Name…………………………………………….
Date…………………………….

TOPIC 1 INTRODUCTION TO THE LAB ACTIVITIES

A) LAB EQUIPMENT

1. Look at the power point presentation and complete the gird.

	ENGLISH	CATALÀ
Used to hold solids or liquids		
Used to measure volumes of liquids		
Used to make little experiments or tests		
Used to hold test tubes		
Used to clean test tubes		
Used to contain small amounts of solids		
Used to manually stir solutions		
Used to measure liquids by drops		
Used to pour liquid in a container		
Used to measure exact volumes of liquid		
Used to contain water		
Used to scoop solids		
Used for heating substances		

2. Work in pairs. Lay all of the cards face down and take it in turns to turn two over. If a player selects matching name and picture, they keep the pair. If not, they must put the cards back. The winner is the player with the most pairs at the end.

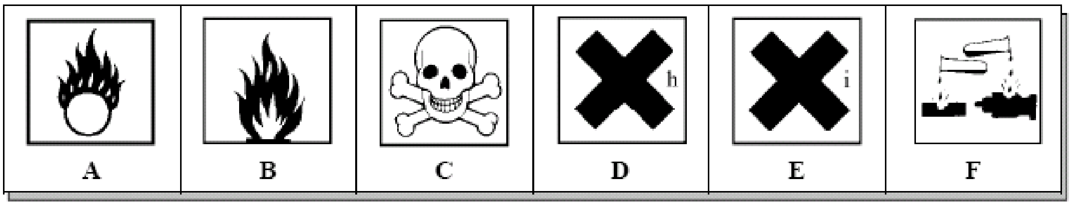
Name……………………………………………
Date……………………………

B) HAZARD SYMBOLS

3. According to the power point presentation define the following terms:

Corrosive…………………………………………………………………………………
……………………………………………………………………………………………
…………………………………………………………………………………………
Flammable…………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………
Harmful……………………………………………………………………………………
……………………………………………………………………………………………
…………………………………………………………………………………………..
Irritant………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………
Oxidising……………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………
Toxic………………………………………………………………………………………
……………………………………………………………………………………………
……………………………………………………………………………………………

5. The table below shows six of the standard hazard symbols used to label chemicals. Match each symbol to the correct meaning from the list in the box. For example, A-flammable.



- **Corrosive**
- **Flammable**
- **Harmful**
- **Irritant**
- **Oxidising**
- **Toxic**

6. Write down the name of the hazard symbol you would find on bottles of:

a) Sulphuric acid………………………………………………………………..

b) Sodium hydroxide…………………………………………………………

c) Ethanol……………………………………………………………………

Name…………………………………………….
Date…………………………….

Homework

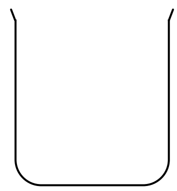
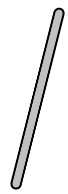
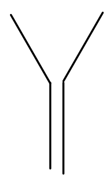
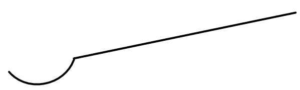
1. Choose the correct answer for each question and make a drawing of any of the lab instruments.

www.sciencegeek.net/Chemistry/taters/labequipment.htm

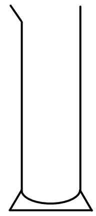
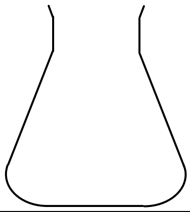
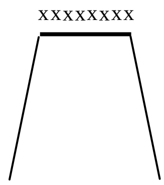
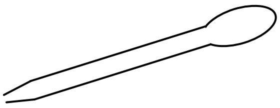
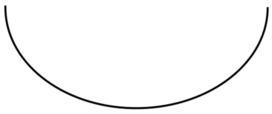
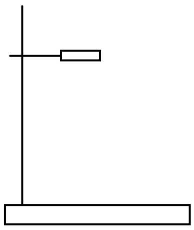
2. Do the quizzes at the end of this web page.
www.ngflcymru.org.uk/vtc/ngfl/science/103_new/asc1/hazardsymbol.htm

3. Use the word bank to complete the following tables.

tripod	test tube rack	test tube	filter funnel	
conical flask	beaker	measuring cylinder	stirring rod	
clamp stand	evaporating basin	spatula	dropper	

APPARATUS	WHAT IT IS USED FOR	SCIENTIFIC DRAWING
	Used for holding small quantities of solids or liquids for chemical tests	
	Used to hold and pour large quantities of solids but more usually liquids.	
	Thin glass rod used for stirring liquids	
	Used to support filter paper in the process of filtration	
	Used to transfer small quantities of solids, usually made of metal	

Name……………………………………………….
Date…………………………….

APPARATUS	WHAT IT IS USED FOR	SCIENTIFIC DRAWING
	Used to accurately measure the volume of liquids	
	Used for holding and mixing liquids	
	Supports a beaker or evaporating basin when being heated by a Bunsen burner	
	used to transfer small quantities of liquids	
	porcelain basin which is shallow and used for the evaporation of liquids	
	used to support other apparatus to allow you to hold something else at the same time.	
	used to support one or more test tubes	

Name…………………………………………….
Date…………………………….

TOPIC 2 ELEMENTS, COMPOUNDS AND MIXTURES

ACTIVITIES

Mixtures are absolutely everywhere you look. Mixtures are the form for most things in nature. Rocks, air, or the ocean, they are just about anything you find. They are substances held together by physical forces, not chemical.
A mixture is a combination of substances in which the individual substances keep their own properties. If you put sand into a glass of water, it is considered to be a mixture. You can always tell a mixture because each of the substances can be separated from the group in different physical ways. You can always get the sand out of the water by filtering the water away.

There are two different types of mixtures. Chemists use the terms heterogeneous and homogeneous. Homogeneous mixtures have one phase and uniform composition. Solutions are great examples of homogeneous mixtures; a solution is a mixture of solute and solvent. The solute is the substance that dissolves; the solvent is the substance that does the dissolving. Heterogeneous mixtures used to describe substances in which you can see more than one colour or type of matter. Heterogeneous substances have more than one phase and a no uniform composition. Mixing sand and iron filings might create a heterogeneous mixture.

A pure substance contains only one substance and nothing else, distilled water is an example. That fact means that there are just water molecules in the liquid. A pure substance is a form of matter that has a definite composition and specific properties. Any pure substance that contains only one kind of an atom is known as an element: Fe(s), N_2(g) ; a compound is formed when two or more elements are chemically joined. Salt (NaCl), and sugar are examples of compounds.

Physical processes separate mixtures of different compounds. Simple physical separation might use the process of filtration, such as removing sand from water; you can also use different boiling points and distillation. Evaporation is used to obtain the solute from a solution and chromatography is used to separate out one colour from a mixture of colours.
Chemical methods are used to change the atomic composition of compounds. When chemical methods are used, you change the original ingredients and the entire mixture changes.

Adapted from
http://www.chem4kids.com/files/matter_mixture.htm

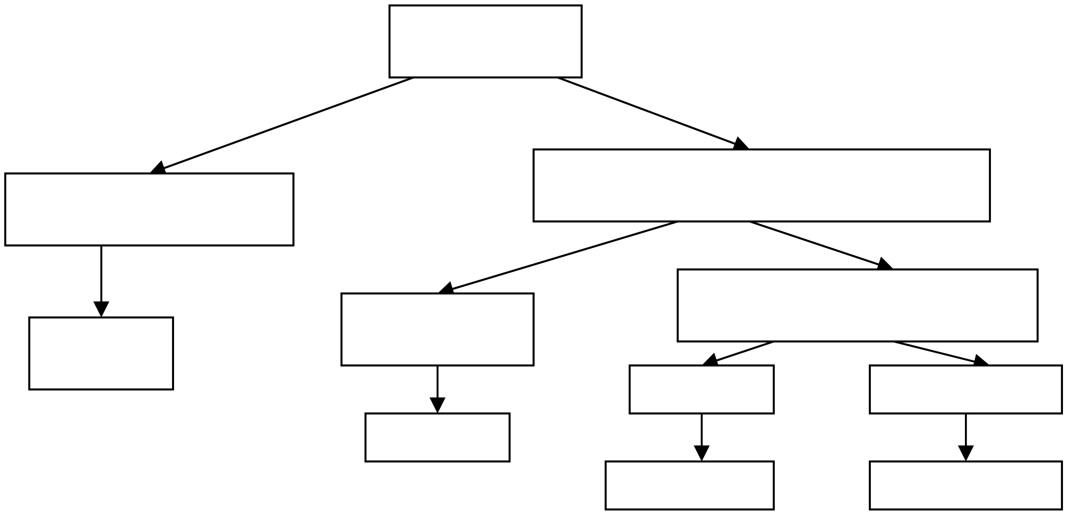
Name……………………………………………….
Date…………………………….

1. Work in pairs. In the spaces provided, describe the distinguishing characteristics of the major categories of matter.

MIXTURES	
HOMOGENEOUS MIXTURES	
HETEROGENEOUS MIXTURES	
SOLUTIONS	
ELEMENTS	
COMPOUNDS	

Name……………………………………………….
Date…………………………….

2. Complete the diagram with the following words: salt (NaCl), matter, solution, iron (Fe), homogeneous, pure substance, oil+vinegar, air, heterogeneous, compound, element.



3. Classify each of the following substances as; an element, a compound, a solution, or a heterogeneous mixture.

1. Sand	2. Salt	3. Pure Water	4. Soil
5. Soda	6. Pure Air	7. Carbon Dioxide	8. Gold
9. Bronze	10. Oxygen	11. Salad Dressing	12. Salt Water

4. Complete the table with different processes to separate mixtures

PROCESS	What it is used for	Examples
	Used for separating a solid from a liquid	Separating SAND from water.
	Used to obtain the solute from a solution	for obtaining SALT from salty water
	Used to obtain the solvent from a solution	for obtaining pure water from sea water
	Used to separate out one colour from a mixture of colours	for separating out the colours in black ink

Name……………………………………………….
Date…………………………….

HOMEWORK ON THE INTERNET

1. Welcome to the mixtures lab! Once you separate a mixture use the chart to record your findings.
   http://www.harcourtschool.com/activity/mixture/mixture.html

Mixtures	**Separation mechanism**	**Physical properties that allow separation**
Sand and iron filings		
Salad		
Salt and water		
Muddy water		
Dust in air		

2. Go to http://www.chem4kids.com/extras/quiz_mattermix/index.html
Answer questions from the quiz on mixtures, remember that you have to justify your answer.
The first one is done as an example.

