Science in SEN

When I was asked to write this article I wondered what I could condense down into key issues and provide some useful comment for others. I hope that you find this helpful and I would be grateful to hear your comments.

The first part of this article gives some pointers for key issues. The second part focuses on forces, with reference to QCA topics 1E, 2E, 3E, 4E, 6E.

Part 1

key issues.

- Assessment
- Differentiation
- Use of ICT
- Links to NLS and NNS.

Assessment

One dramatic change for me has been the development in assessment. The QCA (Qualifications and Curriculum Authority) have now published Performance scales, P scales, for science. With 'P' scales pupils show small steps of progression and achievement they make even when working below level 1. I have studied, in detail, the use of 'P' Scales in Science for KS3 and 4 SEN pupils at a Special School. This work can be viewed on the website (see resources).
Figure 1

The QCA Performance scales material can be viewed on the Standards web site (see resources).

'P' scales allow small steps to be recognised on the way to level 1 of the National Curriculum. Unfortunately QCA have currently not carried the science criteria into level 1 and 2. In literacy and numeracy the criteria split levels 1 and 2 into 3. Levels 1a, 1b and 1c. I hope QCA will adopt this system for science, as it would be useful to recognise small steps in pupil's progress. Otherwise it would be possible for pupils to be level 1 for a considerable amount of time.

'P' scales enable assessment to inform teaching more accurately, because by knowing exactly where pupils are, teachers can target the next steps. These are to be statutory in all subjects from September 2001.

Differentiation

Differentiation makes the lesson appropriate to all of the children in the class.

- Lesson outcomes are split into 3 levels; All pupils, Most pupils, Some pupils. The majority of pupils will reach the "most level" and a few will be extended to the "some level". This could form the basis of assessment during the lesson, and the outcomes can be directly related to 'P' scales and National Curriculum levels of attainment. Be careful as the National

Curriculum Attainment Levels have changed since the QCA scheme was published.

- Differentiation can be by:
    - Outcome : as above.
    - Level of adult support : The teacher works closely with one group, supervises another and a third group work independently.
    - Task : Some pupils may use a writing frame**,** or a computer, etc.

Use of ICT

I find computers helpful in preparing work for lessons. I apologise if you do not share my affinity with the machine. I want to show you some useful software programmes and how the Internet may help. If you are about to start the New Opportunities Fund, NOF, ICT training you may find that you could use some of these ideas when producing your portfolio of evidence.

Programmes to support the teacher.

Some of the children we teach have communication difficulties; they find it difficult to listen to long introductions or to take in vocabulary orally.

One method to help these children is to use cue cards with key words. To make these more accessible we use symbols with the words. These may also be used as reminder cards. For some pupils these may say “listen”, or “write” etc. I have included a sheet of suggestions for cards, which is included in the resources and can be copied by kind permission of Widget software.

These sound difficult to make but using the programme “writing with symbols” from “Widgit” makes it easier. As you type the symbols appear above the words, or you can choose to just have symbols, or just text. Text from Word can be copied into the programme and sheets prepared for the class in Word can be differentiated to meet the needs of others in the class.

The programme can be used in several other ways including the use of “grids” This is like “Clicker Plus” where you can make a grid of key word with symbols over the pictures. When pupils click on the picture with a mouse the word goes into the text. Both these programmes can also make use of “switches” for children who cannot use a standard mouse.

The Internet

The Internet can be of use in finding materials where other people have already done the hard work of putting it together. However it is useful to know where to look in the first place. I regularly use two sites “Primary Resources” and “Teaching Ideas”. There are obviously lots of others. Primary Resources has lots of ideas, is easy to navigate through and down load from. “Educate” enables you to locate resources relating to the QCA topic you are studying and although there are not resources for every topic it is growing.

The Association of Science Education (ASE) has an excellent web site. Here there are message boards that you can post queries on for others to email suggestions.

The Special school where I work is in the process of producing a website and message board about SEN issues. Here questions can be posted for answers by other teachers. This is a developing resource and it is hoped that this will provide a useful link for teachers to specialist SEN teachers. Of course we don't have all the answers, but sharing ideas and problems will hopefully be useful for all.

Other little tricks

- Try to use a font that shows all letters as though they were written by hand. For example does the letter "a" have its normal tail as shown in figure 3.
  Figure 3 here
  One font that does is Sassoon.
- If you are preparing materials for use on an ohp think about the size of the letters and more importantly their thickness. Use "bold" to increase definition on the screen.

