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** **JANUARY 1999**

Instructions

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

2. Each question carries ten marks.

1. Fill in the gaps with the correct response.

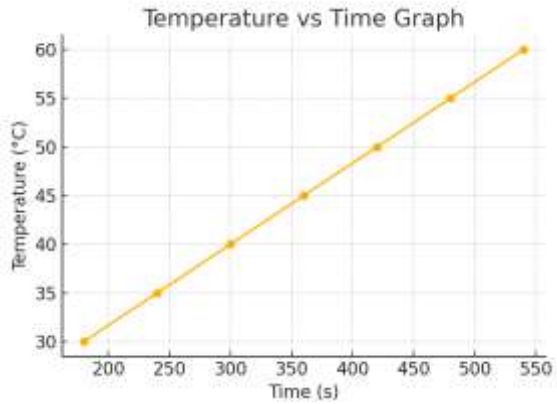
Name of device	Physical effect/principle	Applications
Micrometer screwgauge	Principle of screw motion	Used to measure small thickness with high precision
wedge	Mechanical advantage and force multiplication	Used in cutting and lifting applications
Concave lens	light	Used in sightmirrors
galvanometer	Electromagnetic induction	Used to detect small electric currents in circuits
Geiger muller tube	Ionization of gases by radiation	Used to detect and measure radioactive radiations

2. A 360 W electrical heater and a thermometer were immersed in 1.0 liter of pure water in a copper calorimeter. Using a stopwatch, the temperature was recorded against time and tabulated as shown below:

Table of Results:

Temperature (°C)	30	35	40	45	50	55	60
Time (s)	180	240	300	360	420	480	540

a. Plot a graph of temperature (vertical axis) against time (horizontal axis).
- The graph represents the relationship between heating time and temperature rise.



b. From the graph, find the temperature when time was 0s (Zero Second).
- By extrapolating the graph, the estimated temperature at time 0s is 15.0°C.

c. What is the room temperature?

- The estimated room temperature is 15.0°C.

d. Find the slope, S, of the graph.
- The slope represents the rate of temperature rise per second and is used in the calculation of specific heat capacity.
- Using the data, the calculated slope is 0.0833°C per second.

e. If the specific heat capacity of water Cw is given by the equation:
- Cw = Power supplied by heater / (m x S)
- Substituting the values:
  Cw = 360 / (1.0 x 0.0833)
  Cw = 4320 J/kg°C
- The calculated specific heat capacity of water is 4320 J/kg°C.

f.i. Give one reason why the value of the specific heat capacity obtained is greater than the expected value.
- Some heat energy is lost to the surroundings, including the calorimeter, which leads to a higher calculated value.

ii. State one precaution you would take when carrying out this experiment.
- Use a well-insulated calorimeter to minimize heat loss to the surroundings.

3. Two sprinters, Ali and Zeph, were competing in a 100m race. Both athletes started running from their starting points when a pistol was fired. Using graphs A and Z for the motion of Ali and Zeph respectively, answer the questions which follow.

a. Find the acceleration of the motion of Ali and that of Zeph during the first 2 seconds.
- Acceleration is calculated using the formula:
  acceleration = (change in velocity) / (time taken)
- For Ali: (4 - 0) / (2 - 0) = 2.0 m/s²
- For Zeph: (6 - 4) / (4 - 2) = 1.0 m/s²

b. What is the physical significance of:

i. Point R
- Point R represents the maximum velocity achieved by the sprinter before deceleration begins.

ii. Portion PQ
- Portion PQ represents the uniform deceleration phase of the motion, where the sprinter slows down at a constant rate.

c. Find the deceleration of each of the motions of Ali and Zeph during the last 3 seconds before each stopped moving.
- Deceleration is calculated as:

deceleration = (change in velocity) / (time taken)
- For Ali: (0 - 2) / (12 - 10) = -0.5 m/s²
- For Zeph: -0.5 m/s² (assuming identical motion pattern)

