2021 ASSESSMENT MATERIALS

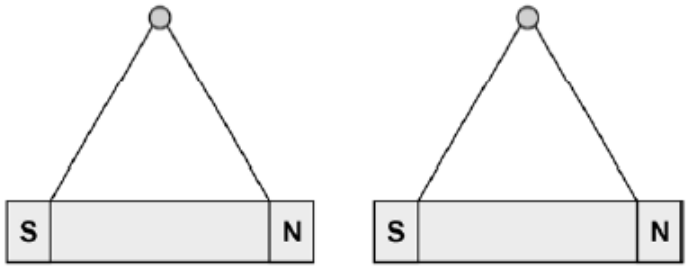
GCSE
PHYSICS

Physics Test 2: Electricity and Magnetism and Electromagnetism (Higher)

Total number of marks: 34

0 8 **Figure 14** shows two bar magnets suspended close to each other.

Figure 14



0 8 . 2 Describe how to plot the magnetic field pattern of a bar magnet.

[3 marks]

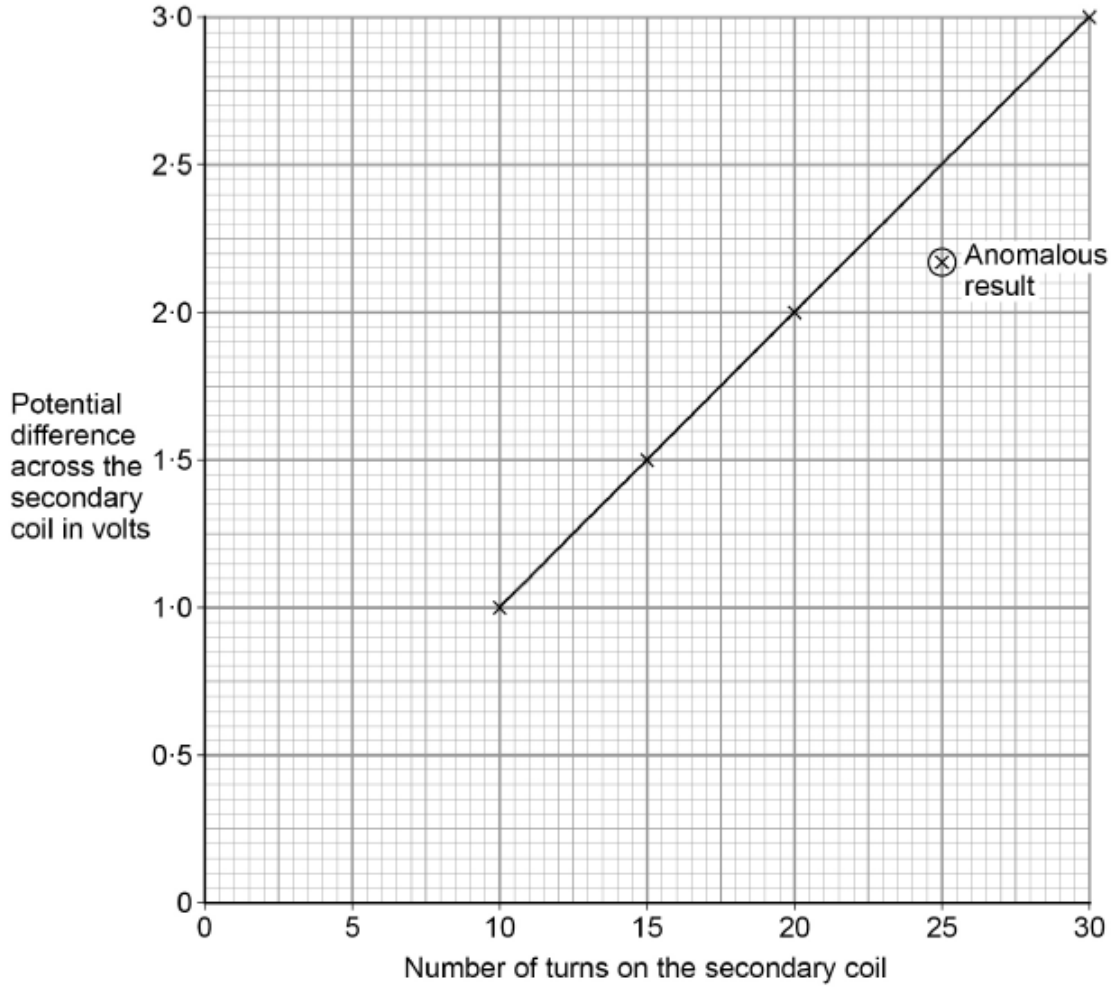
Hold a plotting compass on one end of the magnet and mark with a dot, the direction the compass points. Repeat at multiple places on the same line and join the points on the paper.

