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: 2001**

Instructions

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

2. Each question carries ten marks.

1.

Name of device	Sketch	Physical effect/principle	Application/uses
Simple pendulum	(Simple pendulum diagram)	Oscillatory motion and simple harmonic motion	Used in timekeeping and physics experiments
Thermocouple	(Thermocouple in liquid)	Thermoelectric effect	Used in temperature measurement and sensing
Hydraulic press	(Hydraulic press system)	Pascal's principle	Used in hydraulic systems like car lifts and braking systems
Periscope	(Periscope diagram)	Reflection of light	Used in submarines and periscopic instruments
Electromagnet	(Electromagnet illustration)	Magnetic effect of electric current	Used in electric bells, relays, and magnetic lifting devices

2. A cord was stretched by attaching known masses of brass to it as shown below. The data collected was tabulated as follows:

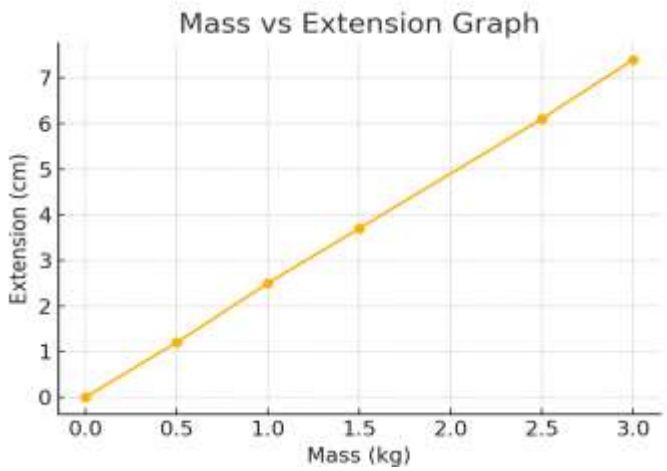
a. Complete the table for extension e (cm)

- The extension is found by subtracting the initial length of the cord (126.4 cm) from the length at each mass.

Mass (kg)	Length (cm)	Extension (cm)
0.0	126.4	0.0
0.5	127.6	1.1999999999999886
1.0	128.9	2.5
1.5	130.1	3.6999999999999886
2.5	132.5	6.099999999999994
3.0	133.8	7.400000000000006

b. Draw a graph of mass m (kg) against extension e (cm)

- The graph of mass vs extension should be a straight line, showing that the extension is proportional to the mass applied.
- This follows Hooke's Law, which states that extension is proportional to force within the elastic limit of the material.



c. Use the graph to find the extension for a mass of 2.0 kg

- Using linear interpolation from the graph, the extension when the mass is 2.0 kg is estimated to be 4.90 cm.

d. Find from the graph the extension for a force of 12.5 N

- Force is calculated using $F = mg$, where $g = 9.8\ m/s^2$.
- The equivalent mass for 12.5 N is $12.5 / 9.8 = 1.28$ kg.
- By interpolating the graph, the extension corresponding to this mass is 3.16 cm.

3. The following figure shows the diagram for an experiment in which a clear liquid L was placed in a tall beaker and pin O was sighted by an eye using a search pin.

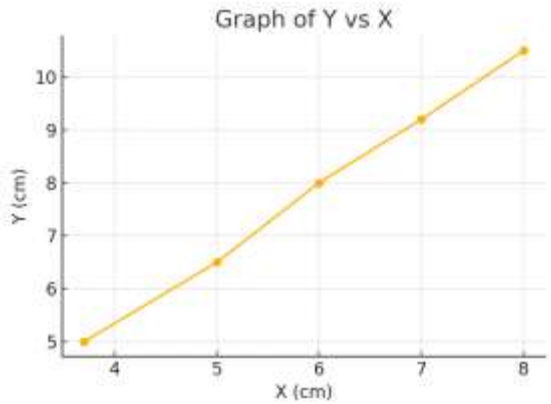
Different values of Y and the corresponding values of X were obtained and tabulated as follows:

Table

Y (cm)	5.0	6.5	8.0	9.2	10.5
X (cm)	3.7	5.0	6.0	7.0	8.0

a. Plot the graph of Y (vertical axis) against X (horizontal axis)

- The graph represents the relationship between the real depth Y and the apparent depth X.
- The slope of the graph is expected to represent the refractive index of the liquid.



b. Find the slope m of the graph

- The slope of the graph is given by:
  slope m = (change in Y) / (change in X)
- Using the data points:
  slope m = (10.5 - 5.0) / (8.0 - 3.7) = 5.5 / 4.3 = 1.28
- The calculated slope m is 1.28.

c. What is the physical meaning of m?

