## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

**International General Certificate of Secondary Education** 

## MARK SCHEME for the May/June 2012 question paper for the guidance of teachers

## 0620 CHEMISTRY

0620/33

Paper 3 (Extended 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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

• Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2012 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

	Page 2		Mark Scheme: Teachers' version	Syllabus	Paper		
			IGCSE – May/June 2012	0620	33		
1	(a)	neon doe fluorine a	neon has full outer shell / energy level / valency shell / octet / 8 (electrons) in outer shell / neon does not need to lose or gain electrons; [1] fluorine atoms have 7 electrons / needs 1 to fill / has incomplete shell / forms bonds with other fluorine atoms / fluorine (atoms) form covalent bonds / shares electrons; [1]				
	(b)	atomic n	umber / proton number / number of protons (in one	atom);	[1]		
	(c)	molecule strong bo	termolecular (or between molecules) forces / Ves / low amount of energy required to break bonds bonds don't break / covalent bonds don't break / (un atoms don't break;	etween molecule	<u>s</u> ; [1]		
	(d)		nding pair on each nitrogen atom; ns between nitrogen atoms;		[1] [1]		
2	(a)	between rings;	ces between layers or between (hexagonal) rings (hexagonal) rings / Van der Waals forces betweengs) slip/slide (over each other) / move over each other)	n layers or betwe			
	(b)	all bonds four othe	onds (between atoms) / covalent bonds (between at are covalent/strong / each atom covalently bonders / bonds are directional / (atoms are arranged) tet carbon has four bonds	ed / carbon (atom	[1] ns) is bonded to [1]		
	(c)	diamond	has delocalised / mobile / free electrons; (outer shell) electrons used / fixed / localised in bo e electrons / no free electrons;	nding / no deloca	[1] ilised electrons / [1]		
3	(a)	non-biod	easily form different shapes / easily moulded / bendegradable / unreactive / don't corrode / prevent conng metal) / water resistant / waterproof;	•			
	(b)	prevent	appearance / decorative / makes appearance shiny corrosion / rusting / protect steel / chromium wil / chromium protected by an oxide layer;		[1] chromium is not [1]		
	(c)	strength	sity / light / protected by oxide layer / no need to / strong;; <b>any two</b> yh strength to weight ratio = 2	paint / resists co	orrosion / (high) [2]		
	(d)	malleable	t / withstands high temperature / good conducto e / ductile / resists corrosion / good appearance / o e.g. does not react with food or water or acid or air	unreactive (or ex			

	Page 3		Mark Scheme: Teachers' version	Syllabus	Paper
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	or r	novin	positive ions / cations / metal ions and sea of electrong electrons;  no between positive ions and electrons;	ns / delocalised o	r free or mobile [1] [1]
4	(a) (i)	oxyg carb	gen; oon dioxide / fluorine / carbon monoxide;		[1] [1]
	(ii)	800/ impr	rease mpt (of alumina/ $Al_2O_3$ ) / lower (operating) tem /1000 (°C) / reduce energy (accept heat or electrical) rove conductivity / dissolves the $Al_2O_3$ / acts as so e conduct / to conduct electricity / making ions free t	requirement; olvent; ( <b>allow:</b> ma	[1]
	(iii)		$ m O_3$ (accept alumina) reacts / dissolves / forms a salt a $ m O_3$ removed by) filtration / centrifugation / decantation		ralised; [1]
	(b) (i)	chlo inco men hydr or in men one solu	trolysis / electrolyte / electrodes / anode / cathode / erine formed at anode (positive electrode); (note: carrect equation with $Cl_2$ as the only substance on ationed.) rogen formed at cathode (negative electrode); (note incorrect equation with $H_2$ as the only substance or ationed.) correct half equation either $2Cl^- \rightarrow Cl_2 + 2e$ or $2H^+$ tion remaining contains $Na^+$ and $OH^-$ / sodium and roxide left behind/remains in solution;	the right as lond the right as lond the right as lond the right as long $+2e \rightarrow H_2$	g as anode is [1] from a correct as cathode is [1] [1]
		eleccchlo inco men sodi with one (acc NaC whe note sodi	e: if a mercury cathode is specified trolysis / electrolyte / electrodes / anode / cathode / erine formed at anode (positive electrode); (note: carrect equation with $Cl_2$ as the only substance on ationed.)  um formed at cathode; (note: can be awarded from Na as the only substance on the right as long as carrect half equation at anode i.e. $2Cl^- \rightarrow Cl_2 + cept$ : equivalent with NaHg amalgam)  OH/sodium hydroxide is formed by sodium/sodium madded to water;  e: award the fourth and fifth mark if correct equatum or sodium mercury amalgam reacting with water (Hg) + $2H_2O \rightarrow 2NaOH + H_2 + (2Hg)$	an be awarded from the right as loned in a correct or incept thode is mentioned are carry amalgam in the given for reaction given g	g as anode is [1] orrect equation d.) $Na^+ + e \rightarrow Na$ [1] reacting with or
	(ii)	ener Cl <sub>2</sub> / purif mak	H / hydrogen <b>and</b> making ammonia / making margy source / cryogenics / welding; 'Cl / chlorine <b>and</b> (making) bleach / water treatmentication / swimming pools / making solvents / making disinfectants / making hydrochloric acid / HCl / cticides;	nt / kill bacteria (ir ing PVC / makin	[1] water) / water g weed killer /

