Rewarding Learning

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Chemistry

Unit A22: Practical Manual

Teacher / Technician Notes

Practical 7.1

Titrate iodine with sodium thiosulfate using starch indicator and hence estimate oxidising agents by their reaction with excess acidified potassium iodide (spec ref: 5.3.1)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 3 × 250 cm^3 beakers
- glass rod
- 250 cm^3 volumetric flask & stopper
- funnel
- deionised water bottle
- plastic dropping pipette
- 50 cm^3 burette
- clamp and stand
- 25 cm^3 pipette
- pipette filler
- 25 cm^3 measuring cylinder
- 3 × 250 cm^3 conical flasks
- white tile
- weighing boat
- approximately 1.0 g potassium iodate(V)
- approximately 100 cm^3 sulfuric acid (1.0 mol dm^{-3})
- approximately 4.5 g potassium iodide
- approximately 200 cm^3 sodium thiosulfate solution (0.1 mol dm^{-3})
- access to starch indicator
- access to a mass balance

The mass of potassium iodate(V) should not be revealed to pupils.

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 7.2

Titrate acidified potassium manganate(VII) with reducing agents (spec ref: 5.3.2)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 250 cm^3 beaker
- 100 cm^3 conical flask & bung/stopper
- 50 cm^3 measuring cylinder
- funnel & filter paper
- 100 cm^3 volumetric flask & stopper
- deionised water bottle
- plastic dropping pipette
- 50 cm^3 burette
- clamp and stand
- 25 cm^3 pipette
- pipette filler
- 25 cm^3 measuring cylinder
- 3 × 250 cm^3 conical flasks
- white tile
- weighing boat
- 5 × iron tablets (200 mg ferrous sulfate tablets available from a pharmacy)
- approximately 200 cm^3 sulfuric acid (1.0 mol dm^{-3})
- approximately 150 cm^3 potassium manganate(VII) solution (0.02 mol dm^{-3})
- access to a mass balance

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 7.3

Determine the purity of a Group II metal oxide or carbonate by back titration (spec ref: 5.3.4)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- weighing boat
- access to mass balance (2 d.p)
- approximately 1.2 g of marble chips (calcium carbonate)
- 3 × 250 cm^3 beakers
- 50 cm^3 measuring cylinder
- funnel & filter paper
- 250 cm^3 volumetric flask & stopper
- 50 cm^3 burette
- clamp and stand
- 25 cm^3 pipette
- pipette filler
- 3 × 250 cm^3 conical flasks
- bottle of deionised water
- 2 × plastic dropping pipettes
- white tile
- phenolphthalein indicator
- approximately 50 cm^3 1.0 mol dm^{-3} hydrochloric acid
- approximately 200 cm^3 0.1 mol dm^{-3} sodium hydroxide solution

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Practical 8.1

Carry out paper and thin-layer chromatography and measure the R_f values of the components and interpret chromatograms (spec ref: 5.4.1/5/4/3)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 250 cm^3 beaker
- 5 × capillary tubes
- filter paper (approximately 12.5 cm × 5.5 cm)
- methyl orange
- methyl red
- bromothymol blue
- phenolphthalein
- a mixture of methyl orange, methyl red and bromothymol blue labelled unknown mixture
- approximately 30 cm^3 sodium hydroxide solution (0.1 mol dm^{-3})

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 9.1

Use ethylene diamine (1,2-diaminoethane), phenylamine and aqueous ammonia to demonstrate ligand replacement based on lone pair availability (spec ref: 5.5.8)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- boiling tube
- 4 × plastic dropping pipettes
- approximately 2 cm^3 copper sulfate solution (0.2 mol dm^{-3})
- approximately 1 cm^3 phenylamine
- approximately 1 cm^3 ammonia solution (0.2 mol dm^{-3})
- approximately 1 cm^3 ethylene diamine

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 9.2

Demonstrate the relative strengths of ligands using hydrated copper(II) ions and hydrochloric acid (spec ref: 5.5.9)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- test tube
- 2 × plastic dropping pipettes
- approximately 2 cm^3 copper sulfate solution (0.2 mol dm^{-3})
- approximately 2 cm^3 concentrated hydrochloric acid

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 9.3

Carry out qualitative tests for the formation of transition metal hydroxides with sodium hydroxide and aqueous ammonia (spec ref: 5.5.12)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 7 × test tubes
- test tube rack
- 9 × plastic dropping pipettes
- approximately 2 cm^3 of each of the following solutions: cobalt(II) chloride, chromium(III) potassium sulfate, copper(II) sulfate, iron(II) sulfate (acidified), iron(III) chloride, manganese(II) chloride (all 0.1 mol dm^{-3})
- approximately 10 cm^3 sodium hydroxide solution (1 mol dm^{-3})
- approximately 10 cm^3 aqueous ammonia (1 mol dm^{-3})

