Space station survival Technician notes

Introduction
Space Station Survival is a collection of problem-solving challenges to teach chemical reactions or heat transfer. Pupils embark on a virtual mission to the International Space Station (ISS), with the help of audio, images and video clips. Unfortunately disaster strikes at the station. Pupils are faced with a challenge and must apply scientific knowledge to solve it. Select one of the following challenges:

Challenge One: Carbon dioxide scrubber
- The space station's CO_2 cleaner has failed, and CO_2 is rising to dangerous levels. Can pupils design and test a home made device to remove CO_2 from the air in time?

Challenge Two: Protective cladding
- A solar panel has broken off from the station, exposing vital circuits to both the heat of the Sun and the intense cold of space. Can pupils design some protective cladding to minimise heat transfer?

Challenge One: Requirements per group
1 conical flask
2 boiling tubes
Bungs and glass tubing (see diagram in pupil sheets)
Litmus paper
Stopwatch/timer
Eye protection

Chemicals for A - CO_2 generator (set out together)
Zinc
Copper
Hydrochloric acid (0.4M)
Marble chips (large size, to give a slow production of CO_2 bubbles)

Chemicals for B – CO_2 scrubber (set out together)
Either provide alkali solutions from this selection (already in boiling tubes, so pupils do not handle the chemical):
Sodium hydroxide solution (1M)
Potassium hydroxide solution (1M)
Sodium carbonate solution (1M)

Or provide solid alkalis from this selection (already in boiling tubes, so pupils do not handle the chemical):
Sodium hydroxide pellets
Lithium hydroxide pellets
Sodium carbonate
Soda lime

Other possibilities for pupils to select from:
Citric acid crystals
Rock salt
Charcoal

Chemicals for C – CO_2 tester (set out together)
Limewater solution
Hydrochloric acid (0.4M)
Splint

Safety information for teacher and technician
You must try this activity before using it with pupils. This will allow you to decide whether they will need to use alkali solutions or the more hazardous solid alkalis for the CO_2 scrubber. A risk assessment always encourages the use of the least hazardous material that produces results. The slower the production of CO_2, the less concentrated alkali needed.

- 1M sodium and potassium hydroxide are corrosive and dangerous to eyes and skin. Solid sodium and lithium hydroxide are more hazardous.
- Eye protection must be worn at all times.

- Warn pupils that the solutions of sodium and potassium hydroxide are corrosive and dangerous to eyes and skin. Tell them to handle the boiling tubes of alkali carefully in order to avoid spills. Ensure that eye wash facilities are available.
- Remind pupils that the acid (0.4M) is not as hazardous as the alkali, but nevertheless they must wear eye protection when using it.
- If you choose to use solid alkalis as a class practical rather than as a demonstration, tell pupils not to open the tubes nor under any circumstances handle the solid pellets.
- Remind pupils to report any alkali spills to you immediately.
- Ensure that pupils check their plans with you before they actually carry them out.

Challenge Two: Requirements per group

Boiling tube (with mark 1cm below top, to denote where to fill it to with hot water)
Thermometer
Sellotape
Table lamp (60W bulb)
Clamp and stand
Cotton wool plug

For coating material A
1 A4 size piece of aluminium foil
1 A4 sheet white paper
1 A4 sheet black paper

For insulation system B
1 A4 sheet paper
Tissue paper (roughly equivalent to A4)

Requirements (for the class as a whole)
Hot water at a consistent temperature

Safety

- Pupils should take care when handling hot water.
- Pupils should be warned that the bulb will become hot.

[Please see the general *Health and Safety* notes on the CD ROM for information on recommended safety publications.]