Question 1:
Mixtures are always combinations of the same compounds that are at different states
False. You can make mixtures out of compounds that are different states of matter and you can also make mixture out of compounds that are the same state of matter

Question 2:
You can separate all mixtures by filtration.
……………………………………………………………………………………..
……………………………………………………………………………………..
……………………………………………………………………………………..
……………………………………………………………………………………….

Question 4:
All mixtures are defined as "heterogeneous."
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………
…………………………………………………………………………………………

Name…………………………………………….
Date…………………………….

Question 5:
Mixtures are generally separated by what methods?
Chemical
Physical
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………

Question 6:
Only specific compounds can be combined to form mixtures.
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………

Question 7:
All solutions are mixtures, but not all mixtures are solutions
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………
………………………………………………………………………………………

Question 9:
Which of these is not a mixture?
Solution
Alloy
Amalgam
These are all mixtures
………………………………………………………………………………………..
………………………………………………………………………………………..
……………………………………………………………………………………….
……………………………………………………………………………………….

Question 10:
Which of these is not a mixture?
Oil and water
Sand and water
Coca Cola
All are mixtures

………………………………………………………………………………………
……………………………………………………………………………………..
……………………………………………………………………………………..
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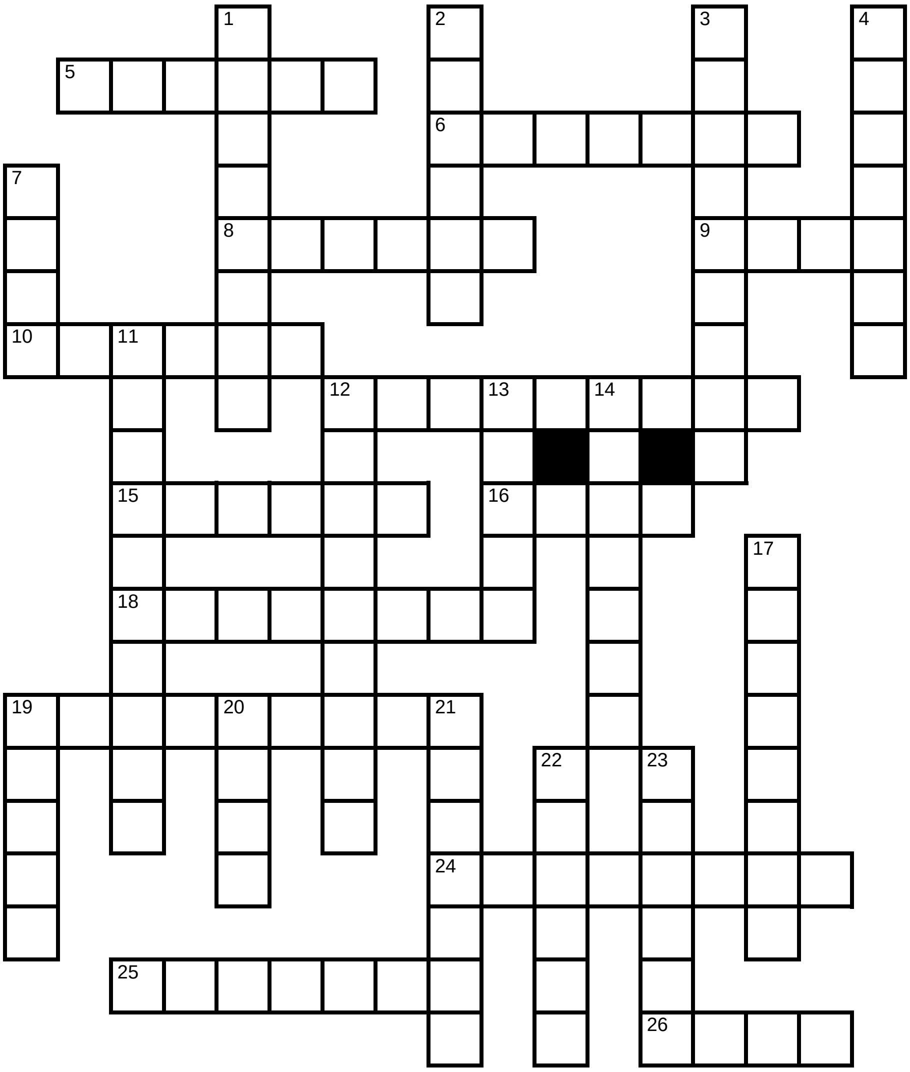
Name……………………………………………….
Date…………………………….

COMPLEMENTARY ACTIVITIES

Elements of the Periodic Table

www.science-teachers.com/physical.htm

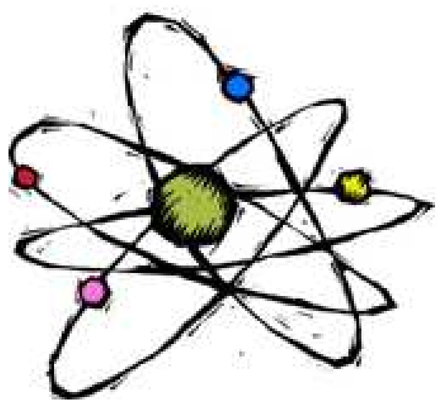


Across

5 He (6)
6 Ca (7)
8 O (6)
9 Fe (4)
10 Cu (6)
12 K (9)
15 Na (6)
16 Au (4)
18 H (8)
19 Be (9)
24 Cl (8)
25 S (7)
26 Ne (4)

Down

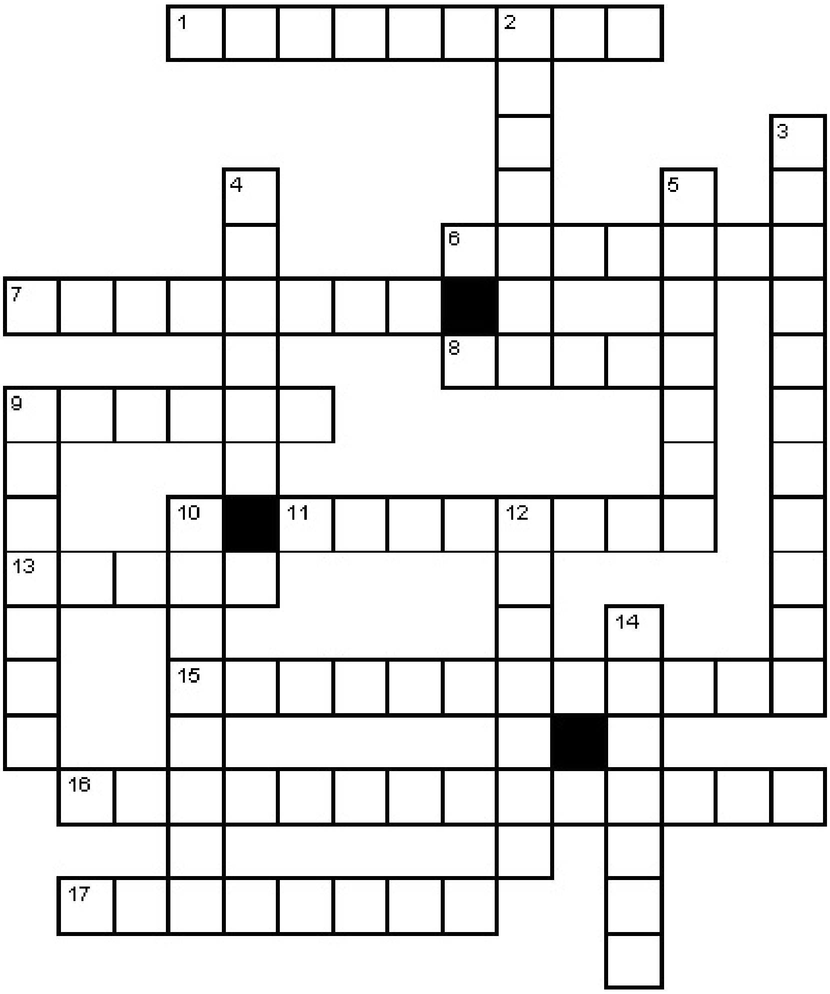
1 N (8)
2 Ni (6)
3 Al (9)
4 As (7)
7 Zn (4)
11 P (10)
12 Pu (9)
13 Ar (5)
14 Si (7)
17 F (8)
19 B (5)
20 Pb (4)
21 Hg (7)
22 Ag (6)
23 C (6)



Name…………………………………………….
Date……………………………

Atomic Structure

www.science-teachers.com/physical.htm



Across

1 Isotope of hydrogen with one neutron. (9)

6 When two atoms of different elements combine chemically, what does it produce? (7)

7 The lightest element. (8)

8 Elements that lend electrons in chemical reactions. (5)

9 A nuclear reaction in which the nucleus of two atoms combine to form one nucleus. (6)

11 Helium, neon, argon, or krypton. (5,3)

13 Where electrons reside in the atom. (5)

15 The most common isotope of carbon. (6,6)

16 The isotope of carbon that is used for dating things in archeology. (6,8)

17 Elements that borrow electrons in chemical reactions. (8)

Down

2 An atom of an element with a different number of neutrons in the nucleus. (7)

3 Unstable. (11)

4 Positively charged particle in the nucleus. (6)

5 The center of an atom. (7)

9 A nuclear reaction in which an atom's nucleus splits to form two new atoms. (7)

10 Negatively charged particle. (8)

12 Isotope of hydrogen with two neutrons. (7)

14 Particle with no charge. (7)

Name…………………………………………….
Date……………………………

Periodic Table of the Elements Quiz

www.science-teachers.com/physical.htm

Fill in the blanks with the atomic symbols of the first 20 elements. And then write the element names in the blanks below.

