MSSI WORKSHOP
FOR GRADE 11 & 12
PHYSICAL SCIENCE EDUCATORS

LIBANGENI CIRCUIT

09 / 06 / 2004
Hlalakahle H.S.

Conducted by Fusako Gomi (JOCV)

[CONTENTS]

Please call me to your Class or Extra lesson (on Saturday)

You can . . .

* do experiment with my help in your class!

* divide class into two and I can take care of one of them!

* do experiment without any preparation (I can prepare the equipments and worksheets for you and your learners!).

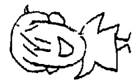
* do more than 6 experiments on one Saturday, off cause without any preparation! (Did you know? The number of the portfolio task for the practical work is 6 by the end of MAY!).

Call anytime!! : 083 9693567 !!

I can deliver the following Experiments to your School !!

(Just a few example !!)

off cause you can order me the experiment from the list or text book !!



I'm waiting for your call !!

EXPERIMENT Momentum (Gr. 12)

AIM

To investigate the conservation of momentum by the addition of a stationary object to a moving mass on a trolley.

APPARATUS / MATERIALS

Run-way, Trolley, Ticker-timer with leads, Masking tape or bostick, G-clamp, A.C. power Supply, Paper-ribbon, Ruler, 1 brick of known mass

METHOD

1) Arrange for the uniform motion of a trolley with mass, down the run-way as in experiment-1.
2) Note the mass of the trolley and the mass on it (m_1).
3) Allow a stationary brick of known mass to fall on the moving trolley and note the new mass (m_2) of trolley system vertically from above (as gently as possible) when the trolley is half-way on the run-way.
4) From the dots on the paper-ribbon, calculate the velocity before and after collision.
5) The time for different displacements may be calculated as in experiment-1.

TABULATION 1

No.	Before collision			After collision		
	Δt	Δs	$v_1=\Delta s/\Delta t$	Δt	Δs	$v_2=\Delta s/\Delta t$
1						
2						
3						
4						
5						
6						

TABLATION 2

No.	Before collision			After collision		
	Total mass (m_1)	Velocity (v_1)	Momentum $p_1=m_1v_1$	Total mass (m_2)	Velocity (v_2)	Momentum $p_2=m_2v_2$
1						
2						

RESULT

What is the relationship between p_1 and p_2?

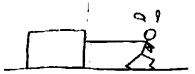
CONCLUTION

Write down whether the total momentum of the system before collision is equal to the total momentum after collision.

(2)

EXPERIMENT

Newton's Second Law (Gr.12)



AIM

To investigate the relationship between acceleration and force when the mass is constant.

APPARATUS / MATERIALS

Run-way, Trolley, 20 x 10g mass pieces, Ticker-timer with leads, String, Hook, Cell holder(3 cells), Paper-ribbon, Ruler

METHOD

1) Compensate for friction as follows: Raise the run-way at one end so that the trolley runs all the way down the ramp at an uniform speed.
2) Attach a pulley to the end of the track.
3) Tie one end of a piece of string (about 1-5m) to a trolley and other end to a hook.
4) Sit the trolley on the track in the start position and run the string over the pulley and attach the 5 x 10g mass pieces to the hook and leave the remaining fifteen on the trolley (the total mass of the system must remain constant in this experiment).
5) They should hang freely over the end of the runway (which should be projecting over the edge of a bench).
6) Hold the trolley in position until the ticker tape has been attached to it and the ticker is going. Then release it.
7) Use the tape to calculate the rate at which the trolley accelerated.
8) Now repeat with 10 mass pieces on the hook (and the other ten on the trolley).
9) Next put fifteen on the hook (leaving the remaining five on the trolley).
10) Finally try with all 20 mass pieces on the hook. This gives us four pairs of values for **F** and **a**.
12) You have enough data now to plot a graph of **a** vs **F** which should make it easy to deduce the relationship between the two quantities.

RESULT

Mass pieces: 5 =50g **a=**

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

Mass pieces: 10 =100g **a=**

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

Mass pieces: 15 = 150g **a=**

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

Mass pieces: 20 = 200g **a=**

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

F (N)	**a** (ms^{-2})	**F/a**

QUESTIONS

1) What does the gradient of **a** vs **F** and?
2) What mathematical relationship between **a** and **F** can be derived from the graphs?

Newtons Second Law (2) (GH/2)

EXPERIMENT

AIM

To investigate the relationship between the mass of an object and the acceleration produced by a constant resultant force.

