

### HOMWORK – PERIODIC TABLE

1) John Newlands was a chemist who worked in a sugar factory. In 1866 he designed a periodic table.

He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.

Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	Li	G	Bo	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru
Pd	Ag	Cd	U	Sn	Sb	Te
I	Cs	Ba, V	Ta	W	Nb	Au
Pt, Ir	Tl	Pb	Th	Hg	Bi	Os

Newlands' periodic table

(a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give two properties of these elements which support the idea that they should be grouped together.

1 .....

2 .....

(2)

(b) Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why. Use the Newlands' periodic table above to help you to answer this question.

.....  
.....  
.....  
.....

(3)

(c) State and explain one way in which Mendeleev improved Newlands' periodic table.

.....

.....

.....

.....

(2)

(Total 7 marks)

2) By 1869, about 60 elements had been discovered. Mendeleev arranged these elements in a table, in order of their atomic weight. He also put elements with similar chemical properties in the same columns.

Mendeleev and part of his table are shown below.



	Group							
	1	2	3	4	5	6	7	8
Period 1	H							
Period 2	Li	Be	B	C	N	O	F	
Period 3	Na	Mg	Al	Si	P	S	Cl	
Period 4	K Cu	Ca Zn	– –	Ti –	V As	Cr Se	Mn Br	Fe Co Ni

(a)(i) Name one element in Group 1 of Mendeleev's table that is not in Group 1 of the periodic table. Give a reason why this element should not be in Group 1.

Name of element .....

Reason .....

(2)

(ii) Which group of the periodic table on the Data Sheet is missing from Mendeleev's table?

.....

(1)

(b) The gaps (–) in Mendeleev's table were for elements that had not been discovered.

(i) Compare Mendeleev's table with the periodic table on the Data Sheet.

Name one of the elements in Period 4 that had not been discovered by 1869.

.....

(1)

(ii) Mendeleev was able to make predictions about the undiscovered elements. This eventually led most scientists to accept his table.

Suggest what predictions Mendeleev was able to make about these undiscovered elements.

.....  
.....  
.....  
.....

(2)

(c) In terms of their electronic structure:

(i) state why lithium and sodium are both in Group 1

.....  
.....

(1)

(ii) explain why sodium is more reactive than lithium.

.....  
.....  
.....  
.....  
.....  
.....  
.....

(3)

(Total 10 marks)

3) These are the electronic structures of the atoms of three different elements.

2.8.1  
element A

2.8.8  
element B

2.8.8.1  
element C

(a) Identify elements A and B.

Element A is .....

Element B is .....

(2)

(b)(i) Why is element C more reactive than element A?

.....  
.....  
.....  
.....

(2)

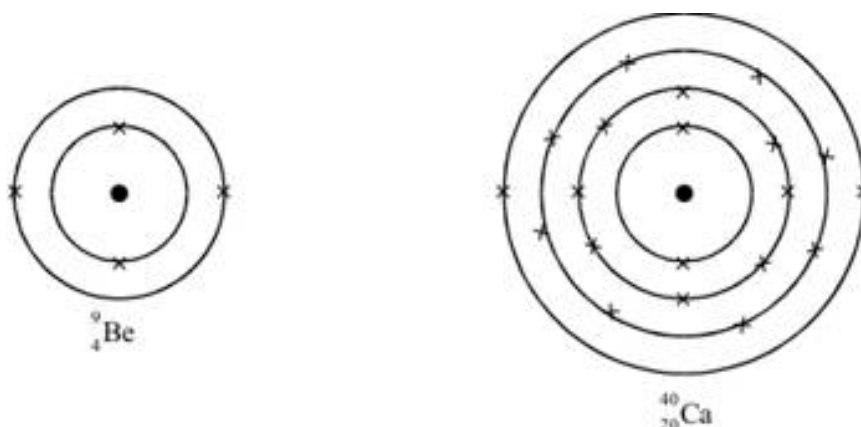
(ii) Why is element B unreactive?

