1) Which of the following pairs of species would have the greatest similarities in chemical properties?

$^{12}_{6}C$ and $^{14}_{6}C$

$^{14}_{6}C$ and $^{14}_{7}N$

$^{14}_{7}N^{3-}$ and $^{14}_{7}N$

$^{12}_{6}C$ and $^{14}_{6}C$ as they are isotopes of the same element and have the same electron configurations (this determines the chemical properties). $^{14}_{6}C$ and $^{14}_{7}N$ are different elements and as such have different electron configurations. $^{14}_{7}N^{3-}$ is an ion with a different electron configuration to $^{14}_{7}N$.

2) Consider the relative abundance of the isotopes of the element Lithium.

Relative abundance of the isotope $^{6}_{3}Li$ = 7.6%
Relative abundance of the isotope $^{7}_{3}Li$ abundance = 92.4%

What is the relative atomic mass of Lithium?

6
7
Between 6 and 6.5
Between 6.5 and 7

3) Write an equation for the first ionisation energy of beryllium (Be)

$Be(g) \rightarrow Be^{+}(g) + e^{-}$

4) Is F larger than F^{-}? No

F^{-} has 1 electron more and therefore electron-electron repulsions mean that the ionic radius is greater than the atomic radius.

5) Is Ca larger than Mg?

Yes, Ca is in period 4 and Mg is in period 3 therefore Ca has 1 more shell of electrons.

6) Is Ca larger than Ca^{2+}?

Yes, Ca^{2+} has lost the two valence electrons from the Ca atom and so Ca^{2+} has 1 electron shell less.

7) Do elements in the same group show similar properties? Why?

Yes, because they have the same number of valence electrons.

7) Do elements in the same period show similar properties? Why?

No, as you saw with the graphs you plotted of ionisation energies and boiling points across periods. The number of electrons in the valence shell is the main factor in the properties of elements.

Look back over the graphs of boiling points across the periodic table we plotted at the start of the year.

8) Do group 2 metals have high or low boiling/melting points?

Group 2 metals have relatively high boiling points (around 1500-1000 °C). They have higher boiling points than group 1 metals because the ions in their metallic structure (remember metals are positive ions and a sea of delocalised electrons) have a 2+ charge whereas in group 1 metals they have a 1+ charge. This means that the attraction between the ions and the delocalised electrons in group 2 metals is stronger than in group 1 metals.

Remind yourself of the demonstration reactions of group 1 metals with water. They reacted violently.

9) Did the group 2 metals (Magnesium and calcium) that you reacted with water react violently with water?

The group 2 metals react far less violently with water than the group 1 metals. This is because it takes much more energy to form the 2+ ions than 1+ ions as we need to remove 2 electrons instead of 1.

10) ***halogen displacement reactions***

Describe and explain (with a relevant equation) what will be observed when chlorine water is added to:

(a) a solution of chloride ions. There is no change as there is no reaction between chlorine and a solution of chloride ions.

(b) a solution of bromide ions. A yellow/brown solution will be formed. This is due to the formation of bromine.

$$Cl_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$$

(c) a solution of iodide ions.

A dark brown solution will be formed. This is due to the formation of iodine.

$Cl_2(aq) + 2I^-(aq) \rightarrow 2Cl^-(aq) + I_2(aq)$

11) State the formula of the following ionic compounds (*You can use the ions table to help you. It will be given to you in the exam*):

You can use the ions table which is found at the bottom of this revision task and will also be provided in the exam and balance the ratio of the positive ion and the negative ion such that the ionic compound is overall neutral.

(a) sodium carbonate Na_2CO_3

(b) aluminium phosphate $AlPO_4$

(c) calcium hydrogencarbonate $Ca(HCO_3)_2$

(d) copper(II) nitrate $Cu(NO_3)_2$

(e) ammonium sulfate $(NH_4)_2SO_4$

(f) lithium iodide LiI

Metals and non-metals form ionic compounds. Metals form positive ions and non-metals form negative ions.

