Proposal For Mobile Science Laboratory™ FET Phase

Grade (10-12)

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Mobile Science Laboratory™ (MSL)

Introduction

The Pfunzo Ye Sive **Mobile Science Laboratory™** has been specifically designed and structured to address the **purpose** and **principles** as set out in the Curriculum and Assessment Policy Statement (CAPS).

As a **purpose** CAPS speaks about:"*equipping learners, irrespective of their socio-economic background, race, gender, physical ability, intellectual ability, with the knowledge, skills and values necessary for self-fulfilment and meaningful participation in society as citizens of a free country*" (CAPS Page 4 paragraph 1.3a)

As a **principal** CAPS speaks about" "*Active and critical learning; encouraging an active an critical approach to learning, rather than rote and uncritical learning of given truths*"
(CAPS Page 4 paragraph 1.3b)

The Pfunzo Ye Sive **Mobile Science Laboratory™** also addressed the cognitive thinking outlined in CAPS about how practical work must be approached namely: " *Practical work must be integrated with theory to strengthen the concepts being taught. These may take the form of simple practical demonstrations or even experiment or practical investigations*." (CAPS page 11 paragraph 2.5)

Pfunzo Ye Sive **Mobile Science Laboratory™** has firmly and successfully establish the central methods of natural and physical sciences, whereby inference from experience guides formulation of hypotheses, whose predictions are validated by experiment.

Laboratory activities in school natural and physical sciences provides experience with phenomena, a starting place for the systematic development of learners' ideas, and a testing ground for the predictive power of their reasoning. It enables learners to have the mental picture of what has been taught and to retain the message in their memory for a long time. That is what we call improvisation of learning sciences in the classroom.

Advantages of Mobile Science Laboratory™ in our school

The **MSL** is set up in such a way that the lab has:-

- adequate and convenient storage for equipment;
- each piece of equipment in the lab has a unique space so that missing items can be detected at a glance;
- a large workspace that allows for group work (4 learners);
- the included lab manuals allows for activities to happen immediately;
- it enables the learners to develop functional and manipulating skills; and
- it enables the learner to develop problem solving skill and encourages scientific attitude.

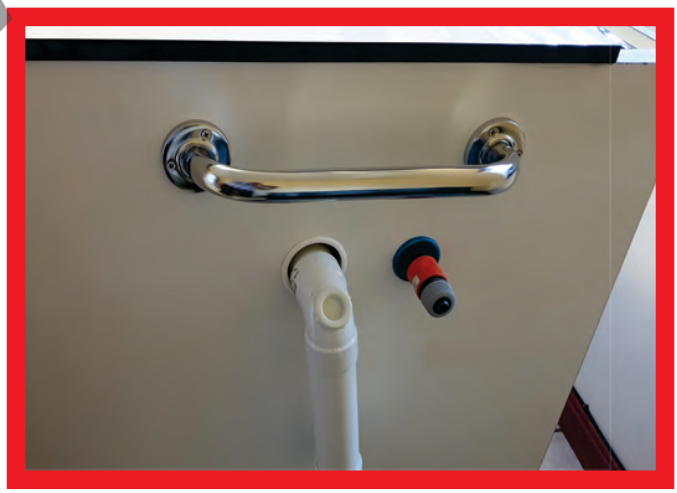
What Mobile Science Laboratory™ do for our learners

Activities are designed to engage learners' minds, so that learners acquire skill and confidence in their:

- measurement of physical quantities with appropriate accuracy;
- recognition of factors that could affect the reliability of their measurements;
- Manipulations of materials, apparatus, tools, and measuring instruments;
- Clear descriptions of their observations and measurements;
- Representation of information in appropriate verbal, pictorial, graphical, and mathematical terms;
- Inference and reasoning from their observations;
- Ability to rationally defend their conclusions and predictions;
- Effective and valued participation with their peers and the teacher in a cooperative intellectual enterprise; and
- Articulate reporting of observations, conclusions, and predictions in formats ranging from:
    - ⇒ informal discussion to a formal laboratory report; and
    - ⇒ ability to recognize those questions that can be investigated through experiment and to plan, carry out, evaluate, and report on such experiments.

Mobile Science Laboratory™ (MSL) Unit Structure

- The Solid wood and acid proof unit is ideal for mobility, long lasting, durability.
- Solid industrial fitted wheels to go on any surface with ease.
- Two stainless steel handles to pull or push around an area.
- Five pull out drawers that store all glassware and other smaller items..
- Two pull out cooling drawers that store the chemicals for experiments.
- Pigeon hold spaces for box and bigger item storage.
- Long flat space to store maps, charts and longer instruments.
- There is a pull up rear board set on ball bearing rails for easy usage by any average adult, which is made to write with white board makers and can be used as a projector screen.
- Two lock up and closed doors makes it ideal for safety and concealment of items.
- FET Phase units come with a stainless-steel tap and sink for water and washing items.
- Inlet pipe is made with durable hose fitting making it easy to contact in any space and class through a garden or bathroom tap.
- Outlet is made of half inch pvc pipe and drops at an angle of 90 degrees into a 25liter bucket.
- Dimensions of the unit are 1200 x 900 x 1100:
  - ⇒ 2 White Melamine Board
  - ⇒ 1 White Iceberg Gloss Board
  - ⇒ 1 White Masonite
  - ⇒ 4 Ball-Bearing Runners and 4 Rubber Wheels
  - ⇒ 4mm Edging Strip and 2mm Edging Strip Potty Hinges
  - ⇒ Chip Board Screws and Door Handles Steel Bar and 2 Side Heavy Duty Handles
  - ⇒ White Self-Stick Screw Cap
  - ⇒ P.V.C Pipe
  - ⇒ Deep Round Single Bowl Zink, Tap, Flexi Pipe
  - ⇒ Valves
  - ⇒ Bolt sand Nuts
  - ⇒ Drawer lock n Shooter
  - ⇒ L/Shape Waste Pipe
  - ⇒ Side Boards - 1200 × 610 and 830 × 690
  - ⇒ Top Surface - 1162 × 705
  - ⇒ Floor Panel - 1168 × 580
  - ⇒ Pull Up Board - 624 × 580
  - ⇒ Pigeon Holes - 178 × 580
  - ⇒ Long Panel - 678 × 70
  - ⇒ Chemical Drawers - 95 × 1168
  - ⇒ Drawers - 70 ×1168
  - ⇒ Doors - 834 × 598
  - ⇒ Side Panels - 840 × 1174
- The handles made of stainless steel with ball bearing running rails which are used to pull out and made to last for a longer life span.



Mobile Science Laboratory™ Unit Content – FET Phase

Acids

- ⇒ Sulphric
- ⇒ Hydrochloric
- ⇒ Nitric
- ⇒ Acetic
- ⇒ White vinegar

Wet and Dry Chemicals

- ⇒ Aluminium strips
- ⇒ Sodium chloride
- ⇒ Silver nitrate solution
- ⇒ Blue copper sulphate
- ⇒ Sodium sulphate
- ⇒ Food colouring
- ⇒ Hydrogen peroxide
- ⇒ Methanol
- ⇒ Ethanol
- ⇒ Steel wool
- ⇒ Vaseline
- ⇒ Sodium iodide
- ⇒ Magnesium powder
- ⇒ Manganese dioxide
- ⇒ Sodium hydroxide
- ⇒ Calcium chloride
- ⇒ Calcium carbonate powder
- ⇒ Calcium carbonate granules
- ⇒ Sodium carbonate
- ⇒ Sodium bicarbonate
- ⇒ Ammonium hydroxide
- ⇒ Aluminium electrode
- ⇒ Zinc electrode
- ⇒ Copper electrode
- ⇒ Lead electrode
- ⇒ Iron electrode
- ⇒ Carbon electrode
- ⇒ Methylated spirit
- ⇒ Lithium metal
- ⇒ Potassium metal
- ⇒ Sodium metal
- ⇒ Copper chloride
- ⇒ Cal-C-Veta tablet/Alka Seltzer
- ⇒ Ammonium mitrate
- ⇒ Magnesium sulphate
- ⇒ Potassium bromine
- ⇒ Sodium bromine

- ⇒ Potassium dichromate
- ⇒ Potassium chloride
- ⇒ Potassium iodide
- ⇒ Ammonium chloride
- ⇒ Potassium permanganate
- ⇒ Lead nitrate
- ⇒ Lime water
- ⇒ Iron powder
- ⇒ Sulphur powder
- ⇒ Ink+pad
- ⇒ Sugar
- ⇒ Silicon tubing
- ⇒ TETRA-test strips
- ⇒ Iodide
- ⇒ Brass (liquid)
- ⇒ Copper (liquid)
- ⇒ Atom model with binds
- ⇒ Iron (iii) chloride

Indicators

- ⇒ Bromothymol blue
- ⇒ Universal indicator
- ⇒ Litmus paper red
- ⇒ Litmus paper blue
- ⇒ Phenolphthalein

Measuring Apparatus

- ⇒ Measuring Tape
- ⇒ Ruler
- ⇒ Stopwatch
- ⇒ Electroscope
- ⇒ Multi-test meter
- ⇒ Thermometer
- ⇒ Spring balance
- ⇒ Mathematical instrument
- ⇒ Double beam mass meter

Electricity and Magnetism

- ⇒ Small compass
- ⇒ Batteries
- ⇒ Circuit board
- ⇒ Cell holder
- ⇒ Bulb holder
- ⇒ Switches
- ⇒ Switch toggle
- ⇒ Light bulb
- ⇒ Electromagnetism kit

- ⇒ Magnets

Waves, Sound and Light

- ⇒ Tuning fork
- ⇒ Toy pistol
- ⇒ Slinky spring
- ⇒ Ripple tank

General Lab and Glassware

- ⇒ Test tubes
- ⇒ Test tube rubber stopper
- ⇒ Test tube rack
- ⇒ Test tube rack wood
- ⇒ Test tube holder
- ⇒ Beaker glass
- ⇒ Conical flask
- ⇒ Measuring cylinder (glass)
- ⇒ Gas delivery tube
- ⇒ Watch glass
- ⇒ Pippete
- ⇒ Water bowl
- ⇒ Stirring rods
- ⇒ Burettes
- ⇒ Funnels (glass)
- ⇒ Petri-dish (glass)
- ⇒ Evaporating basin
- ⇒ Gas jars
- ⇒ Spoons
- ⇒ Magnifying glass
- ⇒ Syringes
- ⇒ Brush

