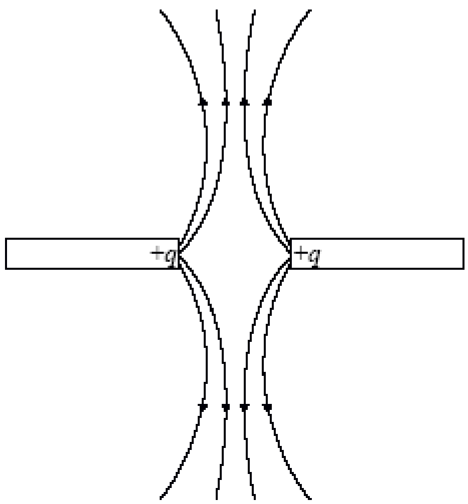
CHAPTER 5 TEST REVIEW -- MARKSCHEME

1.	C	**4.**	A	**7.**	D	**10.**	B	**13.**	B
2.	D	**5.**	C	**8.**	C	**11.**	C		
3.	D	**6.**	B	**9.**	B	**12.**	B		

14. (a) in the plastic there are no free electrons;
(but) electrons can be transferred to/from the cloth (by friction)
leaving an imbalance of charge on the rod / *OWTTE*;
electrons can move freely in copper;
electrons transferred from/to the cloth from/to the rod;
because the body is a conductor;
will flow to/from Earth leaving the rod neutral; 5 max

(b) (i)



at least four field lines (minimum two per rod) to show overall shape of pattern;
direction of lines all away from poles; 2
Ignore all working outside region.
Any field lines crossing loses first mark even if accidental.

(ii) any line labelled V perpendicular to the field lines it traverses; *(judge by eye)* 1
Ignore unlabelled lines as they could be field lines.

(c) use of $l = \frac{RA}{\rho}$; *(allow if correct substitution seen – watch for use of circumference in place of area)*

$= \left(\frac{1.5 \times \pi \times [1.8]^2 \times 10^{-8}}{1.7 \times 10^{-8}} = \right) 9.0\text{m}$ 2

(d) (i) the resistance of a conductor/copper/metal increases with increasing temperature;
increased power (dissipation) leads to higher temperature in the resistor/ resistor heating up; 2

(ii) $I = \left(\sqrt{\frac{P}{R}} =\right)\sqrt{\frac{1.0}{1.5}}$;

(= 0.82 A) 1

Allow working using 0.82 A to show that power is 1.0086 W, in this case final answer must be to 2 sig fig or better.

(iii) total resistance = [R + 3.3];

6.0 = 0.82[R + 3.3];

to give R = 4.0 Ω; (*allow use of 1.65 Ω leading to 3.9 Ω)* 3

or

total resistance in circuit = $\frac{6.0}{0.82}$ = (7.3 Ω);

internal resistance + fixed resistance = 3.3 Ω;

to give R = 4.0 Ω;

15. (a) (i) the work done per unit charge in moving a quantity of charge completely around a circuit / the power delivered per unit current / work done per unit charge made available by a source; 1

(ii) the ratio of the voltage (across) to the current in the conductor; 1

(b) (i) emf × current; 1

(ii) total power is $V_1I + V_2I$;

equating with EI to get result;

or

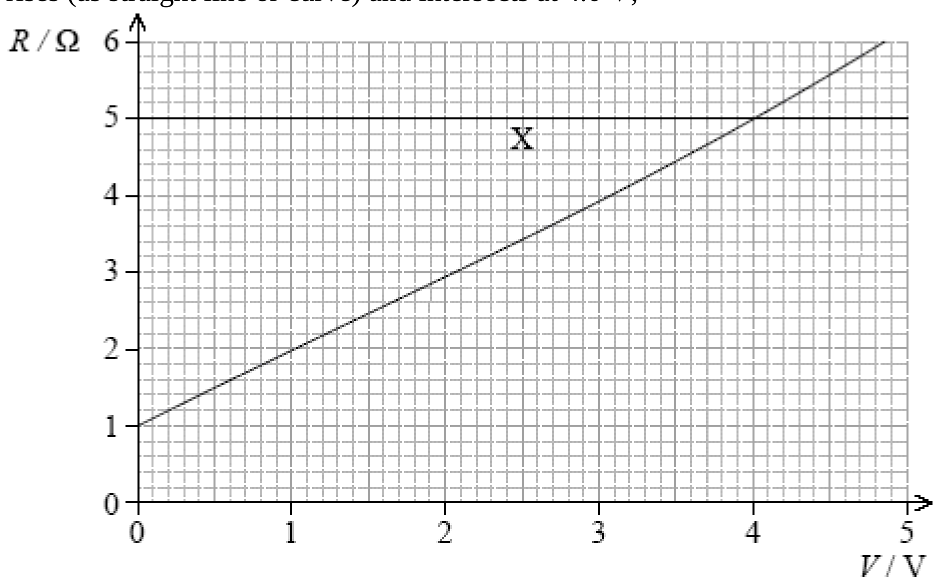
total energy delivered by battery is EQ;

equate with energy in each resistor $V_1Q + V_2Q$; 2

(c) graph X: horizontal straight line;

graph Y: starts lower than graph X;

rises (as straight line or curve) and intersects at 4.0 V; 3



Do not pay attention to numbers on the vertical axis.

