

Group 1(Alkali metals) – Lithium, Sodium, Potassium

Mark Scheme 1

Level	IGCSE(9-1)
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1C)
Topic	Inorganic Chemistry
Sub-Topic	Group 1 (Alkali metals) – Lithium, Sodium, Potassium
Booklet	Mark Scheme 1

Time Allowed: 86 minutes

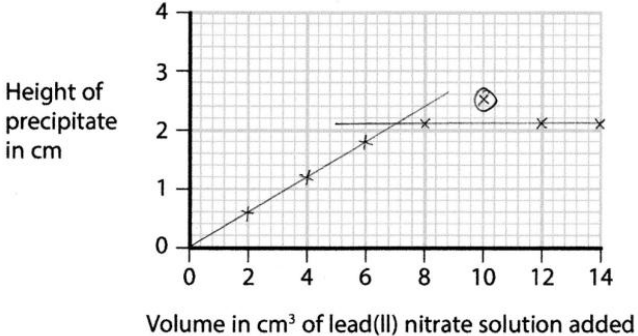
Score: /71

Percentage: /100

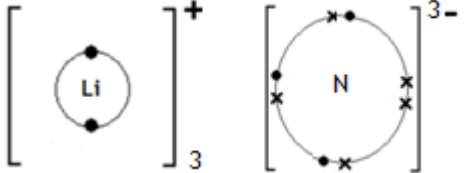
Grade Boundaries:

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

Question number	Answer		Notes	Marks
1(a)	Description of reaction	Metal	3 correct = 2 marks 1 correct = 1 mark accept symbols	2
	it explodes on contact with water	caesium		
	it fizzes gently	lithium		
	it reacts violently and forms a lilac flame	potassium		
(b) (i)	M1 – hydrogen M2 – H ₂		ignore symbol or formula even if incorrect reject H accept H ₂ (g) as a <u>product</u> in an equation ignore name even if incorrect accept LiOH as a <u>product</u> in an equation	1 1
(ii)	M1 – lithium hydroxide M2 – LiOH		ignore formula even if incorrect ignore name even if incorrect	1 1
(iii)	M1 – add (red) litmus M2 - turns blue OR M1 – use a pH meter / measure pH M2 - pH > 7		accept any named indicator accept correct colour for named indicator ignore purple M2 DEP on M1 do not award M1 or M2 if blue litmus is used	1 1
Total 8 marks				

Question number	Answer	Notes	Marks
2 (a)	<u>all</u> of the sodium chloride has reacted / the sodium chloride has been used up	Accept no more sodium chloride left (to react) Accept sodium chloride is the limiting reagent reject all reactants used up Ignore reaction has stopped/is complete	1
(b) (i)	 <p>Height of precipitate in cm</p> <p>Volume in cm³ of lead(II) nitrate solution added</p>	<p>M1 & M2 - all points correctly plotted deduct one mark for each point incorrectly plotted</p> <p>M3 - two straight lines drawn lines must be drawn with the aid of a ruler first line does not need to go through origin second line must be horizontal</p> <p>M4 - lines intersect</p> <p>M4 dep on M3</p>	2 1 1 1 1
(ii)	circle drawn around point (2.5,10)		1
(iii)	A (the precipitate was not allowed to settle before its height was measured)		1
(iv)	no precipitate is produced when no lead(II) nitrate is added	Accept the height of precipitate is (directly) proportional to the volume of lead(II) nitrate (added)	1
		Accept the two variables (plotted) are (directly) proportional (to one another)	1

(v) 7 (cm ³)		Ignore no reaction / reaction not started accept any value between 6.8 and 7.2	
			Total 9 marks

Question number	Answer	Accept	Reject	Marks
3 (a)	 <p>M1 – for both electron diagrams correct IGNORE inner electrons of N even if incorrect</p> <p>M2 – for both charges correct</p> <p>M3 – for correct ratio of ions</p>	any combination of dots and crosses		3
(b)	$6\text{Li} + \text{N}_2 \rightarrow 2\text{Li}_3\text{N}$ <p>M1 – all formulae correct</p> <p>M2 – balanced</p> <p>M2 dep on M1</p> <p>IGNORE state symbols even if incorrect</p>	multiples and fractions		2
(c) (i)	l aq g			1
(ii)	<p>M1 – any number from 8 to 14</p> <p>M2 – LiOH/lithium hydroxide is a base/alkali OR hydroxide <u>ions</u>/OH⁻ formed/present</p>	ammonia / <u>metal</u> hydroxides / <u>Group 1</u> hydroxides are bases/alkalis		1 1

(d)	ions cannot move OR ionic compounds <u>only</u> conduct when molten/in solution IGNORE references to electrons	ionic compounds do not normally conduct when solid		1
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(Total marks for Question 3 = 9 marks)

Question number		Answer	Notes	Marks	
4	a	C (good electrical conductor... and basic oxide)		1	
	b	i	effervescence / fizzing / bubbles sodium moves / darts / floats sodium melts / forms a ball sodium becomes smaller / disappears white trail	Accept gas given off / gas evolved / gas formed / gas produced Accept wrongly identified gas Accept equivalents such as shoots/skims Accept dissolves Ignore white precipitate Do not apply list principle Assume that it = sodium Ignore flames/sparks Any two for 1 each	2
		ii	l aq g	1 1	
	c	hydrogen/gas/potassium burns / flame / fire / sparks	Accept explodes Ignore references to more vigorous reaction / more fizzing	1	
	d	(all have) 1 electron in outer shell	Accept (all have) same number of outer electrons	1	

(Total for Question 4 = 7 marks)

