SOLUTION TO 5070/41/M/J/20

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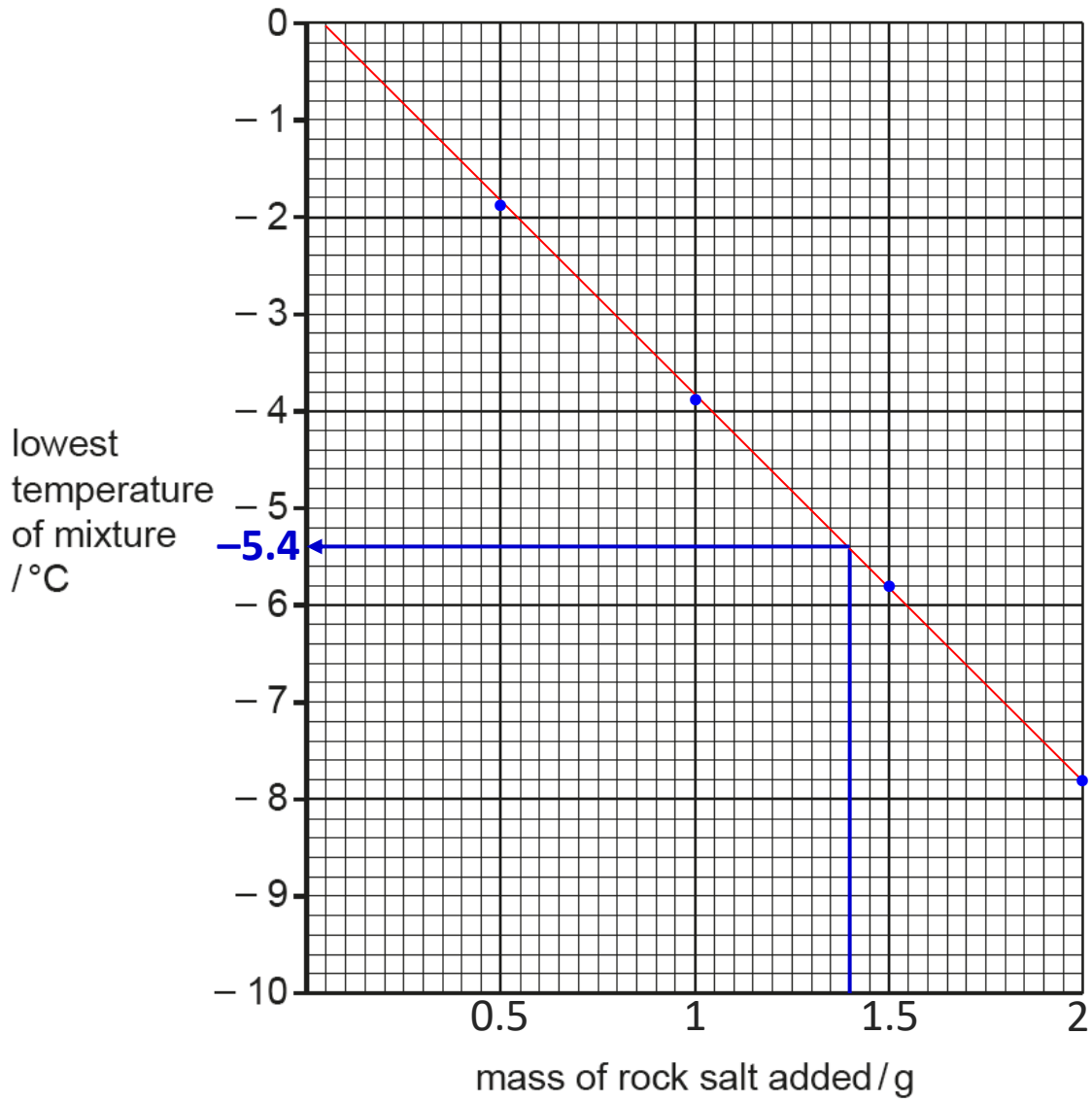
Q1		
	ANSWER	**NOTES**
a (i)	filter funnel	
(ii)	conical flask / Erlenmeyer flask	
(iii)	filtering / filtration	
b	Barium cation (Ba^{2+})	White precipitate = Barium sulfate
c	16 cm^3	
d (i)	mass of ice / volume of water / surface area or particle size of ice	
(ii)	–3.9	

Q1

	ANSWER	NOTES
		
(iv)	As the mass of rock salt added increases, the lowest temperature reached decreases.	

