PERIOD 3: PHYSICAL PROPERTIES OF THE OXIDES

1. a)

ionic:	sodium, magnesium, aluminium oxides
giant covalent:	silicon(IV) oxide
molecular:	phosphorus, sulphur, chlorine oxides

b) The oxides on the left-hand side of the period are ionic, whereas those on the right-hand side are covalent. This is because of the way electronegativity increases across the period.

There is a high enough electronegativity difference between the three metals on the left-hand side and oxygen for the bonds formed to be ionic - the bonding pair is pulled strongly towards the oxygen to give oxide ions and metal ions.

There isn't enough electronegativity difference between the other elements and oxygen for these ions to form, and so covalent bonds are formed instead. With all but silicon, simple molecular oxides are formed. With silicon, although the bonding is covalent, a giant structure is formed instead.

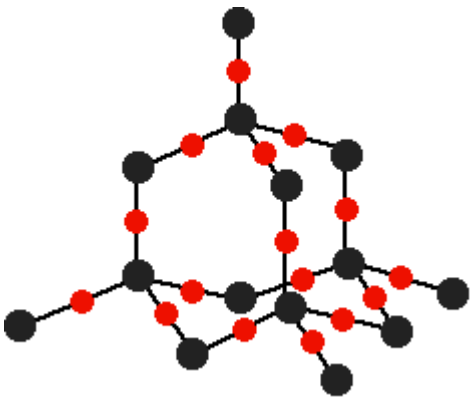
c) For sodium, magnesium, aluminium oxides, they exist as a giant structure of ions with very strong ionic bonds which have to be broken before the solid will melt. Lots of heat is needed to do this.

Silicon(IV) oxide exists as a giant covalent structure with strong Si-O bonds which have to be broken before the solid will melt. Again, lots of heat is needed to do this.

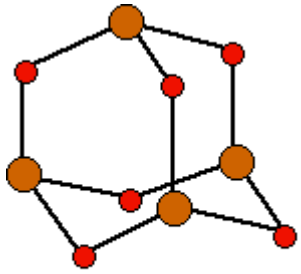
The other oxides consist of molecules of various sizes which are held together in the solid by van der Waals dispersion forces and, in some cases, permanent dipoles. These forces are weaker than ionic or covalent bonds, and so less heat is needed to overcome them. The oxides will therefore be low melting point solids, liquids or gases.

d) The metal oxides don't conduct electricity at room temperature because they don't contain any free electrons or mobile ions. The metal oxides do, however, contain mobile ions when they melt and so will undergo electrolysis if they are molten. The covalently bound oxides don't conduct electricity under any circumstances because they don't contain either free electrons or ions.

2. a)

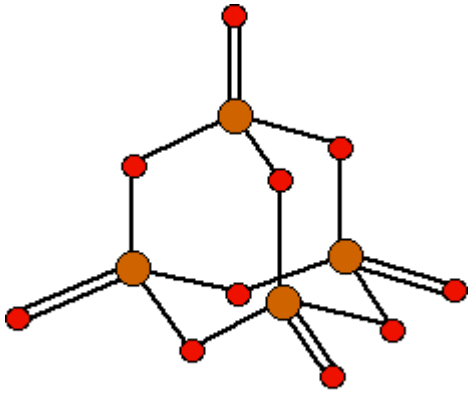


b) P_4O_6



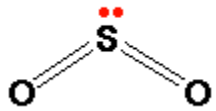
a P_4O_6 molecule

P_4O_{10}

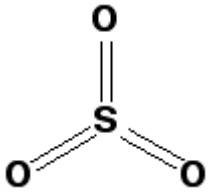


a P_4O_{10} molecule

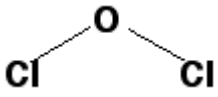
c) SO_2



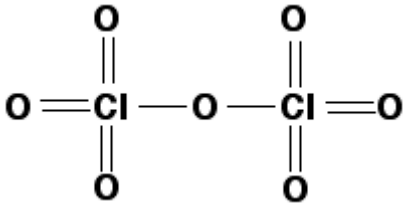
SO_3



d) Cl_2O



Cl_2O_7



(You could try to show the tetrahedral arrangement around each chlorine, but it is awkward to do if you have multiple bonds. Since I haven't attempted it myself, it is unreasonable to expect you to do it!)