APPARATUS / MATERIALS

Run-way, Trolley, 3 x 1kg mass pieces (second trolley can de used as one), 10 x 10g mass pieces, Ticker-timer with leads, String, Hook, Cell holder(3 cells), Paper-ribbon, Ruler

METHOD

1) Compensate for friction as follows: Raise the run-way at one end so that the trolley runs all the way down the ramp at an uniform speed.
2) Attach a pulley to the end of the track.
3) Tie one end of a piece of string (about 1-5m) to a trolley and other end to a hook.
4) Sit the trolley on the track in the start position and run the string over the pulley and attach the 10 x 10g mass pieces to the hook.
5) They should hang freely over the end of the runway (which should be projecting over the edge of a bench).
6) The 'weight' of these 10 mass pieces will provide the constant force which we wish to apply to the trolley.
7) Hold the trolley in position until the ticker tape has been attached to it and the ticker is going. Then release it.
8) Use the tape to calculate the rate at which the trolley accelerated.
9) Now double the mass of the mass of the trolley unit by sitting one of the 1kg masses on top of it.
10) Repeat the procedure and the acceleration calculation.
11) Then put two 1kg masses on the trolley and calculate anther value for **a**.
12) Try once again with three 1kg mass pieces pilled on the trolley.
13) You now have four pairs of values for **a** and **m**, so you can produce graphs of **a** vs **m** and **a** vs **1/m**.

RESULT

m=1kg a=

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

m=2kg a=

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

m=3kg a=

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

m=4kg a=

No.	Total time t (s)	Δt (s)	Total displacement s (m)	Δs (m)	Average velocity Δs/Δt (m/s)	Increase in velocity Δv (m/s)	Acceleration **a** = Δv/Δt (m/s)
1							
2							
3							
4							
5							

F (N)	m (kg)	a (ms^{-2})	F/a	1/m
1	1			
1	2			
1	3			
1	4			

QUESTIONS

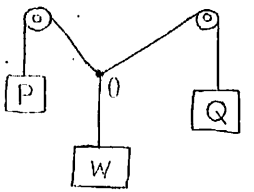
1) What does the gradient of **a** vs **m** and **a** vs **1/m**?
2) What mathematical relationship between **a** and **m** can be derived from the graphs?

(4)

EXPERIMENT Vectors (Gr, II)

AIM
To find the mass (m) of an unknown body using the parallelogram law of forces.

THEORY
If P, Q and W keep the point O in equilibrium, then
i) W is the equilibrant of P and Q.
ii) The resultant of P and Q can be found using the parallelogram law of forces.
iii) The resultant of P and Q is equal in magnitude to W but opposite in direction.



APPARATUS / MATERIALS
Force board, Weights, Thread, Pulleys, Paper, Mathematical set, ruler, etc..

METHOD
1) Set weights as P and Q so that P, Q and W keep to point O in equilibrium as shown in the diagram. On the white sheet of paper, fixed to the force- board, mark the position of O and the directions and magnitudes of P and Q.
2) Represent the forces P and Q in magnitudes and directions by the two sides of a parallelogram, drawn from O.
3) Complete the parallelogram and draw its diagonal from O.
4) Measure the length of the diagonal of the parallelogram from O which represents the weight of the unknown mass.
5) Repeat the experiment by varying the magnitudes of P and Q.

DATA COLLECTION

	P (N)	Q (N)	Length of diagonal	W (N)	Mass M=W/g
1					
2					
3					
4					

RESULT
The mass of the body M=.....kg.

CONCLUSION
i) The parallelogram law of forces can be used to find an unknown mass.
ii) The three forces that keep the point O in equilibrium can be represented in magnitude and direction by the three sides of a triangle, taken in order (Triangular law of forces).

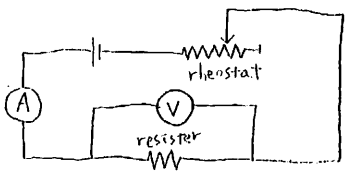
EXPERIMENT Ohm's Law (Gr, 10)

AIM
To verify Ohm's law.

THEORY
The current through a conductor (I) is directly proportional to the potential difference between its ends (V) when the temperature remains constant V/I=R (constant).

APPARATUS / MATERIALS
Battery or cells, 6 connecting wires, rheostat, resister, voltmeter and ammeter.

METHOD



1) Do the connections as in the diagram.
2) Using the rheostat check the maximum and minimum current range you can get on the ammeter [Suppose, it is 0~2A].
3) Adjust the rheostat to read a current of 0,1A on the ammeter and note down the corresponding values of the voltmeter.

OBSERVATION
I) TABULATION

Current I (A)	Potential difference V (V)	V/I

II) GRAPHING
Draw a graph between I (x-axis) and V (y-axis) and interpret the nature of the graph.