Mechanics

- ⇒ Inclined plane
- ⇒ Dynamics kit mini 2
- ⇒ Trolley

Laboratory Apparatus

- ⇒ Spatula
- ⇒ Retort stand with clips
- ⇒ Bunsen burner – gas refill
- ⇒ Bunsen burner – labogaz
- ⇒ Tripod stand
- ⇒ Gauze wire

Miscellaneous/Additional

- ⇒ Polystyrene balls
- ⇒ Iron nails
- ⇒ Paper clips
- ⇒ Filter paper
- ⇒ Bamboo sticks
- ⇒ Matches
- ⇒ String
- ⇒ Candles
- ⇒ Toothpicks
- ⇒ Marbles
- ⇒ Tea bags
- ⇒ Masking tape
- ⇒ Balloons
- ⇒ Elastic band
- ⇒ Plastic bag
- ⇒ Paper
- ⇒ Scissors
- ⇒ Gloves-latex
- ⇒ Food colouring
- ⇒ Methylated spirit
- ⇒ White vinegar
- ⇒ Steel wool
- ⇒ Cal-C-Veta tablet/Alka
- ⇒ Seltzer
- ⇒ Ink+pad
- ⇒ Sugar

Learning and Support Material

- ⇒ Charts
  - Periodic Table of Elements
  - Colour Change Indicators
  - Food Packaging Labels

