Mark Scheme (Results)

Summer 2017

Pearson Edexcel International GCSE
in Chemistry (4CH0) Paper 2CR

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a) (i)	**C** (proton) **The only correct answer is C** A is not correct because X is not an electron B is not correct because X is not an ion D is not correct because X is not a neutron		1
(ii)	**C** (9) **The only correct answer is C** A is not correct because the sum of the number of protons and neutrons is 9 not 4 B is not correct because the sum of the number of protons and neutrons is 9 not 5 D is not correct because the sum of the number of protons and neutrons is 9 not 5		1
(iii)	beryllium	**ACCEPT** Be	1

(b)	**M1** (same) number of protons **M2** (different) number of neutrons	**ACCEPT** same number of electrons **IGNORE** same atomic number **IGNORE** relative atomic mass **IGNORE** different mass number	2
		Total	**5**

Question number	Answer	Notes	Marks
2 (a)	**M1** bubbles (of gas) / effervescence **M2** magnesium disappears / magnesium gets smaller	**ACCEPT** fizzing **ACCEPT** magnesium dissolves **ALLOW** solid for magnesium **IGNORE** reference to movement **IGNORE** reference to temperature change	2
(b)	increases	**ACCEPT** gets hotter	1
(c)	magnesium + (dilute) sulfuric acid → magnesium sulfate + hydrogen	**ALLOW** chemical equation If both word and chemical equation given mark word equation only	1
		Total	**4**

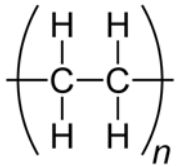
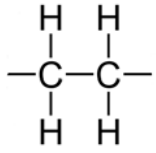
Question number	Answer	Notes	Marks
3 (a)	**M1** (A) hydrochloric acid / HCl (aq)	If both name and formula given, both must be correct. State symbol not needed, but penalise if incorrect	2
	M2 (B) calcium carbonate / marble / limestone / chalk / $CaCO_3$	If both name and formula given, both must be correct	
(b)	(gas) syringe / **downward** delivery (in air)	**ACCEPT upward** displacement of air	1
(c) (i)	orange / yellow	**ACCEPT** yellow-orange **IGNORE** shades or qualifiers, e.g. light	1
(ii)	**M1** (name) carbonic acid		2
	M2 (formula) H_2CO_3	**ALLOW** as the only **product** of an equation	
	Total		**6**

Question number	Answer	Notes	Marks
4 (a)	hydrogen **AND** carbon	**ACCEPT** in either order **ACCEPT** C and H if both names and symbols given, mark name only	1
(b) (i)	(a mixture of) compounds/hydrocarbons/substances with similar boiling points	**REJECT** elements **REJECT** same boiling points **ALLOW** references to condense at similar temperatures **ALLOW** references to similar carbon chain length **IGNORE** references to other physical properties e.g. viscosity **IGNORE** references to similar chemical properties	

Question	Answer	Notes	Marks
(b) (ii)	**M1** vaporise/heat the crude oil **M2** pass vapour/gas into a (fractionating) column/tower **M3** vapours/gases/fractions/hydrocarbons/ substances condense at different heights/ levels/points	**ALLOW** boil **IGNORE** distil **IGNORE** references to temperature **ALLOW** collected for condense **ALLOW** lower boiling point/more volatile substances condense/collected higher up **AND** higher boiling point/less volatile substances condense/collected lower down **ALLOW** shorter chain substances condense/collected higher up **AND** longer chain substances condense/collected lower down **IGNORE** reference to melting points If reference to cracking only **M1** can be scored	3

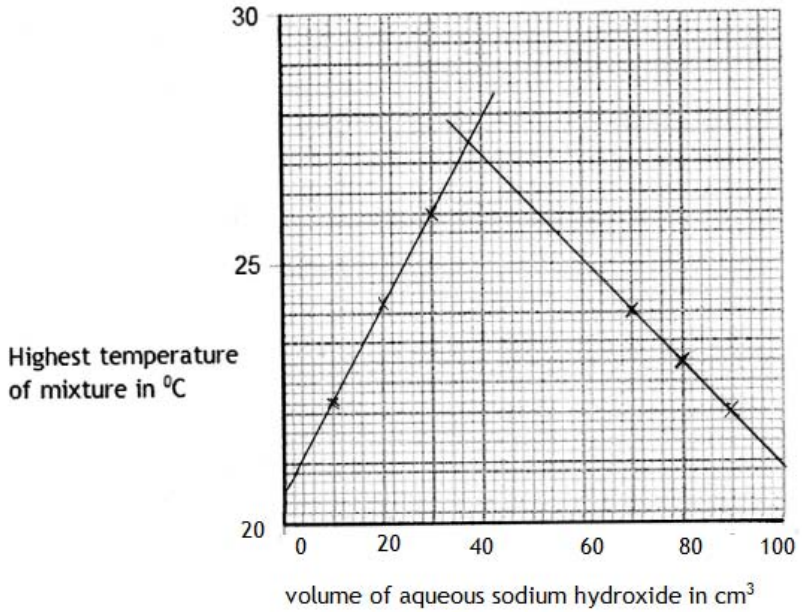
Question	Answer	Notes	marks
4 (c) (i)	bitumen		1
(ii)	gasoline		1
(d) (i)	carbon monoxide	**ACCEPT** CO If both name and formula given, mark name only	1
(ii)	(it is) poisonous / (it is) toxic / (it) reduces the capacity of the blood to carry oxygen	**ACCEPT** correct references to haemoglobin / carboxyhaemoglobin **IGNORE** references to suffocation	1
		Total	**9**

