Name

A-level Chemistry

Bridging Booklet 1

Purpose of the bridging booklet:

To aid progression on the A-level course, it is essential that you hold a solid grounding in the key concepts at GCSE level. This booklet will help you strengthen your application of some of the areas covered at GCSE to accelerate your learning at A-level.

Our expectation is that you complete this booklet and hand it in on your very first A-level chemistry lesson.

Stationary List:

We also expect you to be equipped and ready to go from day one. In your first chemistry lesson, we will show you how to set up your files for the course. This will help with your organisation and provide you with a clear overview of the course.

The following list of items is the stationary that you will require for the course. It is essential that you bring the following equipment to your first lesson.

Items	Check
A4 Lever Arch files x2	
A4 Ringbinder or document wallet x2	
A4 10-Part card file dividers x2	
A4 Ruled refill pads	
HB pencils	
Ruler	
Pens (including red pen)	
Scientific calculator	
Hole puncher *(optional)*	

Chemical formulae

A chemical formula is a useful shorthand method for describing the atoms in a chemical: sometimes you will see the formula used instead of the name, but you should not do this if you are asked for a name.

The chemical formula of an element or compound tells you:

• Which elements it contains: eg $FeSO_4$ contains iron, sulphur and oxygen

• How many atoms of each kind are in each molecule: eg H_2SO_4 contains two atoms of hydrogen, one atom of sulphur and four atoms of oxygen in each molecule

• How the atoms are arranged: eg C_2H_5OH contains a group of atoms known as the ethyl group, $-C_2H_5$, and a hydroxyl group, -OH

• The masses of the various elements in a compound: eg 18 g of water, H_2O, contains 2 g of hydrogen atoms and 16 g of oxygen since the relative atomic mass of hydrogen is 1 (x 2 because there two hydrogen atoms) and that of oxygen is 16.

You should not learn large numbers of chemical formulae by heart. However, it is useful to know a few of them and work out the rest. The table on page 3 shows the names, formulae and valencies (charges) of ions, that you will study.

This set of rules helps you to do this using information in the table.

• Write down the ions given in the chemical name of the compound

• Now cross over the valencies of the ions as shown in the example on page 3

• If an element has more than one valency, the name of the compound will indicate which valency is to be used.

Here are a few examples:

• Sodium Sulphate

$NaSO_4$

2 1

$= Na_2SO_4$

• Calcium Hydrogen carbonate

$Ca(HCO_3)$

2 1

$= Ca(HCO_3)_2$

Note: A bracket must be placed around the ion if it is multiplied by 2 or more and composed of more than one element.

Eg $MgBr_2$ no bracket required

$Ca(OH)_2$ bracket essential as $CaOH_2$ is incorrect.

• Often you can cancel the numbers on the two formulae:

$Ca_2(CO_3)_2 = CaCO_3$

However, you should not do this for organic compounds: C_2H_4 has two atoms of carbon and four of hydrogen so it cannot be cancelled down to CH_2.

• Copper(I) oxide means use copper valency 1, ie Cu_2O: lead(II) nitrate means use lead valency 2, ie $Pb(NO_3)_2$

The periodic table can help you to find the valency of an element and hence the formula of its compounds.

This table contains the more common ions that you met at GCSE. Also included are some that you will meet at A-level.

Cations (Positive ions)			Anions (Negative ions)		
	Formulae	Valency		Formulae	Valency
Aluminium	Al	3	Bromine	Br	1
Ammonium	NH_4	1	Chloride	Cl	1
Barium	Ba	2	Carbonate	CO_3	2
Calcium	Ca	2	Chlorate (I)	ClO	1
Copper	Cu	1&2	Chlorate (V)	ClO_3	5
Hydrogen	H	1	Chromate (VI)	CrO_4	2
Iron	Fe	2&3	Cyanide	CN	1
Lead	Pb	2&4	Dichromate (VI)	Cr_2O_7	2
Magnesium	Mg	2	Hydrogencarbonate	HCO_3	1
Potassium	K	1	Hydroxide	OH	1
Silicon	Si	4	Iodine	I	1
Silver	Ag	1	Manganate (VII)	MnO_4	1
Sodium	Na	1	Nitrate (III)	NO_2	1
Zinc	Zn	2	Nitrate (V)	NO_3	1
			Nitrogen	N	3&5
			Oxygen	O	2
			Phosphate	PO_4	3
			Phosphorous	P	3&5
			Sulfate (IV)	SO_3	2
			Sulfate (VI)	SO_4	2
			Sulfur	S	2

Exercise 1

Writing formulae from names

Use the data in the table on page 3 to write the formulae of the following. Before you start this exercise, make sure you have read page 2-3 of this booklet.

