

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

## **MARK SCHEME for the March 2016 series**

### **0620 CHEMISTRY**

**0620/32**

Paper 3 (Core Theory), maximum raw mark 80

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.

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### Abbreviations used in the Mark Scheme

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

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(a)(i)	N / nitrogen;	<b>1</b>
1(a)(ii)	C / carbon / carbon dioxide;	<b>1</b>
1(a)(iii)	Al / aluminium;	<b>1</b>
1(a)(iv)	Cr / Fe / Al / Ti / chromium / iron / aluminium / titanium;	<b>1</b>
1(a)(v)	Cu / copper	<b>1</b>
1(b)(i)	substance containing only one type of atom;	<b>1</b>
1(b)(ii)	number of protons: 20 and 20; number of neutrons: 23 and 28; number of electrons: 20 and 20;	<b>3</b>
1(b)(iii)	18;	<b>1</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)	anode: bromine / Br <sub>2</sub> ; cathode: potassium / K;	<b>2</b>
2(b)(i)	they are inert / they do not react;	<b>1</b>
2(b)(ii)	any suitable use, e.g. lubricant / pencil leads / brake linings / steelmaking / <u>walls</u> of blast furnace;	<b>1</b>
2(c)	bromine / Br <sub>2</sub> ;	<b>1</b>
2(d)	cream precipitate / cream solid;	<b>1</b>
2(e)	irritates eyes / irritates nose / irritates lungs;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(a)	observations with sodium: fizzes or effervesces / sodium goes into a ball / sodium melts / moves over surface of water; products: sodium hydroxide / hydrogen; observations with iron: red or black or brown solid / iron glows; products: iron oxide / hydrogen;	<b>4</b>
3(b)	gas syringe / upturned measuring cylinder filled with water / upturned burette filled with water; workable apparatus, e.g. airtight; use of stopclock / idea of timing;	<b>3</b>
3(c)	powder → 25 large pieces → 3 small pieces → 10;	<b>1</b>
3(d)(i)	rate increases with increasing temperature; idea that graph is not linear / rate does not increase proportionally / upward curve;	<b>2</b>
3(d)(ii)	16 ( cm <sup>3</sup> hydrogen / min);	<b>1</b>
3(e)	increasing concentration increases rate;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)	up to four from: <ul style="list-style-type: none"> <li>• sodium chloride is ionic;</li> <li>• sodium chloride has a giant structure / lattice;</li> <li>• sodium chloride is not volatile / has a high boiling point;</li> <li>• sodium chloride does not conduct (electricity) <u>when solid</u> / conducts <u>when molten</u> / conducts <u>when aqueous</u>;</li> </ul> up to four from: <ul style="list-style-type: none"> <li>• nitrogen is molecular;</li> <li>• nitrogen has covalent bonds;</li> <li>• nitrogen is volatile / has a low boiling point;</li> <li>• nitrogen does not conduct (electricity);</li> </ul>	<b>5</b>
4(b)(i)	speeds up (rate of) reaction;	<b>1</b>
4(b)(ii)	3(H <sub>2</sub> ); 2(NH <sub>3</sub> );	<b>2</b>
4(b)(iii)	3 bonding pairs of electrons (between N and H) <u>and</u> no extra electrons on H; 2 non-bonding electrons on N atom;	<b>2</b>
4(b)(iv)	copper oxide / CuO; oxygen removed (from copper oxide) / oxidation number of copper decreases / copper ions gain electrons;	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(i)	copper; has high heat conductivity <u>and</u> high melting point;	<b>2</b>
5(a)(ii)	cobalt <u>and</u> copper; high melting point / high strength / high density;	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(a)(iii)	magnesium; low density;	<b>2</b>
5(b)	copper → cobalt → tin → magnesium; one pair reversed = [1]	<b>2</b>
5(c)	any four from: <ul style="list-style-type: none"> <li>• add <u>excess</u> cobalt carbonate to sulfuric acid</li> <li>• filter (off excess cobalt carbonate)</li> <li>• evaporate filtrate to point of crystallisation / evaporate some of the water and allow to cool</li> <li>• filter (off crystals)</li> <li>• dry crystals with filter paper</li> </ul>	<b>4</b>
5(d)(i)	⇌;	<b>1</b>
5(d)(ii)	add water to anhydrous cobalt sulfate / add water to $\text{CoSO}_4$ ; colour changes (from blue) to red / pink;	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(a)	add universal indicator to the lemon juice / solution; match colour with colour chart;	<b>2</b>
6(b)(i)	ring around one or more COOH groups;	<b>1</b>
6(b)(ii)	ethanoic (acid) / any other correctly named carboxylic acid;	<b>1</b>
6(c)(i)	carbon dioxide; water;	<b>2</b>
6(c)(ii)	filtration;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
6(d)	endothermic <u>and</u> energy of products higher than energy of reactants;	<b>1</b>
6(e)(i)	2(C <sub>2</sub> H <sub>5</sub> OH) 2(CO <sub>2</sub> )	<b>2</b>
6(e)(ii)	any two from: <ul style="list-style-type: none"> <li>• yeast/zymase</li> <li>• temperature between 5 °C and 40 °C/room temperature</li> <li>• anaerobic/ no oxygen/ no air</li> <li>• pH ~7</li> </ul>	<b>2</b>
6(e)(iii)	180; one row correct = [1], e.g. 12 × 1 = 12 <b>or</b> 6 × 16 = 96	<b>2</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
7(a)	any three from: <ul style="list-style-type: none"> <li>• silvery/shiny/lustrous</li> <li>• conducts heat/ conducts electricity</li> <li>• malleable</li> <li>• ductile</li> <li>• sonorous</li> <li>• high melting point/ high boiling point</li> <li>• strong/ hard</li> <li>• high density</li> </ul>	<b>3</b>
7(b)	ReCl <sub>3</sub> ;	<b>1</b>
7(c)	change of state (directly) from solid to gas/ gas to solid;	<b>1</b>
7(d)(i)	pH 2;	<b>1</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
7(d)(ii)	water;	<b>1</b>
7(d)(iii)	potassium carbonate;	<b>1</b>
7(e)	glowing splint; relights / idea of bursting into flame;	<b>2</b>