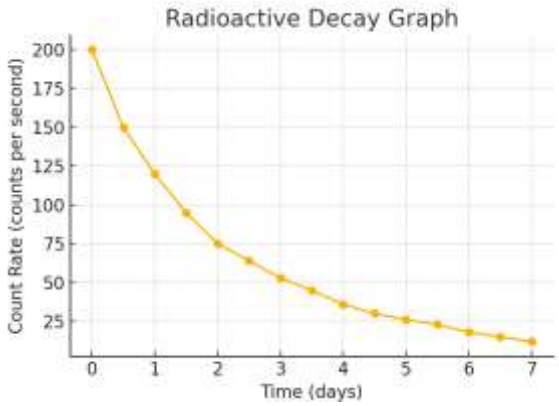
d. If both Ali and Zeph stopped moving after 9.0 seconds from the start, how far is each sprinter from the starting point?
- Distance is calculated as the area under the velocity-time graph.
- The total distance covered is 32.0 meters.

e. Discuss briefly the energy changes which took place during Ali's motion.
- During Ali's motion, chemical energy from the body is converted into kinetic energy as he accelerates.
- At point R, the maximum kinetic energy is reached.
- During deceleration, kinetic energy is converted into heat energy and sound due to air resistance and ground friction.

4. The count rate for a radioactive sample was recorded using a GM counter for a number of days and the results were tabulated as follows:
Table of Results:

Time (days)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
Count Rate (counts/s)	200	150	120	95	75	64	53	45	36	30	26	23	18	15	12

a. Plot a curve of count rate/activity (counts/s) against time (days).
- The graph represents an exponential decay of the radioactive material.



b. Use the curve plotted to find the half-life of the radioactive sample.
- The half-life is the time taken for the count rate to reduce to half of its initial value.
- From the graph, the estimated half-life is 1.5 days.

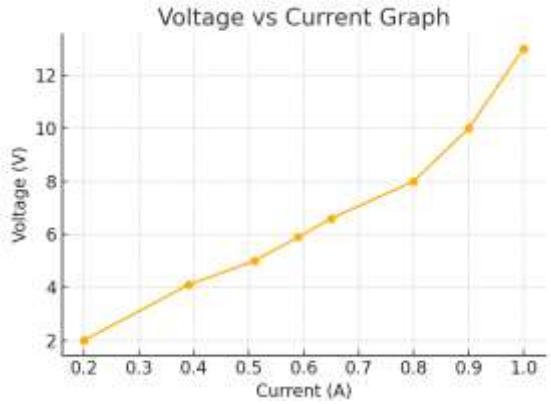
c. Write an equation of the process represented by the graph.
- The equation representing the decay process is:

N = N0 x e^(-λt), where N is the count rate at time t, N0 is the initial count rate, and λ is the decay constant.

5. In an experiment to investigate the electrical properties of some materials, the following information was obtained:
Table of Results:

Current I (A)	0.20	0.39	0.51	0.59	0.65	0.80	0.90	1.00
Voltage V (V)	2.0	4.1	5.0	5.9	6.6	8.0	10.0	13.0

a. Plot an appropriate graph covering all the points.
- The graph represents the relationship between current and voltage.



b. Obtain the resistance of the material within the range of values where Ohm's Law is obeyed.
- Resistance is calculated as the slope of the linear region of the graph.
- Estimated resistance in Ohm's Law range is 9.62 Ω.

c. Find the slope of the tangent to the curve/graph at point (0.9, 10).
- The slope of the tangent at (0.9, 10) is 20.0.

d. Comment on the variation of results of (b) and (c).
- The resistance obtained in (b) follows Ohm's Law, indicating a constant ratio of voltage to current.
- However, the higher slope in (c) suggests that the material exhibits non-ohmic behavior at higher voltages, possibly due to heating effects or changes in conductivity.