.76	3.10
6	90.0	20.71	17.29	19.00	1.90	3.61

[5 marks]

All values of t_{ave} correct	1 mark
All values of T correct All correct → $2 marks$ 1 incorrect → $1\ mark$ 2 incorrect → $0\ marks$	2 marks
All values of T^2 correct	2 marks

c) By comparing Equation 1.1 with the linear graph equation, y = mx + c, show what variable is represented by y, m and x in this experiment.

$$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow T^2 = \frac{4\pi^2}{g}l$$

$$T^2 \mapsto y$$

$$\frac{4\pi^2}{g} \mapsto m$$

$$l \mapsto x$$

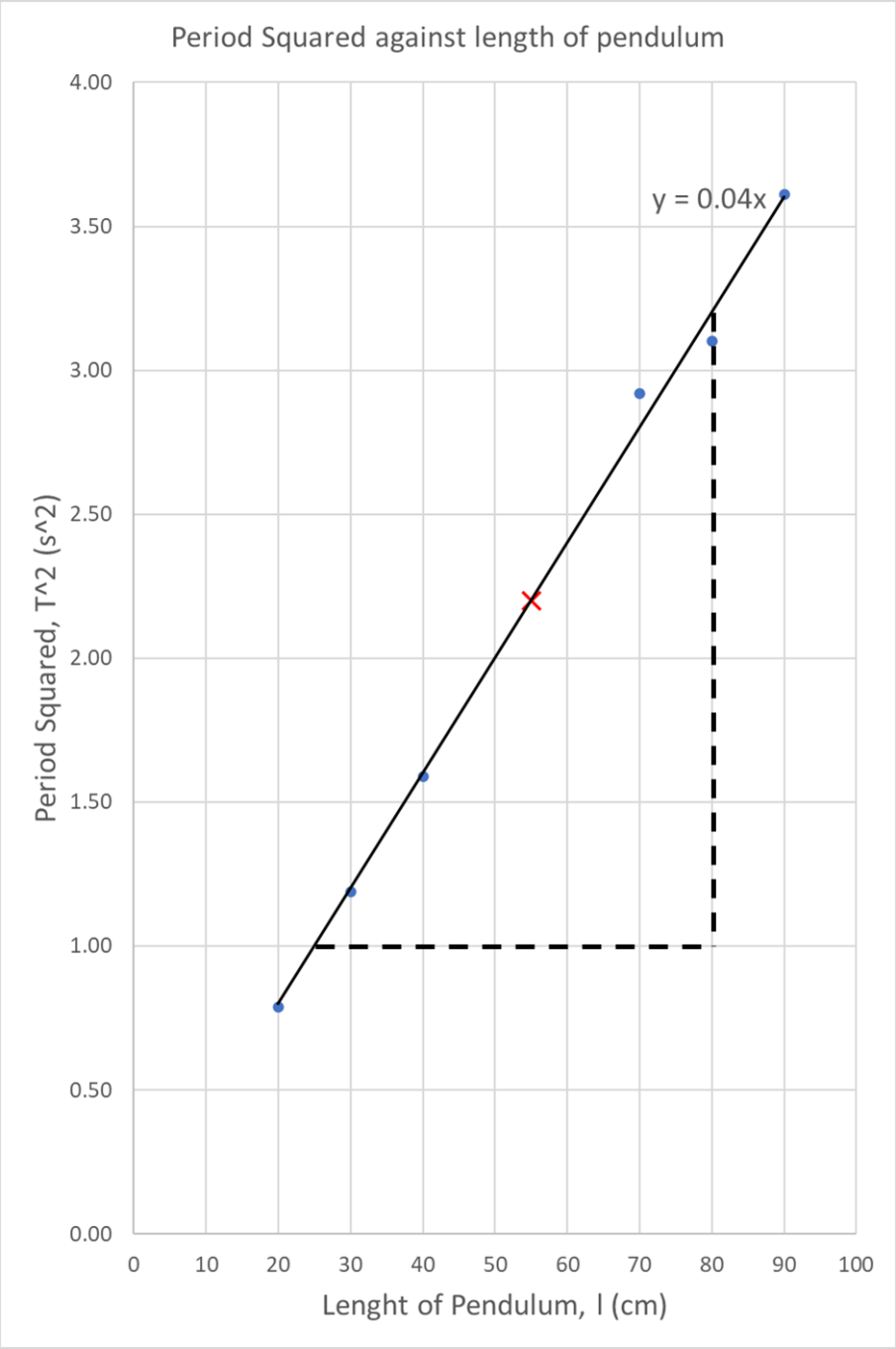
[3 marks]

d) Calculate the centroid point

$\bar{x} = \frac{20 + 30 + 40 + 70 + 80 + 90}{6} cm$ $\bar{y} = \frac{0.79 + 1.19 + 1.59 + 2.92 + 3.10 + 3.61}{6} s^2$	G1
Centroid: $(\bar{x}, \bar{y}) = (55.0cm,\ 2.20s^2)$	JU2

[3 marks]

e) On the graph paper given, plot a graph of T^2 against l. **[6 marks]**



Marks Allocation	
Axes & Unit	1 mark
Uniform Scale	1 mark
Plotting points	1 mark
Centroid	1 mark
Size of graph (>50%)	1 mark
Best line (touches the y-intercept)	1 mark

f) Based on your graph,

i. Calculate the gradient of the graph, m.
Show on the graph how you determine the gradient

$m = \frac{y_2 - y_1}{x_2 - x_1}$	
$m = \frac{3.2 - 1}{80 - 25}$	G1
$m = 0.040\ s^2\ cm^{-1}$	JU1
*Dotted triangle on the graph	K1

[3 marks]

ii. Calculate the uncertainty in the gradient of the graph, Δm by using the table and equation provided below.

