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CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

PHYSICS

UNIT 1 – Paper 032

ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

2 hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
5. You may use a silent, non-programmable calculator to answer questions, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. You are advised to take some time to read through the paper and plan your answers.
7. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
8. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

1. (a) In this experiment you will determine the spring constant of a laboratory spring which obeys Hooke's law.

You are provided with the following pieces of apparatus:

1. Retort stand
2. Spring
3. Twelve 10-g weights
4. Ruler
5. Spring hanger

Procedure:

1. Set up the apparatus as shown in Figure 1.

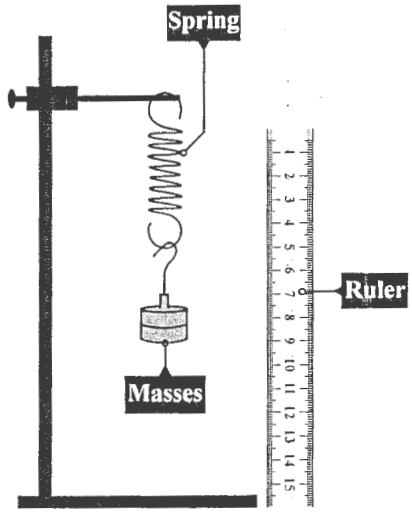

Figure 1. Experimental setup for Hooke's law

2. Place the mass hanger on the spring and record the length, L_0, of the spring.

L_0: .....

3. Add a 10-g mass to the hanger and record the new spring length, L, in Table 1.

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4. Repeat Step 3 by adding the remaining 10-g masses onto the spring and recording the corresponding spring length for EACH additional 10-g mass loaded, until a load of 100-g is reached.

5. Complete Table 1 for force, spring length and extension.

TABLE 1: VALUES FOR FORCE AND EXTENSION

Mass Loaded (g)	Force (N)	Spring length, L (cm)	Extension, e $L - L_0$ (cm)
0	0		0
10			
20			
30			
40			
50			
60			
70			
80			
90			
100			

[4 marks]

(b) (i) On the grid provided in Figure 2 **(page 7)**, plot a graph of force versus extension. **[4 marks]**

(ii) For a spring, such as the one used in the experiment, the force, F, and corresponding extension, e, are related by the equation

$$F = ke,$$

where k is the spring constant of the spring. Determine the spring constant (with appropriate units).

[4 marks]

(c) State TWO possible sources of error in this experiment and suggest how EACH error could be minimized/corrected.

Sources of Error	Steps to Minimize or Correct

[4 marks]

