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Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE in Chemistry (5CH3H) Paper 01 Unit C3: Chemistry in Action

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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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question number	Answer	Notes	Marks
1 (a) (i)	A		1

Question number	Answer	Notes	Marks
1 (a) (ii)	D		1

Question number	Answer	Notes	Marks
1 (b)	A description including: heat/ evaporate/ boil (the sample) (1) solid/ salt /(lime)scale/ residue/ calcium carbonate (1) M2 dependent on M1	Ignore any tests for ions ignore precipitate	2

Question number	Answer	Notes	Marks
1 (c)	An explanation linking: **ion-exchange** (resin/column) (1) {Ca^{2+}/ Mg^{2+} (ions)} are exchanged for {Na^{+}/ H^{+} (ions)} (1) OR add sodium carbonate/ bath salts (1) {Ca^{2+}/ Mg^{2+} (ions)} react with carbonate ions to form a precipitate / {$CaCO_3$ / $MgCO_3$} precipitates out (1) OR **distil** water/ **distillation** (1) pure water distils/ ions causing hardness remain behind (1)	If M1 scored, then allow atoms/ Ca/ Mg/ H instead of ions in M2 If M1 not scored, particles exchanged must be **ions** or show **charges** (ion formula need not be correct but must be a positive ion of Ca or Mg) (one of each pair needed) allow alternatives to exchange eg displace, replace, swap etc allow trade names eg Calgon For distillation: M2 depends on M1, except reject fractional distillation for M1, but mark on	2

Question number	Answer	Notes	Marks
1 (d)	An explanation linking: PROBLEM scum / (lime)scale / fur / lather is {harder to get/ less} (1) …… **with** relevant linked EXPLANATION waste of energy / appliance less efficient / blocked pipes / blocked boiler / damages appliance need to use more soap or shampoo / waste of soap (1)	 allow chemical names ignore cost unless linked to **these reasons** or need to use water softener ignore cost unless linked to more soap etc ignore taste ignore appearance of scale or requirement to clean	2

Question number	Answer	Notes	Marks
2 (a) (i)	**<u>white</u>** (1) precipitate/ solid (1) mark independently	If **additional** responses are given (eg fizzing, colour changes) then give max 1.	2

Question number	Answer	Notes	Marks
2 (a) (ii)	**D** $Ag^+ + Cl^- \rightarrow AgCl$		1

Question number	Answer	Notes	Marks
2 (a) (iii)	A description including: QUALITATIVE (identity of) what is present/ which ions present/ Cl^- present / what type of substance present (1) QUANTITATIVE how much is present / concentration / amount /gives a value (1)	ref. to blood not required ignore 'it's descriptive' 'no numbers' ignore 'has numbers' (note: just the word quantity is not enough)	2

Question number	Answer	Notes	Marks
2 (b)	A description including add (sodium) hydroxide (solution) / OH^- (ions) / ammonia (1) IF NO HYDROXIDE/AMMONIA, NO MARKS AWARDED (white) precipitate (1) Add more hydroxide/ excess: then dissolves / goes colourless (solution) / goes clear (1)	If **additional reagents** added, do not score M1 but mark on for M2 and M3 **reject** any description but white for the precipitate for M2 ignore heating	3

Question number	Answer	Notes	Marks
3 (a)	M_r NaOH = 23+16+1 (=**40**) (1) ratio **24/40** (1) 24/40 **x 4** (= 2.4 dm^3) (1) OR M_r NaOH = 23+16+1 (=**40**) (1) moles NaOH = **4/40** (=0.1) (1) 0.1 **x 24** (1) (= 2.4 dm^3) OR 23 + 16 + 1 (**=40**)g NaOH (1) gives 24 dm^3 ammonia (1) **24** x **4/40** (=2.4 dm^3) ammonia (1) OR Mass of ammonia = 1.7 (g) (1) Moles of ammonia = 1.7/17 = **0.1** (1) 0.1 **x 24** (1) (= 2.4 dm^3)	2.4 as <u>final answer</u> scores 3 [use answer line unless blank] ecf from incorrect M_r mol of NaOH = 0.1 will score 2 ecf from moles of ammonia units not required but penalise incorrect units for M3	3

Question number	Answer	Notes	Marks
3 (b) (i)	An explanation linking: forward reaction and backward reaction occur (at the same time) /reaction goes in both directions / reversible reaction (1) at same **rate** / {amounts/ concentrations} of each substance do not change (1) mark independently	 ignore reactants and products both present ignore general expressions such as 'reactions cancel out' 'no overall effect' allow 'speed' for 'rate' **rate** of forward reaction = rate of backward reaction will score 2	2

Question number	Answer	Notes	Marks
3 (b) (ii)	An explanation linking: if temperature were **higher**: lower equilibrium yield / equilibrium moves left / reverse reaction favoured / backward reaction favoured/ reactants favoured / ORA (1) because a higher temperature favours **endothermic** reaction / ORA (1)	 any comments on cost or safety to be ignored	2

Question number	Answer	Notes	Marks
3 (c)	hydroxide (ion) (1) OH^- (1)	ignore any formulae/ symbols on 'name' line. Reject answers with additional words eg 'calcium hydroxide' allow HO^- reject any other symbols reject OH, oH^-, Oh^-, oh^- must have **– sign** and as superscript	2

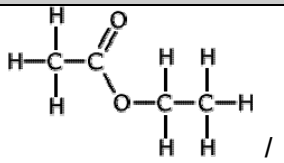
Question number	Answer	Notes	Marks
4 (a)	A sodium chloride crystals		1

Question number	Answer	Notes	Marks
4 (b) (i)	A description including POWER d.c. supply/ battery/ power pack / pass electricity through (1) ELECTRODES impure copper anode/positive electrode (1) pure copper cathode/negative electrode (1) ELECTROLYTE copper sulfate (solution) / Cu^{2+} (ions in solution) / any soluble copper compound (in solution) (1)	**Look at diagram as candidates may add labels which could score all 4 marks** allow unspecified copper salt **if in solution**	4

Question number	Answer	Notes	Marks
4 (b) (ii)	An explanation linking copper: removed from anode / pass into solution / (atoms in electrode) form copper ions (1) deposit/sludge is **impurities** (1)	 allow copper atoms oxidised allow **named** unreactive metals eg silver, gold	2

Question number	Answer	Notes	Marks
4 (c) (i)	An explanation including reduction (1) because (lead ions) gain electrons (1) mark independently	ignore redox for M1	2

Question number	Answer	Notes	Marks
4 (c) (ii)	$2Br^- \rightarrow Br_2 + 2e^-$ OR $2Br^- - 2e^- \rightarrow Br_2$ Br^- on left (charge required) (1) **fully correct** species including charges (but allow e for e^-) with balancing (2)	allow multiples	2

	Answer	Notes	Marks
5 (a) (i)	 / $CH_3COOCH_2CH_3$ / $CH_3COOC_2H_5$ / $C_4H_8O_2$	Any correct structure – must show all atoms but can be mixed displayed/structural accept CO_2 for COO allow **correct** reverses eg $C_2H_5OOCCH_3$ reject other 'isomers'eg $C_2H_5COOCH_3$; C_3H_8COO	1

Question number	Answer	Notes	Marks
5 (a) (ii)	effervescence/ fizzing/ bubbles / solid disappears	**allow** solid dissolves **ignore** gas/CO_2 given off **additional** incorrect responses negate this mark (list principle)	1

Question number	Answer	Notes	Marks
5 (b)	**A** 0.1		1

Question number	Answer	Mark
5 (c)*	A explanation to include some of the following points **Indicative content** **Basic titration** • pipette • burette • wash with appropriate solution • acid or alkali in flask • indicator • swirling • use white tile **End point** • correct starting colour of indicator • controlled addition until indicator changes colour (permanently) • add dropwise near endpoint • correct end colour of indicator • repeat titration until concordant results **Obtaining crystals** • mix volumes without indicator • warm until crystallisation starts • leave to crystallise • dry between absorbent paper/leave to dry	6
Level	No rewardable content	
1	• a limited description of the titration or the crystallisation • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	• a simple description of the titration or the crystallisation OR a limited description of both • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately; • spelling, punctuation and grammar are used with some accuracy	
3	• a detailed description of the titration and the crystallisation • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately; • spelling, punctuation and grammar are used with few errors	

Question number	Answer	Notes	Marks
5 (d)	moles CH_3COOH = 0.01 x 25/1000 (= **0.00025**) (1) moles NaOH = **0.00025**/ 1:1 ratio (1) volume NaOH = 0.00025 **x 1000/0.02** (= 12.5cm^3) (1) OR 1:1 ratio (1) 25 x 0.01 = vol x 0.02 (1) volume NaOH = 0.00025 x 1000/0.02 (= 12.5cm^3) (1)	12.5 *as final answer* scores 3 0.0125 or 12500 scores 2 0.00025 not linked to any substance scores 1; linked to NaOH scores 2 apply ecf [delete 1 mark per error] units not required, but penalise incorrect units	3

Question number	Answer	Notes	Marks
6 (a)	**B** C_4H_{10}		1

Question number	Answer	Notes	Marks
6 (b) (i)	An explanation including AMOUNT OF ETHANOL each drink contains different concentration of ethanol / the whisky contains more alcohol than the beer/ each drink would mean absorbing a different quantity of alcohol (1) AFFECT ON BODY RELEVANT TO DRIVER slower reactions / longer reaction time / lowers inhibitions / poorer vision / dizziness / depressant (1)	alcohol/ethanol can be used interchangeably allow alternatives to concentration eg strength, % alcohol, units of alcohol ignore 'slower reaction time' ignore vague answers eg ability to drive affected / affects brain/ references to drunk or intoxicated	2

Question number	Answer	Notes	Marks
6 (b) (ii)	carboxylic acid(s) [both words required]	**reject** carboxyl group **Ignore** any formulae	1

Question number	Answer	Notes	Marks
6 (c)	$C_3H_7OH \rightarrow C_3H_6 + H_2O$ Any **two** formulae on correct side in equation format = 1 Fully correct balanced equation (allow multiples) = 2	reject formulae with small letters or non-subscripts eg h_2O H2O, H^2O, H_2o, H2o allow = for $\rightarrow$	2

Question number	Answer	Mark
6 (d)*	A explanation to include some of the following points **Indicative content** Ethene • **A** • C and H only in molecule / hydrocarbon • bromine water orange to colourless / unsaturated / alkene • can be polymerised / unsaturated Ethanol • **B** • C, H and O in molecule / not hydrocarbon • oxidises in air / alcohol • no other reactions with metal or carbonate / not acid Ethanoic acid • **C** • C, H and O in molecule / not hydrocarbon • reacts with magnesium giving effervescence / acid • reacts with sodium carbonate giving effervescence/ acid Ethane • **D** • C and H only in molecule/ hydrocarbon • no reaction with bromine water / saturated / alkane Logical order • candidates may identify three and hence deduce fourth	6
Level	No rewardable content	
1	• a limited description identifying two substances and considering one piece of evidence • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	• a simple description identifying at least two substances and considering at least two pieces of evidence • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately; • spelling, punctuation and grammar are used with some accuracy	
3	• a detailed description identifying all four substances and considering at least three pieces of evidence • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately; • spelling, punctuation and grammar are used with few errors	

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