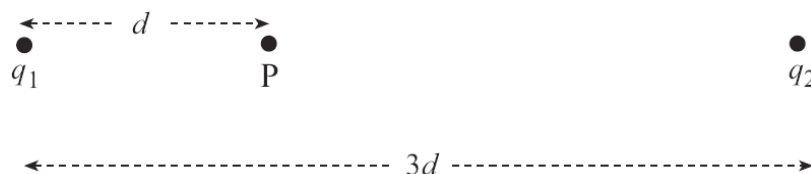


## Electric Fields Questions

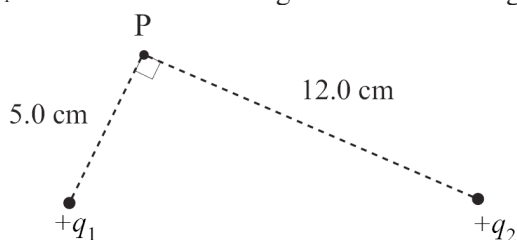
1. Two point charges,  $q_1$  and  $q_2$ , are separated by a distance  $3d$  in a vacuum, as shown in the diagram below. Point P is situated on a line between  $q_1$  and  $q_2$ , at a distance  $d$  from  $q_1$ .



a) Write an expression in terms of  $q_1$  and  $d$  for the electric field at point P due to point charge  $q_1$ . /1

b) The strength of the electric field at point P is zero. Calculate the ratio  $q_1 : q_2$  of the point charges. /3

c) If  $q_1$  is  $+1.0$  C and the charges are now rearranged as shown below:



Calculate the magnitude and direction of electric field strength at point P due to  $q_1$  and  $q_2$ . /7

2. Explain how the electric forces are consistent with Newton's third law. /2

3. You have committed an electric crime and are charged with 2.31 mC. As punishment you are placed in an electric field and feel a force of 462N.

Calculate the magnitude of the electric field strength at the point which you are placed. /2

4. Using Coulomb's law, derive the expression  $E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$  for the magnitude of the electric field at a distance  $r$  from a point charge  $q$ . /3

5.

a) Sketch the electric field produced by a hollow spherical positively charged conductor. /2

b) Explain why there is no electric field inside the conductor. /2

6. Sketch the electric field that results when a solid uncharged conducting sphere is placed in the region between two oppositely charged finite parallel plates. Include any field in and around the plates. /3

7. Explain why the air in the vicinity of a charged sharp point may be ionised. /3

8. Explain why the component of the electric field parallel to a conducting surface will always be zero. /2