

Physics A 3883

AS Assessed Practical

Investigation into the resistance of a filament lamp

In this practical you will carry out all four experimental and investigative skills; Planning, Implementing, Analysing and Evaluating. You will investigate how the current through the filament of a lamp varies with the potential difference across it and hence determine how the resistance of the filament and the power supplied to it vary with the potential difference across it. This will, additionally, enable you to make estimates of the temperature of the filament for different potential differences.

You need to plan your investigation paying careful attention to the safety of all occupants of the laboratory, including yourself. You need to choose suitable equipment so that it covers appropriate ranges of current and potential difference with due regard to minimising uncertainty.

You are expected to use textbooks or other sources of information in order to establish background theoretical knowledge. Your account should acknowledge this by including a bibliography.

All results need to be displayed in a suitable format with correctly labelled table headings and an appropriate number of significant figures for each reading taken. Readings should normally be repeated in order to obtain reliable results.

Graphs should be plotted to summarise your results.

AS Physics Assessed Practical				
Skill P - Planning			Filament lamp experiment	
Mark		Specification Descriptor	Experiment Descriptor	tick
1	P.1a	The candidate defines a question or problem in simple terms and plans a fair test or an appropriate practical procedure, making a prediction where relevant	The candidate knows to get resistance from measurement of voltage and current	
	P.1b	The candidate chooses appropriate equipment	The candidate chooses a variable power supply together with meters suitable for the measurements required.	
2				
3	P.3a	The candidate defines a question or problem using scientific knowledge and understanding; identifies the key factors to vary, control or take account of.	The candidate knows that $V/I = R$ and $V \times I = P$.	
	P.3b	The candidate decides on a suitable number and range of observations and/or measurements to be made	The candidate chooses a suitable range of values of voltage and hence of current	
4				
5	P.5a	The candidate uses detailed scientific knowledge and understanding, and information from preliminary work or a secondary source to plan an appropriate strategy, taking into account the need for safe working and justifying any prediction made; produces a clear account and uses specialist vocabulary appropriately.	The candidate comments on safety, gives a clear outline of procedure to be followed using all electrical terms correctly. (allow the use of either <i>potential difference</i> or <i>voltage</i>)	
	P.5b	The candidate describes a strategy, including choice of equipment, which takes into account the need to produce precise and reliable evidence	The candidate draws a suitable circuit diagram with ammeter in series and voltmeter in parallel.	
6				
7	P.7a	The candidate retrieves and evaluates information from a variety of sources, and uses it to develop a strategy which is well structured, logical and linked coherently to underlying scientific knowledge and understanding; uses spelling, punctuation and grammar accurately.	The candidate uses additional sources to show that resistance is approximately proportional to absolute temperature; describes the way in which the resistance and temperature of the filament when cold enable the high temperature to be obtained.	
	P.7b	The candidate justifies the strategy developed, including the choice of equipment, in terms of the need for precision and reliability	The candidate comments on the accuracy with which the readings might be found in the light of the theory and the apparatus used.	
8			The candidate gives details of research done taking the candidate beyond the specification, e.g. strange behaviour of tungsten giving rise to likely uncertainties, preference to have voltmeter in parallel with bulb, both in series with ammeter, since current drawn by modern voltmeters is very small.	

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. All descriptors for lower defined levels must be satisfied before a higher mark is awarded.

CANDIDATE NAME _____

P Mark Awarded _____ out of a maximum possible of 8

AS Physics Assessed Practical				
		Skill I – Implementing	Filament lamp experiment	
Mark		Specification Descriptor	Experiment Descriptor	tick
1	I.1a	The candidate demonstrates competence in simple techniques and some awareness of the need for safe working.	The candidate correctly wire up the lamp to the power supply.	
	I.1b	The candidate makes and records observations and/or measurements which are adequate for the activity	The candidate uses sensible ranges on the digital (or analogue) meters.	
2				
3	I.3a	The candidate demonstrates competence in practised techniques and is able to manipulate materials and equipment with precision.	The candidate puts the meters in the correct place in the circuit.	
	I.3b	The candidate makes systematic and accurate observations and/or measurements which are recorded clearly and accurately	The candidate works systematically; records meter readings correctly.	
4				
5	I.5a	The candidate demonstrates competence and confidence in the use of practical techniques; adopts safe working practices throughout.	The candidate makes competent use of the power supply and circuit and works safely	
	I.5b	The candidate makes observations and/or measurements with precision and skill records observations and/or measurements in an appropriate format; recognises sources of systematic and random error which could affect accuracy and reliability of results.	The candidate uses suitable, detailed tabulation with consistent significant figures. Takes at least 12 readings over a sensible spread of voltage readings	
6				
7	I.7a	The candidate demonstrates skilful and proficient use of all techniques and equipment	The candidate completes all readings with repeat readings of current.	
	I.7b	The candidate makes and records all observations and/or measurements in appropriate detail and to the degree of precision permitted by the techniques or apparatus; responds to serious sources of systematic and random error by modifying procedures where appropriate.	The candidate takes all readings to 2 or 3 significant figures, with averages calculated for current readings. . Copes with changes of meter range intelligently.	

