



# GCSE Science Specimen Papers

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## Physics 4451

### ISA and marking guidelines

#### Revised Physics 3 – Transformers ISA P3/Specimen

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Dr Michael Cresswell, Director General.

## Revised Specimen ISA Physics 3 - Transformers

This ISA relates to: Unit P3 Physics (4451) section 13.9

### *Area of investigation*

This work should be carried out during the teaching of the section relating to:

### **How do transformers work?**

### **RISK ASSESSMENT**

It is the responsibility of the centre to ensure that a risk assessment is carried out.

### **The Practical Work**

**For this part of the investigation candidates may work individually or in groups.**

A suggested method is described below but centres may adapt this method to suit their own needs.

The teacher must always complete the ISA Explanation sheet. An ISA Explanation Sheet must be included with each piece of candidates' work that is sent to the moderator. Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Candidates should be given the opportunity to carry out an investigation concerning transformers. They may use pre-wound, commercially available coils, or may wind their own coils. They may investigate any aspect of transformers, e.g. the link between the turns ratio and the ratio of the voltages, or the efficiency.

Candidates need to produce a table for the results and draw a graph or bar chart to show their results. They will need to have collected sufficient data to display in such a format.  
(Refer to the Teachers' Guide for further clarification)

### **The Data Processing**

**For this part of the investigation candidates must work individually under direct supervision.**

Each candidate should draw up his or her own table of results and should process the data in an appropriate way, e.g. charts, graphs, diagrams, line of best fit.

The candidates' work should be collected by the teacher at the end of this session and only returned to the candidates when they undertake the subsequent ISA test.

Candidates' work must **not** be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA - e.g. the use of the terms independent/dependent variable.



# ISA Explanation Sheet

to accompany Each ISA  
 (You will need to fill in more than one of these sheets if different students have carried out different methods)

Centre Number						Date Practical Carried Out
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ISA Code	<b>P3/Specimen</b>	ISA Title	<b>Transformers</b>
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Name of Teacher	
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Independent variable	Dependent variable	
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Did you make any changes to the suggested Method?

**YES / NO**

Any other Information:

Teacher Signature:

**Please attach any experimental worksheet or outline used by the candidates to carry out the investigation if available.**

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature		Date	

Leave blank
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General Certificate of Secondary Education  
June 2xxx / June 2xxx



**PHYSICS**  
**ISA P3.3 Transformer**

**PHYC / P3.3**

To be conducted before 4 May 2xxx  
For submission in May 2xxx or May 2xxx or May 2xxx

**For this paper you must have:**

- results tables and charts or graphs from your own investigation.

You may use a calculator.

For Teacher's Use	
Section	Mark
1	
2	
<b>Total</b> (max 34)	

Time allowed: 45 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** and **Section 2**.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

**Information**

- The maximum mark for this paper is 34.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Did this candidate take part in the practical activity?	<b>YES / NO</b>
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Signature of teacher marking this ISA \_\_\_\_\_ Date \_\_\_\_\_

**SECTION 1**

These questions are about the investigation that you carried out on transformers.

Answer all questions in the spaces provided.

**1** What were you trying to find out in your experiment?

.....  
.....  
.....

**2** In your investigation:

*(2 marks)*

(a) Which was the **dependent** variable?

.....

*(1 mark)*

(b) What kind of a variable was this?

Draw a ring around the word that best describes your independent variable.

CATEGORIC    CONTINUOUS    DISCRETE    ORDERED

*(1 mark)*

**3** (a) What was the **range** of values that you chose for the independent variable?

The range was from..... to .....

*(1 mark)*

(b) Was this a sensible range to choose?                      **Yes/No**

Draw a ring around the answer.

Give a reason for your answer.

.....  
.....

*(1 mark)*

- (c) If you had more time, is there any section within that range where you would like to get more results?

Draw a ring around the answer.

**Yes / No**

Give a reason for your answer.

.....  
.....  
.....

(1 mark)

- 4 In your experiment you would have used at least one kind of meter (ammeter, voltmeter or ohmmeter).

- (a) Was the **range** over which this instrument was capable of measuring suitable?

**Yes / No**

Draw a ring around the answer.

Give a reason for your answer.

.....  
.....

(1 mark)

- (b) Was the **sensitivity** of this instrument suitable?

**Yes/No**

Draw a ring around the answer.

Give a reason for your answer.

.....  
.....

(1 mark)

- 5 Before you carried out your experiment, either you or your teacher would have carried out a preliminary test.

What was the reason for doing this?

.....  
.....

(1 mark)

**Turn over ►**

6 What did you find out from your investigation?

.....

.....

.....

*(2 marks)*

7 Make sure that your results tables, and charts or graphs are handed in with this paper.  
You will be awarded up to 6 marks for these.

*(6 marks)*

**SECTION 2**

These questions are about an investigation that may be similar to the one did.

Answer **all** questions in the spaces provided.

