

SP015 ASSIGNMENTS



**SARAWAK MATRICULATION COLLEGE
SCIENCE DEPARTMENT
PHYSICS UNIT**

**SP015 INDIVIDUAL ASSIGNMENT
SEMESTER 1, SESSION 2023/2024**

SUBMISSION DATE :

NAME :

MATRICULATION NO. :

TUTORIAL CLASS :

LECTURER'S NAME :

DATE SUBMITTED :

QUESTION NO.	FULL MARKS	MARKS OBTAINED	MODERATOR
1	16		
2	15		
3	15		
4	14		
TOTAL	60		

SARAWAK MATRICULATION COLLEGE
PHYSICS SP015 SEMESTER 1, SESSION 2023/24

INDIVIDUAL ASSIGNMENT RUBRIC

Name : _____

Matriculation Number : _____

Tutorial Class : _____

Subattribute	1	2	3	4	5	SCORE
Allocated mark	$\left(\frac{\text{Mark Earned}}{\text{Total Marks}}\right) \times 80$					
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 : _____

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

**KOLEJ MATRIKULASI SARAWAK
PHYSICS SP015
SEMESTER 1 SESI 2023/2024
ASSIGNMENT**

Name: _____

Tutorial Group: _____

Instruction:

1. Answer all questions below.
2. Assignment must be submitted by hand latest by 4.30p.m. on the 6th October 2023.

1. (a)

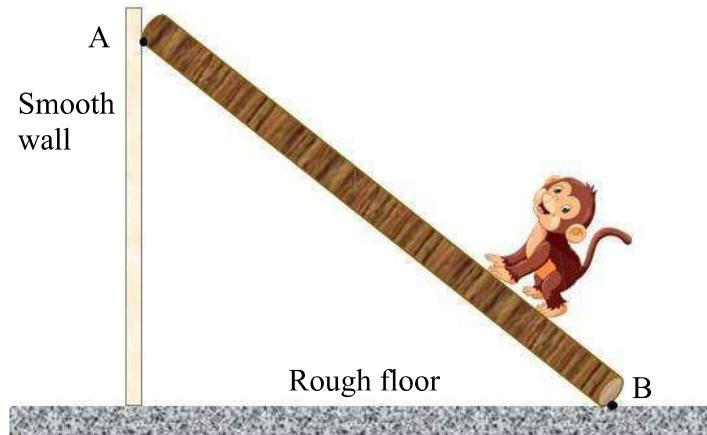


FIGURE 1

FIGURE 1 shows a 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.

- (i) 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]
 - (ii) 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]
-
- (b) On a rotating carousel or merry-go-round, Shafiq sits on a horse near the outer edge and Mary sits on a lion halfway out from the center.
 - (i) Which one has the greater linear velocity? Explain. [2 marks]
 - (ii) Which one has the greater angular velocity? Explain. [2 marks]

2. (a)

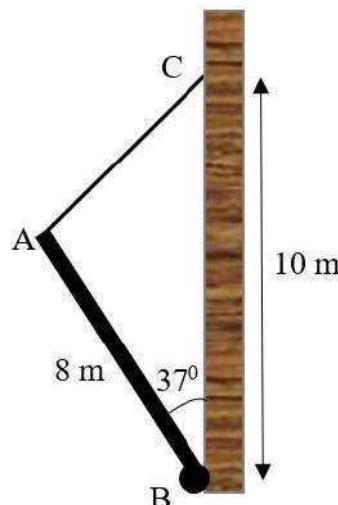


FIGURE 2

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.

[2 marks]

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

[6 marks]

(b)

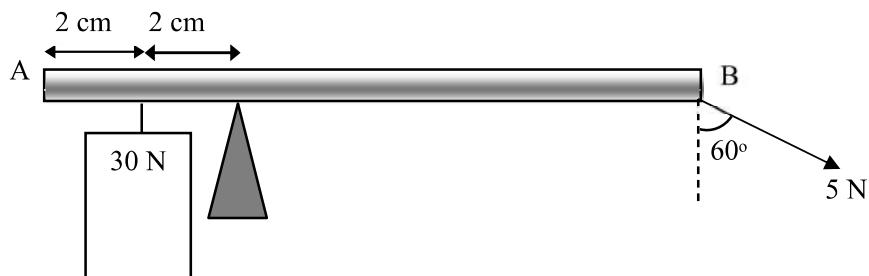


FIGURE 3

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) the reaction force at the hinge.

[4 marks]

3.

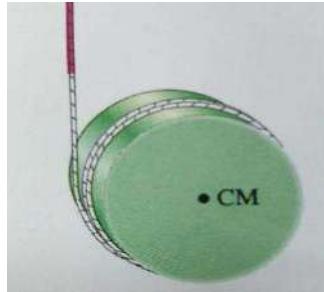


FIGURE 4

- (a) 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 4**. As the cylinder falls, find
- (i) its linear acceleration of the cylinder [5 marks]
 - (ii) the tension in the string. [2 marks]

(b)

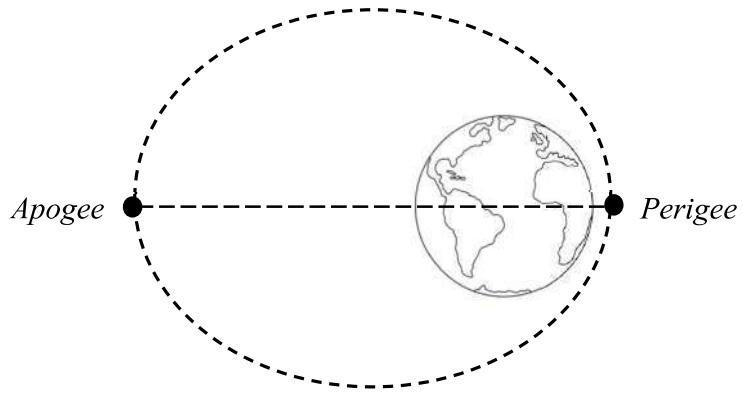


FIGURE 5

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 $r_P = 8.37 \times 10^6 \text{ m}$ from the center of the earth, and its point of greatest distance (called the *apogee*) is $r_A = 25.1 \times 10^6 \text{ m}$ from the center of earth. The speed of the satellite at the perigee is $v_P = 8450 \text{ m s}^{-1}$. Find its speed v_A at the apogee.

[3 marks]

(c)

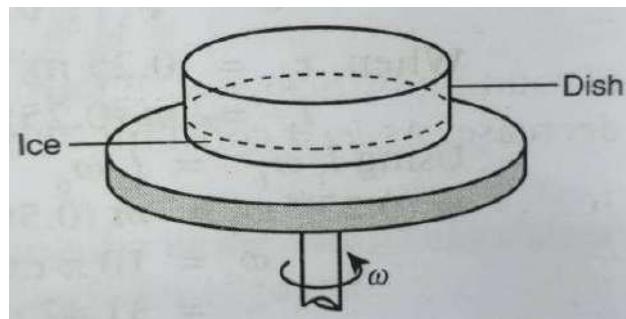


FIGURE 6

- (i) **FIGURE 6** shows a thin layer of ice in a dish placed on top of a rotating table. As the table rotates freely, ice in the dish starts to melt. Describe and explain any changes to the rotational motion of the table.

[3 marks]

- (ii) Misinah is sitting on the spinning seat of a piano stool with her arms folded. Ignore any friction in the spinning stool. What happens to her angular velocity and angular momentum when she extends her arms outward?

