

GCSE to A LEVEL

Summer Project

Name:
Subject: A Level Chemistry

The purpose of this A Level Summer project is to introduce you to studying this subject at A Level standard. You will need to complete 10 hours of study on each subject every week, 4½ in class with your teacher and the rest as independent learning. Therefore, it is important that you enjoy this subject and that you start to practice your study skills as early as possible. Some subjects have significant maths content (for example business, psychology, economics); others require strong essay writing skills (for example history, English). Think about the study skills and underpinning knowledge you will require in this subject - not just the title.

If after completing this project you think this may not be your ideal choice, you can ask to transfer to another subject at the start of term, as long as you have the entry requirements and it fits alongside your other choices on the A Level Matrix (timetable). If you do decide to change subject, you will be required to complete the Summer project for your new choice too.

This is also your first taste of Flipped Learning and elements will be used within your first week of lessons.

Please ensure your name, student number and subject are clearly noted on each page and bring it with you to hand in at Enrolment.

We hope you enjoy this project as you start your A Level journey.

HOW TO SUBMIT:

Please print your completed project and bring a copy with you to Induction in a clearly labelled plastic wallet.

If you don't have access to a printer, electronic copies can be emailed as a Word or PDF attachment to ALevel_Chemistry@chichester.ac.uk with the email clearly labelled 'Chemistry Summer Project' prior to Induction.

A LEVEL CHEMISTRY



Preparation Task for Year 1 Chemistry

Having completed your GCSEs, now is the time to begin the preparation for your A Level Chemistry

Throughout Year 1, there will be Formal Progress Points. Progression into Year 2 will be based on these assessments. It is therefore of great importance that this Summer task is done well, so that you can hit the ground running and make a strong and positive start.

Read and work your way through the attached booklet Answer all questions in the spaces provided and bring the completed workbook with you at the beginning of term.

Thorium

Iodine

Sulfur

Iodine

Sulfur

Lithium

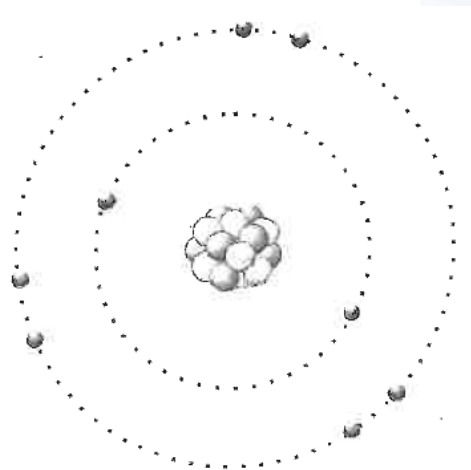
Iron

*Don't waste it

1. ATOMIC STRUCTURE

What are atoms like?

1. All atoms have a nucleus at their centre containing neutrons and protons.
2. Almost all of the mass of the atom is contained in the nucleus which also has an overall positive charge.
3. The positive charge arises because each of the protons in the nucleus has a +1 charge.
4. The nucleus is tiny compared with the total volume occupied by the whole atom.
5. The neutrons in the nucleus have a very similar mass to the protons but they are uncharged.
6. The electrons orbit the nucleus in shells (or energy levels). The electrons are much smaller and lighter than either the neutrons or protons
7. The volume occupied by the orbits of the electrons determines the size of the atom.



What is the charge on an atom?

The overall charge on an atom is zero.

This is because each +1 charge from a proton in the nucleus is cancelled out by a -1 charge from an electron.

If an atom loses or gains electrons it becomes charged. These charged particles are called ions. The fact that the protons and electrons are oppositely charged also helps to explain why the electrons remain in orbit: opposites attract.

Have a go at these questions:

Copy and complete the table

1. What is the charge on an ion formed when an atom loses 2 electrons?
2. What is the charge on an ion formed when an atom gains 2 electrons?

Particle	Relative Mass	Relative Charge
Proton	1	
Neutron		
Electron	$\frac{1}{1840}$ 0	

Answers:

- 1.
- 2.

2. ATOMIC NUMBER, MASS NUMBER AND ISOTOPES

Atomic and Mass Numbers

The atomic number of an element is given the symbol Z .