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Q2

	ANSWER	NOTES
a		

titration number	1	2	3
final reading / cm^3	11.6	23.7	34.9
initial reading / cm^3	0.0	11.6	23.7
volume of 0.10 mol/dm^3 HCl / cm^3	11.6	12.1	11.2

b (i)	Measuring cylinder	
(ii)	Pipette or Burette	
(iii)	Dropwise addition of titrant is essential for accurate determination of end-point. If the addition is not carried out dropwise, there is a possibility of going past the end-point resulting in inaccurate titre values.	
c (i)	$(11.8 + 11.6 + 11.3) \div 3 = 11.7\ cm^3$	

titration number	1	2	3
final reading / cm^3	11.8	23.3	33.6
initial reading / cm^3	0.0	11.7	22.3
volume used / cm^3	11.8	11.6	11.3
best titration results (✓)	✓	✓	11.7

Q2
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	ANSWER	NOTES
(ii)	Average titre value = 11.7 cm^3 = 0.0117 dm^3 n (HCl) = 0.100 × 0.0117 = 0.00117	Number of moles, n = Concentration × Volume
(iii)	**mole ratio** 1 mol of $Ca(OH)_2$: 2 mol of HCl n ($Ca(OH)_2$) = 0.5 × 0.00117 = 0.000585	
(iv)	$\frac{0.000585}{25} \times 1000 = 0.0234$	1 dm^3 = 1000 cm^3
(v)	M_r of $Ca(OH)_2$ = 40 + (16 + 1) × 2 = 74	
(vi)	74 × 0.0234 = 1.73 g	mass = molar mass × number of moles

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Q3		
	ANSWER	**NOTES**
3	Add aqueous Chlorine using a dropper to aqueous Potassium bromide taken in a test-tube. The solution turns orange. Bromine is displaced by Chlorine as it is less reactive than Chlorine. aq. Chlorine + aq. Potassium bromide → aq. Bromine (orange) + aq. Potassium chloride Repeat the above process with aqueous Bromine and aqueous Potassium iodide, all other factors being the same. The solution turns brown. Iodine is displaced by Bromine as it is less reactive than Bromine. aq. Bromine + aq. Potassium iodide → aq. Iodine (brown) + aq. Potassium bromide A more reactive halogen displaces the less reactive halogen from its salt solution. **Order of reactivity:** Chlorine > Bromine > Iodine	

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Q4

	ANSWER	NOTES
a	↓	

(i)

ion	test	observations and conclusions
nitrate, NO_3^-	Add aqueous sodium hydroxide, then add aluminium foil and warm gently.	Gas bubbles are seen. Gas with pungent, irritating odour formed Gas turns damp red litmus blue. Gas is Ammonia.
carbonate, CO_3^{2-}	Add dilute hydrochloric acid.	Fizz / effervescence seen. Gas turns limewater milky. The gas is Carbon dioxide.

(ii) ↓ Fe^{3+} ions react with hydroxide ions to form red-brown precipitate of $Fe(OH)_3$.

ion	test	observations
iron(III), Fe^{3+}	Add aqueous sodium hydroxide.	red-brown precipitate formed
	Add excess aqueous sodium hydroxide.	red-brown precipitate remain insoluble in excess Sodium hydroxide