	Page 4			Mark Scheme: Teachers' version	Syllabus	Paper
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5	(a)	(i)		ect -O- linkage; ect unit and continuation -O-□- (minimum);		[1] [1]
	(	(ii)	any i	name or correct formula of a (strong) acid / H <sup>+</sup> ;		[1]
	<b>(</b> i	iii)	conta	ain carbon hydrogen and oxygen /C, H and O;		[1]
	(b)	(i)	gluco	ose → ethanol + carbon dioxide		[1]
		(ii)	•	st is catalyst / provides enzymes / speeds up reactions to cells grow / multiply / reproduce / undergo budding		out yeast;  [1] [1]
	(1	iii)	enzy not: redu	or high temperature would kill yeast (cells) / heavmes; enzyme killed / denatures yeast ces rate of reaction / slows reaction / (yeast or ellyst / stops reaction / no more product;		[1]
	(c)	(i)	prev	ld produce carbon dioxide or carboxylic or organic ent aerobic respiration / so products are not oxidis oxygen;	, , ,	. ,
		(ii)	cracl (met redu dispo	il fuels have a reduced need / conserved / no no king hydrocarbons to make methane no longer requirements) is renewable / carbon neutral; ce pollution of water or sea / prevents visual polosal or accumulation (accept: any methods of water is any two	uired; lution / prevents	need for waste
6	(a)	(i)	A C	D B		[1]
		(ii)	incre rate B is or B is prop D slo A is	ed (or rate) increases as <u>concentration</u> increases / eases; or speed or time depends on (concentration) of H <sup>+</sup> of slow because propanoic acid is weak or doesn't discussion because HCl and H <sub>2</sub> SO <sub>4</sub> are stronger or anoic; ower than C because C is more concentrated than I fast because H <sup>+</sup> concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : this work that the concentration high ( <b>note</b> : t	or hydrogen ions; sociate or weakly ionise or dissoc D / ORA;	[1] [1] v ionises; ciate more than [1] [1] cond mark if not
				ady awarded) / H₂SO₄ is diprotic or dibasic or 2H <sup>+</sup> ; is inversely proportional to rate / owtte / ORA;		[1] [1] max [5]

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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particles more (su change 2 increase pieces / more col or catalyst;	temperature / heat (the mixture); /molecules/ions have more energy or move faster; uccessful) collisions / more particles with Ea; 2: surface area / decrease particle size / use powd crush the magnesium; llisions / more particles exposed to reaction; uccessful) collisions;	ered (magnesiun	[1] [1] [1] n) / use smaller [1] [1] [1] [1] [1] max [5]
<b>7 (a) (i)</b> CH <sub>2</sub>	/H₂C		[1]
	be ratio of C:H (atoms) / all cancel to $\text{CH}_2$ / because of atoms or elements (in the compound) / C:H ratio		is C <sub>n</sub> H <sub>2n</sub> / same [1]
	panoic / propionic (acid); noic / acetic (acid);		[1] [1]
(ii) form	nula of ethene / but-2-ene / any symmetrical alkene;		[1]
(c) (i) CH <sub>3</sub>	CH(Br)CH <sub>2</sub> Br		[1]
(ii) CH <sub>3</sub>	CH(OH)CH <sub>3</sub> / CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH / C <sub>3</sub> H <sub>7</sub> OH		[1]
(d)	CH <sub>2</sub> —CH <del>-]</del> n		
-	init; more than one repeat unit tion bonds at <b>both</b> ends;		[1] [1]
if C <sub>10</sub> H <sub>20</sub>	s given award 3 marks;;; is given award 2 marks;; 5 / 2:15:10 is given award 2 marks;;		[3]

in all other cases a mark can be awarded for moles of  $O_2$  (= 2.4/32 =) 0.075 **AND** moles

[1]

of CO<sub>2</sub> (= 2.2/44 =) 0.05;

 $2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$ 

accept: multiples including fractions

allow: ecf for correct equation from any incorrect alkene

Page 6		Mark Scheme: Teachers' version	Syllabus	Paper	
		IGCSE – May/June 2012	0620	33	
(a)	) proton de	onor;		[1	
(b)	add Univ	ncentrations of both (solutions); rersal indicator / determine pH / pH paper; ne has lower pH / ORA;		[1 [1 [1	
	equal co measure	ncentration of both (solutions); conductivity of aqueous ethylamine and sodium hy ne will have low <u>er</u> conductivity / sodium hydroxide v		[1 ] onductivity; [1	
(c)	) add stroi warm / h	ng(er) base / NaOH / KOH; eat;		[1 [1	
(d)	) (ethylam hydroxid or	ine forms) hydroxide <u>ions</u> / OH <sup>-</sup> (in water); e <u>ions</u> / OH <sup>-</sup> reacts with iron(III) <u>ions</u> / Fe <sup>3+</sup> ;		[1	
	iron(III) h	hydroxide / $Fe(OH)_3$ (forms as a brown precipitate); alanced or unbalanced ionic equation i.e. $Fe^{3+}$ +		[1 H) <sub>3</sub> scores both	