

Year 1 Assessed Problems

Semester 2

Assessed Problems 1

SOLUTIONS TO BE SUBMITTED
ON CANVAS BY

Wednesday 29th January 2025
at 17:00

Electromagnetism I – Problem sheet 1

Problem 1. Three charges, $+q$, $+Q$ and $-Q$, are placed at the corners of an equilateral triangle as shown in the Figure.



1. Which of the following statements is true?

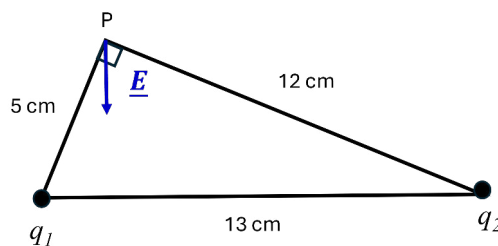
The net force on the charge $+q$ due to the other two charges is:

- (a) vertically up;
- (b) vertically down;
- (c) zero;
- (d) horizontal to the left;
- (e) horizontal to the right.



2. Which of the above statements is true if the $-Q$ charge is replaced by a $+Q$ charge?

Problem 2. Two charges q_1 and q_2 are placed at the vertices of a right-angled triangle as shown in the Figure below. The value of the charge q_1 is $|q_1| = 15\mu C$, but its sign is not known. For the charge q_2 , both the sign and the magnitude are not known. The resulting electric field \underline{E} produced by the two charges at P is as shown, in the negative y direction.



1. Based on symmetry considerations, deduce the sign of the charges q_1 and q_2 .
2. Evaluate the value of the charge q_2 .
3. Evaluate the magnitude of the electric field \underline{E} at P .

★ Problem 1.1 Comparison of Magnesium and Uranium

The density of solid magnesium is $1.7 \times 10^3 \text{ kg m}^{-3}$ and its atomic mass is 24.3 amu. The corresponding figures for solid uranium are $1.9 \times 10^4 \text{ kg m}^{-3}$ and 238 amu.

- (i) Work out the number of atoms per cubic metre in solid magnesium and solid uranium.
- (ii) Estimate the mean separation between the centres of neighbouring atoms for these two solids.
- (iii) How do your answers compare with the sizes of the atoms?