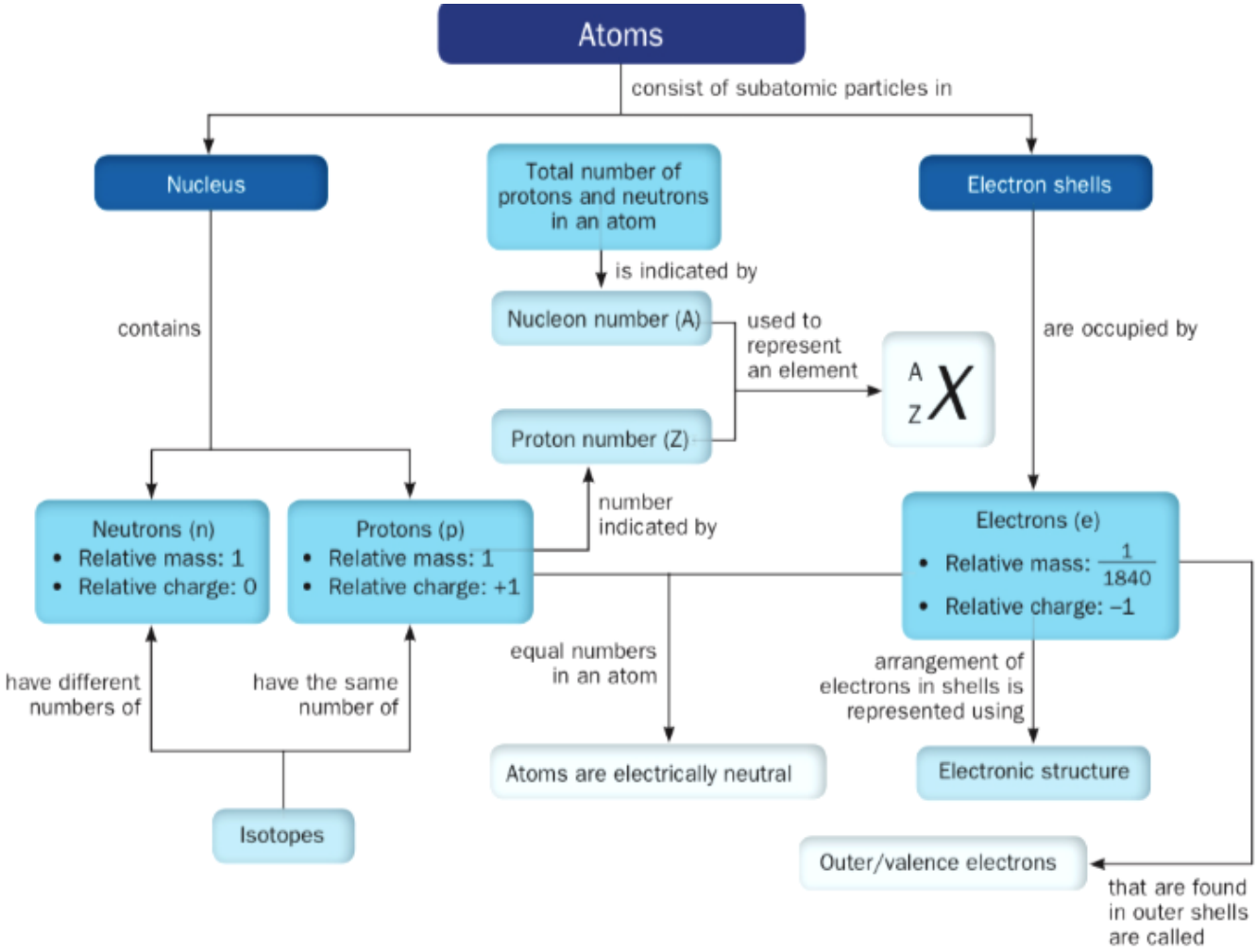
Atomic structure & Periodic table

Student Name: _____

ID: _____

Teacher's comment(s) & Date

MAP it!



Answer the following questions in the spaces provided.

1. The table below shows the relative mass and relative charge of three types of subatomic particles.

	M	N	O
Relative mass	1	1	x
Relative charge	+1	y	−1

(a) Identify the subatomic particles **M**, **N** and **O**.

