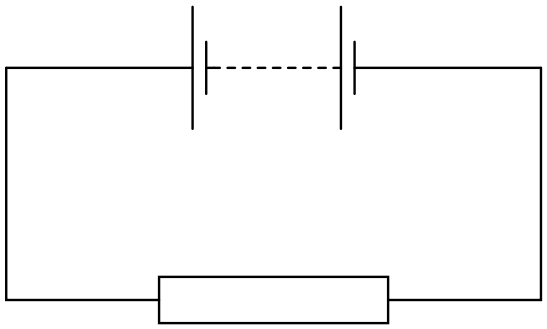
1 In the circuit below, the battery converts an amount E of chemical energy to electrical energy when charge Q passes through the resistor in time t. 9702/1/M/J/02



Which expressions give the e.m.f. of the battery and the current in the resistor?

	e.m.f.	current
A	EQ	Q/t
B	EQ	Qt
C	E/Q	Q/t
D	E/Q	Qt

2 Which equation is used to define resistance? 9702/1/O/N/02

A power = (current)^2 × resistance

B resistivity = resistance × area ÷ length

C potential difference = current × resistance

D energy = (current)^2 × resistance × time

3 The current in a component is reduced uniformly from 100 mA to 20 mA over a period of 8.0 s. 9702/01/M/J/03

What is the charge that flows during this time?

A 160 mC **B** 320 mC **C** 480 mC **D** 640 mC

4 A wire carries a current of 2.0 amperes for 1.0 hour. 9702/01/O/N/03

How many electrons pass a point in the wire in this time?

A 1.2×10^{-15}

B 7.2×10^{3}

C 1.3×10^{19}

D 4.5×10^{22}

5 What is an equivalent unit to 1 volt? 9702/01/M/J/04

A 1 J A^{-1} **B** 1 J C^{-1} **C** 1 W C^{-1} **D** 1 W s^{-1}

6 The potential difference between point X and point Y is 20V. The time taken for charge carriers to move from X to Y is 15 s, and, in this time, the energy of the charge carriers changes by 12 J.

9702/01/M/J/04

What is the current between X and Y?

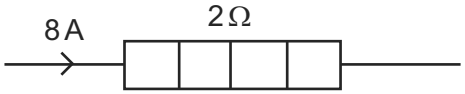
A 0.040 A **B** 0.11 A **C** 9.0 A **D** 25 A

7 The diagram shows four heaters and the current in each.

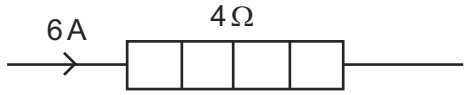
9702/01/O/N/04

Which heater has the greatest power dissipation?

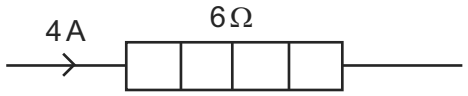
A



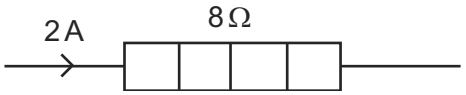
B



C



D



8 A copper wire of cross-sectional area 2.0 mm^2 carries a current of 10 A.

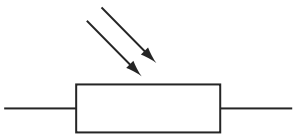
9702/01/M/J/05

How many electrons pass through a given cross-section of the wire in one second?

A 1.0×10^1 **B** 5.0×10^6 **C** 6.3×10^{19} **D** 3.1×10^{25}

9 Which electrical component is represented by the following symbol?

9702/01/M/J/05



A a diode

B a light-dependent resistor

C a resistor

D a thermistor

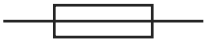
10 A pedal bicycle is fitted with an electric motor. The rider switches on the motor for a time of 3.0 minutes. A constant current of 3.5 A in the electric motor is provided from a battery with a terminal voltage of 24 V.

9702/13/M/J/15

What is the energy supplied by the battery?

A 84 J **B** 250 J **C** 630 J **D** 15 000 J

11 An electrical component has the following circuit symbol. 9702/01/O/N/05



What does this symbol represent?

