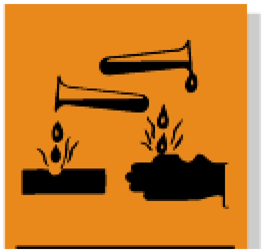
How many can you name?





Explosive
Oxidising
Extremely flammable
Corrosive
Dangerous for the environment

Image taken from meganlee.etsy.com

Initial Science Teacher Development

5.0 Getting practical in science: safe and sound

Dr Jasper Green
www.thescienceteacher.co.uk

What do I need to consider before I do practical work in my school?


SAFETY
FIRST
FAA
Bennett THE CHRISTIAN SCIENCE MONITOR

Health and safety in the science lab

- 1988 COSHH regulations
- You are required to perform a risk assessment of every practical you do. This is a *legal* requirement.

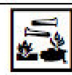
What I need to consider

1. Inherent danger of materials e.g. hazards (HAZCARDS)
2. Your confidence
3. Skills of your class
4. Behaviour of your class
5. Precautions to reduce the risk

(taken from Chapter 5 Frost J (2005). Learning to teach science in the secondary school 2nd ed. RoutledgeFalmer)

Hazcards

47A Hydrochloric acid and other hydrohalic acids

Hydrochloric acid		HCl (aq)
Corrosive		R34: Causes burns. R37: Irritating to respiratory system. Solutions equal to or stronger than 6.5 mol dm^{-3} should be labelled CORROSIVE. Solutions equal to or stronger than 2 mol dm^{-3} but weaker than 6.5 mol dm^{-3} should be labelled IRRITANT. **WEL (mg m^{-3}):** 2 (LTEL), 8 (STEL).

Hydrobromic acid		HBr(aq)
Corrosive		R34: Causes burns. R37: Irritating to respiratory system. Solutions equal to or stronger than 4.5 mol dm^{-3} should be labelled CORROSIVE. Solutions equal to or stronger than 1.2 mol dm^{-3} but weaker than 4.5 mol dm^{-3} should be labelled IRRITANT. **WEL (mg m^{-3}):** 10 (STEL). Purchase the 48% (w/w) acid.

Hydroiodic acid		HI(aq)
Corrosive		R34: Causes burns. Solutions equal to or stronger than 0.7 mol dm^{-3} should be labelled CORROSIVE. Solutions equal to or stronger than 0.3 mol dm^{-3} but weaker than 0.7 mol dm^{-3} should be labelled IRRITANT. Purchase the 55% (w/w) acid.

These substances are dangerous with:	ALUMINIUM, MAGNESIUM, CALCIUM, SODIUM and many other reactive metals. A vigorous or violent reaction occurs. PHOSPHORIC(V) ACID. Hydrogen halide gas is released. POTASSIUM MANGANATE(VII). Explosions can occur. SULFURIC ACID. Hydrogen halide gas is released.

Store: CLa Store large containers at a low level, preferably in a tray to contain spills. Once bottles are opened, gases can leak into the store; this accelerates the corrosion of metals. The gases can also diffuse through plastic so that labels on the containers fade and disintegrate. The gases react with ammonia and amines to deposit a white powder over bottles.	**Disposal:** W1, W4 W4: Use a fume cupboard.

For emergencies, see Hazcard E as well as more detailed information which may be on this Hazcard.

The lab:
how many can you name?

Navigating the lab

Create a bird's eye plan of the lab and then identify and label:

1. Location of the safety equipment
2. Where you will perform demonstrations
3. Where students will be located when you perform demonstrations
4. Specific hazards in the lab
5. Where students will collect apparatus for class practicals
6. Where students will collect chemicals for class practicals

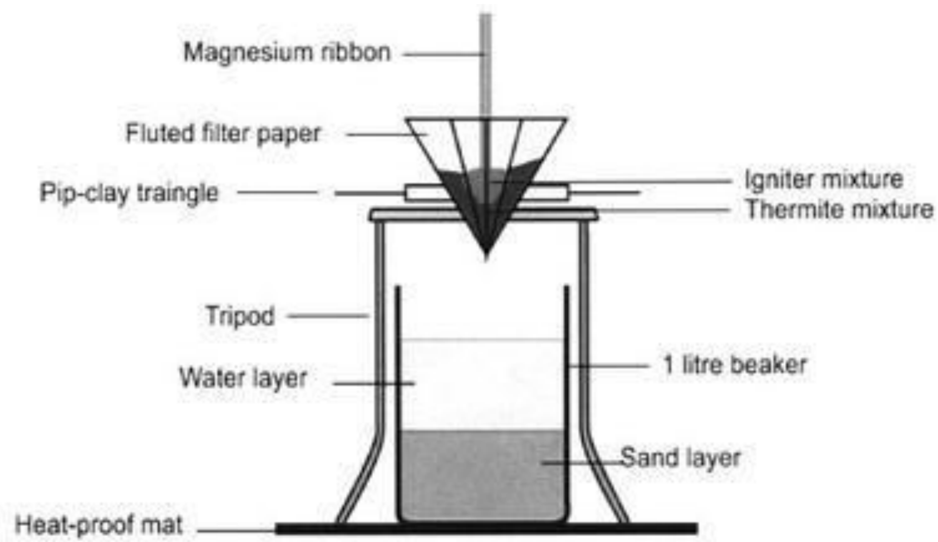
The science prep room and the technicians

True or False?