CONCLUSION
i) V/I=constant and it is in accordance with the Ohm's law.
ii) Graph I vs V is straight line passing through the origin. This shows that $V \propto I$ when temperature remains constant.

PRECAUTIONS
1. The circuit should not be kept closed for a long time while the readings are taken. Otherwise it would heat up the resister.
2. It is better if the resister is kept in a water-bath so that the temperature remains the same (Any heat produced will be absorbed by water.).

EXPERIMENT Ions (Gr.10)

AIM

To distinguish some salts by reactions between anions and some solutions.

APPARATUS / MATERIALS

Test tube (6) in rack, Medicine dropper, Salts (sodium chloride, potassium bromide, potassium iodide, magnesium sulphate, sodium carbonate, potassium nitrate) solutions, Hydrochloric acid solution, Silver nitrate solution, Barium chloride solution

METHOD

1) Add about 5 cm^3 of the solutions listed below (concentration ±0.5 $mol \cdot dm^{-3}$) to separate test tubes in a test-tube rack.

Test tube 1	sodium chloride	Test tube 4	magnesium sulphate
Test tube 2	potassium bromide	Test tube 5	sodium carbonate
Test tube 3	potassium iodide	Test tube 6	potassium nitrate

2) Mark the test tubes so that you know which solution is which.

A. Investigate the reactions between hydrochloric acid and various anions.

1) Pour about 2 cm^3 dilute hydrochloric acid into each test tube. Note with which substance(s) reaction occurs.

B. Investigate the reaction of silver nitrate with various anions.

1) Add about 2 cm3 silver nitrate solution into each test tube. Note in which test tubes a precipitate is formed and also the colour of each precipitate.

C. Investigate the reaction between barium chloride and various anions.

1) Add about 2 cm3 barium chloride solution to each test tube. Note in which test tube a precipitate is formed.

RESULT

	A. HCl	B. $AgNO_3$	C. $BaCl_2$	The solution is.....
1				
2				
3				
4				
5				
6				

COMPLETE EQUATIONS

A. ( ) HCl + ( ) ( ) + ( ) + ( )

B. $AgNO_3$ + ( ) ( ) + ( )

$AgNO_3$ + ( ) ( ) + ( )

$AgNO_3$ + ( ) ( ) + ( )

$2AgNO_3$ + ( ) ( ) + ( )

C. $BaCl_2$ + ( ) ( ) + ( )

$BaCl_2$ + ( ) ( ) + ( )

(6)

EXPERIMENT : Electromagnetic (Gr, 10)

AIM

To investigate the force on a current-carrying conductor in the field of a magnet.

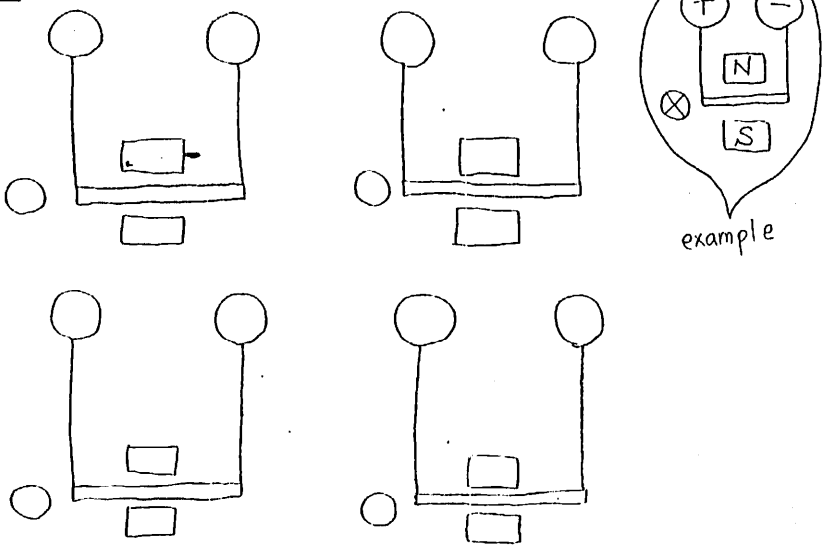
APPARATUS / MATERIALS

Horse-shoe magnet, Battery cell, Conductor, Rheostat, Switch, String, Stand, Ammeter

METHOD

1) Suspend a straight conductor horizontally between the poles of a horse-shoe magnet.
2) Connect the straight conductor to a battery, a rheostat, an ammeter and a switch.
3) Close the switch and watch the conductor.
4) Increase the current in the conductor.
5) Reverse the terminals of the cell and repeat the experiment.
6) Turn the magnet around so that the N-pole is at the bottom and repeat the experiment.

