1) B 1A [current is the same in SERIES]

2). B [R, S are the only Resistors in SERIES]

---

3 a i). 2

a ii). Live – Brown. Neutral – Blue.

b). $I = \frac{P}{V}$

$I = \frac{460}{230}$

$I = 2\ A$

c i). 3 A.

c ii) Protect the flex of hairdryer from overheating.

4 a i). Brown

ii) Blue

iii) Earth

b). To stop Live + Neutral wires being pulled out of their pins, and causing a short circuit.

c). i). Double Insulation.

ii). Earth.

5 a i). light

ii). heat

b i). Kettle or Food Processor.

ii). Green / Yellow.

iii). A 3A fuse. $P < 700\,W$.

B 13A fuse. $P > 700\,W$.

6a) $P = I \cdot V$

$0.3 = I \cdot 6$

$I = \frac{0.3}{6}$

$I = \underline{\underline{0.05\,A}}$

b i). —|| - - ||—

ii). [A] 230 V [B] Transformer

iii). Mains: ac direction of current continuously changes

Battery: dc direction of current is constant. (one direction).

7a) GENERAL

- Producing same amount of light as a filament bulb.
- Last 10× longer as conventional lamps
- Cost 20p rather than £1.00 for the same time + same light

1 of...

b). 100 W: £1 × 365 = £365
20 W: £0.20 × 365 = £73

saving = 365 − 73 = £292

c). a lower powered bulb (20 W) which uses less electrical energy produces the same amount of light as a higher powered bulb [100 W].

d). i In the filament (wire)
ii In the gas.

---

8 a). $V = IR$

$8.8 = 0.02 \times R$

$R = \frac{8.8}{0.02}$

$R = 440\ \Omega$

b). $0.4\ k\Omega = 400\ \Omega$

c i). Circuit 2 scale is too large. [0R]
The reading is too small for the scale.
It can only go up/down in 100's of Ohms.

c ii). Turn dial to Ohms.

9 a i). $V = I R$

$2 = I \cdot 8$

$I = 0.25\ A$

GENERAL

$I = ?$

$R = 8$

$V = 2$

a ii). $V_{MOTOR} = 6 - 2 = \underline{\underline{4V}}$

b). ↓ R → ↑ current → ↑ speed of motor.

c). Volume control, light dimmer switch.

---

10 • CD / Stereo on bath

– could fall in + give person electric shock.

• Too many appliances plugged into 1 socket.

– adaptor could overheat → Fire.

• "Broken" flex insulation wrapped in tape.

– wires could touch, short circuit + cause overheating + fire.

• Vacuum cleaner is a PHYSICAL hazard rather than an Electrical hazard.

11 a). &

b). 12V

c) i). wire

ii). glass

iii). smaller than.

iv). smaller than.

---

12 ai)

	L1	L2	L3
I/A	0.3	0.3	0.3
V/V	12	12	12

aii).

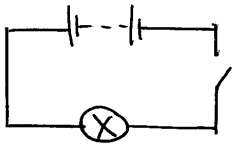
	L1	L2	L3
I/A	0.1	0.1	0.1
V/V	4V	4	4

bi) circuit : (parallel)

bii). Kettle; Electric Fire (appliance switch + socket switch).

---

13 a).



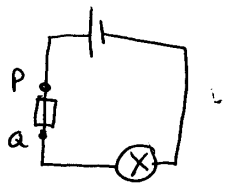
⊢ = a cell

b). charge; current

c). electrical → light

d). To reflect light coming out of the back of the bulb forwards.

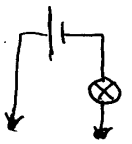
14. a)



b). Fuse put between P+Q.
Bulb does not light
Because circuit is broken [by blown fuse]
If fuse was ok; circuit would be complete and bulb would be lit.

---

15 a).



b). connect probe ends together
circuit is complete
bulb lights.

c). Circuit is broken (wire / filament) so current cannot flow through it.

---

16 a). 230 V.

b). Switch components on/off seperately
All components are at same voltage [230V]

ci). $P_T = 4 \times 800 = 3200\,W$

ii). (A) kwH = $3.2 \times 3 = 9.6$ kwH.

(B) cost = $5p \times 9.6 = 48p$.

d). MCB – Miniature Circuit Breaker
(no mark given for TRIP switch).

