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Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0620 CHEMISTRY

0620/21 Paper 2 (Core 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	Guidance
1(a)(i)	D / graphite / carbon;	1	
1(a)(ii)	C / ethane;	1	
1(a)(iii)	B / $CaCO_3$ / calcium carbonate;	1	**A** D / carbon
1(a)(iv)	D / graphite / carbon;	1	
1(a)(v)	A / CO_2 / carbon dioxide;	1	
1(a)(vi)	B / calcium / calcium carbonate / Ca^{2+};	1	
1(b)	calcium carbonate; carbon dioxide;	2	**I** $CaCO_3$ **I** CO_2
1(c)	limewater / calcium hydroxide / $Ca(OH)_2$; **COND** turns milky / turns cloudy / gives a white precipitate;	2	

Question	Answer	Marks	Guidance
2(a)	temperature rises;	1	**A** gives off heat **I** bubbles given off
2(b)	structure of ethanol completed correctly;	1	**A** OH in place of O–H
2(c)(i)	ethene + water → ethanol;	1	**A** ethene + steam → ethanol **A** correct symbol equation **I** steam over the arrow
2(c)(ii)	2nd and 4th boxes ticked (one mark each);	2	
2(c)(iii)	(aqueous bromine) decolourised / goes colourless;	1	**I** aqueous bromine goes clear / discoloured **I** incorrect colour of bromine **A** colourless solution

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Question	Answer	Marks	Guidance
2(d)	filter (off the solids); distillation; *one of:* • (distil) filtrate; • fractional (distillation) / fractionating (column);	3	**A** boil and condense **I** heat / boil unqualified

Question	Answer	Marks	Guidance
3(a)(i)	breakdown / decomposition of compound using electricity;	1	**A** separation of compounds to elements using electricity **A** substances in place of compounds **A** breakdown of ionic bonds using electricity **I** separation of elements by electricity / plating using electricity / separation of compounds to elements unqualified / separating metals by electricity
3(a)(ii)	U;	1	
3(b)	sodium / Na; bromine / Br_2;	2	**R** sodium ions **R** bromide / bromine water / Br
3(c)	pH 7;	1	
3(d)(i)	ions / cations **and** anions;	1	**A** ionic / ionic bond **I** cations on own / anions on own
3(d)(ii)	solid (particles / ions) close together; (particles / ions) regularly arranged / in rows / lattice;	2	**A** atoms or molecules for ions **A** packed together / no spaces / attached to each other / held together **I** comments about movement **A** fixed shape / fixed positions **I** neat structure / reference to electrostatic forces

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Question	Answer	Marks	Guidance
3(e)	Br_2; 2(Na);	**2**	
3(f)	atoms with same number of protons but different number of neutrons / atoms with same atomic number but different number of neutrons / atoms with same number of protons but different mass number;	**1**	**A** nucleon number for mass number **A** elements with same number of protons but different number of neutrons / atoms of same elements with different numbers of neutrons **I** atoms / elements with different (relative) atomic masses **I** same elements with different numbers of neutrons **I** reference to molecules **I** different neutrons (no number)

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Question	Answer	Marks	Guidance
4(a)	(gas) syringe or measuring cylinder correctly labelled; (gas) tube leading from closed apparatus to flask or from inverted measuring cylinder with mouth underwater to flask; **COND** workable apparatus and apparatus airtight / no gaps in apparatus;	**3**	**A** burette / graduated test-tube drawn and labelled test-tube **R** if tube goes to surface of water or under water in reaction flask
4(b)(i)	44–48 (seconds);	**1**	
4(b)(ii)	41 (cm^3);	**1**	
4(b)(iii)	initial gradient less than the original line AND starting at 0–0; ends up at same final volume;	**2**	**A** straight line instead of curved line **A** line not reached final volume but still going up and likely to reach final volume **A** final horizontal line two small squares below the 25 ºC line **R** if a single straight line is drawn from 0–0 to point 49–140
4(b)(iv)	increased (rate) / faster (rate) / quicker;	**1**	**I** reference to time unless it contradicts increased rate
4(c)(i)	pair of electrons between two (hydrogen) atoms;	**1**	hydrogen atoms do not have to be labelled H
4(c)(ii)	covalent;	**1**	**I** single bond
4(d)	sulfuric acid; magnesium oxide / magnesium hydroxide / magnesium carbonate;	**2**	**A** correct formulae **R** magnesium

