Belmont City College
YEAR 12 PHYSICS

Part 1:	**/15**

PRACTICAL ASSESSMENT, PART 1

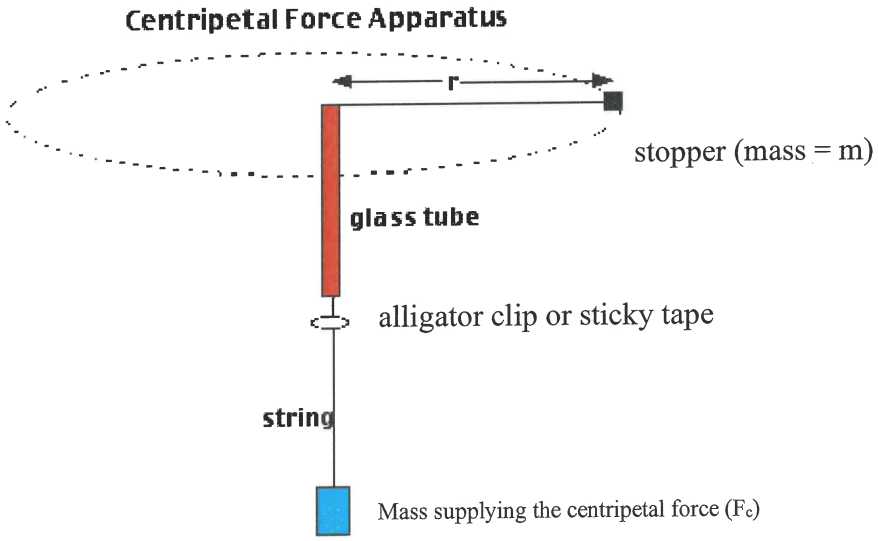
CIRCULAR MOTION

NAME: Solutions

Time allowed: 35 **mins**

A talented physics student conducted an experiment investigating circular motion. The apparatus is shown below.

The stopper was whirled in a circle and the radius of the circle was kept at a constant value of **0.600 m.**



The results obtained are shown in the table on the next page:

M mg $\frac{2\pi r}{T}$

Mass providing centripetal force (kg)	Centripetal force (N)	Time for 20 turns		Average time per turn (s)	Velocity v (m s^{-1})	Velocity^2 v^2 (m^2 s^{-2})
		Trial 1 (s)	Trial 2 (s)			
0.200	1.96	14.9	15.2	0.7525	5.01	25.1
0.250	2.45	14.2	13.1	0.683	5.53	30.5
0.300	2.94	12.9	11.7	0.615	6.13	37.6
0.400	3.92	10.8	10.3	0.528	7.14	51.1
0.450	4.41	10.1	10.2	0.508	7.43	55.2

$\frac{1}{2}$ per column.

1. Complete the table of results above. (2 marks)

2. On the graph paper provided, plot the data of centripetal force versus velocity squared. (3 marks)

See overleaf.

3. Use the graph paper provided to determine the mass of the rubber stopper (show all working below and clearly explain any data taken from the graph or table) (5 marks)

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 0}{56.5 - 0} = 0.0708 \quad]\checkmark$$

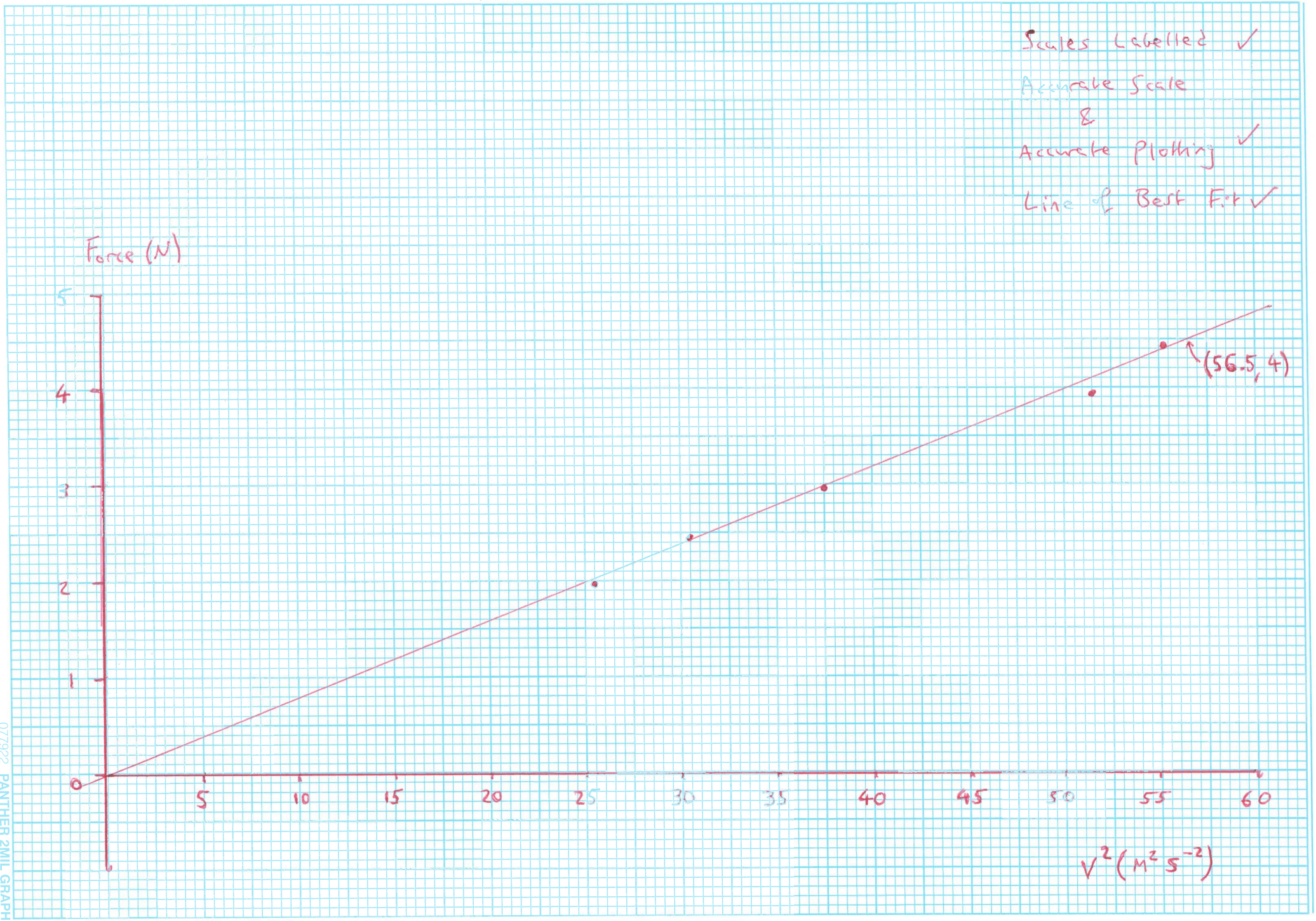
$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{F_c}{v^2}$$

