Electricity

GCSE Science • **Combined and Triple** • Grades 3–6

WORKED SOLUTIONS

Name: worked example Class: _____ Total: 54 / 54

Show all your working. Marks are given for correct method as well as the final answer.

1. Define electric current. **[2 marks]**

measured in amperes

Answer: the rate of flow of charge

2. Write down the equation linking charge, current and time. **[1 mark]**

charge = current × time

Answer: $Q = It$

3. A current of 3 A flows for 40 s. Work out the charge that passes. **[2 marks]**

$3 \times 40 = 120$ C

Answer: 120 **C**

4. Write down the equation linking potential difference, current and resistance. **[1 mark]**

the one equation you cannot afford to forget

Answer: $V = IR$

5. A 12 V supply drives 4 A through a resistor. Work out its resistance. **[2 marks]**

$R = V \div I$
$12 \div 4 = 3\ \Omega$

Answer: 3 Ω

6. A 6 Ω resistor carries 2 A. Work out the potential difference across it. **[2 marks]**

$V = IR$
$2 \times 6 = 12$ V

Answer: 12 **V**

7. Name the instrument used to measure current and say how it is connected. **[2 marks]**

the current must flow THROUGH it

Answer: an ammeter, connected in series

8. Name the instrument used to measure potential difference and say how it is connected. **[2 marks]**

it measures ACROSS a component

Answer: a voltmeter, connected in parallel

9. State what happens to the current at different points in a series circuit. **[2 marks]**

there is only one path

Answer: it is the same everywhere

10. State how the potential difference is shared in a series circuit. **[2 marks]**

the separate p.d.s add up to the supply p.d.

Answer: it is shared between the components

11. Two resistors of 4 Ω and 6 Ω are in series. Work out the total resistance. **[2 marks]**

in series you simply add
4 + 6 = 10 Ω

Answer: 10 Ω

12. Those resistors are connected to a 20 V supply. Work out the current. **[3 marks]**

$I = V \div R$
$20 \div 10 = 2$ A

Answer: 2 **A**

13. State what happens to the potential difference across each branch of a parallel circuit. **[2 marks]**

each branch connects straight to the supply

Answer: it is the same across each branch

14. Explain why adding a resistor in parallel DECREASES the total resistance. **[3 marks]**

more paths means more total current
more current for the same p.d. means less resistance
this is the one everybody gets backwards

Answer: it gives the current another path

15. Give one advantage of wiring household lights in parallel. **[2 marks]**

each bulb gets the full mains p.d.

Answer: each can be switched separately, and one failing does not stop the rest

16. Write down two equations for electrical power. **[2 marks]**

use whichever matches the values you have

Answer: $P = VI$ and $P = I^2R$

17. A 230 V kettle draws 10 A. Work out its power. **[2 marks]**

$P = VI$
$230 \times 10 = 2300$ W

Answer: 2300 **W**

18. Write down the frequency and voltage of the UK mains supply. **[2 marks]**

alternating current

Answer: 50 Hz, 230 V

19. A circuit has a 12 V battery and two 3 Ω resistors.

(a) Work out the current if they are in SERIES. **[3 marks]**

total $R = 3 + 3 = 6\ \Omega$
$I = 12 \div 6$
$= 2\ A$

(b) Work out the total resistance if they are in PARALLEL. **[3 marks]**

two equal resistors in parallel give half of one
$3 \div 2$
$= 1.5\ \Omega$

Answer: 2 A ; 1.5 Ω

20. A 2 000 W heater runs for 30 minutes.

(a) Work out the energy transferred, in joules. **[3 marks]**

30 min = 1800 s
$E = Pt = 2000 \times 1800$
$= 3\,600\,000$ J

(b) Electricity costs 30p per kilowatt-hour. Work out the cost of running it. **[3 marks]**

2 kW for 0.5 h = 1 kWh
$1 \times$ 30p
= 30p

Answer: 3 600 000 J ; 30p

21. Explain the role of the National Grid.

(a) State why transformers are used. **[3 marks]**

step-up transformers raise the p.d. for transmission
step-down transformers lower it for homes

(b) Explain why a high voltage reduces energy losses. **[3 marks]**

for the same power, a higher p.d. means a LOWER current
energy lost as heat depends on I^2R
so halving the current quarters the losses

Answer: step up then down ; lower current means far lower heating losses

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