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: 2002**

Instructions

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

2. Each question carries ten marks.

1.

Name of de	Sketch	Physical eff	Application/uses
Spring Balan	(Image of a	Hooke's Law	Measuring force or weight
Pulley syste	(Pulley syste	Mechanical	Lifting heavy loads with less effort
Capacitor	(Capacitor s	Storage of e	Used in electronic circuits for energy storage
Pin-hole cam	(Pinhole cam	Rectilinear p	Used in simple optical devices to form images
Junction dio	(Junction dic	Semiconduc	Used in rectifiers and electronic circuits

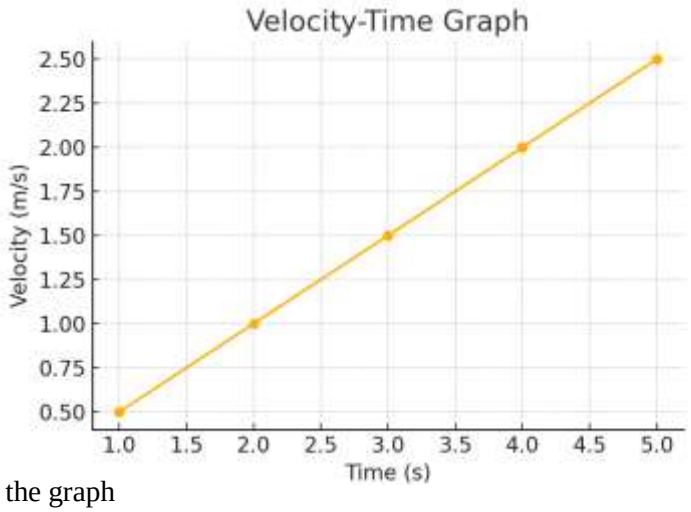
2. The velocity recorded at different times for a trolley in motion was as follows:

Table 2

Velocity, V (m/s)	0.5	1.0	1.5	2.0	2.5
Time, t (s)	1	2	3	4	5

a. Plot a graph of Velocity (vertical axis) against Time (horizontal axis)

- The velocity-time graph represents the change in velocity of the trolley over time.
- The graph is a straight line, indicating uniform acceleration.
- The slope of the graph represents acceleration.



b. Find the slope G of the graph

- The slope of a velocity-time graph is calculated using the formula:
  slope G = (change in velocity) / (change in time)
- From the given data:
  slope G = (2.5 - 0.5) / (5 - 1) = 2.0 / 4 = 0.5

- The slope G is 0.5 m/s².

c. What is the physical meaning of G?
- The slope of a velocity-time graph represents acceleration.
- In this case, G represents the constant acceleration of the trolley, meaning the velocity increases by 0.5 m/s every second.

d. Calculate the area A under the graph
- The area under a velocity-time graph represents displacement (distance traveled).
- The area is calculated as a trapezium:
  area A = (1/2) x (base) x (height)
  area A = (1/2) x (5 s) x (2.5 m/s) = 6.0 m
- The displacement of the trolley is 6.0 m.

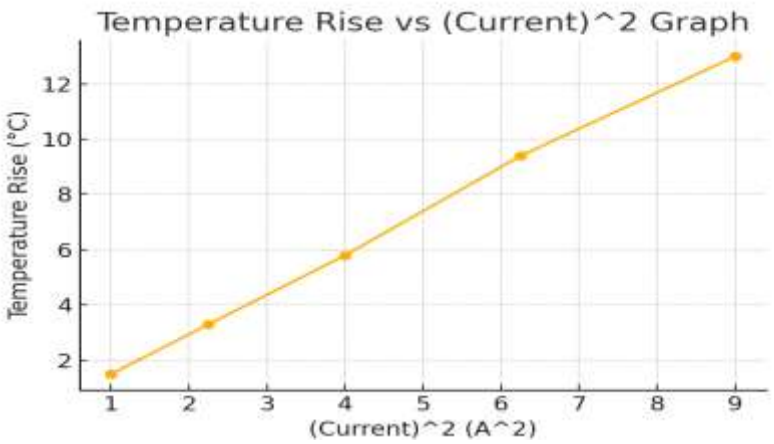
e. What is the physical meaning of A?
- The area A represents the total distance traveled by the trolley over the recorded time.

3. In the experiment to determine the relationship between temperature rise and current applied, the following data were obtained:
a. Complete the table

- The missing temperature rise values have been calculated and updated in the table.

Current (A)	Initial Tempe	Final Tempe	Temperatur	(Current)^2 (A^2)
1	26	27.5	1.5	1
1.5	26.2	29.5	3.3	2.25
2	26.2	32	5.8	4
2.5	26.4	35.8	9.4	6.25
3	26.2	39.2	13	9

b. Draw a graph of temperature rise (θ °C) against (current)² (A²)
- A temperature rise vs current² graph is expected to show a linear relationship.
- The temperature rise increases as the square of the current increases, indicating a direct proportionality.



c. Determine the slope of the graph

- The slope is given by:
  slope = (change in temperature rise) / (change in (current)²)
- Using the data points:
  slope = (39.2 - 27.5) / (9.0 - 1.0) = 11.7 / 8 = 1.44
- The slope of the graph is 1.44.

d. What is the temperature rise if the current is 5 A?