[11 marks]

l	$l - \bar{l}$	$(l - \bar{l})^2$	T^2	$\widehat{T^2}$	$T^2 - \widehat{T^2}$	$(T^2 - \widehat{T^2})^2$
20.0	-35.0	1225.0	0.79	0.80	-0.01	0.0001
30.0	-25.0	625.0	1.19	1.20	-0.01	0.0001
40.0	-15.0	225.0	1.59	1.60	-0.01	0.0001
70.0	15.0	225.0	2.92	2.80	0.12	0.0144
80.0	25.0	625.0	3.10	3.20	-0.10	0.0100
90.0	35.0	1225.0	3.61	3.60	0.01	0.0001
Σ= 330.0		**Σ= 4150.0**				**Σ= 0.0248**

$$\bar{l} = \frac{20 + 30 + 40 + 70 + 80 + 90}{6} cm = 55cm;\ \widehat{T^2} = 0.04l$$

$$\Delta m = \sqrt{\frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{(n-2)\sum_{i=1}^{n}(x_i - \underline{x})^2}}$$

$$\Delta m = \sqrt{\frac{0.0248}{(6-2)(4150)}}$$

$$\Delta m = \pm 0.0012 s^2 cm^{-1}$$

All values of $l - \underline{l}$ is correct	→ 1 *mark*
All values of $(l - \underline{l})^2$ is correct	→ 1 *mark*
All values of $\widehat{T^2}$ is correct	→ 1 *mark*
All values of $T^2 - \widehat{T^2}$ is correct	→ 1 *mark*
All values of $(T^2 - \widehat{T^2})^2$ is correct	→ 1 *mark*
Total value of $(T^2 - \widehat{T^2})^2$ is correct	→ 1 *mark*
All values in the same column must be in same decimal point	→ 1 *mark*
Sum of l, $(l - \bar{l})^2$, and $(T^2 - \widehat{T^2})^2$	→ 3 *marks*
Substitution for Δm	→ 1 *mark*
Value for Δm	→ 1 *mark*
	11 marks

g) By using the value of the gradient, m obtained in (f)(ii), calculate the value of the acceleration due to gravity, g.

$$m = \frac{4\pi^2}{g} \Rightarrow g = \frac{4\pi^2}{m} - - - [K1]$$

$$g = \frac{4\pi^2}{0.040} - - - [G1]$$

$$g = 987 cms^{-2} - - - [JU1]$$

[3 marks]

h) Hence, calculate the uncertainty in the acceleration due to gravity, Δg.

$$\frac{\Delta g}{g} = \frac{\Delta m}{m}$$

$$\Delta g = \left(\frac{\Delta m}{m}\right) g$$

$$\Delta g = \left(\frac{0.001}{0.04}\right)(987) - - - [G1]$$

$$\Delta g = 24.68 cms^{-2} - - - [JU1]$$

[2 marks]

i) Given the standard value for the acceleration due to gravity, $g = 9.81 ms^{-1}$,

i. Determine the percentage of difference between the standard and experimental value.

$$\%_{error} = \left|\frac{g_{exp} - g_{theory}}{g_{theory}}\right| \times 100\% - - - [K1]$$

$$\%_{error} = \left|\frac{987 - 981}{981}\right| \times 100\% - - - [G1]$$

$$\%_{error} = 0.006\% - - - [JU1]$$

[3 marks]

ii. What can you comment about the experimental value by comparing with the standard value?

The standard value of gravitational acceleration is $981 cms^{-2}$ falls within the range of experimental value with its uncertainty ($937.65 cms^{-2} \leq g \leq 1036.35 cms^{-2}$).	[J1]
Experimental value is therefore accepted with uncertainty.	[J1]
Percentage error between standard value and the experimental value is 0.006%, which is less that the 10% of the acceptable percentage error.	[J1]
Experimental value can be accepted, experiment is considered as a success.	[J1]

[4 marks]

j) Random Errors in experimental measurements are caused by unknown and unpredictable changes in the experiment.

i. State two random error that occur during this experiment.

Pendulum rotates;
amplitude of oscillation >10%;
air resistance when fan is not switched off;
Human reaction is pressing the stopwatch, parallax error when measuring the string and

the angle on the protractor.
→ **Any two errors related to experiment**

[2 marks]

ii. Hence, state the precautions to overcome the errors stated in (i)

Ensure pendulum does not rotate during oscillation;
Ensure pendulum is released with amplitude $< 10^o$;
Minimize air resistance by switching off the fan;
Ensure eye is perpendicular to the scale measurement.
→ **Any two precautions related to errors stated in (i)**

[2 marks]

SARAWAK MATRICULATION COLLEGE
SCIENCE DEPARTMENT
PHYSICS UNIT

SP025 INDIVIDUAL ASSIGNMENT
SEMESTER 2, SESSION 2021/2022

SUBMISSION DATE : _____

NAME :

MATRICULATION NO. :

TUTORIAL CLASS :

LECTURER'S NAME :

DATE SUBMITTED :

SECTION A: INDIVIDUAL ASSIGNMENTS

QUESTION NO.	FULL MARK	MARKS OBTAINED	MODERATOR
1	9		
2	8		
3	15		
4	6		
5	12		
JUMLAH	50		

SECTION B: NUMERACY ASSIGNMENT

FULL MARK	MARKS OBTAINED	MODERATOR
20		

PB/PTP

STUDENT'S DECLARATION
MATRICULATION PROGRAMME, MINISTRY OF EDUCATION MALAYSIA

Student's Name :	Course : Code :	Matric No. :
Assignment Title : SP025 Assignment		

Student's Declaration

I hereby declare that this task is my original work except for the citations and summaries of which I acknowledged the source.

Signature :

Nama :

Date :

Note: This form needs to be attached together with written/printed/model assignment and submitted to the respective lecturer for evaluation.