Question number	Answer	Notes	Marks
5 (a)	<p>(because) a precipitate was formed/a reaction took place each time Y was used</p> <p>OR</p> <p>no precipitate was formed/no reaction took place when X and Z were added together</p>	<p>accept 'it reacts with X and Z (to form a precipitate)'</p> <p>allow use of correct names for X, Y and Z</p>	1
(b)	<p>M1 X is (sodium) iodide and Z is (sodium) chloride</p> <p>M2 because X gives yellow precipitate or Z gives white precipitate</p> <p>OR</p> <p>M1 X is (sodium) iodide because it forms a yellow precipitate</p> <p>M2 therefore Z is (sodium) chloride</p> <p>OR</p> <p>M1 Z is (sodium) chloride because it forms a white precipitate</p> <p>M2 therefore X is (sodium) iodide</p>		2

(c)	M1 no change/no reaction with (sodium) chloride M2 colour change (to brown solution) with (sodium) iodide	accept 'orange' / 'orange-brown' accept 'grey/black <u>precipitate</u> ' reject incorrect colour change	2
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Question number	Answer	Notes	Marks
6 (a)	$3\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$ <p>M1 formula for magnesium nitride correct M2 rest of equation correct</p>	M2 dep on M1	2
(b) (i)	<p>M1 (damp) red litmus (paper) M2 turns blue</p> <p>OR</p> <p>M1 mix with hydrogen chloride/HCl M2 white solid/smoke forms</p>	<p>reject 'blue litmus' for both M1 and M2</p> <p>accept any suitable indicator with correct colour change, eg phenolphthalein turns red/pink</p> <p>reject 'hydrochloric acid' / 'HCl(aq)' but accept 'fumes from conc. hydrochloric acid'</p> <p>ignore 'fumes'</p>	2

(b) (ii)	<p>M1 M_r of lithium nitride = 35</p> <p>M2 $(1.40 \div 35 =) 0.04(0)$ (mol)</p>	correct answer scores (2)	2
(iii)	<p>M2 from (b)(ii) $\times 3 / 0.04(0) \times 3 = 0.12$ (mol)</p>		1
(iv)	<p>Using answer to b(iii)</p> <p>M1 answer to (b)(iii) $\div 2 / 0.12 \div 2 = 0.06(0)$ (mol)</p> <p>M2 answer to M1 $\div 0.500 / 0.06(0) \div 0.500$</p> <p>M3 $0.12 \text{ dm}^3 / 120 \text{ cm}^3$</p> <p>Using answer to b(ii)</p> <p>M1 answer to (b)(ii) $\div 2 / 0.04(0) \div 2 = 0.02(0)$ (mol)</p> <p>M2 answer to M1 $\div 0.500 / 0.02(0) \div 0.500$</p> <p>M3 $0.04 \text{ dm}^3 / 40 \text{ cm}^3$</p>		3

Question number	Answer	Notes	Marks
7 a	C (lithium reacts with water to form an alkali)		1
b	A (have the same number of outer shell electrons)		1
c	(similar) bubbles / fizzing / effervescence OR moves / darts / floats OR gets smaller / disappears potassium shows a flame / sparks / explodes OR potassium melts / forms ball	Accept gas given off /evolved/formed/produced Accept hydrogen <u>gas</u> Ignore identity of gas Accept dissolves Accept reverse arguments for lithium	1 1
d	K ₂ O KCl	Accept K ₂ O ₂ and KO ₂ Reject KO If formula shown as <u>product</u> of an equation, ignore reactants and balancing Ignore coefficients	1 1
e	s l aq g		1
f	85 AND 87 calculated (even if not identified) (85 × 0.72) + (87 × 0.28) = 85.6	Accept 37+48 and 37+50 Correct final answer = 2 marks 85.5 or 85.56 = 1 mark No ECF from incorrect mass numbers Ignore units	1 1
Total 9 marks			

Question number	Answer	Accept	Reject	Marks
8 (a)	<p>M1 electronic configuration / 2.1, 2.8.1, 2.8.8.1</p> <p>M2 same number of electrons in outer shell / one electron in outer shell</p> <p>OR</p> <p>the number of electrons in the outer shell determines the chemical properties</p>	electronic structure / arrangement of electrons		1
(b)	melting point / melting temperature			1
(c) (i)	burns with a pop/squeak (when mixed with air and ignited)	use burning/lit spill / flame to see if pop/squeak splint for spill	glowing spill just 'squeaky pop test'	1
(ii)	s l aq g	capital letters		1
(iii)	<p>M1 turns blue IGNORE purple</p> <p>M2 alkaline solution formed/alkali formed/hydroxide ions formed/LiOH is an alkali/LiOH forms hydroxide ions</p> <p>IGNORE references to lithium hydroxide is a metal hydroxide</p> <p>M2 dep on M1 correct or missing</p>	OH ⁻ for hydroxide ions pH is greater than 7		1

(d)	Similarities - any two from:	forms an alkali/forms a hydroxide react vigorously exothermic/gives out heat		2
	<ul style="list-style-type: none"> floats moves around fizzes/effervesces/bubbles/produces gas/produces hydrogen disappears/dissolves forms a solution 			
	Differences – any two from:	reverse arguments for lithium comparison between the two, eg only potassium catches fire, they react at different rates		2
	Potassium: <ul style="list-style-type: none"> more vigorous/move around faster/reacts faster/fizzes more/explodes flame (IGNORE colour)/catches fire forms a ball/bead/melts 			
8	(e) (i)	4Li + O ₂ → 2Li ₂ O IGNORE state symbols	multiplies and halves	2
		M1 formulae M2 balancing M2 dep on M1		
	(ii)	2 (1) (1)	multiplies and halves	1
			Total	14