Key:

element name **atomic number** **symbol** atomic weight

		scandium **21** **Sc** 44.95591	titanium **22** **Ti** 47.867	vanadium **23** **V** 50.9415	chromium **24** **Cr** 51.9961	manganese **25** **Mn** 54.93805	iron **26** **Fe** 55.845	cobalt **27** **Co** 58.9332	nickel **28** **Ni** 58.6934	copper **29** **Cu** 63.546	zinc **30** **Zn** 65.409	gallium **31** **Ga** 69.723	germanium **32** **Ge** 72.64	arsenic **33** **As** 74.9216	selenium **34** **Se** 78.96	bromine **35** **Br** 79.904	krypton **36** **Kr** 83.798
rubidium **37** **Rb** 85.4678	strontium **38** **Sr** 87.62	yttrium **39** **Y** 88.90585	zirconium **40** **Zr** 91.225	niobium **41** **Nb** 92.90638	molybdenum **42** **Mo** 95.94	technetium **43** **Tc** [98]	ruthenium **44** **Ru** 101.07	rhodium **45** **Rh** 102.9055	palladium **46** **Pd** 106.42	silver **47** **Ag** 107.8682	cadmium **48** **Cd** 112.411	indium **49** **In** 114.818	tin **50** **Sn** 118.710	antimony **51** **Sb** 121.760	tellurium **52** **Te** 127.60	iodine **53** **I** 126.9045	xenon **54** **Xe** 131.293

(1) ____________________ (6) ____________________ (11) ____________________ (16) ____________________

(2) ____________________ (7) ____________________ (12) ____________________ (17) ____________________

(3) ____________________ (8) ____________________ (13) ____________________ (18) ____________________

(4) ____________________ (9) ____________________ (14) ____________________ (19) ____________________

(5) ____________________ (10) ____________________ (15) ____________________ (20) ____________________

Hint: Al, Ar, B, Be, C, Ca, Cl, F, H, He, K, Li, Mg, N, Na, Ne, O, P, S, Si,

Name…………………………………………….
Date……………………………

Periodic Table of the Elements

www.science-teachers.com/physical.htm

Key:

element name **atomic number** **symbol** atomic weight

hydrogen **1** **H** 1.00794																	helium **2** **He** 4.002602
lithium **3** **Li** 6.941	beryllium **4** **Be** 9.012182											boron **5** **B** 10.811	carbon **6** **C** 12.0107	nitrogen **7** **N** 14.00674	oxygen **8** **O** 15.9994	fluorine **9** **F** 18.9984	neon **10** **Ne** 20.1797
sodium **11** **Na** 22.98977	magnesium **12** **Mg** 24.3050											aluminium **13** **Al** 26.981538	silicon **14** **Si** 28.0855	phosphorus **15** **P** 30.97376	sulphur **16** **S** 32.065	chlorine **17** **Cl** 35.453	argon **18** **Ar** 39.984
potassium **19** **K** 39.0983	calcium **20** **Ca** 40.078	scandium **21** **Sc** 44.95591	titanium **22** **Ti** 47.867	vanadium **23** **V** 50.9415	chromium **24** **Cr** 51.9961	manganese **25** **Mn** 54.93805	iron **26** **Fe** 55.845	cobalt **27** **Co** 58.9332	nickel **28** **Ni** 58.6934	copper **29** **Cu** 63.546	zinc **30** **Zn** 65.409	gallium **31** **Ga** 69.723	germanium **32** **Ge** 72.64	arsenic **33** **As** 74.9216	selenium **34** **Se** 78.96	bromine **35** **Br** 79.904	krypton **36** **Kr** 83.798
rubidium **37** **Rb** 85.4678	strontium **38** **Sr** 87.62	yttrium **39** **Y** 88.90585	zirconium **40** **Zr** 91.225	niobium **41** **Nb** 92.90638	molybdenum **42** **Mo** 95.94	technetium **43** **Tc** [98]	ruthenium **44** **Ru** 101.07	rhodium **45** **Rh** 102.9055	palladium **46** **Pd** 106.42	silver **47** **Ag** 107.8682	cadmium **48** **Cd** 112.411	indium **49** **In** 114.818	tin **50** **Sn** 118.710	antimony **51** **Sb** 121.760	tellurium **52** **Te** 127.60	iodine **53** **I** 126.9045	xenon **54** **Xe** 131.293
caesium **55** **Cs** 132.90545	barium **56** **Ba** 137.327	lutetium **71** **Lu** 174.967	hafnium **72** **Hf** 178.49	tantalum **73** **Ta** 180.9479	tungsten **74** **W** 183.84	rhenium **75** **Re** 186.207	osmium **76** **Os** 190.23	iridium **77** **Ir** 192.217	platinum **78** **Pt** 195.078	gold **79** **Au** 196.96655	mercury **80** **Hg** 200.59	thallium **81** **Tl** 204.3833	lead **82** **Pb** 207.2	bismuth **83** **Bi** 208.980	polonium **84** **Po** [209]	astatine **85** **At** [210]	radon **86** **Rn** [222]
francium **87** **Fr** [223]	radium **88** **Ra** [226]	lawrencium **103** **Lr** [262]	rutherfordium **104** **Rf** [261]	dubnium **105** **Db** [262]	seaborgium **106** **Sg** [266]	bohrium **107** **Bh** [264]	hassium **108** **Hs** [269]	meitnerium **109** **Mt** [268]	darmstadtium **110** **Ds** [271]	roentgenium **111** **Rg** [272]	ununbium **112** **Uub** [285]		ununquadium **114** **Uuq** [289]				

lanthanum **57** **La** 138.9055	cerium **58** **Ce** 140.116	praseodymium **59** **Pr** 140.90765	neodymium **60** **Nd** 144.24	promethium **61** **Pm** [145]	samarium **62** **Sm** 150.36	europium **63** **Eu** 151.964	gadolinium **64** **Gd** 157.25	terbium **65** **Tb** 158.9253	dysprosium **66** **Dy** 162.50	holmium **67** **Ho** 164.930	erbium **68** **Er** 167.259	thulium **69** **Tm** 168.934	ytterbium **70** **Yb** 173.04
actinium **89** **Ac** [227]	thorium **90** **Th** 232.038	protactinium **91** **Pa** 231.0359	uranium **92** **U** 238.0289	neptunium **93** **Np** [237]	plutonium **94** **Pu** [244]	americium **95** **Am** [243]	curium **96** **Cm** [247]	berkelium **97** **Bk** [247]	californium **98** **Cf** [251]	einsteinium **99** **Es** [252]	fermium **100** **Fm** [257]	**mendelev** **101** **Md** [258]	nobelium **102** **No** [259]

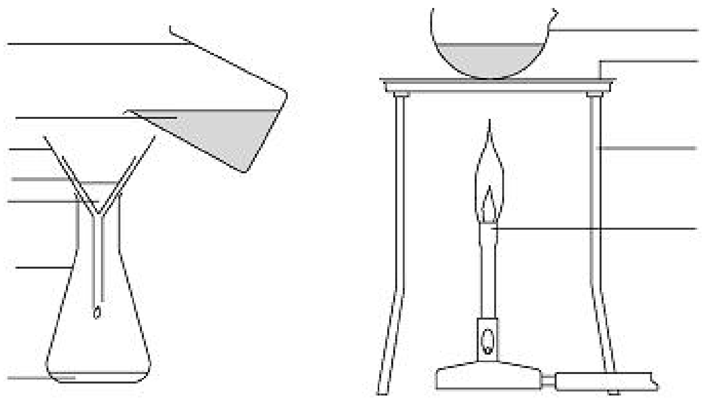
Name……………………………….
Date……………………………….

TOPIC 2. LAB ACTIVITY 1

Separating mixtures

Introduction

In this experiment simple processes are used to separate the different components of a mixture.



Requirements

250 cm^3 Beaker	Tripod
Funnel	Bunsen burner
Filter paper	Evaporating basin
Erlenmeyer Flask	Gauze

Procedure

1. Add the following labels to the diagram:

Bunsen burner, salt solution, Erlenmeyer flask, Funnel, Filter paper, evaporating basin, beaker, sand, salt solution and sand, gauze, tripod.

2. Arrange these instructions into the correct order. Check with your teacher before starting the practical work.
   - Mix about 5 g of the mixture with 50 cm^3 of water in a 250 cm^3 beaker. Stir gently.
   - Filter the mixture into a Erlenmeyer flask and pour the filtrate into an evaporating basin.
   - Heat the salt solution gently until it starts to 'spit'. **Care:** do not get too close.
   - Turn off the Bunsen burner and let the damp salt dry.
   - First rub a magnet through the mixture for a while this will remove all the iron.

Name………………………………
Date……………………………

a) ……………………………………………………………………………………………

b) ……………………………………………………………………………………………

c) ……………………………………………………………………………………………

d) ……………………………………………………………………………………………

e)……………………………………………………………………………………………..

Safety
Wear eye protection.

Questions

1. What happens when you rub a magnet through the mixture?

……………………………………………………………………………………………

……………………………………………………………………………………………

2. Why is the salt, sand and water mixture stirred in step 2?
…………………………………………………………………………………………….

…………………………………………………………………………………………….

3. What happens when this mixture is filtered in the step 3?
……………………………………………………………………………………………

…………………………………………………………………………………………….

4. Why is the salt heated in step 4?
....
…………………………………………………………………………………………

5. Why does water evaporate leaving salt behind?

…………………………………………………………………………………………

…………………………………………………………………………………………

Adapted from Classic Chemistry Experiments
Royal Society of Chemistry

TOPIC 2. LAB ACTIVITY 2

Name……………………………….
Date……………………………….

Iron in breakfast cereal

Introduction
Many breakfast cereals are fortified with iron. This iron is metallic and is added to the cereal as tiny particles of food grade iron before packaging. This experiment involves extracting the iron.

Make a prediction

Do you think it will be possible to separate the iron from the cereal?
1. ……………………………………………………………………………………..
………………………………………………………………………………………

2. Try to prepare a procedure to separate the iron from the cereal. Order these instructions from 1 to 4 and perform the experiment.

- Observe closely in the region of the magnet as the cereal moves over it.
- Spread the powder on a piece of paper.
- Put a magnet under the paper and move the paper over the magnet.
- Put some cereal into a mortar and use a pestle to produce a very fine powder.

Questions

Are all metals attracted to a magnet?

………………………………………………………………………………………

………………………………………………………………………………………

According to the cereal package, what is the daily recommended dose of iron?

……………………………………………………………………………………..

How many servings of cereal are in the box?

……………………………………………………………………………………..

How much iron is in one serving of cereal?

……………………………………………………………………………………..

What are the symptoms of iron deficiency in the diet?

……………………………………………………………………………………..

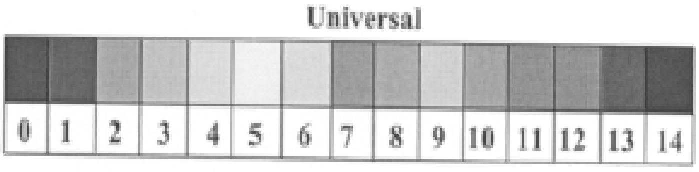
………………………………………………………

Adapted from Classic Chemistry Experiments
Royal Society of Chemistry

Name……………………………….
Date…………………………….…

TOPIC 3 ACIDS AND ALKALIS

ACTIVITIES 4 ESO



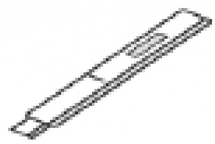
The pH scale is used to measure the acidity (or alkalinity) of a substance.

The substance must be dissolved in water, it must be a solution for the pH to be measured.

