Determining the Specific Heat Capacity of a Material PAG 11.2

*Hello Will. The key is to frame your write-up in terms of an investigation. You just need to outline what you are going to investigate, e.g. how effective the method is, how large the heat losses are, how to account for heat losses – anything will do. Then outline your method and any modifications you made during the experimental work. Present your results and process them so you can draw some conclusions – i.e. explain what you have found out.*

This practical activity is intended to be carried out as an investigation in which you plan and implement work to demonstrate your investigative skills.

**Aims:** To demonstrate investigative skillsTo research, plan and implement a practical activity

To make quantitative observations To relate observations to research or theory

**Equipment (per group)**

sample of material whose SHC is to be determined, electric heater (low voltage), low voltage power supply

joulemeter, leads, beaker, kettle, thermometers, insulating material, heatproof mat, electronic balance

**Health and safety**

Be aware of hot objects and liquids and take appropriate care.

**Procedure**

Determine a strategy to enable you to determine the SHC of the material. Detail your plan. Obtain and record results. Calculate a value and evaluate your findings.

**Recording**

As evidence for the Practical Endorsement you should have detailed your method and the variables which you took into account. You should have evidence of the data collected in a clear and logical format. All work should be clearly dated. In addition, in preparation for the assessment of practical work in the written exam you should record your calculations and an analysis and evaluation of your results.

1.2.1 Practical skills

**Independent thinking**

(a) apply investigative approaches and methods to practical work

**Use and application of scientific methods and practices**

(b) safely and correctly use a range of practical equipment and materials

(d) make and record observations/measurements

(e) keep appropriate records of experimental activities

(f) present information and data in a scientific way

(g) use appropriate software and tools to process data, carry out research and report findings

**Research and referencing**

(h) use online and offline research skills including websites, textbooks and other printed scientific sources of information

(i) correctly cite sources of information

**Instruments and equipment**

(j) use a wide range of experimental and practical instruments, equipment and techniques appropriate to the knowledge and understanding included in the specification.

*Through use of the apparatus and techniques listed below, and a minimum of 12 assessed practicals, learners should be able to demonstrate all of the practical skills listed within 1.2.1 and CPAC as exemplified through:*

1.2.2 Use of apparatus and techniques

(a) use of appropriate analogue apparatus to record a range of measurements (to include length/ distance, temperature, pressure, force, angles and volume) and to interpolate between scale markings

(b) use of appropriate digital instruments, including electrical multimeters, to obtain a range of measurements (to include time, current, voltage, resistance and mass)

(c) use of methods to increase accuracy of measurements, such as timing over multiple oscillations, or use of fiduciary marker, set square or plumb line

(d) use of a stopwatch or light gates for timing

(g) designing, constructing and checking circuits using DC power supplies, cells, and a range of circuit components

Common Practical Assessment Criteria, CPAC

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| (2) Applies investigative approaches and methods when using instruments and equipment |
| (3) Safely uses a range of practical equipment and materials |
| (4) Makes and records observations |
| (5) Researches, references and reports |

Measuring the Heat Capacity of a Metal ΔE = mcpΔθ

Investigating the efficacy of school physics laboratory methodology.

*Below are some things you may want to do / think about.*

Use laptops to research the accepted value for the metal you plan to use.

Research several sources and quote the values with appropriate units and uncertainties if available.

Fully reference each source.

Measure the power output of your heater at a range of supply voltages up to a maximum of 12V.

Estimate the rate of change of temperature at each input power.

Decide upon and justify the input power you plan to use.

Heat up a block by placing it in hot water in sink for 10min. Dry block thoroughly.

Record data to establish a cooling curve for the block.

Carry out some online research to establish the standard school physics laboratory methodology.

Report on your findings. Fully reference each source.

Determine the resolution of each of your measuring instruments.

Decide how you will minimise the uncertainty in your final value.

Use calculations to justify the size of your final uncertainty.

Determine the likely systematic error in your measurements by comparing instruments making the same measurement. Report your findings.

Using the preparatory work completed so far develop and justify your final strategy.

Think carefully about the method and how you can minimise error and uncertainty.

Write a clear method including the settings and variables you plan to use.

Explain fully how your method will minimise or account for unwanted energy transfers.

Carry out your planned method. Record your experimental data fully and in a clear format.

Process your data graphically or numerically to establish your final value.

Make a comparison of your final value with the accepted value.

Comment on the efficacy of your methodology.