$$\circledast \quad F_c = \frac{mv^2}{r} \Rightarrow \frac{F_c}{v^2} = \frac{m}{r} = \text{slope} \quad]\checkmark$$

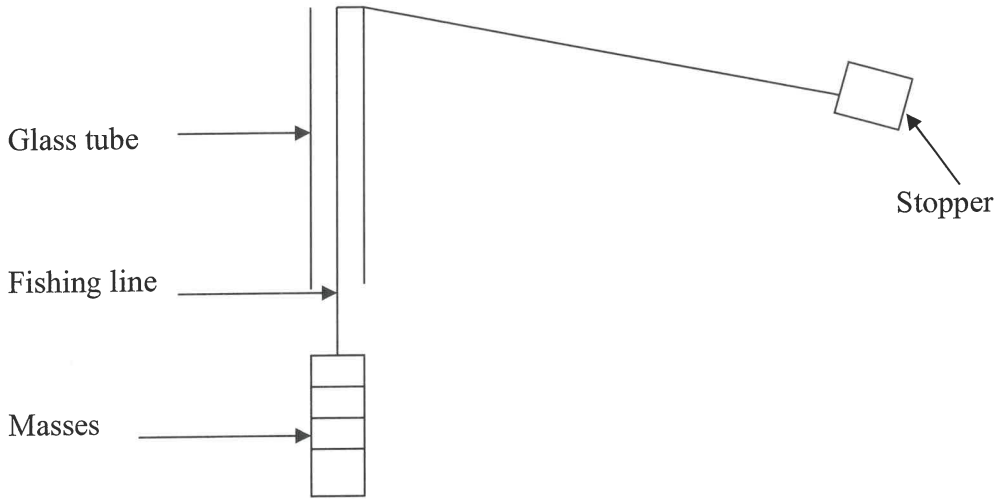
$$\therefore \quad m = r \times \text{slope} = 0.600 \times 0.0708 \quad]\checkmark$$

$$m = 0.0425 \text{ kg} \text{ or } 42.5 \text{ g} \quad]\checkmark\checkmark$$

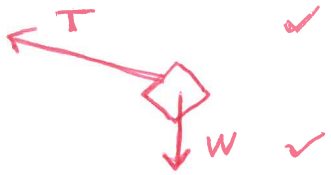
(only 1 if more than 5g off).



4. In reality, the fishing line will not rotate in a perfectly horizontal circle.



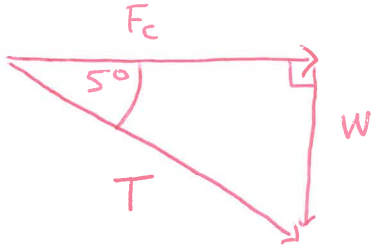
a) Draw fully labeled arrows to represent all forces on the stopper. (2)



b) What force or component of force balances the weight of the stopper? (1)

Vertical component of tension ✓

c) In this experiment, it was assumed that the tension in the fishing line is equal to the centripetal force. If the fishing line makes an angle to the horizontal as shown above, this will not be true. If the angle between the string and the horizontal is 5°, use simple trigonometry to show that the difference between T and Fc is still less than 1% (2)



$\cos 5^\circ = \frac{F_c}{T}$ ✓

$\therefore T\cos 5^\circ = F_c$

$\therefore T(0.996) = F_c$

$\therefore F_c$ is 99.6% magnitude of T

$\therefore$ > 1% difference. ✓