The pH of a solution is usually measured using pH paper or universal indicator.

You can test the pH of a solution using indicator paper or indicator liquid.
An indicator is a chemical which will change colour as the pH changes. There are quite a few indicators in use in the laboratory.

The pH scale ranges from pH number 0 up to pH number 14.
Solutions that have a pH below 7 are acids.
Solutions that have a pH above 7 are *alkalis*.
The pH of water and *neutral* solutions is 7.



The lower the pH of an acid, the *greater* the acidity; a solution with a pH of 2 is *more* acid than a solution with a pH of 6.

The *higher* the pH of an alkali, the greater the alkalinity; a solution with a pH of 14 is *more* alkaline than a solution with a pH of 10.

As an acid solution is diluted, the acidity of the solution decreases and the pH increases.
As an alkaline solution is diluted, the alkalinity of the solution decreases and the pH decreases.

Adapted from "Summary notes Inter 1 Chemistry"
Learning and Teaching Scotland, 2003

Name…………………………………
Date……………………………….

1. Read the text carefully and write down information under the three headings.

Things I knew

Things I didn't Know

Examples to remember

Name…………………………………
Date………………………………

2. Work in groups of three, share your information and present your conclusions to the rest of the class by using the following sentences:

- These are the things most of the group knew………………
- Things some of us didn't know were…………………………
- Some examples to remember are..........……………………..

Homework

3. Read the text again and underline the key points. Use these words to write a summary of the text using exactly fifty words.

Name……………………………….
Date……………………………..

TOPIC 3 ACIDS AND ALKALIS

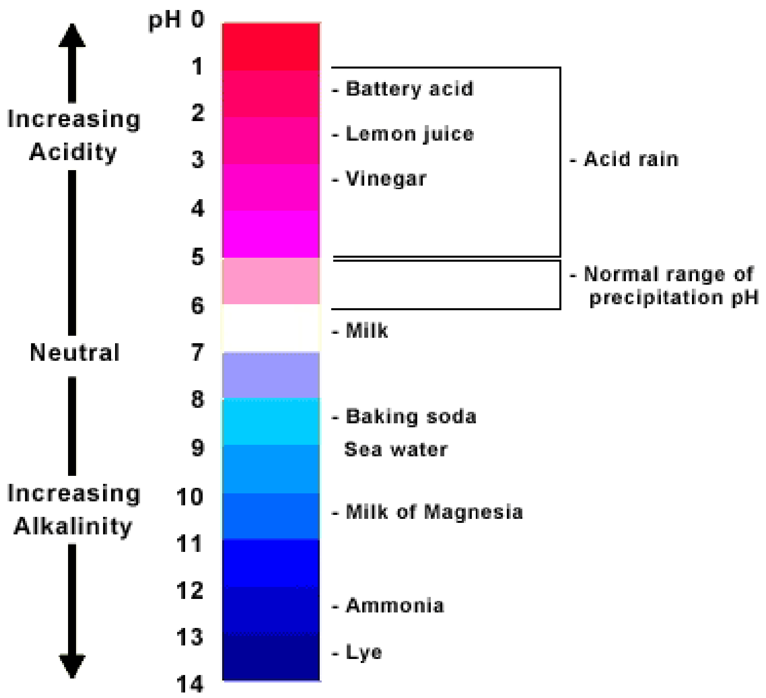
ACTIVITIES 1r BATXILLERAT

You normally have a good idea about acids because of the taste of vinegar and lemon juice, for example. There are many examples of weak acids in our everyday lives.

Rainwater is slightly acidic because it has carbon dioxide gas dissolved in it. Fizzy drinks are acidic for the same reason (and bad for your teeth if you drink too many of them!). You will not often come into contact with strong acids, fortunately. A car battery contains concentrated acid (pH 1 or pH 2) and you might be surprised to know that your stomach produces an acid at pH 2 which helps you to digest your food.

Alkalis are less well known but, in fact, you use an alkali every time you pick up a piece of soap. Alkalis are just as corrosive as acids even though they feel smooth to the touch. One alkali, ammonium hydroxide $NaNH_4$, is used in household cleaning fluids. Ammonium hydroxide is also bleach (a chemical that whitens anything it touches). Bleaching agents are able to kill harmful bacteria.

The pH scale measures how acidic or how alkaline a solution is. The pH scale runs from 0 to 14. Solutions with a pH below 7 are acidic. Solutions with a pH above 7 are alkaline. Neutral solutions have a pH of 7.You can test the pH of a solution using indicator paper or indicator liquid. An indicator is a chemical which will change colour as the pH changes. There are quite a few indicators in use in the laboratory.



Adapted from
http://www.saburchill.com/chemistry/chapters/chap003.html

Name………………………………
Date……………………………..

1. Read the text carefully and write down information under the three headings.

Things I knew

Things I didn't know

Examples to remember

Name……………………………….
Date……………………………..

2. Work in groups of three, share your information and present your conclusions to the rest of the class by using the following sentences:

- These are the things most of the group knew……………..
- Things some of us didn't know were……………………….
- Some examples to remember are.........……………………..

Homework

3. Read the text again and underline the key points. Use these words to write a summary of the text using exactly fifty words.

4. Which ones are true and which ones are false?

a. Vinegar and lemon juice are acids …………………
b. Rainwater has carbon dioxide dissolved in it …………………
c. Your stomach produces an acid with pH 13 …………………
d. Alkalis are less corrosive than acids …………………
e. You can test the pH of a solution using indicator paper ……………
f. Solutions with a pH above 7 are alkaline ……………

5. Answer the following questions.

- Name two examples of acids that you can find at home.
- Why is rain water slightly acid?
- Acids have a pH value of

6. Do the crossword that is in the following internet web page:

http://www.creative-chemistry.org.uk/funstuff/xword/acids.htm

Name…………………………………
Date……………………………….

TOPIC 3 ACIDS AND ALKALIS

ILLUSTRATIVE EXPERIMENTS

- Keep demonstration simple and eye catching
- Do not overlook simple demonstrations. Even trivial activities can spark all sorts of interesting ideas.
- Involve your audience as much as possible; use your students as assistants
- Rehearse the demonstration before hand.
- Demonstrations are not replacements for practical work, but they make good extensions to a topic and help prompt discussion.
- The most important part of a good demonstration is that the students enjoy it.

a) Magic Liquids

Can one solution change colour when added to other solutions? This activity uses an indicator to introduce acids and bases. The teacher adds a purple solution to each of three clear liquids. The first liquid turns purple, the second turns red, and the third turns green.

Materials

1) 250 ml water

2) 250 ml water + vinegar

3) 250 ml water + baking soda

pitcher of cabbage water (the purple indicator)

What to Do

PLACE the three cups next to each other so the class can see them.

ASK the class to predict what will happen if the purple solution is poured into cup 1. Have one student POUR 50 ml cabbage water into cup 1. The solution turns purple.

ASK the class to predict what will happen if the purple solution is poured into cup 2. Have one student POUR 50 ml cabbage water into cup 2. The solution turns red.

ASK the class to predict what will happen if the purple solution is poured into cup 3. Have one student POUR 50 ml cabbage water into cup 3. The solution turns green.

PROMPT the class for questions about this phenomenon, and LIST their questions on the board. REFER to their questions during future lessons on acid and base.

Name…………………………………
Date……………………………….

b) Secret Messages

How can acids and bases be used to write secret messages?

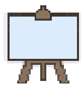
The teacher writes a message, such a note, a word, or a homework assignment, in lemon juice. Then a student sprays cabbage water on the chart paper to reveal the message

Materials

 250 ml water + vinegar

 250 ml water + ammonia

 pitcher of cabbage water (the purple indicator)

 chart paper

 cotton swabs

What To Do

DIP the cotton swab into the ink and use it to WRITE your secret message on the soft porous paper. ALLOW the message to dry completely.

READ the "invisible ink" message by MISTING it lightly with the spray bottle filled with the red cabbage water solution.

Try making different messages with the different solutions. Do they all appear the same way? In what ways are they alike and different?

Challenge. What other solutions can work as invisible ink, or invisible ink revealers?

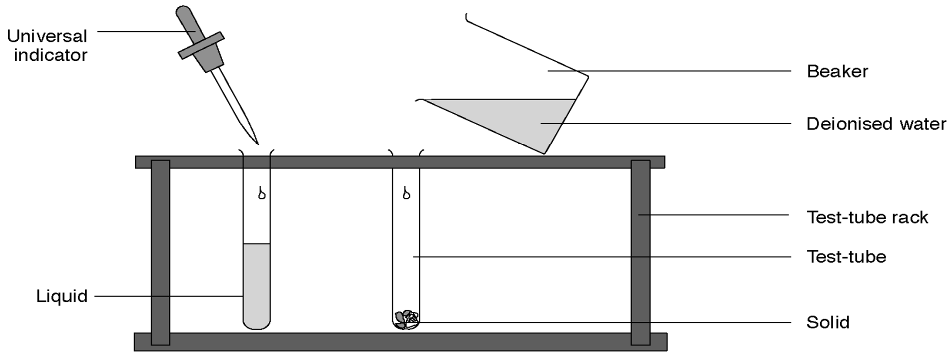
Name……………………………….
Date……………………………..

TOPIC 3. LAB ACTIVITY 1

The pH scale

Introduction

The pH of a substance can be found by dissolving a small amount of the substance in water and adding a few drops of Universal Indicator solution. The colour produced is compared with a pH chart.



REQUIREMENTS

Test tubes	rack
pH colour chart	pH indicator solution
vinegar	soda water
common salt	sugar
lemon juice	diluted ammonia
bicarbonate of soda	washing powder

What to record.

Substances	Colour of Universal Indicator	pH value	Acid, alkali or neutral

Name…………………………………
Date………………………………

Procedure (What to do)

1. Place one spatula measure of solid, or pour a few drops of liquid into a test-tube.
2. Half-fill the test-tube with water from a small beaker, and shake to dissolve the solid or mix the liquid.
3. Add a few drops of Universal Indicator to the test-tube. Make a note of the colour in the table. Compare it against the pH colour chart and record the pH of the nearest colour in the table.

Safety

Wear eye protection.