RESULTS



example

QUESTIONS

1) In which direction does the conductor move when a current flows through it?
2) Does the direction of the current have any effect on the movement of the conductor?
3) Does the magnitude of the current have any effect on the movement of the conductor?
4) Does the direction of the magnetic field have any influence on the movement of the conductor?

EXPERIMENT Acid and Base (Gr, 12)

AIM

To find the concentration of a given hydrochloric acid solution.

THEORY

An acid solution reacts with a base in solution. At the neutralizing point, they have the equivalent quantity of moles.

APPARATUS / MATERIALS

Burette, Pipette, Conical flask, Medicine dropper, Phenolphthalein (Indicator), NaOH to make a standard solution, HCl acid of unknown concentration, Standard flask, Mass meter, Filter paper, distilled water

METHOD

1) Dissolve 10g of NaOH in a 500cm^3 standard flask. This gives a NaOH solution of 0,5-mol/dm^3 solution.
2) Pipette out 25cm^3 of the standard NaOH solution to the conical flask and add 2 or 3 drops of phenolphthalein as indicator.
3) Fill the burette with the given HCl acid solution.
4) Keep the conical flask below the burette and also keep a white sheet of paper below the conical flask to identify any colour change.
5) Add HCl to NaOH solution drop by drop from the burette while the mixture is whirled around for proper mixing.
6) The neutral point is reached when a single drop of acid from the burette make the solution in the conical flask colourless.
7) Note the volume of the acid used up at the neutralization point.
8) The experiment is repeated at least 3 more times by taking fresh quantity of NOH solution (25cm^3) in the freshly cleaned conical flask.

TABULATION

	Volume of NaOH V_b (cm^3)	Volume of HCl V_1 (cm^3)	Average of V_1 V_a (cm^3)
1	25		
2			
3			

CALCULATIONS

Mass of NaOH=m. Formula mass of NaOH, (M=40g) = 1 mol. No. of moles NaOH = m/M = n.
Volume of the standard flask used = V (cm^3)
Concentration of NaOH solution = n/V x 1000 in mol/dm^3

$NaOH + HCl \rightarrow NaOH + H_2O$

1 mol + 1 mol = 1 mol + 1 mol

n_b n_a

Concentration HCl = C_a, Volume of HCl used = V_a, n_a = 1 mol, n_b= 1 mol
Concentration NaOH = C_b, Volume of NaOH used = V_b
$C_aV_a / C_bV_b = n_a / n_b$ or $C_a = n_a / n_b \times C_bV_b / V_a$

RESULT

The concentration of the given HCl acid solution = ... mol/dm^3

Physical Science Grade.11 Experiment List

No.	Section	Ex. No.	Aim
1	Vectors	1	To demonstrate with the help of spring balances how the equilibrant of two forces changes when the angle between the two forces changes.
2	Vectors	2	To confirm experimentally the parallelogram method of finding the resultant of two non-parallel vectors.
3	Vectors	3	The experimental confirmation of the triangle of forces.
4	Vectors	4	To find the vertical and horizontal components of a force with the help of a spring balance.
5	Mechanics	5	To determine the frequency of a ticker timer.
6	Mechanics	6	To measure a walking speed.
7	Mechanics	7	To determine the magnitude of the average velocity of a trolley with zero acceleration.
8	Mechanics	8	To investigate the displacement / time and velocity / time relationships of uniform motion.
9	Mechanics	9	To investigate the displacement / time and velocity / time relationships of uniformly accelerationed motion.
10	Mechanics	10	To determine the acceleration of a falling body using a ticker timer.
11	Waves	12	To investigate diffraction i.e. the bending of waves around the edges of objects.
12	Waves	13	To observe interference patterns in water waves.
13	Light	18	To demonstrate the polarization of light using Polaroid discs.
14	Light	20	To examine the dispersion of white light through a prism.
15	Light	21	To investigate the flame colours of various elements.
16	Light	24	To investigate the liberation of electrons from a zinc plate by ultra violet light.
17	Atomic theory	26	To determine Avogadro's constant using electrolytic method.
18	Polarity	34	To investigate the influence of an electric field on polar and non-polar liquid.
19	Kinetic theory	35	To investigate the relationship between the volume and pressure of a fixed mass of gas at constant temperature.
20	Liquid phase theory	37	To compare the intermolecular forces in a number of liquid.
21	liquids	38	To investigate the influence of pressure on the boiling point of a liquid.
22	Liquids	39	To investigate surface tension in a liquid.
23	Liquids	40	To investigate the difference in vapour pressure between water and ethanol.
24	Liquids	41	To investigate the effect of a non-volatile dissolved substance on the boiling point of water.

