

Surname:

First name:

PMQ1

University of Cape Town  
Department of Physics

## Physics Measurement Questionnaire 1

### Instructions:

Write your name in the box above.

Inside this envelope there are pages numbered 1 to 12.

Read the text below and answer the questions on each sheet.

If you need more space for your answers, then use the backs of the sheets.

It should take you about 5 minutes to answer each question.

**Answer the questions in order and do not skip any sheet.**

**When you have completed a question, put the sheet inside this envelope and do not take it out again, even if you want to change your answer.**

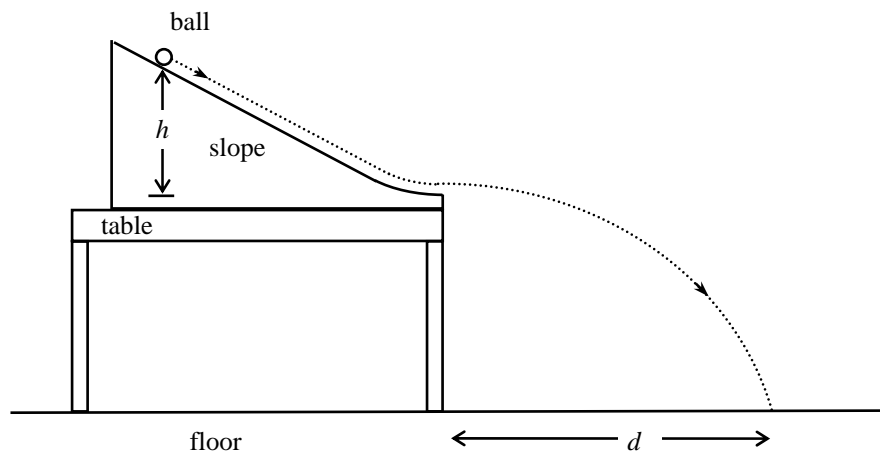
**Note: It is possible that some answers may be similar or exactly the same as others. Please write all answers out in full, even if you feel that you are repeating yourself.**

### Context:

An experiment is being performed by students in the Physics Laboratory.

A wooden slope is clamped near the edge of a table. A ball is released from a height  $h$  above the table as shown in the diagram. The ball leaves the slope horizontally and lands on the floor a distance  $d$  from the edge of the table. Special paper is placed on the floor on which the ball makes a small mark when it lands.

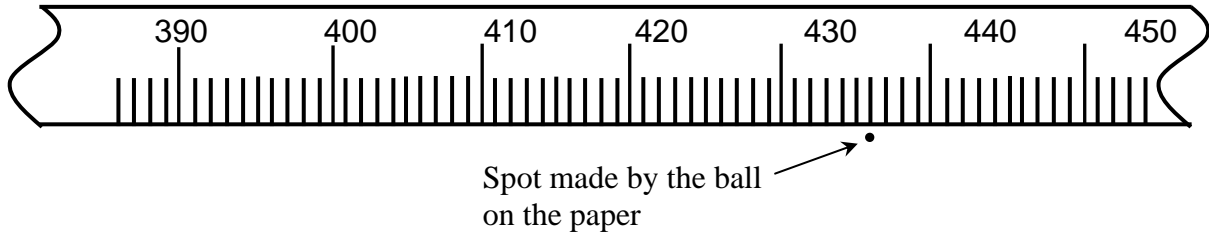
The students have been asked to investigate how the distance  $d$  on the floor changes when the height  $h$  is varied. A metre stick is used to measure  $d$  and  $h$ .





Q 1. (SAG/1)

The students work in groups on the experiment. Their first task is to determine  $d$  when  $h = 90$  mm. One group lets the ball roll down the slope from a height  $h = 90$  mm and use a metre rule to measure the distance  $d$ . What they see is shown below.



I think that the distance  $d$  is exactly 436 mm.

I think that the distance  $d$  is approximately 436 mm.

I think that the distance  $d$  is between 435 mm and 437 mm.

I think that the distance  $d$  is between 435.5 and 436.5 mm.

I don't agree with any of you.

A B C D E

With whom do you most closely agree? (Circle ONE):

A	B	C	D	E
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Explain your choice.