Questions

1. List the substances that were acidic, substances that were alkaline and substances that were neutral.

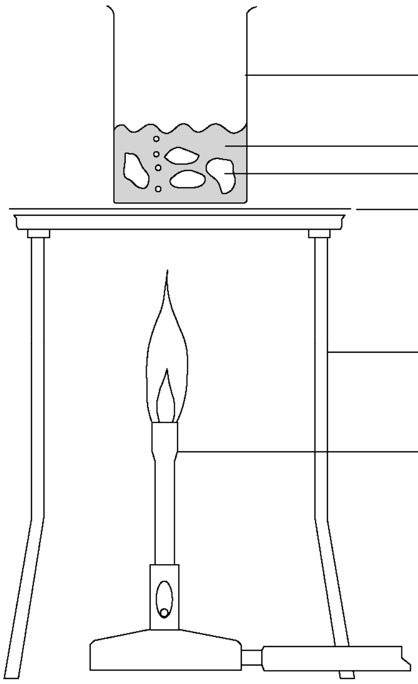
ACIDIC	ALKALINE	NEUTRAL

Adapted from Classic Chemistry Experiments
Royal Society of Chemistry

Name………………………………
Date……………………………….

TOPIC 3. LAB ACTIVITY 2
MAKING A pH INDICATOR

Introduction
A pH indicator is a substance that has a different colour when added to acid or alkali. In this experiment a pH indicator is made from red cabbage.



What to record
Record the colour of the cabbage indicator in the three solutions.

What to do
1. Boil about 100 cm^3 of tap water in a beaker.
2. Add three to four pieces of red cabbage to the boiling water.
3. Boil for about 5 min. The water should have turned blue or green.
4. Turn off the Bunsen burner and allow the beaker to cool for a few minutes.
5. Place three test-tubes in a rack. Half fill one with alkali, one with acid and one with deionised water.
6. Decant approximately 2–3 cm height of cabbage solution into each test-tube.

Questions
1. What colour is the cabbage indicator when alkali?

………………………………………………………………………………………………

2. What colour is the cabbage indicator when acid?

…………………………………………………………………………

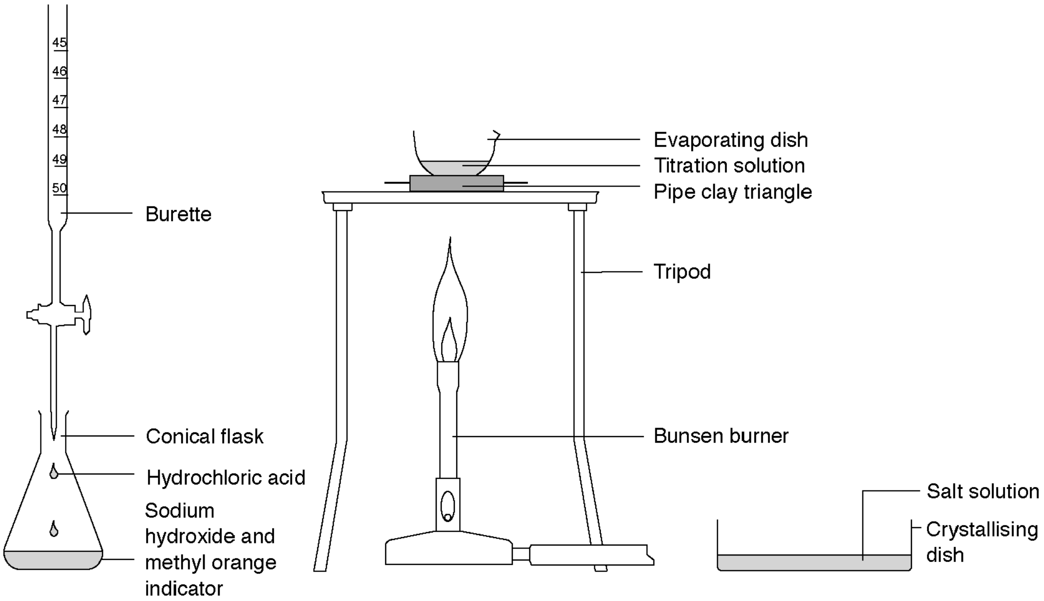
Name…………………………………
Date………………………………

TOPIC 3. LAB ACTIVITY 3

Titration of sodium hydroxide with hydrochloric acid

Introduction

In this experiment sodium hydroxide is neutralised with hydrochloric acid to produce the soluble salt sodium chloride. This is then concentrated and crystallised in a crystallising dish.



What to do

1. Add 25 cm^3 of sodium hydroxide solution (**Corrosive**) to a conical flask using a measuring cylinder and add a couple of drops of methyl orange indicator.
2. Fill the burette with hydrochloric acid and run through to the zero mark (use a funnel to fill the burette and a beaker to collect the excess acid).
3. Add the hydrochloric acid to the sodium hydroxide solution in small volumes swirling after each addition. Continue until the solution turns red and record this reading on the burette.
4. Carefully add this volume of fresh hydrochloric acid to another 25 cm^3 of sodium hydroxide solution to produce a neutral solution.
5. Reduce to about half the volume using an evaporating dish on a gauze over a Bunsen burner flame.
6. Leave to evaporate in a crystallising dish to produce a white crystalline solid.

Safety

Wear eye protection.

Name………………………………
Date…………………………….

Questions

1. What is the everyday name for sodium chloride?

2. This reaction is a specific example of the general reaction:

Acid + alkali → salt + water.
Write a word equation for this specific reaction.

3. Write a formula equation for this reaction.

4. Why must you use another 25 cm^3 of sodium hydroxide solution to make *pure* sodium chloride?

Adapted from Classic Chemistry Experiments
Royal Society of Chemistry

Name……………………………….
Date………………………………

TOPIC 4 . CHEMICAL REACTIONS

ACTIVITIES

1. Listen to the power-point presentation and write some sentences containing these words:
http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/rocks/atomsact.shtml

atomic number   elements   group

chemical symbol

periodic table   chemical symbol   electrons

protons   period   compounds

1…………………………………………………………………………………………

2…………………………………………………………………………………………

3………………………………………………………………………………………

4…………………………………………………………………………………………

5………………………………………………………………………………………

6…………………………………………………………………………………………

7…………………………………………………………………………………………

8………………………………………………………………………………………

9…………………………………………………………………………………………

Name……………………………….
Date………………………………

2. Complete the text with the most appropriate word on the box.

Reactant	Coefficient
Product	Temperature
Precipitate	Energy
Chemical equation	Chemical reaction

$Mg + HCl \longrightarrow MgCl_2 + H_2$

When a piece of magnesium (Mg) is added to dilute hydrochloric acid (HCl), fizzing occurs and hydrogen gas (H_2) is released from the mixture. The fizzing is evidence that a………………….. ……….………………………………… has occurred between magnesium and hydrochloric acid.

The name given to either magnesium or hydrochloric acid in this case is ……………………….. …………………………………………………, and the hydrogen gas that is released is called a ....……..of the reaction.

Some other indications that reactions have occurred might be change of color or ....…, or formation of a solid ……………………………………………………………………

If a thermometer is placed into a mixture undergoing chemical reaction, you might observe that the temperature has gone up or down, indicating that ……….. was being released or absorbed.

The short hand form by which a reaction is represented is called a ……………………………… …………………………………………………………….

You normally select the proper numerical…………………………………………….to indicate the number of units of each substance taking part in the chemical change.

Name……………………………….
Date……………………………….

3. Write a balanced equation for each of the following:

1. Oxygen gas reacts with hydrogen gas to form liquid water.

………………………………………………………………………………

2. Sulphur solid reacts with iron solid to form solid iron (III) sulphide.

……………………………………………………………………………….

3. Aluminium metal burns in pure oxygen to produce solid aluminium oxide.

………………………………………………………………………………

4. Oxygen gas reacts with solid copper metal to form copper (II) oxide solid.

………………………………………………………………………………

5. Hydrogen gas and iron (III) oxide powder react to form liquid water and solid iron powder.

……………………………………………………………………………

6. Hydrogen gas and iron (III) oxide powder react to form liquid water and solid iron powder.

…………………………………………………………………………….

7. Magnesium metal reacts with hydrochloric acid to form magnesium chloride solution and hydrogen gas.

…………………………………………………………………………….

8. Magnesium sulphide solid and hydrochloric acid react to form hydrogen sulphide gas and magnesium chloride solution.

……………………………………………………………………………..

9. Hydrogen gas and aluminium chloride solution are produced when solid aluminium is reacted with hydrochloric acid.

……………………………………………………………………………..

10. Copper metal and iron (II) nitrate in solution are formed when iron metal is added to a solution of copper (II) nitrate

……………………………………………………………………………………

Name…………………………………
Date………………………………

HOMEWORK

Directions:

1. Start Internet Explorer go to Classic Chembalancer.
http://funbasedlearning.com/chemistry/chembalancer/default.htm

2. Click ‘Directions’. Read and understand the directions.
3. Click ‘OK’.
4. Click on ‘Start Game’
5. Try entering some numbers in the text boxes in front of each molecule. What happens?
6. If you forget the directions, click on the ‘How to Play the Game’ link. Click ‘OK’ when you finish reading them to return to the game.
7. When you think you have typed the right numbers in all the boxes, click the ‘Balanced’ button.
8. If you didn’t get it right, try again.
9. If you did get it right, then fill in the correct answers on this worksheet for #1.
10. Repeat steps 7-9 for the other 10 questions.
11. Now do the two problems on the back of this worksheet. You can draw the molecules just like the program did to figure out the answer.

Questions

Fill in the blanks below as you go though the game. This is so I have a record that you did your assignment.

1. _____ Fe + _____ S --> _____ FeS

2. _____ H_2 + _____ Cl_2 --> _____ HCl

3. _____ Mg + _____ O_2 --> _____ MgO

4. _____ O_2 + _____ H_2 --> _____ H_2O

5. _____ HgO --> _____ Hg + _____ O_2

6. _____ Ca + _____ H_2O --> _____ $Ca(OH)_2$ + _____ H_2

7. _____ CH_4 + _____ O_2 --> _____ CO_2 + _____ H_2O

8. _____ Na_2O_2 + _____ H_2SO_4 --> _____ Na_2SO_4 + _____ H_2O_2

9. _____ N_2 + _____ H_2 --> _____ NH_3

10. _____ Al + _____ O_2 --> _____ Al_2O_3

11. _____ $KMnO_4$ --> _____ K_2O + _____ MnO + _____ O_2

Name…………………………………
Date………………………………

TOPIC 4 . CHEMICAL REACTIONS

ILLUSTRATIVE EXPERIMENTS

- Keep demonstration simple and eye catching
- Do not overlook simple demonstrations. Even trivial activities can spark all sorts of interesting ideas.
- Involve your audience as much as possible; use your students as assistants
- Rehearse the demonstration before hand.
- Demonstrations are not replacements for practical work, but they make good extensions to a topic and help prompt discussion.
- The most important part of a good demonstration is that the students enjoy it.