- It is the technicians responsibility to perform risk assessments for your experiments
- The technician will set-up demonstrations for you
- The technician will clear away apparatus for you
- You should consult with the technicians before you book your equipment for the week ahead
- Experiments should be booked the day before
- Technicians can be used to demonstrate and teach practical skills in a lesson

The thermite reaction

- Watch the demonstration
- Complete a risk assessment for this demonstration using the table on the next slide



Incorrect: https://www.youtube.com/watch?v=qqvQwfH_wGQ

The basic risk assessment

Identify the hazard	Assess the risk (how likely is it to go wrong and how serious would it be?)	Reduce the risk by adopting the following control measures

Further information from Cleapps:
http://www.cleapss.org.uk/attachments/article/0/PS90.pdf?Secondary/Science/Guidance%20Leaflets/?New%20teachers/

Why do practical work in science?

Is practical work pointless?

Are science teachers using experiments as props in lessons?

Pupils generally enjoy carrying out experiments - but do teachers overuse them when they should in fact be teaching more theory, asks **Alom Shaha**

Would students learn more in science lessons if they spent less time on practical work? Photograph: Christopher Thomond for the Guardian Christopher Thomond/Guardian

What is bad practical work?

What is good practical work?

Do you agree with Aloma Shaha?

http://www.theguardian.com/science/blog/2011/jun/21/science-teaching-experiments-in-lessons

Types of practical work

- Practical work
  - Illustrative
  - Exercises (techniques and skills)
  - Investigations

(taken from Chapter 5 Frost J (2005). Learning to teach science in the secondary school 2nd ed. RoutledgeFalmer)

Illustrative: a demonstration

Aim: to illustrate a particular scientific phenomena. It acts as a spring board for conversation and explanations.

1. Practice
2. Health and safety
3. Classroom management
4. Distractions
5. Dialogue – prepare a script

How come hot air balloons rise?

Practice the demonstration and prepare a script you would use when showing this to a Year 8 class to teach them about convection.

https://www.youtube.com/watch?v=GkkrXxJ4db8

Illustrative: a whole class practical

Aim: to get students to experience, for themselves, a particular scientific phenomena. It acts as a spring board for conversation and explanation.

1. Practice
2. Health and safety
3. Classroom management
4. Distractions

Properties of water

http://thescienceteacher.co.uk/wp-content/uploads/2014/10/hydrogen-bonding-thinking-task.pdf

Techniques and skills

Aim: to develop specific practical skills during a lesson

1. Identify the skill you want to develop (split-screen objectives can help)
2. Model the skill you want to develop
3. Give time for students to practice the skill you want to develop

DON’T DO, DEVELOP!

Techniques and skills: the clamp

In pairs devise and practice a teaching sequence, with a script and timings, to teach students how to use a clamp, boss and stand.

Think about

1. Classroom management
2. Possible distractions
3. Dialogue

Let's review

1. Describe and give examples of the three main types of practical work
2. Identify reasons for doing practical work in science
3. Produce a valid risk assessment for a practical
4. Practice and reflect on illustrative and skills-based practical work

Getting Practical

Practical work in school science – why is it important?

Emma Woodley

ABSTRACT The reasons for carrying out practical work are explored and activities to increase the quality and relevance of practical work are described.

For most UK science teachers, practical work is part and parcel of what teaching and learning in science is all about. In fact, the TIMSS 2007 study (Sturman *et al*., 2008) found that, as has been the case for many years, 13- to 14-year-old pupils in England are more likely to spend their lesson time doing practical science activities than many of their international counterparts. It also found that science teachers in England tend to adopt a more 'hands-on' approach to their teaching.

Given that such a large proportion of time in science lessons is spent on practical work, it is important to be able to justify that amount of time by understanding the purposes of this type of activity as a tool for teaching and learning. But in order to understand why we use practical activities, we must first consider what practical work in science is.

Earlier this year SCORE (Science Community Representing Education) produced *A framework for practical science in schools* (SCORE, 2009a), defining practical work in science as '*a "hands-on" learning experience which prompts thinking about the world in which we live*'. The associated report (SCORE, 2009b) has a list of activities that could be considered to be practical work. These fall into two main categories:

ICT. These are closely related to the core activities and are either a key component of an investigation, or provide valuable first-hand experiences for students.

A range of activities were also identified which complement, but should not be a substitute for, practical work. These complementary activities include science-related visits, surveys, presentations and role play, simulations including use of ICT, models and modelling, group discussion, and group text-based activities. They have an important role to play supporting practical work in developing understanding of science concepts.

Purposes of practical work

Most practitioners would agree that good-quality practical work can engage students, help them to develop important skills, help them to understand the process of scientific investigation, and develop their understanding of concepts. A further consequence of experiencing practical work, particularly in chemistry, is the acquisition of an understanding of hazard, risk and safe working. These are just some of the many different reasons for choosing to use a practical activity in a lesson. The *Framework for practical science in schools* also identifies a multitude of ways in which practical work can support learning in science, from 'Personal,