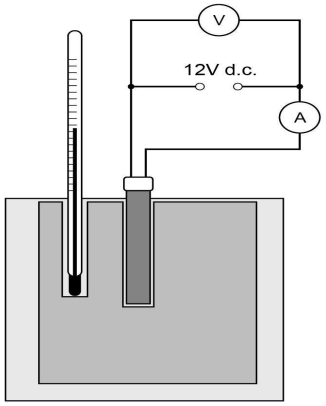
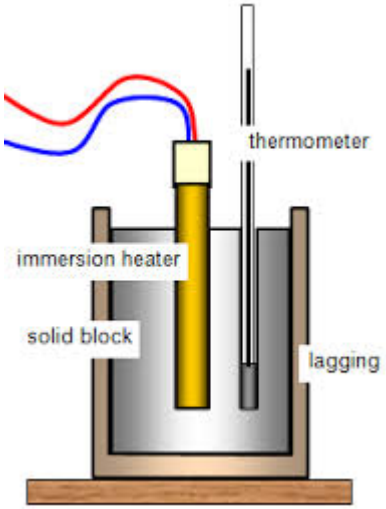
GCSE Physics Required Practicals Paper One

Outline	Glossary and equations	Summary of method and context	Exam question example	Visual aid
1. Specific Heat Capacity *An investigation into the different specific heat capacities of different metals* *Video: Specific Heat Capacity of Aluminium Experiment - GCSE Physics Required Practical*	**Specific heat capacity** - The amount of energy needed to raise the temperature of 1 kg of a substance by 1ºC **Conduction** - the process by which thermal energy is transmitted through a substance through the vibrations of particles, this is most effective in solids Energy (J) = mass (kg) x specific heat capacity (J/kgºC) x temperature change (ºC) Power = current (A) x potential difference (V) Energy (J) = power (W) x time (s)  	1. Choose your material, for example, a steel block, and measure its mass, in kilograms, then wrap the block in insulation This will help to prevent dissipation of the energy to the surroundings 2. Measure the starting temperature of the block You may want to put some water into the hole with the thermometer as this will prevent an air gap and allow a more accurate reading on the thermometer 3. Put a heater in the larger hole in the block. Connect the ammeter, power pack and heater in series 4. Connect the voltmeter across the power pack This needs to be in parallel (piggy backed on) 5. Switch the power pack to 7 V and switch it on. Start the stopwatch as you turn on the power pack 6. Record the ammeter and voltmeter readings. These may vary slightly during the experiment, but not significantly 7. Calculate the power by using the equation power = current x time 7. Record the temperature every minute in your results table 8. After 10 minutes, turn off the power pack 9. Calculate the temperature change for each result 10. Calculate the energy transferred to the block by using the equation energy = power x time 11. Calculate the specific heat capacity by using the equation specific heat capacity = energy / (mass x temperature change)	The specific heat capacity of aluminium can be determined by experiment. (a) Draw a labelled diagram showing how the apparatus used to determine the specific heat capacity of aluminium should be arranged. (b) Describe how you could use the apparatus you drew in part (a) to determine the specific heat capacity of aluminium. (c) Methods used to determine the specific heat capacity of aluminium may give a value greater than the actual value. Explain why.	

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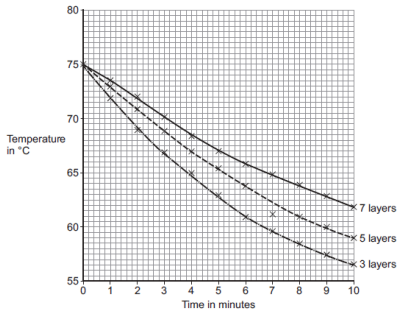
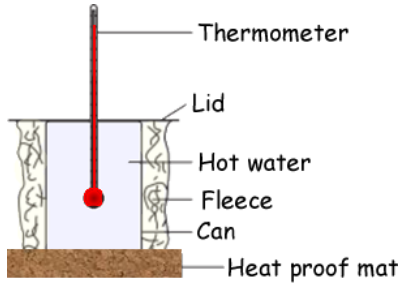
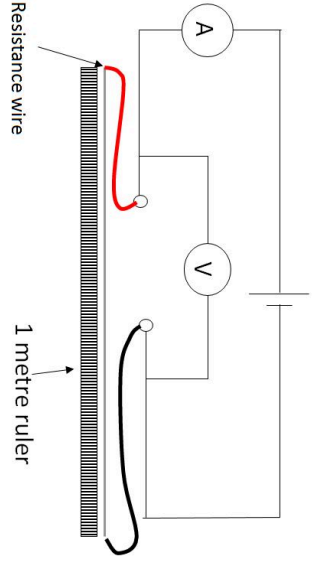
2. Thermal Insulation *An investigation into the most effective insulators and the effect of varying insulator thickness* *Video: INSULATION - Science GCSE Physics Required Practical*	**Insulator** - A material that does not easily allow the transfer of thermal energy Conductor - A material that easily allows the transfer of thermal energy **Conduction** - the process by which thermal energy is transmitted through a substance through the vibrations of particles, this is most effective in solids **Convection** - Heat transfer in a gas or a liquid due to convection currents (the movement of the fluid due to differences in temperature)	1. Measure 200 ml of water into equal sized containers wrapped in insulation (leave one of these without insulation as a control) The control is to see if the insulators make any difference to the experiment of not 2. Place a thermometer into each container and place a lid around this A data logger may also be used, this may have a higher resolution (increment in which it increases is smaller), not need the lid to be taken off, remove human error and also may automatically plit the graph 3. Measure the temperature of the containers every minute for fifteen minutes 4. Plot a graph of temperature vs time Temperature change may be plotted instead to enable a fair comparison as not all containers may start at the same temperature A variation on this experiment is to use different thicknesses of the same insulator instead of completely different insulators.	A student investigated how the thickness of insulation affected the time it takes for water to cool. (a) State one variable that the student should control throughout the investigation (b) The graph below shows the results of the investigation, what can the student conclude about the effect of the layers of insulation? Figure 2  (c) There is one anomalous result above, circle this and describe what may have happened to cause this result.	
3. Resistance of a wire *Investigating whether the length of wire will affect the resistance of the wire* *Video: Resistance of a Wire Experiment - GCSE Physics Required Practical*	**Resistance** - the ratio of potential difference across an electrical component to the current through the component, a measure of how hard or easy it is for current to flow Resistance (Ω) = potential difference (V) / current (A)	1. Connect the wires into the DC socket of the power pack at 4V 2. Connect the ammeter in series with the circuit 3. Connect crocodile clips to each end of the wire nearest to the wire to be tested 4. Place the voltmeter in parallel (piggy backed) onto the back of the crocodile clips 5. Connect the crocodile clips to the wire to be tested at 10cm 6. Record the current and potential difference readings at this point and substitute into the equation resistance = potential difference / current to calculate the resistance Between each reading the circuit must be turned off to prevent the wire from overheating and the resistance being affected 7. Repeat for a range of lengths for the wire	A student tested how the resistance of a piece of nichrome wire varies with length. (a) Describe where you would place the voltmeter and the ammeter in the circuit (b) Describe how the student would obtain the data needed for the investigation. Your answer should include a risk assessment for one hazard in the investigation	