(d) (i) realization that the voltage must be 4.0 V across each resistor;

and so emf is 8.0 V; 2

(ii) power in each resistor = 3.2 W;
and so total power is 6.4 W;

or

current is 0.80 A;
so total power is 8.0×0.80 = 6.4 W; 2

16. (a) (i) use of $R \left(= \frac{\rho l}{A} =\right) \frac{1.1\times10^{-6}\times4.5}{6.8\times10^{-8}}$; 1

72.8 Ω (73 Ω)

(ii) $\frac{240^2}{72.8}$ / shows appropriate alternative equation;
790 W; 2

(iii) one-third length so E_2 has one-third resistance of E_1 /
evaluates R (24 Ω);
(same V so) 3 × power of E_1;
so total power = 4 × E_1 = 3.2 kW; 3

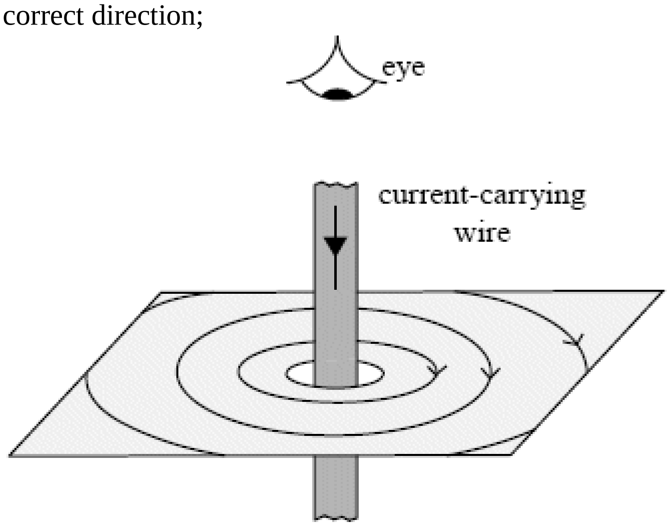
***or** numerical method*

current in R_1 = $\frac{728}{240}$ = 3 A;
current in R_2 = 9 A;
total current = 12 A and total power = 3.2kW;
*Award **[3]** for correct alternative working.*

(iv) the power output will be less;
because the total resistance is greater in the series case;
hence the current is less and power depends on I^2;

$P = \frac{V^2}{R}$; 3 max

(b) (i) concentric circles (by eye);
a minimum of three circles required;
correct direction; 3



(ii) current in one turn produces magnetic field in region of adjacent turn;
this gives rise to force in adjacent turn which also has electric current;
they attract; 3

17. (a) (i) ratio of potential difference to current / $\frac{V}{I}$ with terms defined; 1

(ii) resistance = $\frac{230^2}{980}$;

= 54 Ω;

*Award **[2]** for bald correct answer.* 2

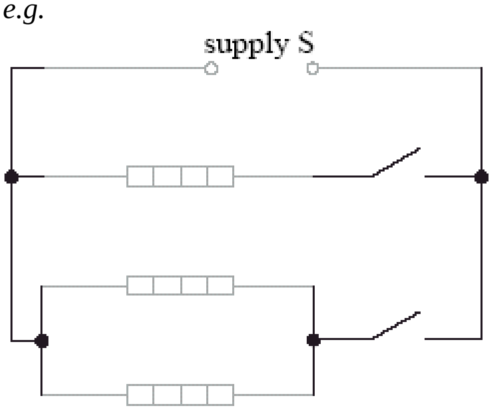
(iii) $L = \frac{RA}{\rho}$;

$= \frac{54 \times \pi \times [1.75 \times 10^{-4}]^2}{1.3 \times 10^{-6}}$;

($L \approx 4$ m) 2

Must see re-arrangement of data booklet equation or completely correct substitution as shown in second line for first mark.

(b) *e.g.*



switch connected so that P can be achieved;

another switch connected so that $2P$ and $3P$ can be achieved;

*Award **[0]** if three or more switches used. Allow any correct alternative including case where single resistor is permanently connected to supply. There are many variants, this diagram is only one example.* 2