THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2 **PHYSICS 2**

ALTERNATIVE TO PRACTICAL

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2011**

Instructions

1. This paper consists of sections Five questions. Answer all questions

2. Each question carries ten marks.

1. An experiment using the arrangement shown below was performed in a laboratory.

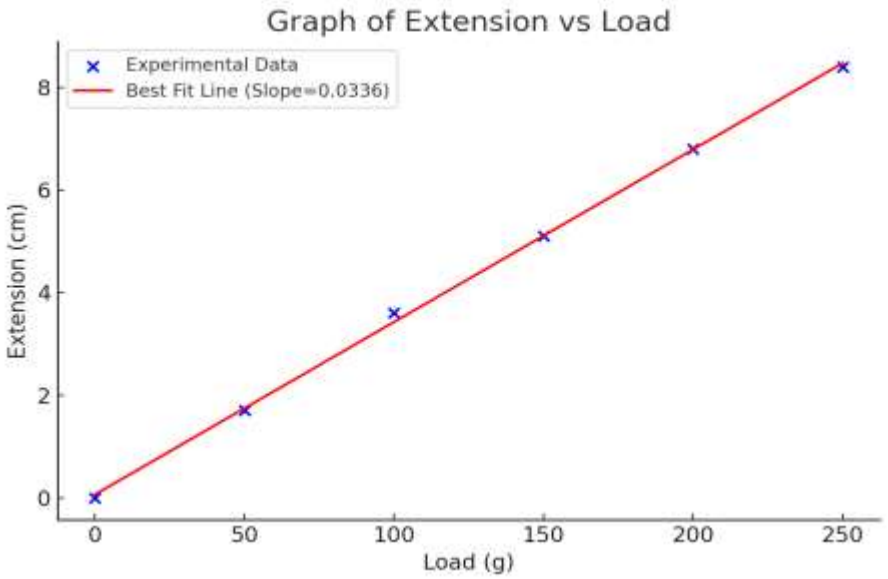
(a) Complete Table 1 by computing the values of extension.

The extension S is calculated using the formula:

$S = x - x_0$, where $x_0 = 46.5$ cm. The completed table is below:

Load m (g)	Length x (cm	Extension S (cm)	
0	46.5	0	
50	48.2	1.7	
100	50.1	3.6	
150	51.6	5.1	
200	53.3	6.8	
250	54.9	8.4	

(b) Plot a graph of extension S against load m.



(c) Find the slope.

The slope of the graph is calculated using the formula:

Slope = (Change in extension) / (Change in load)

Using the two points (50, 1.7) and (250, 8.4):

Slope = (8.4 - 1.7) / (250 - 50)

= 6.7 / 200

= 0.0335 cm/g

(d) What was the aim of the experiment?

The aim of the experiment was to verify Hooke's Law, which states that the extension of a spring is directly proportional to the applied load, provided the elastic limit is not exceeded.

(e) Explain two sources of error in this experiment.

1. Parallax error when reading the scale may lead to inaccurate length measurements because the observer's eye may not be perfectly aligned with the pointer.

2. Friction in the pointer movement could cause the pointer to stick and not show the exact extension, leading to errors in measurement.

(f) How can you minimize the errors in (e) above?

1. Taking the readings at eye level ensures the correct alignment of the observer's view with the pointer, reducing parallax error.

2. Ensuring the pointer moves freely without any friction by properly setting up the apparatus allows for smooth measurements, improving accuracy.