17 a) 1pt ✓

b). S_2 by passes Resistor so more current flows through the Motor.

ci). kwh = 2 x 8 = 16 kw.h.

cii). cost = 9p x 16 = 144p [£1.44]

---

18 ai). 

aii). Earth wire

b). A: Brush.

B: Commutator.

C: Rotating Coil

D: Field Coil.

CREDIT

19 ai). It is double insulated.

ii). Live – Brown + Neutral – Blue

iii). 13A (P > 700 W).

bi). $I = \frac{V}{R}$

$I = \frac{230}{5000}$

$I = 0.046$ A

R = 5000
V = 230
I = ?

bii). Current is less than fuse value (13A)
Fuse would not melt / blow.

biii). Protect flex / lawnmower.

biv). Water will decrease the resistance of the dummy so current will increase.

20ai) 4 A

aii) P = IV
P = 4 × 230
P = 920 W

V = 230 as "mains"

bi). 10 A fuse (note 9A at start)

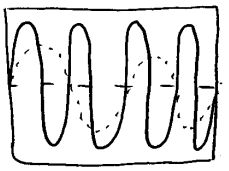
bii). To isolate (seperate from mains) appliance if there is a fault.

21 ai). wire ~~coil~~ is moving in a magnetic field.

aii). loop wire into a coil (or) more wire faster.

b) V_p = 2 squares x 0.2 mV = 0.4 mV

c).



---- OLD TRACE

—— NEW TRACE

- LOUDER ↑ Amplitude
- Higher f : more waves.

---

22 ai). 175 Ω.

aii). $I = \frac{V}{R}$

$I = \frac{230}{175}$

$I = 1.31$ A

aiii). $P = I \cdot V$

$P = 1.31 \times 230$

$P = 301.3$ W

300W lamp

b). In 1st 0.5s, resistance of the lamp is very low causing a high current to flow. This high current can overheat filament wire + melt it.

23 a). $I = P/V$

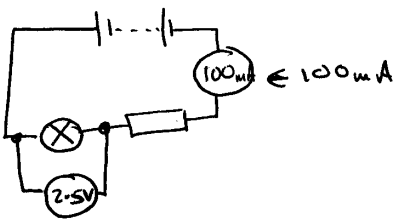
$I = \frac{75 \times 10^{-3}}{3}$

$I = 0.025\,A$ (25 mA).

b). 100 mA fuse.

---

24 a).



b i). $V_R = 12 - 2.5 = 9.5V$

ii). $R = \frac{V_R}{I} = \frac{9.5}{0.1} = 95\,\Omega$

---

25 a). i $R = \frac{V}{I} = \frac{10}{1.2} = 8.33\,\Omega$

a ii). Resistance remains constant ① as graph shows straight line through zero ① so $I \propto V$. ①

(oe)

$I = 1.4\,A \rightarrow V = 11.6\,V$ ①

$R = \frac{11.6}{1.4} = 8.28 = 8.3\,\Omega$ ①

Resistance remains constant ①

25bi). graph is not a straight line.

bii) (A) $I = 3.2\ A$

(B) $P = I.V$

$P = 3.2 \times 12$

$P = 38.4\ W$

---

26 ai). 230 V.

aii). Parallel.

b). $I = \frac{P}{V}$

$I = \frac{170}{230}$

$I = 0.739\,13\ A$

$I = 0.74\ A$

$P = 110 + 22 + 20 + 18$

$P = 170\ W$

c). $P = \frac{V^2}{R}$

$110 = \frac{230^2}{R}$

$R = \frac{52900}{110}$

$R = 481\ \Omega$ $(480.909090\ldots)$

OR calc I from $I_{TV} = \frac{P_{TV}}{V}$ then $V = I_{TV} R_{TV}$.

d). To protect cable & adaptor from overheating.

27 ai) $R = \frac{V}{I}$

$R = \frac{3.0}{0.10}$

$R = 30\ \Omega$

aii). 0.10 A (in series !)

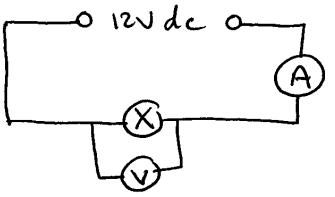
bi). Variable Resistor resistance is lowered ① in steps of 0.05 ① A on the ammeter

bii). Result no. 4 ① because voltage did not increase by 1.5 V. ①

c). The resistance is constant.