Total 16 marks

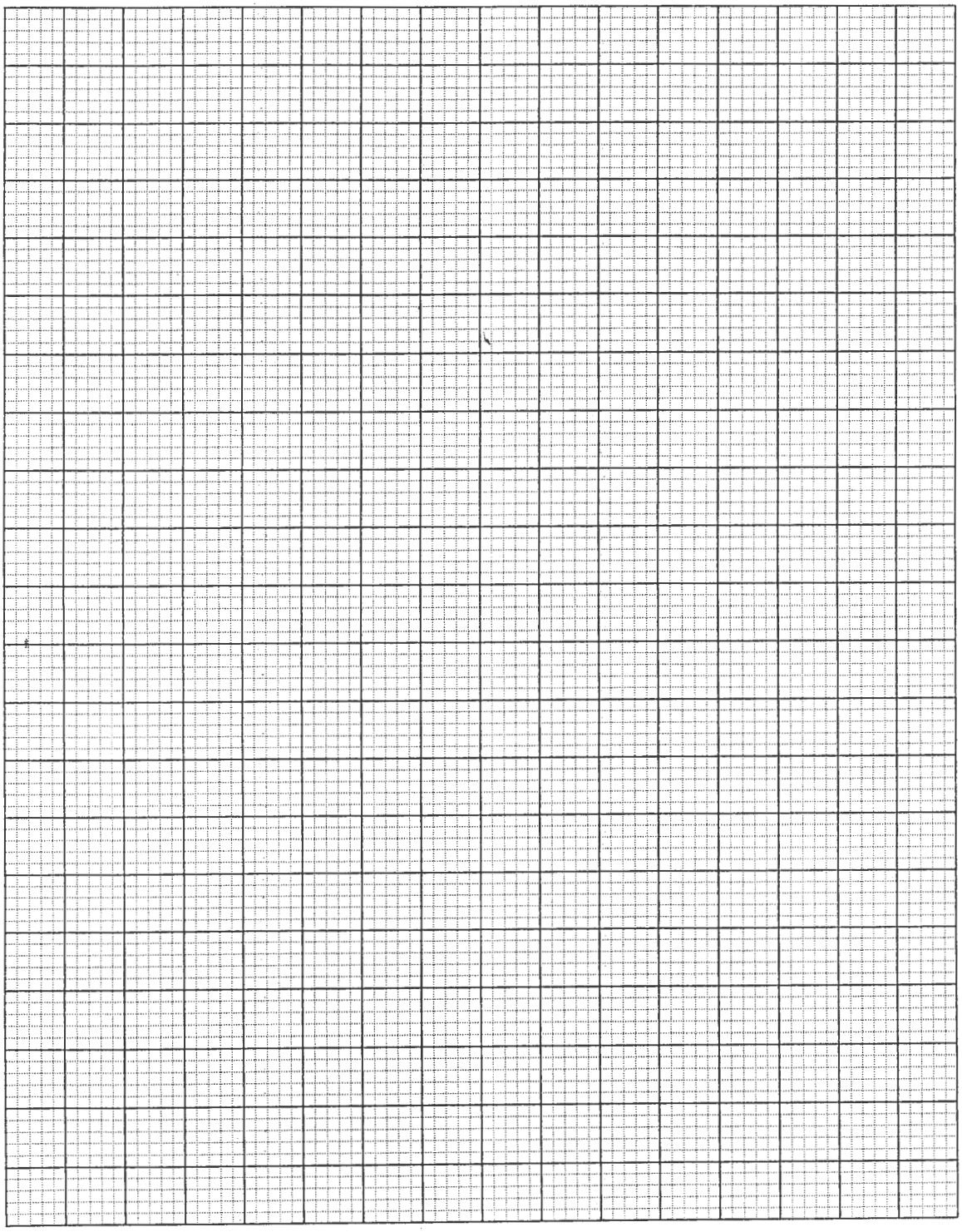

Figure 2. Force versus extension

2. A student is asked to investigate the stopping distance of a motorcycle with a high-performance braking system. To do this, she observes a motorcyclist riding and stopping the motorcycle on a test track, and measures the stopping distance, d, for different speeds, v.

It was suggested that v and d are related by the equation

$$d = \frac{v^2}{2a} + vt$$

where a is the deceleration of the motorcycle and t is the reaction time of the rider.

The values obtained for v and d are recorded in Table 2.

TABLE 2: VALUES FOR VELOCITY AND STOPPING DISTANCE

Velocity $v\ (m\ s^{-1} \pm 1)$	**Stopping Distance** $d\ (m \pm 0.5)$	$\frac{d}{v}\ (s)$
10	13.0	
15	24.5	
20	39.5	
25	57.5	
30	79.0	
35	103.0	

(a) Complete Table 2 by calculating and recording the values of $\frac{d}{v}$. **[4 marks]**

(b) (i) On the grid provided in Figure 3 **(page 9)**, plot a graph of $\frac{d}{v}$ against v and draw the best-fit straight line through your points. **[4 marks]**

(ii) Deduce the expressions for the gradient and the y-intercept in terms of a and t.

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[2 marks]