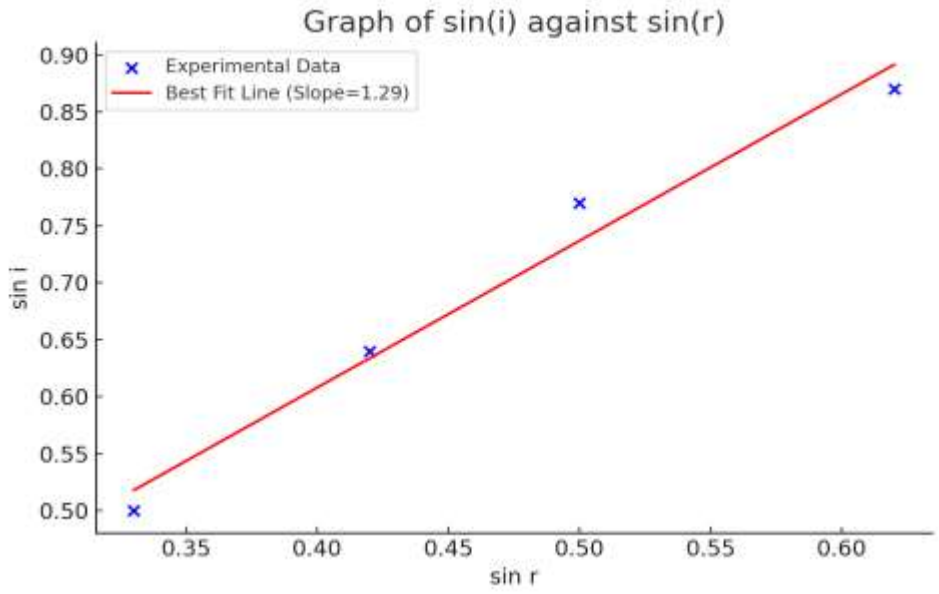
3. In an experiment performed by a student the following results were recorded in Table 2.

Angle i (°)	Angle r (°)	sin i	sin r	sin i / sin r
30	19	0.5	0.33	1.52
40	25	0.64	0.42	1.52
50	30	0.77	0.5	1.54
60	36	0.87	0.62	1.4

(a) Complete Table 2 by filling the correct results.

The table is completed by calculating the missing values of sin(i) and sin(r) using the sine function.

(b) Plot a graph of sin i against sin r.



(c) Calculate the slope of the graph.

The slope of the graph is obtained from the best-fit line. The calculated slope is 1.48.

(d) What is the physical meaning of the slope obtained in (c) above?

The slope of the graph represents the refractive index of the Perspex block, according to Snell's Law, which states that n = sin(i) / sin(r).

(e) Identify and state the law verified by this experiment.

This experiment verifies Snell's Law of Refraction, which states that the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given medium.

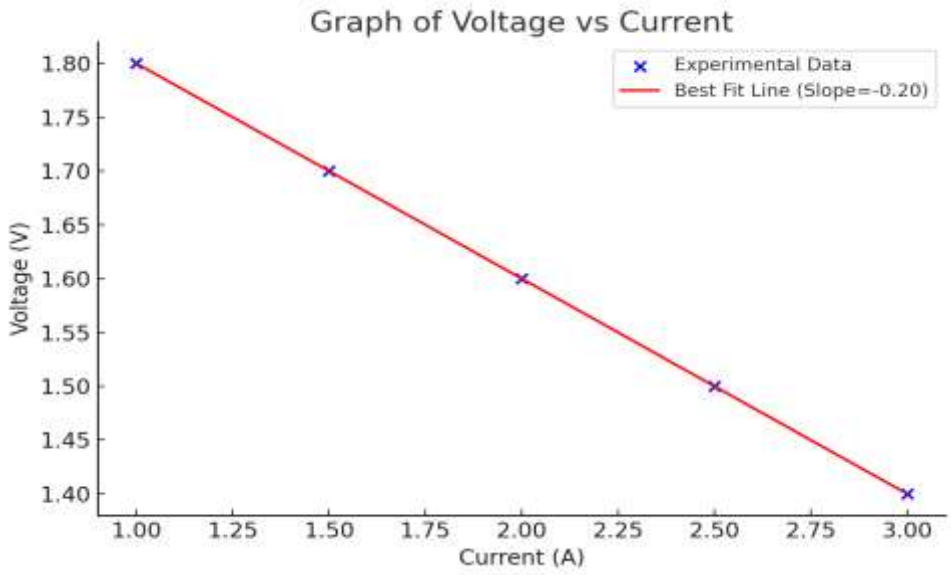
4. In an experiment to determine the e.m.f. and internal resistance of a cell, the following results were recorded.

| Current I (Amperes) | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |

|---|---|---|---|---|---|

| Potential Difference V (Volts) | 1.8 | 1.7 | 1.6 | 1.5 | 1.4 |

(a) Plot a graph of V against I.