0 7 A student used a simple transformer to investigate how the number of turns on the secondary coil affects the potential difference (p.d.) across the secondary coil.

The student kept the p.d. across the primary coil fixed at 2V.

Figure 12 shows the results collected by the student.

Figure 12



0 7 . 1 **Figure 12** contains one anomalous result.

Suggest **one** possible reason why this anomalous result occurred.

[1 mark]

The number of turns on the secondary coil might have been less than 25.

0 7 . 2 The transformer changes from being a step-down to a step-up transformer.

How can you tell from **Figure 12** that this happens?

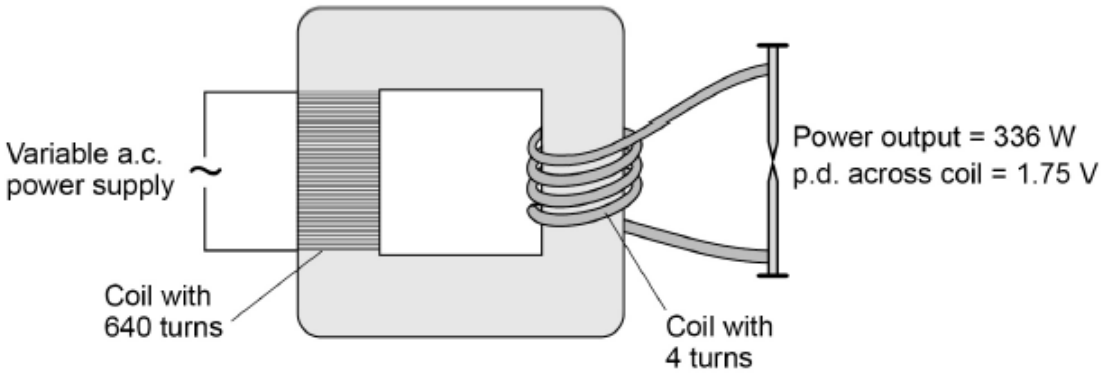
[1 mark]

The pd in the secondary coil changed from being a lower value compared to the primary coil, to a value higher.

A spot-welder is a device that uses a transformer to produce a large current to join sheets of metal together.

Figure 13 shows a transformer demonstrating how a large current can heat and join two nails together.

Figure 13



0 7 . 4 Calculate the current from the power supply needed to provide a power output of 336 W.

Use the data in **Figure 13**.

The transformer is 100% efficient.

[5 marks]

Current = 1.2 A

① $\frac{N_{OUT}}{N_{IN}} = \frac{V_{OUT}}{V_{IN}}$

② $\frac{4}{640} = \frac{1.75}{x}$

$x = \frac{1.75}{4} \times 640$

$= 280\text{V}$

③ $P_{IN} = P_{OUT} = 336\text{ W}$

④ $P = VI$ to find current

$336 = 280 \times I$

0 5 . 1 Complete the sentence. Choose answers from the box.

[2 marks]

charge	potential difference	power	temperature	time

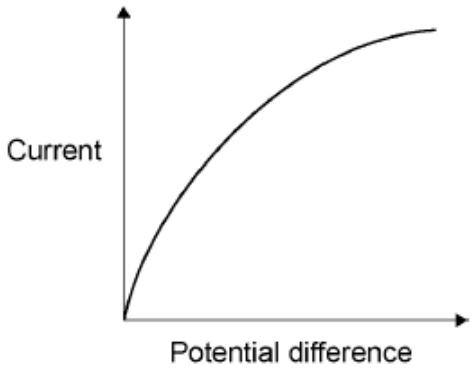
The current through an ohmic conductor is directly proportional to the

potential difference across the component, provided

that the temperature remains constant.