Links to NLS and NNS

The National Literacy Strategy (NLS) and National Numeracy Strategy (NNS) are now well in place in most primary schools. The Key Stage 3 versions are on their way out to secondary schools. It is important to show links from these to science and for once primary teachers have the upper hand , because they are teaching NLS and NNS it is much easier to incorporate that style into other areas of the curriculum.
There are obviously good links to be developed between writing and science especially for writing investigations.
Try to make sure that you have the subject specific vocabulary easily accessible for example on a word wall. If possible use symbols to help children identify the words.

Some schemes like Ginn have strong links to NLS and even produce "big books" for whole class teaching.

When working with number in science make sure that the same methods are used as would be in numeracy or maths lessons. Use number lines and grids, talk about whole numbers for example 36 is 30 and 6 not 3 tens and 6.

Part 2 Forces

Forces

Many teachers seem to find teaching forces a problem, and yet forces are all around us and affect our every day lives. Indeed they can be the most exciting thing since sliced bread!

In general Forces are the 'E' units in the QCA schemes

The "Educate" website has suggestions for each of these topics and is well worth a look.

Force Meters.

- **What are they?**
- **How do they work?**
- **Ways to use them.**
- **Ways not to use them.**

What are they?

In the same way we use a ruler to measure length or scales to measure weight, we use force meters to measure force.

How do they work?

A commercially bought force meter usually has a spring in it, which has been calibrated for measuring. One end of the force meter is fixed usually by being held and the other hook end is attached to what ever you want to measure the force on. For example the meter may be attached to the door handle to measure the force needed to pull open the door. Gently pull the force meter until you reach the point where the door is just about to move. At this stage the pointer inside the force meter should have moved and it should be telling you the force in Newtons needed to move the door.
Some commercial meters can also be used to measure pushing forces, which is nice but they are not calibrated for measuring in units.

Ways to use them

A good way is to make your own in best "Blue Peter" style! You will need two cardboard tubes and an elastic band. The two tubes need to be of different diameter. A "Pringles" and a kitchen paper tube work well, but other combinations are possible, including plastic piping, but one tube must fit inside the other.

Cut the larger tube down so that it is shorter that the smaller tube. About 10cm long is ideal. If you have used a "Pringles" tube you don't want the metal end. Put the smaller tube inside the larger tube. If possible it is best to have some of the smaller tube sticking out at each end, see figure 3.

Figure 3 here.

Next the elastic band needs to go through all of the tubes and be knotted on the outsides of the larger tube (it may be necessary to tie something like washers onto the band to stop it being pulled through the cardboard.

Obviously care needs to be taken when making the holes for the band to go through. You should work out a risk assessment, although you should already have a standard one for using scissors. It may be best to have prepared the tubes with holes or just have a small group doing this activity so that they can be closely supervised. Others could be trying out some of the other force meters.

These home made meters can be used to measure pushing as well as pulling. The amount that the smaller tube moves is the measure of force. Children could mark the tube to show the different forces or they could stick on pieces

of tape. It is best not to let them draw on a scale, as they will usually do this with a ruler and centimetres, which then really confuses the issue. Instead talk about larger / bigger / smaller / more / less etc. If you have a really able group to extend, they can try to calibrate their meter by measuring forces with a commercial meter and then mark theirs accordingly.

Other ideas include changing the elastic bands, or letting children choose their elastic band. Which band is the best for making a force meter and why?

Ways not to use them.
I have already mentioned scales once and with all force meters you need to be careful about the scales. Some commercial meters have grams (g) on one side and newtons (N) on the other and of course you need to make sure the children use N. It may be best to put tape over the g so they are not easily tempted or confused as to which units to use.

Using scales can be very difficult for pupils with SEN and so some thought might be needed to show how to read a scale. I have included a sheet that could be photocopied onto OHP transparency for use in explaining the reading of scales.

Be careful that children don't get confused in to "weighing". Some force meters look like spring balances that any fishermen in your class may have used to weigh their fish. Avoid this by measuring the force needed to drag things. Rather than lifting a pencil case, measure the force needed to drag the pencil case across the desk. This can make reading the scale more difficult, so get children to work in pairs or small groups. This way one can do the pulling while others read the scale and record.