SARAWAK MATRICULATION COLLEGE
PHYSICS SP025
SEMESTER 2, SESSION 2021/2022

INDIVIDUAL ASSIGNMENT RUBRIC

Name :

Matriculation Number :

Tutorial Class :

Subattribute	1	2	3	4	5	**SCORE**
Allocated mark	$\left(\frac{Mark\ earned}{Total\ marks}\right) \times 80$					
Originality	Student's solution have 76% to 99% similarity with other students.	Student's solution have 51% to 75% similarity with other students.	Student's solution have 26% to 50% similarity with other students.	Student's solution have 25% or less similarity with other students.	All the solutions is written in student's own word.	
Solution methods	Less than 25% solutions are written in correct sequence.	25% to 49% solutions are written in correct sequence.	50% to 74% solutions are written in correct sequence.	75% to 99% solutions are written in correct sequence.	All solutions are written in the correct sequence (1a,1b, 1c, 2a, 2b, 2c).	
	Solutions for 3 different questions is written on the same page.	Solution for 1 out of 4 questions are written on a new page.	Solutions for 2 out of 4 questions are written on a new page.	Solutions for 3 out of 4 questions are written on a new page.	The solutions for all 4 questions are written on a new page.	
	Less than 20% of the solution method contains formulas and diagrams.	20% of the solution method contains formulas and diagrams.	40% of the solution method contains formulas and diagrams.	60% of the solution method contains formulas and diagrams.	80% of the solution method contains formulas and diagrams.	
TOTAL MARKS (100)						
TOTAL PERCENTAGE (10 %)						

Evaluated by;

…….

SECTION A : INDIVIDUAL ASSIGNMENT

Instructions: This assignment has 2 sections A and B. Answer all questions.

1

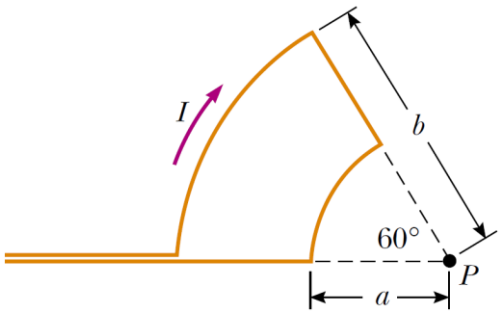


FIGURE 1.1

(a) Consider the current-carrying loop shown in **FIGURE 1.1**, formed of radial lines and segments of circles whose centers are at point P. Find the **magnitude** and **direction** of the magnetic field at ***P***.

[4 *marks*]

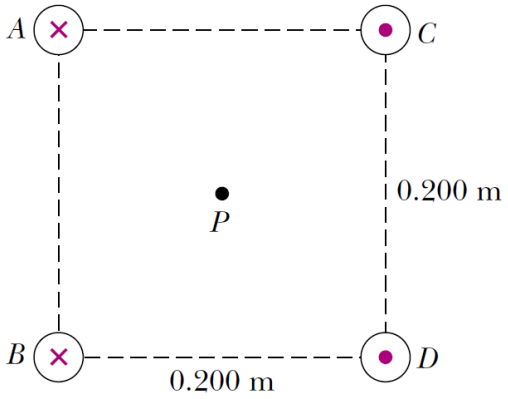


FIGURE 1.3

(b) Four long, parallel conductors can carry equal currents of I = 5.00 A. **FIGURE 1.2** is and end view of the conductors. The current direction is into the page at points A and B and out of the page at C and D. Calculate the magnitude and direction of the magnetic field at point ***P***, located at the center of the square of edge length 0.20 m.

[5 *marks*]

2 (a)

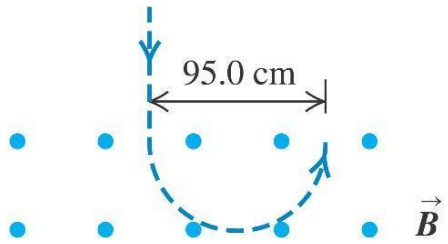


FIGURE 2.1

In an experiment with cosmic rays, a vertical beam of particles that have charge of magnitude 3e and mass 12 times the proton mass enters a uniform horizontal magnetic field of 0.250 T and is bent in a semicircle of diameter 95.0 cm as shown in **FIGURE 2.1**. Find the **speed of the particles** and **the sign of their charge**.

[4 *marks*]

(b)

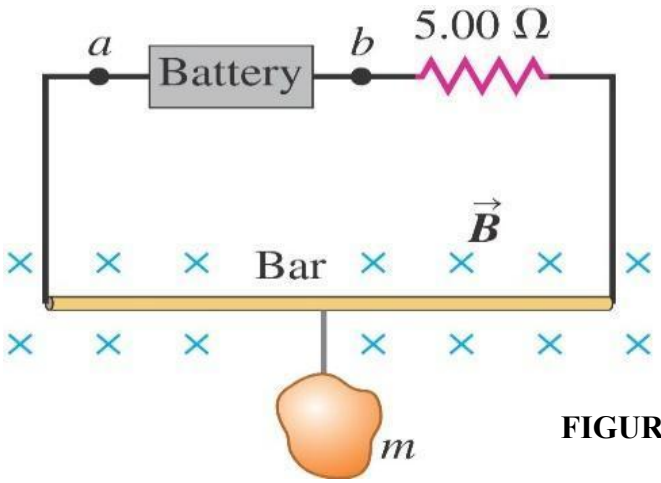


FIGURE 2.2

The circuit shown in **FIGURE 2.2** is used to make a magnetic balance to weigh objects. The mass *m* to be measure is hung from the center of the bar that is in a uniform magnetic field of 1.50 T directed into the plane of the figure. The battery voltage can be adjusted to vary the current in the circuit. The horizontal bar is 60.0 cm long and is made of extremely light weight material. It is connected to the battery by thin vertical wires that can support no appreciable tension; all the weight of the suspended mass *m* is supported by the magnetic force on the bar. A resistor with R=5.00 Ω is in series with the bar; the resistance of the rest of the circuit is much less than this. If the maximum voltage of the battery is 175 V, what is the greatest mass *m* that this instrument can measure?

