Chemistry Practical Revision

Notes for QA

Test for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
lead(II) (Pb^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

[Lead(II) ions can be distinguished from aluminium ions by the insolubility of lead(II) chloride.]

Test for gases

gas	test and test result
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	gives white ppt. with limewater (ppt. dissolves with excess CO_2)
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint
sulfur dioxide (SO_2)	turns aqueous acidified potassium manganate(VII) from purple to colourless

Precision

Instrument	Values can be recorded to the nearest …	Examples
Burette	0.05 cm^3	25.00 cm^3, 10.05 cm^3
Pipette		25.0 cm^3, 20.0 cm^3
Measuring cylinder	0.5 cm^3	14.0 cm^3, 14.5 cm^3
Electronic balance (Copy completely)	0.1 g	150.0 g, 151.8 g
	0.01 g	131.00 g, 189.30 g
Ruler	0.1 cm	11.0 cm, 15.8 cm
Thermometer	0.5 °C	40.0 °C , 40.5 °C
Stopwatch	1s	23 s, 50s

Titration

Table

Titration number	1	2	3
Final burette reading / cm^3			
Initial burette reading / cm^3			
Volume of ___ used / cm^3			
Best titration results (✓)			

Indicators

Indicator	Colour in acid	Colour change	Colour in alkali
Methyl Orange	Red	3-5	Yellow
Litmus	Red	5-8	Blue
Phenolphthalein	colourless	8-10	pink

Observations

- Precipitates are only formed when two solutions are mixed
- All precipitates are insoluble
- 'add till in excess' → at least ¾ of the test tube
- 'add till no further change' → at least ¾ of the test tube

Sources of Error

- Heating experiment
  - Heat loss:
    - Cover
    - Use a Styrofoam cup
    - Thermostatically controlled water bath
- Concentration
  - Evaporation of solution
    - Cover the dish so water won't evaporate
- Human reaction time (**ONLY IF MORE THAN 2 ACTIONS!**)
- Eg: SJC Practical 6 Experiment 2
  - Improvements:
    - Use a burette instead of a measuring cylinder
    - Use a gas syringe
    - Repeat the experiment 3 times and calculate the average
    - Sand the magnesium metal to remove the oxide layer (if present)
  - Measuring cylinder:
    - Advantage: easy to use / convenient
    - Disadvantage: it is only precise to 0.5 cm^3 / nearest whole number / 1 cm^3

Common Questions

1. Explain why it is necessary to stir the mixture in the beaker before the measuring the highest temperature reached.
   To ensure even distribution of heat in the mixture.

2. Suggest two changes to be made to improve the accuracy of the results.
   - Use a burette to measure the volume of P instead of a measuring cylinder.
   - Use a lid to cover the cup
   - Dry the styrofoam cup between each experiment

3. Describe and explain the effect of using 20.0 cm^3 instead of 25.0 cm^3 of solution Q (antiseptic solution containing iodine) on the percentage by mass of iodine in the solution calculated by the student.

   $$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$$

   - Volume of R ($Na_2S_2O_3$) used will be lower than expected as less Q is used.
   - Hence, calculated percentage by mass could be lower than expected.

4. A student repeated the experiment and accidently rinsed the conical flask with solution Q. Describe and explain the effect this would have on the results of the titration.
   P: solution containing 94.5g of $H_2C_2O_4.xH_2O$ in 1.00 dm^3 of solution
   Q: 1.50 mol/dm^3 of sodium hydroxide

   - Volume of Q in the conical flask will be more than 25.0 cm^3.
   - Greater volume of P is required to react with Q in the conical flask.

5. How can you improve reliability of the experiment?
   - Take multiple readings and find the average.

6. How to improve accuracy of the experiment?
   - Take more readings
   - Use instruments that are more precise for measurement

7. What are the advantages of using a measuring cylinder over burette and pipette?
   - Measuring cylinder is quick and convenient to use as opposed to burette and pipette and where time taken to dispense liquid is slower.

8. What are the advantages of using a burette and a pipette over a measuring cylinder?
   - Pipette and burette are more precise instruments

Graph

- at least 2/3 of graph paper
- if question asks for y intercept, then you need (0,0)

Planning

Example 1:

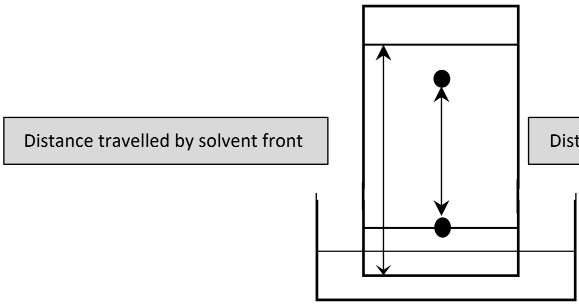
Some soft drinks contain food colourings. Food colourings contains a mixture of different coloured compounds.

E numbers are used to identify compounds added to foods.

E110 is Sunset Yellow and is one of the compounds in a liquid food colouring.

Outline a method you could use to determine whether a sample of this food colouring contains E110.

You are provided with only a liquid sample of this food colouring.



1. Add a drop of food colouring on the start line of the chromatogram.
2. Put the paper chromatogram in a beaker of water, as shown in the diagram.
3. Record the distance travelled by the solvent front and the distance travelled by the food sample.
4. Calculate the Rf value by taking (distance travelled by food colouring)/(distance travelled by solvent front).
5. Compare the Rf value calculated with the Rf value of E110. If the Rf value if the same, the food sample contains E110.

Example 2:

Hydrated copper (II) sulfate crystals molecular formula can be represented as $CuSO_{4}.xH_2O$.

The water of crystallization can be driven off by gentle heating.

You are provided with 1g of hydrated copper(II)sulfate. Suggest how you would determine the value of x in $CuSO_{4}.xH_2O$.

1. Heat the 1g of hydrated copper (II) sulfate crystals gently in a boiling tube.
2. Weigh the hydrated copper (II) sulfate every 5 minutes after cooling, until the weight is constant with a mass balance until the crystals turn from blue to white.
3. Record the final mass of copper (II) sulfate.
4. To find the mass of water, take initial mass of copper (II) sulfate – final mass of copper (II) sulfate.
5. Mass of copper (II) sulfate in 1g = mass of copper (II) sulfate = 1 – mass of water.
6. Number of moles of water = mass of water ÷ Mr of water
7. Final mass of crystals ÷ by the Mr of copper (II) sulfate.
8. Compare the mole ratio.
9. X = (number of moles of water) / (number of moles of copper (II) sulfate)