[2 marks]

4. (a)

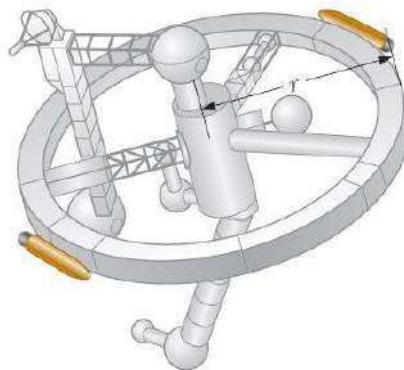


FIGURE 7

- FIGURE 7** shows a space station that is constructed in the shape of a hollow ring of mass 5.0×10^4 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.

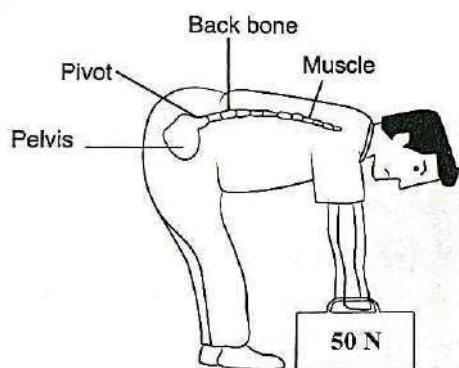
- (i) What angular momentum does the space station acquire?

[2 marks]

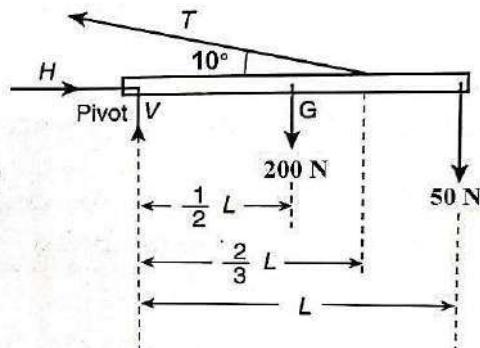
- (ii) For what time interval must the rockets be fired if each exerts a thrust of 125 N?

[3 marks]

(b)



(a)



(b)

FIGURE 8

FIGURE 8(a) 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 8(b)**. 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]
- (iv) Suggest a proper body posture or the correct technique for Aiman to lift the load. Describe and explain your answer clearly. [3 marks]

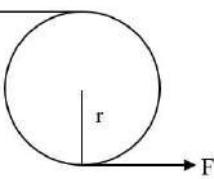
END OF QUESTION

KOLEJ Matrikulasi Sarawak
PHYSICS SP015 ASSIGNMENT
SESSION 2023/2024
MARKING SCHEME

No.	Answer	Marks
1(a)(i)	$\Sigma \tau_B = 0$ $\tau_m + \tau_t + (-\tau_A) = 0$ $(7)(9.81)\left(\frac{17}{3}\right)\left(\frac{15}{17}\right) + (40)(9.81)\left(\frac{17}{2}\right)\left(\frac{15}{17}\right) - N_A(17)\left(\frac{8}{17}\right) = 0$ $N_A = 410.81 \text{ N}$ $\Sigma F_x = 0$ $N_A = f_s$ $f_s = 410.81 \text{ N}$	K1 G1 K1 JU1
	$\Sigma F_y = 0$ $N_B + (-W_m) + (-W_t) = 0$ $N_B = W_m + W_t$ $N_B = g(m_m + m_t)$	
	$N_B = 9.81(7 + 40)$	G1
	$N_B = 461.07 \text{ N}$	JU1
	$\Sigma \tau_B = 0$ $\tau_m + \tau_t + (-\tau_A) = 0$ $(7)(9.81)(15)\left(\frac{15}{17}\right) + (40)(9.81)\left(\frac{17}{2}\right)\left(\frac{15}{17}\right) - N_A(17)\left(\frac{8}{17}\right) = 0$ $N_A = 481.47 \text{ N}$	K1 G1
	Vertical force $\Sigma F_y = 0$ $N_B + (-W_m) + (-W_t) = 0$ $N_B = W_m + W_t$ $N_B = g(m_m + m_t)$ $N_B = 9.81(7 + 40)$ $N_B = 461.07$	
	Horizontal force $\Sigma F_x = 0$ $N_A + (-f_s) = 0$ $N_A + \mu_s N_B = 0$ $\mu_s = \frac{N_A}{N_B}$ $\mu_s = \frac{481.47}{461.07}$ $\mu_s = 1.044$	
1(b)(i)	From $v = r\omega$, $v \propto r$ if ω is constant.	J1
	$r_{Shafiq} > r_{Mary} \Rightarrow v_{Shafiq} > v_{Mary}$	J1
1(b)(ii)	Both Shafiq and Mary will have the same angular velocity because they are rotating with the carousel angular velocity.	J1
	Angular displacement is the same in the same period of time.	J1
	Total	15

2(a)(i)	<p>Let F_1 and F_2 are the horizontal and vertical forces exerted on the rod at B.</p> <p>Taking torque at point B,</p> $\Sigma \tau_B = 0$ $\tau_1 + (-\tau_2) = 0$ $F_1 d_1 - F_2 d_2 = 0$ $W \sin \sin 37^\circ (4) - T(8) = 0$	
	$T = \frac{(4)(400)37^\circ}{8}$	G1
	$T = 120.4 N$	JU1
2(a)(ii)	$\Sigma F_y = 0$ $T_y + F_{1y} + (-W) = 0$ $T \sin (37^\circ) + F_1 - W = 0$ $(120.4) \sin (37^\circ) + F_1 - 400 = 0$ $F_1 = 327.6 N$ $\Sigma F_x = 0$ $T_x + (-F_{2x}) = 0$ $T \cos (37^\circ) - F_2 = 0$ $(120.4) \cos (37^\circ) - F_2 = 0$ $F_2 = 96.2 N$	K1
	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,	
	$\theta = \tan^{-1} \left(\frac{F_1}{F_2} \right)$	
	$\theta = \tan^{-1} \left(\frac{327.6}{96.2} \right)$	G1
	$\theta = 73.6^\circ$	JU1
2(b)(i)	$\Sigma \tau = 0$ $\tau_b + (-\tau_r) + (-\tau_F) = 0$ $W_b(r_b) \sin 90 - W_r(r_r) \sin 90 - F(r_F) \sin 30 = 0$ $(30)(0.02) \sin 90 - W_r(0.08) \sin 90 - 5(0.2) \sin 30 = 0$ $W_r = 1.25 N$	K1
2(b)(ii)	$\Sigma F_y = 0$ $R_y + (-W_b) + (-W_r) + (-F_y) = 0$ $R_y = 30 + 1.25 + 5 \cos 60$ $R_y = 33.75 N$ $R_x = 5 \sin 60^\circ \approx 4.33 N$ $R = \sqrt{33.75^2 + 4.33^2}$ $R = 34.03 N$	K1
	Total	15

3(a)(i)	$\Sigma\tau = I\alpha$	K1
	$Tr = I\alpha$	
	$Tr = I \left(\frac{a}{r}\right)$	
	$T = \frac{Ia}{r^2} -- [1]$	
	$\Sigma F_y = ma$	K1
	$W + (-T) = ma$ $mg - T = ma$ $T = mg - ma$	
	$1 = 2$ $a = \frac{mg}{\left(\frac{I}{r^2}\right) + m}$	K1
	$a = \frac{(3)(9.81)}{\left(\frac{0.1}{0.4^2}\right) + 3}$	G1
	$a = 8.12 \text{ ms}^{-2}$	JU1
3(a)(ii)	$T = \frac{Ia}{r^2}$	
	$T = \frac{(0.10)(8.12)}{(0.4)^2}$	G1
	$T = 5.08 \text{ N}$	JU1
3(b)	$L_A = L_P$	K1
	$I_A \omega_A = I_P \omega_P$ $(mr_A^2) \left(\frac{v_A}{r_A}\right) = (mr_P^2) \left(\frac{v_P}{r_P}\right)$	
	$r_A v_A = r_P v_P$ $v_A = \frac{r_P v_P}{r_A}$	
	$v_A = \frac{(8.37 \times 10^6)(8450)}{25.1 \times 10^6}$	G1
	$v_A = 2817.79 \text{ ms}^{-1}$	JU1
3(c)(i)	Water from the melted ice moves to the side of the dish as the table rotates.	J1
	The moment of inertia I increases.	J1
	Since $I\omega = \text{constant}$, the angular velocity ω decreases.	J1
3(c)(ii)	Angular velocity decreases.	J1
	Angular momentum remains the same.	J1
	Total	15

