MSSI WORKSHOP
FOR GRADE 11 &12
PHYSICAL SCIENCE EDUCATORS

MOUTSE-WEST CIRCUIT

10 / 03 / 2004

Rephafogile H.S.

Conducted by Fusako Gomi (JOCV)

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WHERE IS THE KIT AND HOW TO USE THE KIT

WHERE?

CIRCUIT	SCHOOL	NAME OF HOD	CONTACT No.
Marapyane	Moepi H.S.		
Mmametlhake	Ratlahana H.S.		
Libangeni	Tlhakahla H.S.		
Nokaneng	Thufane H.S.		
Moutse west	Rephafogile H.S.		

How?

1) Check lists of the kit and experiments.
2) If you find a nice experiment, call the HOD of the school in your circuit and make sure the kit is available.
3) Go to the school and take it. Then, make sure that write down your name and school on the lending form.
4) Back the kit up to 1 week. If you use some chemicals, thread, est., fill up the form how much you use these things. If you broke or lost something, you also fill up what you lose or how broke.

Example of entry

MSSI SCIENCE KIT (FOR GRADE 11 AND 12) LENDING LIST CIRCUIT..... SCHOOL.....

When you lend →

When you back →

Date to lend	Date to back	Name of school	Name of educator	Description	Amount	Condition when it back (how much you use)
02.02		Hara J.H.S	Fusako. G	Boiling Flask	1	
				Delivery Tube	1	
				Copper Sulphate	10g	
				Iron Sulphide	10g	
				Beaker	2	
02.02	09.02	Hara J.H.S	Fusako. G	Boiling Flask	1	Good.
				Delivery Tube	1	Good
				Copper Sulphate	10g	2g back
				Iron Sulphide	10g	(finish)
				Beaker	2	1 beaker broken.

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.

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.**
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	48a	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	Exp.4
Boiling Flask	250ml	1	Exp.3
Glass Burette	25ml	1	Exp.4
Large Burner		1	
Glass Conical Flask	250ml	2	Exp.4
Glass Jet		1	
Glass Rod		1	Exp.4
Glass Tube	60mm	4	
Glass Tube	200mm	4	
Evaporating Basin		2	
Plastic Pipette	10ml	1	

Exp.4 means the equipment will be used the exp.

DRAWER 2

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Plastic Trough		1	
Gas Jars		6	
Measuring Cylinder	100ml	1	Exp.2
Gas Cover Slips		6	
Wash Bottle	250ml	1	
Thermometers		2	Exp.2
Pair Safety Glasses		1	
Funnel		1	
Medicine Droppers		2	
Nichrome Wire Holder		1	
Pipeclay Triangle		1	
Thistle Funnel Plastic		1	Exp.3
Stainless Steel Spatula		1	Exp.3&4
Syringe	50ml	1	
Plastic Teaspoons		2	
Deflagarating spoons		2	
Plastic Delivery Tube		4	
Large Wooden Spatulas		2	
Delivery Tubes with elbows		2	Exp.3
Rubber Deliver Tube		1	

DRAWER 3

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Retort Clamp		1	Exp.4
Retort Ring		1	
Retort Stand		1	Exp.4
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.3
Test Tube Brush	24mm	1	
Test Tube Rack	6×24mm	1	Exp.3
Test Tube Clamp with Dowel handle		1	
Test Tubes	24×150mm	6	Exp.3
Boss Head		1	

DRAWER 4

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Circuit Board		1	
Cell Holders		2	Exp.2
Cell Pins		2	
Cell Dividers		2	
Pair Carbon Rods		1	
Connectors		5	
Rectangular Coil		1	
Electroscope		1	
Black Leads Croc	300mm	3	Exp.2
Red Leads Croc	300mm	3	Exp.2
Joules Calorimeter	6	3	1.1, 2.2, 3.3 ohm Exp.2
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	Exp.1
Boyle's Law Value		1	
Reel Cotton		1	Exp.1
Carbon Discs		20	
Force Board Pulleys		2	Exp.1
Hooks		3	Exp.1
Spirit Level		1	Exp.1
Pendulum Bob		1	
Pendulum Bob Support		1	
Ticker Timer Tape		1	
Newton Spring Balance		3	Exp.1
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	

TOP

DESCRIPTION	SIZE/AMOUNT	QTY	MEMO
Ripple Tank		1	
Ammeter Triple Scale		1	Exp.2
Voltmeter		1	
Force Board & Legs		1	Exp.1
Boyles Law Apparatus		1	
Filter Paper 100 Sheets		1	
Balance Kit		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.3
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.3
Lead Nitrate	small	1	Exp.3
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	Exp.4
Sodium Chloride		1	
Sodium Hydroxide	medium	1	Exp.4
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.3
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	

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	Exp.4
Chlorine Water	500ml	1	
Ethanol	500ml	1	
Formic Acid	100ml	1	
Hydrochloric Acid	500ml	1	Exp.3&4
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	

EXPERIMENT 1

Grade 11 Physics (Vector) (No.4)

AIM

To find the vertical and horizontal components of a force with the help of a spring balance.