[4 *marks*]

3 (a) The **FIGURE 3.1** shows two parallel straight wires are placed 42 cm apart carry currents I_1 = 2.5 A and I_2 = 3.2 A in opposite directions.

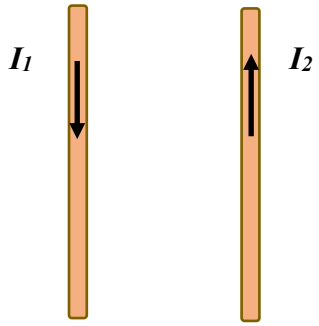


FIGURE 3.1

(i) Copy **FIGURE 3.1** and draw the direction of the magnetic force and magnetic field on each wire.

[2 *marks*]

(ii) Calculate the force per unit length between the wires.

[2 *marks*]

(iii) If the current I_1 is increased to 3.0 A, calculate the current needed in the second wire to maintain the same force per unit length between the wires as in (ii). (Given $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}) [2 *marks*]

(b)

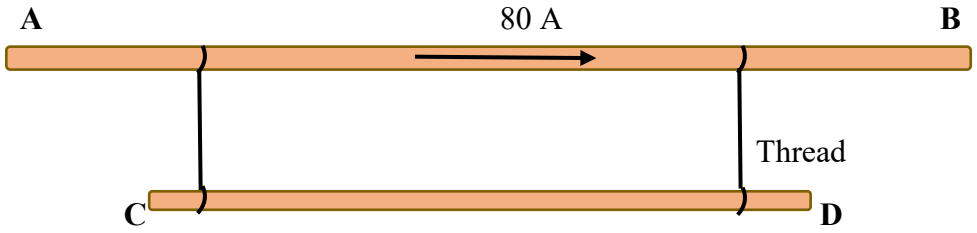
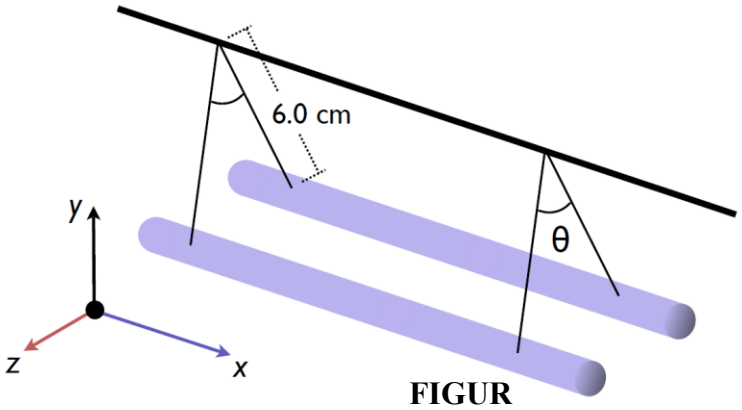


FIGURE 3.2

A horizontal wire AB in **FIGURE 3.2** carries a current of 80 A in the direction AB. A lower wire CD has a mass of 0.12 g per meter of length hangs horizontally from threads of length 20 cm. Determine the direction and magnitude of the current in the wire CD required for the tensions in the threads to become zero.

[4 *marks*]

(c)

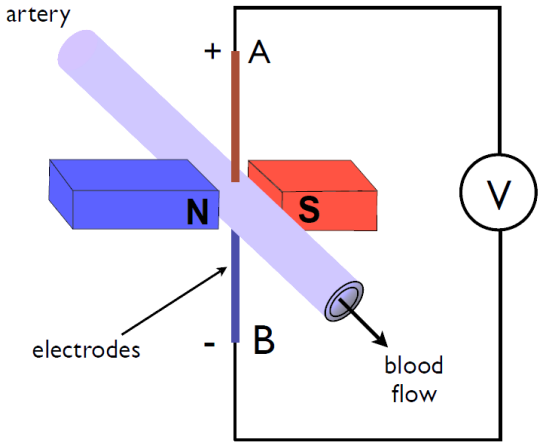


FIGUR

Two long parallel wires, each with a mass per unit length of $\lambda = m/l = 0.040$ kg/m, are supported in a horizontal plane by 6.0 cm strings, as shown in **FIGURE 3.3**. Each wire carries the same current I, causing the wires to repel one another, which causes the supporting strings to make an angle $\theta = 16°$ with one another. Find the magnitude of the current in the wire.

[5 *marks*]

4(a)



FIGUR

Using an electromagnetic flowmeter as in **FIGURE 4.1**, a heart surgeon monitors the flow rate of blood through an artery. Electrodes A and B make contact with the outer surface of the blood vessel, which has inside diameter 3.2 mm. Permanent magnets outside the blood vessel create a magnetic field perpendicular to the blood flow direction. For a magnetic field strength of B = 0.037 T, a potential difference of $\Delta V = 160$ μV appears between the electrodes. Calculate the speed of the blood.

[3 *marks*]

(b)

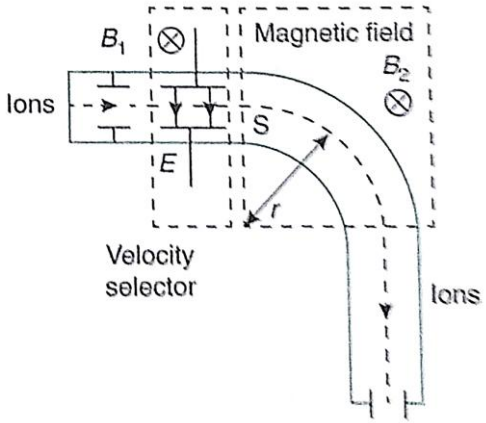


FIGURE 4.2

FIGURE 4.2 shows a schematic model of a mass spectrometer. An ion of charge q enters the velocity selector with electric field E and magnetic field B_1. The velocity of the ion at slit S is v. The ion then enters the region of the magnetic field B_2 where it is deflected in a circular path of radius r. If $B_1 = B_2 = 0.01$ T and $r = 20.0$ cm, calculate two different electric fields that enable the spectrometer to differentiate singly charged copper isotopes $2963Cu$ and $2965Cu$

[3 *marks*]

[Atomic mass of isotope $2963Cu = 62.929601\,u$, isotope $2965Cu = 64.927794\,u$]

5 (a) **FIGURE 5.1** shows a beam of electrons entering a magnetic field of magnetic flux density 8.4 mT. The electrons are travelling with velocity 3.4×10^7 m s^{-1} at right angles to the field.