4(a)(i)	$a_c = g = \frac{v^2}{r} = r\omega^2$ $\omega = \sqrt{\frac{g}{r}}$ $I = Mr^2$ $L = I\omega$ $L = (Mr^2) \left(\sqrt{\frac{g}{r}} \right)$	K1
	$L = (5 \times 10^4)(100^2) \left(\sqrt{\frac{9.81}{100}} \right)$	G1
	$L = 1.566 \times 10^8 \text{ kgm}^2\text{s}^{-1}$	JU1
4(a)(ii)	 $\Sigma\tau = I\alpha = 2Fr \Rightarrow \alpha = \frac{2Fr}{I} \dots [1]$ $\alpha = \frac{\omega_f - \omega_i}{\Delta t} \Rightarrow \text{as } \omega_i = 0, \alpha = \frac{\omega}{\Delta t} \dots [2]$ $[1] = [2] \Rightarrow \frac{2Fr}{I} = \frac{\omega}{\Delta t}$ $\Delta t = \frac{I\omega}{2Fr}$ $\Delta t = \frac{1.566 \times 10^8}{2(125)(100)}$ $\Delta t = 6264 \text{ s}$	
		K1
		G1
		JU1
4(b)(i)	$\Sigma\tau = 0$ $\tau_T + (-\tau_L) + (-\tau_G) = 0$ $T \left(\frac{2}{3} L \right) \sin 10 - W_L(L) \sin 90 - W_G \left(\frac{L}{2} \right) \sin 90 = 0$	
	$T \left(\frac{2}{3} L \right) \sin 10 - 50(L) - 200 \left(\frac{L}{2} \right) = 0$ $T = \frac{(3)150}{(2)\sin 10}$ $T = 1295.72 \text{ N}$	G1
		JU1
4(b)(ii)	$\Sigma F_x = 0$ $H + (-T_x) = 0$ $H = 1295.72 \cos 10$ $H = 1276.04 \text{ N}$	G1
		JU1
4(b)(iii)	$\Sigma F_y = 0$ $V + T_y + (-W_L) + (-W_G) = 0$ $V = -1295.72 \sin 10 + 50 + 200$ $V = 25 \text{ N}$	G1
		JU1
4(b)(iv)	Aiman should bend his knees when lifting a heavy load.	J1
	When bending and lifting our backs becomes a lever system. The spine is the lever, the hips are the anchor point, and the muscles of the back are the supporting rope.	
	When correctly bending the knees and lifting with the legs we keep our shoulders over our hips creating a short lever. As a result a small force is created on the lever (spine) and the weight of the object travels safely down our back and hips. Additionally the muscles are kept in their shortest and safest position.	J1
	When lifting only with the back the shoulders are positioned forward relative to the hips. With the shoulders forward the weight of the object is further away from the hips and creates an increased force on the lever (spine). Additionally the muscles are stretched longer and have to contract with a greater force. This combination of a stressed spine and increased muscle contraction can cause the back to fail.	J1
	Total	15

SP015 LAB TEST

SULIT

SP015

SP015

Physics 1

Fizik 1

Continuous Assessment

Penilaian Berterusan

Semester 1 Session

Semester 1

2023/2024

Sesi 2023/2024

2 hours

2 jam



BAHAGIAN MATRIKULASI

MATRICULATION DIVISION

UJIAN AMALI

PRACTICAL TEST

FIZIK 1

Penilaian

Berterusan 2 jam

**JANGAN BUKA KERTAS SOALANINI 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.

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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:

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

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

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 90° 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.

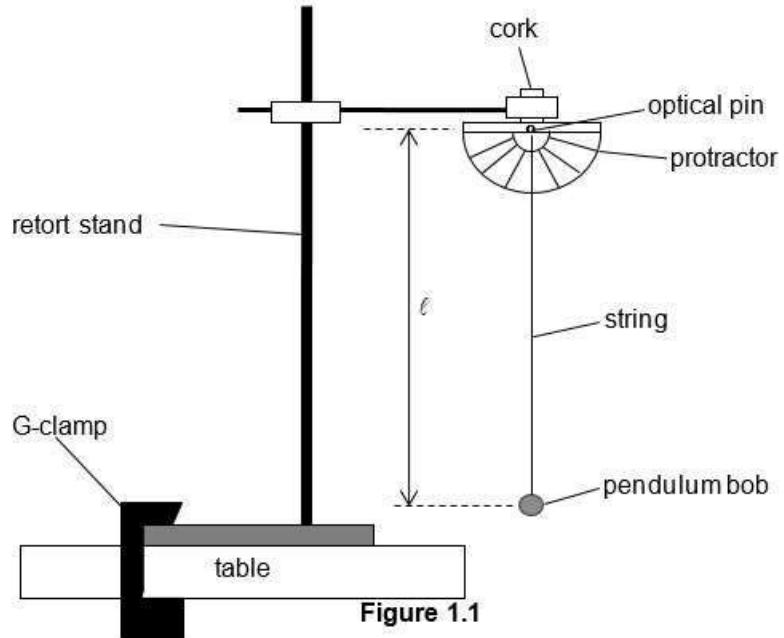


Figure 1.1

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 ($\pm 0.1\text{ cm}$)	Time taken for 10 oscillations, t ($\pm 0.01\text{ s}$)			$T = \frac{t_{ave}}{10}$ (s)	T^2 (s^2)
		t_1	t_2	t_{ave}		
1	20.0	8.62	8.93	8.78	0.88	0.77
2	30.0	11.52	11.46	11.49	1.15	1.32
3	40.0	12.71	12.67	12.69	1.27	1.61
4	50.0	14.77	14.28	14.53	1.45	2.11
5	60.0	15.67	15.38	15.53	1.55	2.41
6	70.0	16.66	16.93	16.80	1.68	2.82

[5 marks]

All values of t_{ave} correct	1 mark
All values of T correct All correct → 2marks 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