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 9.4

Carry out the reduction of acidified ammonium metavanadate with zinc and observe the sequence of colours (spec ref: 5.5.13)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 100 cm^3 conical flask
- test tube and rack
- 25 cm^3 measuring cylinder
- approximately 0.25 g ammonium vanadate(V)
- approximately 25 cm^3 sulphuric acid (2.0 mol dm^{-3})
- approximately 0.25 g zinc powder (1 to 2 spatula loads) or a few pieces of granulated zinc
- weighing boat
- cotton wool plug
- filter funnel and filter paper
- 2 × plastic dropping pipettes
- approximately 10 cm^3 potassium manganate(VII) solution (0.02 mol dm^{-3})
- access to a balance

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 10.1

Determine the electrode potentials of a series of cells and predict their values using standard electrode potentials (spec ref: 5.6.2)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- tweezers
- sandpaper
- 2 × 100 cm^3 beakers
- 100 cm^3 measuring cylinder
- deionised water
- 2 × wire leads – fitted with crocodile clips (so can be attached to a voltmeter)
- high resistance voltmeter
- 4 × strips of filter paper (10–15 cm x 1.5–2.0 cm strips will be long enough to connect two 100 cm^3 beakers)
- 2 × retort stands, boss heads and clamps
- approximately 150 cm^3 saturated potassium nitrate solution
- strip of zinc foil (5 cm × 1 cm)
- strip of copper foil (5 cm × 1 cm)
- iron nail
- strip of lead (5 cm × 1 cm)
- approximately 50 cm^3 copper sulfate solution (1.0 mol dm^{-3})
- approximately 50 cm^3 zinc sulfate solution (1.0 mol dm^{-3})
- approximately 50 cm^3 of acidified Iron(II) sulfate solution (1.0 mol dm^{-3})
- approximately 50 cm^3 of lead(II) nitrate solution (1.0 mol dm^{-3})

In practice in the lab the zinc / copper cell usually gives a voltmeter reading between +1.04 V and +1.10 V

The iron half-cell in practice is the lab is quite unreliable – but it serves its purpose to illustrate the principles behind the construction of feasible cells. In practice the voltmeter reading for the iron / copper cell is around +0.52 V (should be +0.78 V).

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 11.1

Determine the amount of a carbonate, for example calcium carbonate or magnesium carbonate, in an indigestion tablet (spec ref: 5.11.2)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- weighing boat
- access to mass balance (2 d.p)
- indigestion tablet containing 500 mg calcium carbonate
- pestle and mortar
- 3 × 250 cm^3 beakers
- 50 cm^3 measuring cylinder
- funnel & filter paper
- 250 cm^3 volumetric flask & stopper
- 50 cm^3 burette
- clamp and stand
- 25 cm^3 pipette
- pipette filler
- 3 × 250 cm^3 conical flasks
- bottle of deionised water
- 2 × plastic dropping pipettes
- white tile
- phenolphthalein indicator
- approximately 50 cm^3 1.0 mol dm^{-3} hydrochloric acid
- approximately 200 cm^3 0.2 mol dm^{-3} sodium hydroxide solution.

Depending on tablets used – mean titres should be around 20.0 cm^3

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 11.2

Prepare aspirin using salicylic acid and ethanoic anhydride (spec ref: 5.11.7)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 100 cm^3 conical flask
- access to mass balance (2 d.p)
- weighing boat
- 10 cm^3 measuring cylinder
- 2 × plastic dropping pipettes
- thermometer
- 250 cm^3 beaker
- Büchner funnel & flask
- filter paper
- 100 cm^3 beaker
- watch glass
- spatula
- access to a drying oven
- a sealed capillary tube
- access to melting point apparatus
- 3 × test tubes and rack
- approximately 2.5 g salicylic acid
- approximately 4 cm^3 ethanoic anhydride
- approximately 1 cm^3 concentrated sulfuric acid
- ice
- access to ethanol
- approximately 2 cm^3 iron(III) chloride solution (0.5 mol dm^{-3})

Pure aspirin melts between 138–140 °C.

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.

Practical 11.3

Use chromatography to compare the purity of laboratory-made aspirin with commercial tablets (spec ref: 5.11.8)

Teacher / Technician Notes

Each pupil/group will need:

- safety glasses
- 250 cm^3 beaker
- spatula
- tweezers
- 3 × capillary tubes
- 3 × small vials
- plastic dropping pipette
- tlc paper (approximately 12.5 cm × 5.5 cm)
- 50 cm^3 measuring cylinder
- watch glass
- samples of crude and recyrstallised aspirin made in practical 11.2
- sample of a commercial brand of aspirin tablet, crushed
- access to ethanol
- approximately 30 cm^3 ethyl ethanoate
- short wavelength UV lamp (254 nm)
- a few iodine crystals

Centres are responsible for their own hazard analysis and risk assessment before beginning this practical work with pupils.