---

28 a).



b). Resistance.

ci). $IV = 24$. $I^2R = 24$.

ii) Power

iii) Watts.

29 a). 3A

b). $V_x = IR_x$

$V_x = 3 \times 2$

$V_x = \underline{6V}$

c). $R_Y = \frac{V_Y}{I}$ (2)

$R_Y = \frac{18}{3}$ (2)

$R_Y = \underline{6\Omega}$ (1)

$V_Y = 36 - 12 - 6$

$V_Y = \underline{18V}$ (1)

d). In parallel, the total resistance of bulbs decreases.

30 a). Sidelights

b). no current through relay coil opens relay switch to switch off Headlights.

Side lights own connection to battery.

c)i). $I = \frac{P}{V} = \frac{(4 \times 6)}{12} = \frac{24}{12} = \underline{2A}$

ii) $Q = I.t = 2 \times (10 \times 60) = 2 \times 600 = \underline{1200C}$

iii). Headlights have a higher power rating so change more electrical energy → light.

31 a). D

b) i $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_p} = \frac{1}{8} + \frac{1}{4} + \frac{1}{4}$

$\frac{1}{R_p} = \frac{1+2+2}{8} = \frac{5}{8}$

$R_p = \frac{8}{5} = \underline{\underline{1.6\,\Omega}}$

bii). $I = \frac{V}{R}$

$I = \frac{12}{1.6}$

$I = \underline{\underline{7.5\,A}}$

c). Brighter → let more current through
→ lower bulb resistance.
⇒ lower circuit resistance.

32 a i). Y

a ii). Reduce costs of wiring
Can use thinner wires
Use lower currents in wires – safer.

b). lighting fuse lower (5A) as only bulbs are connected to it. Ring circuits can connect higher power devices.

– – – – –

LIVE + NEUTRAL wires are split in a ring circuit to half the drawn current in each wire.
lighting circuit wires are not as they only carry "low" currents.

c i) High Power rating – draws a high current from the mains.

c ii). $E = P \cdot t = 2200 \times [2 \times 60 \times 60]$
$E = 15840000$ J.
$E = 15.84 \ 10^6$ J.

d i). Safety device.

ii). live wire loose + contacts case. /
- [shorts with case]

Case live
- High current flows to earth +
- Blows fuse
- Appliance Isolated

33 a i). To isolate house from the mains.

a ii). RING circuit (B) LIGHTING circuit (E)

a iii). In ring circuit: there are 2 LIVE WIRES and 2 NEUTRAL wires, 2 paths in + 2 paths out for the current.

b i). $P = V^2/R$

$25 = \frac{230^2}{R}$

$R = \frac{52900}{25}$

$R = 2116\ \Omega$

b ii). $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$

$\frac{1}{R_p} = \frac{1}{2116} + \frac{1}{2116} + \frac{1}{2116} + \frac{1}{2116}$

$\frac{1}{R_p} = \frac{4}{2116}$

$R_p = \frac{2116}{4}$ ∝

$R_p = 529\ \Omega$

34 a i) Can be re-set.

a ii)
- current through coil produces a magnetic field
- when current is too high magnetic field is strong enough to pull iron contact across
- This breaks the circuit
- No current can now flow.

b i).

$P = \frac{V^2}{R}$

$60 = \frac{230^2}{R}$

$R = \frac{52900}{60}$

$R = 882\ \Omega$

$P = 60\ W$
$V = 230\ V$
$I =$ NOT GIVEN
$R = ?$.

b ii).

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_p} = \frac{1}{882} + \frac{1}{882} + \frac{1}{882}$ (OR.)

$\frac{1}{R_p} = \frac{3}{882}$

$R_p = \frac{882}{3}$

$R_p = 294\ \Omega$

$P = \frac{V^2}{R}$

$(3 \times 60) = \frac{230^2}{R}$

$180 = \frac{52900}{R}$

$R = 294\ \Omega$

34 b iii). $P = I \cdot V$

$[3+60] = I \cdot 23$

$I = \frac{180}{230}$

$I = 0.78\ A$ ∴ MCB will NOT switch off.

---

35 a).
- change direction of the current [swap battery round].
- change direction of magnetic field [swop poles of magnets round].

b). i (A) Field coil (B) Commutator.

ii). (A) To produce a more constant force acting on the which gives a smoother turning effect. (oe)

(B) Stronger Magnetic field can be produced
They are lighter (for same mag. field)
Magnetic field can be switched off.