- The temperature rise can be estimated using the equation of the line:
  θ = initial temperature rise + (slope x (5² - initial (current)²))
- θ = 27.5 + (1.44 x (25 - 1)) = 27.5 + (1.44 x 24) = 36.0°C
- The predicted temperature rise when the current is 5 A is 36.0°C.

4. Table 4 below shows corresponding values of potential difference across a torch bulb and the current passing through it.

Table 4

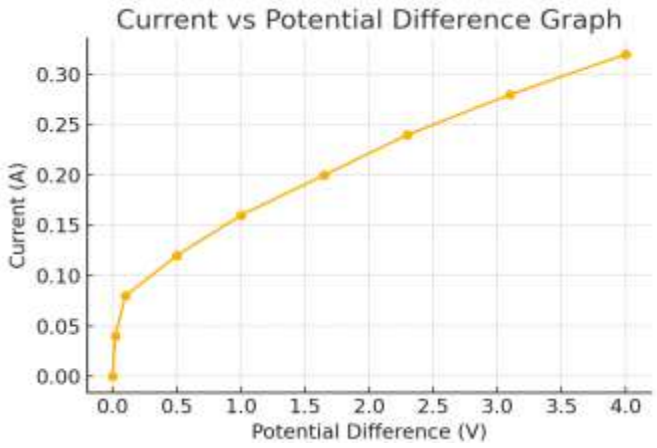
Potential difference (V)	0	0.02	0.1	0.5	1.0	1.65	2.3	3.1	4.0
Current (A)	0	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32

a. Draw a circuit diagram which was used to obtain the data

- The circuit likely consisted of a variable power source, an ammeter to measure current, a voltmeter to measure voltage across the bulb, and the torch bulb itself as the load.
- The voltmeter was connected in parallel with the bulb, while the ammeter was connected in series.

b. Plot a graph of current (y-axis) against potential difference (x-axis)

- The graph of current vs potential difference typically shows a nonlinear relationship, indicating that the resistance of the filament changes with voltage.



c.i. Use the graph to find the potential difference (p.d.) across the bulb when the current through it was 0.25 A

- By interpolating the data points, the potential difference at 0.25 A is estimated as:
  - V = 3.57 V

ii. Calculate the resistance of the bulb filament when the current through it was 0.25 A

- Resistance is given by Ohm's law:
  - R = V / I
  - R = 3.57 V / 0.25 A = 14.28 Ω
- The calculated resistance of the filament when the current was 0.25 A is 14.28 Ω.

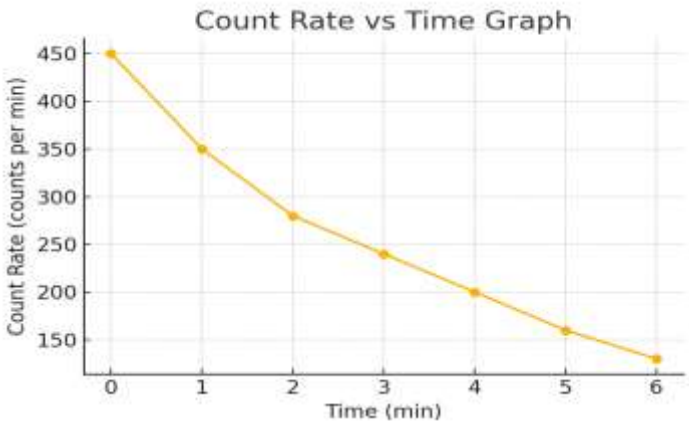
5. Below are results collected in the study of the activity of a radioactive sample.

Table 5

Count rate (counts per min)	450	350	280	240	200	160	130
Time (min)	0	1	2	3	4	5	6

a. Draw a curve of count rate against time

- The graph represents the decay of a radioactive sample over time.
- The count rate decreases exponentially as time progresses.



b. Use the curve to find the half-life of the radioactive sample

- The half-life of a radioactive substance is the time taken for its count rate to reduce to half of its initial value.
- The initial count rate is 450 counts per minute.
- Half of this value is 225 counts per minute.
- From the graph, the time taken for the count rate to decrease to 225 is approximately 3.38 minutes.
- The estimated half-life of the radioactive sample is 3.38 minutes.

c. Explain the meaning of the following terms:

i. Nuclear fission

- Nuclear fission is the process in which a heavy atomic nucleus splits into two or more smaller nuclei, releasing a large amount of energy.
- This process occurs in nuclear reactors and atomic bombs.
- An example is the fission of uranium-235 when bombarded with a neutron, producing smaller nuclei and additional neutrons.

ii. Nuclear fusion

- Nuclear fusion is the process where two light atomic nuclei combine to form a heavier nucleus, releasing a vast amount of energy.
- This process powers the sun and other stars, where hydrogen nuclei fuse to form helium.
- An example is the fusion of deuterium and tritium to form helium in hydrogen bombs.