Kate is on work experience in the research department of a company that manufactures transformers.

The manufacturer is developing a new transformer for an audio speaker system. Kate has to find out how the efficiency of the transformer varies when the *load* applied to the secondary coil is changed.

The *load* is the device connected to the secondary coil, e.g. a speaker. The value of the load is measured in ohms.

Here is a table of Kate's results. The efficiency has been multiplied by 100 to make it a percentage.

Load at secondary in $\Omega$	Efficiency (%)
2	12.15
5	28.4
10	43.5
20	54.0
40	65.6
75	59.9
100	55.3
125	50.3
146	45.6
200	36.9
500	17.0

- 8 Complete the following sentence.

In this data set, the.....is the independent variable and the .....is the dependent variable.  
(1 mark)

- 9 Write down **one** variable that Kate should have controlled or monitored during the investigation.

.....

(1 mark)

**Turn over** ►



10 Look at the first column in the table, headed **Load at secondary**.

(a) Describe the way in which the **interval** of these readings changes over the range.

.....

.....

(1 mark)

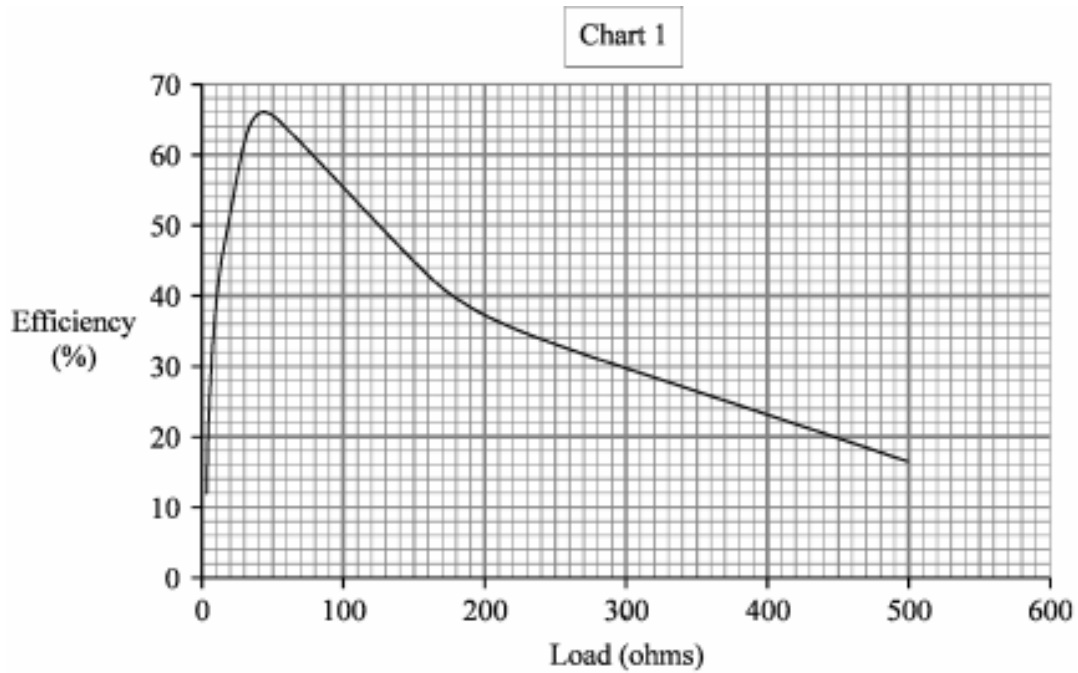
(b) Use the table to explain why Kate should have taken more readings between 20  $\Omega$  and 75  $\Omega$ .

.....

.....

(1 mark)

11 Kate produced two different charts of these results:



(a) Describe in detail what Chart 1 tells you about the relationship between output load and efficiency.

.....

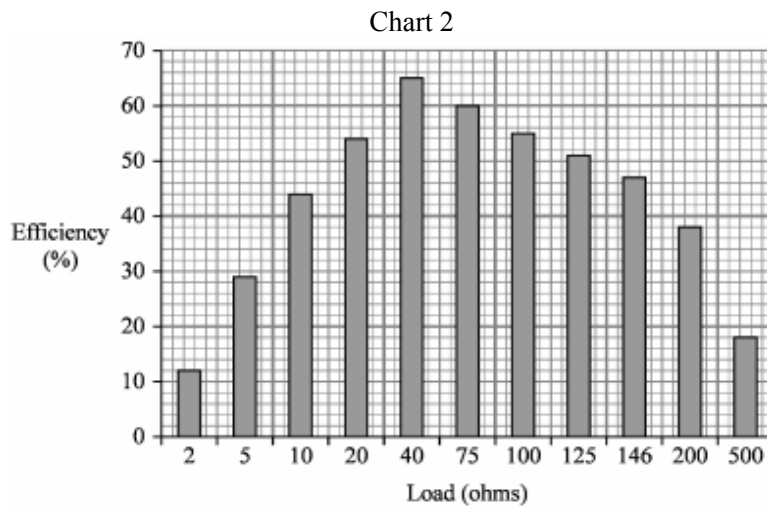
.....