25	Solutions	43	To investigate the solubility of molecular and ionic solids in various solvents.
26	Solutions	44	To investigate the electrical conductivity of various liquids and solutions.
27	**Inorganic chemistry**	**45**	**To prepare hydrogen sulphide by the reaction of iron II sulphide and dilute hydrochloric acid.**
28	Inorganic chemistry	46	To observe the reducing action of hydrogen sulphide on $FeCl_3$, permanganate ions.
29	**Inorganic chemistry**	**47**	**To investigate the action of hydrogen sulphide on certain metallic salts such as:$CuSO_4$, $Pb(NO_3)_2$, $ZnNO_3$.**
30	Inorganic chemistry	48	Preparation of sulphur dioxide by the action of concentrated sulphuric acid on sodium sulphite.
31	Inorganic chemistry	49	Preparation of sulphur dioxide by the action of concentrated sulphuric acid on copper.
32	Inorganic chemistry	50	To investigate the action of sulphur dioxide on water.
33	Inorganic chemistry	51	To investigate the reducing action of sulphur dioxide on potassium permanganate and potassium dichromate.
34	Inorganic chemistry	52	To investigate the oxidising action of sulphur dioxide on hydrogen sulphide and magnesium ribbon.
35	Inorganic chemistry	53	To investigate the action of sulphuric acid on crystals of copper sulphate and sugar.
36	Inorganic chemistry	54	To investigate the action of sulphuric acid on sodium chloride and potassium nitrate. (to demonstrate that HCl and HNO_3 are produced in the action of H_2SO_4 on chlorides and nitrates respectively.)
37	Inorganic chemistry	56/ 57	To examine some precipitations which can be used as tests for the presence of sulphate.
38	Inorganic chemistry	58	To prepare dry ammonia gas.
39	Inorganic chemistry	59	To demonstrate the solubility of ammonia in water via the fountain experiment.
40	Inorganic chemistry	60	To observe the thermal decomposition of ammonium chloride.
41	Inorganic chemistry	61	To investigate the action of nitric acid in copper.
42	Inorganic chemistry	62	To investigate the decomposition of two nitrates on heating.
43	Inorganic chemistry	63	To investigate the effect of temperature on the equilibrium concentrations of NO_2 and N_2O_4.
44	Inorganic chemistry	65	To investigate the effects of heating on nitric acid.
45	Inorganic chemistry	66	To prepare chlorine by: –reacting hydrochloric acid with manganese dioxide. –reacting hydrochloric acid with potassium permanganate.
46	Inorganic chemistry	67	To investigate the reaction of chlorine with halide solutions and to identify the products formed.

47	Inorganic chemistry	68	To investigate the bleaching of chlorine water.
48	Inorganic chemistry	69	To investigate the solubility of hydrogen gas in water.
49	Inorganic chemistry	70	To investigate the actions of Halide solutions on silver nitrate solutions or to test for the presence of halide ions.

Physical Science Grade.12 Experiment List

No.	Section	Ex. No.	Aim
1	Mechanics	2	To illustrate the principle of the Galileo pen and pendulum experiment.
2	Mechanics	5& 7	To study the relationship between the mass of a body and it's acceleration under a constant force.
3	Mechanics	6	To investigate the relationship between acceleration and force when the mass is constant.
4	Mechanics	8	To investigate Newton's third law.
5	Work/ Energy/ Power	11	To estimate the power used by a student climbing some stairs.
6	Mechanics	12	To demonstrate the inclination of a swinging pendulum to conserve mechanical energy.
7	Electricity	18	To investigate some of the factors which influence the force that a current carrying conductor experiences in a magnetic field.
8	Electricity	20	To verify Ohm's law.
9	Electricity	21	To verify Ohm's law.
10	Electricity	22	To determine the equivalent resistance of resistors in : a) series b) parallel.
11	**Electricity**	**23**	**To investigate the relationship between the amount of work done in a resistor and : a) time of current flow b) current strength c) resistance**
12	Reaction rates	25	To demonstrate the effects of the state of division of reactants on the rate of a chemical reaction.
13	Reaction rates	26	To observe the effect of concentration changes on the rates of a chemical reaction.
14	Reaction rates	27	To use the "iodine clock" reaction to demonstrate the effects of temperature and concentration on the rate of a reaction.
15	Reaction rates	(28)	To demonstrate the effects of the presence of a catalyst on the rate of a reaction.
16	Rates/Equili brium	29	To explore some notable exothermic / endothermic situations in chemistry.