M: proton **N:** electron **O:** neutron

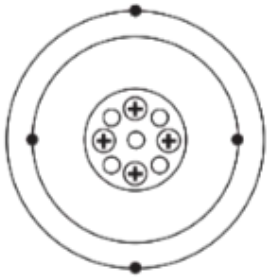
(b) What are the values of **x** and **y**?

x: 0 **y:** 0

2. Lithium (Li), sodium (Na) and potassium (K) are in the same group of the Periodic Table. Complete the table below.

Element	Electronic configuration	Number of electrons	Number of neutrons
$^{7}_{3}Li$	2, 1	3	4
$^{23}_{11}Na$	2, 8, 1	11	12
$^{39}_{19}K$	2, 8, 8, 1	19	20

3. The electronic structure of a beryllium atom is shown in the diagram below.



(a) Write down the symbol of this element, including its proton number and nucleon number.

$^{9}_{4}Be$

(b) Write down the electronic configuration of beryllium.

2, 2

(c) How many valence electrons are there in an atom of beryllium?

2

(d) Deduce the group that beryllium belongs to in the Periodic Table.

II

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4. Correct each of the following statements.

(a) The nucleus of a fluorine atom ($^{19}_{9}F$) contains ~~19~~ neutrons and 9 protons.

10

(b) The first shell in an atom can hold a maximum of ~~eight~~ electrons.

2

(c) A helium atom has ~~eight~~ electrons in its outer shell.

2

(d) Nitrogen has an atomic number of 7. Therefore, there are seven electrons in ~~the outer shell of its atom~~ total

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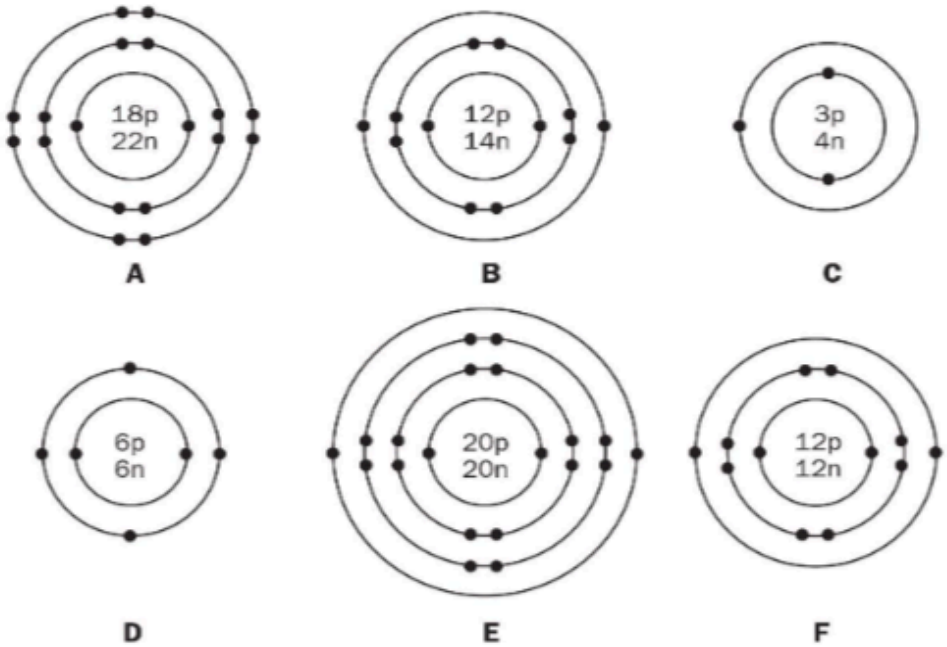
5. The figures below show the electronic structures of six atoms, **A** to **F**.



(a) Which atoms

(i) are isotopes; BF

(ii) have the same nucleon number; AE

(iii) are in the same group of the Periodic Table? BEF

6. At airports, security officers fire neutrons at luggage to detect any hidden explosives. Most explosives contain nitrogen-14. When neutrons collide with nitrogen-14, a radioisotope, nitrogen-15, is formed and high-energy rays are given off. These rays, when detected, indicate the presence of explosives in the luggage.

(a) (i) Write down the electronic arrangement of an atom of nitrogen-15.

2. 5

(ii) Using the Periodic Table, name another element that has similar chemical properties as nitrogen-15.

P

(iii) Explain your answer in (ii).

P is in the same group of N.

(b) State the similarity in the atomic structures of nitrogen-15 and oxygen-16.

