Year: 11	Topic: 5.1 Bonding, structure and properties

Knowledge and Understanding to be developed:

This topic explores the changes to atoms and electron structure during bonding, both ionic and covalent and links this to the resulting structures of substances

Learners will use ideas, theories and models to explain abstract and complex concepts in this topic. They will be able to develop their skill in the clear explanation of ideas and use diagrams to illustrate their explanations. There are opportunities to explain every day and technological applications of science; to evaluate associated personal, social, economic and environmental implications; and to make decisions based on the evaluation of evidence and arguments.

Numerical Skills : Skills in converting units and using multiplying factors will be used in this topic to understand the sizes involved in nanotechnology. Learners will use prefixes and powers of ten for orders of magnitude (milli-, micro- and nano-). They should use simple order of magnitude calculations in comparing nano-scale particles with individual atoms and with everyday objects

Key Terms to be learned this topic:

Ionic	Covalent
Sea of electrons	Metallic
Atomic number	Lattice
Metalloids	Simple Molecular
Properties	Nano
	Smart Materials

Learning Objectives and Outcomes:
Students should be able to demonstrate and apply their knowledge and understanding of :

(a)the properties of metals, ionic compounds, simple molecular covalent substances and giant covalent substances
(b)the 'sea' of electrons/lattice of positive ions structural model for metals in explaining their physical properties
(c)electronic structure in explaining how ionic bonding takes place (and how this is represented using dot and cross diagrams)
(d)the accepted structural model for giant ionic structures in explaining the physical properties of ionic compounds
(e)electronic structure in explaining how covalent bonds are formed (and how this is represented using dot and cross diagrams)
(f) the intermolecular bonding structural model for simple molecular structures in explaining the physical properties of simple molecular substances
(g)the properties of diamond, graphite, fullerenes, carbon nano-tubes and graphene and how these are explained in terms of structure and bonding
(h)individual atoms not having the same properties as bulk materials as demonstrated by diamond, graphite, fullerenes, carbon nano-tubes and graphene having different properties despite all containing only carbon atoms, and by nano-scale silver particles exhibiting properties not seen in bulk silver
(i) the properties and uses of nano-scale particles of silver and titanium dioxide
(j) the possible risks associated with the use of nano-scale particles of silver and titanium dioxide, and of potential future developments in nanoscience
(k) the properties and uses of smart materials including thermochromic pigments, photochromic pigments, polymer gels, shape memory alloys and shape memory polyme