Name: _____

2.1 Inorganic chemistry

Group 1 and 7 ms

Date:

Time:

Total marks available:

Total marks achieved: _____

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Marks
(a)	<table><tr><th>Name of halogen</th><th>Physical state at room temperature</th><th>Colour</th></tr><tr><td>chlorine</td><td>gas</td><td>pale green</td></tr><tr><td>bromine</td><td>liquid</td><td>red-brown</td></tr><tr><td>iodine</td><td>solid</td><td>(dark) grey</td></tr></table>	**ALLOW** black **ALLOW** any combination of grey and black eg grey-black	2
(b)	**M1** (35 × 77.78) + (37 × 22.22) **OR** 3544.44 **M2** 3544.44 ÷ 100 **OR** 35.4444 OR **M1** ÷ 100 **M3** 35.4	(35 × 0.7778) + (37 × 0.2222) **OR** 35.4444/35.444/35.44 with no working scores 2 35.4 with no working scores 3 M3 can be ECF from an incorrect M2	3

(c)	An explanation that links together the following four points: **M1** add chlorine (solution) to potassium bromide (solution) **M2** (solution) turns orange **M3** bromine/Br_2 is displaced **M4** (therefore) chlorine is more reactive (than bromine)	 **ACCEPT** mix the two solutions **ALLOW** any combination of orange/yellow/brown **IGNORE** other observations eg bubbles **ALLOW** bromine/Br_2 is produced/formed **IGNORE** state of bromine **REJECT** bromide **IGNORE** a displacement reaction occurs **M3** can be scored by Br_2 as a product in an equation **ACCEPT** reverse argument "If a reaction occurs then chlorine is more reactive than bromine" scores **M4**	4

Q2.

Question number	Answer	Additional guidance	Mark
(a)	The atoms of both elements have one electron in the outer shell	accept highest energy level in place of outer shell	1

Question number	Answer	Additional guidance	Mark
(b)(i)	A description that makes reference to any two of the following points: • sodium floats/moves across the water (1) • sodium melts (1) • sodium disappears/gets smaller (1) • effervescence/fizzing/bubbles/gas given off (1) • white trail (1)	accept forms a ball accept sodium dissolves ignore name of gas	2

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that makes reference to the following points: • (final colour is) purple/blue (1) • because the solution is alkaline (1)	accept sodium hydroxide forms/ solution has high pH	2

Question number	Answer	Mark
(b)(iii)	D (12)	1

Question number	Answer	Mark
(c)	Lithium	1

Question number	Answer	Additional guidance	Mark
(d)	Potassium catches fire	accept lilac/purple/violet flame	1

Question number	Answer	Additional guidance	Mark
(e)	$2Rb + 2H_2O \rightarrow 2RbOH + H_2$ (1)	accept multiples and fractions	1

(Total for question = 9 marks)

Q3.

Question number	Answer	Notes	Marks
(a) (i)	Any 3 from **M1** effervescence/bubbles/fizzing **M2** moves **M3** floats **M4** disappears/gets smaller **M5** vapour trail/steam	 moves on surface scores **M2** and **M3** **ALLOW** dissolves **IGNORE** melts/heat produced **IGNORE** any reference to indicators	3
(ii)	An explanation that links the following two points **M1** the universal indicator turns purple/blue **M2** (because) OH^-/hydroxide ions are present	 **ALLOW** an alkaline solution /an alkali is produced / a solution of high pH is formed	2
(iii)	$2Li + 2H_2O \rightarrow 2LiOH + H_2$ **M1** all formulae correct **M2** balancing of correct formulae	**ALLOW** multiples and fractions **M2** dep on **M1**	2

(b) (i)	An explanation that links the following two points **M1** to remove any other ions/chemicals/ impurities/ contaminants/ compounds/substances (that may be on the wire) **M2** (so that) they do not interfere with/mask the colour of the flame	 **ALLOW** (so that) they do not affect the result (of the test) **ALLOW** (remove substances) that could colour the flame	2
(ii)	**D** yellow A is incorrect as sodium ions do not give a green flame B is incorrect as sodium ions do not give a lilac flame C is incorrect as sodium ions do not give a red flame		1

Question number	Answer	Notes	Marks
(c) (i)	K^+ and SO_4^{2-}		1
(ii)	An explanation that links the following four points **M1** (potassium sulfate) has a giant (ionic) structure /lattice **M2** electrostatic attraction between oppositely charged ions **M3** (ionic bonds or forces / attractions between ions) are strong **M4** a large amount of energy is needed to overcome the forces/break the bonds	ionic bonds are strong scores M3	4
			Total 15

Q4.

Question number		Answer	Notes	Marks
(a)	(i)	halogens		1
	(ii)	**B** bromine A is incorrect as astatine is a solid at room temperature C is incorrect as fluorine is a gas at room temperature D is incorrect as iodine is a solid at room temperature		1
	(iii)	**C** green A is incorrect as chlorine is not brown B is incorrect as chlorine is not colourless C is incorrect as chlorine is not red		1
	(iv)	M1 (damp) litmus paper M2 bleached	**ALLOW** universal indicator paper/ pH paper **ALLOW** turns white **ACCEPT** (damp) blue litmus paper turns red and then bleached for both marks.	2
(b)	(i)	M1 use of 56 and 35.5 in calculation M2 162.5	 91.5 without working scores 1 correct answer without working scores 2	2
	(ii)	$2\,Fe + 3\,Cl_2 \rightarrow 2\,FeCl_3$	**ALLOW** multiples and fractions	1
				Total 8

Q5.