They has the same number of neutrons.

Free-Response Questions

Answer the following questions.

1. A sample of volcanic rock consists of two isotopes of helium, helium-3 and helium-4, in the following mass ratio:

$$^{3}_{2}\text{He} : ^{4}_{2}\text{He} = 1 : 99$$

(a) Explain what is meant by the term 'isotopes'.

Isotopes is atoms having same number of protons and electrons.

(b) (i) State the difference between the atomic structures of helium-3 and helium-4.

helium-4 has 1 more neutron than helium-3

(ii) Explain why helium-3 and helium-4 have similar chemical properties.

They has the same number of valence electrons.

(c) This sample of volcanic rock also contains hydrogen-3.

(i) Write the symbol of hydrogen-3, showing the atomic and mass numbers.

$^{1}_{3}H$

(ii) List one similarity and one difference between hydrogen-3 and helium-3.

They has the same mass.
They has different proton number.

2. The table below shows the nucleon numbers and proton numbers of atoms **W**, **X**, **Y** and **Z**. (Note: **W**, **X**, **Y** and **Z** are not chemical symbols of elements.)

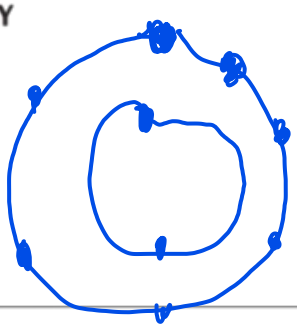
Atom	Nucleon number	Proton number
W	2	1
X	14	6
Y	19	9
Z	37	17

Draw the electronic structures of atoms **W**, **X**, **Y** and **Z**.

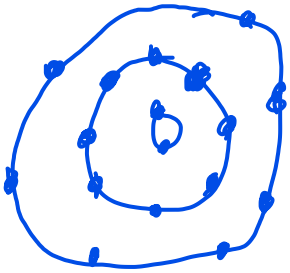
Atom **W**

Atom **X**

Atom **Y**



Atom **Z**



3

The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	15	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

It is a combination of protons, electrons and neutrons. [1]

(ii) **A**, **B** and **C** are all particles of the same element.

They hes the same number of protons [1]

(iii) Particles **A** and **C** are isotopes of the same element.

They has different neutron numbers. [2]

(b) **(i)** What is the electronic structure of particle **A**?

2, 8, 5 [1]

(ii) Is element **A**, a metal or a non-metal? Give a reason for your choice.

non-metal, it is easier to get electrons. [1]

4

Protons, neutrons and electrons are subatomic particles.

(a) Complete the table to show the relative mass and relative charge of a proton, a neutron and an electron.

particle	relative mass	relative charge
proton	1	+1
neutron	1	0
electron	$\frac{1}{1840}$	−1

[3]

(b) Bromine has two isotopes.

(i) Define the term *isotope*.

.....

..... [2]

(ii) Explain why the two isotopes of bromine have the same chemical properties.

.....

..... [2]

(c) The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

particle	number of protons	number of neutrons	number of electrons
$^{7}_{3}Li$	3	4	3
$^{34}_{16}S^{2-}$	16	18	18
$^{41}_{19}K^{+}$	19	22	18

[5]

5

(a) (i) De ine the term *atomic number*.

atomic number is the number of protons [1]

(ii) Define the term *nucleon number*.

nucleon number is the number of protons plus number of neutrons. [2]

(b) The table shows the number of protons, neutrons and electrons in some atoms or ions.

Complete the table. The first line is given as an example.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	6	6	6	$^{12}_{6}C$
B	12	12	12	$^{24}_{12}Mg$
C	8	10	8	$^{16}_{8}O^{2-}$
D	11	10	13	$^{24}_{11}Na$

[6]

6

The table below gives the composition of six particles which are either atoms or ions.

particle	number of protons	number of neutrons	number of electrons
A	33	40	33
B	19	20	18
C	34	45	36
D	33	42	33
E	13	14	13
F	24	28	21

(a) Which particles are atoms? Explain your choice.

A, D, E. They has the same number of protons and electrons.

[2]

(b) Which particle is a negative ion and why has this particle got a negative charge?

C, it has more electrons than protons.

[2]

(c) Which particles are positive ions?

F, B

[1]

(d) Explain why particle **A** and particle **D** are isotopes.

They has the same number of protons but different neutrons.

[2]