- ⇒ Teacher Manual
- ⇒ Learner Manual
- ⇒ Safety Manual

Tape Measure

Test tube rack - Wooden

Bromothymol blue

Toy pistol with Pellets

Dissecting set

Mass pieces on hook

Toggle switch

Inclined plane

Analogue Stop watch

Beaker - Tall form

Iodine solution

Light bulb

Dynamic kit Mini (ii) Trolley

Ripple tank

Moon & earth model

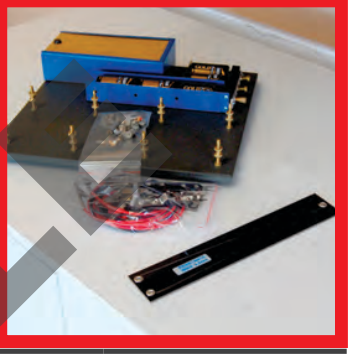
Hand Operated Generator

Triple beam balance

Glass Burette - Ptfe stopcock

Flashlight

Circuit Board



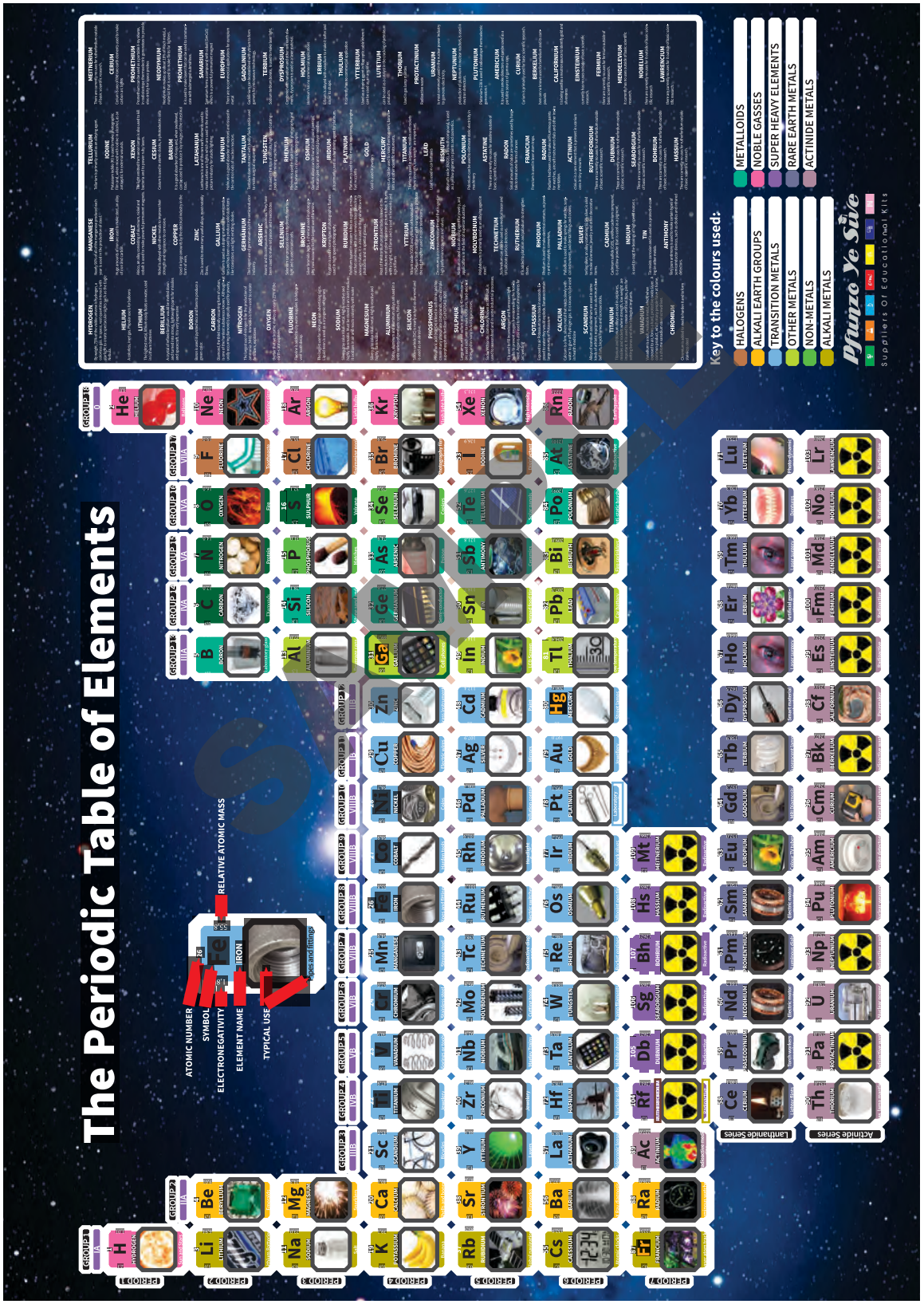
Safety Goggles

Universal retort clamp

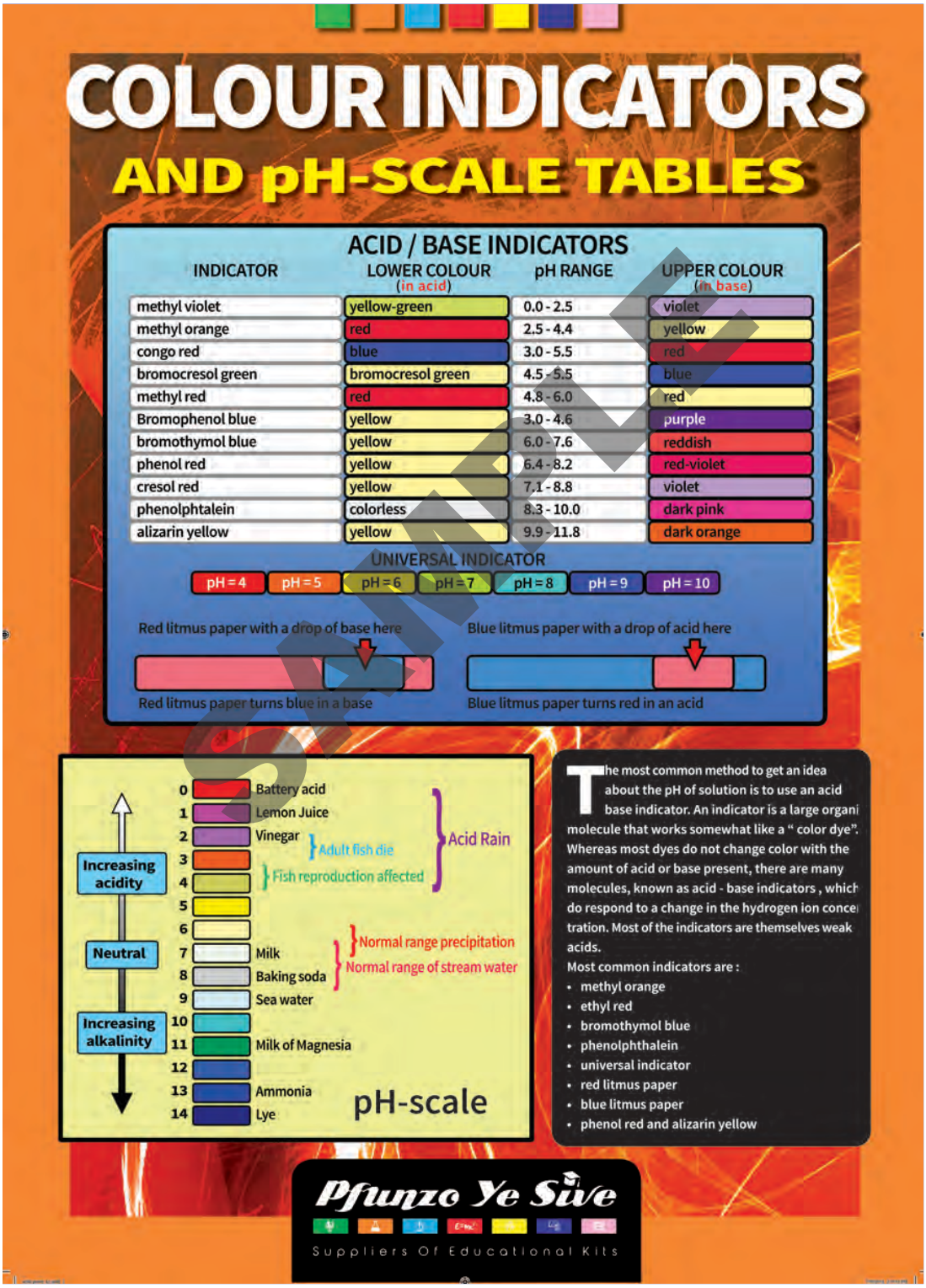
Electroscope

Galvanometer

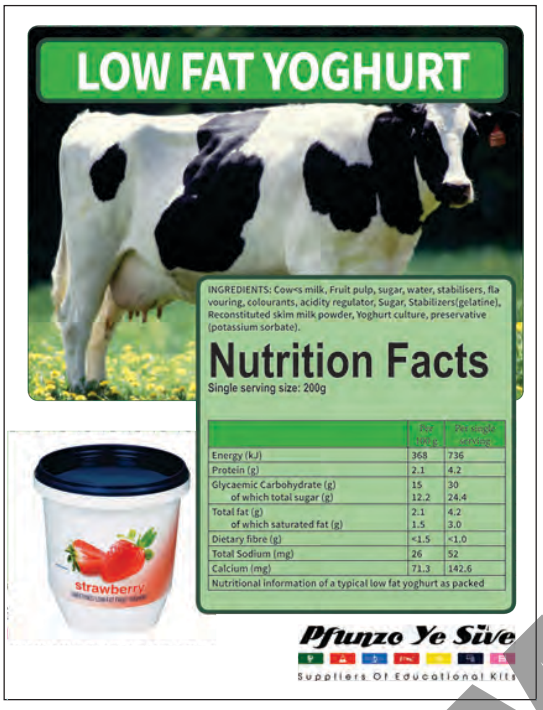
Periodic Table of Elements Chart

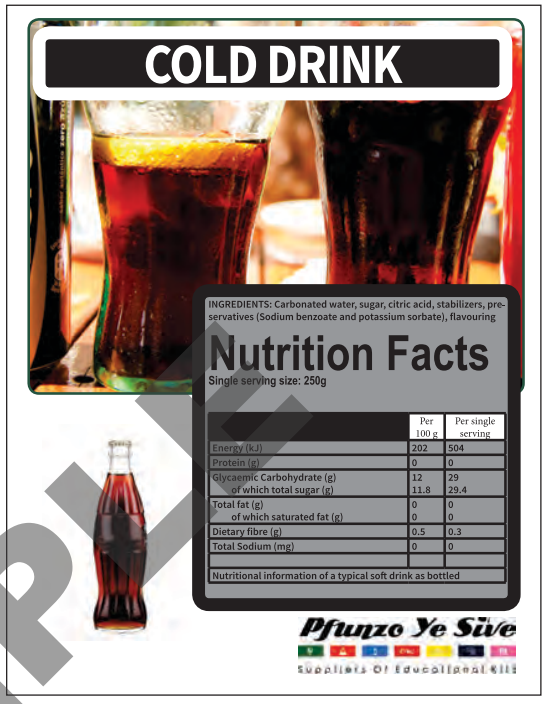


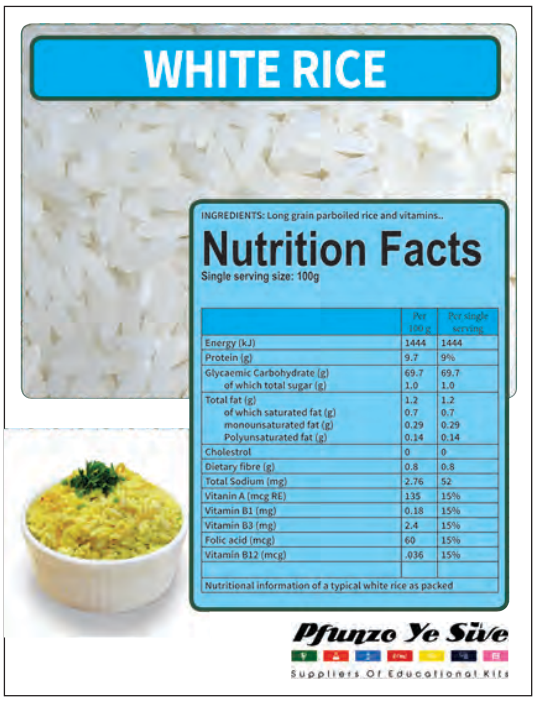
Colour Change Indicators Chart



Food Packaging Labels Charts







Teacher Manual – FET Phase

- The Teacher Manual was designed with CAPS specifications and experiments that are visible and practical for daily teaching.
- Each **MSL** contains a CAPS aligned Teacher Manual to assist the teacher to provide a conducive learning experience to the class.
- The Teacher Manual has been developed to support the content (knowledge, concepts and skills) contained in the National Curriculum Statement (NCS), as organised in the new Curriculum and Assessment Policy Statement (CAPS).
- The Teacher Manual has been organised to support teaching and learning in the classroom by presenting the material to be taught and practised in the classroom in discrete lessons.
- 1 x Teacher – 297 x 210.

TEACHER'S MANUAL

PRACTICAL EXPERIMENTS IN Physical Science

FET Phase

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PHYSICAL SCIENCES

PRACTICAL EXPERIMENTS
FOR EDUCATORS
GRADE 12

Experiment 1:

CONSERVATION OF LINEAR MOMENTUM

AIM:

To investigate the law of conservation of linear momentum when two objects are separated by an explosive force.

APPARATUS

Smooth horizontal track

Spring loaded trolley x 2 (preferably of similar mass)

Barriers x 2

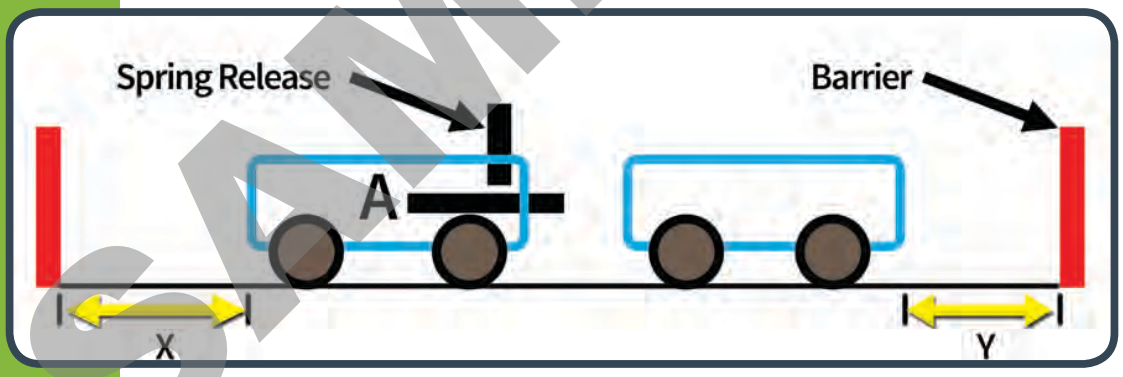
Stop watch

Meter stick

Triple beam balance

Mass pieces x 2

METHOD



1. Measure the mass of each trolley on the triple beam balance.
2. Measure mass of the two mass pieces
3. Place the two trolleys on the track facing each other, with the spring compressed.
4. Mark the starting positions of the back of each trolley on the track
5. Place the barriers on either end of the track and have them firmly held in position.
6. Tap the spring release. The trolleys will move apart and strike the barriers.
7. Repeat this last step several times, moving the barriers after each trial, until the barriers are struck simultaneously.
8. Use the stop watch and measure the time it takes for the two trolleys to strike the barriers.

9. Measure the distance from the back of each trolley to the barriers
10. Calculate the speed of each trolley using the equation:
11. Repeat the procedure with a mass piece on top of one trolley
12. Repeat step 11, now with two mass pieces on one trolley.
13. Calculate the momentum of the two trolleys after each explosion and compare it with the total momentum of the trolleys before the explosion. (Choose one direction as positive.)
14. Record your results

RESULTS

TABLE 1

Object	Mass/ g
Trolley A	
Trolley B	
Mass piece 1	
Mass piece 2	

TABLE 2

Explosion No.	Distance Travelled by A / m (x)	Distance Travelled by B / m (y)	Time taken /s	Momentum of A/ N.s	Momentum of B/ N.s
1					
2					
3					
4					

INTERPRETATION

Using the conservation of momentum,

$$M_A \times V_A = M_B \times V_B$$

$$M_A \times \frac{x}{t} = M_B \times \frac{y}{t}$$

$$\therefore \quad M_A \times x = M_B \times y$$

The calculated values of momentum will be the same and time does not feature in the equation since it is the same for the two trolleys.

CONCLUSION

Momentum of colliding trolleys is constant

Experiment 3:

ORGANIC CHEMISTRY

AIM:

To Determine Saturation on Unsaturation in organic Compounds

APPARATUS

Use of aqueous Potassium permanganate is cheaper than using bromine water and it is less toxic as well.

- *Note that the reaction will continue to give ketones unless a less reactive form of alkaline potassium permanganate is used.*

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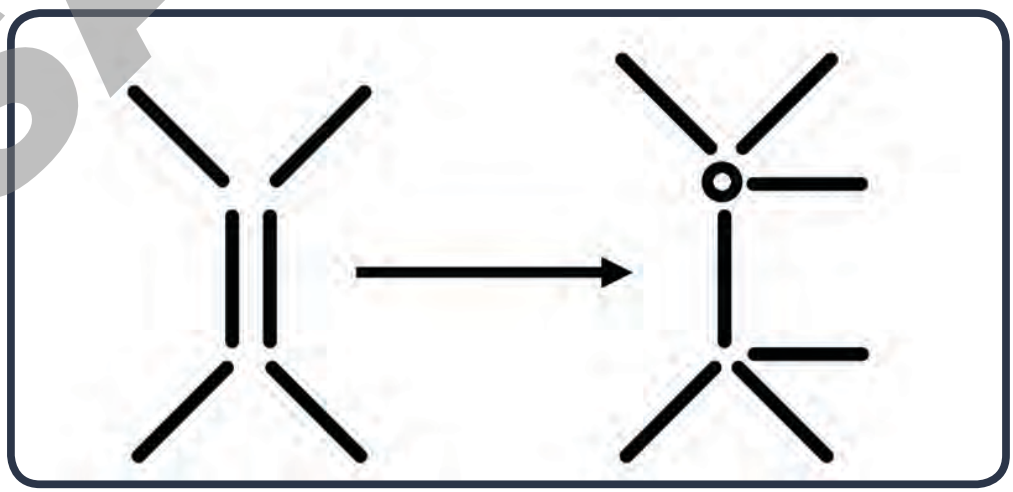
RESULTS AND OBSERVATIONS

Test tube No.	Chemical	Decolourises Bromine water(Yes / No)
1	Butane	No
2	Pentane	No
3	Hexane	No
4	Butene	Yes
5	Pentene	Yes
6	Hexene	Yes

INTERPRETATION OF RESULTS

Potassium permanganate is decolourised by alkenes due to reaction of the double bond with potassium permanganate to form diols as shown below:



CONCLUSION

Alkenes (unsaturated compounds) react with potassium permanganate whilst saturated compounds do not.