It is sometimes called the proton number as it represents the number of protons in the nucleus of the element.

For atoms the number of protons equals the number of electrons, but you need to take care when considering ions as the number of electrons changes when an ion forms from an atom.

The mass number of an atom is given the symbol A . It represents the total number of neutrons and protons in the nucleus. Subtracting Z from A allows you to calculate the number of neutrons in the nucleus.

Try this question. You may need to refer to the Periodic Table.

1. Copy and complete the table.

Element	Symbol	Z	A	No Protons	No Neutrons	No Electrons
Sodium			23			
		6	12			
		12			12	
		84	210			
Chlorine		17	35			
Chlorine		17	37			

Isotopes

The last two examples in the table above show two chlorine atoms with different numbers of neutrons. These are called isotopes of chlorine. Both are chlorine atoms because they have the same number of protons - but they have different numbers of neutrons. In other words they have the same atomic number but different mass numbers. Isotopes are very common: some occur naturally and some are man-made. Some elements may have a large number of isotopes.

Have a go at these questions:

In terms of the numbers of subatomic particles, state one difference and two similarities between two isotopes of the same element.

2. Give the chemical symbol, mass number and atomic number of an atom which has 3 electrons and 4 neutrons.
3. Three isotopes of carbon are: carbon-12, carbon-13 and carbon-14. State the numbers of protons, neutrons and electrons in each.

Answers:

3. ARRANGEMENT OF ELECTRONS

Electrons are arranged in energy levels

Electrons orbit the nucleus in energy levels (also known as shells).

The first energy level can contain up to 2 electrons. It is called an s Level.

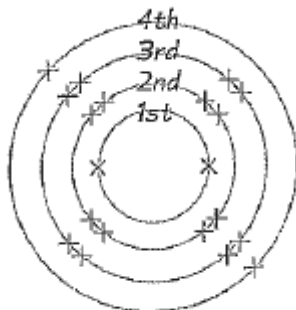
The second energy level can contain up to 8 electrons. However it is actually split into 2 sub-levels. Two of the electrons are an 's level' and the remaining 6 are 'p level'.

At GCSE the 's' and 'p' levels are not distinguished. You simply combine the 2 's' electrons with the 6 'p' electrons to make a total of 8.

How can electron arrangements be represented?

You can draw concentric circles to represent different energy levels.

For an atom with 20 electrons:



The diagram shows the energy levels filling up with electrons. Remember, you should always start filling the innermost levels first.

Here's another way to show electron arrangements:

An atom with 6 electrons: 2,4

An atom with 11 electrons: 2,8,1

An atom with 20 electrons: 2,8,8,2

Use the Periodic Table to help answer the following questions:

1. Draw diagrams to show the electron arrangements of the following elements: carbon, fluorine, magnesium, sulphur.
2. Write the electron arrangements of the following elements using the format shown above: lithium, sodium, potassium, beryllium, magnesium, calcium.

Answers:



4. IONIC BONDING

Reaction between Group 1 and Group 2 elements

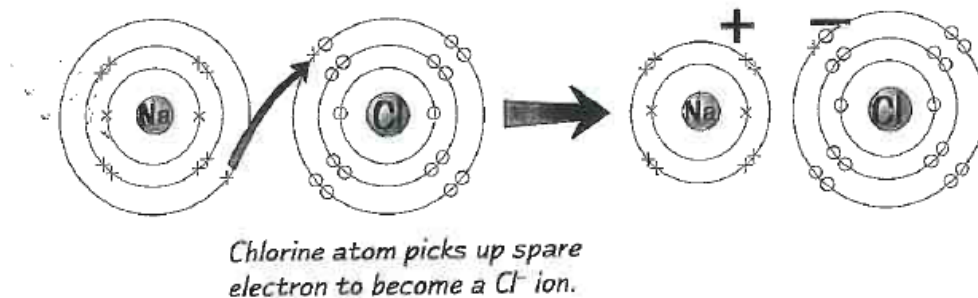
Elements in Groups 1, 2, 6 and 7 react to form ionic compounds.

For example: sodium reacting with chlorine to form sodium chloride.

Example: Sodium reacting with chlorine to form sodium chloride.