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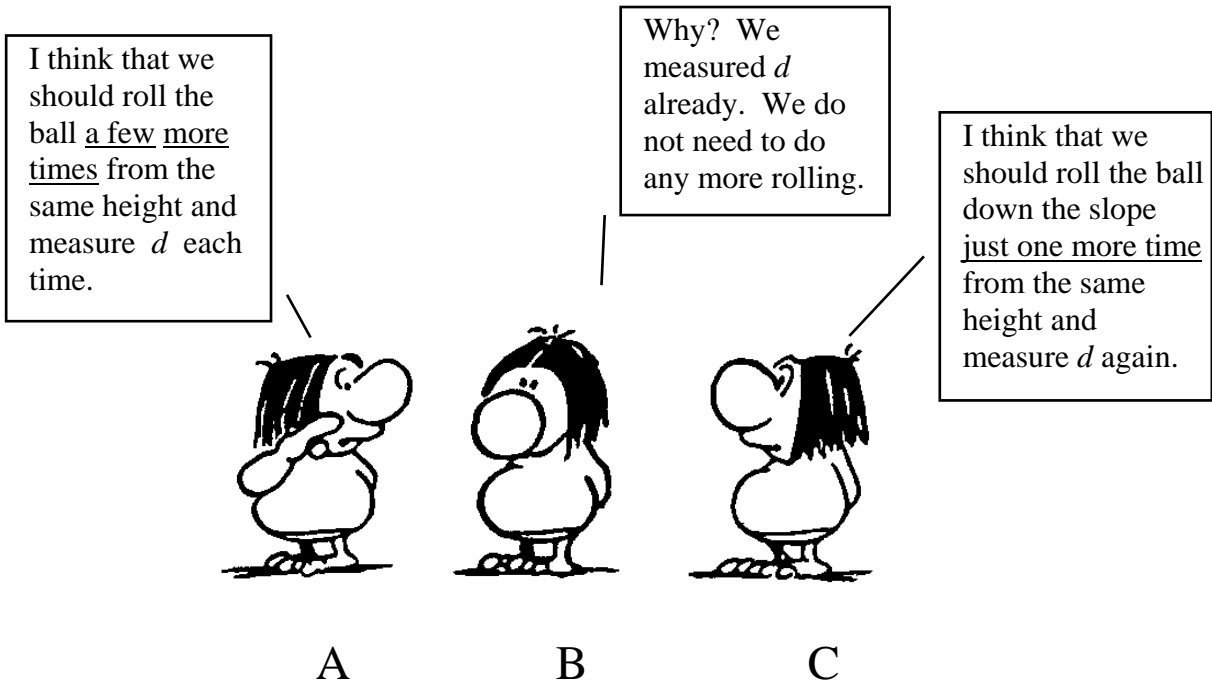
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Q 2. (RD/1)

The following discussion now takes place between the students.



With whom do you most closely agree? (Circle ONE):

A	B	C
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Explain your choice.

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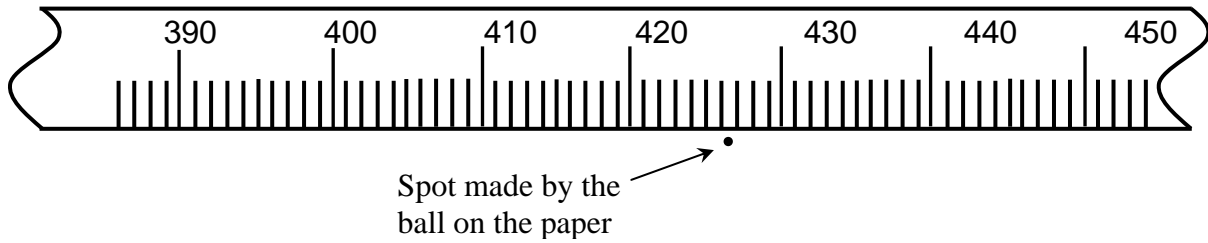
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Q 3. (SAB/1)

The group of students decide to allow the ball to roll again from height  $h = 90$  mm. The students use the same metre rule to measure the distance  $d$ , and what they see is shown below.



I think that the distance  $d$  is exactly 426.5 mm.



A

I think that the distance  $d$  is approximately 426.5 mm.



B

I think that the distance  $d$  is between 426 and 427 mm.



C

I don't agree with any of you.



D

With whom do you most closely agree? (Circle ONE):

A	B	C	D
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Explain your choice.

