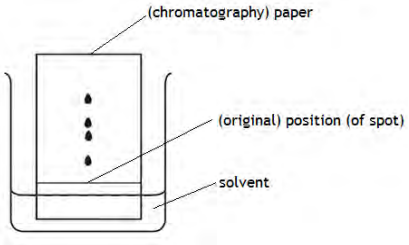
Question number	Answer	Notes	Marks
1 (a)	D (filtration)		1
(b) (i)		award one mark for each correct label solvent: ALLOW label line to any point under the solvent level paper: ALLOW label line to paper, including under solvent level original spot: has to be in the centre of the baseline i.e. below the visible spots	3
(ii)	<u>Four</u> because there are <u>four</u> spots/dots (above the baseline in the chromatogram)	ALLOW blobs / marks / colours IGNORE refs to different heights	1

Question number	Answer	Notes	Marks
2 a	D / simple distillation		1
b	C / fractional distillation		1
c	B / filtration		1
d	A / crystallisation		1

Question number	Answer	Notes	Marks
3 a i	to prevent spots/them dissolving/mixing (in the solvent) / OWTTE	Accept substance(s)/pigment(s)/dye(s) for spots Ignore references to diffusion/absorption Ignore references to spots smudging/running Accept spots would be washed off/away Ignore water for solvent	1
ii	Any two from: M1 evaporation /loss of solvent / OWTTE M2 risk of fire M3 fumes may be toxic/poisonous	Accept water for solvent Ignore gas escaping Ignore it is flammable only Ignore harmful/dangerous Ignore references to substances entering tank/spillage Ignore references to reaction with air	2

b	M1 cross in box A (chlorophyll is **not** present in carrots, sweet potatoes or tomatoes) M2 cross in box C (both beta-carotene and lycopene are present in sweet potatoes) M3 cross in box E (Both carrots and tomatoes contain a pigment **other than** beta-carotene, chlorophyll and lycopene)	If more than three answers given mark on list principle: eg four answers given with 3 correct and 1 incorrect scores 2 marks eg all five answers given so 3 correct and 2 incorrect scores 1 mark	3
c	M1 (distance between start line and solvent front) = 6(.0) M2 correct evaluation of R_f value 1.3/6.0 = 0.22	Accept answer to 1 or more dp, eg 0.2, 0.217, Accept 0.216recurring Reject 0.216 correct answer with no working scores 2 M2 CQ on M1	2
d	(there is a substance in sweet potatoes that) does not dissolve/is insoluble (in the solvent)	Ignore mix Ignore water for solvent Reject not very soluble/partially soluble	1

Question number	Answer	Notes	Marks
4 a	$CaCl_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HCl(aq)$	All four must be correct to score Do not penalise upper case letters	1
b		M1 filter paper in filter funnel Do not penalise inappropriate size M2 everything else correct Not essential that funnel touches flask Reject beaker/tube for M2 Ignore labels Ignore relative sizes	2
c i	Ca^{2+} / calcium (ion)	Reject Ca with incorrect or missing charge Mark (i) and (ii) independently	1
ii	calcium sulfate/$CaSO_4$ is partially/slightly soluble OR contains unreacted/excess calcium chloride/$CaCl_2$ (solution)	Accept unreacted/excess calcium ions	1

Question number	Answer	Notes	Marks
4 d i	white precipitate	Accept solid / ppt / ppte / suspension in place of precipitate Reject other colours Reject other observations eg fizzing Ignore cloudy/milky/grey	1
ii	silver chloride	Accept correct formula Ignore incorrect formula Award both marks if both answers in either (i) or (ii)	1
iii	(hydrochloric/sulfuric) acid / H^+ there OR solution acidic	Accept because there are no other ions that could form a precipitate Accept no carbonate/hydroxide (ions)	1
e	M1 wash/rinse (with water) M2 leave it (to dry) / leave in a warm place / place in an oven / place in desiccator / heat it / dry with absorbent paper (eg kitchen/filter/blotting)	Reject methods that refer to filtrate /solution /crystallisation Ignore other named solvents Accept leave on a window ledge Ignore evaporate it / boil it Award 1 mark for both M1 and M2 correct but in wrong order	2
		Total 10 marks	

