1 **a** What instrument is used to measure electric current?
b How should it be connected in a circuit?
c Draw its circuit symbol.

2 A circuit is set up in which a cell makes an electric current flow through a lamp. Two ammeters are included, one to measure the current flowing into the lamp, the other to measure the current flowing out of the lamp.

a Draw a circuit diagram to represent this circuit.
b Add an arrow to show the direction of the current around the circuit.
c What can you say about the readings on the two ammeters?

3 **a** Name two materials that are good electrical conductors.
b Name two materials that are good electrical insulators.

4 **a** In which direction does conventional current flow around a circuit?
b In which direction do electrons flow?

5 **a** What is the unit of electric current?
b What is the unit of electric charge?

6 **a** How many milliamps are there in 1 amp?
b How many microamps are there in 1 amp?

7 Which of the following equations shows the correct relationship between electrical units?

$1\,A = 1\,C/s$

$1\,C = 1\,A/s$

8 If 20 C of charge pass a point in a circuit in 1 s, what current is flowing?

9 A current of 4 A flows around a circuit for 10 s. How much charge flows around the circuit in this time?

10 **a** What do the letters p.d. stand for?
b What meter is used to measure p.d.?
c Draw the symbol for this meter.

11 **a** What name is given to the p.d. across a cell or battery?
b What unit is this measured in?

12 **a** What is the resistance of a lamp if a current of 2.0 A flows through it when it is connected to a 12 V supply?
b If the p.d. across the lamp is increased, will the current flowing increase or decrease?

13 A student cuts two pieces of wire, one long and one short, from a reel.
a Which piece of wire will have the greater resistance?
b Draw a circuit diagram to show how you would check your answer by measuring the resistances of the two pieces of wire.

14 What p.d. is needed to make a current of 1 A flow through a 20 Ω resistor?

15 **a** What is the resistance of a resistor if a p.d. of 20 V across it causes a current of 2 A to flow through it?
b What p.d. would cause a current of 3 A to flow through the resistor?

16 What current flows when a p.d. of 14.5 V is connected across a 1000 Ω resistor?

17 A 1.0 m length of wire is found to have a resistance of 40 Ω.
a What would be the resistance of a piece of the same wire of length 2.0 m?
b What would be the resistance of a 2.0 m wire with half the cross-sectional area, made of the same material?

18 Write down an equation linking watts, volts and amps.

19 A 10 V power supply pushes a current of 5 A through a resistor. At what rate is energy transferred to the resistor?

20 A tropical fish tank is fitted with an electric heater, which has a power rating of 30 W. The heater is connected to a 12 V supply. What current flows through the heater when it is switched on?

21 How much energy is transformed by an electric lamp in 100 s if a current of 0.22 A flows through it when it is connected to a 120 V supply?

18.1 a Draw a circuit to show how a cell can be connected to a switch and a lamp, so that the lamp lights up when the switch is closed. Label the components in your circuit. [4]

b Add arrows to your circuit to show the direction in which electric current flows in the circuit. [2]

c Name the device you would use to measure the e.m.f. of the cell. [1]

d What unit is e.m.f. measured in? [1]

18.2 To determine the resistance R of a resistor, an ammeter and a voltmeter can be used.

a Draw a circuit diagram to show how you would use these instruments, together with a variable power supply, to determine R. [5]

b What quantity does the ammeter measure? [1]

c What quantity does the voltmeter measure? [1]

d If the voltmeter gave a reading of 6.5 V and the ammeter gave a reading of 1.25 A, what would be the value of R? [3]

18.3 Electrical appliances are used to transform electrical energy into other, more useful, forms of energy.

a Into what useful form of energy does a filament lamp transform electrical energy? [1]

b Into what other, less useful, form is electrical energy transformed by the lamp? [1]

c A lamp is labelled '12 V, 36 W'. This indicates that it should be used with a 12 V supply. What other information does the label provide? [1]

d How much electrical energy does the lamp transform in 1 minute? [3]

e The lamp is connected to a 12 V supply. Use the relationship $P = I\,V$ to calculate the current that flows through it. [3]

18.4 An electric heater is connected to a 10 V supply.

a In 20 s, 30 C of electric charge flows through the heater. Calculate the current flowing. [3]

b Calculate the energy transferred by the heater in 20 s. [4]