$$\bar{x} = \frac{20 + 30 + 40 + 50 + 60 + 70}{6} \text{ cm}$$

$$\bar{y} = \frac{0.77 + 1.32 + 1.61 + 2.11 + 2.41 + 2.82}{6} \text{ s}^2$$

$$\text{Centroid: } (\bar{x}, \bar{y}) = (45.0, 1.84 \text{ s}^2)$$

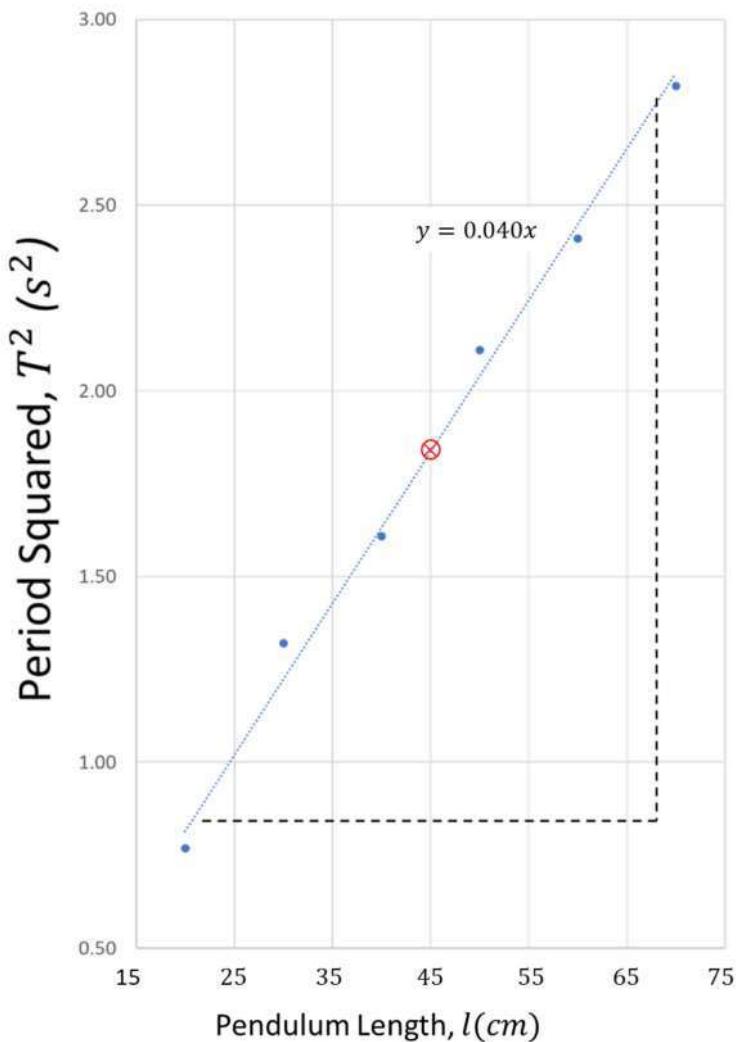
G1

JU2

[3 marks]

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

T^2 vs l



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

$m = \frac{y_2 - y_1}{x_2 - x_1}$	
$m = \frac{2.7 - 0.9}{67.5 - 22.5}$	G1
$m = 0.040 \text{ } s^2 \text{ } cm^{-1}$	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	-25.0	625.0	0.77	0.8	-0.030	-0.0300
30.0	-15.0	225.0	1.32	1.2	0.120	0.1200
40.0	-5.0	25.0	1.61	1.6	0.010	0.0100
50.0	5.0	25.0	2.10	2.0	0.100	0.1000
60.0	15.0	225.0	2.40	2.4	0.000	0.0000
70.0	25.0	625.0	2.82	2.8	0.020	0.0200
$\Sigma = 270$		$\Sigma = 1750.0$				$\Sigma = 0.2200$

$$\bar{l} = \frac{20 + 30 + 40 + 50 + 60 + 70}{6} \\ = 45 \text{ cm}; \widehat{T^2} = 0.04 l$$

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

$$\Delta m = \sqrt{\frac{0.2200}{(6-2)(1750)}}$$

$$\Delta m = \pm 0.005 \text{ } s^2 \text{ } cm^{-1}$$

All values of $l - \bar{l}$ is correct	→ 1 mark
All values of $(l - \bar{l})^2$ 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 .

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

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

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

[3 marks]

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

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

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

$$\Delta g = \left(\frac{0.005}{0.04} \right) (987) \quad [G1]$$

$$\Delta g = 123.38 \text{ cms}^{-2} \quad [JU1]$$

[2 marks]

- i) Given the standard value for the acceleration due to gravity, $g = 9.81 \text{ ms}^{-2}$,

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

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

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

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

[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 ($937.65 \leq g \leq 1036.35$). [J1]

Experimental value is therefore accepted with uncertainty. [J1]

Percentage error between standard value and the experimental value is 0.006%, which is less than the 10% of the acceptable percentage error. [J1]

Experimental value can be accepted. [J1]

[4 marks]

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

- i. State two random errors that occur during this experiment.

Pendulum rotates;

amplitude of oscillation >10%;

air resistance when fan is not switched off;

Human reaction in 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 $< 10^\circ$;
Minimize air resistance by switching off the fan;
Ensure eye is perpendicular to the scale measurement.

[2 marks]



**KOLEJ MATRIKULASI SARAWAK
JABATAN SAINS
UNIT FIZIK
SEMESTER 2, SESI 2022/2023**

NAMA :
NO. MATRIK :
KELAS :
PENSYARAH KULIAH :
TARIKH TUGASAN DIHANTAR :

SECTION A: TUGASAN INDIVIDU

NO. SOALAN	MARKAH PENUH	MARKAH DIPEROLEHI	MARKAH MODERATOR	MARKAH KETUA MODERATOR
1	15			
2	16			
3	17			
4	12			
5	10			
JUMLAH	70			

SECTION B: TUGASAN NUMERASI

MARKAH PENUH	MARKAH DIPEROLEHI	MARKAH MODERATOR	MARKAH KETUA MODERATOR
20			

**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 :

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 2022/2023

INDIVIDUAL ASSIGNMENT RUBRIC

Name : _____

Matriculation Number : _____

Tutorial Class : _____

Subattribute	1	2	3	4	5	SCORE
Allocated mark	$\left(\frac{\text{Mark earned}}{\text{Total marks}} \right) \times 80$					
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:

.....

SARAWAK MATRICULATION COLLEGE
PHYSICS SP025
SEMESTER 2, SESSION 2022/2023

SECTION A : INDIVIDUAL ASSIGNMENT

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

1

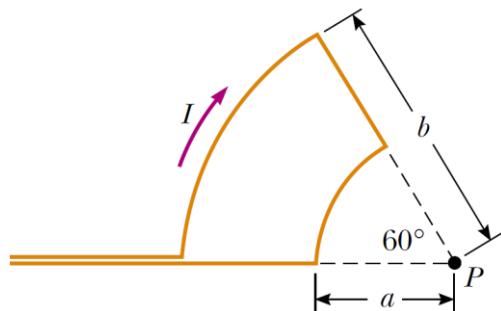


FIGURE 1.1

- (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]

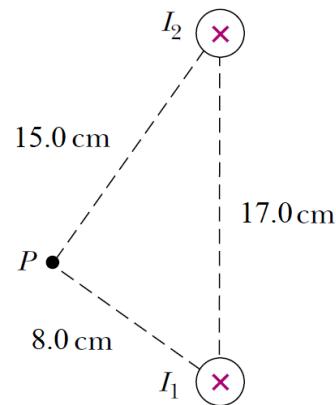


FIGURE 1.2

- (b) Two long, parallel conductors both carrying currents of 2.50 A directed into the page as in **FIGURE 1.2**. Determine the magnitude and direction of the resultant magnetic field at **P**.

[5 marks]

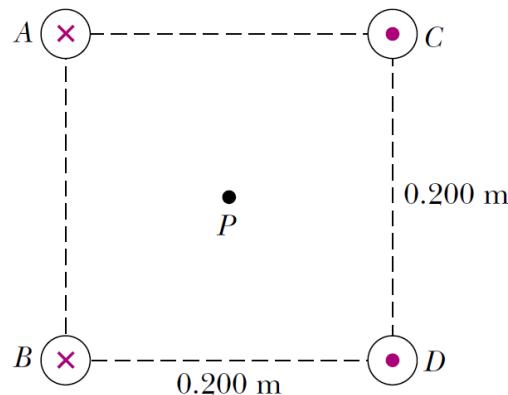


FIGURE 1.3

- (c) Four long, parallel conductors can carry equal currents of $I = 5.00 \text{ A}$. **FIGURE 1.3** 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.

[6 marks]

2 (a)

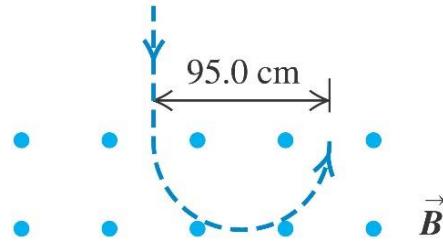


FIGURE 2.1

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**.

- (i) Find the speed of the particles and the sign of their charge.

[4 marks]

- (ii) Is it reasonable to ignore the gravity force on the particles? Explain your answer.

[3 marks]

- (iii) How does the speed of the particles as they enter the field compare to their speed as they exit the field?

[1 mark]

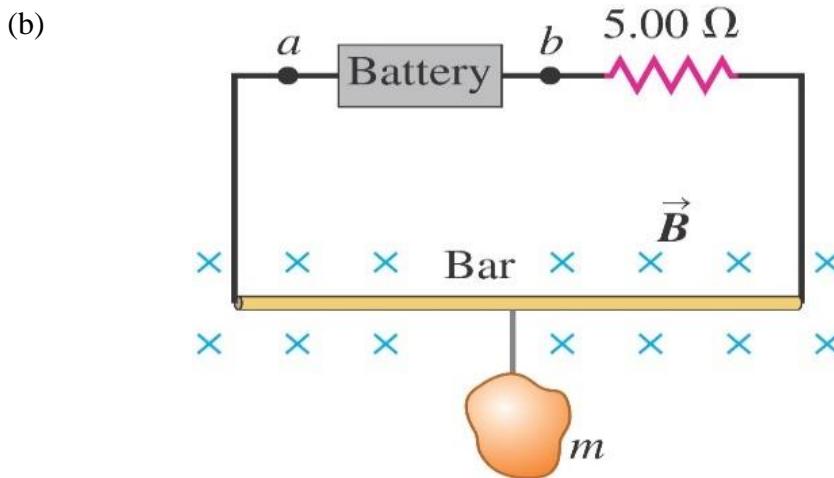


FIGURE 2.2

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 $R=5.00 \Omega$ is in series with the bar; the resistance of the rest of the circuit is much less than this.

- (i) Which point a or b should be the positive terminal of the battery?
Explain your answer.

[4 marks]

- (ii) 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 $I_1 = 2.5 \text{ A}$ and $I_2 = 3.2 \text{ A}$ in opposite directions.

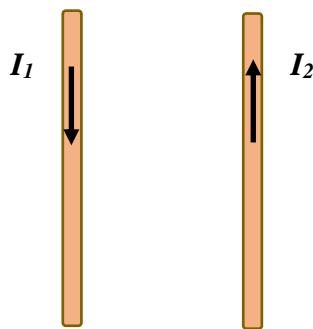


FIGURE 3.1

- (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 $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$) [2 marks]

(b)

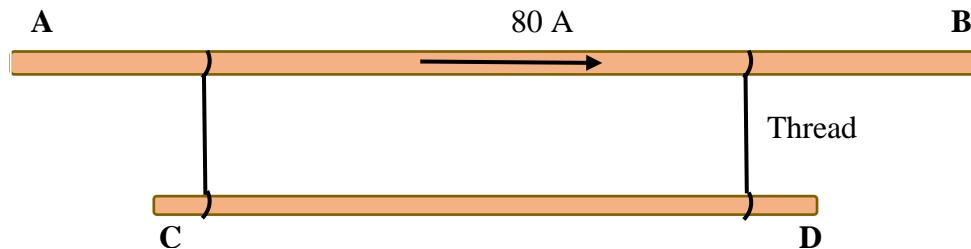
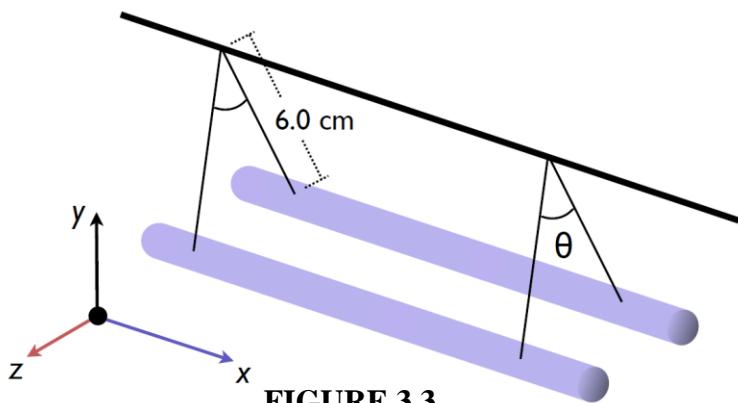


FIGURE 3.2

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)

**FIGURE 3.3**

Two long parallel wires, each with a mass per unit length of $\lambda = m/l = 0.040 \text{ kg/m}$, 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 $\theta = 16^\circ$ with one another.

- (i) Are the currents in the wires in the same or opposite direction? Explain.

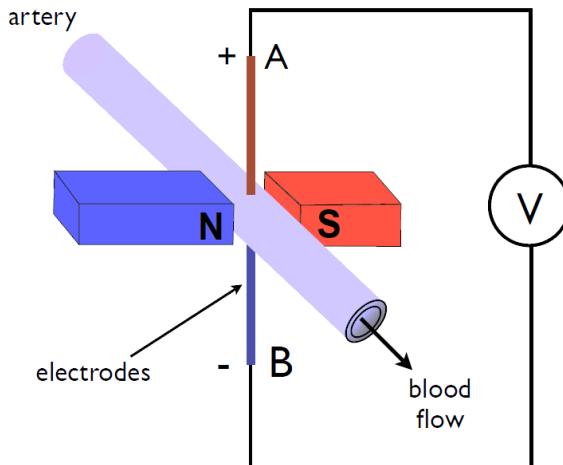
[2 marks]

- (ii) Find the magnitude of the current in the wire.

[5 marks]

4

(a)

**FIGURE 4.1**

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 $B = 0.037 \text{ T}$, a potential difference of $\Delta V = 160 \mu\text{V}$ appears between the electrodes.

- (i) Calculate the speed of the blood.

[3 marks]

- (ii) Does the sign of the potential difference (electrodes) depend on whether the mobile ions in the blood are predominantly positively or negatively charged?

[2 marks]

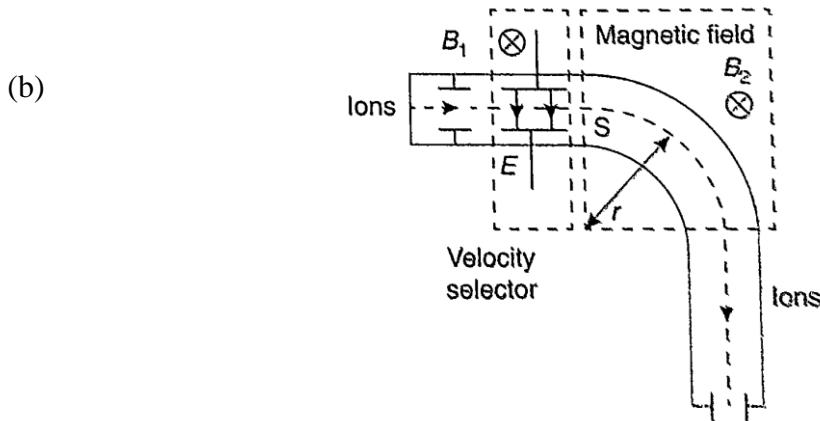


FIGURE 4.2

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 .

- (i) Express v in terms of E and B_1 [1 mark]
- (ii) Derive an expression for the mass m of the ion in terms of E , B_1 , B_2 , r and q . [2 marks]
- (iii) 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 $^{63}_{29}Cu$ and $^{65}_{29}Cu$. [4 marks]

[Atomic mass of isotope $^{63}_{29}Cu = 62.929601 u$, isotope $^{65}_{29}Cu = 64.927794 u$]

- 5
- (a) Briefly describe the workings of Magnetic Resonance Imaging (MRI). [5 marks]
 - (b) Explain the phenomenon of Hall Effect. [5 marks]

SARAWAK MATRICULATION COLLEGE
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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

PHYSICS SP025 ASSIGNMENT
SEMESTER 2 SESI 2022/2023
INDIVIDUAL ASSIGNMENT MARKING SCHEME

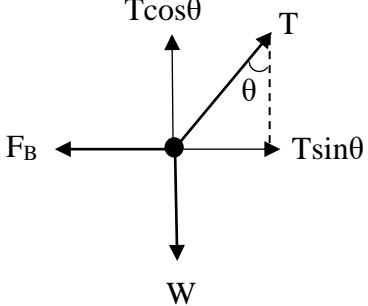
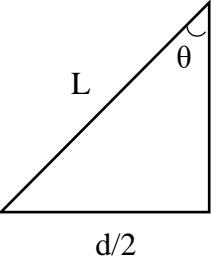
No	Suggested answer	Mark/s												
1(a)	$\Sigma B_P = B_1 + B_2$ $\Sigma B_P = \frac{1}{6} \left[\frac{\mu_o I}{2a} + \left(-\frac{\mu_o I}{2b} \right) \right]$ $\Sigma B_P = \frac{\mu_o I}{12} \left(\frac{1}{a} - \frac{1}{b} \right)$ direction: out of the page	K1 G1 J1 J1												
1(b)	$B_1 = \frac{\mu_o I_1}{2\pi r_1}$ $B_1 = \frac{(4\pi \times 10^{-7})(2.5)}{2\pi(0.08)}$ $B_1 = 6.25 \times 10^{-6} T$ using the same method as above, $B_2 = 3.33 \times 10^{-6} T$ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th><i>x-component</i></th> <th><i>y-component</i></th> </tr> </thead> <tbody> <tr> <td>B_1</td> <td> $B_1 \cos\theta_1$ $= (6.25 \times 10^{-6}) \cos 61.93$ $= + 2.94 \times 10^{-6} T$ </td> <td> $B_1 \sin\theta_1$ $= (6.25 \times 10^{-6}) \sin 61.93$ $= + 5.51 \times 10^{-6} T$ </td> </tr> <tr> <td>B_2</td> <td> $B_2 \cos\theta_2$ $= (3.33 \times 10^{-6}) \cos 28.07$ $= - 2.94 \times 10^{-6} T$ </td> <td> $B_2 \sin\theta_2$ $= (3.33 \times 10^{-6}) \sin 28.07$ $= + 1.57 \times 10^{-6} T$ </td> </tr> <tr> <td>Σ</td> <td>$\Sigma B_x = 0$</td> <td>$\Sigma B_y = 7.08 \times 10^{-6} T$</td> </tr> </tbody> </table> $B_P = \sqrt{\Sigma B_x^2 + \Sigma B_y^2}$ $B_P = \sqrt{0^2 + (7.08 \times 10^{-6})^2}$ $B_P = 7.08 \times 10^{-6} T$ direction: upward at point P @ in +y direction at point P		<i>x-component</i>	<i>y-component</i>	B_1	$B_1 \cos\theta_1$ $= (6.25 \times 10^{-6}) \cos 61.93$ $= + 2.94 \times 10^{-6} T$	$B_1 \sin\theta_1$ $= (6.25 \times 10^{-6}) \sin 61.93$ $= + 5.51 \times 10^{-6} T$	B_2	$B_2 \cos\theta_2$ $= (3.33 \times 10^{-6}) \cos 28.07$ $= - 2.94 \times 10^{-6} T$	$B_2 \sin\theta_2$ $= (3.33 \times 10^{-6}) \sin 28.07$ $= + 1.57 \times 10^{-6} T$	Σ	$\Sigma B_x = 0$	$\Sigma B_y = 7.08 \times 10^{-6} T$	G1 G1 G1 JU1 J1
	<i>x-component</i>	<i>y-component</i>												
B_1	$B_1 \cos\theta_1$ $= (6.25 \times 10^{-6}) \cos 61.93$ $= + 2.94 \times 10^{-6} T$	$B_1 \sin\theta_1$ $= (6.25 \times 10^{-6}) \sin 61.93$ $= + 5.51 \times 10^{-6} T$												
B_2	$B_2 \cos\theta_2$ $= (3.33 \times 10^{-6}) \cos 28.07$ $= - 2.94 \times 10^{-6} T$	$B_2 \sin\theta_2$ $= (3.33 \times 10^{-6}) \sin 28.07$ $= + 1.57 \times 10^{-6} T$												
Σ	$\Sigma B_x = 0$	$\Sigma B_y = 7.08 \times 10^{-6} T$												

1(c)	$ B_A = B_B = B_C = B_D = B$ $B = \frac{\mu_0 I}{2\pi r}$ $B = \frac{(4\pi \times 10^{-7})(5.00)}{2\pi(0.141)}$ $B = 7.09 \times 10^{-6} T$ $B_A + B_D = 1.42 \times 10^{-5} T$ $B_C + B_B = 1.42 \times 10^{-5} T$ As $B_A + B_D$ is perpendicular to $B_B + B_C$, we can consider them as horizontal and vertical components $B_P = \sqrt{(B_A + B_D)^2 + (B_C + B_B)^2}$ $B_P = \sqrt{(1.42 \times 10^{-5})^2 + (1.42 \times 10^{-5})^2}$ $B_P = 2.01 \times 10^{-5} T$ direction: downward at point P @ in -y direction at point P	K1 G1 G1 JU1 J1
	TOTAL	15

No	Answer	Mark/s
2(a)(i)	$r = 47.5 \text{ cm}$ $q = 3e = 3 \times 1.6 \times 10^{-19} C$ $m = 12 \times 1.67 \times 10^{-27} kg$ $B = 0.25 T$ $F_c = F_B$ $\frac{mv^2}{r} = qvB$ $v = \frac{qBr}{m}$ $= \frac{(3)(1.6 \times 10^{-19})(0.25)(0.475)}{12 \times 1.67 \times 10^{-27}}$ $= 2.84 \times 10^6 ms^{-1}$ Sign of the charge = negative	K1 G1 JU1 J1

2(a)(ii)	<p>Yes.</p> $F_B = 3 \times 1.6 \times 10^{-19} \times 2.84 \times 10^6 \times 0.25$ $= 3.4 \times 10^{-13} N$ $W = 12 \times 1.67 \times 10^{-27} \times 9.81$ $= 1.97 \times 10^{-25}$ $\frac{F_B}{W} = 1.7 \times 10^{12}$ <p>Since F_B is 10^{12} greater than the weight, therefore force of gravity can be ignored.</p>	J1 K1 K1
2(a)(iii)	The speed does not change since the force is perpendicular to the velocity. No change in kinetic energy implies that the work done is zero.	J1
2(b)(i)	<p>Point a.</p> <p>F_B should be upward to balance the weight.</p> <p>Therefore, by using right hand rule, the direction of current is to the right.</p> <p>Since the direction of current is from positive terminal to negative terminal, hence the point a is the positive terminal.</p>	J1 K1 K1 K1
2(b)(ii)	$I = \frac{V}{R}$ $= \frac{175}{5}$ $= 35 A$ $F_B \geq mg$ $ILB \geq mg$ $m \leq \frac{35 \times 0.6 \times 1.5}{9.81}$ $m \leq 3.21 kg$ <p>The maximum mass that the bar can support is 3.21 kg.</p>	G1 G1 JU1
	TOTAL	16

No.	Answer	Mark/s
3(a)(i)		D1 – both B correct with label. D1 – both F correct with label.
3(a)(ii)	$\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi d}$ $\frac{F}{l} = \frac{(4\pi \times 10^{-7})(2.5)(3.2)}{2\pi(0.42)}$ $\frac{F}{l} = 3.81 \times 10^{-6} \text{ N m}^{-1}$	G1 JU1
3(a)(iii)	$\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi d}$ $3.81 \times 10^{-6} = \frac{(4\pi \times 10^{-7})(3.0)I_2}{2\pi(0.42)}$ $I_2 = 2.67 \text{ A}$	G1 JU1
3(b)	$F_B = F_g$ $\frac{\mu_0 I_1 I_2 l}{2\pi d} = mg$ $\frac{\mu_0 I_1 I_2}{2\pi d} = \left(\frac{m}{l}\right) g$ $I_2 = \frac{(2\pi d) \left(\frac{m}{l}\right) g}{\mu_0 I_1}$ $I_2 = \frac{2\pi(0.2)(0.12 \times 10^{-3})(9.81)}{(4\pi \times 10^{-7})(80)}$ $I_2 = 14.7 \text{ A}$ <p>Magnetic force on the wire must be upward, this means that the current in two wires must be in the same direction, to the right.</p>	K1 G1 JU1 J1

3(c)(i)	<p>The two wires in the figure are hanging without being in contact with each other. This is only possible because both wires are exerting a repulsive force on each other.</p> <p>For the force between the wires to be repulsive, using Fleming Left Hand rule, the direction of current flowing in the wires is determined to be in opposite direction.</p>	K1 K1
3(c)(ii)	  $\frac{F_B}{L} = \frac{\mu_0 I^2}{2\pi d} \quad \dots \dots 1$ $\begin{aligned} \Sigma F_x &= 0 \\ Ts \sin \theta + (-F_B) &= 0 \\ Ts \sin \theta &= F_B \end{aligned} \quad \dots \dots 2$ $\begin{aligned} \Sigma F_y &= 0 \\ T \cos \theta + (-W) &= 0 \\ T \cos \theta &= W \end{aligned} \quad \dots \dots 3$ $\frac{2}{3} = \frac{Ts \sin \theta}{T \cos \theta} = \frac{F_B}{mg}$ $F_B = mg \tan \theta \quad \dots \dots 4$ <p>sub 4 into 1</p> $\frac{mg \tan \theta}{L} = \frac{\mu_0 I^2}{2\pi d}$ $\text{as } \lambda = \frac{m}{L}, \quad \lambda g \tan \theta = \frac{\mu_0 I^2}{2\pi d}$ $I = \sqrt{\frac{\lambda g \tan \theta (2\pi d)}{\mu_0}}$ $I = \sqrt{\frac{(0.04)(9.81)(\tan 8^\circ)2\pi(0.0167)}{4\pi \times 10^{-7}}}$ $I = 67.84 A$	K1 K1 K1 R1 JU1
		TOTAL 17

No.	Answer	Mark/s
4(a)(i)	$F_E = F_B$ $qE = qvB$ $v = \frac{E}{B} \quad \dots \dots 1$ $\text{as } V = Ed \quad \text{rearrange} \quad E = \frac{V}{d} \quad \dots \dots 2$ $\text{sub 2 into 1 we get } v = \frac{V}{Bd}$ $v = \frac{(60 \times 10^{-6})}{(0.04)(3 \times 10^{-3})}$ $v = 1.33 \text{ ms}^{-1}$	K1 G1 JU1
4(a)(ii)	<p>No. The sign of the potential difference (electrodes) does not depend on whether the mobile ions in the blood are predominantly positively or negatively charged.</p> <p>The direction of magnetic field on all the ions is from left to right and the direction of blood flow is out of the page causing the direction of the magnetic force acting on the positively charged ion is always pointing up while for negatively charged ion always pointing down. Positive ions will accumulate at electrode A making the electrode positive and the negative ions that accumulate at electrode B making the electrode negative.</p>	K1 K1

No.	Answer	Mark/s
4(b)(i)	$v = \frac{E}{B_1}$ <p>where $v = \text{velocity of the ion at slit S}$ $E = \text{Electric field}$ $B_1 = \text{magnetic field in velocity selector}$</p>	R1
4(b)(ii)	<p>In the magnetic field B_2,</p> $qvB_2 = \frac{mv^2}{r}$ $m = \frac{qrB_2}{v}$ $m = \frac{qrB_1B_2}{E}$	K1 J1

4(b)(iii)	$E = \frac{qrB_1B_2}{m}$ <p>For $^{63}_{29}Cu$, $E = \frac{(1.60 \times 10^{-19})(0.2)(0.01)(0.01)}{(62.929601)(1.66 \times 10^{-27})}$</p> $E = 30.6 \text{ V m}^{-1}$ <p>For $^{65}_{29}Cu$, $E = \frac{(1.60 \times 10^{-19})(0.2)(0.01)(0.01)}{(64.927794)(1.66 \times 10^{-27})}$</p> $E = 29.7 \text{ V m}^{-1}$	G1 JU1 G1 JU1
	TOTAL	12

No.	Answer	Mark/s
5(a)	<ol style="list-style-type: none"> In MRI (Magnetic Resonance Imaging) machines, a strong magnetic field is used to align the magnetic moments of hydrogen atomic nuclei in body's tissues. The body is then exposed to radio waves, which causes the nuclei to change their direction slightly. When the body is no longer exposed to the radio waves, the nuclei reverts back to its original position and the nucleus gives off energy in form of radio waves. Coils of varying magnetic field strength pointed at different parts of the body means that each hydrogen nucleus experiences slightly different magnetic fields. Radio waves given off from the nuclei allows scanner to work out what tissues in what locations. 	K1 K1 K1 K1 K1
5(b)	<ol style="list-style-type: none"> The Hall Effect is a phenomenon that occurs when an electric current flows through a conductor placed in a magnetic field. When a current-carrying conductor is held fixed in a magnetic field, the field exerts a sideways force on the charges moving in the conductor. The Hall Effect refers to the creation of a measurable electric field perpendicular to the direction of an electric current flowing through a conductor and the magnetic field. It results in the creation of a measurable voltage perpendicular to both the direction of the current and the magnetic field. The magnitude of the electric field is proportional to the strength of the magnetic field and the current density. 	K1 K1 K1 K1 K1
	TOTAL	10
	GRAND TOTAL	70

PHYSICS SP025 ASSIGNMENT
SEMESTER 2 SESI 2022/2023
NUMERICAL ASSIGNMENT MARKING SCHEME

Suggested answer	Mark/s										
<p style="text-align: center;"><u>Coil A</u></p> <p>Formulating the question, <i>Magnetic field produced by circular coil, $B = \frac{\mu_0 I}{2r}$</i></p> <p style="text-align: center;"><i>By comparing with linear graph equation</i></p> $B = \left(\frac{\mu_0}{2r}\right) (I)$ $y = mx + c$ $y = B$ $x = I$ $m = \frac{\mu_0}{2r}$	K1 J1 J1 J1										
<p style="text-align: center;">Graph of B vs I for Coil A</p> <table border="1"> <caption>Data points estimated from the graph</caption> <thead> <tr> <th>I (mA)</th> <th>B ($\times 10^{-8}$ T)</th> </tr> </thead> <tbody> <tr><td>0.002</td><td>6E-08</td></tr> <tr><td>0.003</td><td>9E-08</td></tr> <tr><td>0.005</td><td>1.5E-07</td></tr> <tr><td>0.006</td><td>1.8E-07</td></tr> </tbody> </table>	I (mA)	B ($\times 10^{-8}$ T)	0.002	6E-08	0.003	9E-08	0.005	1.5E-07	0.006	1.8E-07	x-axis and y-axis with correct unit – 1m 5 correct plotted points – 2 m 4 correct plotted points – 1 m 3 correct plotted points – 0 m
I (mA)	B ($\times 10^{-8}$ T)										
0.002	6E-08										
0.003	9E-08										
0.005	1.5E-07										
0.006	1.8E-07										
$m = \frac{\mu_0}{2r}$ $r_A = \frac{\mu_0}{2m}$ $r_A = 0.021\ m$	K1 JU1										

