

CAMBRIDGE INTERNATIONAL EXAMINATIONS

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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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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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)	2 nd and 4 th 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; <i>one of:</i> <ul style="list-style-type: none"> • (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°C 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 2 nd mark) I high pressure / enzymes (unqualified) / oxygen
5(f)(ii)	4 (C ₂ H 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)	<i>Any two of:</i> <ul style="list-style-type: none"> • 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)	<i>Any 3 of:</i> <ul style="list-style-type: none"> • 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. CO₂ 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 ; <i>3 marks from any 3 differences in observations e.g.</i> <ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 ${}_{10}^{21}\text{Ne}$;	3	