9. Electricity

9.2 Potential difference and power

Paper 1

Question Paper

1 A kettle is connected to a 250 V mains supply.

What are possible values for the power of the kettle and the current in the kettle?

	power / W	current / A
A	500	0.5
B	500	5.0
C	2500	0.1
D	2500	10

2 What is the definition of potential difference across a component?

A energy transferred per unit charge

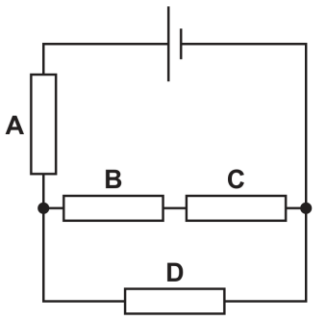
B energy transferred per unit current

C energy transferred per unit distance

D energy transferred per unit time

3 The diagram shows four identical resistors connected in a circuit.

Which resistor dissipates the most power?



4 A torch uses three lamps connected in parallel and is powered by a cell of electromotive force (e.m.f.) 3.0 V and negligible internal resistance. Each lamp dissipates 0.60 W of power.

What is the current in the cell?

A 0.067 A **B** 0.20 A **C** 0.60 A **D** 0.83 A

5 What is the definition of the potential difference across an electrical component?

A the charge per unit time passing through the component

B the energy transferred per unit charge

C the force per unit charge

D the resistance per unit current

6 A resistor of resistance R is connected across a cell of electromotive force (e.m.f.) E and negligible internal resistance.

Which single change to the circuit would lead to the largest increase in the power dissipated in the resistor?

A doubling the value of E

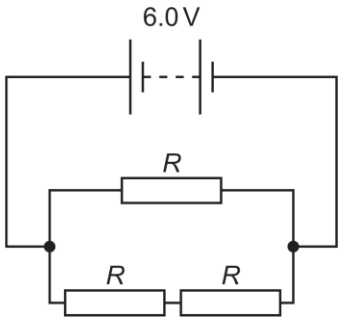
B doubling the value of R

C halving the value of E

D halving the value of R

7 In the circuit shown, the battery has an electromotive force (e.m.f.) of 6.0 V and negligible internal resistance.

The three resistors each have resistance R.

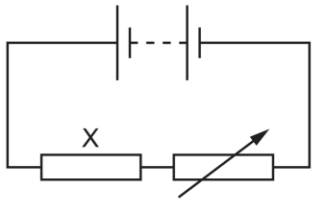


The total power dissipated in the resistor network is 24 W.

What is the value of R?

A 0.50 Ω **B** 1.0 Ω **C** 1.5 Ω **D** 2.3 Ω

8 In the circuit shown, a fixed resistor X is connected in series with a battery and a variable resistor.



The power dissipated in resistor X is 7.2 W when a current of 3.0 A passes through it.

The variable resistor is adjusted so that the power dissipated in X increases by 50%.

What is the new current in the circuit?

A 2.4 A **B** 3.7 A **C** 4.5 A **D** 14 A

9 What is the definition of the potential difference (p.d.) across a component?

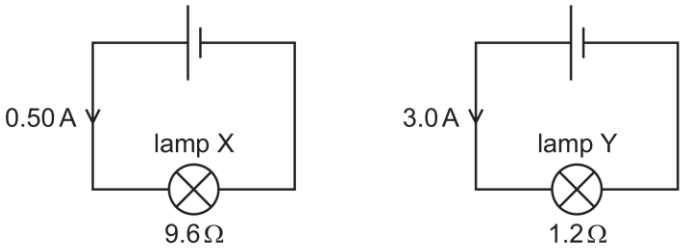
A the electrical power supplied to the component

B the energy transferred to the component per unit charge

C the product of the current in the component and its resistance

D the voltage across the component

10 The circuit diagrams show two lamps X and Y each connected to a cell. The current in lamp X is 0.50 A and its resistance is 9.6 Ω. The current in lamp Y is 3.0 A and its resistance is 1.2 Ω.



What is the ratio $\frac{\text{power in lamp X}}{\text{power in lamp Y}}$?

A 0.22 **B** 0.75 **C** 1.3 **D** 4.5

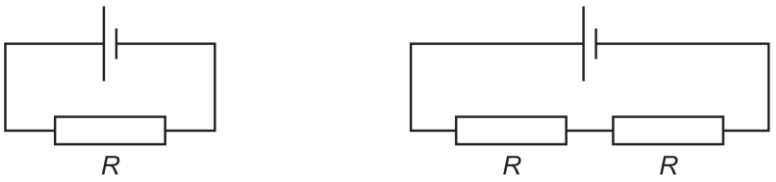
11 A power supply is connected to a component by connecting wires of total resistance 4.9 Ω.

The power supply has an output power of 3.6 W and a terminal potential difference of 12 V.

How much thermal energy is dissipated in the connecting wires in a time of 1.0 hour?