0 5 . 2 **Figure 7** shows a current – potential difference graph for a filament lamp.

Figure 7



Explain how the resistance of a filament lamp changes as the potential difference across it increases.

[3 marks]

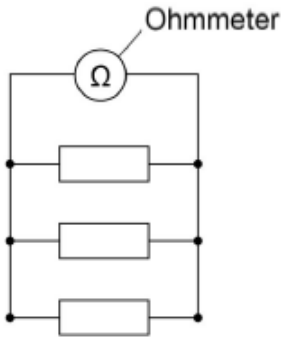
As the potential difference increases, the resistance increases due to the increase of temperature of the filament. Therefore, the current also decreases.

0 8 A student investigated how the total resistance of identical resistors connected in parallel varied with the number of resistors.

The student used an ohmmeter to measure the total resistance of the resistors.

Figure 11 shows the student's circuit with 3 resistors.

Figure 11



The student repeated each reading of resistance three times.

Table 1 shows some of the results for 3 resistors in parallel.

Table 1

Number of resistors	Total resistance in ohms			
	Reading 1	Reading 2	Reading 3	Mean
3	15.8	15.3	**X**	15.7

0 8 . 1 Calculate value **X** in **Table 1**.

[2 marks]

$\frac{15.8 + 15.3 + x}{3} = 15.7$

$31.1 + x = 47.1$

X = 16 Ω

0 8 . 2 The student thought that taking a fourth reading would improve the precision of the results.

The fourth reading was 16.2 Ω.

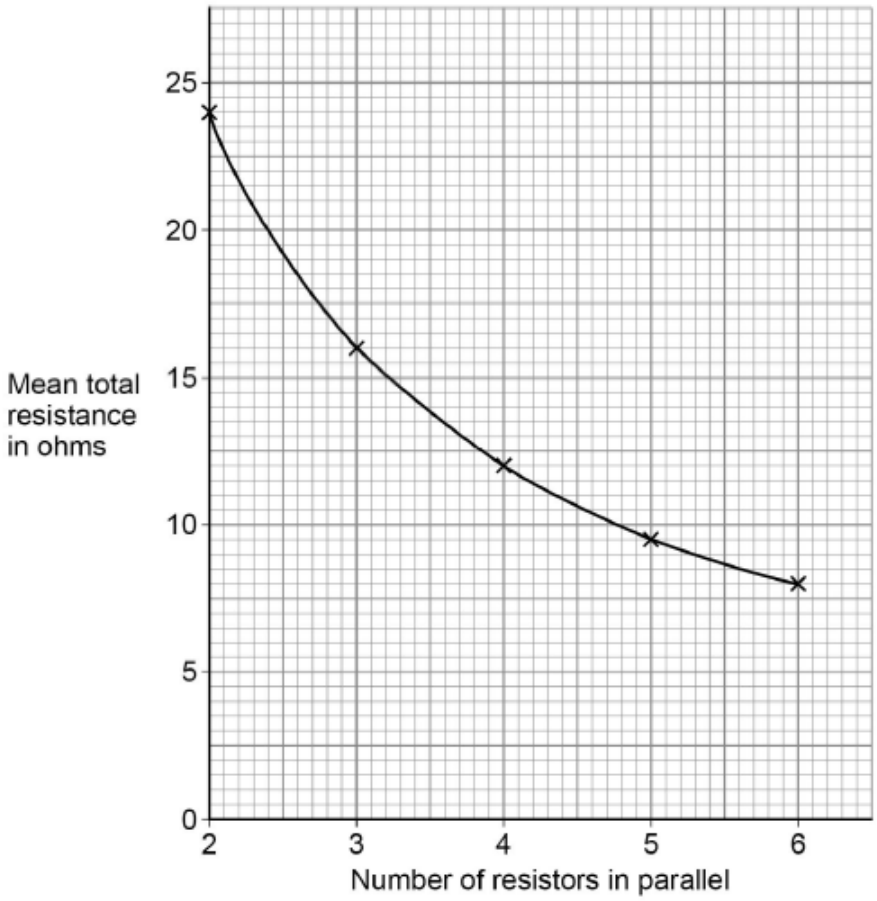
Explain why the student was wrong.