Experiment 7:

ESTERIFICATION REACTION

AIM:

To prepare esters from alcohols and carboxylic acids, and identify the eater by smell

APPARATUS:

Test tube on a rack

250 ml beaker

Bunsen burner

Pipette

CHEMICALS

Methanol

Ethanol

Propan-1-ol

Butan-1-ol

Pentan-1-ol

Ethanoic acid

Salicylic acid

Concentrated sulphuric acid

SAFETY PRECAUTIONS

- *Wear safety googles*
- *Wear rubber gloves*
- *Handle sulphuric acid with care. It is CORROSIVE. In the event of contact, rinse well with water for at least 10 minutes, and then seek medical attention.*
- *Avoid direct flames- organic alcohols are flammable. Use a water bath.*

METHOD

1. Place 5 cm^3 methanol and 5 cm^3 ethanoic acid in a large test tube.
2. Add 10 drops of concentrated sulphuric acid to the above mixture
3. Insert a small test tube into the large test tube and support it with a paper towel wedge.
4. Pour water into the small test tube and put the whole assemble into the

Ester name	Condensed structural formula
Ethyl salicylate (ethyl-2-hydroxybenzoate)	
Pentyl ethanoate	
Pentyl salicylate (pentyl-2-hydroxybenzoate)+	

CONCLUSION

Carboxylic acids and alcohols react to give esters that may or may not be sweet smelling.

Experiment 15:

IODINE CLOCK REACTION

AIM:

To determine the effect of temperature and concentration on the iodine clock reaction.

APPARATUS:

- Volumetric flask (1 litre)
- Beaker (100ml) x 5
- Beaker (250ml)
- Beaker (2 litre)
- 50 ml Measuring cylinders x 5
- Test tube rack
- Measuring cylinder, 50ml + 100ml x 2
- Stirring rod
- Stop watch

CHEMICALS

- 0.2g starch solution
- 50ml Sulphuric acid (1 $Moldm^{-3}$)
- 6.0g Potassium iodide, 6.0g
- 7.5 g Sodium thiosulphate
- 100ml of 20 Volume Hydrogen peroxide solution
- Deionised water

METHOD

SOLUTION X

- **Dissolve 6.0g potassium iodide in 800ml of distilled water**
- **Add 7.5g sodium thiosulphate and dissolve**
- **Transfer solution to 1 litre volumetric flask and top up to the mark with distilled water. Mix well.**

STARCH SOLUTION

- **Make a paste of 0.2g of starch with a few drops of water in a 250ml beaker.**
- **Pour 100ml boiling water to paste and stir.**

1. Place the five 100ml beakers side by side on white tiles / white paper
2. To each beaker add 20ml solution X, 10ml Sulphuric acid, and 2 ml starch solution.
3. Prepare five measuring cylinders containing 30, 25, 20, 15, 10ml respectively of 20 volume hydrogen peroxide. Top up each cylinder to 30ml with distilled water.
4. Add the contents of the five measuring cylinders to corresponding beakers in step 1 at the same time. 5 people are required to do this.
5. Record the time taken for the blue/ black colour change of each beaker.
6. Plot a graph of concentration versus time of reaction
7. Do the iodine clock reaction using one hydrogen concentration at different temperatures and record the time of reaction.
8. Plot graph of temperature versus time of reaction.

RESULTS AND OBSERVATIONS

Table A: Concentration versus time of reaction

Concentration(vol of Hydrogen per-oxide)	Time(s)
30	
25	
20	
15	
10	

Table B: Temperature versus time of reaction

Temperature of Hydrogen peroxide (°C)	Time(s)
50	
40	
30	
20	
10	

INTERPRETATION OF RESULTS

Concentrated solutions have a high proportion of reacting molecules that are close together. This results in a higher chance of an effective collision than in a dilute solution. This results in a faster reaction in a concentrated solution.

Hot water results with a higher reaction rate due to an increase in the number of reactants with the correct energy. This causes an increase in effective collisions hence a faster reaction. Cold water results in a slow reaction due to a lower number of reactant molecules with the correct energy, hence low number of effective collisions

CONCLUSION

The higher the hydrogen peroxide concentration the faster the reaction , and vice versa

The higher the reaction temperature, the faster the reaction. The converse is true.

Experiment 17:

EFFECT OF PARTICLE SIZE

AIM:

To determine the effect of particle size on the reaction between zinc and HCl.

APPARATUS:

Test tube x 2, on a rack

Balance

CHEMICALS

Solid Zinc, approximately 0.5cm x 2cm or solid marble chips

Zinc powder or calcium carbonate powder

HCL (1 Moldm^{-3}) x 10ml

METHOD

1. Place in a test tube a weighed a clean piece of Zinc (0.5cm x 2cm)
2. Weigh an equal mass of Zinc powder and place it in a test tube.
3. Add 5ml of 1 Moldm-3 hydrochloric acid to each test tube.
4. Observe both test tubes and record your observations.
5. Comment on rate of reactions

OBSERVATIONS

Zinc plate reacts slowly with hydrochloric acid compared to powdered zinc.

INTERPRETATION OF RESULTS

The powdered zinc has a larger surface are compared to the plate of zinc. The larger the surface the greater the chance of an effective reaction taking place.

CONCLUSION

The larger the surface area, the faster the reaction.

Experiment 25:

INTERNAL RESISTANCE

AIM:

to determine the internal resistance of a battery

APPARATUS:

Switch

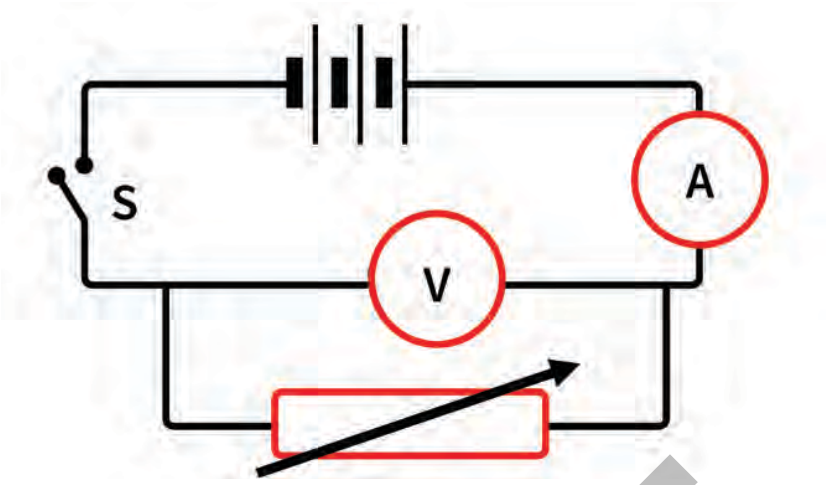
3 battery cells

Rheostat

Voltmeter

Ammeter

METHOD



1. Assemble the apparatus as shown in diagram
2. With the switch open, record the voltmeter and ammeter readings
3. Close the switch and adjust the rheostat setting at least 4 times and take the corresponding readings of the voltmeter and ammeter every time.
4. Draw a best fit graph of potential difference versus current. Indicate the emf value on the graph
5. Rearrange the equation : $\varepsilon = IR + Ir$ so that it is written in the form : $y = mx + c$
6. Hence determine the internal resistance.

RESULTS

With switch open , V= °°°°V; A =°°°°°°.Amp.

Rheostat set-ting	Voltmeter Read-ing/v	Ammeter Reading/ A
1		
2		
3		
4		

INTERPRETATION OF RESULTS

Graph will be a straight line with intercept equal to ”Ir… the lost volts. The gra dient of the curve gives the value of resistance of the external circuit.

The value of r is determined by substituting coordinates of any point on the curve into the equation

Experiment 31:

GALVANIC CELLS

AIM:

To find the galvanic cell with the highest potential.

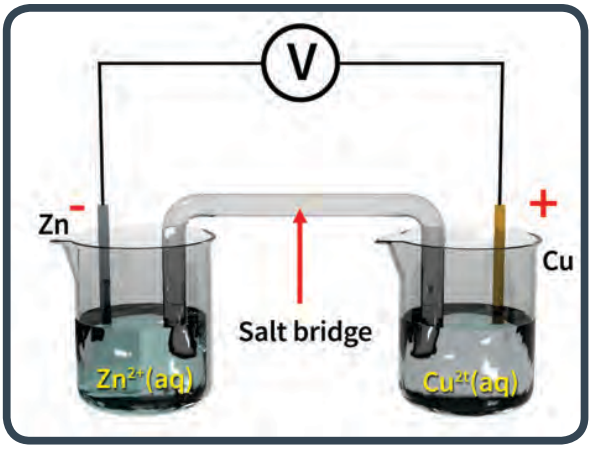
APPARATUS:

- Coper electrodes
- Zinc metal
- Lead
- Zinc sulphate
- Copper sulphate
- Lead nitrate solutions

METHOD

Consider the following Zn – Cu cell:

1. Set up the apparatus as shown in diagram
2. In one half-cell, place a zinc electrode in zinc sulphate solution
3. In another half-cell, place a copper electrode in copper sulphate solution
4. Note the reading on the voltmeter
5. Replace the zinc half-cell with lead electrode in lead nitrate solution and note the new reading
6. Replace the copper half-cell with Zinc electrode in zinc sulphate solution and note the new reading



RESULTS

Cell	Voltage / V (at STP)
Zn - Cu	1.08
Pb - Cu	0.47
Zn - Pb	0.63

CONCLUSION

Zn “ Cu cell has the highest potential

Leaner Manual – FET Phase

- The **MSL** provides for 10 CAPS aligned Learner Manuals due to the fact that science is a group activity, making it possible to teach the class in groups.
- The Learner Manual has been developed to support the content (knowledge, concepts and skills) contained in the National Curriculum Statement (NCS), as organised in the new Curriculum and Assessment Policy Statement (CAPS).
- The Learner Manual has been organised to support teaching and learning in the classroom by presenting the material to be taught and practised in the classroom in discrete lessons.
- The Learner Manual has been organised to support teaching and learning in the classroom by presenting the material to be taught and practised in the classroom in discrete lessons.
- In each lesson the learners will:
  - ⇒ Establish what they already know about a topic.
  - ⇒ Learn new facts about a topic.
  - ⇒ Practise using the new knowledge, concepts and skills they have acquired in the lesson.
- In addition, learners are provided with:
  - ⇒ Additional homework activities.
  - ⇒ Extra practice activities that cater for both learner support and enrichment.
  - ⇒ A summary of a cycle of work.
  - ⇒ A cycle may consist of one or more weeks' work.
- 10 x Learner – 297 x 210.