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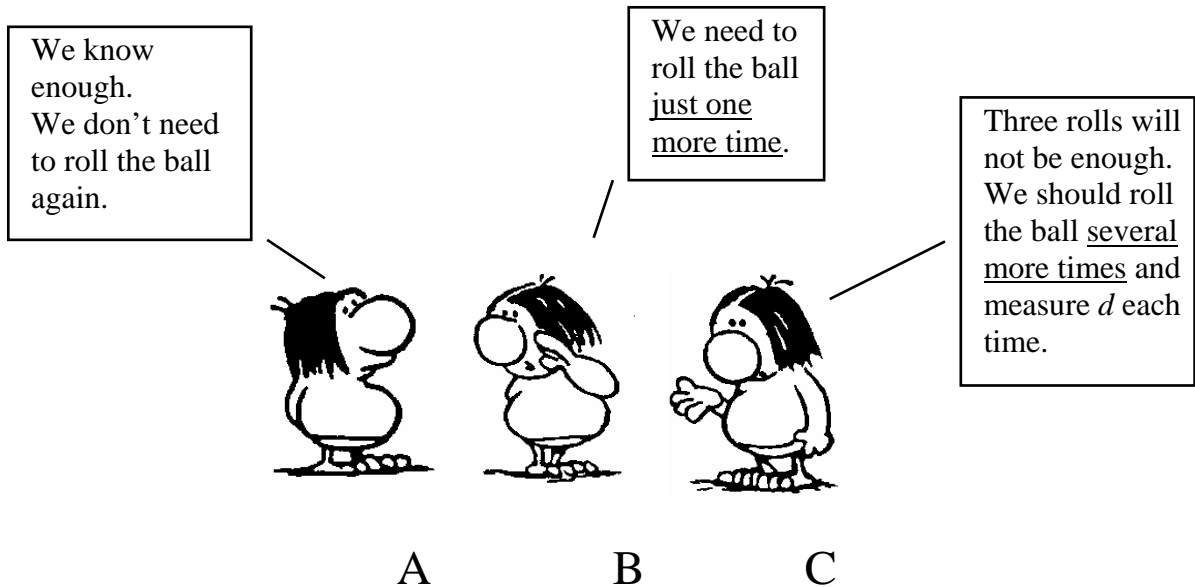


Q 4. (RDA/1)

After two rolls from the same height of  $h = 90$  mm, the students have the following readings:

First release:  $h = 90$  mm  $d = 436$  mm  
Second release:  $h = 90$  mm  $d = 426$  mm

The following discussion then takes place between the students.



With whom do you most closely agree? (Circle ONE):

A	B	C
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Explain your choice.

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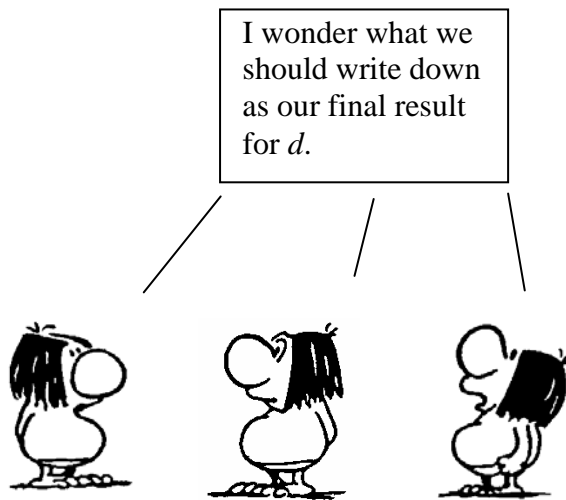


Q 5. (UR/1)

The students continue to allow the ball to roll down the slope from the same height  $h = 90$  mm. Their readings after five rolls are:

<u>Roll</u>	<u><math>d</math> (mm)</u>
1	436
2	426
3	434
4	430
5	434

The students then discuss what to write down for  $d$  as their final result.



Write down what you think the students should write down as their final result for  $d$ .

Explain your answer.

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Q 6. (UA/1)

The students decide to calculate the average of their readings for  $d$ , which is 432 mm.

<u>Roll</u>	<u><math>d</math> (mm)</u>
1	436
2	426
3	434
4	430
5	<u>434</u>
Average:	<b>432</b>

They then discuss what the average for the distance  $d$  tells them.

I think that the distance  $d$  is exactly 432 mm.

I think that the distance  $d$  is approximately 432 mm.

I think that the distance  $d$  is somewhere between 431.5 mm and 432.5 mm.