.....  
.....

(2)

4) Beryllium and calcium are metals in Group 2 of the periodic table.

The diagrams show their electronic structures.



(a) Why do beryllium and calcium have similar chemical properties?

.....  
.....  
.....

(1)

(b) Calcium is more reactive than beryllium.

Suggest an explanation for this in terms of the electronic structure of the two elements.

.....  
.....  
.....  
.....

(2)

1) (a) any two from:

- react with water or very reactive
- (react with water) releasing gas / hydrogen / fizzing
- (react with water) to form an alkaline / hydroxide solution
- form ions with a 1+ charge allow lose one electron from the outer shell  
*ignore other references to electronic structure ignore physical properties* **2**

(b) any three from:

- some boxes contain two elements allow specific examples:  
*Co, Ni or Ce, La or Di, Mo or Ro, Ru or Ba, V or Pt, Ir*
- groups / columns contain elements with different properties  
*allow groups / columns contain both metals and non-metals ignore examples*
- Newlands not a well-known / respected scientist ignore references to sugar factory
- new idea (not readily accepted by other scientists) **3**

(c) one for improvement and one for explanation from:

- left gaps (for undiscovered elements) (1)
- so that elements were in their correct group (1) allow so the elements fitted the pattern of properties **or**
- did not always follow order of relative atomic weights / masses (1)  
*ignore references to atomic number / electronic structure*
- so that elements were in their correct group (1)  
*allow so the elements fitted the pattern of properties* **2**

2) (a) (i) *incorrect or no element = 0 marks*

Hydrogen allow H / H<sub>2</sub> **1**

all the other elements are metals allow hydrogen is a not an (alkali / group 1) metal  
*ignore hydrogen is a gas OR*

copper (1) allow Cu

(copper) is not an alkali metal (1) allow Cu is a transition element / metal  
*allow any valid specific chemical property eg Cu does not react with water*  
*ignore references to electronic structure ignore physical properties* **1**

(ii) Group 0 / noble gases ignore Group 8 **1**

(b) (i) scandium / gallium / germanium accept Sc / Ga / Ge allow Krypton / Kr **1**

(ii) predicted they were metals allow atomic mass / weight ignore atomic structure **1**

predicted their (chemical/physical) properties / reactivity accept any chemical / physical property  
*allow similar properties if mentioned in context of a group* **1**

(c) (i) (both) have one / an electron in the outer energy level / shell

ignore form single plus ions

1

- (ii) *accept shell for energy level*      *accept converse explanation for lithium*  
*if 'outer' not mentioned, max 2 marks*  
*ignore sodium reacts more easily*

sodium loses one outer electron more easily (than lithium)

1

because outer electrons/energy level further from the nucleus in sodium  
or because sodium has more shells (than lithium)

*do not accept 'more outer shells'*      *allow sodium (atom) is larger*

1

because forces/attraction to hold outer electron are weaker in sodium  
(than lithium)

*accept more shielding in sodium (than lithium)*

1

[10]

- 3) a)    A is sodium/Na\*      B is argon/Ar\*      each for 1 mark  
          (\*case of letters must be correct)

2

(b) (i) *ideas that*

- outer electron (in element C / 2.8.8.1 / potassium) is at a higher energy level / in a more outer shell/further away from nucleus / shielded by more full electron shells

- electron is more easily lost/less strongly held / attracted      each for 1 mark

2

(ii) *ideas that*

- (element B / 2.8.8 / argon) has an outer shell that is complete/has 8 electrons

- no tendency to gain or lose electrons / has a stable configuration

- (not 'is stable' / 'in group O' / 'a noble gas')      each for 1 mark

2

[6]

4) (a) same number of outer electrons / have 2 outer electrons

*do not accept inner electrons or 2Xs*

1

(b) calcium (idea) outer electrons / shell  
further from nucleus

*do not credit lower down group*

*do not credit larger / more shells*

1

more easily lost / attraction from nucleus less

*accept screening of inner electrons*

1