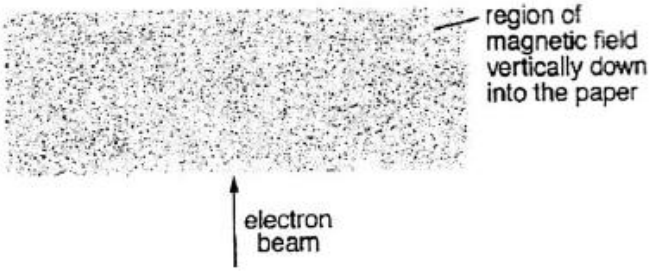


FIGURE 5.1

Calculate, for the electrons in the field, the magnitude of

(i) the force on an individual electron,

[2 marks]

(ii) the acceleration of the electron.

[2 marks]

(iii) Calculate the radius of the path of the electrons within the magnetic field.

[2 marks]

(iv) Sketch the path travelled within and beyond the field.

[2 marks]

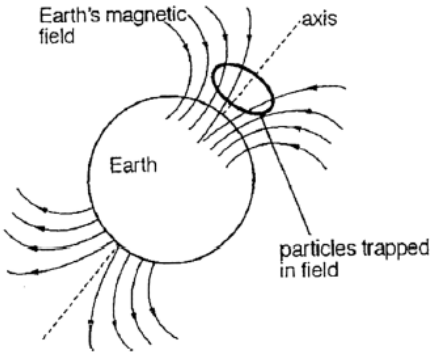


FIGURE 5.2

(b) Charged particles from the Sun, on approaching the Earth, may become trapped in the Earth's magnetic field near the poles, as shown in the **FIGURE 5.2**. This can cause the sky to glow. The phenomenon is called the aurora borealis.

(i) An electron travels in a circular path of radius r = 50 km within a magnetic field of flux density $B = 6.0 \times 10^{-5}$ T. Calculate the speed of electrons.

[3 marks]

(ii) Calculate the speed of a proton traveling in the same path.

[1 marks]

SECTION B : NUMERACY ASSIGNMENT

An electrical engineer is designing a DC electric motor. The DC electric motor required a circular coil with the range of diameter between 4.0 cm to 7.0 cm. **TABLE 1** and **TABLE 2** show a set of data for two circular coils, coil A and coil B. Based on the data given, use a suitable method to identify which coil is the most suitable for the DC electric motor.

[20 *marks*]

TABLE 1: Coil A

B ($\times 10^{-8}$ T)	**6.28**	**9.42**	**12.57**	**15.71**	**18.84**
I (mA)	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**

TABLE 2: Coil B

B ($\times 10^{-8}$ T)	**2.51**	**3.77**	**5.03**	**6.28**	**7.54**
I (mA)	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**

END OF QUESTION

SULIT

SP025

Physics 1

Continuous Assessment

Semester 2 Session

2021/2022

2 hours

SP025

Fizik 1

Penilaian Berterusan

Semester 2

Sesi 2021/2022

2 jam

KEMENTERIAN PENDIDIKAN MALAYSIA

BAHAGIAN MATRIKULASI

MATRICULATION DIVISION

UJIAN AMALI

PRACTICAL TEST

FIZIK 1

Penilaian

Berterusan 2 jam

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

Kertas soalan ini mengandungi **6** halaman bercetak.

*This question paper consists of **6** printed pages.*

Section A

Conduct an experiment by referring to the given procedure carefully. Answer **all** the questions that follows.

Objective : To verify Ohm's law and to determine the effective resistance of the resistors arranged in series.

Apparatus:

i) A DC power supply (4 V)
ii) Two carbon resistors with the same resistance
iii) A DC ammeter (1 A)
iv) A DC voltmeter
v) A rheostat
vi) A switch
vii) Connecting wires with crocodile clips

Procedure:

1.1. Set up the circuit as in **Figure 1**. Connect the two resistors in series.

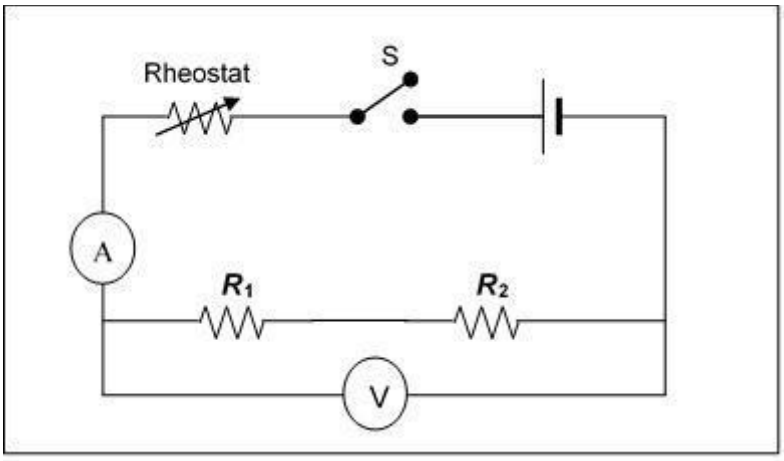


FIGURE 1

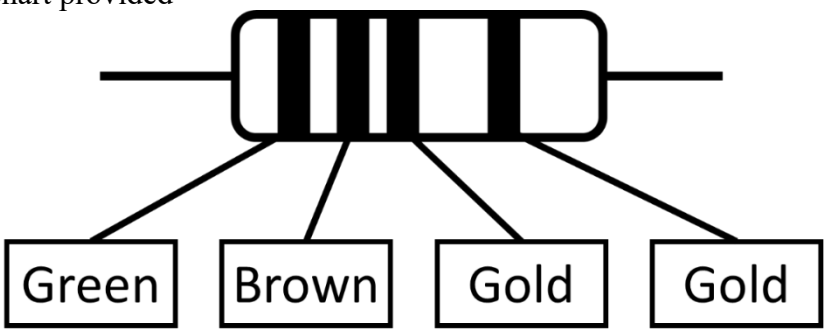
1.2. Change the resistance value in the rheostat to get a minimum and maximum reading of current in the ammeter. Record the reading of the voltmeter, *V* and the ammeter, *I*.

