Electron Structure

Total mark – 20

Question: 1

1. Modern plasma television screens emit light when mixtures of noble gases, such as neon and xenon, are ionised.

The first ionisation energies of neon and xenon are shown in the table below.

element	1st ionisation energy / kJ mol^{-1}
neon	+2081
xenon	+1170

Explain why xenon has a lower first ionisation energy than neon.

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[Total 3 marks]

Question: 2

2. The electron configuration of bromine contains outermost electrons in the 4th shell.

Using your knowledge of Group 7 elements, complete the electron configuration of bromine.

$1s^2 2s^2 2p^6 3s^2 3p^6$ .....

[Total 1 mark]

Question: 3

3. Ammonia reacts with hydrogen chloride, HC*l*, to form ammonium chloride, NH_4Cl.

NH_4Cl is an ionic compound containing NH_4^+ and Cl^- ions.

(i) Complete the electron configuration of the Cl^- ion.

$1s^2$ .....

[1]

(ii) Draw a '*dot-and-cross*' diagram to show the bonding in NH_4^+.

Show **outer** electrons only.

[1]

(iii) State the shape of, and bond angle in, an NH_4^+ ion.

shape: .....

bond angle: .....

[2]

(iv) A student investigated the conductivity of ammonium chloride.

She noticed that when the ammonium chloride was solid it did **not** conduct electricity. However, when ammonium chloride was dissolved in water, the resulting solution did conduct electricity.

Explain these observations.

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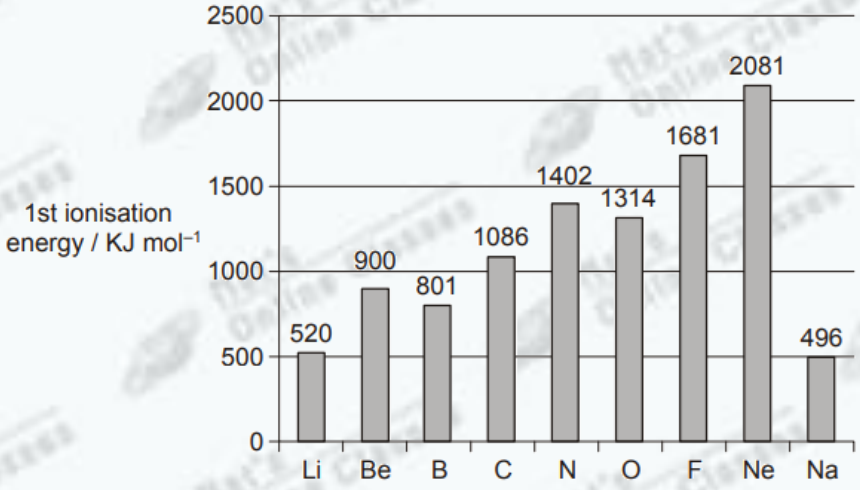
[2]

[Total 6 marks]

Question: 4

4. Ionisation energies have been used to develop the model of the atom.

The first ionisation energies of the elements Li to Na are shown in the figure below.



Define the term *first ionisation energy*.

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[Total 3 marks]

Question: 5

8. Electrons are arranged in energy levels.

(a) An orbital is a region in which an electron may be found.

Draw diagrams to show the shape of an s orbital and of a p orbital.

s orbital	p orbital

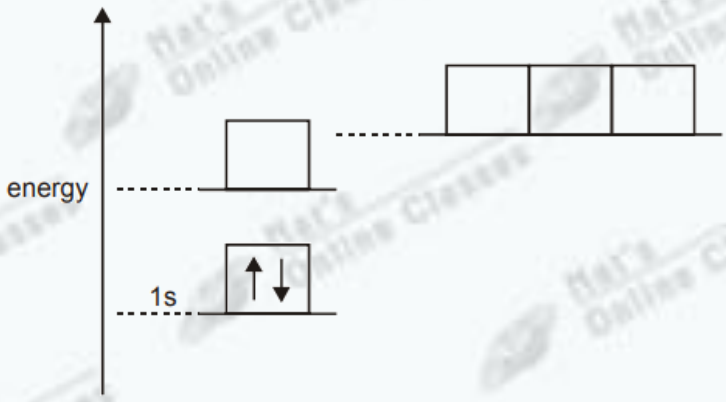
[2]

(b) Complete the table below to show how many electrons **completely** fill each of the following.

	number of electrons
a d **orbital**	
a p **sub-shell**	
the third **shell** (n = 3)	

[3]

(c) The energy diagram below is for the eight electrons in an oxygen atom. The diagram is incomplete as it only shows the two electrons in the 1s level.



Complete the diagram for the oxygen atom by:

(i) adding labels for the other sub-shell levels,

[1]

(ii) adding arrows to show how the other electrons are arranged.

[1]

[Total 7 marks]