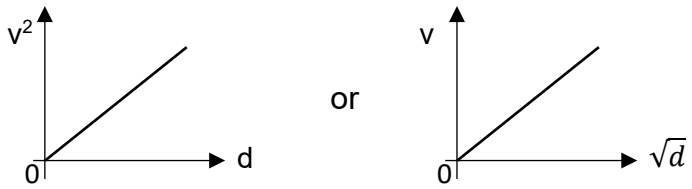
2024 Phy Prelim Practical P3_NHHS_suggested marking scheme

Question			suggested answer	marks
1	(a)	(i)	*d* value recorded <u>with unit</u> to nearest 0.1 mm or better (range from 5.00 mm to 8.00 mm)	1
		(ii)	at least two measurements of time seen, to nearest 0.1 s or better (students need to show evidence that they have taken time for at least two cycles) average time, *t,* <u>with unit</u> and appropriate sf (range of t = 0.40s to 1.00 s)	1 1
		(iii)	Distance travelled = diameter of water surface (range from 16.5 cm to 17.5 cm) correct calculation of speed using candidate's value <u>with unit</u> and appropriate sf	1 1

	(c)		***<u>Marking points</u>***
			• constant variables:
			  • *volume of water droplet*
			  • *position of landing of water droplet*
			  • *height from which water droplet is dropped*
			• description of procedures:
			  • *vary d* (independent variable) and record *t (dependent variable)*
			  • calculate v
			• vary *d* to get at least 5 sets of *t*
			• plot a suitable graph: (eg. Plot v^2 against d or v against $\sqrt{d}$)
			 
			
			• α is the gradient of the graph (for v^2 against d graph)
			or
			α is the square of the gradient of the graph (for v against $\sqrt{d}$ graph)
				1
				
				1
				
				1
				
				together with sketch 1
				
				1

2	(a)	(i)	Marbel placed in between **both masses.** Both masses on edge / vertical and touching the scale • difference in scale readings indicated • set square to arrange masses perpendicular to scale / to ensure masses are vertical (give max 1 mark if two masses are not used)	1 1
		(ii)	*d* value recorded to nearest mm (0.1 cm using ruler) (range = 1.6 – 1.7 cm)	1
	(b)	(i)	d_1 < less than or equal to their *D*, to nearest mm (0.1 cm) (around 1.2 cm)	1
				1

		(ii)	correct calculation of A_1 using candidate's value <u>with unit</u> and appropriate sf (i.e using value from **(b)(i)**) accept $mm^2/cm^2/m^2$		
	(c)	(i)	x and y recorded to nearest mm {x must be less than y}		1
		(ii)	correct calculation of F using candidate's value <u>with unit</u> and appropriate sf		1
		(iii)	$d_2 > d_1$ **and** $A_2 > A_1$ with correct calculation of A_2 using candidate's value {to penalize for no unit and wrong sf}		1
	(d)	**Any two form the list below** <u>clay-related factor from</u>: • time that the force is applied • temperature (of room or clay) • type of modelling clay / hardness / malleability of clay <u>force related factor from</u>**:** • force used/ total mass hung • diameter / size / mass of ball / weight of ball / same ball used (glass or wooden) • weight of wooden strip • same ***x* and *y*** values • time that the force is applied			1 1
3	(b)	T_R value recorded with unit to nearest 0.1 °C (sensible value) (around 32.0 °C) V_R value recorded with unit to nearest 0.05 V (sensible value) (around = 3.60 V)			1
	(c)	(i)	T_W value recorded with unit to nearest 0.1 °C (sensible value) around 75.0 °C to = 95.0 °C V_W value recorded with unit to nearest 0.05 V (sensible value) around 2.00 V		1
		(ii)	Correct calculation of T_C using candidate's value with unit and appropriate sf Correct calculation of V_C using candidate's value with unit and appropriate sf	correct calculation unit & sf	1 1
	(d)	• table with proper headers and unit (for T_W, V_W, T_C and V_C) • at least 5 sets of data (T_W, V_W) with correct trend (T_W down, V_W up) • all values of T_W recorded to nearest 0.5 °C and V_W recorded to nearest 0.05 V • correct calculation of T_C and V_C to appropriate sf			1 1 1 1

sample data:

T_W / °C	V_W / V	T_C / °C	V_C / V
86.0	2.00	54.0	1.60
83.5	2.10	51.5	1.50
80.5	2.20	48.5	1.40
77.5	2.30	45.5	1.30
74.5	2.40	42.5	1.20
71.5	2.50	39.5	1.10
69.0	2.60	37.0	1.00
66.5	2.70	34.5	0.90

(e)

- axes labelled with headers + units and correct orientation — 1
- suitable scale, not based on 3, 6, 7 etc with plotted data occupying >= half the page in both directions — 1
- all points plotted correctly (points must be =< ½ small square from the correct position) — 1
- best fit line and fine crosses — 1

(f)

Constant *G*

- gradient:
  - use of *gradient triangle* that uses more than half the drawn line — *G* 1
  - correct calculation of gradient — *Q* 1
  - *p* calculated **using gradient** with unit and appropriate sf — unit & sf 1

  (around 28.4 °C/V)

Constant *Q*

- y-intercept read correctly from graph (or calculated)
  - *Q* with unit and appropriate sf if calculated or dp if read from graph.