Parachutes
Parachutes suggested in QCA topic 4E can be difficult to make and children can become too focused on the manufacturing of the parachute rather than the science. As suggested in the scheme squared parachutes will make life easier, but using bun cases will make life even easier!
You could get a range of sizes (bun, muffin etc) and children can then concentrate on the science. The science being that the larger bun cases (parachutes) should have greater air resistance, which is a type of friction and so fall slower. However there is a point where the weight or strength of a large parachute is too great and it will not fall properly.

Water resistance
Dropping plasticine into water and measuring the rate of sinking can be fun, but needs a bit of careful thought. It is easiest to measure the speed from the time it takes to sink by measuring it over a long distance. It is worth trying to get some long (1metre) clear plastic tubes, probably from one of the design technology suppliers catalogues rather than the science suppliers.
Place a bung at one end and stand it in a sink, find someway to support it upright. Retort stands are useful for this.

Fill the tube with water and you're away. When you have completed your tests carefully pull out the bung at the bottom to release the water and retrieve the plasticine.

Another way to investigate water resistance is to ask pupils to make a plasticine boat that will float. This is quite tricky and will often result in their attempts sinking. This is easier to do in a tank or sink. Plasticine is very difficult to mould when cold so try to warm it up a bit and possibly use warm water so that the craft can easily be remoulded.

Whenever you are using water, be careful wet floors are usually very slippery.

Spinners
Unit 6E describes using spinners. These can be used to give an effective investigation. The two variables, which work best in my opinion, are the number of paper clips and the length of the rotors. These are good because it is easy to keep the other variables the same and these can be altered easily. For the number of paperclips you can add another one each time, or double the number each time. For length of rotor it is simple to use 5cm, 10cm, 15cm 20cm. You should get some reasonable results from these.

Always remember to start investigations with a "play" session. This exploration enables all pupils to familiarise themselves with the activity. I give all the pupils a template for a spinner and demonstrate how to make it. Then give them chance to try it out, using a space free of furniture or may be outside. Launch the spinners by throwing them up first, or from the top of a flight of stairs.

From this "play" session I would start to ask children what it is that would make any difference in the way the spinner works? Is a good spinner one that takes a long time to hit the ground or a short time? Etc.
What I want to lead them to is the weight of the paperclips and the size of the wings, but other this could include the shape of the wings, materials used (card, tissue paper) etc

Writing frames might support and possibly extend pupils.

Fictional friction writing
Recently, when my wife and her colleagues were teaching this work, the invented " Fearless Friction" !!!! Because friction is an invisible force that acts to help us by slowing things down, they thought of it as a superhero who went around stopping cars and people sliding over. They wrote stories, cartoon strips and illustrations. Some invented a sidekick for "Fearless" called Captain Newton and an archenemy. You can imagine the fun and some excellent links to NLS!

Summary
I hope these thoughts are of use to you. Increasingly teaching needs to be about working smarter not just harder. Sharing our ideas and work can help

us with this. Please submit work to websites and email me if you have a comment or suggestion to make.

Resources-websites
SEN website http://home.onet.co.uk/~champmon

DFEE standards website, 'P' scales document.
http://www.standards.dfee.gov.uk/otherresources/publications/targetsetting

Primary resources www.primaryresources.co.uk

Educate www.edcucate.org.uk/teacher_zone/classroom/science/index.htm

Sassoon Font www.clubtyple.co.uk/sassoonintro.html

Writing with symbols, Widget Software www.widget.com

Clicker Plus- cricksoftware. www.cricksoft.com free grids to download at www.clickergrids.com

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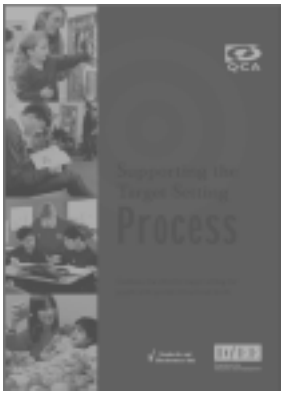


Figure 1

Figure 2 “a” Sassoon font.

