

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0620 CHEMISTRY

0620/32

Paper 3 (Extended Theory), maximum raw mark 80

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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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Question	Answer	Marks
1	${}_{19}^{39}\text{K}$; 26p 26e 30n All three for 1 mark; ${}_{3}^{7}\text{Li}^{+}$ numbers and symbol; charge +; 31p 28e 39n All three for 2 marks, any two for 1 mark; ${}_{34}^{79}\text{Se}^{2-}$ numbers and symbol; charge 2^{-} ;	8

Question	Answer	Marks
2(a)	E; high melting point / mp / mpt OR high boiling point / bp / bpt; poor / non conductor (when liquid and / or solid);	3
2(b)	B; (good) conductor when <u>solid</u> (and liquid);	2
2(c)	A; melting point / $-7 (^{\circ}\text{C})$ is below room temperature / $25 (^{\circ}\text{C})$ / RTP ora; boiling point / $59 (^{\circ}\text{C})$ is above room temperature / $25 (^{\circ}\text{C})$ / RTP ora;	3
2(d)	C; high melting point / mp / mpt OR high boiling point / bp / bpt; BOTH poor / non conductor when solid and good conductor when liquid OR molten / only conduct when liquid;	3

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Question	Answer	Marks
3(a)	<p>M1 both correct charges of ions (calcium 2+ and nitrogen 3–);</p> <p>M2 8 electrons around nitrogen (can be 3 dots and 5 crosses or 5 crosses and 3 dots or all dots or all crosses, but reject any other combinations of dots and crosses);</p> <p>M3 Two electrons on the inner shell on any nitride ions/nitrogen atom: allow 2x or 2o once;</p>	3
3(b)(i)	<p>regular / repeated / pattern / framework / periodic / ordered / alternating / organised;</p> <p>(of) particles / atoms / molecules / ions / cations / anions;</p>	2
3(b)(ii)	<p>M1 (so that ionic) charges balance or cancel / charge = 0 / no charge / number of positive = number of negative charges / charge is neutral or neutralised;</p> <p>M2 $3(-) \times 2 = 2(+) \times 3$;</p>	2
3(c)	<p>it (refers to Ca) / Calcium / Ca (atom) loses / gives / donates electrons / e / e⁻ ;</p> <p>(these are) gained by nitrogen / N / N₂ ;</p> <p>nitrogen / N / N₂ is reduced so calcium / Ca is the reducing agent (these two statements could be split i.e. not in same sentence) OR reducing agents are electron donors / give / lose electrons OR calcium / Ca is oxidised (by electron loss) therefore calcium is the reducing agent (these two statements could be split i.e. not in same sentence);</p>	3

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Question	Answer	Marks
4(a)	large surface area / large area of contact / large surface; more (successful) collisions (between catalyst and gases or between reacting gases) OR more active sites OR faster reaction / increase rate / increase speed;	2
4(b)	decrease temperature / temperature below 450 °C / quoted temperature below 450 °C; increase pressure / pressure above 200 atm / quoted pressure above 200 atm;	2
4(c)	decreased <u>temperature</u> would reduce rate / reaction slower / too slow; increased <u>pressure</u> expensive / uneconomic / safety risks / leaks / explosions / yield or rate good enough at lower pressure / strong pipes needed / thick pipes needed / sturdy pipes needed / requires a lot of energy;	2

Question	Answer	Marks
5(a)	method A; hydrochloric acid / HCl / hydrogen chloride solution; nickel carbonate + hydrochloric acid → nickel chloride + water + carbon dioxide;	3
5(b)	method C; any (aqueous / dilute / solution of soluble) bromide including potassium bromide / KBr, hydrogen bromide / HBr i.e. all bromides except silver, lead and mercury; $\text{Pb}^{2+} + 2\text{Br}^{-} \rightarrow \text{PbBr}_2$;	3
5(c)	method B; sulfuric acid / hydrogen sulfate / H ₂ SO ₄ ; $2\text{LiOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Li}_2\text{SO}_4 + 2\text{H}_2\text{O}$ species; balancing;	4