12) Do metals form positive ions because they have

The 'crude' definition of electronegativity is the pulling power of an atom over electrons and therefore an atom that is highly electronegative is likely to form negative ions.

a) a low ionistaion energy Yes

b) high electronegativity No

13) Do non-metals form negative ions because they have

a) a low ionistaion energy No

b) high electronegativity Yes

14) Why does electronegativity increase from left to right across a period and decrease down a group (*see viescolaire for last lessons powerpoint if you are unsure*)?

Electronegativity increases across a period because there are more protons in the nucleus and the atomic radius is smaller.

Electronegativity decreases down a group because whilst there are more protons in the nucleus, the effective nuclear charge is the same due to shielding of the positive nuclear charge by core electrons (all the elctrons except the valence electrons) and the atomic radius is much larger as there are more shells.

15) Balance the following equation:

$1C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$

What is the sum of all the coefficients?

a) 15 (1+6+4+4)
b) 16
c) 17
d) 18

16) State the equation for the reaction of potassium metal with water

$2K\ (s) + 2H_2O\ (l) \rightarrow 2KOH\ (aq) + H_2\ (g)$

17) Does potassium react more violently than lithium? Why?

Yes because K has a lower ionization energy than Li and as such it takes less energy to form the K^+ ion present in KOH than the Li^+ ion present in LiOH.

18) How many different elements are there in nitric acid (HNO_3)?

There are 3 different elements in nitric acid (HNO_3). Hydrogen (H), Nitrogen (N) and oxygen (O). There are 5 atoms in total (1 x H) + (1 x N) + (3 x O).

19) How many negative ions are there in nitric acid (HNO_3) (*You can use the ions table provided*)? There is 1 negative ion, NO_3^-.

20) Hydrogen can form H^+ ions and H^- ions. HNO_3 is a neutral compound. What is the charge on the hydrogen ion? H^+

21) What type of bonding (ionic or covalent) is there between sulfur and hydrogen? State the formula of the compound and draw the Lewis structure.

Sulfur is a non-metal and hydrogen is a non-metal therefore the bonding between these elements is covalent.

The Lewis structure is as below. The outer shell of each hydrogen is full as it has 2 electrons and the outer shell of sulfur is full as it has 8 electrons.

Periodic Table

1 **H** 1.01				Atomic Number Atomic Mass													2 **He** 4.00
3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.71	29 **Cu** 63.55	30 **Zn** 65.37	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** 98.91	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.40	49 **In** 114.82	50 **Sn** 118.69	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
55 **Cs** 132.91	56 **Ba** 137.34	57 † **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.21	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.37	82 **Pb** 207.19	83 **Bi** 208.98	84 **Po** (210)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 ‡ **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs**	109 **Mt**									

†	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** 146.92	62 **Sm** 150.35	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.92	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
‡	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (242)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (254)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Ions Table

Postive ions (Cations)			Negative ions (Anions)		
Name	Symbol	+	Name	Symbol	-
hydrogen	H^+	1+	chloride	Cl^-	1-
lithium	Li^+		bromide	Br^-	
sodium	Na^+		fluoride	F^-	
potassium	K^+		iodide	I^-	
silver	Ag^+		hydroxide	OH^-	
ammonium	NH_4^+		hydrogencarbonate	HCO_3^-	
calcium	Ca^{2+}	2+	nitrate	NO_3^-	
barium	Ba^{2+}		oxide	O^{2-}	2-
magnesium	Mg^{2+}		sulphide	S^{2-}	
copper (II)	Cu^{2+}		sulphate	SO_4^{2-}	
zinc	Zn^{2+}		carbonate	CO_3^{2-}	

lead	Pb^{2+}		phosphite	PO_3^{3-}	
iron (II)	Fe^{2+}		phosphate	PO_4^{3-}	$3-$
iron (III)	Fe^{3+}	$3+$	phosphide	P^{3-}	
aluminium	Al^{3+}		nitride	N^{3-}	