LEARNER'S MANUAL

PRACTICAL EXPERIMENTS IN

Physical Science

FET Phase

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PHYSICAL SCIENCES

PRACTICAL EXPERIMENTS FOR LEARNERS

GRADE 12

Experiment 1:

CONSERVATION OF LINEAR MOMENTUM

AIM:

To investigate the law of conservation of linear momentum when two objects are separated by an explosive force.

APPARATUS

Smooth horizontal track

Spring loaded trolley x 2 (preferably of similar mass)

Barriers x 2

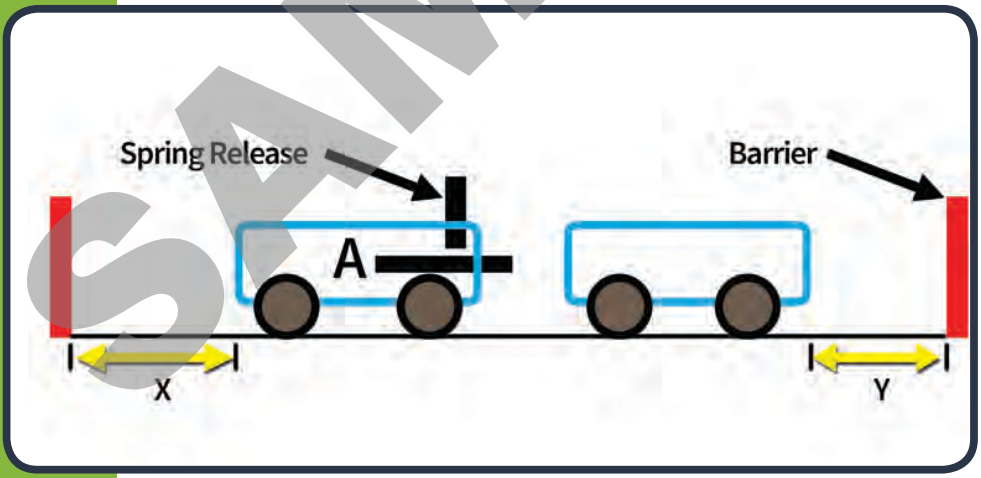
Stop watch

Meter stick

Triple beam balance

Mass pieces x 2

METHOD



1. Measure the mass of each trolley on the triple beam balance.
2. Measure mass of the two mass pieces
3. Place the two trolleys on the track facing each other, with the spring compressed.
4. Mark the starting positions of the back of each trolley on the track
5. Place the barriers on either end of the track and have them firmly held in position.
6. Tap the spring release. The trolleys will move apart and strike the barriers.

7. Repeat this last step several times, moving the barriers after each trial, until the barriers are struck simultaneously.
8. Use the stop watch and measure the time it takes for the two trolleys to strike the barriers.
9. Measure the distance from the back of each trolley to the barriers
10. Calculate the speed of each trolley using the equation :

$$v = \frac{\text{distance between barrier and starting point}}{\text{time(s)}}$$

11. Repeat the procedure with a mass piece on top of one trolley
12. Repeat step 11, now with two mass pieces on one trolley.
13. Calculate the momentum of the two trolleys after each explosion and compare it with the total momentum of the trolleys before the explosion. (Choose one direction as positive.)
14. Record your results

RESULTS

TABLE 1

Object	Mass/ g
Trolley A	
Trolley B	
Mass piece 1	
Mass piece 2	

TABLE 2

Explo-sion No.	Distance Travelled by A / m (x)	Distance Travelled by B / m (y)	Time taken /s	Momen-tum of A/ N.s	Momen-tum of B/ N.s
1					
2					
3					
4					

INTERPRETATION

CONCLUSION

EXPERIMENT 3:

ORGANIC COMPOUND SATURATION

AIM:

To Determine Saturation on Unsaturation in organic Compounds using Bromine water

APPARATUS

Test tubes on a rack

Bromine water

Butane, Pentane, Pentene, Hexane, hexane

METHOD

1. Label the test tubes from No. 1 to 6
2. Pour 2 ml of each organic chemical into the labelled test tube as listed above
3. Using a pipette dropper put 5 drops into each test tube.
4. Swirl the contents and observe.

RESULTS AND OBSERVATIONS

Test tube No.	Chemical	Decolourises Bromine water (Yes / No)
1	Butane	
2	Pentane	
3	Hexane	
4	Butene	
5	Pentene	
6	Hexene	

INTERPRETATION OF RESULTS

CONCLUSION

PRESCRIBED EXPERIMENT EXPERIMENT 7:

ESTERIFICATION REACTION

AIM:

To prepare esters from alcohols and carboxylic acids, and identify the eater by smell

APPARATUS:

Test tube on a rack

250 ml beaker

Bunsen burner

Pipette

CHEMICALS

Methanol

Ethanol

Propan-1-ol

Butan-1-ol

Pentan-1-ol

Ethanoic acid

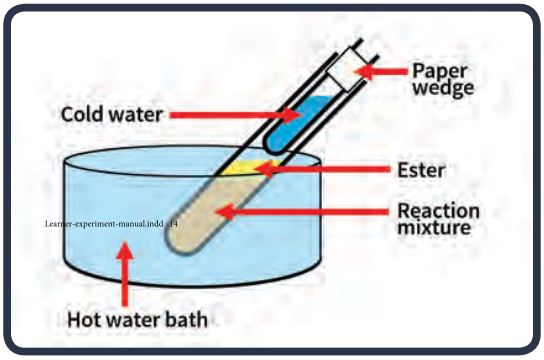
Salicylic acid

Concentrated sulphuric acid

SAFETY PRECAUTIONS

- *Wear safety googles*
- *Wear rubber gloves*
- *Handle sulphuric acid with care. It is CORROSIVE. In the event of contact, rinse well with water for at least 10 minutes, and then seek medical attention.*
- *Avoid direct flames- organic alcohols are flammable. Use a water bath.*

METHOD



1. Place 5 cm3 methanol and 5 cm^3 ethanoic acid in a large test tube.
2. Add 10 drops of concentrated sulphuric acid to the above mixture
3. Insert a small test tube into the large test tube and support it with a paper towel wedge.
4. Pour water into the small test tube and put the whole assemble into the water bath as shown in above diagram.
5. Heat the water test tube slowly and avoid water boiling.
6. After 2 minutes , remove test tube and allow to cool
7. Pour the cool mixture into a test tube containing calcium carbonate to neutralise excess acid.
8. Using a pipette remove the top layer (that is the ester) and place a few drops on filter paper
9. Smell the product.
10. Repeat the above steps with other alcohols and carboxylic acids. Note that salicylic acid is a solid and hence you will have to use only a quarter of a spatula of the solid.

RESULTS

Alcohol	Acid	Ester smell
Methanol	Ethanoic acid	
Methanol	Salicylic acid	
Ethanol	Ethanoic acid	
Ethanol	Salicylic acid	
Propan-1-ol	Ethanoic acid	
Propan-1-ol	Salicylic acid	
Butan-1-ol	Ethanoic acid	
Butan-1-ol	Salicylic acid	
Pentan-1-ol	Ethanoic acid	
Pentan-1-ol	Salicylic acid	

INTERPRETATION OF RESULTS

Ester name	Reaction Equation (structural formula)	Condensed structural formula

Ester name	Reaction Equation (structural formula)	Condensed structural formula

CONCLUSION

EXPERIMENT 15:

IODINE CLOCK REACTION

AIM:

To determine the effect of temperature and concentration on the iodine clock reaction.

APPARATUS:

Volumetric flask (1litre)

Beaker (100ml) x 5

Beaker (250ml)

Beaker (2 litre)

50 ml Measuring cylinders x 5

Test tube rack

Measuring cylinder, 50ml + 100ml x 2

Stirring rod

Stop watch

CHEMICALS

0.2g starch solution

50ml Sulphuric acid (1 Moldm^{-3})

6.0g Potassium iodide, 6.0g

7.5 g Sodium thiosulphate

100ml of 20 Volume Hydrogen peroxide solution

Deionised water

METHOD

SOLUTION X

- Dissolve 6.0g potassium iodide in 800ml of distilled water
- Add 7.5g sodium thiosulphate and dissolve
- Transfer solution to 1 litre volumetric flask and top up to the mark with distilled water. Mix well.

STARCH SOLUTION

- **Make a paste of 0.2g of starch with a few drops of water in a 250ml beaker.**
- **Pour 100ml boiling water to paste and stir.**

1. Place the five 100ml beakers side by side on white tiles / white paper
2. To each beaker add 20ml solution X, 10ml Sulphuric acid, and 2 ml starch solution.
3. Prepare five measuring cylinders containing 30, 25, 20, 15, 10ml respectively of 20 volume hydrogen peroxide. Top up each cylinder to 30ml with distilled water.
4. Add the contents of the five measuring cylinders to corresponding beakers in step 1 at the same time. 5 people are required to do this.
5. Record the time taken for the blue/ black colour change of each beaker.
6. Plot a graph of concentration versus time of reaction
7. Do the iodine clock reaction using one hydrogen concentration at different temperatures and record the time of reaction.
8. Plot graph of temperature versus time of reaction.

RESULTS AND OBSERVATIONS

TABLE A: CONCENTRATION VERSUS TIME OF REACTION

Concentration(vol of Hydrogen peroxide)	Time(s)
30	
25	
20	
15	
10	

TABLE B: TEMPERATURE VERSUS TIME OF REACTION

Temperature of Hydrogen peroxide (°C)	Time(s)
50	

Temperature of Hydrogen peroxide (°C)	Time(s)
40	
30	
20	
10	

INTERPRETATION OF RESULTS

CONCLUSION

EXPERIMENT 17:

EFFECT OF PARTICLE SIZE

AIM:

To determine the effect of particle size on the reaction between zinc and HCl.

