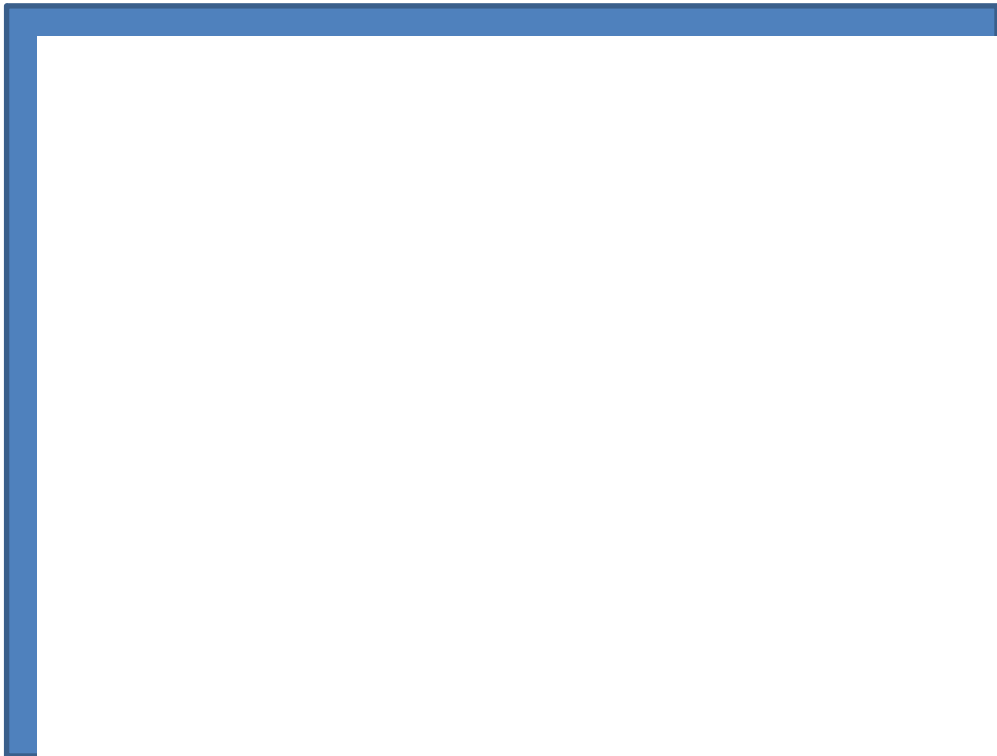
Additional/Separate Physics ISA 2014-15
Thermistors

PART 1

In groups of 4 – What do you know about thermistors?

2 minutes…



Some ideas…

THEY'RE AFFECTED BY TEMPERATURE

USED IN THERMOSTATS

WHAT ARE THERMISTORS?

RESISTANCE CHANGES DUE TO DIFFERENT TEMPERATURES

USED IN CIRCUITS TO PREVENT OVERHEATING

AS TEMPERATURE INCREASES THE RESISTANCE DECREASES IN A NON-LINEAR

USED IN HEAT DETECTORS FIRE ALARMS

What is a HYPOTHESIS?

A proposal intended to explain facts or observations

YOU'RE GOING TO MAKE YOUR OWN HYPOTHESIS AND YOU'RE GOING TO DO AN INVESTIGATION TO SEE IF IT'S TRUE

ADDITIONAL PHYSICS ISA INVESTIGATION:

"WHAT FACTORS AFFECT THE RESISTANCE OF A THERMISTOR"

VARIABLES:

INDEPENDENT: TEMPERATURE OF WATER

DEPENDENT: RESISTANCE OF THERMISTOR

CONTROLS: SAME PRECISION AMMETER/VOLTMETER/OHM-METER, LENGTH OF WIRES FROM THERMISTOR TO METERS, LIQUID THAT THE THERMISTOR IS SUBMERGED IN.

QUESTION 1 FROM THE PHYSICS ISA SUMMER 2013

1 Write down your hypothesis.

Explain why you made this hypothesis.

Hypothesis AN INCREASE IN AFFECTS THE RESISTANCE OF A THERMISTOR.

Explanation AS TEMPERATURE INCREASES THE RESISTANCE DECREASES IN A NON-LINEAR FASHION – HIGH RESISTANCE CHANGE AT FIRST AND LOW LATER. THIS WOULD SUPPORT THE HYPOTHESIS.

(3 marks)

QUESTION 2 FROM THE PHYSICS ISA SUMMER 2013

2 Think about the research that you did to find out how to test your hypothesis.

Identify **two** sources that you used for your research.

SOURCE 1 – FULL WEBSITE ADDRESS

SOURCE 2 – FULL WEBSITE ADDRESS

Which of these sources did you find the more useful?

Why was this source better than the other source?

E.G.: SOURCE 1 IS BETTER THAN SOURCE 2

BECAUSE SOURCE 1 HAS A MORE DETAILED METHOD AND SOURCE 2

ALSO DOESN'T HAVE A RISK ASSESSMENT

(3 marks)

SAME QUESTION FROM EVERY ADDITIONAL SCIENCE ISA

3 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

From the research that you have done, describe in detail how you are going to do your investigation.

You should include:

- the equipment that you plan to use
- how you will use the equipment
- the measurements that you are going to make
- how you will make it a fair test
- a risk assessment.