.....

.....

(2 marks)

(b)



Explain **two** reasons why Chart 2 is a **bad** way to present the results.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

**Turn over** ►

**12** Kate's supervisor looked at the table of results and said that it was a poor way of reporting. He said that Kate had not quoted any *measurements* of the outcome, but had only quoted a *calculated* result of the efficiency. This also meant that he did not know if Kate had repeated any of the tests.

(a) Why would it have been important for Kate to repeat the tests?

.....  
.....

(1 mark)

(b) In fact Kate had done each test 3 times. What should she have done with these results?

Tick the box beside your choice.

Chosen the best set and discarded the others

Taken an average of all three sets

Discarded any anomalous results and averaged the rest

Taken the middle value out of each set

(1 mark)

(c) Explain why it is important to show actual results as well as calculated values.

.....  
.....

(1 mark)

**13** Why is it important that transformers should be as efficient as possible?

.....  
.....

(1 mark)

**14** The supervisor said, “If we publish Chart 2, our customers may think we have produced an excellent transformer. But if we hide the real data, the company will be accused of being *biased*.”

(a) What did he mean by using the word *biased*?

.....  
.....

(1 mark)

(b) Why might a manufacturer sometimes want to present a biased report?

.....  
.....

(1 mark)

**END OF QUESTIONS**

# GCSE Science - Investigative Skills Assignment - Marking Guidelines

## Physics 3/Specimen – Transformers

For use in May xxxx or May xxxx

Please mark in red ink, and use one tick for one mark. Each part of each question must show some red ink to indicate that it has been seen.

Subtotals for each part of each question should be written in the right-hand margin.

Enter the marks for **Section 1** and **Section 2** and the **total mark** on the front cover of the answer booklet.

The teacher must sign and date the front cover of the ISA.

The papers must be kept in a secure place and must **not** be returned to the candidates

Section 1			
Question	Answer	Additional guidance	Marks
<b>1</b>	Dependent variable correctly named	e.g. voltage at secondary	1 mark
	Independent variable correctly named	e.g. the voltage at primary/ turns ratio	1 mark
<b>2 (a)</b>	Correct variable identified	e.g. the voltage at secondary	1 mark
<b>2 (b)</b>	Continuous		1 mark
<b>3 (a)</b>	Correct range identified	Units not essential, but must be correct if included	1 mark
<b>3 (b)</b>	Reason given, e.g. YES, because e.g. it gave a good variation in the output variable Or, NO, because e.g. there was little variation in output variable	No mark for choosing Yes or No	1 mark
<b>3 (c)</b>	Reason given, e.g. NO, because e.g. there were sufficient results to come to a conclusion Or, YES, because, e.g. there was a gap in the results where the pattern was uncertain	No mark for choosing Yes or No	1 mark

4 (a)	Reason given, e.g. YES because e.g. all readings fitted onto scale Or, NO because e.g. needed readings higher than scale	No mark for choosing Yes or No	1 mark
4 (b)	Reason given, e.g. YES because significant difference between all readings Or NO because e.g. hardly any change in readings	(No mark for simply choosing Yes or No)	1 mark
5	Suitable suggestion,	e.g. to determine suitable range or choice of measuring instrument	1 mark
6	Simple statement,	e.g. the voltage at primary/ turns ratio did affect the output voltage	1 mark
	Further detail,	e.g. the greater the voltage at primary, the greater the voltage at secondary	1 mark
7	<p><b>Table:</b> Correct headings AND units all correct for all measured variables</p> <p><b>Graph:</b></p> <ul style="list-style-type: none"> <li>• X axis: suitable scales chosen and labelled with quantity and units</li> <li>• Y axis: suitable scales chosen and labelled with quantity and units</li> <li>• Points or bars plotted correctly to within <math>\pm 1</math> mm</li> <li>• Suitable line drawn on graph or bars correctly labelled on bar chart</li> </ul>	<p>Table with incomplete headings or units for the measured variables = 1 mark e.g. all headings present = 1 e.g. all units present = 1</p> <p>Accept axes reversed</p> <p>It may not always be necessary to show the origin</p> <p>Scales should be such that the plots occupy at least one third of each axis</p> <p>Allow <b>one</b> plotting error out of each 5 points plotted</p> <p>Allow error carried forward from incorrect plots</p> <p>If wrong type of graph/chart, maximum 3 marks</p> <p>If the independent variable is:</p> <ul style="list-style-type: none"> <li>• <i>continuous</i>, should draw a <i>best fit line graph</i></li> <li>• <i>categoric</i>, should draw a <i>bar chart</i></li> <li>• <i>discrete</i>, allow either a bar chart or a line graph</li> </ul>	<p>2 marks</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p>

