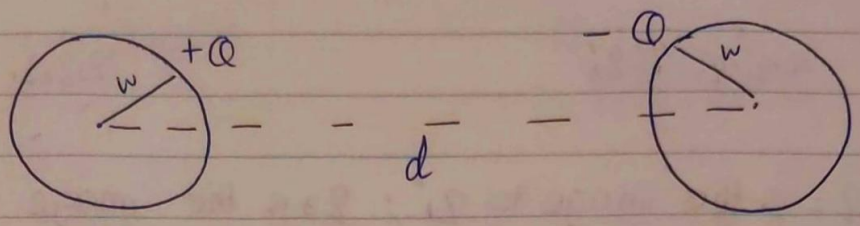
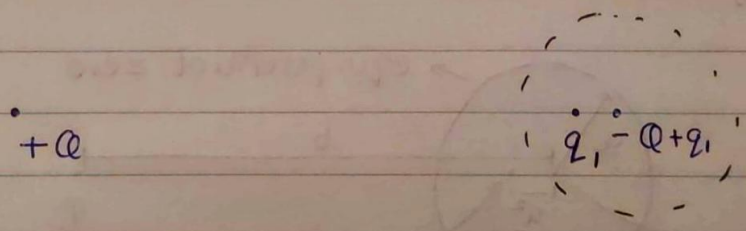
Problem of the week #1

solution:

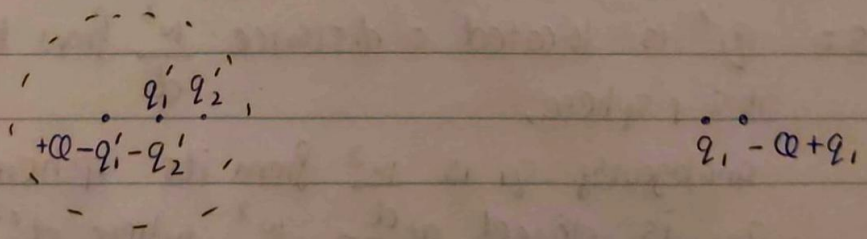


The strategy is to first approximate one sphere as a point charge and place images such that the other sphere is an appropriate equipotential. Then with this new collection of charges, place images such that the first is an equipotential, and so on.

Stage 1:

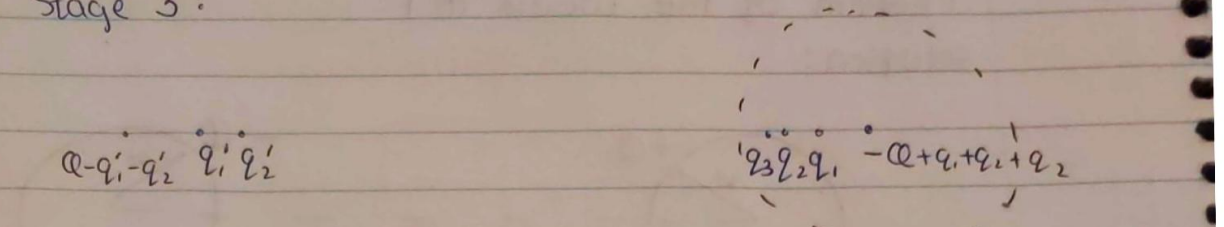


Stage 2:



where q_1' is the image to $-Q+q_1$, q_2' is the image to q_1

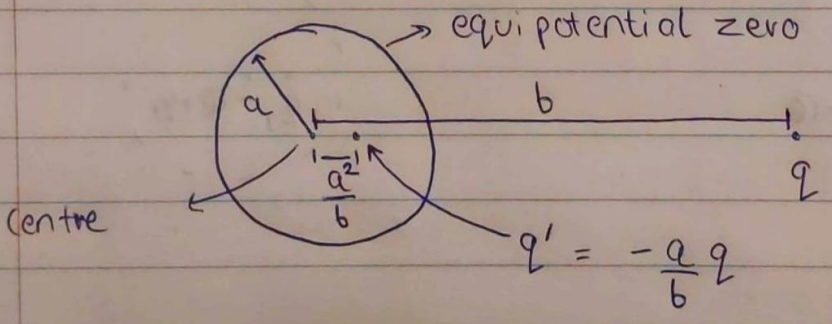
Stage 3:



q_2 is the image to q_1'; q_3 is the image to q_2'

Note: the charge at the centre of each sphere is adjusted at each stage to produce the appropriate charge inside the sphere

Quantitatively, the positions of each image charge is determined using the following known system:



Thus: q_1' is located a distance $\frac{w^2}{d}$ from the centre of its sphere,

analogously q_1 is $\frac{w^2}{}$ from its sphere

q_2 is placed at $\frac{d}{d'} \rightarrow \frac{w^2}{}$ where d' is the distance of q_1' from the centre of q_2's sphere, and so on

The convergence of this soln can be seen from $q_n \rightarrow 0$