PHYSICAL VS CHEMICAL
"REACTIONS IN A BAG" EXPERIMENTS

EXPERIMENT 1:

MAKE YOUR OWN INSTANT COLD PACK (PHYSICAL)

The process in making the cold pack is not a chemical reaction but merely the physical act of dissolving. When ammonium nitrate is dissolved in water, the process is endothermic, thus producing the cold pack.

You will need: Ammonium nitrate, tap water, zip lock bag (sandwich size), graduated cylinder

1. Weigh out 25 grams of ammonium nitrate directly into a one-quart size Ziplock plastic bag.

2. Using a graduated cylinder, measure out 50 mL of water.

3. Quickly, pour the water into the bag of ammonium nitrate, and seal the bag (try and remove excess air before sealing the bag.)

4. Gently squeeze the bag to mix the solid and water.

5. Let the students feel the bag. It becomes cold within seconds and will remain cold for about 20 minutes.

Name………………………………
Date……………………………….

EXPERIMENT 2:
CALCIUM CHLORIDE: A REACTION IN A BAG. (CHEMICAL)

Introduces students to a chemical reaction involving a color change, the formation of a gas and heat changes from hot to cold. The students can actually hold this chemical reaction in their hands to see and feel the reaction take place.
The acid-base indicator will change colors (from basic to acidic). For example: phenol red solution goes from red to orange to yellow. Universal indicator solution starts out green and changes to pink. Cabbage juice, changes from blue-green to purple to pink. The plastic bag will also inflate due to the formation of carbon dioxide gas.

You will need: calcium chloride, Sodium Bicarbonate (baking soda), Acid-Base indicator (any kind), Ziplock sandwich bags, spoons, graduated cylinder

1. Place one spoonful of calcium chloride into a plastic sealable bag.
2. Place 1 spoonful of sodium bicarbonate into the bag. Seal the bag, shake it and see if a chemical reaction takes place.
3. Measure 10 ml (or 2 teaspoons) of indicator solution. Carefully add it to the bag. Flatten the bag to remove the air and seal it.
4. Tilt the bag back-and-forth to wet all of the solid. Squeezing the bag may also help in wetting the solid. Be careful not to squeeze the bag too hard as it might break or open up.
5. Observe the reaction. If the bag gets tight due to pressure, open the seal to release the pressure then reseal it.

6. Answer the following:

   a.) How was this experiment different then the one before?

   b.) Did a noticeable reaction occur before the indicator solution was added?

   c.) What color change did the indicator go through?

   d.) Why does the bag inflate?

   e.) Does the reaction get hot or cold initially?

   f.) Does the reaction get hot or cold after 1 minute?

   g.) What observations did you make that tell you a chemical reaction is taking place?

   h.) Was this experiment a physical or chemical reaction?

Name…………………………………
Date……………………………….

Investigation sheet Experiment 1

We are finding out about:
……

………..

……….

This is what we will do:
……

……

……

……

……

……

This is a picture of what we need:

We found out that:
……

……

……

……

Name…………………………………
Date………………………………

Investigation sheet Experiment 2

We want to find out:
………

………………………………………………………………………………………

We will need:

First we will ……………………………………………………………………..................................

………

Next we will …………………………………………………………………………………………….

………

Then we will ……………………………………………………………………………………………..

…………………………………..

This is what we think will happen:
………

………

After the experiment, we found out that:
………

………

………

……………………………………………………………….

We think this happened because:
………

………

………

Name…………………………………
Date……………………………….

TOPIC 4 LAB ACTIVITY 1

CHEMICAL REACTIONS

Purpose:
To observe different type of chemical reactions
To identify the type of various chemical reactions
To predict the products of each
To write and balance chemical reactions

Procedure:

1. Each group will be assigned a reaction to demonstrate and explain to the class. One member of each group will demonstrate the experiment, another one will explain the lab activity to the class and the last one will write the chemical equation on the board.

2. Follow the instructions for the reaction.
3. Write the formulas for reactants in your table.
4. Predict the products by writing the full chemical equation for the reaction- be sure to balance each equation and use symbols where appropriate
5. Balance the equation. Classify the reaction.
6. Record observations about all details of the reaction
7. Keep the test tubes containing reactions in a rack
8. After you are finished with all six reactions, look over the test tubes that you have in your rack. Record any additional observations from changes that occurred over the lab period
9. When finished, clean the equipment you used and put it away.

Reactions:

1. In one test tube, mix a few pieces of solid zinc metal with two dropper-fulls of copper (II) nitrate solution.

2. In a new test tube, mix one dropper of ammonium hydroxide solution with one dropper of copper (II) nitrate solution.

3. In a new test tube, add a small piece of magnesium metal to one dropper of hydrochloric acid.

4. In a new test tube, mix one dropper of potassium iodide solution with one dropper of lead (II) nitrate solution.

5. Add 5-8 drops of $AgNO_3$ (aq) and the same quantity of $CaCl_2$ (aq) in a test tube

6. Add a small piece of zinc to a test tube. Add approximately 5ml of $CuSO_4$ to the test tube.

Name…………………………………
Date………………………………..

Data Table

REACTANTS	BALANCE CHEMICAL EQUATION	TYPE OF REACTION	OBSERVATIONS

Name…………….
Date…………………

TOPIC 4 LAB ACTIVITY 2

REACTIONS OF METALS WITH ACIDS

Introduction

Different metals react at different speeds with acid. A metal which reacts quickly with acid is called a reactive metal. An unreactive metal reacts only slowly or does not react at all.

By finding out how quickly different metals react with acid we can put them in order of reactivity.

When a metal reacts with an acid bubbles of gas are produced. The speed at which the bubbles are given off tells us how reactive the metal is.
The aim of this experiment is to place the metals, aluminium, zinc, magnesium, iron and copper in order of reactivity by watching how quickly they react with hydrochloric acid.

Requirements (what you need)

test tubes
test tube rack
beaker

dilute hydrochloric acid
samples of zinc, magnesium, iron, aluminium and copper

Hazards

Dilute hydrochloric acid irritates the eyes and magnesium ribbon is highly flammable.
When a metal reacts with acid, an acid mist is formed which irritates the eyes and throat.
Hydrogen gas is produced in the reaction and it is highly flammable.

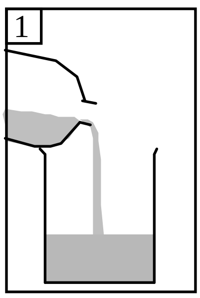
Procedure (what you do)

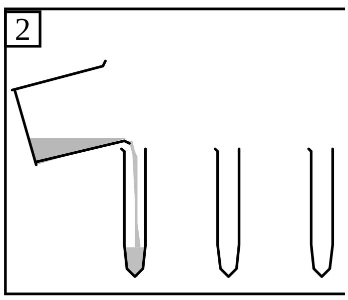
1. Add dilute hydrochloric acid to the beaker until it is half full.

2. Put five test tubes in the test tube rack.

   Pour some of the hydrochloric acid into the first test tube to a depth of about 4 cm.

   Pour the same volume of acid into the other four test tubes.





Name…………….
Date…………………

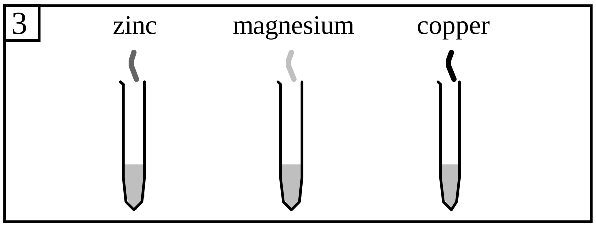
3. Add a piece of zinc to the first test tube.

   Add a piece of magnesium to the second test tube.

   Add a piece of copper to the third test tube.

   Add a piece of iron to the fourth test tube

   Add a piece of aluminium to the fifth test tube



4. Watch carefully what happens in each test tube.

   • the name of each metal

   • whether bubbles of gas were given off or not

   • the speed at which the bubbles were given off.

-QUESTIONS-

1. What was the aim of the experiment?

2. What allowed you to get some idea of the reactivity of the metals?

Name……………
Date…………………

Results

3. Complete the following table:

Metal	Bubbles of gas produced?	Reaction speed

4. Write and balance the single replacement reaction that has occurred between the acid and each metal.

Conclusion

5. Put the metals in order of reactivity starting with the most reactive.

Prescribed Practical Activities
Learning and Teaching Scotland

Name……………
Date…………………

TOPIC 4 LAB ACTIVITY 3

PREPARATION OF A SALT

Introduction

A salt is formed when the hydrogen ions of an acid are replaced by metal ions. For example, if the hydrogen ions in sulphuric acid were replaced by magnesium ions then the salt magnesium sulphate would be formed.

$$H_2SO_4 + MgCO_3 \longrightarrow MgSO_4$$

The aim of this experiment is to prepare a pure sample of magnesium sulphate.

An excess of $MgCO_3$ has to be used to make sure all the acid is used up. If any acid remained then the salt would be impure.

The fact that a gas is produced on reacting magnesium carbonate with an acid allows us to tell when all the acid has been consumed. At this point no more bubbles of gas will appear and the excess magnesium carbonate will remain as a solid in the reaction mixture.

Requirements

- small glass beaker
- measuring cylinder
- glass rod
- filter funnel and paper
- conical flask
- evaporating basin
- tripod
- dilute sulphuric acid
- magnesium carbonate

Hazards

Sulphuric acid irritates the eyes and skin and magnesium turnings are highly flammable.
When magnesium and magnesium carbonate react with sulphuric acid an acid mist is formed which irritates the lungs.
In the magnesium/sulphuric acid reaction hydrogen is given off and it is highly flammable.

Procedure

1. Using a measuring cylinder add 20 cm3 of dilute sulphuric acid to the beaker.
2. Add a spatulaful of magnesium carbonate to the acid and stir the reaction mixture with the glass rod.
3. If the entire solid reacts add another spatulaful of magnesium carbonate and stir the mixture.
4. Continue adding the magnesium or magnesium carbonate until no more bubbles of gas are produced and some of the solid remains unreacted.
5. Place the filter funnel in the neck of the conical flask. Fold the filter paper and insert it in the funnel.
6. Carefully pour the reaction mixture into the filter paper.
7. When the filtration is complete, transfer the salt solution from the conical flask into the evaporating basin.
8. Leave it until your next lesson to allow the solution to crystallize slowly.
9. Transfer the crystals onto a piece of filter paper. Examine them with a hand lens and draw one of the crystals.

