Mark scheme – Predicting Chemical Reactions (F)

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td></td><td></td><td>C most reactive
A
D
B least reactive
correct order – 2 marks
C as most reactive and B as least – 1 mark</td><td>2
(AO3.2b)</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>2</td><td>a</td><td></td><td>$2Na + 2H_2O \rightarrow 2NaOH + H_2$

Formulae ✓
Balancing ✓</td><td>2
(AO1.1)
(AO2.1)</td><td>ALLOW any correct multiple, including fractions
DO NOT ALLOW and / & instead of ‘+’

balancing mark is dependent on the correct formulae but
ALLOW 1 mark for a balanced equation with a minor error in subscripts / formulae eg $2Na + 2H_2O \rightarrow 2NaoH + H2$</td></tr>
<tr><td></td><td>b</td><td></td><td>(Sodium atom) loses an electron /

Oxidation is loss of electrons ✓</td><td>1
(AO1.1)</td><td></td></tr>
<tr><td></td><td>c</td><td></td><td>Any two from:
<u>Outer electron</u> in rubidium is further from the nucleus / ORA ✓

Idea that attraction of rubidium’s nucleus for <u>outer electron</u> is less / ORA ✓

<u>Outer electron</u> in rubidium is lost more easily / ORA ✓</td><td>2
(AO1.1)</td><td>Assume unqualified answer refers to rubidium

ALLOW <u>outer electron</u> in higher energy level / shell

ALLOW more shielding in rubidium

IGNORE idea that outer electron is lost more quickly

Reference to outer electron needed at least once</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>3</td><td>a</td><td></td><td>
<table>
<tr><th>Element</th><th>Formula</th><th>Colour</th><th>State at room temperature</th></tr>
<tr><td>Fluorine</td><td>F_2</td><td>pale yellow</td><td>Gas</td></tr>
<tr><td>Chlorine</td><td>Cl_2</td><td>green✓</td><td>gas ✓</td></tr>
<tr><td>Bromine</td><td>Br_2</td><td>brown</td><td>liquid</td></tr>
<tr><td>Iodine</td><td>I_2</td><td>grey</td><td>solid ✓</td></tr>
</table>
</td><td>3(AO 1.1)</td><td><u>Examiner’s Comments</u>

 
Misconception

The colour of chlorine as yellow and iodine</td></tr>
</table>

					being a liquid at room temperature were common misconceptions.
	b		(Fluorine has) weak intermolecular forces / weak forces between molecules ✓ which only require a small amount of energy to break / which are easy to break ✓	2(AO 1.1)	**ALLOW** weak intermolecular bonds **DO NOT ALLOW** references to covalent bonds between <u>molecules</u> **OR** weak forces between <u>atoms</u> – scores 0 **<u>Examiner's Comments</u>** Higher ability candidates described that fluorine has weak intermolecular forces, which are easily broken. **Misconception** A common misconception is still that simple covalent molecules have low melting & boiling points due to weak covalent bonds between molecules or weak forces between atoms.
	c		(Group 0 elements) have a full / complete outer shell ✓ Idea that they have no tendency to lose or gain electrons ✓	2(AO 1.1)	**ALLOW** 8 electrons in outer shell **IGNORE** idea that they have no tendency to react unless linked to gaining a full outer shell (of electrons) **<u>Examiner's Comments</u>** Good responses to this question described that the elements in Group 0 have a full outer shell, so have no tendency to lose or gain electrons.
	d		**Any two from:** (Potassium) reacts violently / sparks / ignites / explodes ✓ floats / moves around on surface of water ✓ moves quickly (on water) ✓ lilac flame ✓ melts (into a ball) ✓ dissolves ✓ (hydrogen gas ignites with) a squeaky pop ✓	2(AO 2.2)	**ALLOW** (potassium) disappears / gets smaller **<u>Examiner's Comments</u>** Most candidates were able to give two correct observations.

					When candidates did not gain credit, it was usually because they stated the type of observations you would make (eg **if** the potassium caught fire, **if** the potassium floated etc) rather than the actual observations made.
	e		**Any two from:** (Down Group 1) <u>outer</u> electron or <u>outer</u> shell gets further from the nucleus / more shielding / atomic radius increases / more electron shells / ORA ✓ Idea of less attraction between nucleus and <u>outer</u> shell electron ✓ <u>Outer</u> shell electron is lost more easily ✓	2(AO 1.1)	**ALLOW** <u>outer</u> electron in potassium is further from the nucleus than in lithium / ORA **IGNORE** potassium has more electrons (than lithium) **DO NOT** allow idea that outer electron is lost more quickly / AW **<u>Examiner's Comments</u>** Good responses to this question described the idea that down Group 1 there are more electron shells, so there is less attraction between the nucleus and the **outer** shell electron, which is lost more easily. When candidates did not gain both marks it was usually because they did not state that it was the **outermost** or **outer** shell electron that is lost.
			Total	**11**	
4			D	1	
			Total	**1**	
5			Enter text here.		
			D	1	
			Total	**1**	
6	a	i	Molecular formula: At_2 (1) Atomic radius: 148 – 168 (1)	2	**DO NOT ALLOW** AT_2 / At2 **ALLOW** any range of numbers provided it is completely within the range given for the answer
		ii	Makes iodine and sodium bromide (1)	1	
		iii	Bromine is more reactive than iodine (1)	1	**ALLOW** ORA
	b	i	Same number of electrons in outer shell / all have 7 electrons in outer shell (1)	1	**ALLOW** outer electrons or valence electrons rather than electrons in the outer shell **ALLOW** valence shell rather than outer shell

					DO NOT ALLOW the wrong number of electrons in the outer shell
		ii	$2Na + Br_2 \rightarrow 2NaBr$ Correct formulae of reactants and products (1) Balancing – depend on correct formulae (1)	2	**ALLOW** any correct multiple of the equation including fractions **ALLOW** = or ⇌ instead of → **DO NOT ALLOW** and or & instead of + **ALLOW** one mark for correct balanced equation with minor errors of case and subscript, e.g. 2NA + Br2 → 2NaBr
		iii	KAt (1)	1	
			Total	**8**	