

C3 Revision – Periodic Table (inc group 1, 7 and transition metals)

Q1. Platinum and gold are transition elements. They can both be used to make wedding rings.

(a) Platinum and gold are good materials for making wedding rings.

Use your knowledge of the properties of transition elements to suggest why.

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.....
.....
.....(2)

(b) Explain, in terms of electronic structure, why transition elements have similar chemical properties.

.....
.....
.....
.....
.....
.....(2)(Total 4 marks)

Q2. (a) Dimitri Mendeleev was one of the first chemists to classify the elements by arranging them in order of their atomic weights. His periodic table was published in 1869.

How did Mendeleev know that there must be undiscovered elements and how did he take this into account when he designed his periodic table?

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.....

.....(2)

(b) By the early 20th century protons and electrons had been discovered.

Describe how this discovery allowed chemists to place elements in their correct order and correct group.

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.....
.....
.....
..... (3)

(c) The transition elements are a block of elements between Groups 2 and 3 of the periodic table.

(i) Transition elements have similar properties.

Explain why in terms of electronic structure.

.....
.....
.....
..... (2)

(ii) There are **no** transition elements between the Group 2 element magnesium and the Group 3 element aluminium.

Explain why in terms of electronic structure.

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

(1)
(Total 8 marks)

Q3. 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)(Total 6 marks)

Q4. The following article appeared recently in the *Manchester Gazette*.

Sodium Drum Blaze Scare

A 20 litre drum containing sodium burst into flames when it reacted violently with rainwater at a Manchester factory. It is believed that the sodium, which is normally stored under oil, had been accidentally left outside with the lid off.

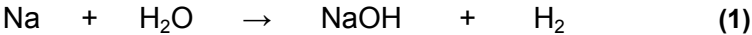
A factory worker put out the blaze before the fire services arrived, and a leading fire fighter said, "It was fortunate that potassium wasn't involved as it would have reacted more violently and exploded. These Group 1 *alkali metals* can be very dangerous".

(a) Group 1 metals are stored under oil.

Suggest why.

..... (1)

(b) Balance the equation which represents the reaction between sodium and water.



(c) Explain why the Group 1 metals are called the *alkali metals*.

.....
.....(1)

(d) Explain, in terms of electrons, why potassium reacts more violently than sodium.

.....
.....

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

.....(3)(Total 6 marks)

Q5. The table shows the properties of four elements from Group VII of the Periodic Table.

(a) Complete the spaces in the table. (4)

(b) Comment briefly on the trend in melting points for these four elements.

.....
.....

(1)

(c) Explain, in as much detail as you can:

(i) why the reactions of these elements with hydrogen are similar.

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

(ii) why their reactivity with hydrogen decreases from fluorine to iodine.

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

.....(4)(Total 9 marks)

Q6. Sodium and potassium are both in Group 1 of the Periodic Table.

(a) Explain, by reference to their electronic structures, why both elements are placed in Group 1.

.....
.....(1)

(b) Use the Data Sheet to help you to answer this question.
The diagrams below represent the electronic structures of some atoms and ions.

Which one of the structures, **A - F**

(i) represents a sodium **atom**, (1)

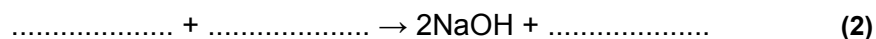
(ii) represents a potassium **ion**? (1)

(c) Sodium and potassium both react with cold water.

(i) The word equation represents the reaction of sodium with water.



Complete and balance the symbol equation for this reaction.



(ii) How does the reactivity of potassium with water differ from that of sodium with water?

.....

Explain this difference in reactivity by reference to the electronic structures of the potassium and sodium atoms.

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

.....(4)(Total 9 marks)

Q7. Read the information about the development of the periodic table and answer the questions that follow.

John Newlands was one of the first chemists to arrange the known elements in order of increasing atomic mass. In 1866, he put forward the Law of Octaves. He suggested that there was a repeating pattern of elements with similar chemical properties every eighth element, just like the eighth note of an octave of music. A version of his periodic table is shown below.

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	Os	Hg	Tl	Pb	Bi	Th

However, other chemists did not accept Newlands' ideas. It was not until much later that his contribution to the development of the modern periodic table was recognised.

The modern periodic table on the Data Sheet may help you to answer these questions.

(a) What is the modern symbol for the element 'Bo'?(1)

(b) Describe **one** piece of evidence to support the Law of Octaves.

.....
.....
.....
..... (2)

(c) Suggest **two** reasons why other chemists did not accept Newlands' ideas.

1
.....
.....
2
.....
..... (2)

(d) The alkanes are a series of hydrocarbons with similar chemical properties. They have the general formula C_nH_{2n+2} .

Suggest why the alkanes do not appear in the periodic table.

.....
.....(1)(Total 6 marks)

Q8. Fluorine is more reactive than chlorine. Fluorine reacts with most elements in the Periodic Table. However, fluorine does not react with argon.

Atomic numbers: F 9; Cl 17; Ar 18.

(a) To which group of the Periodic Table do fluorine and chlorine belong?

..... (1)

(b) (i) Give **one** use for argon.

..... (1)

(ii) Explain why the noble gas argon is unreactive.