APPARATUS:

Test tube x 2, on a rack

Balance

CHEMICALS

Solid Zinc, approximately 0.5cm x 2cm or solid marble chips

Zinc powder or calcium carbonate powder

HCL (1 Moldm^{-3}) x 10ml

METHOD

1. Place in a test tube a weighed a clean piece of Zinc (0.5cm x 2cm)
2. Weigh an equal mass of Zinc powder and place it in a test tube.
3. Add 5ml of 1 Moldm^{-3} hydrochloric acid to each test tube.
4. Observe both test tubes and record your observations.
5. Comment on rate of reactions

OBSERVATIONS

INTERPRETATION OF RESULTS

CONCLUSION

PRESCRIBED EXPERIMENT EXPERIMENT 25:

INTERNAL RESISTANCE

AIM:

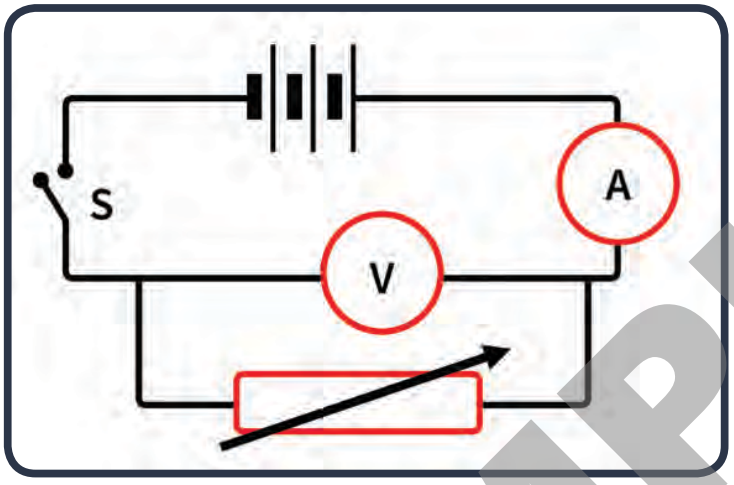
To determine the internal resistance of a battery

APPARATUS:

Switch
3 battery cells
Rheostat
Voltmeter
Ammeter

METHOD

1. Assemble the apparatus as shown in diagram
2. With the switch open, record the voltmeter and ammeter readings
3. Close the switch and adjust the rheostat setting at least 4 times and take the corresponding readings of the voltmeter and ammeter every time.
4. Draw a best fit graph of potential difference versus current. Indicate the emf value on the graph



5. Rearrange the equation : $\varepsilon = IR + Ir$ so that it is written in the form:

   $y = mx + c$

6. Hence determine the internal resistance.

RESULTS

With switch open , V= °°°°V; A =°°°°°° .Amp.

Rheostat setting	Voltmeter Reading/v	Ammeter Reading/ A
1		
2		
3		
4		

INTERPRETATION OF RESULTS

CONCLUSION

EXPERIMENT 31:

GALVANIC CELLS

AIM:

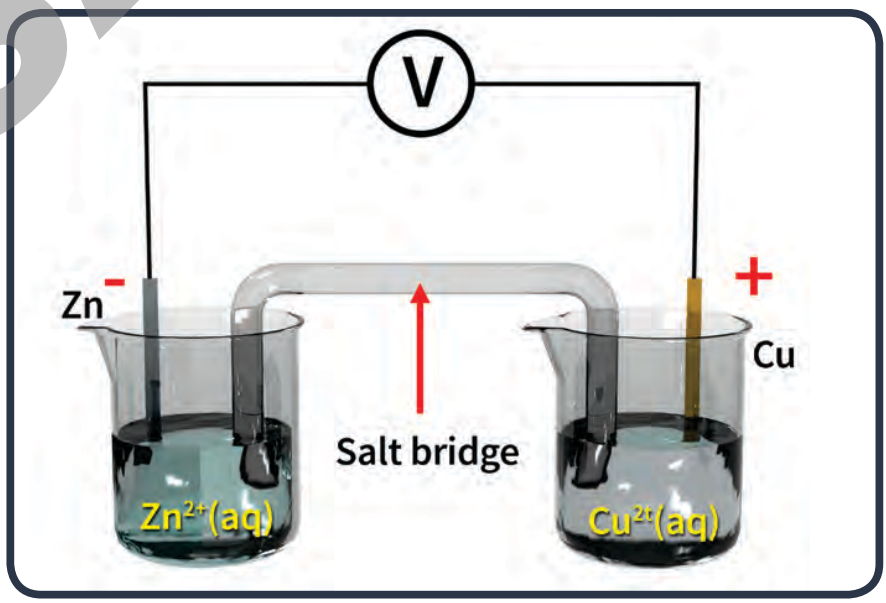
To find the galvanic cell with the highest potential.

APPARATUS:

- Coper electrodes
- Zinc metal
- Lead
- Zinc sulphate
- Copper sulphate
- Lead nitrate solutions

METHOD

Consider the following Zn – Cu cell below:



1. Set up the apparatus as shown in diagram
2. In one half-cell, place a zinc electrode in zinc sulphate solution
3. In another half-cell, place a copper electrode in copper sulphate solution
4. Note the reading on the voltmeter
5. Replace the zinc half-cell with lead electrode in lead nitrate solution and note the new reading
6. Replace the copper half-cell with Zinc electrode in zinc sulphate solution and note the new reading

RESULTS

Cell	Voltage / V
Zn - Cu	
Pb - Cu	
Zn - Pb	

CONCLUSION

Safety Manual

1 x Laboratory Safety Database – 297 x 210

Disclaimer

This manual contains information and guidelines that are believed to be reliable regarding the safe use and handling of chemicals in laboratories and student classrooms. The South Africa Chemical Institute (SACI) , however, does not purport in this manual, or in any other publication, to specify minimum safety or legal standards or to address all of the compliance requirements, risks, or safety problems associated with the handling of hazardous chemicals, their use, or the methods prescribed for using them in laboratories or classrooms. This manual is intended to serve only as a beginning point for information and should not be construed as containing all the necessary compliance, safety, or warning information, nor should it be construed as representing the policy of SACI.

No warranty, guarantee, or representation is made by SACI as to the accuracy or sufficiency of the information and guidelines contained herein, and SACI assumes no liability or responsibility in connection therewith. It is the responsibility of the users of this manual to consult and comply with pertinent local, provincial and national laws, regulations, and standards with respect to the handling of chemicals. Users of this manual should consult with the school's legal counsel or other professional advisers about the applicable laws, safety issues, and compliance issues for storing chemicals and the methods for using the chemicals in school classrooms and laboratories.

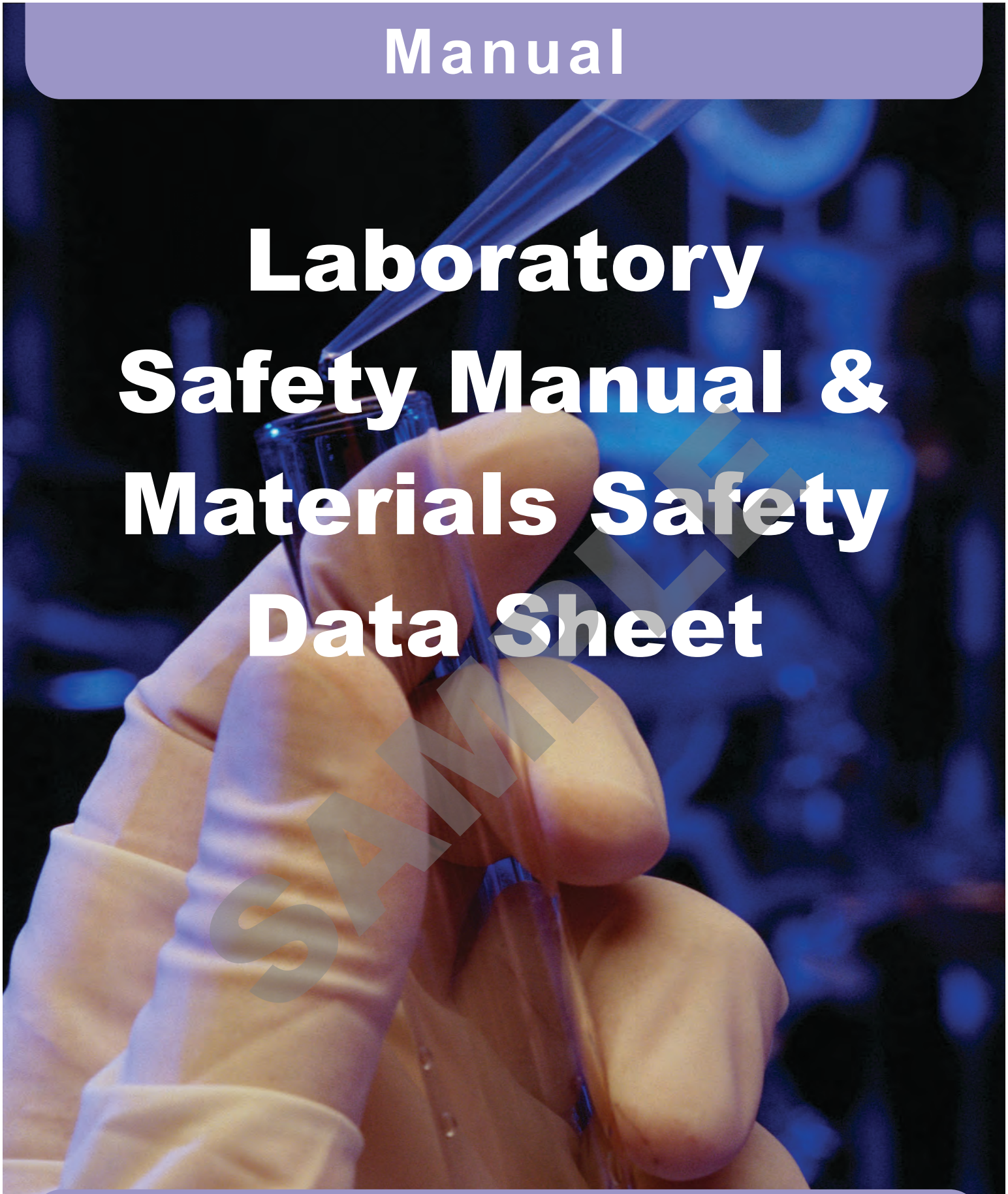
Introduction

All chemicals are hazardous, but they all can be used safely if we know how to control their hazardous characteristics while we use them. The suppliers of chemicals used in our schools are aware of and fulfil their responsibilities to inform their customers of the hazardous characteristics of the chemicals they provide. Suppliers provide this information both by labels on the containers and by Material Safety Data Sheets (MSDSs) (provided separately). According to the South African, Occupational Safety and Health Administration (OSHA) and, in some cases, corresponding national regulations, it is the employer's responsibility to ensure that this important precautionary information is conveyed to educators. Typically, a supervisor informs educators on behalf of the principal.