A variable resistor (rheostat)

B fuse

C light-dependent resistor

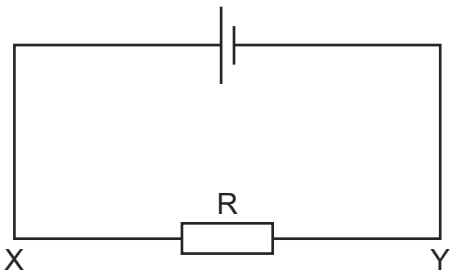
D thermistor

12 Two heating coils X and Y, of resistance R_X and R_Y respectively, deliver the same power when 12 V is applied across X and 6 V is applied across Y. 9702/01/O/N/07

What is the ratio R_X / R_Y?

A ¼ **B** ½ **C** 2 **D** 4

13 The current in the circuit is 4.8 A. 9702/01/M/J/06



What is the rate of flow and the direction of flow of electrons through the resistor R?

A $3.0 \times 10^{19}\,s^{-1}$ in direction X to Y

B $6.0 \times 10^{18}\,s^{-1}$ in direction X to Y

C $3.0 \times 10^{19}\,s^{-1}$ in direction Y to X

D $6.0 \times 10^{18}\,s^{-1}$ in direction Y to X

14 The charge that an electric battery can deliver is specified in ampere-hours. 9702/11/M/J/15

For example, a battery of capacity 40 ampere-hours could supply, when fully charged, 0.2 A for 200 hours.

What is the maximum energy that a fully charged 12 V, 40 ampere-hour battery could supply?

A 1.7 kJ **B** 29 kJ **C** 1.7 MJ **D** 29 MJ

15 The resistance of a device is designed to change with temperature. 9702/01/O/N/06

What is the device?

A a light-dependent resistor

B a potential divider

C a semiconductor diode

D a thermistor

16 The current in a resistor is 8.0 mA. 9702/01/M/J/07

What charge flows through the resistor in 0.020 s?

A 0.16 mC **B** 1.6 mC **C** 4.0 mC **D** 0.40 C

17 What is a correct statement of Ohm's law? 9702/01/M/J/07

A The potential difference across a component equals the current providing the resistance and other physical conditions stay constant.

B The potential difference across a component equals the current multiplied by the resistance.

C The potential difference across a component is proportional to its resistance.

D The potential difference across a component is proportional to the current in it providing physical conditions stay constant.

18 A power cable X has a resistance *R* and carries current I. 9702/01/M/J/08

A second cable Y has a resistance 2*R* and carries current $\frac{1}{2}I$.

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

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

19 Which electrical quantity would be the result of a calculation in which energy transfer is divided by charge? 9702/01/O/N/07

A current

B potential difference

C power

D resistance

20 A total charge of 100 C flows through a 12 W light bulb in a time of 50 s. 9702/01/M/J/08

What is the potential difference across the bulb during this time?

A 0.12 V **B** 2.0 V **C** 6.0 V **D** 24 V

21 The charge that a fully-charged 12 V car battery can supply is 100 kC. The starter motor of the car requires a current of 200 A for an average period of 2.0 s. The battery does not recharge because of a fault. 9702/01/O/N/08

What is the maximum number of times the starter motor of the car can be used?

A 21 **B** 25 **C** 42 **D** 250

22 The potential difference across a resistor is 12 V. The current in the resistor is 2.0 A. 9702/01/M/J/08

4.0 C passes through the resistor. What is the energy transferred and the time taken?

	energy / J	time / s
A	3.0	2.0
B	3.0	8.0
C	48	2.0
D	48	8.0

23 A 12 V battery is charged for 20 minutes by connecting it to a source of electromotive force (e.m.f.). The battery is supplied with 7.2×10^4 J of energy in this time. 9702/01/M/J/09

How much charge flows into the battery?

A 5.0 C **B** 60 C **C** 100 C **D** 6000 C

24 What is meant by the electromotive force (e.m.f.) of a cell? 9702/01/M/J/09

A The e.m.f. of a cell is the energy converted into electrical energy when unit charge passes through the cell.

B The e.m.f. of a cell is the energy transferred by the cell in driving unit charge through the external resistance.