1. Sodium Chloride _____
2. Sodium Hydroxide _____
3. Sodium Carbonate _____
4. Sodium Sulfate (VI) _____
5. Sodium Phosphate _____
6. Potassium Chloride _____
7. Potassium Bromide _____
8. Potassium Iodide _____
9. Potassium Hydrogencarbonate _____
10. Potassium Nitrate (V) _____
11. Magnesium Chloride _____
12. Magnesium Nitrate (III)_____
13. Magnesium Hydroxide _____
14. Magnesium Oxide _____
15. Magnesium Carbonate _____
16. Magnesium Sulfide _____
17. Calcium Oxide _____
18. Calcium Chloride _____
19. Calcium Nitride _____
20. Calcium Sulfate (VI) _____
21. Calcium Carbonate _____
22. Calcium Hydrogen Carbonate _____
23. Barium Chloride _____
24. Barium Sulfate (VI) _____
25. Aluminium Chloride _____
26. Aluminium Oxide _____
27. Aluminium Hydroxide _____
28. Aluminium Sulfate (VI) _____
29. Aluminium Sulfide _____
30. Copper(II) Sulfate (IV) _____

31. Copper(II) Oxide _____
32. Copper(II) Chloride _____
33. Copper(II) Nitrate (V) _____
34. Copper(I) Oxide _____
35. Copper(I) Chloride _____
36. Copper (I) Nitride _____
37. Zinc Nitrate _____
38. Zinc Carbonate _____
39. Zinc Oxide _____
40. Silver Chloride _____
41. Silver Bromide _____
42. Silver Iodide _____
43. Silver Nitrate (III)_____
44. Silver Oxide _____
45. Iron(II) Sulfate (VI) _____
46. Iron(II) Chloride _____
47. Iron(III) Sulfate (IV) _____
48. Iron(III) Chloride _____
49. Iron(III) Hydroxide _____
50. Iron(II) Hydroxide _____
51. Ammonium Chloride _____
52. Ammonium Carbonate _____
53. Ammonium Hydroxide _____
54. Ammonium Nitrate (V) _____
55. Ammonium Sulfate (VI)_____
56. Ammonium Phosphate _____
57. Hydrogen Phosphate (Phosphoric Acid)_____
58. Hydrogen Sulfate (Sulfuric Acid) _____
59. Hydrogen Nitrate (Nitric Acid) _____
60. Hydrogen Chloride (Hydrochloric Acid) _____

Naming of compounds

At A-Level you will meet many compounds that are new to you; a lot of these will be organic compounds. In this section, we will be looking at the naming of compounds that you may already have met at GCSE level. Many of these compounds are named using simple rules.

However, there are some that have 'trivial' names not fixed by the rules. It is important that you learn the names and formulae of these compounds. Later in the course, you will learn the rules for naming most of the organic compounds you will meet.

Naming inorganic compounds

The name must show which elements are present and, where confusion is possible, the valency of the elements concerned.

1) You need to remember that if there are only two elements present then the name will end in -ide

Thus, **oxides** contain an element and oxygen

eg Na_2O is Sodium Oxide

CaO is Calcium Oxide

Chlorides contain an element and chlorine

eg $MgCl_2$ is Magnesium Chloride

$AlCl_3$ is Aluminium Chloride

Bromides and **Iodides** have an element and either bromine or iodine

eg KBr is Potassium Bromide

ZnI is Zinc Iodide

Hydrides contain an element and hydrogen and Nitrides an element and nitrogen.

eg LiH is Lithium Hydride

Mg_3N_2 is Magnesium Nitride

Other elements also form these types of compounds and the name always ends in -ide. The exceptions to this are hydroxides that have the -OH group and cyanides, which have the -CN group.

eg NaOH is Sodium Hydroxide

$Ca(OH)_2$ is Calcium Hydroxide

KCN is Potassium Cyanide

2) If the elements concerned have more than one valency this may need to be shown. Thus as iron has valency 2 and 3, the name Iron Chloride would not tell you which of the two possible compounds $FeCl_2$ or $FeCl_3$ is being considered. In this case the valency of the iron is indicated by the use of a Roman II or III in brackets after the name of the metal. In this case Iron(II) Chloride for $FeCl_2$ or Iron(III) Chloride for $FeCl_3$.