17	Chemical equilibrium	30	To observe the effect of pH on an equilibrium chromate / dichromate solution.
18	Chemical equilibrium	31	To observe the roles played by temperature and concentration in the reversible reaction.
19	Chemical equilibrium	32	To observe the influence of concentration on equilibrium.
20	Chemical equilibrium	34	To demonstrate "the common ion effect".
21	—	35	To look at methods of removing (by precipitation) various cations from a solution.
22	Acids & Bases	36	To compare the electrical conductivities of a strong and a weak acid.
23	Acids & Bases	37	Measuring the pH of successive dilutions of hydrochloric acid.
24	Acids & Bases	39	To determine the exact concentration of a solution of HCl (i.e. to standardize it) by titrating it against a sodium carbonate solution of known concentration.
25	Acids & Bases	40	To use the HCl solution standardized previously to standardize a sodium hydroxide solution.
26	Acids & Bases	41	To determine the concentration of the ethanoic acid solution which is domestic vinegar.
27	Redox	42	To compare the relative oxidizing powers of three halogens.
28	Redox	43	To compare the reducing ability of a few metals (by looking at some displacement reactions).
29	Electrochemical cells	44	To build the zinc / copper cell.
30	Organic chemistry	47	To use bromination as a distinguishing test between an alkane and an alkene.
31	Organic chemistry	48 a	To investigate the products of the oxidation of an alcohol.
32	Organic chemistry	49	To make some esters.

Bold means the experiment will be done in this workshop.

SCIENCE KIT (GRADE 11-12)

DRAWER 1

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Beakers Glass	250ml	2	
Boiling Flask	250ml	1	Exp.2
Glass Burette	25ml	1	
Large Burner		1	
Glass Conical Flask	250ml	2	
Glass Jet		1	
Glass Rod		1	
Glass Tube	60mm	4	
Glass Tube	200mm	4	
Evaporating Basin		2	
Plastic Pipette	10ml	1	

Exp.2 means the equipment will be used the exp.2.

TOP

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Ripple Tank		1	
Ammeter Triple Scale		1	Exp.1
Voltmeter		1	
Force Board & Legs		1	
Boyles Law Apparatus		1	
Filter Paper 100 Sheets		1	
Balance Kit		1	

DRAWER 2

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Plastic Trough		1	
Gas Jars		6	
Measuring Cylinder	100ml	1	Exp.1
Gas Cover Slips		6	
Wash Bottle	250ml	1	
Thermometers		2	Exp.1
Pair Safety Glasses		1	
Funnel		1	
Medicine Droppers		2	
Nichrome Wire Holder		1	
Pipeclay Triangle		1	
Thistle Funnel Plastic		1	Exp.2
Stainless Steel Spatula		1	Exp.2
Syringe	50ml	1	
Plastic Teaspoons		2	
Deflagarating spoons		2	
Plastic Delivery Tube		4	
Large Wooden Spatulas		2	
Delivery Tubes with elbows		2	Exp.2
Rubber Deliver Tube		1	

DRAWER 3

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Retort Clamp		1	
Retort Ring		1	
Retort Stand		1	
Solid Stopper	24mm	2	
1 Hole Stopper	24mm	2	
2 Hole Stopper	24mm	2	
1 Hole Stopper	30mm	1	
2 Hole stopper	30mm	1	Exp.2
Test Tube Brush	24mm	1	
Test Tube Rack	6×24mm	1	Exp.2
Test Tube Clamp with Dowel handle		1	
Test Tubes	24×150mm	6	Exp.2
Boss Head		1	

DRAWER 4

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Circuit Board		1	
Cell Holders		2	Exp.1
Cell Pins		2	
Cell Dividers		2	
Pair Carbon Rods		1	

Connectors		5	
Rectangular Coil		1	
Electroscope		1	
Black Leads Croc	300mm	3	Exp.1
Red Leads Croc	300mm	3	Exp.1
Joules Calorimeter		3	1.1, 2.2, 3.3 ohm Exp.1
Resistance Board Short		1	
Resistors Mounted		3	10, 15, 22 ohm
Switch		1	
Bar magnet (pair)		1	
Electrostatic Pack		1	
Perspex Strips	260×20×3mm	2	
Polythene Strips	260×20×3mm	2	
Pin Stands		2	
Flannel Cloth		1	
Red/Black Leads	1m	2	
Red/Black Lead croc	1m	1	
Clip & banana plug		1	
Magnet Support		1	

DRAWER 5

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Dynamics Trolley		2	
Ticker Timer		1	
Weight		1	
Metal Mass Pieces		20	
Boyle's Law Value		1	
Reel Cotton		1	
Carbon Discs		20	
Force Board Pulleys		2	
Hooks		3	
Spirit Level		1	
Pendulum Bob		1	
Pendulum Bob Support		1	
Ticker Timer Tape		1	
Newton Spring Balance		3	
Set of 4 Ripple Tank Legs		1	
Roller Bar		1	
Convex Perspex Shape		1	
Concave Perspex Shape		1	
Perspex Rectangular		1	
Equilateral Prism		1	
Ripple Tank Light		1	
Ripple Tank Holder		1	
Curved Wave Barrier		1	
Straight Wave Barriers		3	
Polaroid Discs		2	
Prestik		1	