- The slope m represents the refractive index of the liquid, as this experiment is likely related to the measurement of refraction using the apparent depth method.

d. Suggest the aim of this experiment.

- The aim of this experiment is to determine the refractive index of the liquid by measuring the real and apparent depth.

e. Mention one source of error in this experiment.

- One source of error in this experiment is parallax error when aligning the search pin with the apparent position of the object pin.

4. The heat developed by a heater in different times due to the flow of current was recorded as follows:

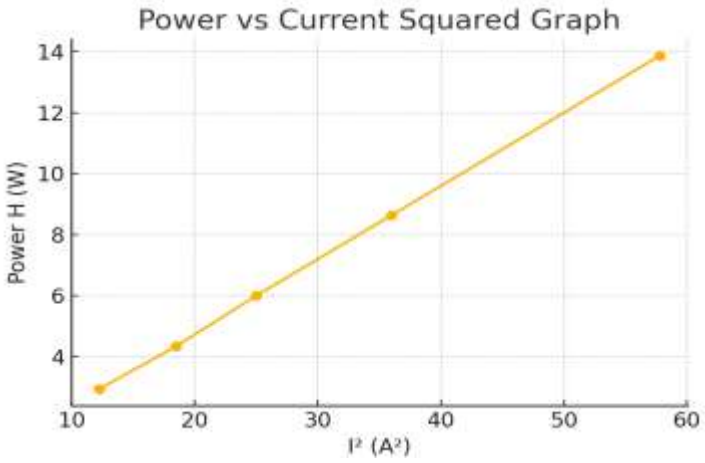
a. Complete the table by adding rows for the respective values of H (W) and I^2 (A^2)

- Power H is calculated using the formula: H = Q / t.
- The square of the current I^2 is also calculated for each case.

Current (A)	Heat Q (J)	Time (s)	Power H (W)	I^2 (A^2)
7.6	416.0	30.0	13.866666666666667	57.76
6.0	432.0	50.0	8.64	36.0
5.0	420.0	70.0	6.0	25.0
4.3	434.0	100.0	4.34	18.49
3.5	441.0	150.0	2.94	12.25

b. Draw a graph of heat developed per second H (W) against the square of the current, I^2

- The graph should show a linear relationship between power H and I^2, indicating that power is proportional to the square of the current, following Joule's law of heating.



c. Determine the slope S of the graph

- The slope is given by:
  slope S = (change in power H) / (change in I^2)
- Using the calculated values, the slope is found to be 0.24.

d. What does S represent?

- The slope S represents the resistance of the heater, as per Joule's Law ($H = I^2R$).
- Since power H is proportional to I^2, the slope of the graph corresponds to the resistance of the heating element.

5. The following graph represents the count rate of a radioactive source over time.

a. Use the graph to find

i. Half-life of the radioactive source of β– particles

- The half-life of a radioactive substance is the time taken for its count rate to decrease to half of its initial value.
- From the graph, the initial count rate is determined at t = 0.
- The time at which the count rate reaches half of this value is identified as the half-life.
- The estimated half-life from the graph is approximately 8 minutes.

ii. Count rate of the radioactive source when the time (t) was 12.5 min

- From the graph, the count rate corresponding to t = 12.5 min is interpolated.
- The estimated count rate at this time is about 120 counts per minute.

b. What would be the effect of

i. Placing the rate counter far away from the source?

- As the distance between the radioactive source and the counter increases, the count rate decreases.
- This happens because radiation follows the inverse square law, meaning intensity reduces with the square of the distance.

ii. Placing a thin sheet of paper between the rate counter and the radioactive source?

- Since β-particles are low-penetrating radiation, a thin sheet of paper will absorb or significantly reduce their intensity.
- This results in a sharp drop in the count rate detected by the counter.

c. Briefly explain what would be the effect on the β– particles when a pole of a strong bar magnet is placed in their path.

- β– particles are negatively charged electrons and are deflected by a magnetic field.
- When a strong bar magnet is placed, the β– particles will be deflected in a circular or curved path due to the Lorentz force acting on them.
- The direction of deflection follows Fleming's Left-Hand Rule, meaning they curve perpendicularly to both the field and their motion.