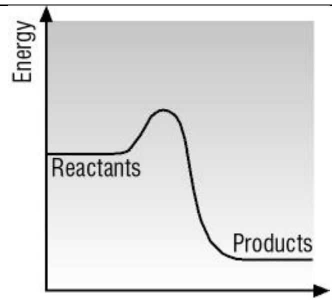
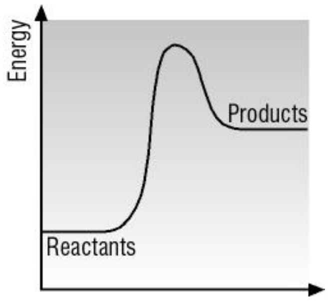
5.1	a) Describe how to **measure** the **temperature change** in a **reaction** (2) b) Name some examples of reactions that cause a change in temperature. (2)	a) Use a **thermometer** or **temperature probe** to take the **temperature** of the chemicals before adding them together. Add chemicals and wait for temperature to reach it's maximum or minimum, record temperature again (1) take starting temp away from final temp to work out **temperature change** (1) b) Any two from: Salts dissolving in water/ neutralisation reaction/ displacement reaction/ precipitation reaction (2)
5.2	a) Give a **definition** of an **exothermic reaction** (1) b) Give an **example** of an **exothermic reaction** (1)	a) A **reaction** that gives out **heat energy** (temperature of surroundings increases) (1) b) **Combustion** (burning) reaction/ **neutralisation** of acid and alkali/ **respiration (1)**
5.3	a) Give a **definition** of an **endothermic reaction** (1) b) Give an **example** of an **endothermic reaction** (1)	a) A **reaction** that takes in **heat energy** (temperature of surroundings decreases) (1) b) **Photosynthesis/ ammonium nitrate dissolving in water (1)**
5.4	a) **Describe** the **energy change** when **bonds are broken** (1) b) **Describe** the **energy change** when **bonds are made** (1)	a) **Energy** is taken in- **endothermic process** (1) b) **Energy** is released – **exothermic process** (1)
5.5a	**Explain** why a **reaction** is **exothermic** by comparing **energy** needed to **break and make bonds (2)**	More **energy** is **released making bonds** (1) than is **taken in to break the bonds (1)**.
5.5b	**Explain** why a **reaction** is **endothermic** by comparing **energy** needed to **break and make bonds (2)**	Less **energy** is **released making bonds** (1) than is **taken in to break the bonds (1)**.

5.6a	a) Draw an energy level diagram of an exothermic reaction (1) Explain why it represents an exothermic reaction (1) b) Draw an energy level diagram of an endothermic reaction (1) Explain why it represents an exothermic reaction (1)	 (1) a) *The products are at lower energy level than the reactants, as energy has been released in the reaction (1)*  b) *The products are at higher energy level than the reactants, as energy has been taken in during the reaction (1)*
5.7a	a) Describe how to investigate the effect of temperature on the rate of reaction between marble (calcium carbonate) and acid b) Describe how to investigate the effect of concentration on the rate of reaction between marble and acid c) Describe how to investigate the effect of surface area on the rate of reaction between marble and acid	a) Take the temperature of 20ml of 1M acid and add 0.1g of marble powder (it could be any volume, concentration and mass- as long as it is kept the same in all experiments). Measure volume of gas given off in 3o seconds. Repeat keeping all variables the same except the temperature of the acid 10-60°C b) Same as above except keep temperature the same and change the concentration of acid between experiments 0.5M- 2.5M c) Same as a) except keep the temperature the same and use marble chips instead of powder for the second test. Powder has a larger surface area than marble chips
5.8	Give an example of a fast and slow reaction (2)	Fast reactions- explosions/ combustion Slow reactions- rusting/ rotting fruit
5.9	a) Describe how increasing temperature effects the rate of a reaction b) Describe how increasing concentration effects the rate of a reaction	a) Higher **temperatures** make **reactions** faster b) Higher **concentrations** make **reactions** faster

	c) Describe how increasing surface effects the rate of a reaction	c) <u>Larger **surface area**</u> makes **reactions** faster
5.10	a) Use collision theory to explain why increased temperature effects the rate of a reaction (3) b) Use collision theory to explain why increasing concentration effects the rate of a reaction (3) c) Use collision theory to explain why increasing surface area effects the rate of a reaction (3)	a) Higher temperature gives particles more energy (1), they move faster (1) and there is a higher frequency of successful collisions (1) b) Higher concentration has more particles in a given space (1), leading to a higher frequency of successful collisions (1) c) Larger surface area (smaller pieces) means more particles are exposed (1)), leading to a higher frequency of successful collisions (1)
5.11	Explain why not all collisions between reactants results in a reaction. (2)	Particles may not collide with enough energy to react (1). The minimum energy needed for a reaction to take place is called the activation energy (1)
5.12	Recall the effect of a catalyst on the rate of a reaction.	*Catalysts speed up reactions (1) (catalysts are not used up the reaction)*
5.13	a) Describe what a catalytic converter does (1) b) Explain why a catalytic converter has a honeycomb structure (2)	a) The catalyst helps to react carbon monoxide and unburnt fuel (petrol od diesel) with oxygen (1) to make carbon dioxide and water (1). b) The honey comb structure gives the catalyst a larger surface area- so increases the rate of reaction.
Quantitative Chemistry		
6.1	Calculate the relative formula mass (Mr) of the chemicals below: (The Ar of C = 12, O = 16, H = 1, Ca = 40). a) H_2O b) CO_2 c) $CaCO_3$ d) $Ca(OH)_2$	a) H = 1, O = 16 Mr of H_2O = (2x1) + 16 = 18 b) C = 12, O = 16 Mr of CO_2 = 12 + (2x16) = 44 c) Ca = 40, C = 12, O = 16 Mr of $CaCO_3$ = 40 + 12 + (3x16) = 100 d) Ca = 40, O =16, H = 1 Mr of $Ca(OH)_2$ = 40 + (16 + 1)2 = 74

