

This paper will assess the following skills areas:
 Planning (P)
 Manipulation, measurement and observation (MMO)
 Presentation of data and observations (PDO)
 Analysis, conclusions and evaluation (ACE)

Name:

Index:

Class:

Go through Video at:
<https://tinyurl.com/ytssprelimP32022>



Only penalise **once per question** on unit and precision error respectively.

Notation: ✓dp: condone second precision error in reading.
 ✓sf: condone second precision error in calculation.
 ✓uu: condone second error in units.

Ques	Answer	Marks	Score						
1(a)	MMO I is measured to <u>2 dp</u> in <u>A</u> . (FYR: 0.30 A – 0.50 A)	1							
	MMO V is measured to <u>2 dp</u> in <u>V</u> . (FYR: 1.30 V – 1.60 V)	1							
	ACE (Working should be clearly shown) (condone) E.g. $0.30 \times 1.30 = 0.39 \text{ W}$ (2sf) Correct calculation of P in <u>W</u> and recorded in <u>least sf. (2 sf.)</u> P should be in the <u>range of 0.30 W to 1.5 W</u> . (condone)	1							
1(c)	ACE (Working should be clearly shown) (condone) Correct calculation of m in <u>g</u> and recorded in <u>least sf. (2 sf.)</u> <u>$m = 36 \text{ g}$</u>	1							
1(d)	MMO t is measured to <u>1 dp</u> in <u>s</u> . (condone 2 dp) t should be in the <u>range of 55 s to 150 s</u> .	1							
1(e)	Plan - Stating at least two controlled quantities correctly: - The (mass or volume or type) of oil. - The power of the heater. - The EMF of battery. - The resistance of the heater. - The type of heater Do NOT accept “ <i>The circuit / The oil / The wires / Type of wire</i> ”	1							
	- The graph plot should have the independent variable as X-axis and dependent variable as Y-axis - Possible answer includes:<table><tr><td>$t \text{ vs } \Delta\theta$</td><td>$Pt \text{ vs } \Delta\theta$</td><td>$t \text{ vs } \Delta\theta / P$</td></tr><tr><td>$t \text{ vs } m$</td><td>$Pt \text{ vs } m$</td><td></td></tr></table>	$t \text{ vs } \Delta\theta$	$Pt \text{ vs } \Delta\theta$	$t \text{ vs } \Delta\theta / P$	$t \text{ vs } m$	$Pt \text{ vs } m$		1	
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$t \text{ vs } m$	$Pt \text{ vs } m$								
	for graphs:	1							

Ques	Answer			Marks	Score																						
	<table><tr><td>t vs $\Delta\theta$</td><td>$c = (\text{gradient}) \times P/m$</td></tr><tr><td>$Pt$ vs $\Delta\theta$</td><td>$c = (\text{gradient}) /m$</td></tr><tr><td>t vs $\Delta\theta / P$</td><td>$c = (\text{gradient}) /m$</td></tr><tr><td>t vs m</td><td>$c = (\text{gradient}) \times P/\Delta\theta$</td></tr><tr><td>$Pt$ vs m</td><td>$c = (\text{gradient}) /\Delta\theta$</td></tr></table>	t vs $\Delta\theta$	$c = (\text{gradient}) \times P/m$	Pt vs $\Delta\theta$	$c = (\text{gradient}) /m$	t vs $\Delta\theta / P$	$c = (\text{gradient}) /m$	t vs m	$c = (\text{gradient}) \times P/\Delta\theta$	Pt vs m	$c = (\text{gradient}) /\Delta\theta$																
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	Mark according to the graph to be plotted <table><tr><td colspan="2">t vs $\Delta\theta$</td><td>Pt vs $\Delta\theta$</td><td>t vs $\Delta\theta / P$</td></tr><tr><td>t / s</td><td>$\Delta\theta / ^\circ\text{C}$</td><td>$Pt / Ws$</td><td>$\Delta\theta / P / ^\circ\text{C} / W$</td></tr><tr><td></td><td></td><td></td><td></td></tr></table> <table><tr><td colspan="2">t vs m</td><td colspan="2">Pt vs m</td></tr><tr><td>V / cm³</td><td>m / g</td><td>t / s</td><td>Pt / Ws</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>	t vs $\Delta\theta$		Pt vs $\Delta\theta$	t vs $\Delta\theta / P$	t / s	$\Delta\theta / ^\circ\text{C}$	Pt / Ws	$\Delta\theta / P / ^\circ\text{C} / W$					t vs m		Pt vs m		V / cm ³	m / g	t / s	Pt / Ws					1	
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	- Describe how the exp should be performed by including: - Two <u>measure and record steps</u> for IV and DV <u>using the the correct equipment</u> respectively. <u>Calculation step</u> (e.g. Pt or $\Delta\theta / P$) <u>Tabulation step</u>. (condone missing quantities here) <u>Repeat step</u> to obtain 4 or 5 other sets of data <u>Plotting step</u> (condone wrong graph here) Plan should be expressed as steps each starting on a new line. Key action words must be used. Otherwise, loss this [1]	1																									

Ques	Answer	Marks	Score
2(c)	MMO u is measured to <u>1 dp</u> in <u>cm</u> .	1	
2(d)	ACE EITHER use a ruler to determine the thickness of the lens, t . measure the distance between the insert and the lowest point of the lens, d . calculate $u = d + t/2$ OR other ideas that make sense.	1	
2(e)	ACE Show evidence of averaging. MMO h_1 measured to <u>1 dp</u> in <u>cm</u> . (FYR: $h_1 = 1.7$ cm)	1 1	
2(f)	ACE	1	

Ques	Answer	Marks	Score
	- It is difficult to measure h_1 on a curved surface - light reflect into the eyes making it hard to read the scale - difficult to align the scale of the ruler to the scale of the image - accept lens is not parallel to the page / cannot be held at fixed height DO NOT ACCEPT image is blur or distorted		
2(g)	ACE M is calculated correctly and recorded to the <u>least sf (2 sf) between 2.0 to 4.0</u>	1	
2(h)	ACE f_1 is calculated correctly and recorded to the <u>least sf (2 sf) in cm</u>	1	
2(i)	MMO f_2 measured to <u>1 dp in cm</u> . (FYR: $t_2 = 9.0$ cm)	1	
2(j)	ACE - Work on the %difference as supporting evidence. (Condone difference) - Make a conclusion base on the evidence	1 1	

Ques	Answer	Marks	Score
3(b)	MMO T is measured to <u>2 dp</u> and <u>in N</u> . (FYR: $T = 0.12\text{N}$, $\theta = 65^\circ$)	1	
3(c)	ACE Answer given in 2 sf. (FYR: 0.47 – 0.84) DO NOT accept the $1/\tan = \text{adj}/\text{opp}$ method	1	
3(d)	ACE <u>Use the ruler and ensure that the height from the bench to X and to Y are the same.</u>	1	
3(e)	MMO 5 sets of data including 3(b) and (c)	1	
	PDO Min range of θ is 35 degrees	1	
	PDO Table heading: $\theta/^\circ$, $\frac{1}{\tan \theta}$ and T/N	1	
	PDO Data recorded to the correct precision. θ in 0 dp, $\frac{1}{\tan \theta}$ in 2sf and T in 2 dp.	1	
	PDO Correct trend, as θ increases, T decreases. (condone 1 exception)	1	

Ques	Answer	Marks	Score
3(f)	PDO Graph drawn with T as y-axis and $1/\tan \theta$ as x-axis, and correctly labelled with units.	1	
	PDO Sufficient scale marking every 2 cm and suitable scale - not based on 3, 6, 7, etc. Points occupy at least half of the graph paper in both axes.	1	
	PDO All points plotted correctly. (Within half the smallest grid square)	1	
	PDO Best fit line is drawn.	1	
3(g)	ACE Identified and labelled two coordinates on the graph and use of a triangle that uses more than half the drawn line.	1	
	ACE <u>Correct calculation</u> of gradient. The input data should be <u>read to half the smallest square</u> (Condone) on the grid. Answer to be given in <u>least s.f.</u> and <u>correct unit</u> (in N).	1	
	MNO gradient is in the range of 0.4 to 0.6.	1	
3(h)	MMO W_D is recorded as <u>2 dp</u> and in <u>N</u> .	1	
3(i)	ACE Student should use the value of the gradient and compare it with W_D .	1	
3(j)	ACE When $\theta = 0^\circ$, according to the equation, tension in XY T will need to be at infinity (or larger than the range of the newton meter).	1	
3(k)	ACE Award (2) as long (R)(I) or (D)(I) are mentioned. (D) There is no reference horizontal to string XY (R) Difficult to measure θ in mid-air (I) Hence, the measurement of θ is affected (D) There is no reference horizontal to string XY (R) Difficult to ensure that the spring balance is horizontal (I) Hence, the measurement T is affected.	2	

INTERNAL DATA – NOT FOR SHARING

Unknown mass used is 50g

$\theta / ^\circ$	$1/\tan \theta$	T
65	0.466308	0.12
57	0.649408	0.25
47	0.932515	0.38
40	1.191754	0.47
35	1.428148	0.63
30	1.732051	0.77