Sodium atom gives up outer electron to become a Na^+ ion.

The positively charged Na^+ ion is attracted to the negatively charged Cl^- ion, forming an ionic bond.



The example shows a typical reaction between a Group 1 element and a Group 7 element. The sodium atom donates its single outer electron to the outer shell of the chlorine atom. As a result, both elements end up with a full outer shell of electrons.

In a similar way, Group 2 elements react by donating two electrons and Group 6 elements react by gaining two electrons.

Have a go at these:

1. Draw a diagram showing how a magnesium atom reacts with an oxygen atom. In your diagram try to clearly demonstrate the electron transfer process.
2. Draw a diagram showing the electron transfer process that results in the formation of calcium chloride (CaCl_2).

Answers:

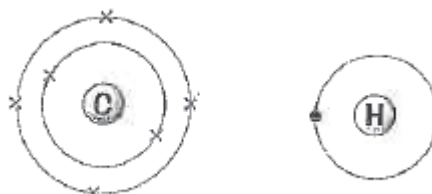


5. COVALENT BONDING

Reaction between carbon and hydrogen

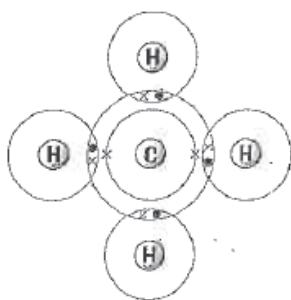
Ionic bonding only really works between metals with one or two electrons in their outer shell, and non-metals that are one or two electrons short of a full outer shell. Elements with half-full shells have to do something different.

The diagram below shows 2 such atoms: carbon and hydrogen.

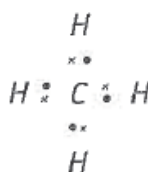


These elements do not gain or lose electrons. They share their electrons rather than transferring them. This results in the formation of covalent bonds. A covalent bond is a shared pair of electrons. When a small number of atoms share electrons in this way a small covalent molecule results.

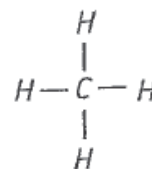
Such molecules can be represented in several different ways:



where dots represent electrons from the H and crosses represent electrons from the C



this is a much simplified version of the previous representation



here each dash represents a single covalent bond (this is the easiest, and therefore most common notation)

Try this question:

1. Draw 'dot and cross' diagrams showing the shared electron pairs in the following molecules: hydrogen (H_2), chlorine (Cl_2), ammonia (NH_3), water (H_2O), oxygen (O_2). Ethane (C_2H_6)

Answers:

6. FORMULAE OF COMPOUNDS

Deducing the formulae of ionic compounds

The formula of a compound tells you the ratio of the elements that it contains. This ratio is fixed, and for ionic compounds that means it's easy to work out the formula from the charges on the ions.

Metal ions (and hydrogen ions) always carry a positive charge, whilst non-metal ions carry a negative charge. If you imagine that a positive charge is a 'hook' and a negative charge is an 'eye' then the formula can be deduced by exactly matching up the hooks and eyes. (This is to make the compound electrically neutral - it's the same idea as the ionic lattices further on in this document.)

Na^+ (sodium ion) has +1 charge so 1 hook

Mg^{2+} (magnesium ion) has +2 charge so 2 hooks

OH^- (hydroxide ion) has -1 charge so 1 eye

O^{2-} (oxide ion) has -2 charge so 2 eyes

Example 1: What is the formula of sodium oxide?



We need an extra Na^+ to give us a second hook to match the second of the eyes on the O^{2-} ion.

We have 2 Na^+ ions to every O^{2-} ion, so the formula is Na_2O .

Example 2: What is the formula of magnesium hydroxide?



Note the use of a bracket to show 2 lots of OH which is not the same as OH_2 . Brackets are most often used when the non-metallic ion contains more than one element.

There are 2 OH^- ions to every Mg^{2+} ion so the formula is $\text{Mg}(\text{OH})_2$.

Now try these.

