Electricity and Magnetism Revision Answers

1.

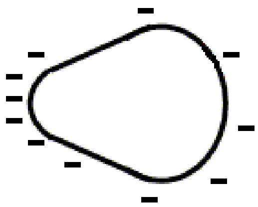
(a) A charged object is brought near the uncharged object, which polarises the uncharged object. If the uncharged object is then connected to earth, charge will flow to balance one end of the electric dipole. The original charged object is then removed, leaving the originally uncharged object now with a charge.

(b) The electrons will transfer to the object with greater affinity for electrons.

(c) The neutral object's atoms and/or molecules may polarise. Like charges will repel from the charged object, and unlike charges will attract, forming a dipole in the neutral object. This may cause the neutral object and charged object to attract.

(d) Charges will transfer until both objects are as neutral as they can be.

(e)



2.

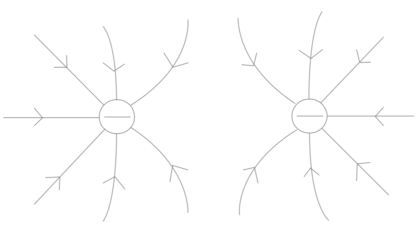
(a) The greater the distance between the charges, the smaller the force they experience. The squared makes the effect more dramatic e.g. halving the distance quadruples the force.

(b) $F = k\frac{q_1 q_2}{r^2} = 9.0\times10^9 \frac{2.4\times10^{-9}\times1.9\times10^{-9}}{(0.84)^2} = 5.8\times10^{-8}$ N attraction

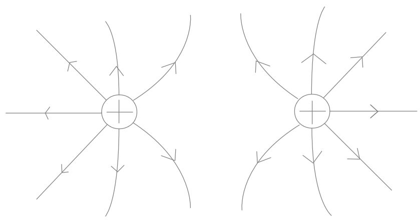
3.

(a) Places where an electric charge would feel a force.

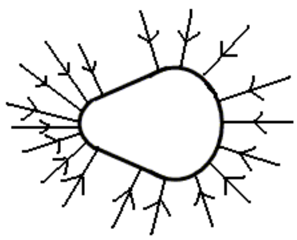
(b)



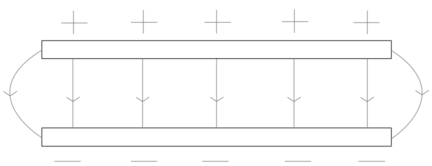
or



(c)



(d)



4.

(a) $W = q\Delta V$

$= 1.6\times10^{-19}\times1.5$

$= 2.4\times10^{-19}$ J

(b) $E_1 = k\frac{q_1}{r^2} = 9.0\times10^9 \frac{2.4\times10^{-9}}{(0.42)^2} = 122\ \text{NC}^{-1}$ (towards negative charge)

$E_2 = k\frac{q_2}{r^2} = 9.0\times10^9 \frac{1.9\times10^{-9}}{(0.42)^2} = 96.9\ \text{NC}^{-1}$ (towards negative charge)

Field strengths are in same direction so add:

E_T =122 + 96.9

= 220 NC^{-1} (2 s.f.) towards the negative charge

5. They are in opposite directions.

6.

(a) Resistance is equal to voltage divided by current

(b) $R = \frac{\Delta V}{I} = \frac{6.0}{250\times10^{-3}} = 24\ \Omega$

(c) $P = \Delta V \times I = 6.0\times250\times10^{-3} = 1.5\ \Omega$

7.

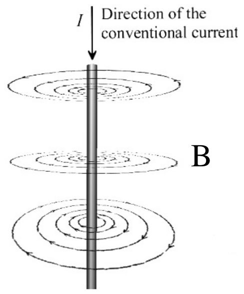
(a) $R_T = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}} = \frac{1}{\frac{1}{1.2}+\frac{1}{0.9}} = 0.5\ \Omega$

(b) $R_T = R_1 + R_2 + R_3 = 1.2\times10^{-3} + 1.1\times10^{-3} + 1.0\times10^{-3} = 3.3\times10^{-3}\ \Omega$

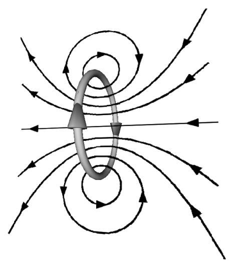
8.

(a) Similarity: Both show strength of field by density of lines (more lines per area means stronger field). Difference: Line direction shows force on a positive charge for electric field but North pole for magnetic field.

(b)



(c)



(d) Up towards the top of the page.

(e) $F = BI\Delta l \sin\theta = 3.2\times1.5\times0.20\times\sin(30°)$ = 0.48 N into the page

9. A current-carrying wire is coiled around an iron bar. The coil produces a magnetic field through the iron bar which is then amplified by the iron.

10. A coil of wire is placed inside a magnetic field, and current is run through the wire. This causes a force on the coil, turning the motor.