1. A carbon atom is 1.7×10^{-10} m wide.

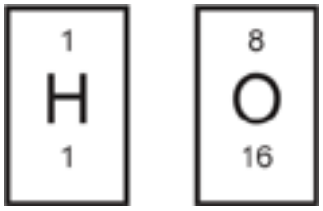
A diamond is 4.0×10^{-3} m wide.

Calculate the number of carbon atoms that fit in the width of the diamond.

Give your answer in **standard form** to **1** decimal place.

Number of carbon atoms = ... **[3]**

2. Water, H_2O, contains hydrogen and oxygen atoms.



i. How many protons does an oxygen atom have?

_____ **[1]**

ii. How many neutrons does a hydrogen atom have?

_____ **[1]**

iii. What is the relative charge of a proton?

_____ **[1]**

3. Which scientist suggested the idea that electrons exist in electron shells?

A Bohr
B Dalton
C Rutherford
D Thomson

Your answer ☐ **[1]**

4. The table shows information about some atoms and ions.

Which two are **isotopes**?

Atom or ion	Number of protons	Number of neutrons	Number of electrons
1	17	18	17
2	17	18	18
3	17	20	17
4	18	20	18

A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 4

Your answer ☐ **[1]**

5. You should spend a **maximum** of **30 minutes** on this section.

Write your answer to each question in the box provided.

Which part of an atom is **negatively** charged?

A Electron
B Neutron
C Nucleus
D Proton

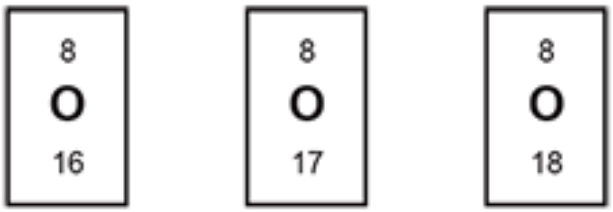
Your answer ☐ **[1]**

6(a). Draw lines to connect each **particle** with its correct **description**.

Particle	Description
proton	relative mass of 0.0005
electron	positively charged and relative mass of 1
neutron	no charge

[2]

(b). The element oxygen has three different isotopes.



i. Which isotope has the **highest** mass?

_____ **[1]**

ii. Which isotope has the **same number** of protons and neutrons?

_____ **[1]**

iii. Atoms of each isotope have the same number of electrons.
How many electrons do these atoms have?

_____ **[1]**

(c). A sample of air contains three isotopes of oxygen.
It contains 99.759% of isotope **1** and 0.037% of isotope **2**.

Calculate the percentage of isotope **3** in the sample of air.

Percentage of isotope 3 = ... % **[2]**

7. Thomson discovered the first sub-atomic particle.

Which sub-atomic particle did Thomson discover?

A Atom
B Electron
C Neutron
D Proton

Your answer ☐ **[1]**

8. Where is most of the mass found in an atom?

A Electrons
B Neutrons
C Nucleus
D Protons

Your answer ☐ **[1]**

9. When the model of the atom was developed, scientists reviewed the work of other scientists.

Why is it important for scientists to review each other's work?

A They will copy the experiments to complete the research first.
B They will evaluate the data and suggest improvements.
C They will make sure that personal protective equipment is worn.
D They will start an argument about who is correct.

Your answer ☐ **[1]**

10. Which particles are smaller than 1×10^{-9} m?

A Nanoparticles, molecules and atoms
B Nanoparticles, neutrons and electrons
C Neutrons, atoms and electrons
D Neutrons, polymers and protons

Your answer ☐ **[1]**

11(a).

Complete the sentences about the structure of an atom. Use words from the list.

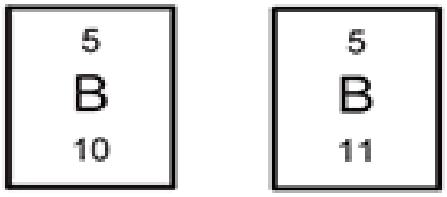
electrons	**negative**	**neutral**	**neutrons**	**positive**	**protons**

An atom has a nucleus with a ..... charge. The nucleus is made up of ..... and ..... .

[3]

(b).

i. Look at the information about two **isotopes** of boron.



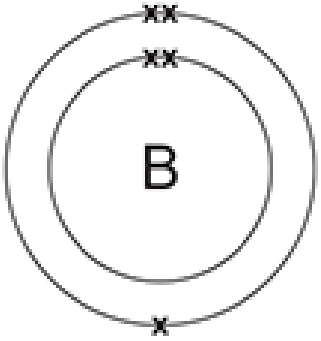
Which statements about the isotopes of boron are correct?

Tick (✓) **two** boxes.

Boron has 11 protons. ☐
The atomic number of boron is 5. ☐
The electrons are heavier than the protons. ☐
The isotopes of boron have different numbers of neutrons. ☐
The isotopes of boron have different numbers of protons. ☐
The mass number of boron is the same for both isotopes. ☐

[2]

ii. The diagram shows a boron atom.



Explain why boron is in Group 3 of the Periodic Table.

_____

_____ **[1]**

12. What did Rutherford suggest about the model of the atom?

A Atoms contain a nucleus.
B Atoms contain electrons.
C The atom is a solid sphere like a billiard ball.
D The nucleus is made up of protons and neutrons.

Your answer ☐ **[1]**

END OF QUESTION PAPER