Problems on Dipole moment and Electric field

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Five problems on dipole moments:

Problem 1:
Calculate the dipole moment of a water molecule (H2O) given that the bond length is 0.96 Å (angstroms) and the charge separation between the oxygen atom and each hydrogen atom is approximately 0.43 Å.

Problem 2:
A diatomic molecule has a bond length of 1.5 Å and a charge separation of 0.2 Å between the two atoms. Calculate the dipole moment of this molecule.

Problem 3:
A molecule consists of three point charges: +2e, -3e, and +e, placed at the vertices of an equilateral triangle with sides of length 1 Å. Find the dipole moment of this molecule.

Problem 4:
For a molecule composed of two identical atoms, explain why the dipole moment is always zero.

Problem 5:
Two molecules, one with a dipole moment of 1.5 D and another with a dipole moment of 2.0 D, are placed at a distance of 5 Å from each other. Calculate the electrostatic potential energy between these two molecules.

Five problems on electric field:

Problem 1:
A point charge of +5 μC is placed at the origin (0,0,0) in three-dimensional space. Calculate the electric field at a point (3 m, 4 m, 0 m) along the x-axis.

Problem 2:
Two point charges, +2 mC and -3 mC, are placed 5 meters apart on the x-axis at points (0, 0, 0) and (5 m, 0, 0), respectively. Find the electric field at a point (3 m, 0, 0) on the x-axis.

Problem 3:
A uniformly charged infinite line with a linear charge density of 2 μC/m is located along the z-axis. Calculate the electric field at a point (2 m, 2 m, 2 m) in space.

Problem 4:
A spherical shell with a radius of 10 cm carries a charge of +6 μC distributed uniformly on its surface. Find the electric field at a point 15 cm from the center of the shell.

Problem 5:
A non-uniformly charged rod with a linear charge density λ = 2 μC/m is aligned along the x-axis, extending from x = 0 to x = 4 m. Calculate the electric field at a point (3 m, 0, 0) on the x-axis.

If you need solutions or further explanations for any of these problems, please let me know.

SPECIAL INSTRUCTION: SEND THE FINAL ANSWER OF ALL THE PROBLEMS BEFORE THE CLASS