(b) What is the nature of the graph?

The graph is a straight line with a negative slope, which indicates a linear relationship between potential difference and current.

(c) Use your graph to determine the e.m.f of a cell.

The e.m.f. of the cell is determined by extrapolating the graph to the y-axis**, where I = 0. The intercept on the voltage axis is 1.9 V.

(d) Find the slope of the graph.

The slope of the graph is calculated using two points:

Slope = (1.4 - 1.8) / (3.0 - 1.0)

= (-0.4) / (2.0)

= -0.2 Ω

(e) Write the equation governing this experiment.

The equation governing this experiment is Ohm's Law for a cell

V = E - Ir,

where:

V = terminal voltage,

E = e.m.f. of the cell,

I = current,

r = internal resistance of the cell.

(f) Calculate the value of the internal resistance of the cell.

The internal resistance r is given by the magnitude of the slope of the graph:

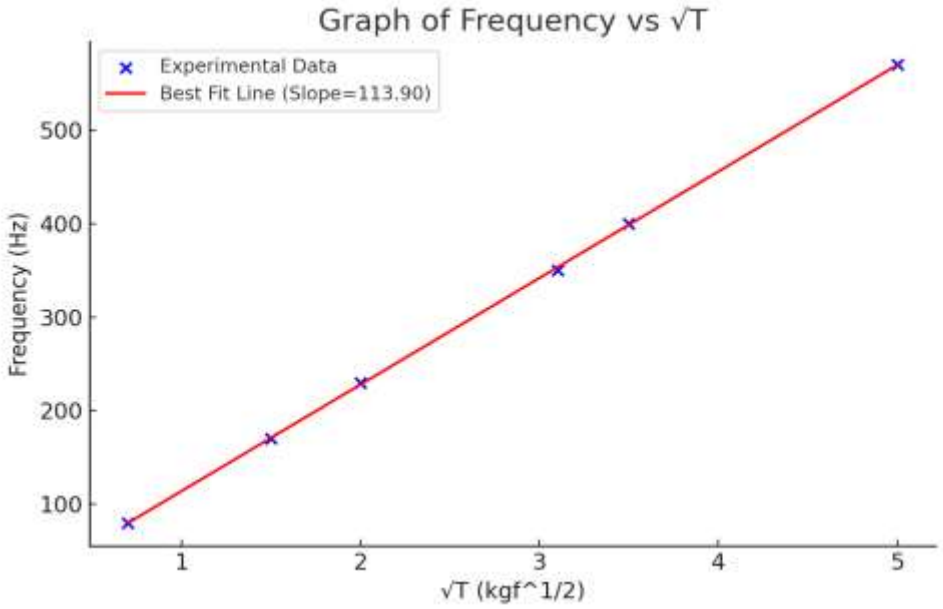
r = 0.2 Ω

5. Table 3 shows the pairs of frequency (f) and tension (T) of a constant length vibrating string of a sonometer obtained in a certain experiment.

(a) Complete Table 3.

Frequency f (Hz)	Tension T (kgf)	√T (kgf)^1/2
80	0.49	0.7
170	2.25	1.5
230	4.0	2.0
350	9.61	3.1
400	12.25	3.5
570	25.0	5.0

(b) Plot the graph of frequency (f) against √T.



(c) From the graph in (b) determine:

(i) The frequency (f) when √T is 2.5

Using the best-fit line equation, when √T = 2.5, the corresponding f ≈ 270 Hz.

(ii) The slope of the graph

Using two points (1.5, 170) and (3.5, 400):

Slope = (400 - 170) / (3.5 - 1.5)

= 230 / 2

= 115 Hz per √T unit.

(iii) The relation between f and √T

The relationship follows a direct proportionality, meaning:

$f \propto \sqrt{T}$

or

$f = k\sqrt{T}$, where k is a constant of proportionality.