

Current, charge, potential difference and resistance

AQA GCSE Physics 8463 and Combined Science Trilogy 8464 | Foundation and Higher | Paper 1

Suggested 35-40 minutes independent work + 15-20 minutes review | 44 practice marks

Specification points covered

8463 4.2.1.1 / 8464 6.2.1.1: circuit symbols and meter positions
8463 4.2.1.2 / 8464 6.2.1.2: charge flow, current and time
8463 4.2.1.3 / 8464 6.2.1.3: current, resistance and potential difference
8463 4.2.1.4 / 8464 6.2.1.4: constant resistance (selected content)
8463 4.2.4.2 / 8464 6.2.4.2: electrical energy and charge (selected content)

A repair cafe restores small battery-powered devices. You will check measurements, choose replacement resistors and decide which light can finish a repair job. Each test is separate. Use only the values given for that test.

Show your working and units. Equations used: $Q = It$, $V = IR$ and $E = QV$. Use the Physics Equations Sheet if needed.
 $1000 \text{ mA} = 1 \text{ A}$; $60 \text{ s} = 1 \text{ minute}$.

1 Meaning of the quantities

1(a) Define electric current. [1 mark]

1(b) Define potential difference in terms of energy and charge. [1 mark]

2 Charge passing through devices

Use $Q = It$. Convert current to A and time to s before substituting.

2(a) A lamp carries a steady current of 0.20 A for 40 s. Calculate the charge that passes through it. [1 mark]

2(b) The lamp now carries 0.20 A for 150 s. Calculate the charge that passes through it. [1 mark]



2 Charge passing through devices continued

2(c) During a fan test, 36 C passes a point in 120 s. Calculate the mean current. [1 mark]

2(d) A buzzer carries 0.15 A and transfers 108 C of charge. Calculate its operating time in seconds. [1 mark]

2(e) A small motor carries a steady current of 250 mA for 2.0 minutes. Calculate the charge that passes through it. [2 marks]

2(f) A trainee claims that test (b) had a larger current than test (a) because more charge passed. Explain why this claim is wrong. [2 marks]

3 Potential difference and energy

The cafe tests several devices. Use $E = QV$ for energy transferred.

3(a) A device has a potential difference of 9.0 V across it. State the energy transferred when 1.0 C passes through it. [1 mark]

3(b) A radio transfers energy at 9.0 V while 20 C passes through it. Calculate the energy transferred. [1 mark]

3(c) A device transfers 72 J when 12 C passes through it. Calculate the potential difference across it. [1 mark]

3(d) An indicator has a potential difference of 5.0 V across it and transfers 60 J of energy. Calculate the charge that passes through it. [1 mark]

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3 Potential difference and energy continued

3(e) A motor carries a steady current of 0.30 A for 50 s at a potential difference of 4.0 V. Calculate the electrical energy transferred to the motor. **[2 marks]**

3(f) In a second test, the same 12 C passes through a device at 3.0 V. Compare the energy transferred with the 72 J in part (c). Explain your comparison. **[2 marks]**

4 Connecting the meters

Figure 1 shows a cell, a resistor and two empty meter positions, P and Q.

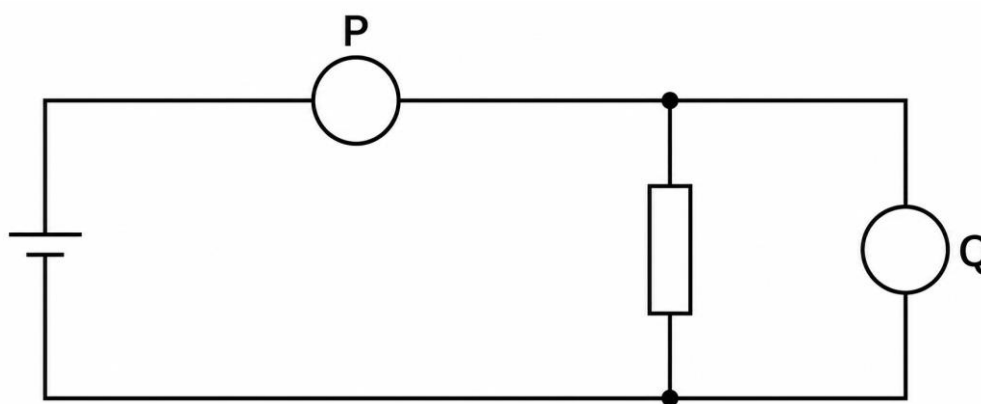


Figure 1

4(a) Identify the meter required at P and the meter required at Q. **[2 marks]**

4(b) The resistor carries 0.80 A with 4.8 V across it. Calculate its resistance. **[1 mark]**

4(c) The ammeter is moved to the bottom wire without any other change. State its reading and explain why it is not smaller. Assume the meters do not affect the circuit. **[2 marks]**



5 Choosing a replacement resistor

Two fixed resistors are tested at constant temperature. Table 1 gives the readings.

Table 1

Resistor	Potential difference / V	Current
A	6.0	0.30 A
B	6.0	150 mA

5(a) Use Table 1 to calculate the resistance of resistor A. **[1 mark]**

5(b) Use Table 1 to calculate the resistance of resistor B. **[2 marks]**

5(c) Resistor B remains at the same temperature. Calculate its current when the potential difference across it is 4.0 V. **[1 mark]**

5(d) The potential difference is kept constant. A resistor is replaced by one with twice the resistance. State what happens to the current and to the charge passing in the same time. **[2 marks]**

5(e) An alarm circuit must carry between 0.12 A and 0.18 A, inclusive, when 6.0 V is across its resistor. Choose A or B and justify your choice using Table 1. **[2 marks]**

5(f) At the same temperature, resistor A gives 0.10 A at 2.0 V and 0.20 A at 4.0 V. Do these two measurements support a constant resistance? Use calculated values to justify your answer. **[2 marks]**

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6 Will the light last for the repair?

A partly used battery pack has 180 C of usable charge remaining at a steady 4.5 V. A repair needs light for 30 minutes. Either unit in Table 2 gives enough light. Assume the current and potential difference remain constant until the usable charge is exhausted.

Table 2

Light unit	Operating potential difference / V	Steady current / mA
L	4.5	80
M	4.5	120

6(a) Calculate the electrical energy that the remaining usable charge can transfer at 4.5 V. **[1 mark]**

6(b) Calculate the charge needed to run light unit L for the full 30 minutes. **[2 marks]**

6(c) Calculate the charge needed to run light unit M for the full 30 minutes. **[2 marks]**

6(d) Choose the unit that can complete the repair. Justify your choice by comparing both calculated charges with the 180 C available. **[2 marks]**

6(e) Calculate the maximum time, in seconds, that unit M can run using the 180 C available. **[2 marks]**

6(f) A different battery also has 180 C of usable charge, but its potential difference is 9.0 V. A trainee says it contains twice as much usable charge as the 4.5 V pack. Explain why this is wrong. Do not connect it to the light units. **[2 marks]**

Review: correct one conversion error and one explanation after checking your answers.

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