



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

---

**CHEMISTRY (US)**

**0439/31**

Paper 3 Core Theory

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

---

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level components and some Cambridge O Level components.

<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge IGCSE – October/November 2016</b>	<b>0439</b>	<b>31</b>

<b>Question</b>	<b>Answer</b>	<b>Mark</b>
1(a)(i)	H/hydrogen	<b>1</b>
1(a)(ii)	H/hydrogen	<b>1</b>
1(a)(iii)	S/sulfur	<b>1</b>
1(a)(iv)	Ca/calcium	<b>1</b>
1(a)(v)	Al/aluminium	<b>1</b>
1(b)(i)	atoms with the same number of protons but different <u>number</u> of neutrons <b>OR</b> atoms of the same element with different <u>number</u> of neutrons	<b>1</b> <b>1</b> <b>1</b> <b>1</b>
1(b)(ii)	124	<b>1</b>
1(b)(iii)	80	<b>1</b>
1(b)(iv)	78	<b>1</b>

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
2(a)(i)	any 2 from: <ul style="list-style-type: none"> <li>more Na<sup>+</sup> ions in sample <b>B OR A</b></li> <li>more Cl<sup>-</sup> ions in sample <b>B OR A</b></li> <li>more Mg<sup>2+</sup> ions in sample <b>B OR A</b></li> <li>more HCO<sub>3</sub><sup>-</sup> ions in sample <b>A OR A</b></li> <li>more Ca<sup>2+</sup> ions in sample <b>A OR A</b></li> <li>more K<sup>+</sup> ions in sample <b>A OR A</b></li> <li>more SiO<sub>3</sub><sup>2-</sup> ions in sample <b>A OR A</b></li> </ul>	2
2(a)(ii)	Mg <sup>2+</sup>	1
2(a)(iii)	2 mg = [2]  $\frac{200}{1000} \times (10) = [1]$ <b>OR</b> $0.2 \times (10) = [1]$	2
2(b)	<i>test:</i> flame test / description of flame test <i>result:</i> yellow (flame)	2
2(c)	Brownian (motion)	1
2(d)(i)	indicates a reversible reaction	1
2(d)(ii)	dip (indicator) paper in solution / put (indicator paper) in solution compare the colour with the (colour) chart / different colours represent different pH values	1 1
2(d)(iii)	absorbs heat / absorbs infra-red radiation / causes global warming	1
2(d)(iv)	<i>gas:</i> methane <i>source:</i> gases from (digestion in) animals / swamps / decomposition of vegetation / rice paddy fields / fracking / melting of permafrost /	1 1

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
3(a)	2 electrons in the outer shell inner shells correct (2, 8, 8)	1 1
3(b)	cathode electrolyte anode	2
3(c)	H <sub>2</sub> (on right) 2(H <sub>2</sub> O) (on left)	1 1
3(d)	<p><i>manufacture</i> (max = [2])</p> <ul style="list-style-type: none"> <li>• limestone / calcium carbonate heated</li> <li>• thermal decomposition</li> <li>• heated in kiln / heated in current of air / coke for heating / carbon for heating</li> </ul> <p><i>uses</i> (max = [2])</p> <ul style="list-style-type: none"> <li>• neutralise acidic waste / treating flue gases</li> <li>• neutralise acidic soils</li> <li>• steelmaking / removing impurities in iron</li> <li>• (lime) mortar / cement / plaster / lime wash</li> <li>• slaked lime / limewater</li> </ul> <p><i>equation</i> (max = [2])</p> <ul style="list-style-type: none"> <li>• e.g. calcium carbonate → calcium oxide + carbon dioxide</li> <li>• calcium oxide + acid → calcium salt + water</li> </ul>	4

