18. Electric Fields

18.3 Electric force between point charges

Paper 4

Marking Scheme

Q1.

(a)	(electric) force is (directly) proportional to product of charges	**B1**
	force (between point charges) is inversely proportional to the square of their separation	**B1**
(c)(iii)	• the (positive) charge is all the way around the surface • a charge placed inside the sphere is pulled equally in all directions • if the field was not zero, the charges would move (until field is zero) • electric field lines go from positive charge to negative charge, and there are no negative charges inside the sphere *Any point, 1 mark*	**B1**

Q2.

(a)	(electric) force is (directly) proportional to product of charges	**B1**
	(electric) force (between point charges) is inversely proportional to the square of their separation	**B1**
(b)	$F = Q^2 / 4\pi\varepsilon_0 x^2$ $6.3 \times 10^{-17} = Q^2 / [4\pi \times 8.85 \times 10^{-12} \times (3.8 \times 10^{-6})^2]$	**C1**
	charge = 3.2×10^{-19} C	**A1**

Q3.

(a)	(electric) force is (directly) proportional to product of charges	**B1**
	force (between point charges) is inversely proportional to the square of their separation	**B1**
(b)(ii)	$F = e^2 / 4\pi\varepsilon_0 x^2$	**C1**
	$= (1.60 \times 10^{-19})^2 / [4\pi \times 8.85 \times 10^{-12} \times (2 \times 1.59 \times 10^{-10})^2]$ $= 2.28 \times 10^{-9}$ N	**A1**

Q4.

(c)(ii)	charges on spheres attract/affect each other **or** charge distribution on each sphere distorted by the other sphere **or** charges on the surface of the spheres move	**B1**
	spheres are not point charges (at their centres)	**B1**

Q5.

(b)(i)	no electric field inside a conductor	**B1**
	R = 4.5 cm	**A1**