1.3. Change the resistance value in the rheostat to obtain at least five different values of *V* and *I*.

Section B – Answer all the question based on the data provided in the table below.
Experimental Data:

No.	Current, I (± 0.01A)	Voltage, V (± 0.05V)
1	0.12	1.20
2	0.14	1.40
3	0.16	1.60
4	0.18	1.80
5	0.20	2.00
6	0.22	2.20

a) Determine the resistance of each resistor from their colour bands by using the chart provided



5.1 ± 0.3 Ω (JU1)

Both resistance & tolerance must be in 1 decimal only

Tolerance must be written in numbers and not percentage (5%)

Tolerance [1], 5.1 [1], 0.3 [1]

[3 marks]

b) **State**:

(i) the manipulated variable
Current (J1) – *Ammeter reading not acceptable*

(ii) the responding variable
Voltage (J1) – *Voltmeter reading not acceptable*

(iii) the constant variable
Effective resistance of the resistors (J1)
– number of resistors or other answer is not acceptable

[3 marks]

d) By comparing $V = I\,R$ with the linear graph equation, $y = mx + c$, **state**, what variable is represented by y, m and x in this experiment.

y is represented by voltage, V (J1)
x is represented by current, I (J1)
m is represented by effective resistance of the resistors, R (J1)

[3 marks]

e) Calculate the centroid point.

$$\underline{x} = \frac{0.12 + 0.14 + 0.16 + 0.18 + 0.20 + 0.22}{6} \quad \textbf{(G1)}$$

$$= 0.17\ A \quad \textbf{(JU1)}$$

$$\underline{y} = \frac{1.20 + 1.40 + 1.60 + 1.80 + 2.00 + 2.20}{6} \quad \textbf{(G1)}$$

$$= 1.70\ V \quad \textbf{(JU1)}$$

Centroid point = (0.17 A, 1.70 V) (J1)

Decimal place must be consistent with sensitivity [5 marks]

f) On the graph paper provided, plot a graph of V against I
Both axes is labelled with the correct variable and unit – 1
The scales chosen on both axes is suitable and with correct sensitivity – 1
All the data points are transferred correctly onto the graph – 1
Centroid point – 1
Best line graph is plotted passing through the centroid – 1
Graph is plotted with y-intercept – 1

[6 marks]

g) By using the graph plotted in f), calculate the gradient of the graph, m. Show on the graph how you determine the gradient.

From Graph 1 **From Graph 2**

(G1)

$$m = 10.00\ VA^{-1} \quad \textbf{(JU1)}$$

Gradient unit in Ohm is not acceptable
2 decimal points
Dotted gradient triangle - 1

[3 marks]

h) By using the value of the gradient, m, obtained in f), determine the effective resistance of the resistors.

$$R_{eff} = m \quad \textbf{(K1)}$$

$$m = 10.00\ VA^{-1}$$

$$R_{eff} = 10.00\ \Omega \quad \textbf{(JU1) 2 decimal only}$$

[2 marks]

i) From the value obtained in (a), calculate the actual value of effective resistance of the resistors.

$$R_{eff} = R_1 + R_2$$

$$R_{eff} = 5.1 + 5.1 \quad \textbf{(G1)}$$

$$R_{eff} = 10.2\ \Omega \quad \textbf{(JU1) 1 decimal point}$$

[2 marks]

j) Calculate the uncertainty in the gradient of the graph, Δm by using the table and equation provided below.

[10 marks]

	(1)	**(1)**		**(1)**	**(1)**	**(1)**
$\boldsymbol{I}$	$I - \underline{I}$	$(I - \underline{I})^2$	V	$\hat{V}$	$V - \hat{V}$	$(V - \hat{V})^2$
0.12	- 0.05	0.0025	1.20	1.20	0.00	0.00
0.14	- 0.03	0.0009	1.40	1.40	0.00	0.00
0.16	- 0.01	0.0001	1.60	1.60	0.00	0.00
0.18	0.01	0.0001	1.80	1.80	0.00	0.00
0.20	0.03	0.0009	2.00	2.00	0.00	0.00
0.22	0.05	0.0025	2.20	2.20	0.00	0.00
Σ= 1.02		**Σ= 0.0070 (1)**				**Σ=0.00 (1)**

$$\hat{V} = 10.00\,\hat{I} + 0.0 \quad \textbf{(G1)}$$

$$\Delta m = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \hat{y}_i)^2}{(n-2)\sum_{i=1}^{n} (x_i - \underline{x})^2}}$$

$$\Delta m = \sqrt{\frac{0.00}{(6-2)(0.0070)}} \quad \textbf{(G1)}$$

$$\Delta m = 0.00\ VA^{-1} \quad \textbf{(JU1) 2 decimal points}$$

k) Determine the uncertainty in the effective resistance, ΔR_{eff}

$$\frac{\Delta R_{eff}}{R_{eff}} = \frac{\Delta m}{m}$$

$\Delta R_{eff} = \frac{\Delta m}{m}(R_{eff})$ **(K1)** R_{eff} from question (h)

$\Delta R_{eff} = \frac{0.0}{10.0}(10.0)$ **(G1)**

$\Delta R_{eff} = 0.0\ \Omega$ **(JU1)**

[3 marks]

l) Calculate the percentage of difference between the actual value and experimental value of the effective resistance of the resistors.

$$\%\ of\ difference = \left|\frac{R_{exp} - R_{theo}}{R_{theo}}\right| \times 100\%$$

$\%\ of\ difference = \left|\frac{10.0-10.2}{10.2}\right| \times 100\%$ **(G1)**

$\%\ of\ difference = 1.96\ \%$ **(JU1)**

[2 marks]

m) Give comments about the experimental value by comparing with the actual value.