A 0.44 J **B** 29 J **C** 1.6 kJ **D** 11 kJ

12 The diagrams show two different circuits.



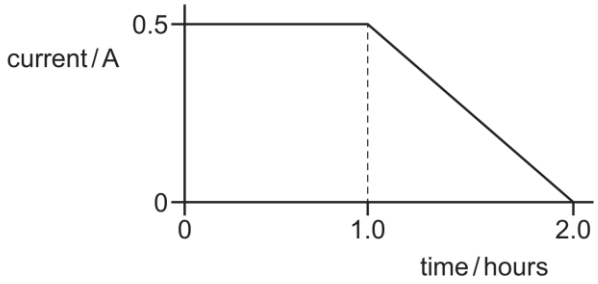
The cells in each circuit have the same electromotive force (e.m.f.) and negligible internal resistance. The three resistors each have the same resistance *R*.

In the circuit on the left, the power dissipated in the resistor is *P*.

What is the total power dissipated in the circuit on the right?

A $\frac{P}{4}$ **B** $\frac{P}{2}$ **C** P **D** $2P$

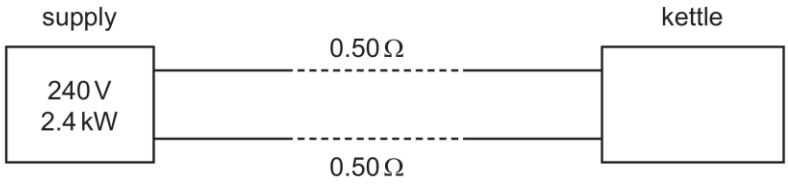
13 A mobile phone battery is charged by connecting it to a constant potential difference of 5.0 V. After a time of 1.0 hour, the initial current of 0.50 A slowly decreases to zero, as shown.



What is the best estimate of the energy transferred to the battery during the time of 2.0 hours shown in the graph?

A 2700 J **B** 9000 J **C** 14 000 J **D** 18 000 J

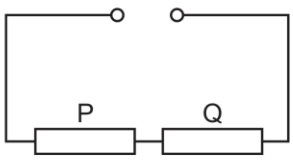
14 The power output of an electrical supply is 2.4 kW at a potential difference (p.d.) of 240 V. The two wires between the supply and a kettle each have a resistance of 0.50 Ω, as shown.



What is the power supplied to the kettle and what is the p.d. across the kettle?

	power / kW	p.d. / V
A	2.3	230
B	2.3	235
C	2.4	230
D	2.4	235

15 A circuit contains two resistors, P and Q, and a power supply of negligible internal resistance, as shown.



The current in resistor P is 2.0 A and the power dissipated by resistor P is 18 W.

Resistor Q dissipates 240 J of energy when a charge of 40 C passes through it.

What is the electromotive force (e.m.f.) of the power supply?

A 3.0 V **B** 6.0 V **C** 9.0 V **D** 15 V

16 An electric kettle is rated at 2.0 kW, which describes the power supplied to the heating coil in the kettle.

The coil has a resistance of 5.0 kΩ.

What is the current in the coil?

A 0.40 A **B** 0.63 A **C** 1.6 A **D** 2.5 A

17 What is the definition of potential difference?

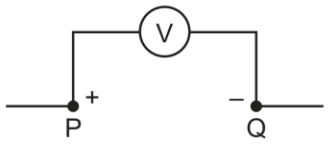
A power per unit current

B product of current and resistance

C product of electric field strength and distance

D work done per unit charge

18 A voltmeter connected between two points P and Q in an electrical circuit shows a reading of 1 V.



Which statement is correct?

A The energy needed to move +1 C of charge from P to Q is 1 J.

B The energy needed to move +1 C of charge from Q to P is 1 J.

C The energy needed to move one electron from P to Q is 1 J.

D The energy needed to move one electron from Q to P is 1 J.

19 What could **not** be used as a unit of potential difference?

A $A\Omega$ **B** $Nm^{-1}C^{-1}$ **C** WA^{-1} **D** $(\Omega W)^{\frac{1}{2}}$

20 A fixed resistor of resistance 12 Ω is connected to a battery. There is a current of 0.20 A in the resistor. The current is now doubled.

What is the new power dissipated in the resistor?

A 0.48 W **B** 0.96 W **C** 1.9 W **D** 4.8 W

21 There is a current in a resistor for an unknown time.

Which two quantities can be used to calculate the energy dissipated by the resistor?

A the current in the resistor and the potential difference across the resistor

B the resistance of the resistor and the current in the resistor

C the total charge passing through the resistor and the potential difference across the resistor

D the total charge passing through the resistor and the resistance of the resistor

22 What is equivalent to one volt?

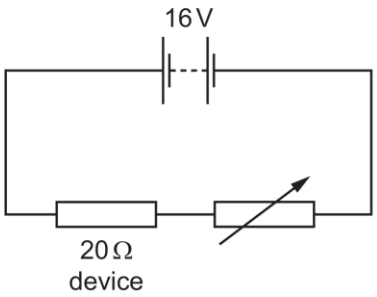
A one coulomb per second

B one joule per coulomb

C one joule per second

D one joule second per coulomb squared

23 An electrical device of fixed resistance 20 Ω is connected in series with a variable resistor and a battery of electromotive force (e.m.f.) 16 V and negligible internal resistance.



What is the resistance of the variable resistor when the power dissipated in the electrical device is 4.0 W?

A 16 Ω **B** 36 Ω **C** 44 Ω **D** 60 Ω