Suggested answer	Mark/s												
<p style="text-align: center;"><u>Coil B</u></p> <p>Formulating the question, <i>Magnetic field produced by circular coil, $B = \frac{\mu_0 I}{2r}$</i></p> <p><i>By comparing with linear graph equation</i></p> $B = \left(\frac{\mu_0}{2r}\right) I$ $y = mx + c$ $y = B$ $x = I$ $m = \frac{\mu_0}{2r}$	K1												
<p>Graph of B vs I for Coil B</p> <table border="1"> <caption>Data points estimated from the graph</caption> <thead> <tr> <th>I (mA)</th> <th>B ($\times 10^{-8}$ T)</th> </tr> </thead> <tbody> <tr><td>0.0022</td><td>2.5E-08</td></tr> <tr><td>0.0032</td><td>3.7E-08</td></tr> <tr><td>0.0042</td><td>5.0E-08</td></tr> <tr><td>0.0052</td><td>6.3E-08</td></tr> <tr><td>0.0062</td><td>7.5E-08</td></tr> </tbody> </table>	I (mA)	B ($\times 10^{-8}$ T)	0.0022	2.5E-08	0.0032	3.7E-08	0.0042	5.0E-08	0.0052	6.3E-08	0.0062	7.5E-08	x-axis and y-axis with correct unit – 1m 5 correct plotted points – 2 m 4 correct plotted points – 1 m 3 correct plotted points – 0 m
I (mA)	B ($\times 10^{-8}$ T)												
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0.0062	7.5E-08												
$m = \frac{\mu_0}{2r}$ $r_A = \frac{\mu_0}{2m}$ $r_A = 0.063 \text{ m}$	K1 JU1												
$r_A = 0.021 \text{ m}, d_A = 0.042 \text{ m}$ $r_B = 0.063 \text{ m}, d_B = 0.126 \text{ m}$	determine the diameter – JU1 decision making – JU1												
TOTAL	20 MARKS												

NAMA :	
KELAS :	
MIS NO :	

Marks:	
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SULIT
SP025
Physics
Continuous Assessment
Semester 2
Session 2023/2024
2 hours

SP025
Fizik
Penilaian Berterusan
Semester 2
Sesi 2023/2024
2 jam



BAHAGIAN MATRIKULASI
MATRICULATION DIVISION

UJIAN AMALI SP025
PRACTICAL TEST SP025

JANGAN BUKA KERTAS SOALANINI SEHINGGA DIBERITAHU.
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Section A

Conduct an experiment by referring to the given procedure carefully.

Answer **all** the question 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.

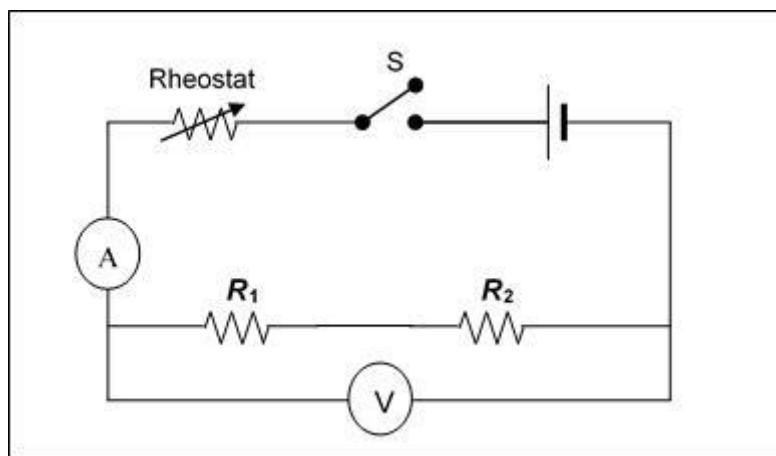


FIGURE 1

- 1.2. Change the resistance value in the rheostat to get a minimum and maximum reading of current in the ammeter.
- 1.3. Record the reading of the voltmeter, V and the ammeter, I in the blank paper provided.
- 1.4. Change the resistance value in the rheostat to obtain at least five different values of V and I and tabulate the data.

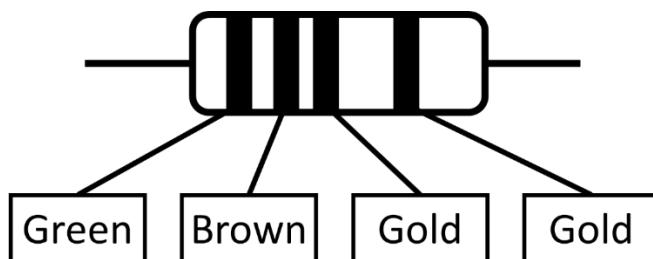
Section B

Answer **all** the question based on the data provided in the table below.

Experimental Data:

No.	Current, I ($\pm 0.01A$)	Voltage, V ($\pm 0.02V$)
1	0.12	1.30
2	0.14	1.50
3	0.16	1.70
4	0.18	1.90
5	0.20	2.10
6	0.22	2.30

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



[3 marks]

- b) **State:**

- (i) the manipulated variable

- (ii) the responding variable

- (iii) the constant variable

[3 marks]

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

[3 marks]

- e) Calculate the centroid point.

[5 marks]

- f) On the graph paper provided, plot a graph of V against I

[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.

[3 marks]

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

[2 marks]

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

[2 marks]

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

I	$I - \bar{I}$	$(I - \bar{I})^2$	V	\hat{V}	$V - \hat{V}$	$(V - \hat{V})^2$
$\Sigma =$		$\Sigma =$				$\Sigma =$

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

[8 marks]

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

[3 marks]

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

[2 marks]

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

[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.

[1 marks]

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

[1 marks]

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

[1 marks]

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

[4 marks]

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

[2 marks]

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

(i) State Ohm's Law

[1 mark]

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

[2 marks]

END OF QUESTION PAPER

KERTAS SOALAN TAMAT

SARAWAK MATRICULATION COLLEGE
PHYSICS SP025

PRACTICAL TEST SCORE SHEET

Name : Table No. :
 Matriculation No. : Date :
 Tutorial Class : Time :

EXPERIMENT : OHM'S LAW				
Criteria	Aspects/skills evaluated	Score	Marks	
Experimental Setup <i>[8 marks]</i>	The voltage of the power supply used is 4 V			
	The circuit is setup/connected starting from the power supply			
	The rheostat is connected properly to the circuit			
	The ammeter is selected to measure the current in the circuit			
	The ammeter is connected in series to the circuit			
	Two resistors are connected in series to the circuit			
	Voltmeter is connected in parallel to the circuit			
	Rheostat is used to manipulate the current in the circuit			
Experimental Skills <i>[4 marks]</i>	The resistance of the resistor is determined by using the provided colour band chart			
	The switch is open after taking each measurement to avoid heating in the wires and resistors (<i>not by turning the power supply on/off</i>)			
	Eyes are perpendicular to ammeter's scale when taking readings			
	Eyes are perpendicular to voltmeter's scale when taking readings			
Collecting and recording data <i>[4 marks]</i>	All values of the manipulated variable are written in the table before conducting the experiment			
	The minimum and maximum value of current and the corresponding voltage is recorded			
	All values of current and voltage are recorded in the correct sensitivity			
	Minimum of 5 different values of current and voltage are recorded			
Safety <i>[2 marks]</i>	Proper safety precautions are consistently used			
	Always think ahead to ensure safety in the laboratory			
Cleanliness <i>[2 marks]</i>	All apparatus are returned to their original position			
	The experiment area (table and floor) is cleaned after experiment			
TOTAL MARKS (20)				
PRACTICAL TEST TOTAL (10 %)				

Marking instruction: (✓) = 1 mark, (✗) = 0 mark

Evaluated by,

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