C The e.m.f. of a cell is the energy transferred by the cell in driving unit charge through the internal resistance of the cell.

D The e.m.f. of a cell is the amount of energy needed to bring a unit positive charge from infinity to its positive pole.

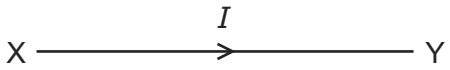
25 Which amount of charge, flowing in the given time, will produce the largest current? 9702/01/M/J/09

	charge / C	time / s
A	4	$\frac{1}{4}$
B	4	1
C	1	4
D	$\frac{1}{4}$	4

26 Which values of current and resistance will produce a rate of energy transfer of 16 J s^{-1}? 9702/11/O/N/09

	current / A	resistance / Ω
A	1	4
B	2	8
C	4	1
D	16	1

27 The diagram shows the symbol for a wire carrying a current I. 9702/11/O/N/09



What does this current represent?

A the amount of charge flowing past a point in XY per second

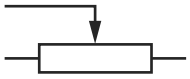
B the number of electrons flowing past a point in XY per second

C the number of positive ions flowing past a point in XY per second

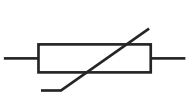
D the number of protons flowing past a point in XY per second

28 Which symbol represents a component whose resistance is designed to change with temperature? 9702/11/M/J/14

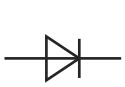
A



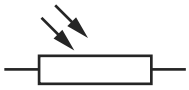
B



C



D



29 Which electrical component is represented by the following symbol? 9702/12/O/N/10

A a diode

B a potentiometer

C a resistor

D a thermistor

30 Which unit is **not** used in either the definition of the coulomb or the definition of the volt? 9702/12/M/J/15

A ampere

B joule

C ohm

D second

31 A cell of e.m.f. E delivers a charge Q to an external circuit. 9702/12/M/J/15

Which statement is correct?

A The energy dissipation in the external circuit is EQ.

B The energy dissipation within the cell is EQ.

C The external resistance is EQ.

D The total energy dissipation in the cell and the external circuit is EQ.

32 The potential difference across a component in a circuit is 2.0 V. 9702/11/M/J/14

How many electrons must flow through this component in order for it to be supplied with 4.8 J of energy?

A 2.6×10^{18} **B** 1.5×10^{19} **C** 3.0×10^{19} **D** 6.0×10^{19}

33 When there is **no current** in a wire, which statement about the conduction electrons in that wire is correct? 9702/12/O/N/10

A Electrons in the wire are moving totally randomly within the wire.

B Equal numbers of electrons move at the same speed, but in opposite directions, along the wire.

C No current is flowing therefore the electrons in the wire are stationary.

D No current is flowing therefore the electrons in the wire are vibrating around a fixed point.

34 A battery is marked 9.0 V. 9702/11/M/J/11

What does this mean?

A Each coulomb of charge from the battery supplies 9.0 J of electrical energy to the whole circuit.

B The battery supplies 9.0 J to an external circuit for each coulomb of charge.

C The potential difference across any component connected to the battery will be 9.0 V.

D There will always be 9.0 V across the battery terminals.

35 What describes the electric potential difference between two points in a wire that carries a current? 9702/12/M/J/11

A the force required to move a unit positive charge between the points

B the ratio of the energy dissipated between the points to the current

C the ratio of the power dissipated between the points to the current

D the ratio of the power dissipated between the points to the charge moved

36 Two copper wires of the same length but different diameters carry the same current. 9702/12/M/J/12

Which statement about the flow of charged particles through the wires is correct?

A Charged particles are provided by the power supply. Therefore the speed at which they travel depends only on the voltage of the supply.

B The charged particles in both wires move with the same average speed because the current in both wires is the same.

C The charged particles move faster through the wire with the larger diameter because there is a greater volume through which to flow.

D The charged particles move faster through the wire with the smaller diameter because it has a larger potential difference applied to it.

37 There is a current of 10 mA in a conductor for half an hour. 9702/11/M/J/12

How much charge passes a point in the conductor in this time?

