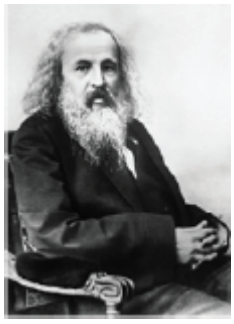
1 By 1869, about 60 elements had been discovered.
Mendeleev arranged these elements in a table, in order of their atomic weight.
He also put elements with similar chemical properties in the same columns.

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 on the Data Sheet.
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)

2 The idea of a periodic table of the elements was started by John Newlands about 140 years ago.

He wrote down the elements he knew about in order, starting with the lightest atoms.

Then he arranged them into seven groups, like this:

1	2	3	4	5	6	7
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca				

(a) Write down **three** differences between the groups in Newlands' periodic table and the groups in the modern periodic table (up to the element Ca, which is calcium).

.....

.....

.....

.....

.....

(3)

(b) Suggest **one** reason why this part of Newlands' table was different from the modern one.

.....

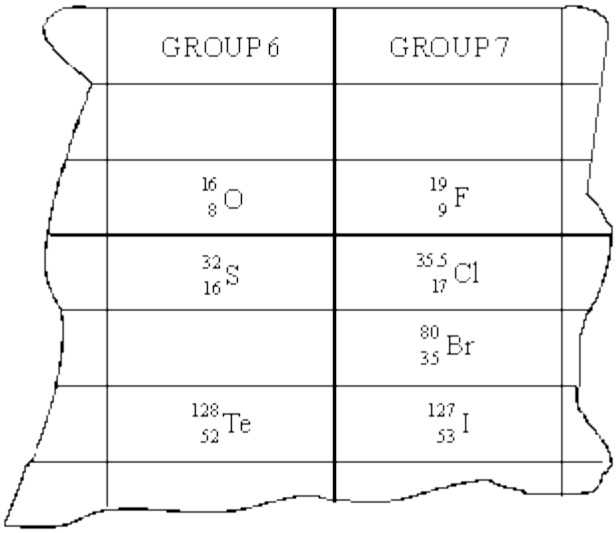
.....

(1)

(c) Dimitri Mendeléev later developed the periodic table of the elements. He arranged the elements according to their properties and their relative atomic masses.

The diagram shows where Mendeléev put tellurium (Te) and iodine (I) in his table because of their properties.

(The diagram uses present day symbols and the atomic numbers of the elements have been added to Mendeléev's table.)



(i) What is wrong with this arrangement of tellurium and iodine in terms of their relative atomic masses?

.....

.....

(1)

(ii) Explain why this is not a problem in the modern periodic table.

.....

.....

.....

.....

(2)

(Total 7 marks)

Mark schemes

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

hydrogen

allow H / H_2

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 <u>one</u> / <u>an</u> 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]

2 (a) ideas that

- hydrogen is in a group / is with the halogens
- only seven groups / no group O / no noble gases / fewer elements
- halogens are in the first group / Group 1
- other elements are in one group higher *(or example)*
- modern table only has two elements in the top row / period
- modern table not in order of atomic weight/mass
- metals and non-metals not at opposite ends

(NB allow converse answers throughout)

any three for 1 mark each

3

(b) ideas that

- all rows / periods are the same length / have seven elements
- all elements had to be in one of the groups
- he didn't know about the noble gases / not all the elements had been discovered
- he didn't know about atomic/proton number/electron structure
- he arranged elements in order of atomic weight/mass

any one for 1 mark

1

(c) (i) *ideas that*
tellurium and iodine are in reverse order

for 1 mark

1

(ii) elements are arranged in order of proton (atomic) number
or based on electron structure/outer shell electrons
(so tellurium is correctly placed before iodine)
[tellurium = 'dead mark']

each for 1 mark

2

[7]