SCIENCE MADE EASY

Summary of each Demonstration

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1. INTRODUCTION (DVD 1)

Demo	Title	Purpose
1.1	Introduction to Series	To describe the purpose of this DVD series of science demonstrations
1.2	Why do Science Demonstrations	To explain the importance of doing activities with students
1.3	Tips for Doing Science Demonstrations	To give some tips on how to do science demonstrations successfully
1.4	Acknowledgements	To thank those who helped make this project possible
1.5	Basic Lab Equipment	To show the basic equipment needed to carry out science activities To learn the proper names for common science equipment To learn how to use some of the basic equipment
1.6	Heat Sources	To show different types of heat sources that can be used in the elementary classroom To discuss advantages and disadvantages of different heat sources
1.7	Common Chemicals	To show some of the common chemicals that can be obtained locally in different retail outlets To learn the common and chemical names and what these chemicals are used for
1.8	Solvents	To discuss different sources of water for use in science activities To identify other solvents available locally
1.9	Distribution of Chemicals	To suggest ways of storing and dispensing chemicals and reagents for student use To make it easier to do teacher demonstrations
1.10	Working with Glass Tubing	To show some basic skills required to work with glass tubing (cutting, polishing, bending, drawing out)

2. PROPERTIES OF MATTER (DVD 1)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
2.1	Compressibility of Gases, Liquids and Solids	To demonstrate the compressibility of gases but not of solids or liquids	Large syringe	1. Why can a gas be compressed but not a solid or liquid? 2. What does this demonstration tell you about the particles making up each substance?		
2.2	Boiling Points of Water and Methanol	To show that different liquids have different boiling points	Thermometers, water, methanol, test tubes, stand, clamp, burner, small stones	1. What is the 'boiling point'? 2. Does each liquid have its own unique boiling point? 3. Why might you boiling points be off slightly? 4. Does the temperature continue to rise once the liquid boils? What can you conclude about the temperature during a change in state?	Have students determine the boiling point of water; teacher should do methanol	See also: PROPERTIES OF WATER – 3.5
2.3	Vaporization of Water	To show that the vaporization of water causes cooling	Two thermometers, gauze, water	1. Why did the thermometer with the wet gauze cool down? What happened to the heat energy? 2. Trees evaporate large quantities of water through their leaves. What effect will that have on surrounding temperatures?	Place a drop of water on student's skin and ask them to describe its effect	See also: WEATHER – 18.3
2.4	Melting of Ice	To show that the melting of ice takes energy To show that melting occurs at $0^{o}C$	Crushed ice, beaker, stand, ring clamp, burner, thermometer	1. Why must the ice-water mixture be stirred continuously? 2. What happened to the heat energy added to the beaker? Why did the temperature not rise? 3. What is the difference between heat and temperature? 4. What can you conclude about the temperature during a change in state?	Have students record temperature every 30 seconds while heating crushed ice; graph results with time along x-axis, temp. along y-axis	See also: HEAT – 7.8
2.5	Sublimation of Moth Balls	To demonstrate sublimation of moth balls	Two beakers (50 and 100 mL), ice, moth balls (naphthalene), burner, ring clamp, stand	1. What is meant by 'sublimation'? 2. In order for you to smell a solid, what must be happening to its molecules? 3. Why was the cold beaker necessary? 4. How do the crystals get to the inner beaker? 5. Give other examples of sublimation.		Bring heated moth balls outside after demo is finished. See also: WEATHER – 18.5

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
2.6	Diffusion in Gases	To demonstrate diffusion in a gas	Water bottle, ammonia, phenolphthalein indicator, cotton balls	1. Why was it necessary to show the diffusion of ammonia in a closed bottle? 2. If there were no convection currents in a room, estimate how long it would take for the smell of ammonia to travel from the front to the back of the room.	Let students measure how long it took before the indicator started to change colour	See CHEMISTRY – 13.7 re: phenolphthalein indicator
2.7	Diffusion in Liquids	To demonstrate diffusion in a liquid	Test tube, water, food colouring	1. Why is it important not to disturb the test tube for the duration of this demonstration? 2. What does this demonstration show about the rate of diffusion in a liquid?		Let the test tube stand undisturbed for several days
2.8	One Volume + One Volume = Two Volumes??	To show that, when two different liquids are mixed, the combined volume is less than the sum of the two	Graduated cylinders, water, methanol	1. When 50 mL of each liquid were mixed, what was the final volume? 2. Why is there a decrease in the total volume?		You must measure the volumes carefully!
2.9	Shrinking Liquids	To show that, when two liquids are mixed, their total volume decreases	Test tubes fitted with stopper and long tube	1. Why was it important to carefully add the methanol to the water? What would happen if the water were added to the methanol? 2. Why did the liquid in the tube go down when the test tube was inverted? What does that tell you about the change in volume?		