Question number	Answer	Notes	Marks
5 (a)	**M1** – C **M2** – (it) has a spot in line with/at the same height as (the spot produced by) bute/an illegal drug	 Accept references to travelling same distance / having same R_f value **M2** dep on **M1**	1 1
(b)	a substance/liquid that dissolves a solute/solid/another substance	Accept it forms a solution with a solute/solid/substance	1
(c)	**M1** $\frac{\text{correctly measured distance for lasix spot}}{\text{correctly measured distance of solvent front}}$ **M2** – any value in range 0.73 – 0.77	Lasix spot 62-64 mm / 6.2-6.4 cm Solvent front 84 mm / 8.4 cm Minimum of 2 dp correct answer with no working scores 2 **M2** csq on **M1**	1 1
(d)	the more soluble the substance the further it will travel	Allow distance increases with (increasing) solubility ignore any reference to proportionality	1
			Total 6 marks

Question number	Answer	Notes	Marks
6 (a) (i)	green	ignore shades accept yellow-green	1
(ii)	to allow (excess/unreacted) gas to escape/to prevent pressure build up	accept to prevent (the risk of) an explosion/breaking the apparatus	1
(iii)	Chlorine/the gas is toxic/poisonous	ignore harmful, dangerous, etc.	1
(b) (i)	**M1** - $\frac{2.8(000)}{56}$ and $\frac{5.325}{35.5}$ **OR** 0.05(00) and 0.15(00) **M2** – 1:3 **M3 –** $FeCl_3$	award 0/3 if division by atomic numbers / wrong way up / multiplication used do not penalise roundings or minor transcription errors (e.g. 5.235 for Cl) If 71 used for Cl_2, lose **M1** but **M2** and **M3** can be awarded – consequential answer from this error is Fe_2Cl_3 **M2** subsumes **M1** Accept symbols in any order	1 1 1
(ii)	iron(III) chloride	Award 3 marks for correct final answer with no working accept ferric chloride ignore iron chloride accept iron trichloride	1

9 (c)	Cl_2 + 2 NaOH → NaCl + NaClO + H_2O **M1** – all formulae correct **M2** – balanced using correct formulae		2

Question number	Answer	Notes	Marks
7 (a) (i)	$Zn(s) + 2\,HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$ **M1** – all formulae correct and equation balanced **M2** – state symbols correct	 **M2** can be awarded for near misses on formulae, e.g. ZnCl and H accept upper case letters for state symbols	2
(b)	**M1** bubbles/fizzing/effervescence **M2** zinc/solid gets smaller/disappears	accept gas given off ignore hydrogen given off accept zinc/solid dissolves / (final) solution is <u>colourless</u> reject zinc melts and other Group 1 observations, eg floats / moves across surface Ignore references to heat and temperature change	2

Question number	Answer	Notes	Marks
7 (c) (i)	<table><tr><th></th><th>Experiment 1</th><th>Experiment 2</th></tr><tr><td>Final burette breading in cm^3</td><td>10.40</td><td>22.70</td></tr><tr><td>Initial burette reading in cm^3</td><td>0.00</td><td>1.90</td></tr><tr><td>Volume of acid added in cm^3</td><td>10.40</td><td>20.80</td></tr></table> **M1** – all four burette readings correct **M2** – subtractions correct **M3** – all six values in table given to 2 decimal places	Ignore trailing zeroes for **M1** and **M2** **M2** CSQ on burette readings given in table	3
(ii)	**M1** – (because) the volume/amount of acid required has doubled **M2** – the concentration is half / 0.37 (mol dm^{-3}) **OR** **M1** for use of an expression such as $V_1c_1 = V_2c_2$ **M2** for indicating how c_2 can be calculated (e.g. because V_1, c_1, and V_2 are known) / for an answer of 0.37 (mol dm^{-3})	Mark independently accept either a calculation or a description	1 1