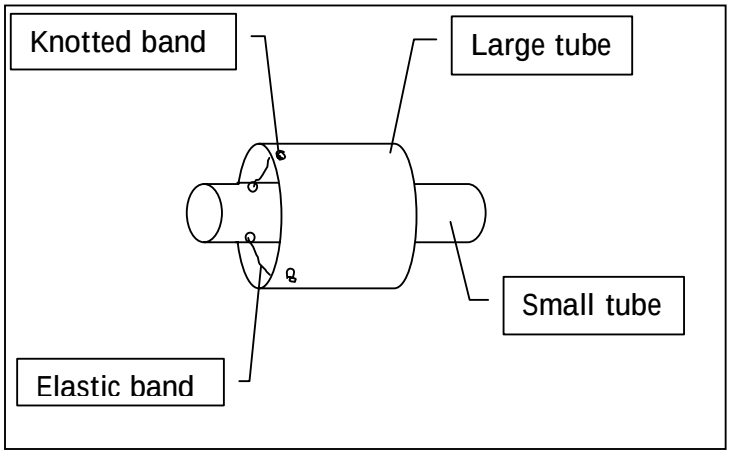
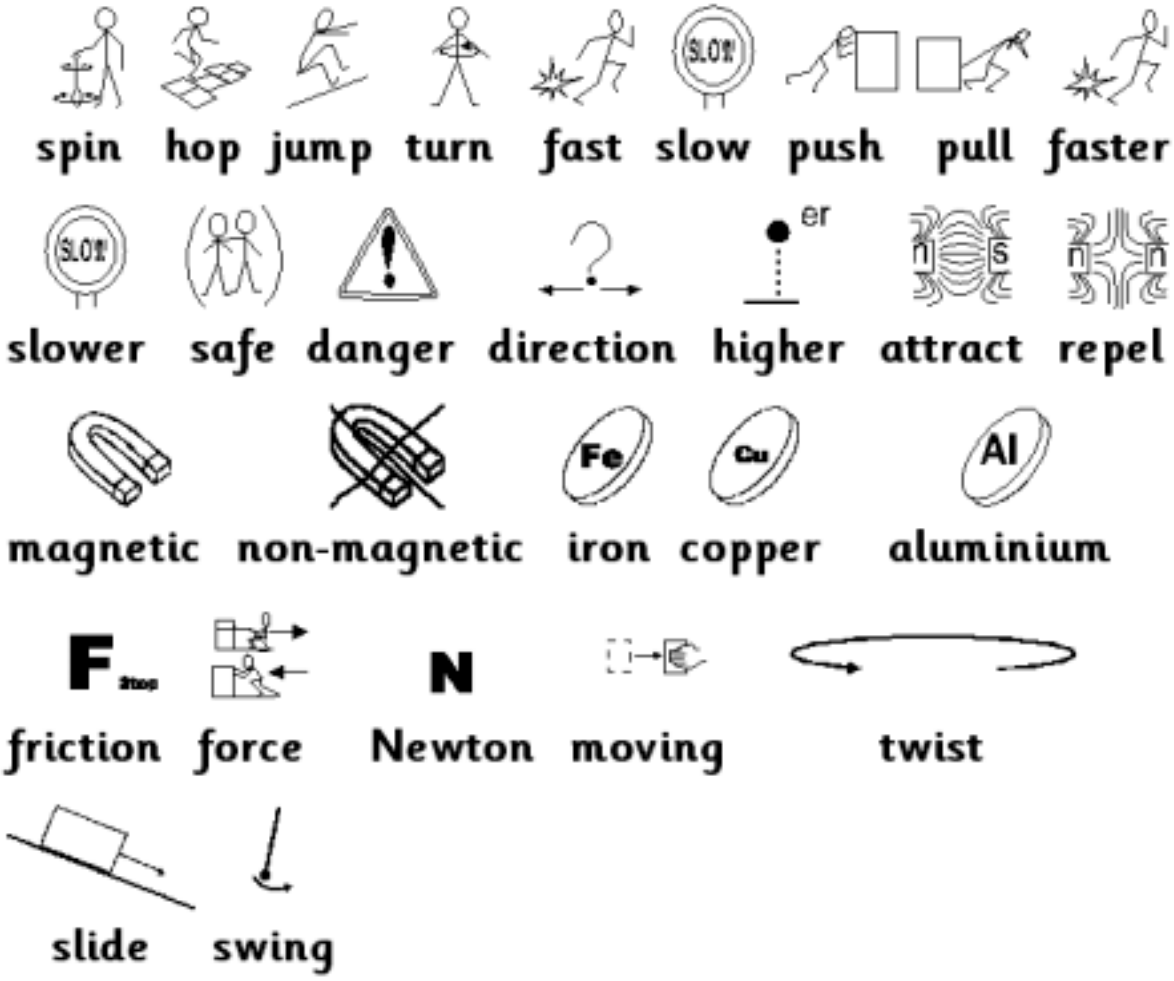


Figure 3 “home made” force meter.