Use the charges on the ions shown below to deduce the formulae of the following ionic compounds:

1. sodium chloride	6. potassium oxide
2. calcium bromide	7. aluminium oxide
3. sodium carbonate	8. potassium nitrate
4. aluminium oxide	9. aluminium sulfate
5. iron (II) chloride	10. iron (III) nitrate

aluminium: Al^{3+}

chloride: Cl^-

oxide: O^{2-}

bromide: Br^-

iron(II): Fe^{2+}

potassium: K^+

calcium: Ca^{2+}

iron(III): Fe^{3+}

sodium: Na^+

carbonate: CO_3^{2-}

nitrate: NO_3^-

sulfate: SO_4^{2-}

Answers:



7. WRITING AND BALANCING EQUATIONS

Example: write a balanced equation for the reaction of magnesium with hydrochloric acid.

Step 1: *Magnesium + hydrochloric acid → magnesium chloride + hydrogen*

Step 2: $\text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

Step 3: $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
(the Mgs already balance,
put a 2 in front of HCl to balance the Hs and Cls. Check that all still balances.)

Now try this question.

1. Write a balanced symbol equation for the combustion of methane (CH_4) in oxygen:

Step 1 has been done for you

Step 1: *Methane + oxygen → carbon dioxide + water*

Use everything you have learned in this document so far to answer these questions:

- 2) Balance the symbol equations for the following reactions:
 - a) $\text{K} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2$
 - b) $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - c) $\text{Na}_2\text{O} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 - d) $\text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
- 3) Write balanced symbol equations for the following reactions.
 - a) the complete combustion of the fuel ethanol ($\text{C}_2\text{H}_5\text{OH}$) in oxygen.
 - b) the reaction of calcium hydroxide with hydrochloric acid to give calcium chloride and water.

chloride ion: Cl^- hydrogen ion: H^+ hydroxide ion: OH^- calcium ion: Ca^{2+}

Answers:



8. THE MOLE

A Mole is a number of particles

If you wanted to count the number of atoms that you had in a sample of a substance, you would have to use some very big numbers, and spend a very long time counting.

So you need a unit to describe the amount of a substance that you have - that unit is the mole.

One mole of a substance contains 6.02×10^{23} particles.

6.02×10^{23} mol⁻¹ is known as Avogadro's number

The particles can be anything - e.g. atoms or molecules.

So 6.02×10^{23} atoms of carbon is 1 mole of carbon, and 6.02×10^{23} molecules of CO₂ is 1 mole of CO₂



Molar Mass is the mass of one Mole

One mole of atoms or molecules has a mass in grams equal to the relative formula mass (A_r or M_r) of that substance.

Carbon has an A_r of 12 \longrightarrow 1 mole of carbon weighs 12 g \longrightarrow The molar mass of carbon is 12 g/mol
 CO₂ has an M_r of 44 \longrightarrow 1 mole of CO₂ weighs 44 g \longrightarrow The molar mass of CO₂ is 44 g/mol
 So you know that 12 g of carbon and 44 g of CO₂ must contain the same number of particles.

You can use molar mass in calculations to work out how many moles of a substance you have.

Just use this formula:
$$\text{Number of moles} = \frac{\text{Mass of substance (g)}}{\text{Molar mass (g/mol)}}$$

Example: how many moles of sodium oxide are present in 24.8g of Na₂O?

Molar mass of Na₂O = $(2 \times 23) + (1 \times 16) = 62 \text{ g/mol}$

Number of moles of Na₂O = 24.8g divided by 62g/mol
 = 0.4 moles

Use the Periodic Table to help you answer these questions:

1. Find the molar mass of zinc
2. Find the molar mass of sulphuric acid H_2SO_4
3. How many moles of sodium chloride are present in 117g of NaCl
4. I have 54g of water (H_2O) and 84g of iron (Fe). Do I have more moles of water or of iron?

Answers:

9. DETERMINATION OF FORMULA FROM EXPERIMENTS

Empirical and molecular formulae

The empirical formula of a compound is the simplest ratio of the atoms of each element in the compound.

The molecular formula of a compound gives the actual number of atoms of each element in the compound.

For example, a compound with the molecular formula C_2H_6 has the empirical formula CH_3 .

The **ratio** of the atoms is one C to every three Hs.

Calculating empirical formulae

Often, the only way to find out the formula of a compound is through experimentation and calculation. You can calculate the formula of a compound from the masses of the reactants.

