Chemical Equations: Gases

Mark Scheme

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Chemistry Lab Skills 1
Sub Topic	Chemical Equations: Gases
Booklet	Mark Scheme

Time Allowed: **26 minutes**

Score: **/21**

Percentage: **/100**

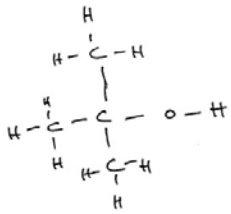
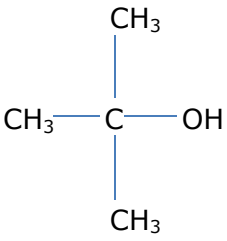
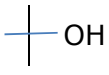
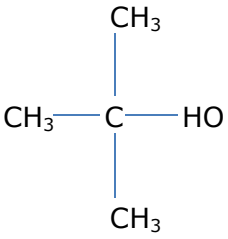
Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Question Number	Acceptable Answers	Reject	Mark
1(a)	**ST** Add PCl_5 / phosphorus(V) chloride / phosphorus pentachloride /$SOCl_2$ / thionyl chloride / sulphur dichloride oxide (1) **RESULT** Mark depends on correct reagent, but allow PCl_5 (aq) Steamy / misty / white fumes ALLOW Gas for fumes (1) Ignore incorrect identification of fumes **OR** **TEST** Add sodium / Na (1) **RESULT** Mark depends on correct reagent Effervescence / bubbling / fizzing Ignore incorrect identification of fumes and tests for products white solid (forms) / sodium dissolves mixture gets hot (1)	Acidified PCl_5 / PCl_5 (aq) Acidified dichromate(VI) PCl_3 Test to form an ester Any smoke Just "HCl fumes" Just "gas turns litmus red" Just "hydrogen"	2

Question Number	Acceptable Answers	Reject	Mark
1(b)	(primary / secondary / tertiary) Alcohol **and** carboxylic acid ALLOW ROH **and** RCOOH R_2CHOH/ R_3COH for ROH $C_nH_{2n+1}OH$ for ROH RCO_2H for RCOOH Phenol(s) (as one alternative) Fatty acid / alkanoic acid for carboxylic acid	diol carboxyl cyclic alcohol specific alcohol eg ethanol	1

Question Number	Acceptable Answers	Reject	Mark
1(c)	Z identified as tertiary alcohol (1) **Justification:** Any one from Test with litmus Not (carboxylic) acid because there is no change (in (blue) litmus paper) It's an alcohol because there is no change (in (red / blue) litmus paper) It is neutral /not an acid or an alkali because there is no change (in (red / blue) litmus paper) Test with dichromate It is a tertiary alcohol because it can't be oxidized (by acidified dichromate(VI))/ doesn't react with acidified dichromate(VI) It is not a primary or secondary alcohol because it can't be oxidized (by acidified dichromate(VI))/ doesn't react with acidified dichromate(VI) IGNORE Not an amine (1) If more than one justification is given, both must be correct		2

Question Number	Acceptable Answers	Reject	Mark
1(d)	MP1 (0.1 mol **Z** produces) 0.4 mol CO_2 OR 1 mol Z produces 4 mol CO_2 (1) MP2 (dependent on MP1 awarded) So **Z** has 4C atoms ALLOW Formula shown with 4C (1) MP3 (stand alone)  OR  ALLOW undisplayed CH_3 and OH as above Skeletal formula  (1)	Just 9.6/24 = 0.4 with no reference to what numbers refer to or if not applied  Only if bond clearly shown to the H of OH	3

Question Number	Acceptable Answers	Reject	Mark
1(e)(i)	Molecular ions have same *m/e* ALLOW same molecular ion isomers have same molar mass / molecular mass molecular ion with same mass same maximum *m/e* value same peak furthest to right same last peak Parent ion / M^+ for molecular ion IGNORE Reference to peak heights	Same fragments Same *m/e* value for highest peak Similar for "same"	1

Question Number	Acceptable Answers	Reject	Mark
1(e)(ii)	They both have an (absorption) peak for (wavenumber of) alcohol / hydroxyl group / O-H ALLOW both have peak for –OH / OH frequency / wavelength for wavenumber IGNORE wavenumber values have peak with specific shape for OH	Absorption for C-OH	1

Total for Question 1 = 10 marks

Question Number	Acceptable Answers	Reject	Mark
2(a)	(Bubble into) lime water / calcium hydroxide (solution) / $Ca(OH)_2$((aq)) **and** Goes cloudy / white precipitate forms / turns milky / turns chalky IGNORE extinguishes a lighted splint	 Goes muddy Turns misty	1

Question Number	Acceptable Answers	Reject	Mark
2(b)	Flask stoppered with connection to apparatus in which gas can be collected. ALLOW Either bung in neck or side arm sealed IGNORE Small gaps between bung and mouth of flask Heater under flask **(1)** Syringe OR inverted burette/ inverted measuring cylinder in trough of water ALLOW Tubes without graduation marks shown if labelled as burette, syringe or measuring cylinder **(1)**	Large gaps in connection to flask / unstoppered flask Delivery tube through wall of trough Burette or measuring cylinder without water (Test) tube without graduation marks	2

Question Number	Acceptable Answers	Reject	Mark
2(c)	(Mol gas = 41/24000 =) 1.7083×10^{-3} / 0.0017083 (mol) Ignore sf except 1sf Ignore lack of units	 Incorrect units	1

Question Number	Acceptable Answers	Reject	Mark
2(d)	Correct answer of **87.8** without working scores 2 Mol XCO_3 = 1.7083 x 10^{-3} **(1)** Mass of 1 mol = (0.15/1.7083 x 10^{-3}) = 87.8 (Use of 1.7 gives mass 88.2 use of 1.71 gives 87.7) Ignore sf except 1 sf **(1)** TE from 2c Ignore lack of units	Incorrect units but do not penalise if already penalised in (c).	2

Question Number	Acceptable Answers	Reject	Mark
2(e)	Relative atomic mass X = (87.8-(12+48)) = 27.8 X = Mg ALLOW Mg^{2+} No mark for identification of Mg **without** relative atomic mass or some working. ALLOW Calculation of atomic mass shown in (d) TE from 2d	Element with no justification. Identification as Sr because 2(d) gives 88	1

Question Number	Acceptable Answers	Reject	Mark
2(f)	(Some) carbon dioxide dissolved in the dilute hydrochloric acid / water ALLOW CO_2 reacts with water Ignore references to standard conditions and faulty apparatus	CO_2 reacts with hydrochloric acid. Impure carbonate Impure acid Incomplete reaction Side reactions	1

Question Number	Acceptable Answers	Reject	Mark
2(g)	No colour/ no change (to flame) ALLOW Colourless flame TE from incorrect Group 2 metal in 2(e): Ca (brick) red/ yellow-red Sr crimson/ (dark) red Ba green	White/ bright light Answers about Mg metal No flame More than one colour given	1

Question Number	Acceptable Answers	Reject	Mark
2(h)	Some sulfates are insoluble/ $BaSO_4$ is insoluble/ Sulfates become less soluble going down group ALLOW A precipitate of the **sulfate** would form IGNORE All group II sulfates are insoluble **(1)** Reaction with acid will be incomplete **(1)** Mark independently.	Carbonates become less soluble going down group Element is insoluble in sulfuric acid. Gases other than carbon dioxide form e.g SO_2. Just "**it** would form a precipitate"	2

Total for Question 2 = 11 marks