LIQUID CHEMICALS

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Diethyl Ether	100ml	1	
Acetic Acid	500ml	1	
Ammonium Hydroxide	500ml	1	
Bromine Solution	500ml	1	
Bromothymol blue Solution	100ml	1	
Chlorine Water	500ml	1	
Ethanol	500ml	1	
Formic Acid	100ml	1	
Hydrochloric Acid	500ml	1	Exp.2
Methanol	500ml	1	
Methylated Spirits	500ml	1	
Nitric Acid	500ml	1	
Silver Nitrate Solution	500ml	1	
Universal Indicator	100ml	1	
Xylene	500ml	1	
Sulphuric Acid	500ml	1	

SOLID CHEMICALS

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Aluminium Sulphate	small	1	
Ammonium Carbonate	small	1	
Ammonium Chloride	small	1	
Ammonium Thiocyanate	small	1	
Calcium carbonate	small	1	
Calcium Chloride	medium	1	
Calcium Hydroxide	small	1	
Cobalt Chloride	small	1	
Copper Nitrate	small	1	
Copper Sulphate	small	1	Exp.2
Iodine Crystals	medium	1	
Iron III Chloride	Ferric	1	
Iron II Sulphate	small	1	
Iron III Nitrate	small	1	
Iron Fillings	small	1	
Iron Sulphide	small	1	Exp.2
Lead Nitrate	small	1	Exp.2
Manganese Dioxide	small	1	
Manganese Sulphate	small	1	
Magnesium Nitrate	small	1	
Magnesium Sulphate	small	1	
Mercury	small	1	
Mercury II Chloride	small	1	
Oxalic Acid	small	1	
Potassium Bromide	small	1	
Potassium Chloride	small	1	
Potassium Chromate	small	1	
Potassium Dichromate	small	1	
Potassium Iodine	small	1	
Potassium Iodate		1	
Potassium Nitrate	small	1	
Potassium Permanganate	small	1	
Potassium Thiocyanate	small	1	
Sodium Bisulphate	small	1	
Sodium Carbonate		1	
Sodium Chloride		1	
Sodium Hydroxide	medium	1	
Sodium Nitrate	small	1	
Sodium Oxalate	small	1	
Sodium sulphate	small	1	
Sodium sulphite	small	1	
Sodium Thiosulphate	small	1	
Starch Powder	small	1	
Sulphur Powder	small	1	
Zinc Granules	small	1	
Zinc Nitrate	small	1	Exp.2
Zinc Sulphate		1	
Glass wool		1	
Bk. Litmus Paper Red		1	
Bk. Litmus Paper Blue		1	
Magnesium Ribbon	12g	1	
Steel Wool		1	
Pair Copper Strips		1	
Pair Zinc Strips		1	

EXPERIMENT 1

Grade 12 Physics (Electricity) (No.11)

AIM

To investigate the relationship between the amount of work done in a resister and

a) time of current flow
b) current strength
c) resistance

APPARATUS

Joules calorimeters(4), Cell holders(with 4 cells each)(2), Leads, Rheostat(Resistance Board Short), Thermometer, Ammeter, Measuring cylinder.

METHOD

A. Relationship between energy transferred and the time of current flow (resistance And current kept constant.)

1) Put 50cm^3 of water in one of the calorimeter.
2) Connect it in series with a rheostat, an ammeter and a switch to the two cell holders (arranged in parallel).
3) Set the rheostat to its maximum resistance, close the circuit and adjust the rheostat to maintain the current at a fixed point throughout, say at 1A.
4) Take temperature readings at regular intervals, for 5 minutes.

B. Relationship between energy transferred and the magnitude of the current (resistance and time kept constant).

1) Repeat with all conditions being the same except that we maintain a low current, say 0,5A, in one for a fixed period of time (e.g. 5 minutes) and a higher current, say 1,5A, in the other for the same time period.
2) Note the difference in the temperature increases.

C. Relationship between energy transferred and the resistance of the conductor (magnitude of current and time of current flow kept constant).

1) Connect all three calorimeters in series with the ammeter and cell holders.
2) Make sure that each has exactly the same quantities of water (e.g. 50 cm^3).
3) Close the circuit and allow current to flow for some time (e.g.5 minutes).
4) Note the difference in the temperature increases.