APPARATUS

Force board and stand, Force board pulley, Cotton thread, Hook, Protractor*, Spring balance, Mass pieces (10gx20), White papers* Spirit level

METHOD

1) Tie thread together at one point.
2) Tie the hooks of two Newton spring balances to two of the threads and all the mass pieces to the third.
3) Tie the ring of one spring balance to a Force board pulley and pull the other spring balance and its thread horizontally. To make sure that it is horizontal, use the scale on the Force board.
4) Take the readings on the spring balances and trace positions of thread on paper.
5) Contract a vector diagram which shows the directions of three forces.
6) Find the magnitude of the components of the force in the spring balance attached to the Force board pulley, (F), by calculation.
7) See how they compare with the experimental values.
8) Repeat with various masses and tabulate your results as follows:

	The mass of mass pieces (g)	Force (F) in Newton (N)	Θ (degrees)	Fsinθ Fcosθ	Gravitational force on mass pieces (N) f (N)
A					
B					
C					
D					

QUESTION

How do the magnitudes of the components obtained by calculation compare with those determined experimentally?

EXPERIMENT 2

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?

EXPERIMENT 3 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?

EXPERIMENT 4 Grade 12 Chemistry (Acid and Bases) (No.24, 25 combined)

AIM

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, and to use the HCl solution to standardize a sodium hydroxide solution.

APPARATUS

Burette, Retort clamp, Retort stand, Beaker, Spatula, Glass rod, Conical flask, Measuring cylinder, Sodium carbonate, Hydrochloric acid, Bromothymol blue, Sodium hydroxide.

METHOD

A.

1) Prepare a hydrochloric acid solution by dissolving about $5cm^3$ of concentrated acid in $500cm^3$ of water. This has a concentration of around 0.1 $mol \cdot dm^{-3}$.
2) Now prepare a standard solution of sodium carbonate of precisely 0.1 $mol \cdot dm^{-3}$. This can be done by dissolving exactly 5.2g of any sodium carbonate in $500cm^3$ of water.
3) Place the burette in the clamp.
4) Use the funnel to fill the burette to above the zero mark with the acid solution.
5) Then, holding the beaker which you used to pour the acid, beneath the burette, gradually open the tap.
6) Allow the level of the acid to come down to exactly zero.
7) Pipette exactly $25cm^3$ of the sodium carbonate into a conical flask.
8) Add a few drops of bromothymol blue to this.
9) Hold the conical flask beneath the burette with your right hand and gradually open the tap with your left hand.
10) Swill the conical flask continuously and watch it closely for the first sign of a colour change.
11) As you see that you are approaching the point of neutralization close the tap slightly so that you are adding drop by drop.
12) When the colour changes completely the titration finished.
13) Close the tap and read from the burette how much acid was used.
14) Repeat this procedure at least twice so that you have three readings for the volume of HCl required to neutralize exactly $25cm^3$ of sodium carbonate.
15) Take an average of these three and use it to calculate the concentration of HCl.

B.

1) Prepare a solution of sodium hydroxide by dissolving approximately 2g of dry sodium hydroxide in $500cm^3$ of water.
2) Using the normal titration procedures described in the previous expt. find out what volume of HCl (of known concentration) as determined previously is required to exactly neutralize $25cm^3$ of this NaOH solution (of unknown concentration).
3) Hence calculate the concentration of the NaOH solution.

RESULTS

A.

Volume of Na_2CO_3	Volume of HCl	Average of HCl
$25cm^3$		
$25cm^3$		
$25cm^3$		

The concentration of the HCl solution is _____ $mol \cdot dm^{-3}$

B.

Volume of NaOH	Volume of HCl	Average of HCl
$25cm^3$		
$25cm^3$		
$25cm^3$		

The concentration of the NaOH solution is _____ $mol \cdot dm^{-3}$