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
4(a)	any 3 from: <ul style="list-style-type: none"> <li>• diffusion</li> <li>• particles move / motion of particles</li> <li>• (movement is) random / in any direction / in all directions</li> <li>• particles spread out / particles mix</li> <li>• particles move from high to low concentration</li> </ul>	3
4(b)(i)	energy (production) / power (production)	1
4(b)(ii)	any suitable use, e.g. treatment of cancer / tracer / thyroid function / sterilising (medical) instruments /	1
4(b)(iii)	average mass of <u>atoms</u> (of an element) (on a scale where) the $^{12}\text{C}$ atom has a mass of (exactly) 12 (units)	1 1
4(c)(i)	$\text{Cl}_2$ (on left) 2(KCl) (on right)	1 1
4(c)(ii)	any suitable use, e.g. sterilising / killing bacteria / swimming pools / bleach /	1
4(c)(iii)	<u>acidic</u> because chlorine is a non-metal / <u>acidic</u> because chlorine is on the right of the Periodic Table	1
4(c)(iv)	goes colourless / bleached / (goes) white	1

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
5(a)(i)	the more carbon, the higher the strength <b>ORA</b>	1
5(a)(ii)	(no) the melting point range does not increase regularly / the melting point range goes up and down / the melting point range remains fairly constant <b>OR</b> (yes) the more carbon, the greater the melting point range / the difference between the higher and lower number is greater with more carbon <b>OR</b> (yes) the average melting point range is higher the more carbon (except for <b>D</b> ) / the general trend is for a higher melting point range with more carbon	1
5(a)(iii)	<b>D</b> because it is resistant to corrosion	1
5(b)	<b>A</b>	1
5(c)(i)	gives strength / so the wire does not break / so the wire does not sag / for support	1
5(c)(ii)	<i>use</i> : any suitable use, e.g. food container / saucepan / aircraft body / <i>property</i> : any suitable property related to the use, e.g. (food container) resistant to acidic foods / (saucepan) good conductor of heat / (aircraft body) low density /	1 1
5(d)(i)	Al / aluminium it gains oxygen	1 1
5(d)(ii)	<u>exothermic</u> because the reactants have more energy than the products / <u>exothermic</u> because the products have less energy than the reactants	1

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
6(a)	<p><i>effect on indicator</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• turn (blue) litmus red</li> <li>• turn methyl orange red / pink</li> </ul> <p><i>reaction with metals</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• react with metals to produce hydrogen</li> <li>• react with metals to form a salt</li> </ul> <p><i>reaction with bases</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• react with bases to form a salt and water</li> </ul> <p><i>reaction with carbonates</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• react with carbonates to form a salt and water</li> <li>• react with carbonates to form carbon dioxide</li> </ul> <p><i>one other effect / reaction</i> (max = [1])</p> <ul style="list-style-type: none"> <li>• e.g. have a sour taste / pH below 7 / another property selected from the bullet points above</li> </ul>	4
6(b)(i)	density decreases as the number of carbon atoms increases <b>ORA</b>	1
6(b)(ii)	values between and including 170 (°C)–220 (°C)	1
6(b)(iii)	solid its melting point is above 15 °C / 15 °C is below its melting point	1 1
6(b)(iv)	displayed structure of COOH group showing all of the atoms and all of the bonds	1
6(b)(v)	88 4 × C <b>OR</b> 8 × H <b>OR</b> 2 × O <b>OR</b> C = 48 <b>OR</b> O = 32 scores [1]	2
6(c)	physical / chemical / physical	2

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0439	31

Question	Answer	Mark
7(a)	<b>A</b> = melting / fusion <b>B</b> = boiling / vaporisation	<b>1</b> <b>1</b>
7(b)	<i>arrangement</i> : irregular / random / no fixed position / no (fixed) arrangement <i>motion</i> : rapid / fast / random	<b>2</b>
7(c)	any suitable use, e.g. tyre manufacture / making sulfur dioxide / making sulfuric acid / pesticide / insecticide /	<b>1</b>
7(d)	sulfur dioxide is formed sulfur dioxide causes irritation of the throat ( <b>OR</b> nose <b>OR</b> lungs <b>OR</b> eyes or skin)	<b>1</b> <b>1</b>
7(e)(i)	C <sub>4</sub> H <sub>4</sub> S	<b>1</b>
7(e)(ii)	speeds up the rate of a reaction	<b>1</b>
7(e)(iii)	25.2 (g)	<b>1</b>