RESULTS

A. resistance:_____ Ω current:_____ A

Time (sec.)	0	30	60	90	120	150	180	210	240	270	300
Temperature (°C)											
Temperature Increase (°C)											

B. resistance:_____ Ω time:_____ sec.

Current (A)	Current^2 (A^2)	Initial temp. (°C)	Final temp. (°C)	Temp. increase (°C)

C. current:_____ A time:_____ sec.

Resistance (R)	Initial temp. (°C)	Final temp. (°C)	Temp. increase (°C)

ACTIVITY

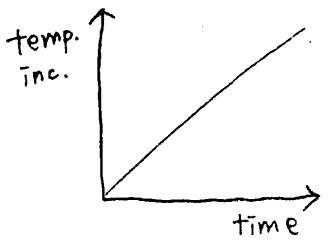
1) Plot graphs of
   i) temperature increase – time
   ii) temperature increase – current
   iii) temperature increase – current^2
   iv) temperature increase – resistance .

2) What single mathematical relationship expresses all the results obtained in this experiment?

Worksheet for Experiment 1

Memo

* From graph i)



Temperature increase is directly proportional to time.

↓

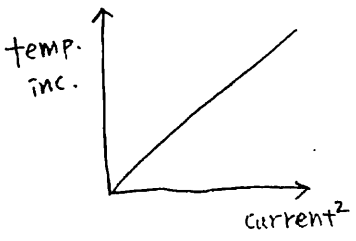
Work

↓

Energy is directly proportional to time.

in symbols: $W \propto t$

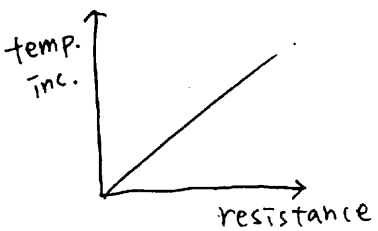
* From graph iii)



Energy is directly proportional to current²

in symbols: $W \propto I^2$

* From graph iv)



Energy is directly proportional to resistance

in symbols: $W \propto R$

* Combing the 3 ideas together $W \propto I^2 \cdot R \cdot t$

* Now you can find out $W = k I^2 \cdot R \cdot t$

If you choose the suitable units, we have Joule's equation as:

$$W = I^2 \cdot R \cdot t$$

$$[J] \quad [A^2] \; [\Omega] \; [s] \leftarrow \text{unit}$$

EXPERIMENT 2 Grade 11 Chemistry (Inorganic chemistry) (No.27, 29 combined)

AIM

To prepare hydrogen sulphide by the reaction of iron II sulphide and dilute hydrochloric acid, and to investigate the action of hydrogen sulphide on certain metallic salts such as :

a) copper II sulphate
b) lead II nitrate
c) zinc nitrate

APPARATUS

250cm^3 boiling flask, Two hole stopper, Delivery tube, Test tube (3) in rack, Spatula, Thistle funnel, Dilute hydrochloric acid, Iron II sulphide, Copper sulphate, Lead nitrate, Zinc nitrate

METHOD

1) Half fill three test tubes with water and add one or two crystals of copper sulphate to one, lead nitrate to the next and zinc nitrate to the third.
2) Place a few pieces of iron II sulphide in the boiling flask.
3) Fit the flask with a two hole rubber stopper, thistle funnel and delivery tube.
4) pour dilute hydrochloric acid into the flask.
5) Very soon hydrogen sulphide gas will be evolving from the delivery tube, and bubble gas through each of the solutions until precipitations can be seen.

RESULTS

Salt	Colour change	Chemical reaction
Copper II sulphate		
Lead II nitrate		
Zinc II nitrate		

QUESTION

1) What sulphides are formed in the above precipitation reactions?

Worksheet for Experiment 2

Fill the blanks.

Memo

* To prepare hydrogen sulphide

$$FeS + 2HCl \rightarrow FeCl_2 + H_2S\uparrow$$

(Iron II Sulphide) (Hydrochloric acid) (Ferric Chloride) (Hydrogen Sulphide)

* The precipitation reactions

$$CuSO_4 + H_2S \rightarrow H_2SO_4 + CuS\downarrow$$

(Copper II Sulphate) + (Hydrogen Sulphide) (Sulphuric acid) (Copper Sulphide)

colour = (black)

$$Pb(NO_3)_2 + H_2S \rightarrow 2HNO_3 + PbS\downarrow$$

(Lead II nitrate) + (Hydrogen Sulphide) (Nitric acid) (Lead Sulphide)

colour = (black)

$$Zn(NO_3)_2 + H_2S \rightarrow 2HNO_3 + ZnS\downarrow$$

(Zinc II nitrate) (Hydrogen Sulphide) (Nitric acid) (Zinc Sulphide)

colour = (white)