.....
.....
.....
..... (2)

(c) (i) Give **one** use for chlorine.

..... (1)

(ii) Draw the electron arrangement of a chlorine atom.

(2)

(iii) Explain why fluorine is more reactive than chlorine.

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

(3)
(Total 10 marks)

- M1.** (a) any **two** from:
- do not react with water
 - do not react with air
allow unreactive or stay shiny or do not tarnish or do not corrode for either of first two points for 1 mark
ignore rusts
ignore durable
 - malleable
ignore hard / strong
 - high melting point
ignore boiling point
ignore other correct properties

2

- (b) (transition elements have) same number / two electrons in outer shell / energy level / fourth shell
ignore references to (metallic) structure / bonding

1

any **one** from:

- because lower energy level / inner shell being filled
- because third energy level can hold up to eighteen electrons

1

[4]

- M2.** (a) left gaps

1

if placed consecutively, then elements would be in wrong group / have wrong properties / owtte

allow some elements didn't fit pattern

1

- (b) (elements placed in) atomic / proton number order

1

(elements in) same group have same number of outer electrons

1

any **one** from:

- number of protons = number of electrons
- reactions (chemical) properties depend on the (outer) electrons
- number of shells gives the period
allow number of shells increases down the group

1

- (c) (i) (transition elements usually) have same / similar number of outer / 4th shell electrons

1

inner (3rd) shell / energy level is being filled
ignore shells overlap

1

- (ii) 2nd shell / energy level can (only) have maximum of 8 electrons

or

2nd shell / energy level cannot have 18 electrons

1

[8]

- M3.** (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]

M4. (a) acts as barrier between sodium and air / oxygen / water (vapour)
accept because they are reactive
ignore oil will not react

1

(b) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
allow multiples / fractions

1

(c) these metals react with water producing an alkaline solution

or

produce solution with pH greater than 7 / high pH

owtte

allow produce OH. ions

not these metals are / form alkalis

ignore 'strong' pH

1

(d) *it = potassium*
outer electron must be mentioned once for all 3 marks

bigger atom

or

outer shell electron further from nucleus

or

more shells

or

converse argument for sodium less reactive provided sodium is

specified

1

less attraction to nucleus

or

more shielding

not less magnetic attraction

1

outer electron more easily lost

ignore potassium reacts more easily

1

[6]

M5. (a) (i) 9

(ii) 2.8.7 gas

(iii) liquid

each for 1 mark

4

(b) increase as go down the table/F → I/down group/
as more protons/as atoms get bigger

for 1 mark

1

(c) (i) reactions depend on taking/sharing electrons
same number of electrons in outer shell/highest energy level

(ii) F → I electrons in a higher energy level/further from nucleus
so less easy to gain/hold electrons

each for 1 mark

4

[9]

M6. (a) same number of electrons in outer shell / 1 / an electron in outer shell / lose one electron
for 1 mark

1

(b) (i) C

for 1 mark

1

(ii) E

for 1 mark

1

- (c) (i) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$
 symbols must be correct
 correct multiples / fractions accepted
 Balancing mark is independent

formulae gains 1 mark
balancing gains 1 mark

2

- (ii) Assume 'it' means potassium
 potassium more reactive / vigorous / faster reaction / violent (can be awarded in either section)
 potassium atom larger than sodium / higher outer energy level /
 outer shell further from nucleus / more shells (not just more electrons)
 electron in outer shell is less strongly attracted / greater shielding
 outer electron more easily lost

for 1 mark each

4

[9]

M7. (a) B

1

- (b) eg link between Li, Na, K, (Rb, Cs)

or Mg, Ca, (Sr, Ba)

or F, Cl, Br, I

*allow any **two** elements in the same group (in both Newland's **and** the modern periodic table)*

1

linked appropriate comment about that link eg similar physical / chemical properties **or** similar specific reactions **or** same number of outer electrons

*if no elements identified, allow **1** mark for a general comment about elements **in the same column** having similar properties*

*"every eighth element has similar properties" = **1** mark*

1

- (c) any **two** from:

- no gaps for undiscovered elements **or** elements still being discovered
- some boxes have 2 elements

- metals and non-metals in same column / mixed up / some elements in the same column had different properties
- pattern for first 16 or so elements only
- any sensible suggestion about misplaced elements eg copper in group 1 metals

2

(d) alkanes are not elements **or** alkanes are compounds
ignore molecule / molecular

1

[6]

M8. (a) group seven/7VII
accept halogens

1

(b) (i) in light **bulbs**/lasers
accept any other specified use as an inert atmosphere e.g. (argon)
welding, storing explosives, fluorescent lights

1

(ii) 2.8.8/has a full/8 in/outer shell

1

electrons

accept does not need to share/gain/lose electrons

1

(c) (i) any one from:
disinfectant
bleaching agent
sterilising water/kills bacteria
manufacture of HCl
water treatment

1

not: *cleaning/in pools*
purification of water

kills germs
warfare
antiseptic

- (ii) inner shells 2,8 1
- outer shell 7 1
- (iii) fluorine:
accept the converse reasons for chlorine
gains **one**/an electron easier/is more
strongly attracted
***not** more strongly held* 1
- less shielding of nucleus by inner electron shells 1
- less distance from (attraction of)
nucleus/less shells 1

[10]