I think that the distance  $d$  is somewhere between 426 mm and 436 mm.

I don't agree with any of you.

A B C D E

With whom do you most closely agree? (Circle ONE):

A	B	C	D	E
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Explain your choice.

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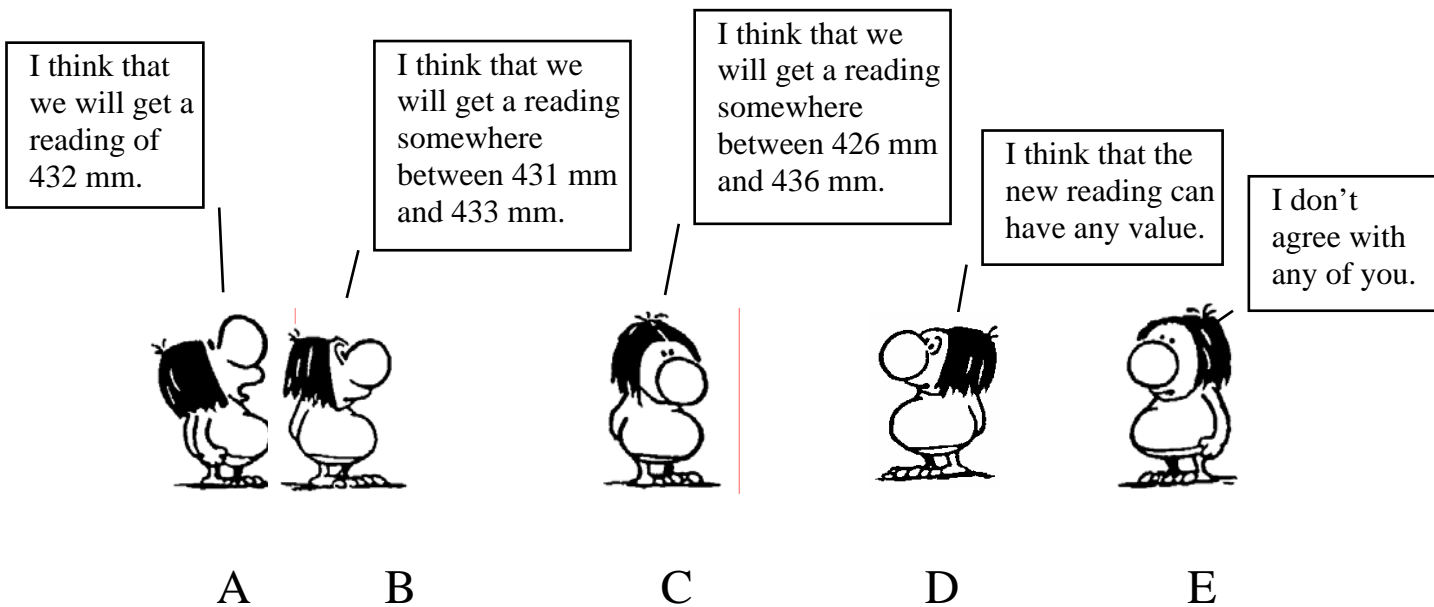


Q 7. (UAA/1)

The students have 5 readings for  $d$  obtained from allowing the ball to roll from the same height  $h = 90$  mm:

<u>Roll</u>	<u><math>d</math> (mm)</u>
1	436
2	426
3	434
4	430
5	<u>434</u>
<b>Average:</b>	<b>432</b>

The students now discuss what reading they will get for  $d$  if they roll the ball again (for the sixth time) from  $h = 90$  mm.



With whom do you most closely agree? (Circle ONE):

A	B	C	D	E
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Explain your choice.

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Q 8. (SMDS/1)

Two groups of students compare their measurement of  $d$  obtained by letting the ball roll from  $h = 90$  mm. Their readings for five rolls are shown below, together with their averages.

<u>Roll</u>	<u>Group A</u> <u><math>d</math> (mm)</u>	<u>Group B</u> <u><math>d</math> (mm)</u>
1	444	441
2	432	460
3	424	410
4	440	424
5	<u>435</u>	<u>440</u>
Average:	<b>435</b>	<b>435</b>

Our result for  $d$  is better. All our readings are between 424 mm and 444 mm. Your readings are spread between 410 mm and 460 mm.

Our result for  $d$  is just as good as yours. Our average is the same as yours. We both got 435 mm for  $d$ .

