1 (a) An atom of copper has an atomic number of 29 and a mass number of 63.

(i) Complete the table to show the numbers of protons, neutrons and electrons in this atom of copper.

(2)

particle	number
proton	
neutron	
electron	

(ii) Copper is in period 4 of the periodic table.

State what information this gives about the number of shells that contain electrons, in a copper atom.

(1)

.....

(iii) Copper exists as isotopes.

Explain what is meant by the term **isotopes**.

(2)

.....

.....

.....

.....

(iv) A sample of copper contains

70% of copper-63 atoms and

30% of copper-65 atoms.

Use this information to calculate the relative atomic mass of copper in this sample.

(3)

relative atomic mass of copper = ...

(b) Copper nitrate contains copper ions, Cu^{2+}, and nitrate ions, NO_3^-.

(i) Describe, in terms of electrons, how a copper atom, Cu, becomes a copper ion, Cu^{2+}.

(2)

(ii) Write the formula for copper nitrate.

(1)

(Total for Question 1 = 11 marks)

2 (a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	**relative charge**	**position in atom**
proton		+1	
neutron	1		in nucleus
electron			

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom of an element **always** contains

(1)

☒ **A** more protons than neutrons

☒ **B** equal numbers of protons and neutrons

☒ **C** more electrons than protons

☒ **D** equal numbers of protons and electrons

(c) The symbols for some atoms are given in the box

Ca	Cl	K	N	Ne	O

From the box, choose the symbol of

(i) an atom in group 2 of the periodic table

(1)

.....

(ii) an atom that readily forms an ion with a charge of 2–

(1)

.....

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

.....

(ii) What is the most likely formula of aluminium nitride?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** $Al(NO_3)_2$

☐ **B** $AlNO_3$

☐ **C** $AlNO_2$

☐ **D** AlN

(Total for Question 2 = 8 marks)

3 (a) Chlorine has an atomic number of 17.

Chlorine-35 and chlorine-37 are two isotopes of chlorine.

(i) Complete the table to show the numbers of protons, neutrons and electrons in each of the isotopes.

(2)

	chlorine-35	**chlorine-37**
number of protons		
number of neutrons		
number of electrons		

(ii) A normal sample of chlorine contains only chlorine-35 and chlorine-37 atoms.

Explain why the relative atomic mass of chlorine is 35.5

(2)

.....

.....

.....

.....

(b) Tetrachloromethane is a simple molecular, covalent compound.
The formula of its molecule is CCl_4.

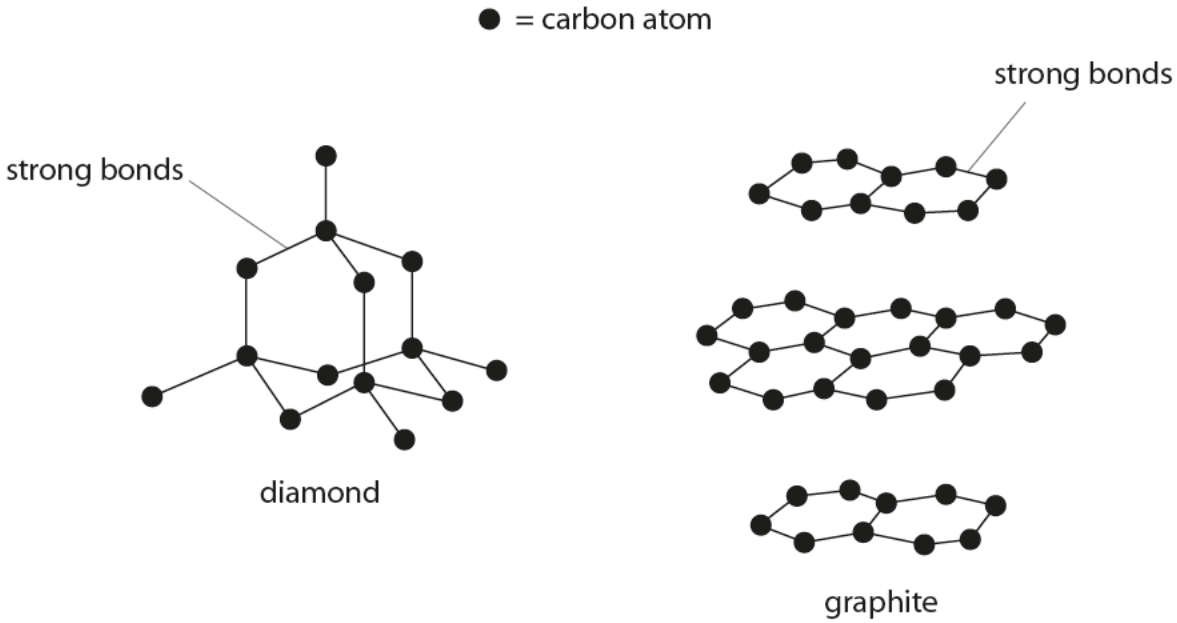
There are four electrons in the outer shell of a carbon atom.
There are seven electrons in the outer shell of a chlorine atom.

Draw a dot and cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

Show outer shell electrons only.

(2)

*(c) The diagrams show the arrangements of carbon atoms in diamond and in graphite.



Compare a use of diamond with a use of graphite, explaining each use in terms of the bonding and structure. In your answer you should use information from the diagrams.

(6)

(Total for Question 3 = 12 marks)

4 (a) The table shows the number of electrons, neutrons and protons in particles P, Q, R, S, T and V.

particle	number of		
	electrons	**neutrons**	**protons**
P	1	0	1
Q	3	4	3
R	8	8	8
S	13	14	13
T	18	16	16
V	18	20	20

(i) Which particle is a negatively charged ion?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** P

☐ **B** S

☐ **C** T

☐ **D** V

(ii) Which particles are atoms of metals?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** P and R

☐ **B** Q and R

☐ **C** Q and S

☐ **D** Q, S and V

(b) Each element has an atomic number.

(i) State what is meant by **atomic number**.

(1)

(ii) The atomic number of boron is 5.
Boron exists as two isotopes boron-10 and boron-11.

Use this information to explain why boron-10 and boron-11 are isotopes.

(2)

(c) (i) Explain what is meant by the term relative atomic mass.

(2)

(ii) A sample of boron contains
19.7% of boron-10.
80.3% of boron-11.

Use this information to calculate the relative atomic mass of boron.

(3)

(Total for Question 4 = 10 marks)