Here is a simple set of rules to follow when calculating a formula:

1. Write the mass or percentage mass of each element.
2. Find the number of moles of each substance by dividing by the atomic or molecular mass.
3. Divide all answers by the smallest answer.
4. If required: multiply to make up to whole numbers.
5. Use the ratio of atoms to write the formula (this gives the empirical formula).

Example: find the formula of an oxide of aluminium formed from 9.00g aluminium and 8.00g oxygen.

- 1) First write down the mass of each substance:
Al: 9.00 g O: 8.00 g
- 2) Divide the mass by the atomic masses to find the number of moles of each substance:
Al: $9.00 \div 27.0 = 0.333$ moles O: $8.00 \div 16.0 = 0.500$ moles
- 3) Divide by the smallest number, which is 0.333:
Al: $0.333 \div 0.333 = 1.00$ O: $0.5 \div 0.333 = 1.50$
- 4) Multiply by 2 to give whole numbers:
Al: $1.00 \times 2 = 2$ O: $1.50 \times 2 = 3$
- 5) The ratio of Al:O is **2:3**.
The empirical formula is **Al₂O₃**.

Questions:

1. Find the empirical formulae of the following oxides:
(a) An oxide containing 12.9g of lead to every 1.00g of oxygen
(b) An oxide containing 2.33g of iron to every 1.00g of oxygen
(Relative atomic mass values: Pb = 207.2, O = 16.0, Fe = 55.8)
2. Calculate the empirical formula of the carboxylic acid that is comprised of 4.30% hydrogen, 26.1% carbon and 69.6% oxygen
(Relative atomic mass values: H = 10, C = 12.0, O = 16.0)

Answers:

1. (a)
1. (b)

2.

10. CALCULATION OF MOLECULAR FORMULAE

Use the Relative Formula Mass to work out the Molecular Formula

To find the molecular formula from the empirical formula, you need to know the relative formula mass of the compound. This will usually be given to you in the question. Read through the example below and then try the questions.

EXAMPLE: Calculate the molecular formula of a hydrocarbon molecule if the compound contains 85.7% carbon and its relative formula mass is 42.0.

First calculate the empirical formula:

In 100 g of the compound, there will be:

C: 85.7 g H: (100 g – 85.7 g) = 14.3 g

Number of moles of each compound:

C: $85.7 \div 12.0 = 7.14$ H: $14.3 \div 1.0 = 14.3$

Divide by the smallest number (7.14):

C: $7.14 \div 7.14 = 1$ H: $14.3 \div 7.13 = 2$

So the ratio of C:H is **1:2**.

The empirical formula is **CH₂**.

Hydrocarbons only contain carbon and hydrogen, so any mass that isn't carbon will be hydrogen.

Calculate how many multiples of the empirical formula the molecular formula contains:

The empirical formula (CH₂) has a relative mass of $12.0 + 1.0 + 1.0 = 14.0$.

The molecular formula has a relative mass of 42.0.

$42.0 \div 14.0 = 3$

To find the molecular formula, multiply each of the values in the empirical formula by 3:

C: $1 \times 3 = 3$ H: $2 \times 3 = 6$

The molecular formula is **C₃H₆**.

The example above uses percentage compositions rather than the mass of each element in the compound. You can calculate the percentage composition yourself using the formula:

$$\text{percentage composition of element X} = \frac{\text{total mass of element X in compound}}{\text{total mass of compound}} \times 100\%$$

Questions:

1. Calculate the molecular formula of a compound containing 52.2% carbon, 13.0% hydrogen and 34.8% oxygen if the relative formula mass of the compound is 46.0
(Relative atomic mass values: C = 12.0, H = 1.0, O = 16.0)
2. Calculate the molecular formula of a hydrocarbon with a relative formula mass of 78.0 that contains 92.3% carbon
(Relative atomic mass values: C = 12.0, H = 1.0)
3. Find the percentage composition of oxygen in each of the following compounds:
 - (a) Ethanol ($\text{C}_2\text{H}_5\text{OH}$)
 - (b) Nitric acid (HNO_3)
 - (c) Propanone ($\text{C}_3\text{H}_6\text{O}$)

Answers:

10. MAKING USE OF THE PERIODIC TABLE

The Periodic Table holds lots of useful information

From the atomic number you can work out the electronic configuration of an atom of the element.