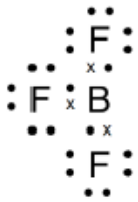
Question number	Answer	Mark
(a)	Fluorine	1

Question number	Answer	Mark
(b)	Iodine OR astatine	1

Question number	Answer	Mark
(c)(i)	Cl_2 + **2**Br^- → $2Cl^-$ + **2**Br	**1**

Question number	Answer	Additional guidance	Mark
(c)(ii)	(they are) Losing electrons	accept oxidation number (of bromine) increases accept oxidation number (of bromine) changes from −1 to 0	**1**

Question number	Answer	Additional guidance	Mark
(c)(iii)	2Br → Br_2	accept Br + Br = Br_2	**1**

Question number	Answer	Mark
(d)	A diagram that shows: • all three bonding pairs correct (1) • all non-bonding pairs (1) Example 	**2**

(Total for question = 7 marks)

Q6.

Question number	Answer	Additional guidance	Marks
(a) (i)	red	**REJECT** brick-red / orange-red and all other colours	1
(ii)	Li^+	**IGNORE** name even if incorrect	1
(iii)	An explanation that links the following two points **M1 (**litmus turns) blue **M2** (because) hydroxide (ion) / OH^- forms / solution is alkaline / an alkali	 **REJECT** purple	2
(b) (i)	Any two from: **M1** forms a ball **M2** disappears / gets smaller **M3** forms a white trail **M4** bubbles/fizzes/effervescence	 **ALLOW** melts **ALLOW** dissolves **IGNORE** hydrogen or gas given off/evolved/formed/ produced	2
(ii)	$2\,Na + 2\,H_2O \rightarrow 2\,NaOH + (1)\,H_2$	**ACCEPT** multiples and fractions **IGNORE** state symbols, even if incorrect	1

Question number			
(c) (i)	Any one from: **M1** burns / catches fire / (lilac/purple) flame produced **M2** moves (around the surface) more quickly	 **REJECT** any incorrect flame colour **ALLOW** reacts more vigorously	 1
(ii)	Any number or range of numbers between 8 and 14 inclusive		1
(d)	An explanation that links together the following two points: **M1** rubidium/it is below potassium (in Group 1) **M2** and the reactivity (of the elements/metals) increases down the group/as the group is descended/as atomic number/ atomic mass increases	 **ACCEPT** rubidium/it is lower down in the Periodic Table **ACCEPT** rubidium/it has bigger atoms/more shells (of electrons)/more shielding **ACCEPT** rubidium (atom)/it loses electrons more easily/readily **ACCEPT** correct reverse argument	 2
		Total	**11**

Q7.

Question number	Answer	Notes	Marks
(a) (i)	$2\ Na(s) + 2\ H_2O(l) \rightarrow 2\ NaOH(aq) + H_2(g)$ M1 correct balancing numbers M2 (s) and (aq) for state symbols	**ALLOW** multiples or fractions.	2
(ii)	hydroxide or OH^-	**REJECT** OH	1
(iii)	Any **three** from: M1 the sodium moves (on the surface) M2 effervescence or bubbles (of gas) M3 (indicator or phenolphthalein or water) turns pink M4 the sodium gets smaller M5 the sodium melts or turns into a ball	**ALLOW** sodium floats **IGNORE** gas or hydrogen produced **IGNORE** initial colour of indicator **ALLOW** the sodium disappears / (appears to) dissolve	3

(b)	M1 electron configuration of sodium is 2,8,1 and electron configuration of potassium is 2,8,8,1 M2 outer electron less attracted (to the nucleus of potassium) M3 therefore (outer shell electron) is more easily lost	**ALLOW** the outer shell is further from the nucleus **ALLOW** potassium has more shells **ALLOW** larger atom / larger atomic radius **ALLOW** reverse argument for sodium	3
			9 marks

Q8.

Question number	Answer	Additional guidance	Mark
(a)(i)	A description that makes reference to any two of the following points: • sodium floats/moves across the water (1) • sodium melts/forms a ball (1) • sodium disappears/gets smaller (1) • effervescence/fizzing/bubbles/gas given off (1) • white trail (1)	accept sodium dissolves ignore name of gas	**2**

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that makes reference to the following two points: • (final colour is) purple/blue (1) • because the solution is alkaline (1)	accept sodium hydroxide forms/solution has high pH	**2**

Question number	Answer	Mark
(a)(iii)	D	**1**

Question number	Answer	Additional guidance	Mark
(b)	Potassium catches fire	accept lilac/purple/violet flame	**1**

Question number	Answer	Additional guidance	Mark
(c)	**2**Rb + **2**H_2O → **2**RbOH + H_2 (1)	accept multiples and fractions	**1**