1 The table gives the melting points, the boiling points and the electrical properties of six substances A to F.

substance	melting point / °C	boiling point / °C	electrical conductivity as a solid	electrical conductivity as a liquid
A	–210	–196	does not conduct	does not conduct
B	777	1627	does not conduct	good conductor
C	962	2212	good conductor	good conductor
D	–94	63	does not conduct	does not conduct
E	1410	2355	does not conduct	does not conduct
F	1064	2807	good conductor	good conductor

(a) Which **two** substances could be metals? ..... [1]

(b) Which substance could be nitrogen? ..... [1]

(c) Which substance is an ionic solid? ..... [1]

(d) Which substance is a liquid at room temperature? ..... [1]

(e) Which substance has a giant covalent structure similar to that of diamond? ..... [1]

(f) Which **two** substances could exist as simple covalent molecules? ..... [1]

[Total: 6]

2 The Group I metals show trends in both their physical and chemical properties.

(a) How do their melting points vary down the Group?

..... [1]

(ii) Which element in the Group has the highest density?

..... [1]

(iii) All Group I metals react with cold water. Complete the following equation.

.....Rb + ...H_2O $\rightarrow$ ..... + ...

[2]

(b) Lithium reacts with nitrogen to form the ionic compound, lithium nitride.

(i) State the formula of the lithium ion. .....……. [1]

(ii) Deduce the formula of the nitride ion. .....……. [1]

(iii) In all solid ionic compounds, the ions are held together in a lattice.
Explain the term *lattice*.

.....

..... [1]

(iv) What is the ratio of lithium ions to nitride ions in the lattice of lithium nitride?
Give a reason for your answer.

..... lithium ions **:** ..... nitride ions

.....

..... [2]

[Total: 9]

3 The uses of a substance are determined by its properties.

(a) Plastics are poor conductors of electricity. They are used as insulation for electric cables. Which other **two** properties of plastics make them suitable for this purpose?

.....

..... [2]

(b) Chromium is a hard, shiny metal. Suggest **two** reasons why chromium is used to electroplate steel.

.....

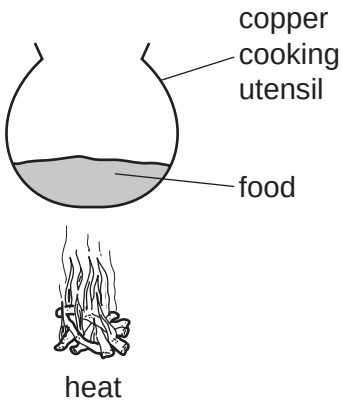
..... [2]

(c) Why is aluminium used extensively in the manufacture of aeroplanes?

.....

..... [2]

(d) Why is copper a suitable material from which to make cooking utensils?



.....

..... [2]

(e) Describe the bonding in a typical metal.

.....

.....

..... [2]

[Total: 10]

4 Three of the halogens in Group VII are listed below

chlorine

bromine

iodine

(a) How does their colour change down the Group?

..... [1]

(ii) How do their melting points and boiling points change down the Group?

..... [1]

(iii) Predict the colour and physical state (solid, liquid or gas) of astatine, At.

colour .....

physical state ..... [2]

(b) A radioactive isotope of iodine, $^{131}_{53}\mathrm{I}$, is used to treat cancer.

(i) Define the term *isotope*.

.....

..... [2]

(ii) How many protons, electrons and neutrons are there in one atom of $^{131}_{53}\mathrm{I}$?

number of protons .....

number of electrons .....

number of neutrons ..... [2]

(iii) When this isotope, $^{131}_{53}\mathrm{I}$, emits radiation, a different element with a proton number of 54 is formed.
What is the name of this element?

..... [1]

(c) Fluorine, the most reactive halogen, forms compounds with the other halogens. It forms two compounds with bromine.
Deduce their formulae from the following information.

compound 1
The mass of one mole of this compound is 137 g.

Its formula is ..... [1]

compound 2
0.02 moles of this compound contain 0.02 moles of bromine atoms and 0.1 moles of fluorine atoms.

Its formula is ..... [1]

[Total: 11]

5 The first three elements in Group IV are
carbon,
silicon,
germanium.

(a) The element germanium has a diamond-type structure. Describe the structure of germanium. A diagram is acceptable.

[2]

(b) Unlike diamond, graphite is soft and is a good conductor of electricity.

(i) Explain why graphite has these properties.

.....

.....

..... [3]

(ii) Give a use of graphite that depends on one of these properties.

property .....

use ..... [1]

(c) Carbon dioxide and silicon(IV) oxide have similar formulae but different types of structure.

(i) Give the formulae of these oxides.

..... [1]

(ii) How are their structures different?

.....

..... [2]

(d) All these elements form compounds with hydrogen called hydrides. The saturated hydrides of carbon are the alkanes. Predict the formula of the hydride of germanium which contains two germanium atoms.

..... [1]

6 **(a** Copper has the structure of a typical metal. It has a lattice of positive ions and a "sea" of mobile electrons. The lattice can accommodate ions of a different metal.

Give a **different** use of copper that depends on each of the following.

(i) the ability of the ions in the lattice to move past each other

..... [1]

(ii) the presence of mobile electrons

..... [1]

(iii) the ability to accommodate ions of a different metal in the lattice

..... [1]

(b) Aqueous copper(II) sulphate solution can be electrolysed using carbon electrodes. The ions present in the solution are as follows.

$Cu^{2+}(aq)$, $_4^{2}$ (aq), $^{+}$(aq), (aq)

(i) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

(ii) A colourless gas was given off at the positive electrode (anode) and the solution changes from blue to colourless.

Explain these observations.

.....

..... [2]

(c) Aqueous copper(II) sulphate can be electrolysed using copper electrodes. The reaction at the negative electrode is the same but the positive electrode becomes smaller and the solution remains blue.

(i) Write a word equation for the reaction at the positive electrode.

..... [1]

(ii) Explain why the colour of the solution does not change.

.....

..... [2]

(iii) What is the large scale use of this electrolysis?

..... [1]