Charge, current and resistance

Worked solutions

GCSE science calculations

This topic online

1 A current of 2 A flows through a lamp for 30 s.

Calculate the charge that flows through the lamp.

(2 marks)

Charge flow = current x time

$Q = 2 \times 30$

$Q = 60\ C$

60 C

2 A current of 0.5 A flows through a resistor of resistance 24 Ω.

Calculate the potential difference across the resistor.

(2 marks)

Potential difference = current x resistance

$V = 0.5 \times 24$

$V = 12\ V$

12 V

3 Ruby connects a 10 Ω resistor and a 15 Ω resistor in series.

Calculate the total resistance of the two resistors.

(1 mark)

Total resistance in series = $R_1 + R_2$

$R_{total} = 10 + 15$

$R_{total} = 25\ \Omega$

25 Ω

4 A current of 250 mA flows through a buzzer for 40 s.

Calculate the charge that flows through the buzzer.

(3 marks)

Charge flow = current x time

250 mA = 0.25 A

$Q = 0.25 \times 40$

$Q = 10\ C$

10 C

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5 Daniel charges his phone overnight. The charger supplies a steady current of 1.5 A for 2 hours.

Calculate the charge that flows into the phone. (3 marks)

Charge flow = current × time

2 hours = 2 × 60 × 60 = 7200 s

$Q = 1.5 \times 7200$

$Q = 10800$ C

10800 C

6 An LED circuit has a 450 Ω resistor. A current of 20 mA flows through the resistor.

Calculate the potential difference across the resistor. (2 marks)

Potential difference = current × resistance

20 mA = 0.02 A

$V = 0.02 \times 450$

$V = 9$ V

9 V

7 An electric fan heater is connected to the 230 V mains supply. The resistance of its heating element is 46 Ω.

Calculate the current in the heating element. (3 marks)

Potential difference = current × resistance

$230 = I \times 46$

$I = 230 \div 46$

$I = 5$ A

5 A

8 In a Year 10 practical, Sofia measures a potential difference of 6.0 V across a resistor. The ammeter reads 40 mA.

Calculate the resistance of the resistor. (3 marks)

Potential difference = current × resistance

40 mA = 0.04 A

$6 = 0.04 \times R$

$R = 6 \div 0.04$

$R = 150\ \Omega$

150 Ω

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9 A current of 0.8 A flows through an electric motor in a toy car. A total charge of 1200 C flows through the motor.

Calculate how long the motor was running. Give your answer in minutes. (3 marks)

Charge flow = current x time

$1200 = 0.8 \times t$

$t = 1200 \div 0.8$

$t = 1500$ s

÷ 60 to change seconds to minutes

$t = 25$ minutes

25 minutes

10 Ethan builds a series circuit with a 9.0 V battery, a 220 Ω resistor and a lamp. The current in the circuit is 30 mA.

Calculate the resistance of the lamp. Show your working. (4 marks)

Potential difference = current x resistance

30 mA = 0.03 A

$9 = 0.03 \times R_{total}$

$R_{total} = 9 \div 0.03$

$R_{total} = 300\ \Omega$

Total resistance in series = R1 + R2

$300 = 220 + R_{lamp}$

$R_{lamp} = 300 - 220$

$R_{lamp} = 80\ \Omega$

80 Ω

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11 A potential difference of 4.5 V is applied across a 30 Ω resistor for 3 minutes.
Calculate the charge that flows through the resistor. Show your working.

(4 marks)

Potential difference = current × resistance

$4.5 = I \times 30$

$I = 4.5 \div 30$

$I = 0.15\ A$

Charge flow = current × time

3 minutes $= 3 \times 60 = 180\ s$

$Q = 0.15 \times 180$

$Q = 27\ C$

27 C

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12 A 470 Ω resistor and a 330 Ω resistor are connected in series with a 9.0 V battery.

a. Calculate the total resistance of the circuit.

b. Calculate the current in the circuit. Give your answer in mA to 2 significant figures.

c. The circuit is switched on for 10 minutes. Calculate the charge that flows. Give your answer to 2 significant figures. Show your working.

(5 marks)

a)

Total resistance in series = R1 + R2

R total = 470 + 330

R total = 800 Ω

800 Ω

b)

Potential difference = current x resistance

9 = I x 800

I = 9 ÷ 800

I = 0.01125 A

x 1000 to change A to mA

I = 11.25 mA

11 mA

c)

Charge flow = current x time

Keep the full value of the current in the calculator

10 minutes = 600 s

Q = 0.01125 x 600

Q = 6.75 C

6.8 C

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13 A lamp and a resistor are connected in series to a 12 V battery. A voltmeter across the resistor reads 4.5 V. The current in the circuit is 0.15 A.

Calculate the resistance of the resistor. (2 marks)

Use the p.d. across the resistor (4.5 V), not the battery p.d. (12 V)

Potential difference = current x resistance

$4.5 = 0.15 \times R$

$R = 4.5 \div 0.15$

$30\ \Omega$

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