



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

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**CHEMISTRY (US)**

**0439/43**

Paper 4 Theory (Extended)

**May/June 2016**

**MARK SCHEME**

Maximum Mark: 80

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**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.

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### Abbreviations used in the Mark Scheme

- ; separates marking points
- / separates alternatives within a marking point
- **OR** gives alternative marking point
- **R** reject
- **I** ignore mark as if this material was not present
- **A** accept (a less than ideal answer which should be marked correct)
- **COND** indicates mark is conditional on previous marking point
- owtte or words to that effect (accept other ways of expressing the same idea)
- max indicates the maximum number of marks that can be awarded
- ecf credit a correct statement that follows a previous wrong response
- ( ) the word / phrase in brackets is not required, but sets the context
- ora or reverse argument

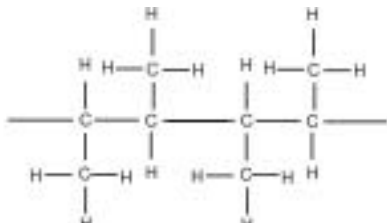
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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	A;	<b>1</b>
1(a)(ii)	B;	<b>1</b>
1(a)(iii)	D;	<b>1</b>
1(a)(iv)	C;	<b>1</b>
1(a)(v)	C;	<b>1</b>
1(b)(i)	(hot) air;	<b>1</b>
1(b)(ii)	(molten) iron;	<b>1</b>
1(b)(iii)	any 2 from: carbon dioxide; carbon monoxide; nitrogen;	<b>2</b>
1(c)(i)	as the percentage of carbon increases, so the malleability decreases;	<b>1</b>
1(c)(ii)	<b>M1</b> oxygen (gas) blown in; <b>M2</b> carbon dioxide formed / $C + O_2 \rightarrow CO_2$ ;	<b>2</b> 1 1

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)	butane;	<b>1</b>
2(b)	compounds: <b>E and F</b> ; general formula: $C_nH_{2n+2}$ ; <b>OR</b> compounds: <b>A and B</b> ; general formula: $C_nH_{2n}$ ;	<b>2</b> 1 1 1 1
2(c)	compounds: <b>E and F</b> ; explanation: same molecular formula/contain the same number of atoms each element; different structures/ different structural formulae/different arrangement of atoms;	<b>3</b> 1 2
2(d)	contains a double bond / not all bonds are single bonds; C and H <u>only</u> ;	<b>2</b> 1 1
2(e)	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ ;  any 2 from: high temperature / 220 °C–350 °C; high pressure / 60 atm–70 atm; phosphoric acid catalyst;	<b>3</b> 1 2

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Question	Answer	Marks
2(f)	 <p><b>M1</b> correct carbon structure with only single bonds;  <b>M2</b> continuation bonds;</p>	2

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)	any 2 from: carbon dioxide; nitrogen; any named noble gas;	<b>2</b>
3(b)	any 6 from:  carbon monoxide; from incomplete combustion (of carbon-containing fuel);  sulfur dioxide; from burning fossil fuels/roasting ores which contain sulphur/volcanoes;  oxides of nitrogen; nitrogen reacting with oxygen in car engines/lightning;  methane; from anaerobic decomposition/anaerobic decay;	<b>6</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)(i)	<b>M1</b> movement of electron(s) from potassium to iodine; <b>M2</b> one electron transferred;	<b>2</b> 1 1
4(a)(ii)	<b>M1</b> regular arrangement/ (giant) lattice of alternating; <b>M2</b> positive potassium ions / $K^+$ <b>and</b> negative iodide ions / $I^-$ ;	<b>2</b> 1 1
4(a)(iii)	<b>M1</b> strong (forces of) attraction (between oppositely charged ions) / ionic bonds are strong; <b>M2</b> which require lots of energy to overcome / break;	<b>2</b> 1 1
4(b)(i)	<b>M1</b> dissolve solids (in water) and mix / combine / add; <b>M2</b> filter; <b>M3</b> wash the residue (with water); <b>M4</b> leave to dry / place in oven / dry between filter papers;	<b>4</b> 1 1 1 1
4(b)(ii)	$Pb^{2+} + 2I^- \rightarrow PbI_2$ formulae of ions correct; rest correct;	<b>2</b>
4(c)(i)	start colour: colourless; end colour: brown;	<b>2</b> 1 1
4(c)(ii)	<b>M1</b> iodide / $I^-$ ; <b>M2</b> it is oxidised <b>OR</b> it loses electrons / it increases oxidation number / it reduces the chlorine;	<b>2</b> 1 1

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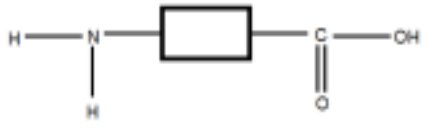
<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)	carbon dioxide / a gas is made;	<b>1</b>
5(b)(i)	red;	<b>1</b>
5(b)(ii)	0.001;	<b>1</b>
5(b)(iii)	0.0005;	<b>1</b>
5(b)(iv)	0.031 (2 marks) <b>M1 (iii)</b> / 0.0162;	<b>2</b>
5(c)	0.48 (dm <sup>3</sup> ) <b>M1</b> moles carbon dioxide = 0.02; <b>M2</b> volume carbon dioxide = 0.02 × 24; <b>M3</b> = 0.48 (dm <sup>3</sup> );	<b>3</b> 1 1 1



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)(i)	$\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$ ;	<b>1</b>
6(a)(ii)	diffusion;	<b>1</b>
6(a)(iii)	solid forms at: A; explanation: ammonia molecules/particles have a smaller mass; (and so) move/diffuse faster;	<b>3</b> 1 2
6(a)(iv)	<b>M1</b> solid forms in less time/faster/quicker; <b>M2</b> particles/molecules have more energy; <b>M3</b> (and so) move faster/diffuse faster;	<b>3</b> 1 1 1
6(b)(i)	test: add sodium hydroxide (solution and warm); result: test gas/ammonia with (red) litmus/Universal Indicator/pH paper; indicator turns blue/ammonia produced;	<b>3</b> 1 2
6(b)(ii)	test: add silver nitrate (solution); result: add (dilute) nitric acid; white precipitate;	<b>3</b> 1 2

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Question	Answer	Marks
6(c)(i)	covalent;	1
6(c)(ii)	<b>M1</b> one shared pair of electrons between each N and H; <b>M2</b> one shared pair of electrons between the N atoms; <b>M3</b> one lone pair on each N and no additional electrons anywhere;	1 1 1 3
6(d)(i)	amide;	1
6(d)(ii)	proteins are made from more than two monomers; <b>OR</b> nylon is made from 1 or 2 monomers (only);	1
6(d)(iii)	amino acids;	1
6(e)	 ;	1