Name……………
Date…………………

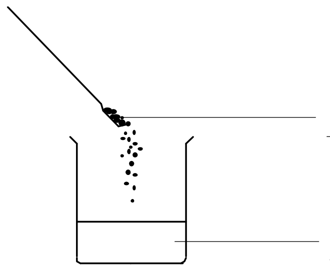
- QUESTIONS-

1. State the aim of the experiment indicating the names of the chemicals used to make the salt.

2. Why was an excess of magnesium or magnesium carbonate added to the acid?

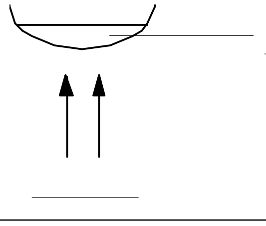
3. The three steps involved in preparing magnesium sulphate are the 'reaction' step, the 'filtration' step and the 'evaporation' step.
Label the diagrams which illustrate the 'reaction' step and the 'evaporation' step and draw a labelled diagram of the assembled apparatus used in the *'filtration' step.*

'reaction'



'filtration'

'evaporation'



Name…………….
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Results

4. Draw a crystal of magnesium sulphate.

Conclusion

5. Write a word equation for the reaction you carried out to prepare the salt.

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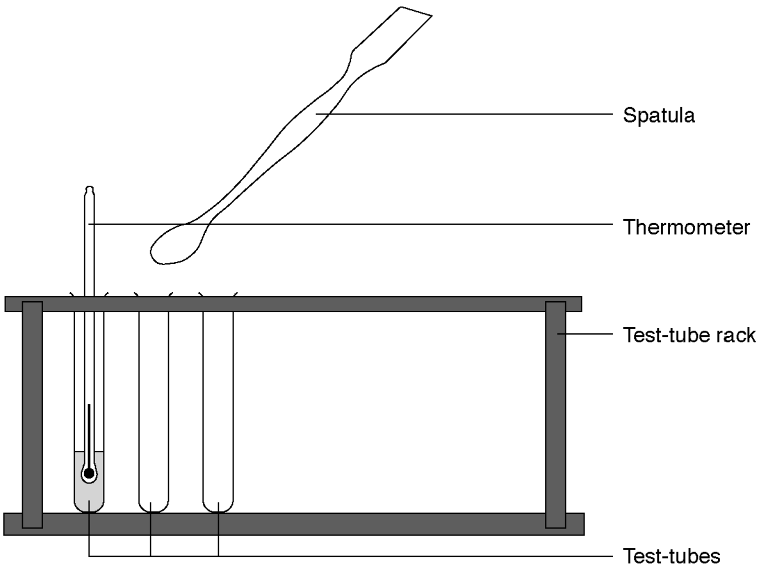
TOPIC 4 LAB ACTIVITY 4

Heats of reaction (exothermic or endothermic reactions)

Introduction

Some reactions give out heat and others take in heat. In exothermic reactions the temperature goes up, in endothermic reactions the temperature goes down. In this experiment, various reactions are examined. Temperatures are measured to decide whether a particular reaction is exothermic or endothermic.



What to record

What was done and any changes in temperature from the starting temperature of your reaction. A table may be useful.

Initial solution	**Temp of solution /℃**	**Solid added**	**Final temp of mixture/℃**	**Temperature change**	**Type of reaction**

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What to do

Experiment 1.

1. Put 2 cm^3 of water in a test-tube.
2. Record the temperature of the water.
3. Add a spatula measure of anhydrous (white) copper (II) sulfate.
4. Carefully stir, using the thermometer, and record the temperature again.

Experiment 2.

1. In a dry test-tube mix one spatula measure of citric acid and one spatula measure of sodium hydrogencarbonate.
2. Put 2 cm^3 of water in another test tube.
3. Record the temperature of the water.
4. Add the mixture to the water.
5. Watch what happens and take the temperature of the solution.

Experiment 3.

1. Put about 5 cm^3 of copper(II) sulfate solution in a test-tube.
2. Record the temperature.
3. Add a spatula measure of powdered zinc.
4. Record the new temperature.

Safety

Wear eye protection.
Anhydrous copper(II) sulfate is harmful.
Zinc powder is flammable.

Questions

1. Which reactions are exothermic and which are endothermic?

2. Write word and symbol equations for Experiment 3.

3. Which two substances could be put in a cold pack?

4. Golfers need a hand warmer to keep their hands warm on a cold day. Which chemicals could be put in these warmers?

Adapted from Classic Chemistry Experiments
Royal Society of Chemistry

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TOPIC 5 RATE OF REACTION

ACTIVITIES

The rate of a reaction is the speed at which a reaction happens. If a reaction has a slow reaction rate, that means the molecules combine at a slower speed than a reaction with a fast reaction rate. Some reactions take hundreds, maybe even thousands of years while others can happen in less than one second. The rate of reaction depends on the type of molecules that are combining.

Collision theory states that the more collisions in a system, the more probable combinations of molecules will happen. As the number of collisions in a system increases, more combinations of molecules will occur. The reaction will go faster, and the rate of that reaction increases.

Reactions happen, no matter what. Chemicals are always combining or breaking down. The reactions happen over and over but not always at the same speed. A few things affect the overall speed of the reaction and the number of collisions that can occur.

Concentration: If there is more of a substance in a system, there is a greater chance that molecules will collide and speed up the rate of the reaction. If there is less of something, there will be fewer collisions and the reaction will probably happen at a slower speed.

Temperature: When you increase the temperature of a system, the molecules bounce around a lot more (because they have more energy). When they move faster, they are more likely to collide. That fact means they are also more likely to combine. When you decrease the temperature, the molecules are slower and collide less. That temperature drop slows down the rate of the reaction.

Pressure: Pressure affects the rate of reaction, especially when you study gases. When you increase the pressure, the molecules have less space in which they can move. That greater concentration of molecules increases the number of collisions. When you decrease the pressure, molecules don't collide as often. The lower pressure decreases the rate of reaction.

Particle size: Reactions in which one of the reactants is a solid can be speeded up or slowed down by altering the particle size of the solid. The surface area of the solid will affect how fast the reaction goes. So the larger the surface area of the solid, the faster the reaction will be.

Catalyst: The presence of a catalyst increases the reaction rate (in both the forward and reverse reactions) by providing an alternative pathway with lower activation energy.

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1. Work in groups of 3. Work out the correct order for the 6 slips of the text and stand in that order. The teacher is going to ask you to read your slips in your chosen order to check that they are correct. The whole class listens and checks.

1. The rate of a reaction is the speed at which a reaction happens. If a reaction has a slow reaction rate, that means the molecules combine at a slower speed than a reaction with a fast reaction rate. Some reactions take hundreds; maybe even thousands of years while other

can happen in less than one second. The rate of reaction depends on the type of molecules that are combining.
Collision theory states that the more collisions in a system, the more probable combinations of molecules will happen. As the number of

collisions in a system increases, more combinations of molecules will occur. The reaction will go faster, and the rate of that reaction increases.

Reactions happen, no matter what. Chemicals are always combining or breaking down. The reactions happen over and over but not always at the same speed. A few things affect the overall speed

of the reaction and the number of collisions that can occur.

Concentration: If there is more of a substance in a system, there is a greater chance that molecules will collide and speed up the rate of the reaction. If there is less of something, there will be fewer collisions and the reaction will

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probably happen at a slower speed.

Temperature: When you increase the temperature of a system, the molecules bounce around a lot more (because they have more energy). When they bounce around more, they are more likely to collide. That fact means they are also more likely to combine. When you decrease the temperature, the molecules are slower

and collide less. That temperature drop slows down the rate of the reaction.

Pressure: Pressure affects the rate of reaction, especially when you study gases. When you increase the pressure, the molecules have less space in which they can move. That greater concentration of molecules increases the number of collisions. When you

decrease the pressure, molecules don't collide as often. The lower pressure decreases the rate of reaction**.**

Particle size: Reactions in which one of the reactants is a solid can be speeded up or slowed down by altering the particle size of the solid. The surface area of the solid

the solid will affect how fast the reaction goes. So the larger the surface area of the solid, the faster the reaction will be.

Catalyst: The presence of a catalyst increases the reaction rate (in both the forward and reverse reactions) by providing an alternative pathway with lower activation energy

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2. Complete the sentences with the appropriate words listed below. Remember that you may have to use the words more than once:

increase **decrease**

speed up **slow down**

more **fewer** **greater** **larger** **smaler**

faster **slower**

a. If there is an …………………in the number of collisions in a system,………… combinations of molecules will occur.

b. If there is a …………….in the number of collisions in a system,...................... combinations of molecules will occur.

c. If we increase the concentration of substances there is a ………… chance that molecules will collide and …………………the rate of the reaction.

d. If we decrease the concentration of substances, the rate of the reaction…………………………………………….

e. When you raise the temperature of a system there is a ……..............chance that molecules will collide and …………………………...the rate of the reaction.

f. When you lower the temperature the molecules move more slowly, collide less and the rate of the reaction …………………………

g. An increase in pressure…………………………. the rate of reaction

h. A decrease in pressure …………………………the rate of reaction

i. The …………… the surface area of the solid, the ………… the reaction will be.

j. The……………..the surface area of the solid, the……………the reaction will be.

j. The presence of a catalyst ……………………………. the reaction rate

3. In Summary:

SLOW REACTIONS	**FAST REACTIONS**
Large particles	……………………………………
…………………………….	High concentration
Low temperatures	……………………………………
………………………………..	High pressure

TOPIC 5 RATE OF REACTION

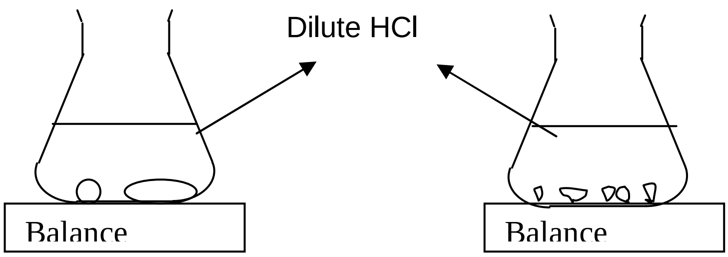
ILLUSTRATIVE EXPERIMENTS

- Keep demonstration simple and eye catching
- Do not overlook simple demonstrations. Even trivial activities can spark all sorts of interesting ideas.
- Involve your audience as much as possible; use your students as assistants
- Rehearse the demonstration before hand.
- Demonstrations are not replacements for practical work, but they make good extensions to a topic and help prompt discussion.
- The most important part of a good demonstration is that the students enjoy it.

Changing the speed of reactions. What makes a reaction go faster?

1. Particle size

Perhaps the size of the particles which are reacting has an effect on the speed. The reaction between marble chips and acid can be used to investigate the effect of particle size on the speed of reaction.
Two experiments are set up. The first uses dilute acid and large marble chips. The second has the same concentration of acid and the same mass of marble, however now the marble is in the form of small chips.
In both cases the speed of the reaction is found by measuring the mass of the flasks every minute. The flasks become lighter as the carbon dioxide gas escapes. A simple subtraction gives the mass of carbon dioxide produced.