Question number	Answer	Notes	Marks
5 (a) (i)	46.6 (g)	Ignore trailing zeros e.g. accept 46.60	1
(ii)	as temperature increases, solubility decreases	**ACCEPT** reverse argument **IGNORE** any reference to inverse proportionality **REJECT** reference to (direct) proportionality **ALLOW** references to negative correlation	1
(b)	**M1** use a fume cupboard **M2** (because) ammonia is toxic/poisonous	**ALLOW** carry out in a well-ventilated area **IGNORE** reference to lab coats/goggles/(gas) masks/gloves **IGNORE** do not inhale fumes **IGNORE** dangerous/harmful/irritant	2
(c)	water evaporates (more quickly) / ammonia escapes (as it is less soluble in hot water)	**ALLOW** (ammonia) solution evaporates **IGNORE** ammonia evaporates	1
(d)	measure the pH (of the solution using universal indicator or pH meter) **OR** titrate with acid		1
		Total	**6**

Question number	Answer	Notes	Marks
6 (a)	**M1** (method 1) zymase **M2** (method 2) phosphoric acid / H_3PO_4	**ACCEPT** yeast If both name and formula given, mark name only	2
(b)	**M1** company A chooses method 1/fermentation **AND** company B chooses method 2/ethene with steam/hydration **M2** company A has (access to) a supply of sugar (cane)/glucose **M3** company B can obtain ethene from crude oil/an oil refinery **M4** company A does not need pure ethanol / company B does need pure ethanol	 **IGNORE** company A only needs a dilute solution of ethanol **IGNORE** references to batch/continuous processes	4
(c) (i)		**M1** one correct repeat unit drawn with continuation bonds e.g.  or $-CH_2-CH_2-$ **M2** rest of diagram correct ie brackets <u>and</u> balanced using n	2

(ii)	$C_{12}H_{26}$	**ALLOW** n in any position after bracket but not before **M2** DEP **M1**	
(iii)	crude oil is a finite/limited resource OR ethanol can be made from sugar (cane)/glucose which is a renewable resource	**ALLOW** crude oil is non-renewable **IGNORE** reference to high/increasing demand for ethene	
		Total	**10**

Question number	Answer	Notes	Marks
7 (a)	**M1** polystyrene is a better insulator **M2** so less heat (energy)/thermal energy is transferred/lost to the surroundings/atmosphere/air	**ALLOW** polystyrene is an insulator **REJECT** no heat loss to the surroundings	2
(b)	**M1** (before) 18.6 (ºC) **M2** (after) 22.8 (ºC)	one mark for correct answers in the wrong order Ignore trailing zeros e.g. accept 18.60	2

Question	Answer	Notes	Marks
(c) (i)			4
	M1 and **M2** all points plotted correctly to the nearest gridline	deduct one mark for each incorrectly plotted point	
	M3 best fit straight line through first 3 points drawn with the aid of a ruler **M4** best fit straight line through last 3 points drawn with the aid of a ruler	**ALLOW M3** and **M4** even if lines do not intersect Penalise lack of use of a ruler once only	

Question	Answer	Notes	Marks
(c) (ii)	**M1** (sodium hydroxide) expected value 37-38 cm^3 **M2** (hydrochloric acid) (100 – **M1**) expected value 63-62 cm^3	mark CSQ on candidates graph read to nearest gridline	2
(iii)	sodium hydroxide (has the greater concentration because) **M1** sodium hydroxide and hydrochloric acid react in a 1:1 (molar) ratio **M2** the volume of sodium hydroxide required is less (than the volume of hydrochloric acid required)	**ALLOW** hydrochloric acid has the lower concentration because the volume of hydrochloric acid required is more (than the volume of sodium hydroxide)	2
		Total	**12**

Question number	Answer	Notes	Marks
8 (a) (i)	**M1** 0.02350 x 0.0200 **M2** 0.000470 / 4.70 x 10^{-4} (mol)	do not penalise missing trailing zeros 0.0005 scores 1/2 **ACCEPT** 0.47 for 1 mark Correct answer without working scores 2	2
(ii)	**M1** **M2** from (i) ÷ 0.0250 / (0.000470) ÷ 0.0250 **M2** 0.0188 (mol/dm^3) **OR** **M1** $\frac{\textbf{M2 from (i)} \times 1000}{25}$ **M2** 0.0188 (mol/dm^3) **OR** **M1** (23.5 ÷ 25.0) x 0.0200 **M2** 0.0188 (mol/dm^3)	do not penalise missing trailing zeros **ACCEPT** any number of sig fig except one Correct answer without working scores 2	2

8 (b)	**M1** heat/boil until crystals form in a sample of solution that has been removed and cooled	**ACCEPT** heat/boil to produce a (hot) saturated/concentrated solution **ACCEPT** heat/boil until crystals start/begin to form **ALLOW** (heat/boil to) evaporate some of the water **ALLOW** heat/boil to crystallisation point **IGNORE** references to filtering before heating	4
	M2 cool/leave (the solution) until crystals have formed	**M2** DEP on **M1**	
	M3 filter (to remove the crystals) **AND** wash with (a little deionised/distilled) water	**ACCEPT** decant/pour off the liquid/(excess solution) **M3** dep on crystals having been formed	
	M4 suitable method of drying the crystals	e.g. place in (warm) oven / leave to dry (in warm place) / use filter paper / use kitchen towel **REJECT** any reference to heating directly with a flame, e.g. with a Bunsen If **M1** not scored then award 1 mark out of 4 for leaving the solution until the water evaporates fully OR for evaporating solution to dryness	
		Total	**8**

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