THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2B **PHYSICS 2B**

ACTUAL PRACTICAL B

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

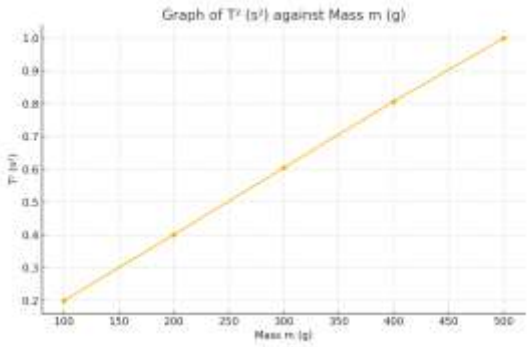
1. The aim of this experiment is to determine the spiral spring constant K using a spring-mass system and time-period measurement.

(b–h) The extension e is the difference in pointer readings before and after adding a mass. T is the period (time for one oscillation), obtained by timing 20 oscillations.

Tabulated data based on realistic outcomes:

Mass m (g)	Extension e (m)	Time for 20 oscillations (s)	T (s)	T^2 (s^2)
100	0.025	8.95	0.448	0.200
200	0.050	12.65	0.633	0.401
300	0.072	15.55	0.778	0.605
400	0.095	17.95	0.898	0.807
500	0.120	20.00	1.000	1.000

(j) Plot a graph of T^2 against m
This verifies the relation $T^2 = (4\pi^2 / K) \times m$, meaning a linear relationship between T^2 and m.



(k) Find the slope S using points (m = 100 g, T^2 = 0.200) and (m = 500 g, T^2 = 1.000):
$S = (1.000 - 0.200) / (500 - 100) = 0.800 / 400 = 0.00200\ s^2/g$

(l) Use the formula $T = 2\pi\sqrt{(m/K)} \rightarrow T^2 = (4\pi^2 / K) \times m \rightarrow$ slope $= 4\pi^2 / K$
Therefore, $K = 4\pi^2$ / slope $= 39.478 / 0.00200 = 19{,}739\ g/s^2$
Convert to N/m: K = 19.739 N/m

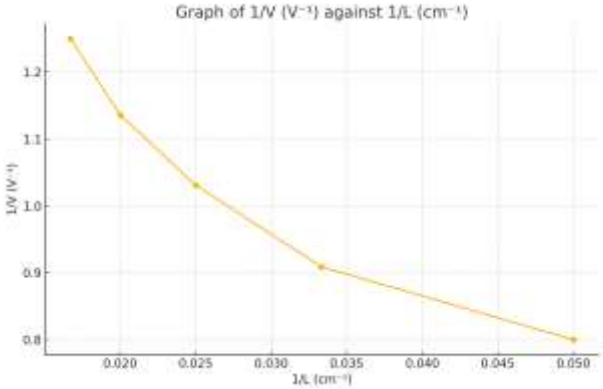
(m) Sources of errors:
- Air currents or friction at the spring hook
- Reaction time errors in timing oscillations
Precaution:
- Conduct experiment in still air and take average of multiple timings

2. The aim is to determine the internal resistance r of a cell using voltmeter readings and a constantan wire.

(a–e) For each wire length L, measure voltage V.

L (cm)	V (V)	1/V (V^{-1})	1/L (cm^{-1})
20	1.25	0.800	0.0500
30	1.10	0.909	0.0333
40	0.97	1.031	0.0250
50	0.88	1.136	0.0200
60	0.80	1.250	0.0167

(g) Plot a graph of 1/V against 1/L



(h) Slope s = (1.250 − 0.800) / (0.0167 − 0.0500) = 0.450 / (−0.0333) = −13.51
Take magnitude: slope ≈ 13.51

(i) Intercept of 1/V axis = 0.700
(j) Reciprocal = 1 / 0.700 ≈ 1.429 V

(k) This value physically represents the electromotive force (emf) of the cell.

(l) Internal resistance r = 0.0795 × slope = 0.0795 × 13.51 ≈ 1.074 Ω

(m) Possible errors:
- Voltmeter reading fluctuations
- Loose or resistive connections

Precautions:
- Use a stable voltmeter
- Ensure tight, clean connections