A 0.3 C **B** 5 C **C** 18 C **D** 300 C

38 Which statement is **not** valid? 9702/11/O/N/11

A Current is the speed of the charged particles that carry it.

B Electromotive force (e.m.f.) is the energy converted to electrical energy from other forms, per unit charge.

C The potential difference (p.d.) between two points is the work done in moving unit charge from one point to the other.

D The resistance between two points is the p.d. between the two points, per unit current.

39 Which of the equations that link some of the following terms is correct? 9702/11/O/N/11

potential difference (p.d.)	V
current	I
resistance	R
charge	Q
energy	E
power	P
time	t

A $P = \frac{Q^2R}{t}$

B $ER^2 = V^2t$

C $\frac{VI}{P} = t$

D $PQ = EI$

40 A charge of 8.0 C passes through a resistor of resistance 30 Ω at a constant rate in a time of 20 s. 9702/12/O/N/11

What is the potential difference across the resistor?

A 0.40 V **B** 5.3 V **C** 12 V **D** 75 V

41 A power cable X has resistance R and carries current I. 9702/12/M/J/12

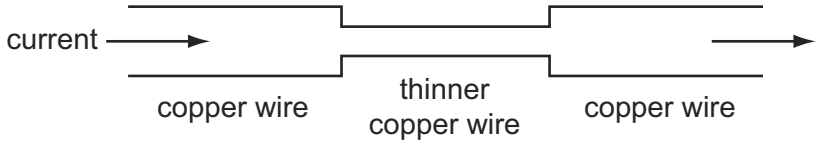
A second cable Y has resistance $2R$ and carries current $\frac{1}{2}I$.

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

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

42 An electric current is passed from a thick copper wire through a section of thinner copper wire before entering a second thick copper wire as shown.

9702/13/O/N/13



Which statement about the current and the speed of electrons in the wires is correct?

A The current and the speed of the electrons in the thinner wire are both less than in the thicker copper wires.

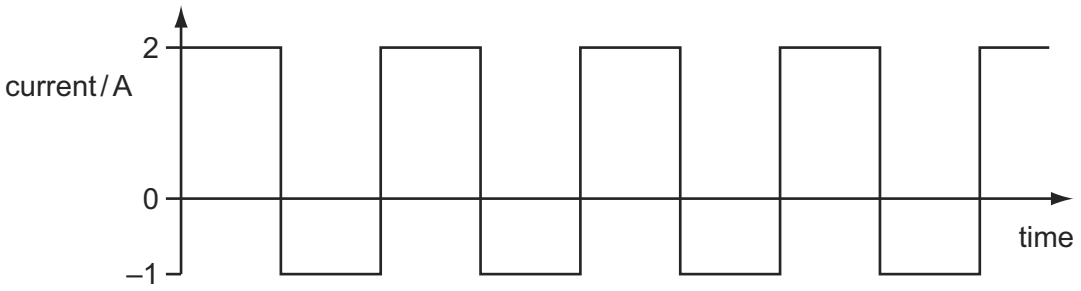
B The current and the speed of the electrons is the same in all the wires.

C The current is the same in all the wires but the speed of the electrons in the thinner wire is greater than in the thicker wires.

D The current is the same in all the wires but the speed of the electrons in the thinner wire is less than in the thicker wire.

43 A 100 Ω resistor conducts a current with changing direction and magnitude, as shown.

9702/12/O/N/12



What is the mean power dissipated in the resistor?

A 100 W **B** 150 W **C** 250 W **D** 400 W

44 Four statements about potential difference or electromotive force are listed.

9702/12/O/N/12

1 It involves changing electrical energy into other forms.

2 It involves changing other energy forms into electrical energy.

3 It is the energy per unit charge to move charge right round a circuit.

4 It is the work done per unit charge by the charge moving from one point to another.

Which statements apply to potential difference and which apply to electromotive force?

	potential difference	electromotive force
A	1 and 3	2 and 4
B	1 and 4	2 and 3
C	2 and 3	1 and 4
D	2 and 4	1 and 3

45 A filament lamp has a resistance of 180 Ω when the current in it is 500 mA.

What is the power transformed in the lamp?

A 45 W **B** 50 W **C** 90 W **D** 1400 W

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45