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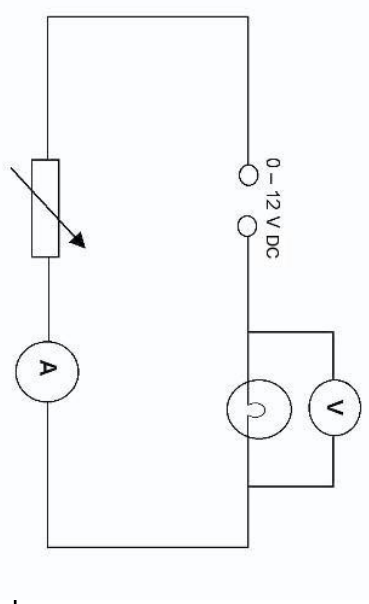
4. IV Graphs *An investigation into the effect of changing the current on the potential difference of a component* *Video: IV Characteristics of a Resistor Experiment - GCSE Physics Required Practical*	**Ohm's law** - a resistor obeys Ohm's law if the current through the resistor (at a constant temperature) if directly proportional to the potential difference across it **Directly proportional** - if one variable will change, the other one will change by the same amount each time **Variable resistor** - a resistor where the resistance can be varied, this will affect the current of the circuit	1. Set up the component in series with a 6V DC power supply 2. Place a variable resistor in the circuit The variable resistor will be used to alter the current, the greater the resistance, the lesser the current, the resistance is adjusted until the current roughly changes by 0.1A 3. Place an ammeter in series and a voltmeter in parallel (piggy backed) with the component being tested 4. Record potential difference and current 5. Alter the resistance on the variable resistor to alter the current and to take a range of readings The three components used here are the diode (only allows electricity to flow in one direction, that of the arrow in the component, starts conducting at 0.6 V with a low resistance, filament bulb (creates a S shaped graph, as current increases so does resistance), and an ohmic resistor (the trend will be directly proportional). The circuit needs to be switched off between readings in order to avoid overheating and readings being affected by this increasing resistance.	A student wants to investigate how the how the current flow through a filament lamp affects its resistance. (a) State the circuit components needed and draw the circuit that would be used. (b) Describe how the student could use her circuit to investigate how the current through a filament lamp affects its resistance.	
5. Density *Describing a method to calculate the density of regular and irregular shaped objects.* *Video: Density Experiment - GCSE Physics Required Practical*	**Density** - the measure of the amount of substance per unit volume, this is measured in kg / m^3 **Eureka can** - a can with a spout, that when an object is placed in, will expel the same volume of water as the volume of the object Density (kg/m^3) = mass (kg) / volume (m^3)	**Method 1 - Regular shape** 1. Find the mass of the object by using a mass balance 2. Measure the height, width and depth of an object using a ruler or vernier callipers 3. Multiply these values together to calculate the volume of the object 4. Substitute the values into the equation density = mass / volume in order to calculate the density **Method 2 - Irregular shape** 1. Find the mass of the object by using a mass balance 2. Fill a eureka can to the spout and place a measuring cylinder beneath this 3. Submerge the object into the can and record the volume of the water displaced (this is equal to the volume of the object) 4. Substitute the values into the equation density = mass / volume in order to calculate the density This process uses Archimedes principle which states that the volume of liquid displaced by an object is equal to the volume of the object	A student wants to calculate the density of a regular metal cube and an irregular shaped statue. Describe the methods that the student should use to calculate the density of the two objects.