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|  | **12 ATAR Physics 2016**    **Practical Validation**  **Circular Motion**  **NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  ***(44 marks)*** |

The diagram underneath refers to an investigation performed in class where you investigated **the circular motion of a rubber stopper.** Remember the rubber stopper can have any speed at any radius because the person swinging the stopper around had control over how hard the string pulled in on the stopper. The masses hung from the string provided the pull on the string.



A Year Twelve Physics student wished to keep the force on the string the same whilst calculating the speed of the stopper at different radii.

1. Below is a list of events performed by this Physics student. Unfortunately they have scrambled the order around and need you to place the steps in the correct order in the space provided by **listing the correct order of the letters (A-E).**

**A.** Timed the stopper for 20 swings. The period is 1/20 of this time.

**B.** Repeated for at least 5 radii with the same mass on the string.

**C.** Put say 100g on the string and swung the stopper in a circle. The speed was adjusted to

match the radius by lining up the tape mark.

**D.** The weight (tension T), radius r, period T and speed v were all tabulated.

**E.** The radius was set by putting some tape on the string just below the glass tube.

(at about 50cm when the stopper was swung).

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The following **results** were obtained:

Mass of stopper used = 35.6 g

Mass of slotted weights used =100g

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| Radius(m) | Time for 20 swings (s) | | Average period T  ( ) | V =  (m.s -1) | V2 ( ) |
| Trial 1 | Trial 2 |
| 0.50 | 16.94 | 17.00 |  |  |  |
| 0.60 | 18.55 | 18.90 |  |  |  |
| 0.40 | 15.15 | 15.20 |  |  |  |
| 0.80 | 21.42 | 21.22 |  |  |  |
| 1.0 | 23.95 | 23.85 |  |  |  |

1. Complete the table above (6 marks)

3a. Graph the **speed** versus the **radius** in the space below. (Plot speed, v on the y-axis

and radius, r on the x-axis.) (4 marks)





3b. Graph the **speed squared (v2)** versus the **radius, r** in the space provided below.

(Plot v2 on the y-axis and radius, r on the x-axis) (4 marks)





3c. What can you conclude from the graphs about the relationship between

1. r & v,
2. r & v2? (2 marks)

(i)

(ii)

3d. Determine the gradient of the graph in question 3b above. Be sure to indicate

on the graph how the gradient was calculated. (3 marks)

3e. What does this slope represent? Compare it to the value obtained using the mass of the

stopper and the centripetal force and comment on the validity of the experiment. (6 marks)

3f. Supply an equation for the graph obtained in question 3b above. (2 marks)

1. State **three** errors affecting the results of the experiment above. ( 3 marks)

5a. Use a line of data eg 0.6 m and the corresponding v2, together with the mass of the stopper

and calculate Fc = mv2 / r. (2 marks)

5b. Calculate the centripetal force by making use of the slotted mass pieces which are providing

this force. (1 mark)

5c. Find the percentage difference and comment the relative closeness of these values.(2 marks)

5d. Why is the Fc from the weight slightly greater than the Fc calculated by mv2/ r ? (3 marks)

1. Why are 20 swings used to obtain the period (T)? ( 4 marks)

The END