1) (if uncertainty value = 0) **the experimental value, R = (10.0 ± 0.0) Ω is in the range of theoretical value R = (10.2 ± 0.6) Ω. Hence the experimental value can be accepted**

(if uncertainty value ≠ 0) the theoretical value, R = 10.2 Ω is in the range of experimental value R = (10.0 ± ΔR) Ω. Hence the experimental value can be accepted.

2) The percentage of difference between the theoretical and the standard value is 1.96 % which is less than acceptable percentage 10.0 %. Thus the experimental value is accepted.

Compare experimental value with theoretical value – 1
State whether experimental value is accepted or not - 1

[4 marks]

n) In the experimental procedure 1.2, you were asked to find the minimum and maximum current and voltage in the circuit, explain the relevant of this particular step.

The step will gave us the smallest and biggest value of current and voltage so that the subsequent or the value in between could be determined/manipulated. (J1)

[1 mark]

o) How do you determine the sensitivity of the voltmeter?

As the voltmeter reading is determined by using one point method, the sensitivity is half of the smallest scale of the voltmeter. (J1)

[1 mark]

p) What is the function of rheostat in this experiment?

To manipulate the value of current in the circuit. (J1)

[1 mark]

q) **State** two errors in this experiment and **explain** how exactly those errors can affect the progress of the experiment. **(any two answers)**

1) **By continuing to conduct the experiment without opening the switch, current will keep on flowing in the connecting wires and resistors that cause them to heat up (rise in temperature). As resistance is directly proportional to temperature, the resistance of the connecting wires and resistors will increase, resulting in smaller value of current displayed on the ammeter (less than actual value)**

2) **Usage of long connecting wires to connect the apparatus/ from resistor 1 to resistor 2 will cause the resistance in the circuit to increase because resistance is directly proportional to the length of the wire. This will cause the value of current displayed on the ammeter to become less than actual value.**

3) **Zero errors in the ammeter and voltmeter cause the recorded value to be less or more than the actual value.**

4) **Any other errors related to this experiment**

   State the error – 1

   Clearly explains how the error affects the experimental result - 1

[4 marks]

r) Hence, state the precautions to overcome the errors stated in q)

1) **The switch needs to be open / voltage supplied needs to be disconnected after taking each measurement of current/voltage.**

2) **Use shorter connecting wires / reduce the number of wires / connect both resistors in series directly without any wires.**

3) **Eliminate zero error by recalibrating the measuring instrument.**

4) **Any other precaution to solve error in q)5**

[2 marks]

s) The objective of this experiment is to verify Ohm's Law.

(i) State Ohm's Law

Ohm's Law states that the potential difference across the conductor is directly proportional to the current across the conductor at constant temperature.

[1 mark]

(ii) How does your experimental result verify Ohm's Law? Explain your answer.

1) The graph of V vs I plotted in this experiment yields a linear graph. This shows that the relation between V and I is directly proportional. (J1)

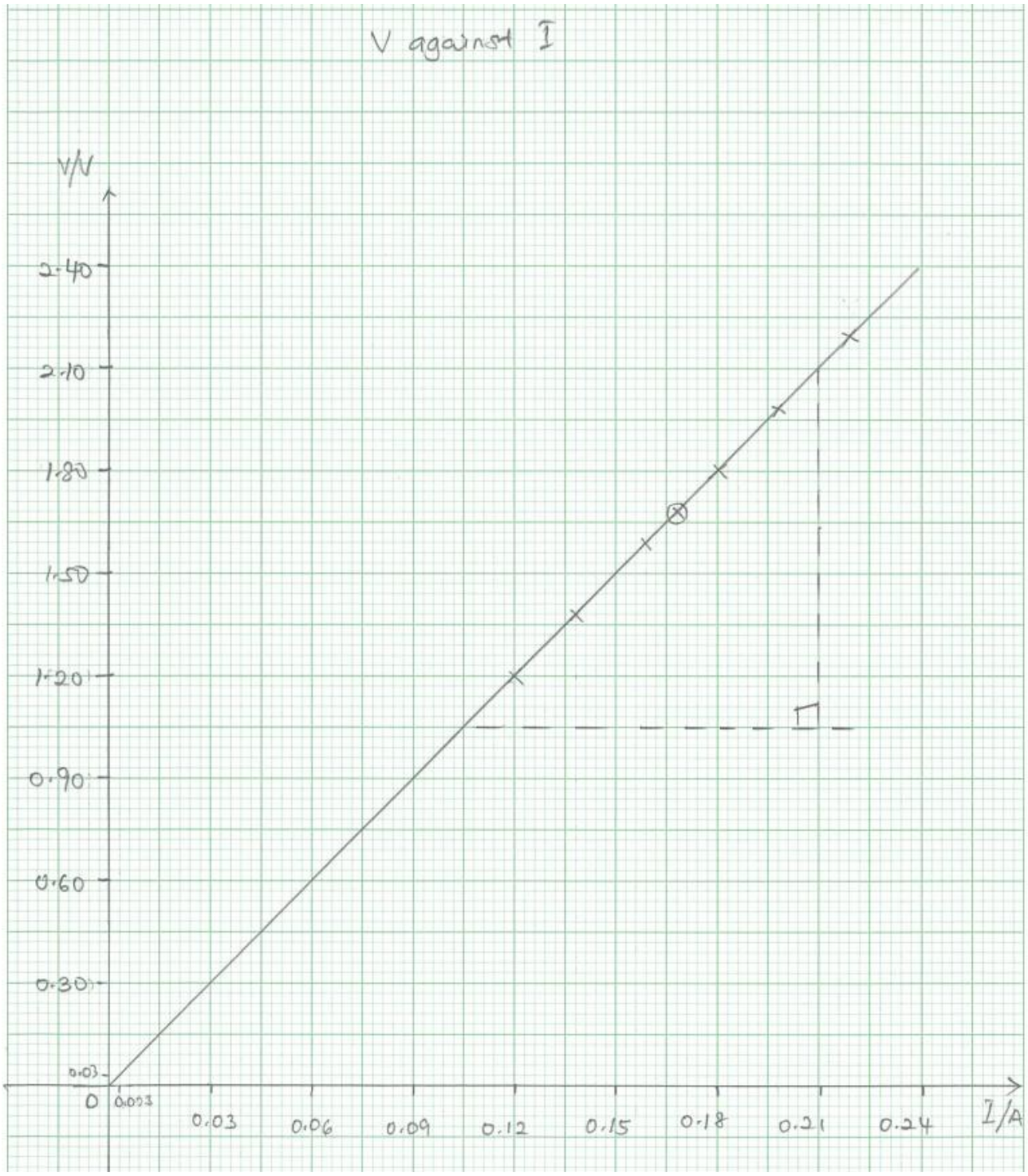
2) As the gradient of V vs I graph represents the resistance of the resistors and the gradient value is constant, we can say that the resistance is also constant. Resistance can only be constant if the temperature is constant, hence we can claim that the temperature is constant. (J1)