[2 marks]

Precision is the closeness of the measurements to each other. However, the value of 16.2Ω is not close to the mean of other readings and it will hence further lower the precision.

Figure 12 shows the results from the investigation.

Figure 12



0 8 . 3 The student concluded that the number of resistors in parallel was inversely proportional to the mean total resistance.

Explain why the student was correct.

Use data from **Figure 12** in your answer.

[3 marks]

When the number of resistors has doubled from 2 to 4 the mean total resistance has halved from 24Ω to 12Ω. Hence, an inversely proportionality is seen.

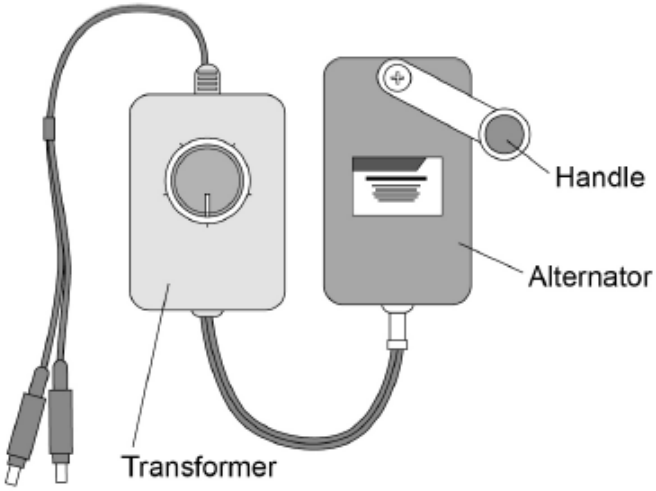
0 8 . 4 Explain why adding resistors in parallel decreases the total resistance.

[2 marks]

Each resistor would get the same pd and a current will flow through it. However, the total current in the circuit is equal to the sum of individual currents in the resistors and the total resistance decreases as there are more paths for the current to flow.

0 7 **Figure 10** shows a portable power supply.

Figure 10



0 7 . 1 The portable power supply has an alternator connected to a transformer.

The transformer can be adjusted to have different numbers of turns on the secondary coil.

Suggest why.

[2 marks]

To change the voltage output of the power supply, to power different sorts of devices that have different voltage requirements.

0 7 . 2 A lamp is connected to the power supply.

The lamp requires an input potential difference of 5.0 V.

The alternator generates a potential difference of 1.5 V.

The primary coil of the transformer has 150 turns.

Calculate the number of turns needed on the secondary coil.

[3 marks]

Number of turns on the secondary coil = 500

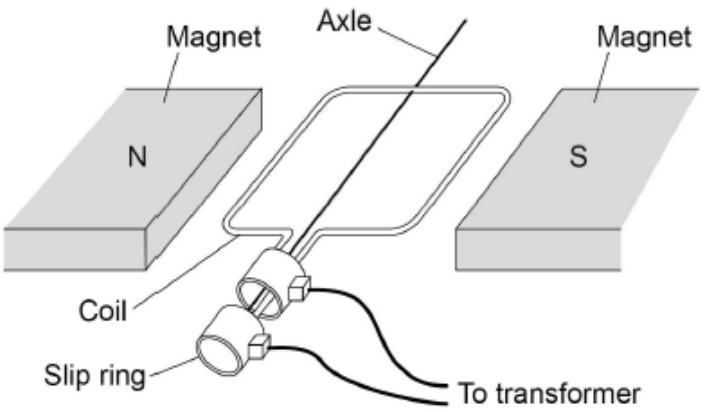
$\frac{N_{OUT}}{N_{IN}} = \frac{V_{OUT}}{V_{IN}}$

$\frac{N_{OUT}}{150} = \frac{5}{1.5}$

$N_{OUT} = \frac{5}{1.5} \times 150$

Figure 11 shows the inside parts of the alternator.

Figure 11



0 7 . 3 The handle of the alternator is turned, causing the coil to rotate.

Explain why an alternating current is induced in the coil.

[5 marks]

As the coils rotate, magnetic field lines of the magnets are cut, producing an EMF in the coil.. As one side of the coil moves up, the current is produced in one direction and reverses as that side moves down after a half turn. Hence, an alternating current is produced.