Senior physics practical

**SENIOR OLYMPIADS PHYSICS PRACTICAL**

**QUESTION ONE**

**In this experiment you will investigate the deflection of a metre rule when a mass is suspended from its centre.**

**You are provided with the following:**

1. **Two blocks**
2. **Two metre rules**
3. **Triangular prisms**
4. **Sting**
5. **Mass of 500g**
6. **(i) Set up the apparatus as shown in Figure 1.1 with a distance *l* between the supports of**

**approximately 95 cm.**

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**Figure. 1.1**

**(ii) Measure and record *l***

***l= ………………………………………………….……………*….**

**(iii) Midway between the support, measure and record the height *ho* of the bottom of the rule**

**above the bench.**

***ho = …………………………………………………………………..***

1. **(i) Use the small loop of a string to suspend the mass from the rule, midway between the**

**supports.**

**(ii) Midway between the supports, measure and record the new height *h* of the bottom of the**

**rule above the bench.**

***h = ………………………………………………………………*……**

**(iii) Calculate the deflection *d* of the beam where**

***d = ho – h***

***d* = ………………………………………………………………..**

1. **Estimate the percentage uncertainty in your value of *d*.**

**Percentage uncertainty = ………………..…………………….**

1. **Change *l* to approximately 60 cm, repeat (a)(ii), (a)(iii) and (b)**

***l =* ………………………………………………….**

***ho = ……………………….……….………………*..**

***h = …*…………………………………………………**

***d = …………………………………………………….***

1. **It is suggested that the quantities *d* and *l* are related by the equation**

***d = kl2***

**Where *k* is a constant**

1. **Using your data, calculate two values of *k***

**First value of k = …………………..…………**

**Second value of k …………………………….**

1. **Explain whether your results support the suggested relationship.**

**……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………**

1. **(i) Describe four sources of uncertainty or limitations of the procedure for this**

**experiment.**

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5. **Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.**
6. **………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………**
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**QUESTION TWO**

**In this question you will investigate how what is seen in mirror depends on the distance from the mirror.**

1. **(i) On the sheet of plain paper provided, draw a line AB 4 cm from the top edge and parallel**

**with it. See Fig. 2.1**

**(ii) Mark the centre of AB and label this point C.**

**(iii). From C draw a line CD, perpendicular to AB, to the bottom of the paper.**

**(iv). On CD, mark the point 8.0 cm from C. Label this point E.**

**The distance between C and E is called d.**

**(v). Draw a line through E, perpendicular to CD. Label the line FG.**

**Fig.2.1 Fig.2.2**

1. **Using the four drawing pins, fix the sheet of paper to the board. See Fig. 2.2.**
2. **Stick a pin P1 vertically into the board on the line CD, at a distance 5.0 cm from C.**
3. **Place the front of the mirror along the line AB with the centre of the useful part of the mirror at point C.**

**Fig. 2.3**

1. **Looking along the line DC, view the image of the pin P1, seen in the mirror Fig.2.3.**
2. **Move your head slowly to the right until the image of the pin disappears from view.**
3. **Move your head back to the left until you can just see the image again.**

**Now stick a second pin P2 vertically into the board along the line FG and in line with the image of P1 seen in the mirror.**

1. **Now move your head to the left of D until, once again, the image of the pin P1 is just about to disappear from view. Stick a third pin P3vertically into the board along the line FG and in line with the image of P1 seen in the mirror.**
2. **Measure the distance s between P1 and P3.**
3. **Repeat the steps set out in (a)(iv), (a) (v) and (c) (iii) and (c)(iv) until you have a total of five sets of values of *d* and *s* for the range 8.0 cm to 24.0 cm.**
4. **(i) Plot a graph of s/cm (y – axis), starting your scales at point (0,0).**

**Draw the best straight line through your points.**

1. **From your graph, determine the so, the value of s when d = 0.**
2. **Determine the gradient G of your line, showing how you obtain the necessary information from the graph.**
3. **Calculate another value for so using the equation**

**So = Kg,**

**Where k = 5.0 cm.**

1. **Give one precaution that would increase the accuracy of the experiment.**

**……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………**

**QUESTION THREE**

**In this experiment you will investigate the variation of Potential difference along a uniform resistance wire carrying a steady current.**

**Figure 3.3 shows the circuit which has been set up for you.**

**Figure 3.3**

1. **(i) Place the jockey J on the resistance wire AC at a distance l from A where l = 10 cm.**

**(ii) Close key K and record the potential difference V between A and J as registered on the**

**voltmeter.**

**V = …………………………………………..**

1. **Repeat this procedure for AJ = 20cm, 30 cm, 40 cm, 50 cm, 60 cm, 70 cm and 80 cm tabulating all your results.**
2. **Plot a graph of AJ cm (x – axis) against V volts (y – axis) and measure its slope.**
3. **What conclusion can you draw about the variation of potential difference with distance along the wire? Justify your answer.**
4. **What assumption did you make**

**…………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………**

1. **What is the fall in potential per cm of wire?**

**QUESTION FOUR**

**In this experiment, you will investigate how the motion of a pendulum bob is affected by the height of the bob above the bench.**

**You have been provided with the following; Metre rule, Bob, String, Stop watch, Clamp and stand**

1. **(i) Set up the apparatus as shown in Figure 4.1.**

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**Figure 4.1**

**The distance h from the point of suspension to the bench should be as large as**

**possible.**

**The distance x between the centre of the bob and the bench should be approximately**

**5 cm.**

**(ii) Measure and record distance h.**

**h= ……………………………………………………**

**Through out this experiment, do not change the distance h.**

**(iii) Measure and record distance x.**

**x = ………………………………………………………**

1. **Displace the bob a small distance to the left. Release the bob and watch the movement.**

**The time the bob takes for each complete swing, first to the right and then back to the left, as shown in Figure 4.2.**

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**Fig.4.2**

**By timing several of these complete swings, determine an accurate value of T.**

**T = ……………………………………………**

1. **Keeping h constant, change x and repeat (a)(ii) and (b) until you have six sets of values for x and T.**

**Include values for T2 in your table of results.**

1. **(i) Plot a graph of T2 on the y – axis against x on the x – axis.**

**(ii) Draw the straight line of best fit.**

**(iii) Determine the gradient and y – intercept of this line of best fit.**

**Gradient = …………………………………………………………**

**y – intercept = …………………………………………………..**

1. **The quantities T and x are related by the equation**

**T2 = A – Bx**

**Where A and B are constants.**

**Use your answers to (d)(iii) to determine the value of .**

**Give an appropriate unit.**

**= …………………………………………………**