6.2	a) Describe what an empirical formula is (1) b) Simplify the following formula to work out the empirical formula: i) H_2O_2 ii) C_2H_4 iii) $C_6H_{12}O_6$	a) Empirical formula is the simplest ratio of atoms in a compound. (1) bi) HO bii) CH_2 biii) CH_2O To work them out identify the smallest number then divide all atom numbers by this number. In biii) the smallest number is 6. $C_6/6$ = C $H_{12}/6$ = H_2 $O_6/6$ = O. Therefore CH_2O
6.3	Calculate the empirical formula of the chemicals below given the following reacting masses and Ar. a) 2.4g of magnesium react with 1.6g of oxygen (Ar of Mg = 24, O = 16) b) 4.8g of magnesium reacts with 14.2g of chlorine. (Ar of Mg = 24, Cl = 35.5) c) 3.6g of carbon reacts with 4.8g of oxygen (Ar of C = 12, O = 16)	a) Mg = 2.4/24 = 0.1, O = 1.6/16 = 0.1 Mg = 0.1/0.1 = 1 O = 0.1/0.1 = 1 Ratio of Mg:O = 1:1 Formula is MgO b) Mg = 4.8/24 = 0.2, Cl = 14.2/35.5 = 0.4 Mg = 0.2/0.2 = 1 Cl = 0.4/0.2 = 2 Ratio of Mg:Cl = 1:2 Formula is $MgCl_2$ c) C = 3.6/12 = 0.3, O = 4.8/16 = 0.3 C = 0.3/0.3 = 1, O = 0.3/0.3 = 1 Ratio of C:O = 1:1 Formula is CO Method: Divide mass in grams by the Ar of the element, this works out the number of moles. Look for the smallest number of moles, and divide all by this number to work out the simplest ratio.
6.4	Calculate the percentage composition by mass of the following, given the : Ar of C = 12, O = 16, Na =23, Fe = 56, Ca = 40, H = 1 (2 marks per question) a) Calculate the percentage mass of carbon in CO_2 b) Calculate the percentage mass of sodium in sodium oxide Na_2O c) Calculate the percentage mass of iron in iron oxide Fe_2O_3 d) Calculate the percentage mass of oxygen in calcium hydroxide $Ca(OH)_2$	a) Mr of CO2 = 12 + (2x16) = 44 % C in CO2 = (12/44)x100 = 27% b) Mr of Na2O = (23x2)+16 = 62 % Na in Na2O = 74.2% c) Mr of Fe_2O_3 = (2x56) + (3x16) = 160 % Fe in Fe_2O_3 = (2x56/160)X100 =70% d) Mr of $Ca(OH)_2$ = 40 + 2(16+1) = 74 % O in $Ca(OH)_2$ = 100(2x16)/74

6.5	Calculate the mass of carbon dioxide produced when 64g of methane are burnt. Use the balanced symbol equation to help. (3 marks) (Ar of C =12, H =1, O = 16) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	Identify the chemicals relevant to the question and work out their relative formula mass (Mr) methane CH4 = 12 + (1X4) = 16 Carbon dioxide CO2 = 12 + (16X2) = 44 (1mark) Calculate the number of moles of methane in 64g. One mole of methane = 16g Therefore number of moles = $\frac{\text{mass in g}}{\text{Mr}}$ $\frac{\text{mass in g of methane}}{\text{Mr of methane}} = \frac{64}{16} = 4$ (1mark) From the balanced equation 1 mole of CH_4 makes 1 mole of CO_2. We have 4 moles of methane, so this would make 4 moles of carbon dioxide. 1 mole of carbon dioxide weighs 44g, therefore 4 moles = 44 X4 = 176g (1 mark)
6.6	Define what yield is in a reaction (1)	Yield is the amount of product made in a reaction. (1)
6.7 & 6.9	I can explain why a reaction never gives 100% yield (2)	Incomplete reactions (1), unwanted reactions take place (1), losses during the preparation method (1) max 2 marks
6.8	Calculate the percentage yield in a reaction where it was calculated the maximum mass of product formed from 250g of reactants could be 120g, but the actual mass of product formed was 60g. (2)	Actual yield = 60g Maximum theoretical yield = 120g % yield = $\frac{\text{actual yield X100}}{\text{max theoretical yield}}$ % yield = $\frac{60}{120}$ X 100 = 50%
6.10	Why do some waste products from reactions can cause problems? (2)	Some have no use- so can't be sold for profit (1), some are hazardous and costly to dispose of (1)
6.11	Explain what conditions chemist look for to make the most economical reaction processes (3)	High percentage yield (1), all products are commercially useful (1), the reaction takes place at suitable speed (1)

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	29 P phosphorus 15	31 S sulfur 16	35.5 Cl manganese 17	55 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	55 Po polonium 84	55 At astatine 85	55 Rn radon 86
[223] Mn francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenicated						

** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.*

The relevant atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Highlight the Group 1 alkali metals on the periodic table above:

Write down 2 similarities in how the group 1 metals sodium and potassium react with water.

1. …….
2. ……

Write down 2 differences in how sodium and potassium react with water.

1. …….
2. ……

Highlight the Group 7 Halogens on the periodic table above:

Describe the appearance of fluorine….

Describe the appearance of chlorine…

Describe the appearance of bromine…

Describe the appearance of iodine…

Highlight the Group 0 Nobel gases on the periodic table above: