1 Ionic compounds contain ions.

(a) The numbers of electrons, neutrons and protons in four particles, **W**, **X**, **Y** and **Z**, are shown in Figure 5.

particle	electrons	neutrons	protons
W	9	10	9
X	10	14	12
Y	16	16	16
Z	18	18	16

Figure 5

Explain which particle, **W**, **X**, **Y** or **Z**, is a negative ion.

(2)

.....

.....

.....

.....

(b) Calcium nitrate contains calcium ions and nitrate ions.

Calculate the relative formula mass of calcium nitrate, $Ca(NO_3)_2$.
(relative atomic masses: Ca = 40, N = 14, O = 16)

(2)

relative formula mass = ...

(c) Lithium fluoride, LiF, is an ionic compound.

It contains lithium cations and fluoride anions.

The electronic configurations of a lithium atom and of a fluorine atom are shown in Figure 6.



Figure 6

Complete Figure 7 to show the electronic configurations and charges of the ions in lithium fluoride.

(4)



charge on ion ..... charge on ion .....

Figure 7

(Total for Question 1 = 8 marks)

2 (a) The table shows the names and formulae of three ions.

name of ion	formula of ion
calcium	Ca^{2+}
nitrate	NO_3^-
phosphate	PO_4^{3-}

What is the formula of calcium nitrate?

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

(1)

☐ **A** Ca_2NO_3

☐ **B** $CaNO_3$

☐ **C** Ca_3NO_2

☐ **D** $Ca(NO_3)_2$

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

The number of oxygen atoms in the formula $Ca_3(PO_4)_2$ is

(1)

☐ **A** 2

☐ **B** 4

☐ **C** 8

☐ **D** 12

(c) The table gives some information about the elements sodium and sulfur.

	sodium	**sulfur**
metal or non-metal	metal	non-metal
atomic symbol	Na	S
number of electrons in one atom	11	16

Sodium sulfide is an ionic compound.

Describe, in terms of electron transfer, how sodium atoms react with sulfur atoms to form sodium sulfide.

Your description should include the charges on the ions formed.

(4)

*(d) Explain the difference in the ability of solid sodium chloride and molten sodium chloride to conduct electricity in terms of their structures.

(6)

(Total for Question 2 = 12 marks)

3 (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)

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(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)

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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)

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.....

.....

(ii) Write the formula for copper nitrate.

(1)

.....

(Total for Question 3 = 11 marks)