The mass number is the total number of protons and neutrons in the nucleus of one atom of an element.

The first letter of the symbol is always a capital. If there is a second then it is lower case e.g. C, Na, K, Cl

This line marks the boundary between metals and non-metals. All those elements to the right of it are non-metals.

Atomic number (or proton number) is the number of protons in the nucleus. This is also the number of electrons in an atom.

The relative atomic mass is the average mass number for all the isotopes of an element, taking into account their relative abundance (see page 3).

Group 1 2

Group 3 4 5 6 7 8

Group 9 10 11 12 13 14 15 16 17 18

Group 19 20

Group 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000

Transition Metals

P block

S block

A more attractive version is shown below!

PRODUCED BY THE FOUNDATION FOR EDUCATION, SCIENCE AND TECHNOLOGY FOR NATIONAL SET WEEK 2003

PERIODIC TABLE of the ELEMENTS

PROBABLY COMPILED BY THE SHUTTLEWORTH FOUNDATION

DEPARTMENT OF SCIENCE AND TECHNOLOGY

DMITRI MENDELEEV (1834 - 1907)

The Russian chemist, Dmitri Mendeleev, was the first to observe that if elements were listed in order of atomic mass, they showed regular (periodical) repeating properties. He formulated his discovery as periodic table of elements, now regarded as the backbone of modern chemistry.

The crowning achievement of Mendeleev's periodic table lay in his prophesy of then undiscovered elements. In 1869, the year he published his periodic classification, the elements gallium, germanium and scandium were unknown. Mendeleev left spaces for them in his table and even predicted their atomic masses and other chemical properties. Six years later, gallium was discovered and his predictions were found to be accurate. Other discoveries followed and their chemical behaviour matched that predicted by Mendeleev.

This remarkable man, the youngest in a family of 17 children, has left the scientific community with a classification system so powerful that it became the cornerstone in chemistry teaching and the prediction of new elements ever since. In 1955, element 101 was named after him: 101, Mendelevium.

Legend: Gas, Liquid, Solid, Man-made (synthetic)

States of matter at room temperature (approximate):

- Gas: H, He, Ne, Ar, Kr, Xe, Rn, N, O, F, Cl, Br, I, At, Hg, Tl, Pb, Bi, Po, At, Rn, Fr, Ra, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr
- Liquid: Hg, Br, I, At, Rn, Fr, Ra, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr
- Solid: All other elements
- Man-made (synthetic): All elements with atomic number greater than 82 (lead)

You can follow trends in physical and chemical properties down vertical groups and across horizontal lines.

All elements in a group have the same outer electron configuration and so form ions with the same charge.

Knowing the number of electrons in the outer shell means you can work out the formulae of compounds.

Learn and practice some important skills

You'll find chemistry heaps easier if you get used to working with the basic information that's contained in the Periodic Table.

1. One of the most important things that you can learn is the names and symbols of the elements -particularly the more common ones that you'll need to use a lot.
2. If you know the atomic number of an element in the Periodic Table, you can work out its electronic configuration.
3. Being able to do that will help you to work out the formulae of compounds, ionic or covalent, quickly.

Use these questions and the Periodic Table to improve your skills.

1. Find the symbols or names of the following elements: calcium, vanadium, phosphorous, Br, tin, Au, W, potassium, manganese, boron, Sb, thallium.
2. Find the proton number for each of the elements in question 1.
3. Using only the proton number, write out the electronic configurations, using both crosses and the shorthand (2,8,4), for these elements: Na, 5, Ca, N, Mg, He.
4. What is the charge on the ions formed by each of these elements: K, magnesium, nitrogen, sulfur, Al, I?
5. Work out the formulae of the following compounds: magnesium oxide, lithium bromide, aluminium sulfide, iron(II) oxide, copper(II) chloride.
6. Use the following information to predict the properties of a bromide.

Fluorine is a highly reactive gas with a boiling point of -188°C

chlorine is a reactive gas with a boiling point of -35°C ,

iodine is a fairly unreactive solid with a boiling point of 184°C .

Answers: