M1.(a) 13 (protons)
The answers must be in the correct order.
if no other marks awarded, award $\mathbf{1}$ mark if number of protons and electrons are equal

14 (neutrons)

13 (electrons)
(b) has three electrons in outer energy level / shell
allow electronic structure is 2.8.3
(c) Level 3 (5-6 marks):

A detailed and coherent comparison is given, which demonstrates a broad knowledge and understanding of the key scientific ideas. The response makes logical links between the points raised and uses sufficient examples to support these links.

## Level 2 (3-4 marks):

A description is given which demonstrates a reasonable knowledge and understanding of the key scientific ideas. Comparisons are made but may not be fully articulated and / or precise.

## Level 1 (1-2 marks):

Simple statements are made which demonstrate a basic knowledge of some of the relevant ideas. The response may fail to make comparisons between the points raised.

0 marks:
No relevant content.
Indicative content
Physical
Transition elements

- high melting points
- high densities
- strong
- hard


## Group 1

- low melting points
- low densities
- soft

Chemical
Transition elements

- low reactivity / react slowly (with water or oxygen)
- used as catalysts
- ions with different charges
- coloured compounds

Group 1

- very reactive / react (quickly) with water / non-metals
- not used as catalysts
- white / colourless compounds
- only forms a +1 ion

M2.(a) The forces between iodine molecules are stronger
(b) anything in range +30 to +120
(c) Brown
(d) $2 \mathrm{I}^{-}+\mathrm{Cl}_{2} \rightarrow \mathrm{I}_{2}+2 \mathrm{Cl}^{-}$
(e) It contains ions which can move
(f) hydrogen iodine

M3.(a) (i) protons
allow "protons or electrons", but do not allow "protons and electrons"
(ii) protons plus / and neutrons
(so fluorine and chlorine are in the same group) because they have the same number of or 7 electrons in their highest energy level or outer shell
if no other mark awarded, allow 1 mark for have the same / similar properties
(d) S

M4.(a) (iron) is a metal

> accept transition element
> allow (iron) had different properties (to oxygen and sulfur)
> ignore electrons
(b) so that elements with similar properties could be placed together allow to make the pattern fit ignore undiscovered elements
(c) atomic number(s)
allow proton number(s)

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M5.(a) increase
(b) (i) $\mathrm{Na}^{+}$and $\mathrm{Br}^{-}$
both required
(ii) sodium chloride
allow NaCl
do not allow sodium chlorine
(iii) chlorine is more reactive than bromine
allow converse argument
allow symbols $\mathrm{Cl}_{1} \mathrm{Cl}_{2}, \mathrm{Br}$ and $\mathrm{Br}_{2}$
allow chlorine / it is more reactive
do not allow chloride or bromide
(iv) fluorine
allow $F / F_{2}$
do not allow fluoride.

M6.(a) Li and K
either order
allow lithium and potassium
(b) Fe
allow iron
(c) N and As

> either order
> allow nitrogen and arsenic
(d) Cu

> allow copper

M7.(a) similar properties
allow same properties
allow correct example of property
ignore answers in terms of atomic structure
(b) (i) in order of atomic / proton number allow increasing number (of protons)
(ii) elements in same group have same number (of electrons) in outer shell or highest energy level
allow number (of electrons) increases across a period
(c) any two from:
statements must be comparative

- stronger / harder
ignore higher densities
- less reactive
- higher melting points
ignore boiling point
(d) reactivity increases down group
allow converse throughout
for next three marks, outer electron needs to be mentioned once otherwise max $=\mathbf{2}$
outer electron is further from nucleus
allow more energy levels / shells
allow larger atoms
less attraction between outer electron and nucleus
allow more shielding
therefore outer electron lost more easily

M8.(a) (i) hydrogen

> accept $\mathrm{H}_{2}$
> allow H
(ii) hydroxide

```
accept OH-
allow OH
do not accept lithium hydroxide
```

(b) any two from:
'it' $=$ potassium
potassium:
accept converse for lithium

- reacts / dissolves faster
allow reacts more vigorously / quickly / violently / explodesignore reacts more
- bubbles / fizzes faster
allow fizzes more
allow more gas
- moves faster (on the surface)
allow moves more
- melts
allow forms a sphere
- produces (lilac / purple) flame
allow catches fire / ignites
do not accept other colours

M9. (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 $\underline{1+}$ charge allow lose one electron from the outer shell ignore other references to electronic structure ignore physical properties
(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
- $\quad$ so that elements were in their correct group (1)
allow so the elements fitted the pattern of properties