eg $Fe(OH)_2$ is Iron(II) Hydroxide

CuCl is Copper (I) Chloride

3) For compounds containing two non-metal atoms the actual number of atoms of the element present are stated.

eg CO is Carbon Monoxide where **mon-** means one

CO_2 is Carbon Dioxide where **di-** means two

SO_2 is Sulphur Dioxide. This could be called Sulphur(IV) Oxide

SO_3 is Sulphur Trioxide. This could be called Sulphur(VI) Oxide

PCl_3 is Phosphorus Trichloride. This could be called Phosphorus(III) Chloride

PCl_5 is Phosphorus Pentachloride. This could be called Phosphorus(V) Chloride

CCl_4 is Carbon Tetrachloride and $SiCl_4$ is Silicon Tetrachloride.

4) Where a compound contains a metal, a non-metal and oxygen it has a name ending in –ate. You need to remember the names and formulae of the groups listed on page 3.

Thus a compound of sodium, carbon and oxygen would be Na_2CO_3 and would be called Sodium carbonate.

eg $NaNO_3$ is Sodium Nitrate

$Mg(NO_3)_2$ is Magnesium Nitrate

$Fe_2(SO_4)_3$ is Iron(III) Sulfate

$FeSO_4$ is Iron(II) Sulfate

5) Because most non-metals can have more than one valency they can also produce more than one acid upon which these groups are based. Sulfate can also be referred to as sulfate(VI) or sulfate(IV). In the case of nitrogen with oxygen the compounds could be nitrate(V) or nitrate(III).

Great care needs to be taken when using these systematic names, as they are called, because the properties of the two groups of compounds will be very different. In some cases the use of the wrong compound in a reaction could cause considerable danger. For this reason you should always read the label on a bottle or jar and make sure it corresponds exactly to what you should be using.

Other elements can form compounds involving oxygen in this way. These include Chlorate(V), Chromate(VI), Manganate(VII) and Phosphate(V).

eg KNO_2 is Potassium Nitrate(III)

Na_2SO_3 is Sodium Sulfate(IV)

K_2CrO_4 is Potassium Chromate(VI)

$KMnO_4$ is Potassium Manganate(VII)

$KClO_3$ is Potassium Chlorate(V)

6) When a compound is considered it is usual to put the metal down first both in the name and the formula. The exceptions to this rule are in organic compounds where the name has the metal first but the formula has the metal at the end.

eg CH_3COONa is Sodium Ethanoate

7) The elements nitrogen and hydrogen can join together to form a group called the ammonium group. This must not be confused with the compound ammonia, but more of that later. This ammonium group has the formula NH_4^+ and sits in the place generally taken by a metal in the formula.

eg NH_4Cl is Ammonium Chloride

$(NH_4)_2SO_4$ is Ammonium Sulfate

NH_4ClO_3 is Ammonium Chlorate(V)

8) There are a small number of simple molecules that do not follow the above rules. You will need to learn their names and formulae.

They include:

Water which is H_2O

Sulphuric Acid which is H_2SO_4

Nitric Acid which is HNO_3

Hydrochloric Acid which is HCl

Ammonia which is NH_3

Methane which is CH_4

9) Organic compounds have their own set of rules for naming but you will need to learn some of the basic rules. The names are generally based on the names of the simple hydrocarbons.

These follow a simple pattern after the first four:

CH_4 is Methane

C_2H_6 is Ethane

C_3H_8 is Propane

C_4H_{10} is Butane

After butane the names are based on the prefix for the number of carbons C5-pent, C6 - hex and so on.

Thus organic compounds with 2 carbons will either start with Eth- or have -eth- in their name.

eg C_2H_4 is Ethene

C_2H_5OH is Ethanol

CH_3COOH is Ethanoic Acid

C_2H_5Cl is Chloroethane

Exercise 2

Names from formulae

Before you start this exercise make sure you have read page 6-7 of this booklet.

1. H_2O _____
2. CO_2 _____
3. NH_3 _____
4. O_2 _____
5. H_2 _____
6. SO_2 _____
7. SO_3 _____
8. HCl _____
9. HI _____
10. HF _____
11. CH_4 _____
12. H_2S _____
13. HBr _____
14. H_2SO_4 _____
15. HNO_3 _____
16. NaCl _____
17. $NaNO_3$ _____
18. Na_2CO_3 _____
19. NaOH _____
20. Na_2SO_4 _____
21. Na2Cr2O7
22. Na MnO4
23. $CaCl_2$ _____
24. $Ca(NO_3)_2$ _____
25. $Ca(OH)_2$ _____
26. $CaSO_4$ _____
27. $BaCl_2$ _____
28. $AlCl_3$ _____
29. $Al(NO_3)_3$ _____
30. $Al_2(SO_4)_3$ _____
31. $FeSO_4$ _____

32. $FeCl_2$ _____

33. $FeCl_3$ _____

34. $Fe_2(SO_4)_3$ _____

35. $Fe_2(SO_3)_3$ _____

36. ZnO _____

37. Zn_3N_2 _____

38. $Zn(NO_2)_2$ _____

39. $Cu(NO_3)_2$ _____

40. $CuCl$ _____

41. $CuCl_2$ _____

42. $CuSO_4$ _____

43. $ZnCl_2$ _____

44. $AgNO_3$ _____

45. NH_4Cl _____

46. $(NH_4)_2SO_4$ _____

47. $KClO_3$ _____

48. KIO_3 _____

49. $NaClO$ _____

50. $NaNO_2$ _____

51. C_2H_6 _____

52. C_4H_{10} _____

53. C_8H_{18} _____

54. $(NH_4)_2CO_3$ _____

55. $KMnO_4$ _____

56. K_2CrO_4 _____

57. $KHCO_3$ _____

58. KI _____

59. $Co(NO_3)_2$ _____

60. KAt _____

Name

A-level Chemistry

Bridging Booklet 2

Purpose of the bridging booklet:

One of the topics that always proves to be troublesome for students at A-level is bonding and structures; in part this is because students hold over misconceptions (wrong ideas) from GCSE. This booklet will help identify the misconceptions that you hold and hopefully encourage you to think more deeply about concepts on bonding and structures.

Our expectation is that you complete this booklet and hand it in on your very first A-level chemistry lesson.

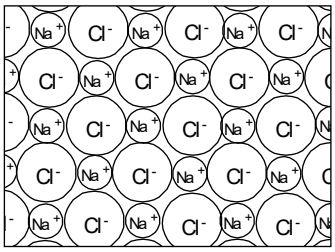
A reminder:

The following list of items is the stationary that you will require for the course. It is essential that you bring the following equipment to your first lesson.

Items	Check
A4 Lever Arch files x2	
A4 Ringbinder or document wallet x2	
A4 10-Part card file dividers x2	
A4 Ruled refill pads	
HB pencils	
Ruler	
Pens (including red pen)	
Scientific calculator	
Hole puncher *(optional)*	

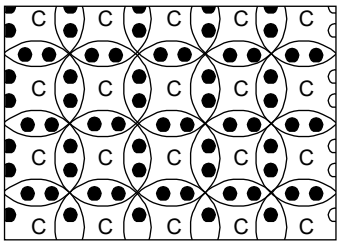
Spot the bonding

This exercise comprises of a set of diagrams showing a range of chemical species and systems. For each diagram: either write the name or names of the type or types of bonding present, or write none (if there is no chemical bonding) or do not know if you are unsure.



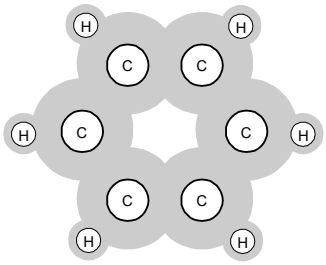
Sodium chloride lattice

1. _____
_____
_____



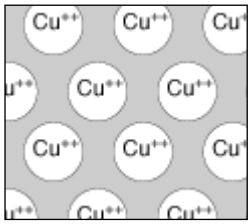
Diamond lattice

2. _____
_____
_____



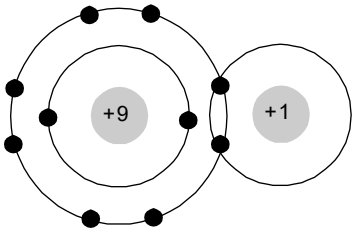
Benzene molecule

3. _____
_____
_____



Copper metal lattice

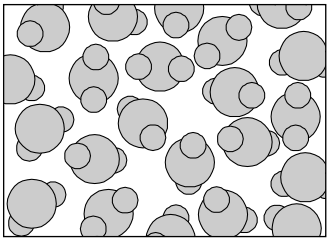
4. _____
_____
_____



Hydrogen fluoride molecule

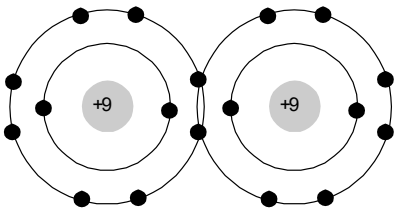
Hydrogen fluoride molecule

5. _____
_____
_____



Liquid water

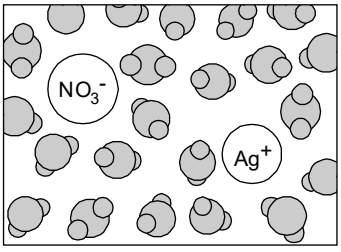
6. _____
_____
_____



Fluorine molecule

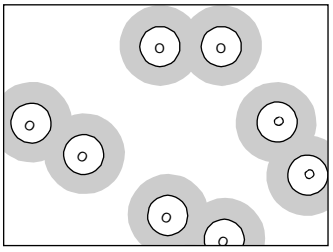
Fluorine molecule

7. _____
_____
_____



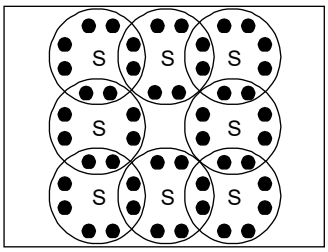
Sodium nitrate solution

8. _____
_____
_____



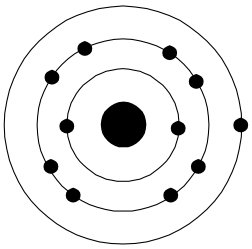
Oxygen gas

9. _____
_____
_____



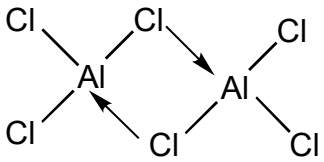
Sulfur molecule

10. _____
_____
_____



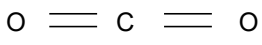
Sodium atom

11. _____
_____
_____



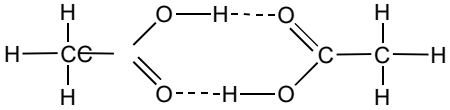
Aluminium chloride dimer

12. _____
_____
_____



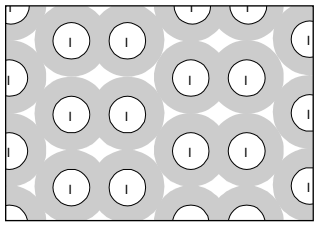
Carbon dioxide molecule

13. _____
_____
_____



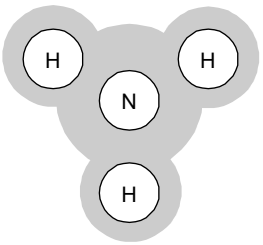
Ethanoic acid dimer

14. _____
_____
_____



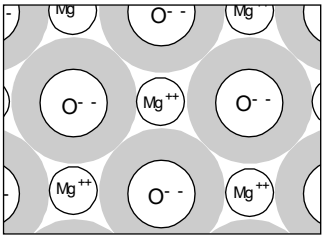
Iodine lattice

15. _____
_____
_____



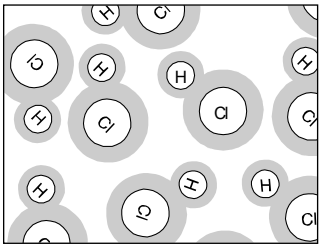
Ammonia molecule

16. _____
_____
_____



Magnesium oxide lattice

17. _____
_____
_____

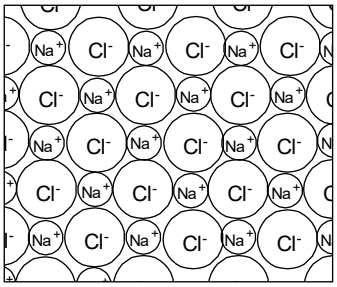


Liquid hydrogen chloride

18. _____
_____
_____

Ionic bonding – true or false?

The statements below refer to the diagram of the structure of sodium chloride. The diagram shows part of a slice through the three dimensional crystal structure.

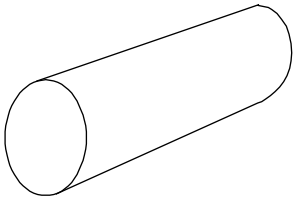


Please read each statement carefully, and decide whether it is correct or not.

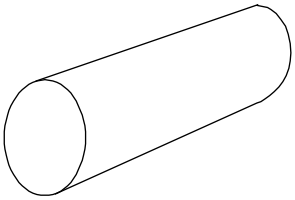
1. A positive ion will be attracted to any negative ion.
2. A sodium ion is only bonded to the chloride ion it donated its electron to.
3. A sodium atom can only form one ionic bond, because it only has one electron in its outer shell to donate.
4. The reason a bond is formed between chloride ions and sodium ions is because an electron has been transferred between them.
5. In the diagram a chloride ion is attracted to one sodium ion by a bond and is attracted to other sodium ions just by forces.
6. In the diagram each molecule of sodium chloride contains one sodium ion and one chloride ion.
7. An ionic bond is the attraction between a positive ion and a negative ion.
8. A positive ion can be bonded to any neighbouring negative ions, if it is close enough.
9. A negative ion can be attracted to any positive ion.
10. It is not possible to point to where the ionic bonds are, unless you know which chloride ions accepted electrons from which sodium ions.
11. A chloride ion is only bonded to the sodium ion it accepted an electron from.
12. A chlorine atom can only form one ionic bond, because it can only accept one more electron into its outer shell.
13. There is a bond between the ions in each molecule, but no bonds between the molecules.
14. A negative ion can only be attracted to one positive ion.
15. The reason a bond is formed between chloride ions and sodium ions is because they have opposite charges.
16. In the diagram a sodium ion is attracted to one chloride ion by a bond and is attracted to other chloride ions just by forces.
17. A positive ion can only be attracted to one negative ion.
18. An ionic bond is when one atom donates an electron to another atom, so that they both have full outer shells.
19. A negative ion can be bonded to any neighbouring positive ions if it is close enough.
20. There are no molecules shown in the diagram.

Chemical comparisons

The two diagrams below show things you might study in chemistry. Think about how the things shown in the diagrams are similar and how they are different:



Iron



Sulfur

List the similarities and differences you can think of below.

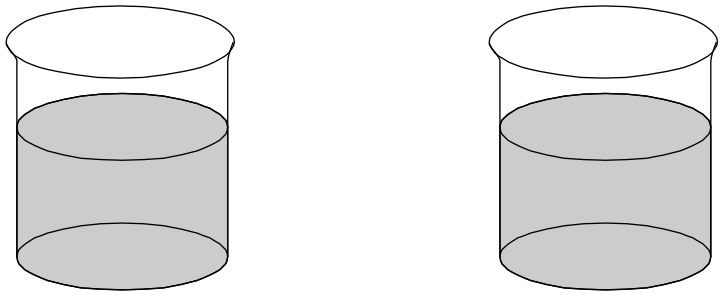
In which ways are they alike?

In which ways are they different?

Which of these similarities and differences do you think are important to chemists? Put a star symbol (*) in front of the important similarities, and the important differences.

Chemical comparisons

The two diagrams below show things you might study in chemistry. Think about how the things shown in the diagrams are similar and how they are different:



Water

Sugar solution

List the similarities and differences you can think of below.

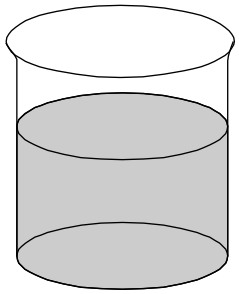
In which ways are they alike?

In which ways are they different?

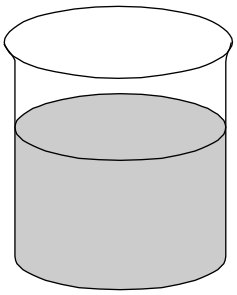
Which of these similarities and differences do you think are important to chemists? Put a star symbol (*) in front of the important similarities, and the important differences.

Chemical comparisons

The two diagrams below show things you might study in chemistry. Think about how the things shown in the diagrams are similar and how they are different:



Sea water



Mercury

List the similarities and differences you can think of below.
In which ways are they alike?

In which ways are they different?

Which of these similarities and differences do you think are important to chemists? Put a star symbol (*) in front of the important similarities, and the important differences.