

CIE A-Level Physics 9702 Paper 5 Practice

Paper (Planning, Analysis and Evaluation)

Total: 30 marks · 1 h 15 min · 2 questions · 11 parts

Data and formulae

Quantity	Value
Acceleration of free fall g	9.81 m s^{-2}
Elementary charge e	$1.60 \times 10^{-19} \text{ C}$
Electron rest mass	$9.11 \times 10^{-31} \text{ kg}$
Planck constant h	$6.63 \times 10^{-34} \text{ J s}$
Speed of light c	$3.00 \times 10^8 \text{ m s}^{-1}$
Permittivity of free space ϵ_0	$8.85 \times 10^{-12} \text{ F m}^{-1}$

Q 1 · Planning: frequency of a stretched wire and tension [15]

- (a) A student investigates how the frequency f of a stretched wire depends on the tension T . The length and the material of the wire are kept the same. State the independent variable, the dependent variable and two control variables. [2]
- (b) Describe how the tension T is changed in steps between 2.0 N and 8.0 N and how each value of T is found accurately. [3]
- (c) Describe how the wire is made to resonate and how its frequency f is measured accurately. [4]
- (d) Theory gives $f = (1/2l) \times \sqrt{T/\mu}$. State which graph should be plotted to test this relationship, the expected shape of the graph and the meaning of the gradient. [3]
- (e) Give three precautions that improve the reliability of this experiment and state one safety risk. [3]

Q 2 · Analysis and evaluation: capacitor discharge [15]

(a) A 6.00 V capacitor discharges through a 220 k ohm resistor. The student obtains the data below. Complete the last column, $\ln(V/V_0)$, to two decimal places.

t / s	V / V	$\ln(V/V_0)$
0	6.00	
10	3.64	
20	2.21	
30	1.34	
40	0.81	
50	0.49	

[2]

(b) Plot a graph of $\ln(V/V_0)$ against t and draw the best-fit straight line. Describe the line you obtain. [3]

(c) Determine the gradient of your line and give its unit. [2]

(d) During discharge $V = V_0 \exp(-t/RC)$, so the gradient of $\ln V$ against t equals $-1/(RC)$. Use your gradient to find the capacitance C. [2]

(e) The resistor is marked with a tolerance of plus or minus 5% and the gradient read from the graph has an uncertainty of plus or minus 3%. Find the percentage and the absolute uncertainty in C. [2]

(f) Evaluate two sources of error in this experiment and suggest one specific improvement for each. [4]