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Question	Answer	Marks	Guidance
5(a)	COOH group circled;	1	
5(b)(i)	30;	1	
5(b)(ii)	speeds up reaction / increases rate (of reaction);	1	**A** lowers the activation energy / allows the reaction to occur by more favourable mechanism
5(b)(iii)	poisonous / toxic / death;	1	**A** harmful / makes breathing difficult / respiratory problems **A** combines with haemoglobin / reduces the amount of oxygen in the blood / stops you breathing / asphyxiation / suffocates you **I** lung cancer / lung damage
5(c)(i)	gain of electrons / loss of oxygen / decrease in oxidation number;	1	**A** gain of hydrogen
5(c)(ii)	carbon;	1	**A** C
5(d)	grind grape skins / blend skins / crush skins; (grape skins) in water / in solvent / in named solvent; filter (off the solid / grape skins);	3	**A** crush grapes **I** grapes squeezed NOTE: mark for the idea that the grape skins are in solvent but NOT solvent in context of chromatography. **I** grapes in acids / alkalis
5(e)	ethene;	1	**A** alkene
5(f)(i)	high temperature; catalyst / aluminium oxide / zeolites;	2	**A** heat / stated temperatures between 200–1000 °C **A** absence of oxygen (for 2nd mark) **I** high pressure / enzymes (unqualified) / oxygen
5(f)(ii)	4 (C_2H_4);	1	

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Question	Answer	Marks	Guidance
6(a)(i)	B and D; they have low(er) density / they are soft;	2	**A** they have densities of 0.97 and 0.86 / light(weight) **I** comments about conductivity and boiling point
6(a)(ii)	*Any two of:* • high densities; • high melting points / high boiling points; • catalysts; • (compounds have) variable valency / variable oxidation numbers / form ions with different charges; • form coloured compounds; • form complex ions;	2	**A** heavy for high density **A** they are coloured for coloured compounds **A** hard BUT not hardness / medium hard
6(a)(iii)	3 (Co); 4 (H_2);	2	
6(a)(iv)	*Any 3 of:* • oxygen blown through molten iron / oxygen added to molten iron; • (oxygen) reacts with impurities / carbon / silicon / phosphorus; • oxides formed; • calcium oxide added / lime added / limestone / calcium carbonate added; • (calcium oxide) reacts with acidic oxides / silicon dioxide / oxides of phosphorus; • idea of slag being formed; • statement about removal of impurities e.g. CO_2 formed escapes as gas / slag removed from surface of molten iron; • other metals added;	3	**I** (oxygen) oxidises iron / bonds to iron **A** suitable named oxides including CO / CO_2 **R** iron bonds with other metals

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6(b)	(lithium) hydroxide / (potassium) hydroxide; hydrogen / H_2; *3 marks from any 3 differences in observations* e.g. • more bubbles with K ORA; • it / K moves faster (on water surface) ORA; • Li does not catch fire / K catches fire / K bursts into flame; • it / K fizzes more than Li ORA; • it / K disappears rapidly; • K explodes / lithium does not explode; • K melts / ball with K / lithium does not melt / does not go into ball;	**5**	**A** correct formulae **I** smoke **A** K spits / K pops
7(a)	• liquids / water have particles close together / touching; • gases / helium have particles far apart / room between gas particles / more space between gas particles; • volume of liquid does not decrease / liquid not compressed / liquid not squeezed / plunger does not move; • volume of gas decreases / gas compressed / plunger moves;	**4**	**A** no spaces between particles **A** syringe is not reduced **A** syringe is reduced **I** there is room / not room (reference to space between particles)
7(b)(i)	increases / gets larger;	**1**	**A** becomes heavier
7(b)(ii)	2,8;	**1**	**A** 2 in the first shell and 8 in the second
7(b)(iii)	liquid;	**1**	
7(b)(iv)	krypton;	**1**	
7(c)	He: number of neutrons = 1; Ar: number of electrons = 18; symbol for neon is $^{21}_{10}Ne$;	**3**	

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