GCSE CHEMISTRY AQA - COMBINED SCIENCE MARK SCHEME

C1
ATOMIC STRUCTURE AND THE PERIODIC TABLE TEST 1
Mark schemes

(a) (i) 7
(ii) –1
(iii) neutrons

(b) number of protons

(c) atom Y

(d) (i) Ne 
   allow neon
   (ii) has a full outer shell
       allow in Group 0
       allow a noble gas
   or
       full outer energy level
       allow the shells are full
   or
       has 8 electrons in its outer shell
       ignore in Group 8

(a) the melting point increases

(b) 337 °C
   allow an answer in the range 278 °C to 337 °C

(c) bromine

(d) Group 7
(e)  

7 electrons in outer shell

(f)  

$\text{Cl}_2 + 2\text{NaBr} \rightarrow \text{Br}_2 + 2\text{NaCl}$

correct formulae for products

correct balancing

(g)  

fluorine

(because it is) more reactive than chlorine

allow because it is the most reactive element

(a)  

Chemical properties

(b)  

three / 3

(c)  

They all have a stable arrangement of electrons

(d)  

less dense than water

allow lighter than water

gas / hydrogen produced

an alkali / hydroxide is produced

sodium is more reactive than lithium
### (a)  

<table>
<thead>
<tr>
<th>name of particle</th>
<th>relative mass</th>
<th>charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>proton</td>
<td>(1)</td>
<td>(+1)</td>
</tr>
<tr>
<td>neutron</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>electron</td>
<td>(very small)</td>
<td>−1</td>
</tr>
</tbody>
</table>

*allow words instead of numbers  
allow neutral or no charge for the neutron*

### (b)  

(protons) 3  
(neutrons) 4  
(electrons) 3

*allow words instead of numbers*

### (c)  

[Diagram of atomic models with stages of development]

### (a)  

any two from:  
- hydrogen is in a group  
  *allow converse arguments*  
  *allow hydrogen is with the halogens*  
- only seven groups  
- no group 0  
  *allow no noble gases*  
- halogens are in Group 1  
  *allow fluorine and/or chlorine are in Group 1*  
- other elements are in one group higher  
  *allow one example of this*  
- transition metals included in groups  
  *allow one example, e.g., iron in same group as aluminium*
(b) similar properties occur at regular intervals

(c) some elements appeared to be in the wrong group

(when) the elements were arranged in order of relative atomic mass

allow (so) he placed them into groups with similar properties

(d) most elements are mixtures of isotopes

(so) should be arranged in order of atomic number

(e) 

(a) electrons
neutrons
protons

for 1 mark each

(b) mass number no. of neutrons
14 8

for 1 mark each

(a) (i) electronic structure 2,3 drawn

allow any representation of electrons, such as, dots, crosses, or numbers (2,3)

(ii) nucleus

(iii) protons and neutrons

do not allow electrons in nucleus

(relative charge of proton) +1

allow positive
(relative charge of neutron) 0
  allow no charge/neutral
  ignore number of particles

(b) too many electrons in the first energy level or inner shell
  allow inner shell can only have a maximum of 2 electrons

too few electrons in the second energy level or outer shell
  allow neon has 8 electrons in its outer shell or neon does not have
  1 electron in its outer shell
  allow neon has a stable arrangement of electrons or a full outer
  shell
neon does not have 9 electrons or neon has 10 electrons
  allow one electron missing
  allow fluorine has 9 electrons
  ignore second shell can hold (maximum) 8 electrons or 2,8,8 rule or
  is a noble gas or in Group 0
max 2 marks if the wrong particle, such as atoms instead of
  electrons
  if no other mark awarded allow 1 mark for the electronic structure of
  neon is 2,8

(a) (i) a correct link between any two named elements eg same group / column
  same properties / number of outer electrons
  allow some link between any two elements in the same group (in
  both Newlands and or the modern periodic table)
(ii) any two from:

ignore statements about lack of evidence / proof

• elements still being discovered

or

no gaps for undiscovered elements

• some boxes have 2 elements in them

• metals and non-metals in same column / mixed up

accept some elements in same column have different properties.

allow any sensible suggestion about misplaced elements eg copper in group 1 elements

• pattern for first 16 or so elements only

allow did not work for all elements

2

(b) (i) Cl > Br > I

accept reactivity / it decreases down the group

or

I < Br < Cl

1

Cl has 2 reactions, Br has 1 reaction, I doesn’t react

owtte

allow Cl has most / more reactions and I has least / less reactions

(must be clear about where Br fits in)

1

(ii) Br

allow multiples / fractions if correctly completed and balanced

1

(iii) (they) have 7 outer electrons

allow (they) have 7 electrons in highest occupied (energy) level / shells / rings

1
outer / last / final must be mentioned once in correct context, otherwise max 2 marks comparative required on all three points accept converse ie less reactive up group
don down group (atom / elements) bigger

or

outer electrons (level / shell /ring) further from nucleus / centre ignore more electrons

or

more shells / level / rings

do not accept more outer shells for this mark

force(s) / attraction(s) are weaker allow electron(s) attracted less easily allow electron(s) less under influence (of nucleus)
or

more shielding

or

attracts less

do not accept magnetic / gravitational / intermolecular forces

electron(s) lost more easily allow electron(s) more likely to be lost allow easier to give away

(a) did not appear because they had not been discovered or they are unreactive or they did not form compounds

(b) arranged in order of atomic / proton number

elements in the same group have the same number of electrons in the outer shell

(c) chlorine>bromine>iodine

table shows that chlorine displaces bromine and iodine

and bromine displaces iodine
(d) \[ \text{Cl}_2(\text{aq}) + 2 \text{Br}^-(\text{aq}) \rightarrow \text{Br}_2(\text{aq}) + 2 \text{Cl}^-(\text{aq}) \]

- correct formulae 1
- correct balancing 1
- correct state symbol 1

(e) the further down the group, the halogen becomes less reactive because outer electrons are further from the nucleus

so less attractive force on an incoming electron 1

(a) because they form hydroxides

that give alkaline solutions (in water) 1

(b) the atoms have more electron shells (as move down the group)

so the electron in the outer shell is further away from the nucleus 1

which reduces the attraction to the nucleus 1

so the electron is lost more easily from the atom 1

(c)

- electronic structure of lithium drawn correctly 1
- electronic structure of oxygen drawn correctly 1
- correct charge on ions (Li$^+$ and O$^{2-}$) 1
- correct number of each ion (2 lithium, 1 oxygen) 1