2. Catalyst

There is a way to speed up a reaction without increasing the temperature or the concentration of the reactants. That is, by adding a substance called a catalyst.
Hydrogen peroxide solution is a liquid which decomposes slowly to give oxygen and water, as shown in the equation:

$$H_2O_2 \longrightarrow H_2 + O_2$$

Normally this reaction is so slow that you cannot see any signs of it taking place. But when manganese dioxide is added, bubbles of oxygen are produced very quickly.
We can say the manganese dioxide is a catalyst for the decomposition of hydrogen peroxide.
Chemists have discovered many different catalysts. However, all catalysts:

- Speed up some reactions
- Are not used up during a reaction.

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TOPIC 5. LAB ACTIVITY 1

THE EFFECT OF TEMPERATURE CHANGES ON REACTION RATE (A)

Ideas

1. In order for a chemical reaction to occur, the particles, atoms or ions, which are REACTANTS, must physically come into contact with one another. Anything that increases the frequency of these encounters will increase the rate at which PRODUCTS are formed.

2. The rate of a chemical reaction can be increased by increasing the temperature of these reactants.

My predictions:

Using hot water out of the tap, the rate of reaction will be …………….. times faster than at 0 degrees C.

Materials

- 6 Clear cups
- Measuring cup
- Thermometer, -20 degrees C to 110 degrees C
- 3 soluble tablets
- Stopwatch
- Mortar and pestle
- Hot water
- Ice cubes
- Graph paper

Procedure

A. Hot Water

1. Run water from the hot tap until it is as hot as possible. Fill a clear glass with exactly 250 ml of hot water.

2. Use the thermometer to take the temperature and record it on your data sheet.

3. Remove 1 tablet from its package. Drop it into water. Measure the time required for tablet to fully dissolve. Be prepared to start and stop on time. Record the time.

B. Room Temperature Water

1. Fill a clear glass with exactly 250 ml of room temperature water.

2. Use the thermometer to take the temperature and record it on your data sheet.

3. Drop 1 tablet into the water. Measure the time required for the reaction to be completed. Record the time.

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C. Cold Water

1. Fill a clear glass with 100 ml of water and add enough ice to adjust the level to 250 ml. Stir the ice water for about 15 seconds so the temperature will come to equilibrium.

2. Use the thermometer to take the temperature and record it on your data sheet. (Leave the ice cubes in the water!)

3. Drop 1 tablet into the water. Measure the time required for the reaction to be completed. Record the time.

Observations

Water Temperature - Time for Reaction to be Completed

Hot Tap ……….degrees °C ……………….Seconds

Room temperature ………………degrees °C ………………….Seconds

Ice Water …………….. degrees °C ………………Seconds

Analysis

Graph your data points (water temperature vs. time to fully dissolve) to show the effect of temperature on Rate of Reaction.

Summary

As the temperature increases, the rate of reaction _______________.

Questions

1. At a temperature of 10 degrees C, it would take ………………………. seconds for 1 tablet to react with 250 ml of water.

2. If the temperature is doubled from 20 degrees C to 40 degrees C, the time for the rate of reaction …………………..by approximately ………………………….

3. Using hot tap water, the rate was……………………………….. times faster than at 0 degrees C.

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TOPIC 5. LAB ACTIVITY 2

THE EFFECT OF TEMPERATURE CHANGES ON REACTION RATE

Introduction

Oxalic acid reacts with acidified solution of potassium permanganate:

$$5(COOH)_{2\,(aq)} + 6H^{+} + 2MnO_4^{-} \longrightarrow 2Mn^{2+}{}_{(aq)} + 10\,CO_{2\,(g)} + 8\,H_2O_{(l)}$$

Initially the reaction mixture is purple in colour due to the presence of permanganate ions but it will turn colourless as soon as they are used up. This colour change allows us to follow the course of the reaction.
If the amount of the permanganate ions initially present in a series of experiments is the same, then the point at which the purple colour disappears will always represent the same extent of reaction. So if it is the time it takes for the colour change to occur then take 1/t as a measure of the reaction rate.

Requirements

Selection of syringes
100 cm^3 glass beakers
timer
tripod
white tile
Bunsen burner and heating mat
thermometer

0,2 M oxalic acid
1 M sulphuric acid
0,02 potassium permanganate

Hazards
Oxalic acid, sulphuric acid and potassium permanganate irritate the eyes and are harmful if swallowed.

Care
Wear eye protection.
If any chemicals splashes on your skin, wash it off immediately.
When using the syringes always keep them pointing downwards.

Procedure

1. Using syringes add 5 cm^3 of sulphuric acid, 2 cm^3 of potassium permanganate solution and 40 cm^3 of water to a 100 cm^3 dry glass beaker.
2. Heat the mixture to about 40^0 C.
3. Place the beaker on a white tale
4. Add the oxalic acid to the mixture in the beaker as soon as possible and at the same time start the timer.
5. gently stir the reaction mixture with the thermometer.
6. When the reaction mixture just turn colourless stop the timer and record the time (in seconds). Measure and record the temperature of the reaction mixture.
7. Work out the reaction rate.
8. Repeat this procedures another three times but at higher temperatures.

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ASSESSMENT SHEET

The Effect of Temperature Changes on Reaction Rate

1. State the aim of the experiment.

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

Procedure

2. State two factors which had to be kept constant in the experiments.

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

3. How was the rate of the reaction determined?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

Results

4. Present your results in tabular form.

5. Work out the rate of each reaction and add these to your results table.

6. Draw a line graph of ‘reaction rate / s^{-1} against ‘temperature / °C’.

Conclusion

7. State the conclusion of the experiment.

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

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TOPIC 5. LAB ACTIVITY 3

The Effect of Concentration Changes on Reaction Rate

The course of the reaction between sodium persulphate ($Na_2S_2O_8$) and potassium iodide (KI) solutions can be followed by adding small quantities of starch and sodium thiosulphate ($Na_2S_2O_3$) to the reaction mixture.

(1) $S_2O_8^{2-}{}_{(aq)} + 2I^-{}_{(aq)} \longrightarrow 2SO_4^{2-}{}_{(aq)} + I_{2\,(aq)}$ (very slow)

(2) $2S_2O_3^{2-}{}_{(aq)} + I_{2\,(aq)}$ $2S_2O_6^{2-}{}_{(aq)} + 2I^-{}_{(aq)}$ (very fast)

Initially the mixture is colourless but after some time a blue/black colour suddenly appears as the starch reacts with the iodine produced in the reaction.
If (**t**) is the time taken for the blue/black colour to appear then the rate of the reaction can be expressed as: Rate = 1/t

If t is in seconds then the rate will have units, s^{-1}
A series of experiments will be carried out in which only the concentration of one of the reactants will be varied. All other variables will be kept constant.

Requirements

Selection of syringes	0.10 M sodium persulphate solution
100 cm^3 glass beakers	0.10 M potassium iodine solution
timer	0,05 M sodium thiosulphate solution

Hazards
There is a small risk of skin sensitization from the sodium persulphate solution

Care
Wear eye protection and when working with the sodium persulphate solution, wear gloves to avoid contact with the skin.
When using the syringes always keep them pointing downwards.

Procedure

9. Using syringes measure out 10 cm^3 of sodium persulphate solution and add 1 cm^3 of starch solution into a dry 100 cm^3 glass beaker and place the beaker on a white piece of paper.
10. Fill another syringe with 10 cm^3 of potassium iodine solution. Quickly add this to the sodium persulphate solution in the glass beaker and at the same time start the timer.
11. When the reaction mixture suddenly goes blue/black in colour stop the timer and record the time in seconds.
12. Work out the reaction rate.
13. Repeat this procedure another three times but use a different concentration of sodium persulphate each time. The concentration of sodium persulphate can be reduced by tacking less than 10 cm^3 of it and making up the difference with deionised water.
14. Note: Don't go bellow 4 cm^3 of sodium persulphate solution; otherwise the reaction time will be too long.

Name……………
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ASSESSMENT SHEET

The Effect of Concentration Changes on Reaction Rate

Objective

1. State the aim of the experiment

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

Procedure

2. How has the concentration of the sodium persulphate ($Na_2S_2O_8$) varied?

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

3. How was the rate of the reaction determined?

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

Results

4. Complete the following table:

Experiment	*1*	*2*	*3*	*4*
Volume of sodium persulphate / cm^3	*10*	*8*		
Volume of water / cm^3	*0*	*2*		
Time for blue/black colour to appear / s				
Rate / s^{-1}				

5. Draw a graph to illustrate your results. Draw a line graph of ‘reaction rate / s^{-1}’ against ‘volume of sodium persulphate. solution / cm^3’ (Since the total volume of the reaction mixture was the same in each experiment we can assume that the volume of the sodium persulphate solution is a measure of its concentration)

Conclusion

6. State the conclusion of the experiment

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

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REVISION ACTIVITY

1. Draw a nine-square grid. Choose nine of the keywords and write each one in a square, in any order.
2. Your teacher will read a definition. If you have the matching word with the definition that your teacher has just read, cross it out.
3. When a student has crossed out a whole line of words, he or she calls out Line!!. The line could be vertical, horizontal or diagonal. Read out your words and the meaning of each one.
4. The teacher will continue to read the definitions until one student has crossed out all his or her squares. This student calls out: Full House!!
5. Then the student has to read one of his or her words, asking someone in the class to give its meaning. Continue like this until all that student's words have been read out.
6. The teacher is going to read out any definitions still remaining and is going to ask students to give his or her matching word.
7. Write the keywords and definitions in your notebook.

Keywords	Definitions
Acid	A chemical compound which has a sour taste and will change indicator paper to red.
Exothermic	The reaction supplies the energy as heat.
Synthesis	Two or more substances combine to form a more complex substance.
Neutralization	Combine and acid with a base to produce a salt and water
Single replacement	A single element replaces another in a compound.
Compound	Material made from atoms of different elements
Molecule	The combination of two or more atoms chemically joined together to form a compound
Experiment	A planned test which gives evidence for or against a scientific idea
Alkali	A chemical compound which contains hydroxide ions and can be dissolved in water. It will turn indicator paper blue.
Electrolysis	The separation of elements in a chemical compound by electricity
Endothermic	In these reactions energy has to be supplied from outside, usually as heat.
Decomposition	A complex substance breaks down into two or more products
Oxidation	Oxygen usually combines with substances to make the oxide
Double replacement	Parts of two compounds switch places to form two new compounds.