Mark scheme

Experimental design and separation techniques

Chemistry 0620 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

76

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	7	7	8	6	6	6	6	12	13	**76**

Question 1 [5]

1(a)	distillation	**1**
1(b)	electrolysis	**1**
1(c)	filtration	**1**
1(d)	fractional distillation / fractionation	**1**
1(e)	chromatography	**1**

Question 2 [7]

2 **(a)** **(i)** medicines / food / (drinking) water / air quality [1]
ignore: kitchens / clothes

(ii) 1st box down ticked (boils slightly above 100 °C) [1]

(b) all 4 correct = 2 marks [2]
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks
top right → solvent front
bottom right → chromatography paperbottom left → solvent
top left → origin line

(c) **(i)** C [1]

(ii) A, C and D (all three correct for 1 mark) [1]

(iii) B [1]

[Total: 7]

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Question 3 [7]

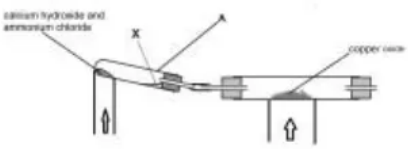
3 **(a)** measuring cylinder (1) [1]

(b) **(i)** condenser (1) **accept** condensing tube
evaporating dish/basin/bowl (1) accept crystallising dish/basin/bowl
tripod (1) [3]

(ii) A/distillation (1) [1]

(c) **ignore** reference to filtering
heat/evaporate/use apparatus B (1) **not** 'heat' if the method would not work
to crystallising point/until saturated (1) [2]

Question 4 [8]

4(a)	**A** boiling tube / test-tube	1
	B measuring cylinder	1
4(b)	 one arrow in each region shown	2
4(c)	water / H_2O	1
4(d)	ammonia dissolves in the water	1
4(e)	it is air	1
4(f)	ammonia is toxic / poisonous	1

Question 5 [6]

5	Any 6 from: • crush / grind root • with pestle / mortar • with water / solvent • place (drop of) liquid / colour on paper • conduct chromatography • (bottom of) paper placed in a suitable solvent / water • number of coloured substances = number of spots	6

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Question 6 [6]

6	add metals to HC*l* in a beaker / flask / test-tube **fair test – max 4** • same volume HC*l* • some concentration HC*l* • same temperature acid • same mass / moles / amount metals • same surface area / form of metal **measure** • start timing when solid added • stop timing when all solid gone / reaction to stop	6

6	**OR** • start timing when solid added • stop timing when collected set volume of gas **OR** • start timing when solid added • measure volume of gas after a set time **OR** • measure temperature at start • measure temperature after reaction **OR** highest temperature reached **conclusion** • shortest time is most reactive **OR** • biggest volume of gas most reactive **OR** • biggest temperature change most reactive	

Question 7 [6]

7	**max 6** **to obtain ethanol** **MP1** filter the initial mixture (ethanol obtained as filtrate)	1
	and then any five from: **to obtain zinc carbonate** **MP2** add water to the residue / mixture **MP3** stir / warm after adding water **MP4** filter after adding water **MP5** wash residue from filtration after the addition of water **MP6** dry the solid zinc carbonate **to obtain sodium chloride** **MP7** heat filtrate to remove water and obtain solid sodium chloride **If candidates do not have a valid method of obtaining ethanol then MP1 cannot be awarded and the maximum score is 5. If ethanol is obtained AFTER adding more ethanol to the mixture, then do not award MP1, maximum 5**	5

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Question 8 [6]

8	**1 mark for any 6 of:** • 100 cm^3 of water measured using suitable apparatus and placed into a suitable container • water is heated to 50 °C • water is maintained at this temperature • magnesium sulfate is added in excess or in portions until no more dissolves • the mixture is stirred • the solution is filtered to remove undissolved magnesium sulfate or the mass used is known • the use of appropriate measurements to calculate the solubility.	6

Question 9 [12]

9(a)(i)	measure volume of gas / measure amount of gas; gas collected in the measuring cylinder; at different times / use of stopclock to measure time;	1 1 1
9(a)(ii)	faster reaction / rate increases;	1
9(b)(i)	same concentration of acid; same mass of iron; same size of iron pieces;	1 1 1

9(b)(ii)	rate increases with increase in temperature rate increases with temperature = [1]	2
9(c)	any three from: • filter (off the iron); • evaporate water / heat gently; • to crystallisation point / leave to cool (after heating); • filter off / pick out crystals; • dry crystal between filter papers;	3

Question 10 [13]

10(a)	a substance made from two (or more) **elements**	1
	chemically combined	1
10(b)	dissolving	1
	filtration	1
	evaporation / crystallisation	1
	three correct stages in the correct order	1
10(c)(i)	condenser	1
	arrow pointing into lower aperture **only**	1
10(c)(ii)	stopper shown in diagram	1
	gases or vapours escape	1
10(c)(iii)	(mixture is) (in)flammable	1
10(c)(iv)	water bath cannot exceed 100 (°C)	1
	C AND D have a boiling point above 100 (°C)	1

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