  (around = 8.56 °C)

(g) (i)

Correct calculation of V_N with unit to appropriate sf — 1

Using $V_N = 3.42$ V

$$V_N = 3.60 - \left(\frac{37.0 - 32.0}{28.4}\right) = 3.42 \text{ V}$$

(ii)

Appropriate calculation with recorded value of V_B and V_N from (e)(i) — 1

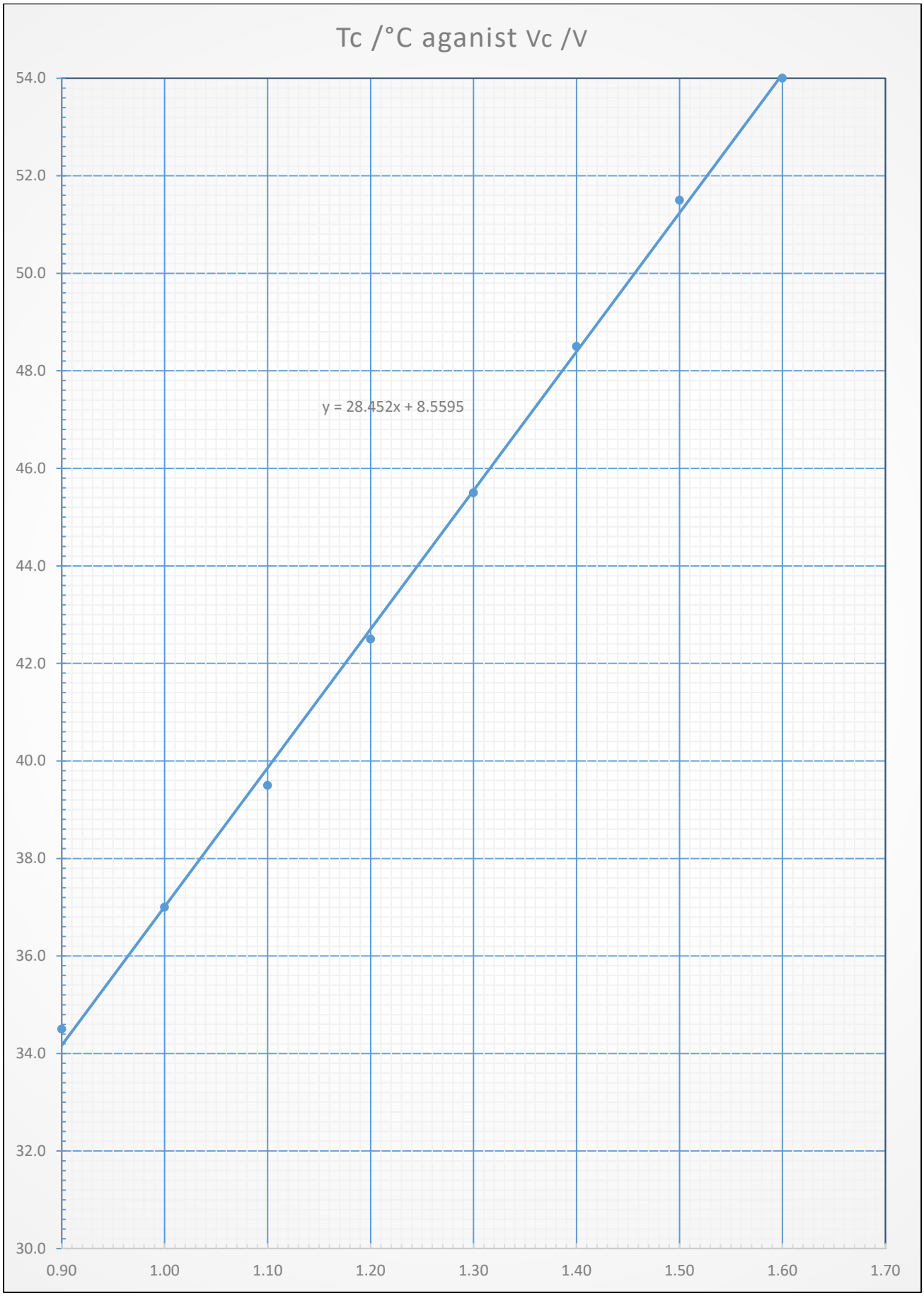
$V_B = 3.30$ V

V_N and V_B are equal within the limits of experimental accuracy (with relevant working shown) — 1

(iii)

Any two: — 1,1

- Allow thermistor to cool to room temperature before performing experiment
- Ensure fingers cover the thermistor fully
- Place thermistor in palm
- Keep hand still to avoid fluctuations in reading
- Ensure good contact between skin and thermistor without excessive pressure
- Take average of few readings


Tc /°C aganist Vc /V
y = 28.452x + 8.5595
54.0
52.0
50.0
48.0
46.0
44.0
42.0
40.0
38.0
36.0
34.0
32.0
30.0
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70