



eye
protection
must be
worn



wear gloves



HARMFUL
copper
sulphate
nickel
sulphate

26: Electroplating Faces

● Intermediate/high level ● 30-60 minutes

Requirements

100 cm³ beaker
2-4 V d.c. power supply,
leads, crocodile clips

copper electrolyte: copper sulphate, CuSO₄ (aq) (1.0 mol dm⁻³)
nickel electrolyte: nickel sulphate, NiSO₄ (aq) (1.0 mol dm⁻³)

eye protection
disposable plastic gloves

foreign copper coin
copper foil for anode
foreign nickel coin
nickel foil for anode

Method

See pupils' sheet.

Safety advice

Nickel salt solutions should only be used by pupils aged 13-14 and older.

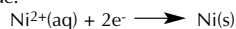
Nickel metal and solutions of nickel salts may cause sensitisation by skin contact so ensure that pupils wear gloves.

Chemical Background

At anode:



At cathode:



27: Strengthening Ice

● Intermediate/high level ● 30-60 minutes to prepare

● 1-2 days to freeze ● 30-60 minutes to test

Requirements

access to a freezer
ice trays
cotton wool
iron wool

straw (or any other material suggested by the group)
100 g masses - quite a few will be needed for strong material
string, or similar, for suspending 100 g masses from the ice cubes
some means of catching the masses when the ice breaks (e.g. polystyrene
or other packaging)

Method

See pupils' sheet.

Chemical background

Composite materials have been used since the Pharaohs put straw in their bricks. The purpose of putting chopped plant fibres into Inca and Mayan pottery was exactly the same as for the Egyptian bricks: to prevent cracking when the wet clay was dried rapidly in the sun.

Small amounts of fibre do have a considerable effect in improving the strength and toughness of weak brittle materials. The project Max Perutz worked on was devised by an English scientist called Geoffrey Pyke. His original idea was to tow an iceberg into the Atlantic. However he soon found that natural ice is quite weak in tension. It is brittle and cracks spread easily. This is why icebreakers can sail through icebergs. Pyke strengthened the iceberg by adding wood pulp to his ice; cracks are stopped or deflected by the presence of fibres.

SOME USEFUL BACKGROUND READING:

J E Gordon *The New Science of Strong Materials*. Penguin Books
E N Ramsden *Materials Science*. Stanley Thornes Ltd.

28: Technicolour Fun

A. Technicolour Tubes

- Intermediate/high level
- Initial trial 30 minutes, can be extended

You could provide a range of liquids like those used in *The Apothecary's Cocktail*. You must check each one before you allow pupils to mix potentially reactive mixtures.

B. Creating Colour

- Intermediate level
- 30-60 minutes total

Requirements

5cm³ universal indicator
hydrochloric acid, HCl, (0.1 mol dm⁻³)
sodium hydroxide, NaOH, (0.1 mol dm⁻³)
Allocate a small amount of universal indicator to each pupil or group.

29: Create Your Own Chemistry Trail

- High level
- Long term project

See pupils' worksheet for useful references.