USE THESE AS GUIDANCE

FURTHER TIPS FOR 9 MARKS:

- **WRITE IN POINT FORM LIKE THE SOURCES HAVE DONE**
- **MENTION THE CONTROL VARIABLES NEEDED SO THE INVESTIGATION ISN'T AFFECTED BY THEM ("FAIR TEST")**
- **MENTION THE RANGE AND INTERVALS YOU WANTED TO USE, E.G.: TEMPERATURE RANGE FROM 80°C – 20 °C DECREASING IN APPROXIMATELY 10 °C INTERVALS**
- **MEASURING THE INDEPENDENT VARIABLE**

SAME QUESTION FROM EVERY ADDITIONAL SCIENCE ISA

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USE THESE AS GUIDANCE

- **MEASURING THE INDEPENDENT VARIABLE**
- **REPEATS NEEDED TO GET REPEATABLE AND RELIABLE RESULTS AND THUS BEING ABLE TO CALCULATE A MEAN**
- **USING AN OHM-METER TO READ THE RESISTANCE OR A COMBINATION OF VOLTMETER AND AMMETER AND POWER SUPPLY AND THUS USING OHMS LAW.**
- **MENTION THE HAZARD OF HOT WATER AND MINIMISING THE RISK OF SCOULDS BY TAKING CARE WHEN HANDLING THE HOT WATER**

DIGITAL MULTIMETER

ANALOGUE AMMETER

What's the difference?

Which one would you want to use and why?

- Easier to read the DMM and have a more precise answer
- The range can be changed on the DMM giving more precise readings
- The analogue ammeter can be easily reset and get rid of zero error more easily.

Errors:

The **error** might be a **systematic error**. This means that the method was carried out consistently but an error was being repeated. A systematic error will make your readings be spread about some value other than the true value. This is because your results will differ from the true value by a consistent amount each time a measurement is made.

No number of repeats can do anything about systematic errors. If you think that you have a systematic error, you need to repeat using a different set of equipment or a different technique. Then compare your results and spot the difference!

A **zero error** is one kind of systematic error. Suppose that you were trying to measure the length of your desk with a metre rule, but you hadn't noticed that someone had sawn off half a centimetre from the end of the ruler. It wouldn't matter how many times you repeated the measurement, you would never get any nearer to the true value.

What is wrong with the following?

(a) And (c) don't start at zero

They have zero errors

How could you correct this error?

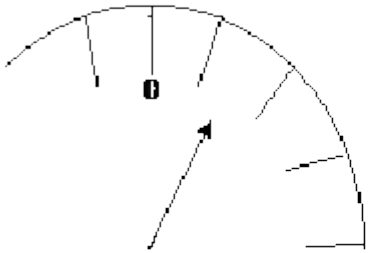
Either:

1) Replace the measuring device with a calibrated one

OR

2) Subtract/Add the extra to the final reading

(a)



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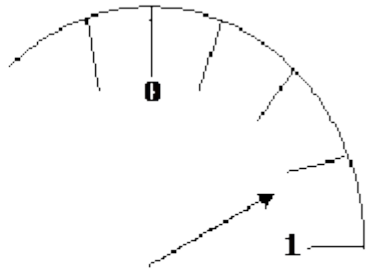

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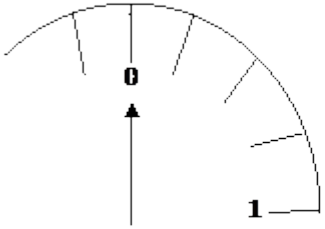
(b)



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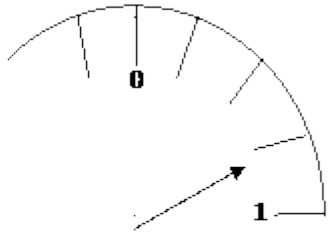

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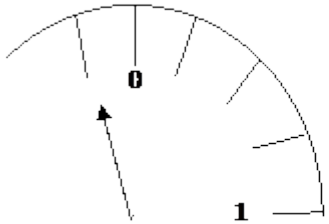
(c)



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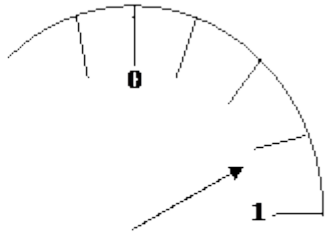

After

CONTEXT: THERMOSTATS

INVESTIGATION RELATING TO THE CONTEXT:

Thermistors can be used in thermostats. As the temperature changes the resistance will change and affect a temperature controlling circuit: switching the house heating on or off.

***Results from your investigation could support a potential question in paper 2 ***

Use the sources to design an experiment to investigate your hypothesis or even help you write a hypothesis.

Things to write on your Candidate Research Form (CRF):

- Your name, candidate number and sign it
- Write the hypothesis, context and context relating to the experiment on your CRFs.

In the rest of the boxes:

- draw a simple diagram and write the list of equipment
- write down the independent, dependent and control variables – identify them from the hypothesis
- Write a step by step guide which is **PRECISE** in the method (don't worry about going over the lines and writing in other boxes)
- Say in the method what you **controlled** for a fair test.

From the sources, choose the best two to help you. Write on your CRF:

- **the names/ websites of the sources**
- **give a reason for each one, saying which one is the best and why one is better than the other.**

How to draw a table to get maximum marks (2):

Temperature (°C)	Resistance (Ω)
One mark for identifying the heading WITH UNIT	**One mark for identifying the other heading WITH UNIT**