Metals, non-metals and metalloids

1

a. *Who will be the quickest to classify the elements below?*
Write M for metals, NM for non-metals, and MO far metalloids next to the elements below:

☐ Antimony	☐ Arsenic	☐ Barium	☐ Boron	☐ Calcium	☐ Carbon
☐ Chlorine	☐ Chromium	☐ Cobalt	☐ Fluorine	☐ Germanium	☐ Iodine
☐ Magnesium	☐ Manganese	☐ Mercury	☐ Neon	☐ Phosphorous	
☐ Potassium	☐ Silicon	☐ Sodium	☐ Sulphur	☐ Tellurium	

b. *The following are general properties of metals and non-metals. Write M or NM in the boxes according to whether they apply to metals or non-metals:*

☐ silver colour ☐ no general colour ☐ dull ☐ shiny ☐ solids, liquids and gases ☐ solids ☐ brittle ☐
☐ malleable and ductile ☐ good conductors of heat and electricity ☐ bad conductors of heat and electricity
☐ form positive ions ☐ form negative ions (if any) ☐ form acidic oxides ☐ form neutra! or alkaline oxides
☐ sometimes displace hydrogen from dilute acids ☐ never displace hydrogen from dilute acids ☐

Although the periodic table does not classify elements as metals and non-metals there is, however, a fairly obvious division between the two. “Fairly obvious”, you will note, not “clear cut”. The fairly obvious division between metals and· non-metals is shown by a thick stepped line. The 20 or so non-metals are packed into the top right-hand corner above the thick stepped line. Some of the elements next to the thick steps, such as germanium, arsenic and antimony, have similarities to both metals and non-metals and it is difficult to place these, with certainty, in one class or the other. Chemists sometimes use the name metalloid (or semi-metal) for these elements which are difficult to classify one way or the other.

In spite of its limitations, the classification of elements as metals, metalloids nd non-metals is both useful and convenient. The commonest classification is based on electrical conductivity. Metals are good conductors of electricity. Metalloids are poor conductors of electricity. Non-metals are non-conductors.

Metals form giant metallic structures. They have high melting points, high boiling points, high density, high conductivity and high heats of fusion and vaporisation. These high values suggest that strong forces exist between the separate atoms in the metal.

Metalloids and diamond form giant molecular structures. They have very high melting points, very high boiling points, high density but poor conductivity.

Metalloids (boron, graphite and silicon) and diamond have giant covalent structures. These elements have very high melting points and boiling points, very high heats of fusion and vaporisation and they are very hard.

Non-metals (except diamond) form simple molecular structures. They have low melting points, low boiling points, low density and are non-conductors.

From: Hill-Hollman, *Chemistry in context*, Nelson.

2

Complete the table about the properties of metals, non-metals and metalloids. Use these adjectives and phrases: very high, high, low, low (if any), no.

Property	Metals	Non-metals except diamond	Metalloids and diamond
Melting point			
Boiling point			
Density			
Conductivity			
Heat of fusion			
Heat of vaporisation			

3

a. *Group the adjectives in the box to make pairs of antonyms*

ambiguous • convenient • difficult • easy • good • high • low • obvious • poor • strong • unsuitable • useful • useless • weak

b. *Match the words in the box with the definitions.*

boiling point • conductivity • covalent bond • density • heat of fusion • heat of vaporisation • melting point

1. .....: the temperature at which the crystal lattice structure of a solid breaks down and solid is converted to liquid.

2. .....: the temperature at which the vapour pressure of a liquid is equal to the external pressure on the liquid.

3. .....: the ratio of the mass of an object to its volume.

4. .....: the power of passing along heat or electricity.

5. .....: the energy required to convert a solid to a liquid.

6. .....: the amount of heat required for a molecule to overcome intermolecular forces and move from the liquid to the gas phase.

7. .....: the interactive attraction deriving from the sharing of electrons between the atoms.