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Question	Answer	Marks
6(a)(i)	(Haber process makes) ammonia / NH ₃ ; (ammonia converted into) fertilisers / nitrates / ammonium salts or names or formulae of examples e.g. ammonium nitrate / NH ₄ NO ₃ / ammonium sulfate / (NH ₄) ₂ SO ₄ / calcium nitrate / Ca(NO ₃) ₂ / urea / CO(NH ₂) ₂ ;	2
6(a)(ii)	it (refers to sodium nitrate) / sodium nitrate would dissolve (in rain) / soluble (in water) / wash away / leach / drain off;	1
6(a)(iii)	potassium (is required by plants as well as nitrogen) / NPK;	1
6(b)(i)	2NaNO ₃ → 2NaNO ₂ + O ₂ species; balancing;	2
6(b)(ii)	(colour changes) from pink / purple; to colourless / decolourised;	2
6(b)(iii)	the more reactive the metal the lower rate of decomposition / more difficult the decomposition / more stable the nitrate / more energy needed to decompose / decomposes at higher temperature or;	1
6(c)(i)	(changes from) blue solid / blue crystals; black solid formed; brown gas / brown vapour / (pungent) smell;	3

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Question	Answer	Marks
6(c)(ii)	<p>Avogadro('s) number / constant / 6.02×10^{23}; COND particles;</p> <p>OR (the number of particles which is equal to the number of atoms in) 12 g of carbon 12; COND atoms;</p> <p>OR the mass in grams which contains Avogadro('s) Number; COND particles;</p> <p>OR (the amount of substance which has a mass equal to) its <u>relative</u> formula mass / RFM / <u>relative</u> atomic mass / Ar / <u>relative</u> molecular mass / Mr / molar mass; COND in grams;</p> <p>OR (the amount of substance which has a volume equal to) 24 dm^3; COND of a gas at RTP;</p>	2
6(c)(iii)	<p>M1 (number of moles of CuO formed =) 0.03;</p> <p>M2 (number of moles of $\text{Cu}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$ in 7.26 g =) 0.03;</p> <p>M3 (mass of 1 mole of $\text{Cu}(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$ $7.26 \div 0.03 =$) 242 (g); (mass of 1 mole of $\text{Cu}(\text{NO}_3)_2$ is 188 g)</p> <p>M4 the value of x = 3;</p>	4

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Question	Answer	Marks
7(a)(i)	living/organism or named example e.g. yeast / cells / plants / animals / part of animal or plant e.g. muscle / humans / micro-organisms; produces / releases or gain or obtain energy / exothermic / heat; from food / named foodstuff / carbohydrate / named carbohydrate / sugar / named sugar / glucose / nutrients;	3
7(a)(ii)	Any 2 from 3: carbon dioxide / CO ₂ ; water / H ₂ O; adenosine triphosphate / ATP;	1
7(a)(iii)	biological catalyst or protein catalyst;	1
7(a)(iv)	answer must include both measuring the time and measuring a relevant quantity; OR alternatively measuring the time taken for something to happen; alternatives to time are: units of time / apparatus to measure time / regular intervals / how long examples of relevant quantities are: (Increase in / decrease in) amount / mass / volume / bubbles of carbon dioxide / bubbles of gas OR (Increase in / decrease in) mass of apparatus;	1
7(b)(i)	temperature increase / heat increase / warmer / high temperature / exothermic / more yeast / yeast reproduces / yeast increases / yeast multiplies;	1
7(b)(ii)	more yeast / yeast reproduces / increases / multiplies;	1
7(b)(iii)	<u>all</u> glucose or reactant(s) reacted OR no glucose or reactant(s) left OR glucose or reactant(s) used up / finished / runs out / reacted completely / fully reacted; yeast (cells) dies OR enzymes denatured OR ethanol is toxic to yeast / ethanol kills yeast;	2

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Question	Answer	Marks
7(c)	<p>Any two from: fuel; OR petrol additive; OR solvent / tinctures; OR (making) perfumes; OR varnishes; OR preserving biological specimens / preserving food; OR essence / flavourings; OR antiseptic / kill bacteria (in medicine) / sterilizer; OR antitussive agent; OR (in) disinfectant / hand sanitizer; OR to make esters / esterification; OR to make ether(s); OR to make amines; OR to make carboxylic acid(s) / vinegar / ethanoic acid; OR thermometers; OR alcohol lamp / spirit burners; OR any other suitable use;</p>	2
7(d)	<p>cracking / crack; (hexane to obtain) ethene / C₂H₄ ; C₆H₁₄ → C₂H₄ + C₄H₁₀ ; hydration (of ethene) / hydrate / hydrated or add(ition of) water / add(ition of) steam / addition; C₂H₄ + H₂O → C₂H₅OH ;</p>	5