The educators inform their students what to do and what to avoid when they prepare and perform experiments that involve chemicals and when they clean up afterward. Everyone is responsible: students, educators, Head of Departments (HoD's), and higher administrators. All must work together to ensure that educators and students use and handle chemicals with appropriate care and precaution. It is the intent of this manual to assist all those responsible, particularly HoD's and educators, in fulfilling these responsibilities.

Manual

Laboratory Safety Manual & Materials Safety Data Sheet



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LABORATORY RULES

1. Conduct yourself in a responsible manner at all times in the laboratory.
2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ASK YOUR TEACHER BEFORE PROCEEDING WITH THE ACTIVITY.
3. Never work alone in the laboratory. No student may work in the science classroom without the presence of the teacher.
4. When first entering a science room, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.
5. Perform only those experiments authorized by your teacher. Carefully follow all instructions, both written and oral. Unauthorized experiments are not allowed.
6. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.
7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.
8. Always work in a well-ventilated area.
9. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times.
10. Be alert and proceed with caution at all times in the laboratory. Notify the teacher immediately of any unsafe conditions you observe.
11. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water. Check with your teacher for disposal of chemicals and solutions.
12. Labels and equipment instructions must be read carefully before use. Set up and use the equipment as directed by your teacher.
13. Keep hands away from face, eyes, mouth, and body

while using chemicals or lab equipment. Wash your hands with soap and water after performing all experiments.

14. Experiments must be personally monitored at all times. Do not wander around the room, distract other students, startle other students or interfere with the laboratory experiments of others.

15. Know the locations and operating procedures of all safety equipment including: first aid kit(s), and fire extinguisher. Know where the fire alarm and the exits are located.

16. Know what to do if there is a fire drill during a laboratory period; containers must be closed, and any electrical equipment turned off.

REFLEXES

LONG HAIR MUST BE TIED BACK, WEAR GLOVES, WEAR A LAB COAT(MANDATORY).

CLOTHING

17. Any time chemicals, heat, or glassware are used, students will wear safety goggles. NO EXCEPTIONS TO THIS RULE!

18. Contact lenses may not be worn in the laboratory.

19. Dress properly during a laboratory activity. Long hair, dangling jewellery, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back, and dangling jewellery and baggy clothing must be secured. Shoes must completely cover the foot. No sandals allowed on lab days.

20. A lab coat or smock should be worn during laboratory experiments.

ACCIDENTS AND INJURIES

21. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the teacher immediately, no matter how trivial it seems. Do not panic.

22. If you or your lab partner is hurt, immediately (and loudly) yell out the teacher's name to get the teacher's attention. Do not panic.

23. If a chemical should splash in your eye(s) or on your skin, immediately flush with running water for at least 20 minutes. Immediately (and loudly) yell out the teacher's name to get the teacher's attention.

HANDLING CHEMICALS

24. 24. All chemicals in the laboratory are to be considered dangerous. Avoid handling chemicals with fingers. Always use a tweezers. When making an observation, keep at least 1 foot away from the specimen. Do not taste, or smell any chemicals.

25. Check the label on all chemical bottles twice before removing any of the contents. Take only as much chemical as you need.

26. 26. Never return unused chemicals to their original container.

27. Never remove chemicals or other materials from the laboratory area.

HANDLING GLASSWARE AND EQUIPMENT

28. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken glass in the designated glass disposal container.

29. Examine glassware before each use. Never use chipped, cracked, or dirty glassware.

30. If you do not understand how to use a piece of equipment, ASK THE TEACHER FOR HELP!

31. Do not immerse hot glassware in cold water. The glassware may shatter.

32. Do not operate a hot plate by yourself. Take care that hair, clothing, and hands are a safe distance from the hot plate at all times. Use of hot plate is only allowed in the presence of the teacher.

33. Heated glassware remains very hot for a long time. They should be set aside in a designated place to cool, and picked up with caution. Use tongs or heat protective gloves if necessary.

HEATING SUBSTANCES

34. Never look into a container that is being heated.

35. Do not place hot apparatus directly on the laboratory to cool before touching it.

36. Always use an insulated pad. Allow plenty of time for hot apparatus

PICTOGRAMS AND HAZARD CODES

They inform you of the major risks.


F-Highly flammable


T-Toxic, T[1]very toxic


X-Harmful
Xi- Irritant


O - Oxidizing


C - Corrosive


E - Explosive


B - Biohazard


N - Dangerous for the environment


R - Radioactive

Note: the letters E, O, F, F+, T, T+, C, Xn, Xi, N do not form part of the symbols.

CHEMICAL HAZARDS

CHEMICAL PRODUCTS = DANGER, INFORM YOURSELF ABOUT THE RISKS!

Due to their physicochemical, toxicological and eco-toxicological properties chemicals can be dangerous for the physical integrity and health of individuals and for the safeguarding of the environment.

Do not manipulate them without knowing the risks related to their use. Check the labelling of commercial products and the Material Safety Data Sheet.

Pictograms and Hazard codes
They inform you of the major risks.

Note: the letters E, O, F, F+, T, T+, C, Xn, Xi, N do not form part of the symbols.

The statements R and S
The statements of risks R and safety precautions S, which are present on the labels, supplement the pictograms.

Attention !
For certain toxic products (mutagenic, cancerogenic, reprotoxic) no pictograms exists, but phrases like:

R 39 Danger of very serious irreversible effects
R 39 Danger of very serious irreversible effects
R 45 May cause cancer
R 46 May cause heritable genetic damage
R 60 May impair fertility
R 61 May cause harm to the unborn child

Material Safety Data Sheet (MSDS)
Before using or even buying a product, consult its MSDS. You will find information (which complements those of the label) on its physicochemical properties, on the risks related to its use and the measures of prevention, on its storage and on its disposal.

ACETONE

MATERIAL SAFETY DATA SHEET

Chemical Product

Product Name: Acetone

Synonym: 2-propanone; Dimethyl Ketone; Dimethyl formaldehyde; Pyro-acetic Acid

Chemical Name: Acetone **Chemical Formula:** CH_3COCH_3

Composition and Information on Ingredients

NAME	% by weight
Acetone	100

Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female,

Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance maybe toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C

Flash Points: CLOSED CUP: -20°C. OPEN CUP: -9°C.

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO_2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapour may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:

Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulphuric acid, chromic anhydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permono-sulphuric acid, Thiodiglycol +hydrogen peroxide, potassium ter-butoxide, sulphur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Handling and Storage

Precautions:

Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:

Store in a segregated and approved area (flammables area). Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapour respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapour respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) TWA: 750 STEL: 1500 (ppm)

Physical and Chemical Properties

Physical state and appearance: Liquid.

Odour: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Colour: Colourless. Clear

pH (1% solution/water): Not available.

Boiling Point: 56.2°C

Melting Point: -95.35

Critical Temperature: 235°C

Specific Gravity: 0.79 (Water = 1)

p. 4

vapour Pressure: 24 kPa (@ 20°C)

vapour Density: 2 (Air = 1)

Volatility: Not available.

Odour Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water

Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. ACUTE ORAL TOXICITY (LD50): 3000 MG/KG [MOUSE]. ACUTE TOXICITY OF THE VAPOUR (LC50): 44000 MG/M3 4 HOURS [MOUSE].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified

Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury.

Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behaviour) characterized by dizziness, drowsiness, confusion, headache, muscle weakness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting).

Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also

affect the Central Nervous System (behaviour), characterized by depression, fatigue, excitement, stupor, coma, head ache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis.

Eyes: Eye irritation.

Disposal Considerations

Waste Disposal:

Dispose of in a manner consistent with state, and local regulations.

Transport Information

DOT Classification: CLASS 5.1: Oxidizing material.

Identification: : Silver nitrate UNNA: 1493 PG: II

Special Provisions for Transport: Not available.

SULPHURIC ACID
MATERIAL SAFETY DATA SHEET

Chemical Product

Product Name: Sulphuric acid

Synonym: Sulphuric acid

Chemical Name: sulphuric acid **Chemical Formula:** H_2SO_4

Composition and Information on Ingredients

NAME	% by weight
Silver nitrate	100

Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of ingestion. Hazardous in case of skin contact (permeator), of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (corrosive). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering.

Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Prolonged exposure may result in skin burns and ulcerations. Over exposure by inhalation may cause respiratory irritation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs. The substance may be toxic to mucous membranes, skin, and eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

First aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: organic materials, combustible materials

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Contact with combustible or organic materials may cause fire.

Special Remarks on Explosion Hazards:

Silver nitrate mixed with dry powdered magnesium may ignite explosively on contact with a drop of water. An explosive fulminate may be formed if silver nitrate is mixed with alcohols. Highly explosive is formed by the addition of calcium carbide to silver nitrate solution.

Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Oxidizing material. Corrosive solid. Stop leak if without risk. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material.

Use water spray to reduce vapours. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Handling and Storage

Precautions:

Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice

immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Sensitive to light. Store in light-resistant containers.

Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Synthetic apron. Vapour and dust respirator. Be sure to use an approved / certified respirator or equivalent.

Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapour and dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 (mg/m Ag) (TLV); TWA: 0.01 (mg/m Ag) from OSHA (PEL). Consult local authorities for acceptable exposure limits.

Physical and Chemical Properties

Physical state and appearance: Solid. (Crystals solid.)

Odour: Not available.