Q4
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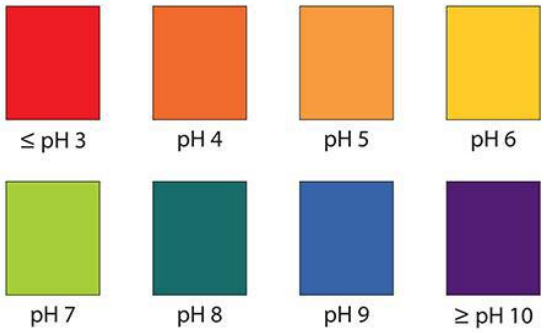
	ANSWER	NOTES
b	yellow	
	Universal indicator pH colour chart  	
c	**Test:** Add dilute Nitric acid to the soil solution followed by aqueous Silver nitrate. **Result:** Yellow precipitate is formed.	Iodide ions react with Silver ions to form a yellow precipitate of Silver iodide. $Ag^+ + I^- \rightarrow AgI$

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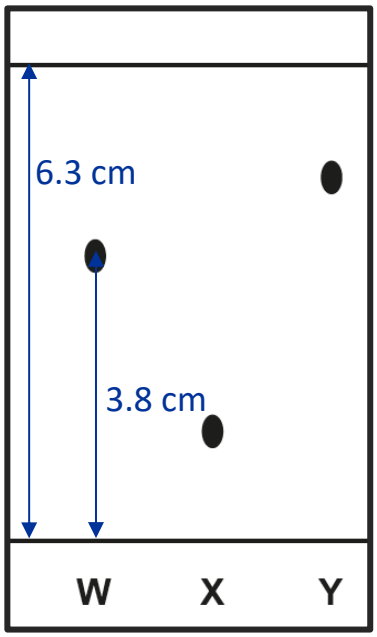
Q5		
	ANSWER	**NOTES**
a (i)	Cutting and grinding facilitates (helps in) extraction of pigments from the leaves.	
(ii)	Diagram D	
(iii)	**Mistake 1:** The solvent level is above the baseline in diagrams A and C. **Explanation:** The spotted pigments will dissolve in the ethanol. No separation would occur. **Mistake 2:** No lid has been used in diagrams B and C. **Explanation:** Ethanol will evaporate from the beaker. The beaker will not be saturated with the solvent vapours. **Mistake 3:** The baselines have been drawn in ink in diagrams A and B. **Explanation:** The ink will dissolve in the solvent and will undergo chromatographic separation as well. It will interfere with the actual separation.	

Q5 (continued from previous page)		
	ANSWER	**NOTES**
a (iv)	Pigments dissolve in Ethanol.	Pigments are organic substances. They dissolve in organic solvents such as Ethanol. They are generally insoluble in water.
(v)	**Property:** Ethanol is volatile and inflammable. **Precaution:** No open flames / lighted Bunsen burners must be used in the laboratory while performing this investigation.	
3 (i)	3 pigments	3 spots = 3 pigments
(ii)	Pigment X	
(iii)	R_f value = distance moved by pigment ÷ distance moved by solvent = 3.8 ÷ 6.8 ≈ 0.6	
(iv)	grass and spinach	

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Q6

	ANSWER	NOTES
a		Copper + Magnesium sulfate → No change / No reaction Magnesium is more reactive than Copper, hence cannot be displaced by Copper from Magnesium sulfate solution. Magnesium + Iron(II) sulfate → Magnesium sulfate + Iron Magnesium is more reactive than Iron, hence displaces Iron from Iron(II) sulfate solution. The red / brown solid formed is Copper. Magnesium is more reactive than Copper, hence can displace Copper from Copper(II) sulfate solution.

metal	solution	observation
copper	magnesium sulfate	no change
copper	iron(II) sulfate	no change
magnesium	copper(II) sulfate	red/brown solid formed
magnesium	zinc sulfate	silver/grey solid formed
magnesium	iron(II) sulfate	grey / black solid formed
iron	Copper(II) sulfate	red/brown solid formed
zinc	iron(II) sulfate	grey/black solid formed
zinc	magnesium sulfate	no change

Q6
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	ANSWER	NOTES
b	Most reactive: Magnesium Zinc Iron Least reactive: Copper	

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