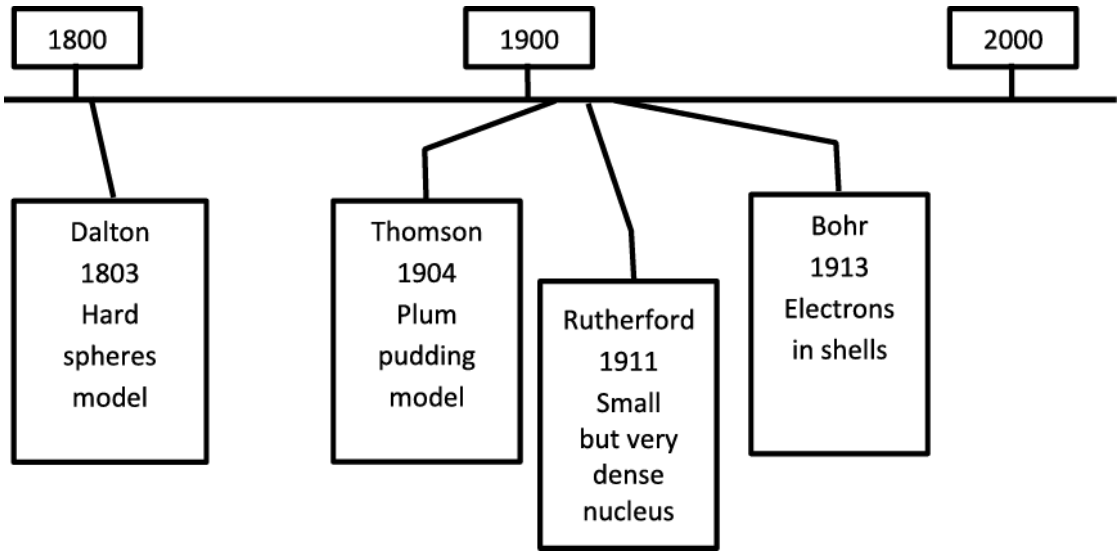
1(a). The models scientists use to describe atoms have changed over the last 200 years.
This timeline shows some of the main ideas.



Write the name of the scientist whose model of the atom could be represented by each of these pictures of everyday items. Use each name once.



…….. …….. …….. ……..

[2]

(b). Which scientist was the first scientist to include electrons in his model?

Put a (ring) around the correct answer.

Dalton Thomson Rutherford Bohr

[1]

2. Ben finds out that arsenic is in Group 5 of the Periodic Table.

Some arsenic atoms have different atomic structures to other arsenic atoms.

The table shows information about two different arsenic atoms.

	Relative atomic mass	Number of protons	Number of neutrons	Number of electron shells
arsenic-75	75	33	42	4
arsenic-73	73	33	40	4

How does the table show that the two atoms are the same element?

Put a tick (✓) in the box next to the correct answer.

Both atoms have similar relative atomic masses. ☐

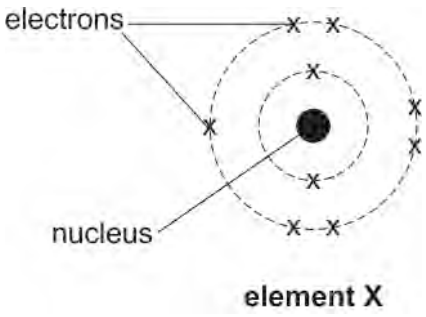
Arsenic-75 has two more neutrons than arsenic-73. ☐

Both atoms have the same number of protons. ☐

The number of electron shells is the same. ☐

[1]

3(a). The diagram shows the arrangement of electrons in an atom of an element, **element X**.



element X

Use the diagram and the Periodic Table to identify the element and to complete the missing information in the table.

Name of element	
Number of electrons	9
Number of protons	
Number of neutrons	
Periodic Table Group	

[3]

(b). The diagram below shows the arrangement of electrons in **an ion** of another element from the same group, **element Y**.

ion of element Y

(i) What is the charge on the ion?

Explain your answer.

Charge ----------

Explanation ----------

---------- [2]

(ii) Explain how you can tell from the diagrams that **element X** and **element Y** are in the same group of the Periodic Table.

---------- [1]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		left to right: Bohr, Dalton, Rutherford, Thomson ✓✓	2	3 or 4 correct = 2 marks 2 correct = 1 marks 1 correct = 0 mark
	b		Thomson ✓	1	
			Total	**3**	
2			Both atoms have similar relative atomic masses. ☐ Arsenic-75 has two more neutrons than arsenic-73. ☐ Both atoms have the same number of protons. ✓ The number of electron shells is the same. ☐	1	**Examiner's Comments** Most knew that the same types of atom have the same number of protons. Some candidates ticked two, rather than one box, implying that they had not read the question instructions carefully.
			Total	**1**	
3	a		fluorine protons: 9 neutrons : 10 group: 7 / 17	3 (AO 3 × 2.1)	All 4 correct = ✓ ✓ ✓ 3 correct = ✓ ✓ 1 or 2 correct = ✓ Examiner's Comments This question was well answered. Almost all candidates correctly identified both the group and the element. Some put the numbers of protons and neutrons in the wrong order.
	b	i	- 1 ✓ it has gained (an) electron ✓	2 (AO 2.1) (AO 1.1)	ALLOW '-' IGNORE 'negative' ALLOW M2 for idea of gaining electrons, even if M1 is not awarded. ALLOW 'has (one) more electron than protons' Examiner's Comments Most knew that the atom had gained an electron. When giving a charge on an ion, 'negative' is not enough, a negative ion could have a range of charges. Best answered stated clearly that the charge is '–1'.

Question			Answer/Indicative content	Marks	Guidance
		ii	the atoms both have 7 electrons in the outer shell / both atoms have the same number of electrons in the outer shell / both need one electron to give a full outer shell ✓	1 (AO 1.1)	
			Total	6	