Photocopiable sheets

1 widgit sheet
2 ohp Newton meter
3 spinner
4 writing frame.

Photocopy these on to card or paper, enlarge if needed and cut into “cue “ cards or have a sheet for pupils who may need the vocabulary.
Alternatively photocopy on to acetate for use on an ohp.



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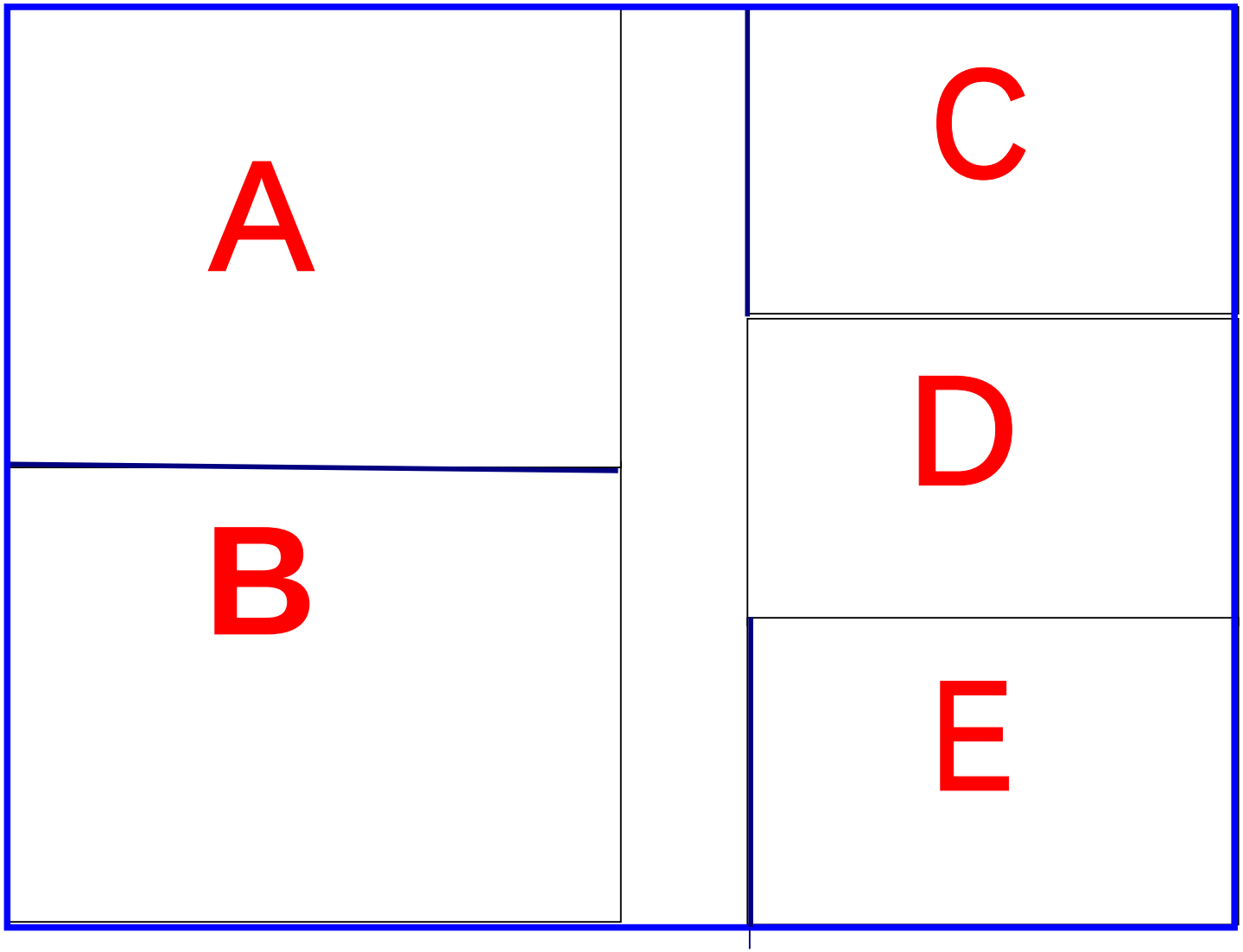


To make a spinner.
Cut around the outside of the spinner.