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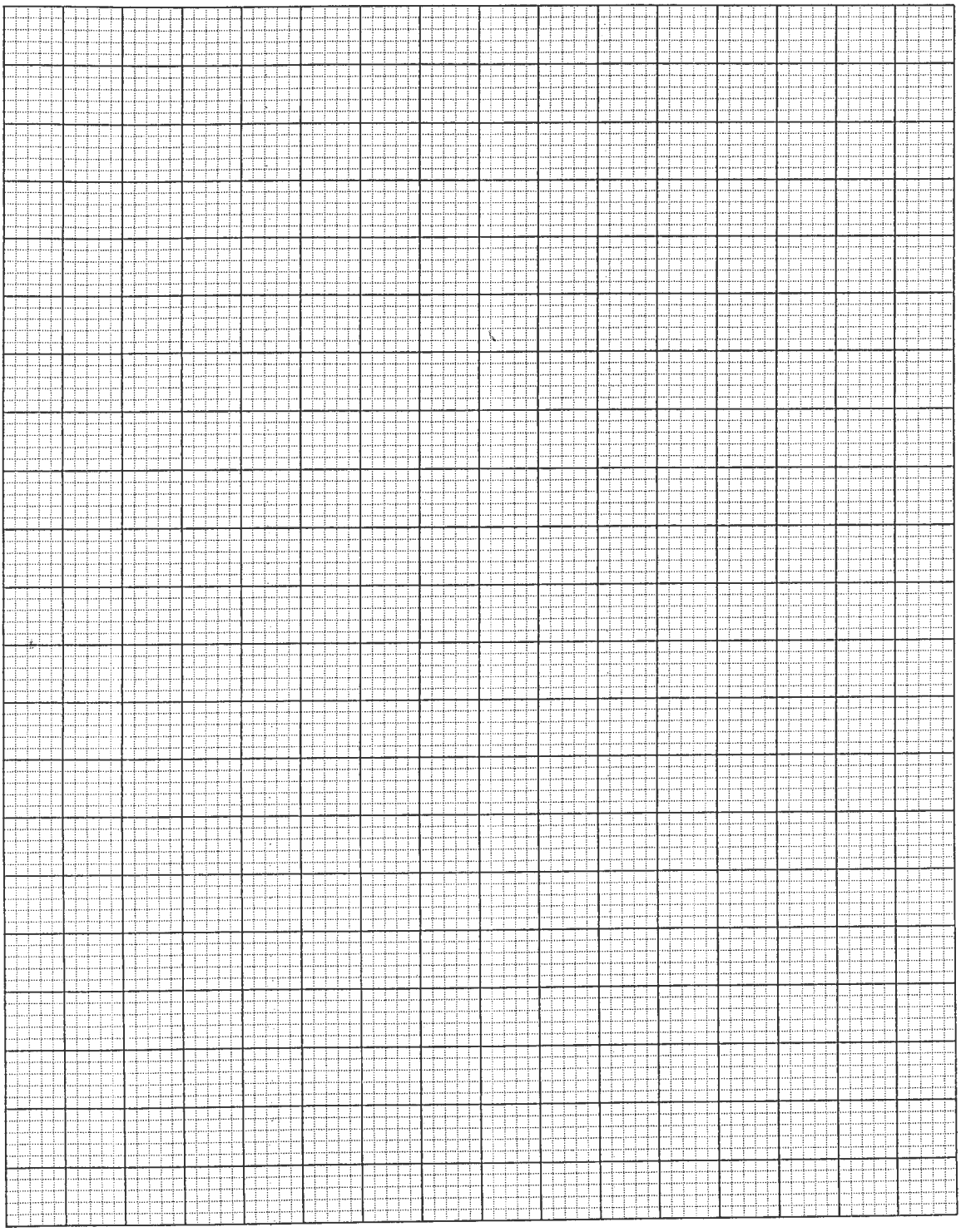

Figure 3. $\frac{d}{v}$ **versus** v

(iii) From your graph, determine the gradient AND the y-intercept.

[4 marks]

(iv) Use your answer for the gradient in (b) (iii) to calculate the value of a (include units).

[2 marks]

Total 16 marks

3. Two students are having a discussion about an experiment in which the air inside a bell jar with a ringing bell is gradually removed. One student reports that the pitch of the sound decreases as the air is removed from the jar.

He suggests that the frequency, f, of a sound wave and the pressure, p, are related by the equation

$f = kp$, where k is a constant.

Design an experiment to test the relationship between f and p. Write your answer under the following headings:

(a) Apparatus

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[3 marks]

(b) Reasons for including each item of apparatus

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[3 marks]

(c) Procedure

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[3 marks]

(d) Method of analysis of data

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[4 marks]

(e) TWO safety precautions

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[2 marks]

(f) Control variable

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[1 mark]

Total 16 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.