



## Assigning Labels to Unknown Solutions

### Task

There are six bottles of solutions on your desk but the labels have fallen off. In your team, you will complete a series of tests in order to put the labels on the right bottles.

The labels are:

copper (II) chloride

iron (III) chloride

iron (II) sulphate sulphuric acid

copper (II) sulphate

ammonium chloride

There are a variety of ways in which you can organise your group. It may help to appoint an overseer or chairman to check progress. Each person could be asked to assign one solution, but this will probably take longer than other methods of organisation.

If you get stuck, your teacher has some hints which may help you.

Once you have completed the practical task please fill in the table below:

| Unknown | Name of ionic compound in solution | Formula of ionic compound |
|---------|------------------------------------|---------------------------|
| A       |                                    |                           |
| B       |                                    |                           |
| C       |                                    |                           |
| D       |                                    |                           |
| E       |                                    |                           |
| F       |                                    |                           |

## Stretch and Challenge

At the end of *Harry Potter and the Philosopher's Stone*, Harry and Hermione face a riddle set by Professor Snape in which they need to identify unknowns using cold hard logic. The riddle is as follows:

Danger lies before you, while safety lies behind,  
Two of us will help you, whichever you would find.  
One among us seven will let you move ahead,  
Another will transport the drinker back instead.  
Two among our number hold only nettle wine,  
Three of us are killer waiting hidden in line.  
Choose, unless you wish to stay here forevermore,  
To help you in your choice we give you these clues four:  
First, however slyly the poison tries to hide  
You will always find some on nettle wine's left side;  
Second, different are those who stand at either end  
But if you would move onwards, neither is your friend;  
Third as you see clearly, all are different size  
Neither dwarf nor giant hold death in their insides;  
Fourth, the second left and the second on the right  
Are twins once you taste them, though different at first sight.

Can you come up with a riddle for identifying your unknowns?

## Hint 1

You may find the following questions useful when planning the practical:

1. How do I identify which solutions contain a sulphate ion?
2. How do I identify which solutions contain a chloride ion?
3. How do I identify the presence of an ammonium ion?
4. What will be observed when sodium hydroxide is added to sulphuric acid?
5. How can all of the unknown be identified in as few steps as possible (hint: only two different anions are present)

| Hint 2  | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| <p>Add sodium hydroxide to a sample of the solution</p> <p>If no precipitate forms, heat the test tube gently and test any gas formed with red litmus paper</p> |   |   |   |   |   |   |
| <p>Add a couple of drops of hydrochloric acid to a sample of the solution, then add barium chloride solution</p>  |   |   |   |   |   |   |
| <p>Add a couple of drops of nitric acid to a sample of the solution, then add silver nitrate solution</p>   |   |   |   |   |   |   |