3) In conclusion, because V & I is directly proportional and the temperature is constant, this experiment has verified Ohm's Law.

[2 marks]

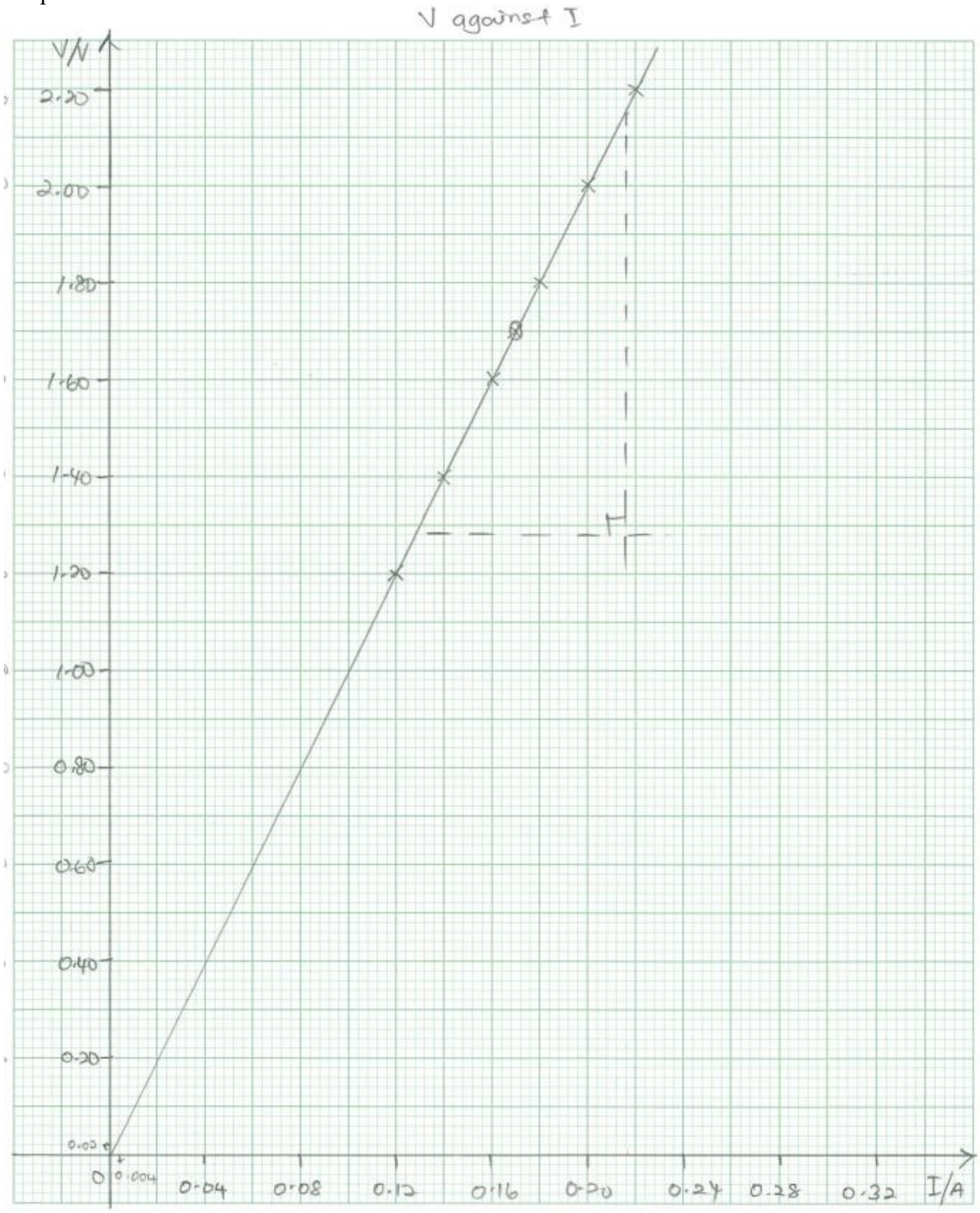
END OF QUESTION PAPER

Graph 1


V against I
V/V
2.40
2.10
1.80
1.50
1.20
0.90
0.60
0.30
0.03
0
0.003
0.03
0.06
0.09
0.12
0.15
0.18
0.21
0.24
I/A

Atau

Graph 2


V against I
V/V
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
0.004
0.04
0.08
0.12
0.16
0.20
0.24
0.28
0.32
I/A