



General Certificate of Education
Advanced Level Examination
June 2015

Physics

PHY6T/P15/TN

Unit 6 Investigative and Practical Skills in A Level Physics

Investigative Skills Assignment (ISA) P

Teachers' Notes

Confidential

The Exams Officer should make two copies of these Teachers' Notes; one copy for the Head of A-level Physics and one for the technician.

These copies can be released to the Head of A-level Physics and the technician at any point following publication but must be kept under secure conditions at all times.

Teachers can have sight of the Teachers' Notes but no further copies should be made.

All teacher-assessed marks to be submitted by 15 May.

ISA (P) Capacitor Discharge

Centre instructions for the investigation

In this ISA candidates will be required to investigate how the pd across a capacitor varies with time as it discharges through different resistances. Candidates should be familiar with the significance of the time constant when a capacitor discharges through a resistor.

Information for centres

Candidates should be told approximately one week before undertaking Stage 1 of the ISA that the investigation will involve measuring how the pd varies with time as a capacitor discharges through a combination of resistors that may be in series or in parallel.

Apparatus

Centres should ensure that the apparatus provided can be used safely. Each candidate will need:

- (a) 6 V battery or a stabilised low-voltage power supply set to provide an emf of 6 V.
Rechargeable batteries should not be used as there is a risk of short circuiting
- (b) three resistors labelled with their values: 56 k Ω , 120 k Ω and 220 k Ω
- (c) 220 μ F 25 V capacitor with its value concealed and labelled C. The connecting legs of the capacitor should be clearly labelled + and – to indicate correct polarity
- (d) dc digital voltmeter capable of providing readings in the range 0–10 V
- (e) switch or other means of disconnecting the power source
- (f) component holders, crocodile clips or similar to easily connect the capacitor, together with one or two resistors, into the discharge circuit
- (g) connecting leads
- (h) digital stopclock or stopwatch, reading to 0.1 s or better.

Note that supervisors are required to check candidates' circuits before they switch them on. In particular, supervisors should check that:

- the positive side of the capacitor connects to the positive terminal of the battery
- the candidate has selected the 56 k Ω and 120 k Ω resistors and connected them correctly in parallel
- the voltmeter is correctly connected in parallel to the other components.

Any mistakes should be corrected and noted on the candidate's script. Candidates should not be penalised for help given where the problem is due to faulty components.

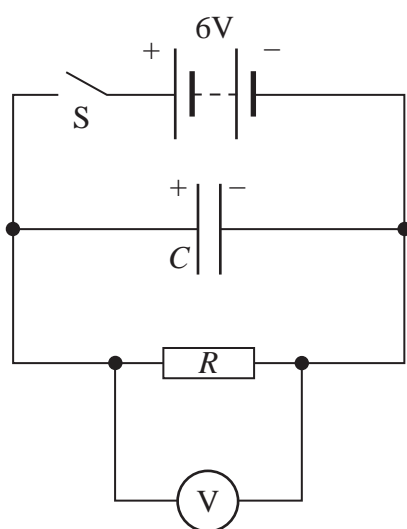
Task Sheet

This task is worth 7 marks

You are advised to read through these instructions before beginning your work.

You are going to investigate how long it takes for the potential difference (pd) across a charged capacitor to fall by two thirds when the capacitor is discharged through a resistor.

Figure 1



Useful formulae

Resistors in series $R = R_1 + R_2$

Resistors in parallel $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

- Set up the circuit shown in **Figure 1** using two resistors connected in parallel that give the lowest possible value for R . If a switch S has not been provided you will be told how to disconnect your power source.
- **Before switching on you must ask your supervisor to check your circuit.**
- Close switch S and record the voltmeter reading V_0 .
- Open S and observe that the voltmeter reading decreases as the capacitor discharges.
- Close S .
- Open S and start the clock at the same time.
- Record the time $T_{\frac{1}{3}}$ for the voltmeter reading to fall to $\frac{V_0}{3}$.
- You are not required to record repeat readings.
- Repeat this experiment using two resistors which when combined provide the highest possible resistance.
- Obtain further readings until you have a total of six values of $T_{\frac{1}{3}}$ corresponding to different values of R . Use only **one** or **two** resistors each time.
- Present all your results in a table.
- Plot a graph of $T_{\frac{1}{3}}$ on the vertical axis against R . Draw a straight line of best fit.

After the Investigation

At the end of the investigation, hand in all your written work, including the graph and recorded results, to the supervisor.

This documentation will be required for Stage 2 of the ISA. Ensure that you have entered your centre details, candidate number and name on all the sheets you have completed.