I think that the result of group B is better than the result of group A.



A



B



C

With which group do you most closely agree? (Circle ONE):

A	B	C
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Explain your choice. Do not use the word “results” in your explanation.

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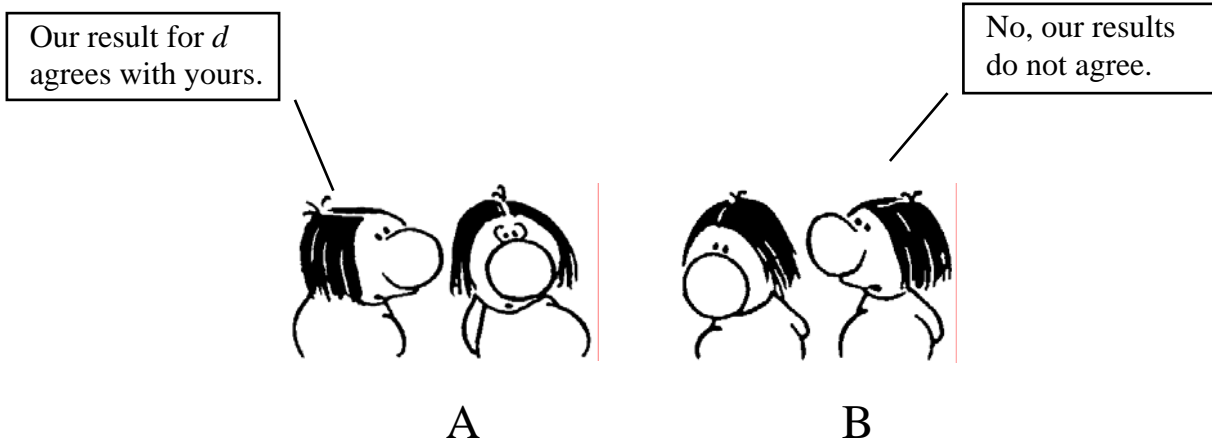
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Q 9. (DMSS/1)

Two other groups of students compare their measurement of  $d$  obtained from allowing the ball to roll from  $h = 90$  mm. Their readings for five rolls are shown below, together with their averages.

<u>Roll</u>	<u>Group A</u> <u><math>d</math> (mm)</u>	<u>Group B</u> <u><math>d</math> (mm)</u>
1	440	432
2	438	444
3	433	426
4	422	433
5	<u>432</u>	<u>440</u>
Average:	<b>433</b>	<b>435</b>



With which group do you most closely agree? (Circle ONE):

A	B
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Explain your choice. Do not use the word “results” in your explanation.

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Q 10. (SD/1)

The lecturer now comes around with a special electronic meter which has a digital display and uses it to measure the distance  $d$  for one of the rolls from  $h = 90$  mm.

Here is what the electronic meter shows:



The following discussion takes place between the students.

I think that the distance  $d$  is exactly 423.7 mm.

I think that the distance  $d$  is approximately 423.7 mm.

I think that the distance  $d$  is between 423 mm and 424 mm.

I think that the distance  $d$  is between 423.65 and 423.75 mm.

I don't agree with any of you.

A B C D E

With whom do you most closely agree? (Circle ONE):

A	B	C	D	E
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Explain your choice.

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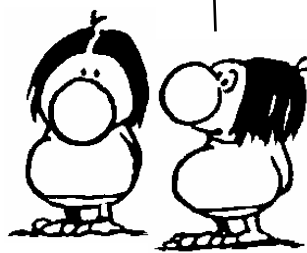
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Q 11. (UU/1)

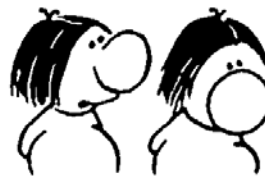
When they are finished, the two groups discuss how they can improve their rolling ball experiment next time.

If we practice enough and work very carefully, all our readings will be the same. Then we will know the true value of  $d$ .



A

No, even if your readings are all the same, you will still not know the true value of  $d$ .



B

With which group do you most closely agree? (Circle ONE):

A	B
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Explain your choice.

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Q 12.

Comments.

Are there any answers to the previous question sheets that you want to change?

**Please do not remove any sheets from the envelope.**

What was the question about and how do you want to change your answer?



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Any other comments?

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In this laboratory questionnaire, I thought that the cartoon figures were (tick one):	male	female	mixed gender
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