OCR AS LEVEL CHEMISTRY A

1.1.1 ATOMS

1.2.1 ELECTRON STRUCTURE

1.3.1 PERIODICITY (a) – (d)

TEST

Answer all questions

Max 47 marks

Name ……..
Mark ……../47 ……....% Grade ……

1. Carbon is in the p-block of the Periodic Table. Naturally occurring carbon contains a mixture of two isotopes, ^{12}C and ^{13}C.

Complete the table below for the atomic structure of the isotopes ^{12}C and ^{13}C.

isotope	protons	neutrons	electrons

^{12}C			
^{13}C			

[Total 2 marks]

2. Carbon occurs in a wide range of compounds and is essential to living systems.

Two isotopes of carbon are ^{12}C and ^{13}C.

(i) State what is meant by the term *isotopes*.

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.....

[1]

(ii) Isotopes of carbon have the same chemical properties.

Explain why.

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[1]

(iii) The ^{12}C isotope is used as the standard measurement of relative masses.

Define the term *relative isotopic mass*.

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[2]

[Total 4 marks]

3. A sample of carbon was found to contain 95% of ^{12}C and 5% of ^{13}C.

(i) The ^{13}C isotope has a relative isotopic mass of 13.00.
Define the term *relative isotopic* mass.

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.....

[2]

(ii) Calculate the relative atomic mass of this sample of carbon to three significant figures.

A_r = ...

[2]

[Total 4 marks]

4. Magnesium exists naturally as a mixture of its isotopes, ^{24}Mg, ^{25}Mg and ^{26}Mg.

The isotopes in magnesium can be separated by mass spectrometry. The diagram below shows a mass spectrometer.

(i) Complete the table below to show the composition of the ^{25}Mg and ^{26}Mg isotopes.

	protons	neutrons	electrons
^{25}Mg			
^{26}Mg			

[2]

(ii) Complete the electronic configuration of an atom of ^{24}Mg.

$1s^2$ .....

[1]

(iii) Results from the mass spectrum of a sample of magnesium are shown below.

isotope	^{24}Mg	^{25}Mg	^{26}Mg
relative isotopic mass	24.00	25.00	26.00
% abundance	78.60	10.11	11.29

Calculate the relative atomic mass of the sample of magnesium.
Give your answer to two decimal places.

answer .....

[2]

[Total 5 marks]

5. The electronic configuration of a bromine atom can be written in terms of sub-shells.

(i) Complete the electronic configuration of a bromine atom.

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

[2]

(ii) Why is bromine classified as a p-block element?

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.....

[1]

[Total 3 marks]

6. The Periodic Table is a table of elements arranged in order of atomic number. The elements are classified into blocks.

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

.....

[1]

(ii) Complete the full electron configuration for a titanium atom.

$1s^2$ .....

[1]

(iii) Identify the **seventh** element in the **fourth** period.

State which block this element is in.

element ..... block .....

[1]

[Total 3 marks]

7. In their reactions, calcium and strontium each lose electrons to form ions with a 2+ charge. The first and second ionisation energies of calcium and strontium are shown below.

	1st ionisation energy / kJ mol^{-1}	2nd ionisation energy / kJ mol^{-1}
calcium	590	1145
strontium	550	1064

(i) Write an equation, with state symbols, to represent the **second** ionisation energy of calcium.

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[2]

(ii) Why are the second ionisation energies of calcium and strontium greater than their first ionisation energies?

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[1]

(iii) Explain why the first and second ionisation energies of strontium are less than those of calcium.

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[3]

[Total 6 marks]

8. This question refers to the elements in the first four periods of the Periodic Table.

							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr

Ionisation energies provide information about the model for the electron structure of elements.

(i) Explain why first ionisation energies show a general increase across Period 3, Na–Ar.

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[3]

(ii) Write an equation, including state symbols, to represent the third ionisation energy of sodium.

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[1]

(iii) Element **X** is in Period 3 of the Periodic Table, Na–Ar.

The first six ionisation energies of an element **X** are shown below.

ionisation number	1st	2nd	3rd	4th	5th	6th
ionisation energy /kJ mol–1	789	1577	3232	4 556	16091	19 785

Predict, with reasons, the identity of element **X**.

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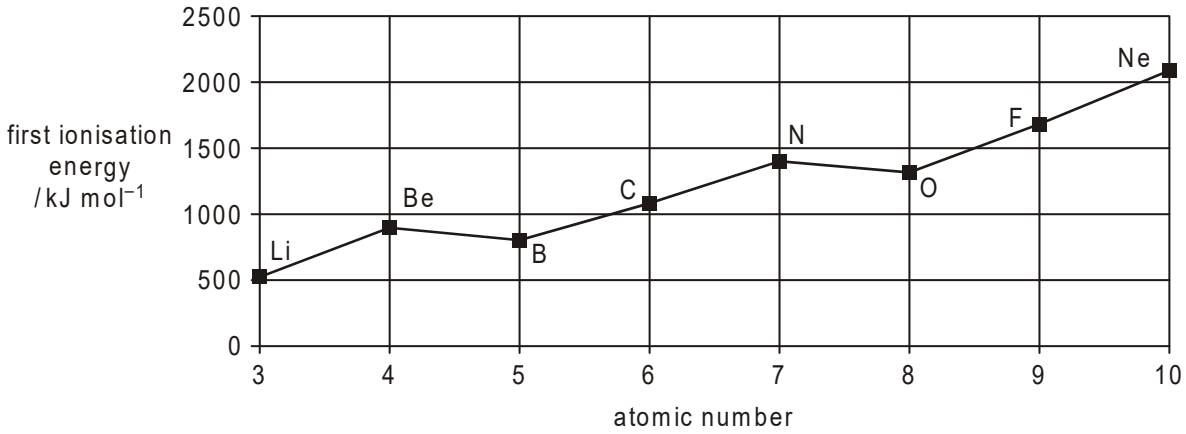
[2]

[Total 6 marks]

9. The diagram below shows the variation in the first ionisation energies of elements across Period 2 of the Periodic Table.



(i) Define the term *first ionisation energy*.

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[3]

(ii) Explain why the first ionisation energies show a **general** increase across Period 2.

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[2]

(iii) Explain why the first ionisation energy of B is **less** than that of Be.

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[2]

[Total 7 marks]

10. Barium, Ba, was discovered by Davy in 1808. The element gets its name from the Greek 'barys' meaning 'heavy'.

The table below compares some properties of barium with caesium.

element	Cs	Ba
group	1	2
atomic number	55	56
atomic radius / pm	531	435

(i) Why do caesium and barium have different atomic numbers?

.....

[1]

(ii) State the block in the Periodic Table in which caesium and barium are found.

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[1]

(iii) Explain why the atomic radius of barium is **less** than the atomic radius of caesium.

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[3]

(iv) Predict and explain whether a barium **ion** is *larger*, *smaller* or the *same size* as a barium **atom.**

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[2]

[Total 7 marks]