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CANDIDATE NAME _____

I Mark Awarded _____ out of a maximum possible of 7

		AS Physics Assessed Practical		
		Skill A - Analysing	Filament lamp experiment	
Mark		Specification Descriptor	Experiment Descriptor	tick
1	A.1a	The candidate carries out some simple processing of the experimental evidence.	The candidate can work out resistance.	
	A.1b	The candidate identifies trends or patterns in the evidence and draws simple conclusions.	The candidate deduces that the resistance increases as the voltage increases.	
2				
3	A.3a	The candidate processes and presents experimental evidence including, where appropriate, the use of appropriate graphical and/or numerical techniques.	The candidate calculates all resistances and powers and plots graphs of both against voltage, using suitable scales.	
	A.3b	The candidate links conclusions drawn from processed evidence with the associated scientific knowledge and understanding.	The candidate relates increase in resistance to rise in temperature of filament.	
4				
5	A.5a	The candidate carries out detailed processing of evidence and analysis including, where appropriate, the use of advanced numerical techniques such as statistics, the plotting of intercepts or the calculation of gradients.	The candidate correctly identifies the resistance of the filament when cold.	
	A.5b	The candidate draws conclusions that are consistent with the processed evidence and links these with detailed scientific knowledge; produces a clear account which uses specialist vocabulary appropriately.	The candidate calculates the temperature of the filament at each voltage reading, using proportionality of resistance with absolute temperature.	
6				
7	A.7a	The candidate, where appropriate, uses detailed scientific knowledge and understanding to make deductions from the processed evidence, with due regard to nomenclature, terminology and the use of significant figures (where relevant).	The candidate shows full regard for units and uses an appropriate number of significant figures throughout.	
	A.7b	The candidate draws conclusions which are well structured, appropriate, comprehensive, concise and accurate and which are coherently linked to underlying scientific knowledge and understanding; uses spelling, punctuation and grammar accurately	The candidate has all calculations correct and makes well reasoned conclusion regarding the temperature of the filament; uses spelling, punctuation and grammar accurately	
8			Additional comment showing insight. E.g. zero of p.d. resulting in zero power but not zero resistance (I tends to zero as V tends to zero), approximate temperatures associated with different colours of filament	

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CANDIDATE NAME _____

A Mark Awarded _____ out of a maximum possible of 8

		AS Physics Assessed Practical		
		Skill E - Evaluation	Filament lamp experiment	
Mark		Specification Descriptor	Experiment Descriptor	tick
1	E.1a	The candidate makes relevant comments on the suitability of the experimental procedures.	The candidate makes relevant comments on the suitability of the experimental procedures.	
	E.1b	The candidate recognises any anomalous results.	The candidate recognises any anomalous results if there are any.	
2				
3	E.3a	The candidate recognises how limitations in the experimental procedures and/or strategy may result in sources of error.	The candidate makes comment on the fluctuating readings on a digital meter or on need to change scale range.	
	E.3b	The candidate comments on the accuracy of the observations and/or measurements, suggesting reasons for any anomalous results.	The candidate recognises that there is a problem with the low voltage readings.	
4				
5	E.5a	The candidate indicates the significant limitations of the experimental procedures and/or strategy and suggests how they could be improved.	The candidate specifies the limitations of the method used	
	E.5b	The candidate comments on the reliability of the evidence and evaluates the main sources of error.	The candidate suggests an improvement which can be made to obtain resistance readings at low temperature.	
6				
7	E.7a	The candidate justifies proposed improvements to the experimental procedures and/or strategy in terms of increasing the reliability of the evidence and minimising significant sources of error.	The candidate suggests improvements which can be made in procedures Or comments on the reasonability of the final values.	
	E.7b	The candidate assesses the significance of the uncertainties in the evidence in terms of their effect on the validity of the final conclusions drawn.	The candidate suggests how uncertainties in readings feed through into uncertainties in the values given on the graph.	

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CANDIDATE NAME _____

Mark Awarded _____ out of a maximum possible of 7