3. For each species listed in the table below draw an electron-dot diagram showing all the valence shell electron pairs and bond diagram showing the bonding structure. (8)

|  |  |  |
| --- | --- | --- |
| **Species** | **Electron dot diagram** | **Bonding structure** |
| Phosphate ion  (PO43-) |  |  |
| Phosphine  (PH3) |  |  |
| Dichlorosulfogene  Cl2CS |  |  |
| Thionyl chloride  SOCl2 |  |  |

4. a) For each of the solid substances state the two most important types of bonding acting within that substance. The first one is done for you. (6)

|  |  |
| --- | --- |
| **Substance** | **Two strongest binding forces** |
| Oxygen (O2) | Covalent, Dispersion |
| Hydrogen chloride | *Covalent, dipole-dipole* |
| Sodium hydroxide | *Ionic, covalent* |
| Graphite | *Covalent network, dispersion* |
| Water | *Covalent, hydrogen bonding* |
| Aluminium nitrate | *Ionic, covalent* |

b) Boron trifluoride and Nitrogen trifluoride have different shapes and polarities. Explain, with the aid of diagrams, why their shapes and polarities are different. (2)

*Boron trifluoride, BF3 is a molecule in which all the valance electrons of Boron atom are bonded to the fluorine atoms. It has a triangular planar shape and is a symmetrical molecule. Nitrogen trifluoride, on the other hand, has only three of five valence electrons of the central Nitrogen atom bonded to fluorine atoms. This leaves one loan pair. Due to the Electron Pair Repulsion on the other bonded pairs, the shape becomes triangular pyramidal and asymmetrical. (The explanation should be accompanied by suitable electron dot diagrams.)*