## Answers for Tutorial 1

The marks to be awarded for each question are indicated in square brackets.

Problem 1 [10]

a. The force is attractive as one ball has a positive charge (has lost electrons) and the other has a negative charge (has gained electrons). [2]

b.  (as q1 = ‑ q2 ≡ q). [2]

 [3]

c.  electrons. [3]

Problem 2 [10]

Consider e.g. field due to charges 12q and 6q (at 12 and 6 o’clock, respectively). Get field in direction 12 o’clock of strength 6 units [4 for understanding this]. Field due to charges –q and 7q is also of strength 6 units, but directed towards 7 o’clock. A similar argument applies for the fields due to charges 2q and 8q, 3q and 9q, 4q and 10q, and 5q and 11q. We thus have six contributions to the electric field of equal strength pointing in the 7, 8, 9, 10, 11 and 12 o’clock directions (see diagram) [4 if manage to understand this/draw diagram]. Adding these gives a field pointing towards the “mean” position, i.e. the hour hand is pointing towards 9:30 [2 if get time correct].

-12q

-6q

-9q

-3q

-1q

-2q

-4q

-5q

-7q

-8q

-10q

-11q

Problem 3 [10]

a.  [2] [1]



b. [2] [2]



c.  [2] [1]



You could discuss the difference between situation a. (stable equilibrium) and c. (unstable).

The maximum total mark for this Tutorial is 30.