Taste: Bitter. Metallic

Molecular Weight: 169.87 g/mole

Colour: Colourless. White.

pH (1% solution/water): 6 - 7 [slightly acidic to neutral]

Boiling Point: Decomposition temperature: 440°C

Melting Point: 212°C

Critical Temperature: Not available.

Specific Gravity: 4.35 (Water = 1)

Vapour Pressure: Not applicable.

Vapour Density: 5.8 (Air = 1)

Volatility: Not available.

Odour Threshold: Not available.

Water/Oil Dist. Coeff: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

Easily soluble in cold water, hot water. Soluble in diethyl ether. Very slightly soluble in acetone. Solubility in water: 122 g/100 ml water @ 0°C. Solubility in water: 952 g /100 ml water @ 190 °C Solubility in alcohol: 1 g/30 ml alcohol; 1g/ 6.5 ml boiling alcohol. Solubility in acetone: 1 g/ 253 ml acetone.

Stability and Reac6tivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, light

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Sensitive to light. Incompatible with antimony salts, arsenites, bromides, carbonates, chlorides, iodides, thiocyanates, ferrous salts, hypophosphites, morphine salts, oils, creosote, phosphates, tannic acid, tartrates, vegetable decoctions, and extracts, sodium hydroxide, charcoal, benzalkonium chloride, halogenated acids and their salts. Silver nitrate reacts with acetylene in presence of ammonia to form silver acetylide, a sensitive powerful detonator when dry. Reaction between silver nitrate and chlorosulphonic acid is violent. Silver nitrate is reduced by hydrogen sulphide in the dark. Silver nitrate is easily reduces to metallic silver by ferrous salts, arsenites, hypophosphites, tartrates, sugars, tannins, volatile oils.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

TOXICOLOGICAL INFORMATION

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 50 mg/kg [Mouse].

Chronic Effects on Humans:

Causes damage to the following organs: lungs. May cause damage to the following organs: mucous membranes, skin, and eyes.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion. Hazardous in case of skin contact (permeator), of inhalation.

Slightly hazardous in case of skin contact (corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenic). May cause cancer based on animal test data. May cause adverse reproductive effects.

Special Remarks on other Toxic Effects on Humans

Acute Potential Health Effects: Skin: Causes severe irritation and burns. It may cause dermatitis. It may be absorbed through the skin. Eyes: Causes severe irritation, corneal opacification, bleeding conjunctiva, burns of conjunctiva, argyria, blindness

Inhalation: Causes irritation of the respiratory tract and mucous membranes with possible chemical burns. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting. Ingestion: Severe gastrointestinal tract irritation and burns, pain and burning in the mouth, violent abdominal pain, argyria -greyish/blackening of skin and mucous membranes, throat and abdomen, salivation, vomiting of black material, diarrhoea, hypermotility, ulcerative gingivitis . May affect kidneys (lesions of kidneys, anuria,) and lungs

Ecological Information

Eco-toxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

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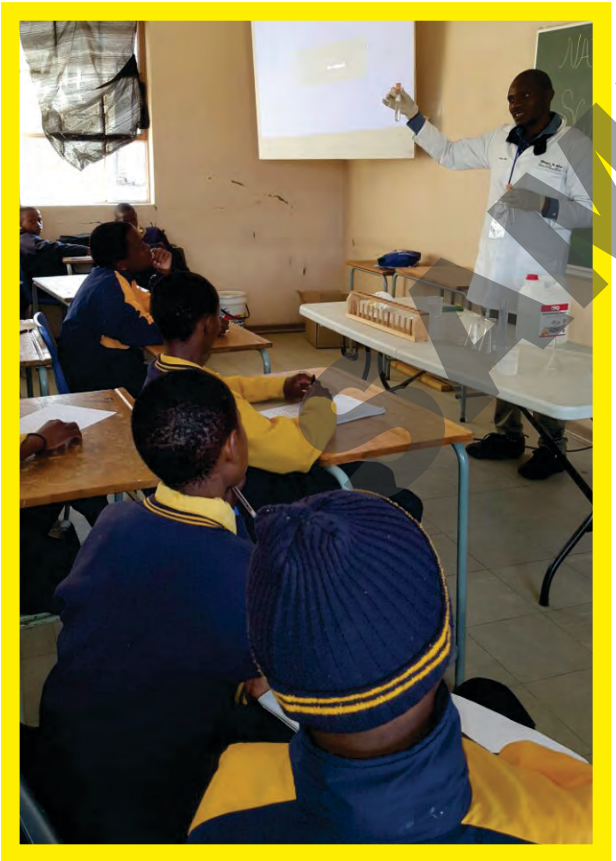
Training

- Educator training will be done for the **Mobile Science Laboratory™** upon delivery, describing content and usage of the Lab, for **FREE**.
- 5 days a week call center will also be available for further assistance from 8am to 5pm.

Additional Training

- Any additional training that is needed can be done over 4 sessions, which amounts to 8 hours at R 1, 800 per educator, over a period of 2 – 3 days, depending on the teacher's schedule.
- Further training is avaible per educator at a fee of R450 per session for 2 hours.
- All educators attending the additional training will be awarded a report for **Certifcate of Attendance**.
- The teachers will choose from a menu of items.
- Areas tackled are as follows:
    - Content & Methodology;
    - Problem solving;
    - Understanding the total curriculum;
    - Lesson planning;
    - Testing and assessment;
    - Tackling language diversity;
    - Teaching activities;
    - Transfer of learning;
    - Projects and practical work;
    - Materials and resources;
    - Tracking of learner performance; and
    - ICT-based learning.
- The Department of Basic Education requires teachers to engage in workshops that improve their professionalism, competencies and gain PD (Professional Development) points.
- In 2016, it became a legal requirement and has been monitored by the Department of Basic Education.
- Each teacher will be expected to achieve at least 150 PD points in every three year cycle.
- SACE will issue a Certificate of Achievement to each teacher who achieves the target number of PD points within the three years, as follows:
    - 150 points: Certificate of Achievement Bronze;
    - 151-300 points: Certificate of Achievement Silver; and
    - 300+ points: Certificate achievement Gold.

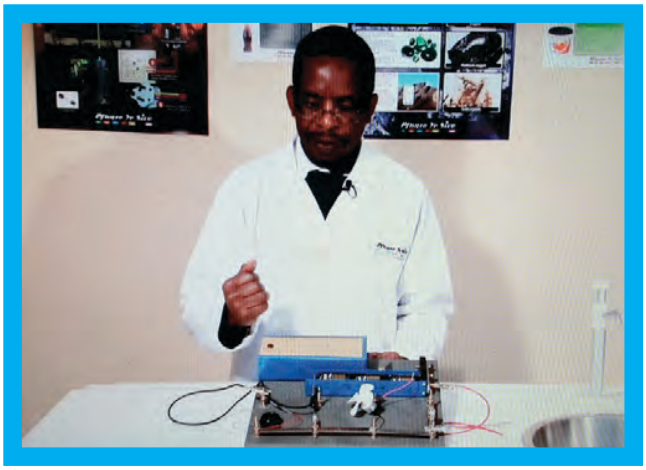


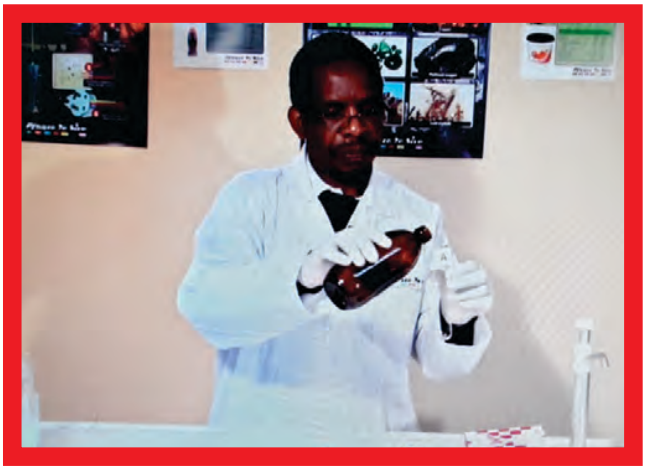
Optional Extra

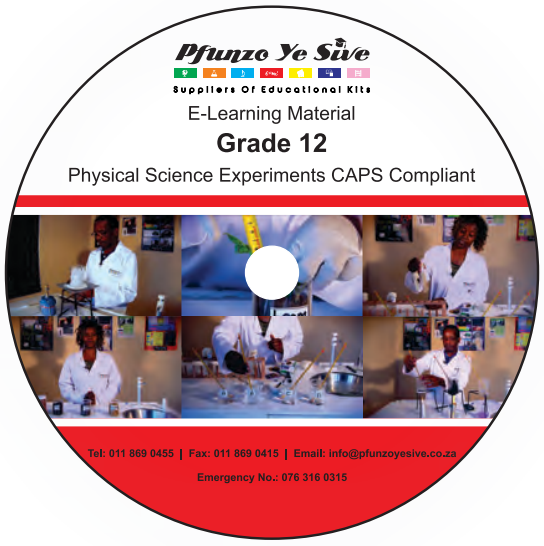
- We have an IPAD with Experimental DVD – CAPS Aligned.
- Loaded with live demonstrations of the work to be covered in the term and year of assessment.
- These dvd's serves dual purposes:
    - For the teacher to brush up on lesson plans; and
    - For learners to watch and learn how to do experiments.

Pfunzo Ye Sive™
Suppliers Of Educational Kits

Experimental DVD







Pfunzo Ye Sive™
Suppliers Of Educational Kits

Recommendation

- 4 units per school

Transportation and Delivery

- We can deliver 10 – 15 units per week to respective schools.
- Depending on the size of the order, we would need lead time to plan and executive.
- Training will be done 2 days after deliver of units by our professional staff.
- All transporting will be handled by a Supplier, that has a proven track record, to deliver great service.
- Our transport provider is 100% BBBEE owned company employing over 80% preciously disadvantaged individuals.

Cost per unit

- Pfunzo Ye Sive **Mobile Science Laboratory™** FET Phase (*including transport*):

  ⇒ Total: **Price on Request.**.

- Optional Extra:

  ⇒ IPAD with Experimental DVD – **R 8, 980-00**.

- Additional Educator Training:

  ⇒ 4 sessions (8 hours) at **R 1, 800-00**.
  ⇒ Additional to above will be at **R 450-00** per session.