Cut along the thick line between A and B.

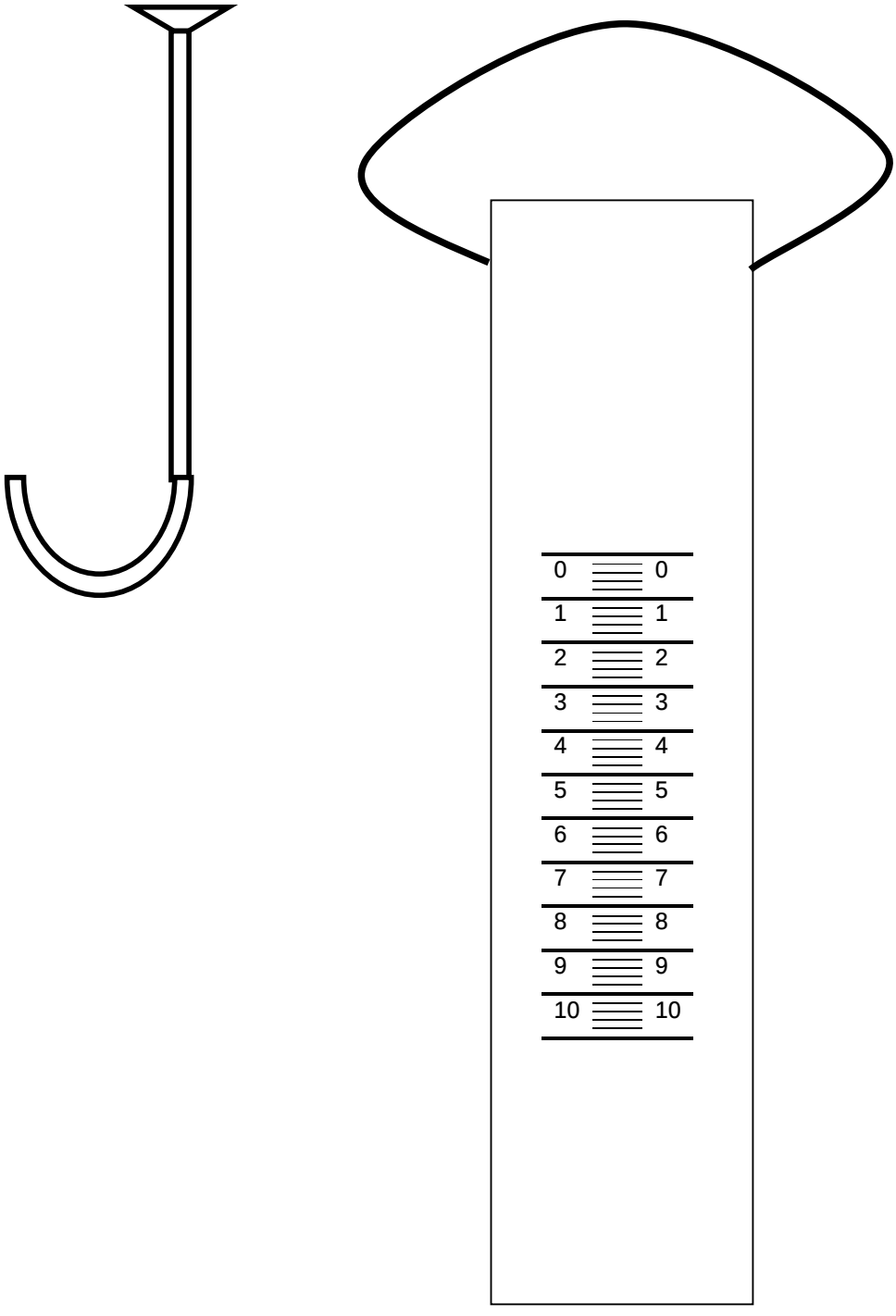
Cut along the thick line between C and A.

Cut along the thick line between B and E.

Fold C onto D. Fold E onto D and fix with a paperclip.

Fold A forward and B backward to make a spinner.

A large drawing of a force meter that could be photocopied onto acetate for use with an ohp.



Science Investigation

Name: Date:

Title of investigation:_____

Plan:
I am going to try to find out:

I think..... What things do you already know about this investigation?

What will you do? How will you do it?

What equipment will you need?

How will you record your results?