Many of the other topics also deal with properties of matter (e.g. Density, Magnetism, Chemistry, Properties of Water)

3. PROPERTIES OF WATER (DVD 1)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
3.1	Expansion of Ice	To show that when water freezes, it expands	Glass bottle with cap, freezer	1. Why should the bottle be wrapped in heavy plastic? 2. What could happen to a water pipe if the water freezes in the winter?		
3.2	Lifting an Ice Cube	To lift an ice cube out of a glass of water without touching it To demonstrate the effect of salt on ice	Glass of water with an ice cube, thread, salt	1. What do you notice on the surface of the ice cube before salt is added? 2. What happens after the salt is sprinkled on the ice cube? 3. What does the salt do to the melting point of ice?	Students could do activities 3.2, 3.7 and 3.8	
3.3	Cold Ice	To show how the addition of salt to ice lowers its freezing point	Crushed ice, salt, thermometer	1. How cold did the ice get? 2. In order for the temperature to go down, the heat has to go somewhere; where does it go? 3. Why is salt not very effective on roads if the temperature is very cold (e.g. -15^{o}C)?		See also WEATHER – 18.5
3.4	Wire Through Ice	To show that pressure can lower the melting point of ice	Block of ice, thin wire, two weights (2 L pop bottles filled with water), stand, ring clamp	1. What evidence is there that the pressure of the wire on the ice causes it to melt? 2. Why does the water refreeze above the wire? 3. Do you think this would happen if the ice were really cold (e.g. -15^{o}C)? 4. Why is it hard to skate on ice when the ice is really cold?		
3.5	Raising Boiling Point by Adding Salt	To show how the addition of salt affects the boiling point of water	Test tube, thermometer, salt, burner, stand, clamp	1. How much did the boiling point increase when salt was added to the water? 2. The antifreeze used in automobile radiators is a mixture of water and ethylene glycol; would you expect its boiling point to be 100^{o}C?		
3.6	Floating Metal Objects on Water	To place metal objects on the surface of water To show the effect of detergent	Tray, water, paper clip, copper wire, thumb tack, tweezers, detergent	1. Why is it important to place the objects carefully on the surface of the water? 2. What prevents the metal objects from breaking through the surface? 3. Why does detergent cause the objects to sink?		
3.7	Scattered Chalk Dust	To show the effect of detergent on chalk dust floating on water	Large tray, water, chalk dust, detergent	1. Why does the chalk dust float on the water? 2. Describe what happened when a drop of detergent was added in the centre of the tray. 3. Where do you think the detergent is? Why?		
3.8	Centering a Cork in a Glass of Water	To move a cork from the edge of a glass to the center	Glass of water, cork (e.g. from a wine bottle)	1. Why does the cork appear to stick to the side of the glass when the glass is partially full? 2. As water is added to the glass until it is almost full, what happens to the film of water between the cork and the inside of the glass		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
3.9	Adding Pennies to a Full Glass of Water	To show how water can form a ‘head’ on a glass of water To demonstrate the effect of adding a detergent	Glass of water, pennies, detergent	1. What did you observe about the water level in the glass as the pennies were added? 2. Why was it important to add the pennies carefully? 3. What prevented the water from overflowing the glass? 4. What was the effect of adding a drop of detergent? Why?		
3.10	Pouring Water Along a String	To show how a wet string can be used to transfer water	Length of yarn, two beakers	1. Why did the water travel along the wet string but not along the dry string? 2. What is meant by the terms ‘adhesion’ and ‘cohesion’? How do they apply in this example?		
3.11	Capillary Action	To show how water creeps up a thin tube	Glass tubes of different diameters, water	1. In which tube did the water creep the highest, the thinner one of the wider one? 2. Why does water creep up the glass? 3. What causes a drop water to spread out on a piece of paper? 4. How can water move through soil?		Tubes can be made from glass tubing. See INTRODUCTION 1-10
3.12	Three Become One	To show the presence of cohesive forces in water	Plastic container, water, stand, ring clamp	1. What had to be done to change the three streams of water into one stream? 2. What force kept the three streams together? 3. Would this work if the holes were further apart? Try it!		
3.13	Holey Nylon	To show how nylon can keep water in a container	Jar with large mouth, part of nylon stocking, elastic band	1. Why did the water flow through the nylon initially, but not when the jar was inverted? 2. What must enter the jar in order for the water to flow out? 3. If the jar is tilted, the water will flow out. Why?		See also AIR PRESSURE – 6.6
3.14	Inverted Bottles of Water	To show how a bottle of water can be inverted To show how window screen can keep water in	Two bottles with screw rings, fiberglass window screen	1. Why does the paper over the mouth of the bottle keep the water in? 2. Why did the water in the second bottle not come out after the paper was moved?		
3.15	Coloured Streamers	To show convection currents in warm and cold water	Coloured ice cube, large clear container	1. What causes the movement of water as seen by the coloured streamers?		See also DENSITY – 4.11
3.16	Which Contains Warm Water?	To allow inverted bottles of water to mix and predict which contains warm or cold water	Four juice bottles, small pieces of transparency sheets	1. In which set of bottles did mixing occur? 2. Which set of bottles contains warm water in the bottom and cold in the top? How do you know?		See also WEATHER – 18.9
3.17	Maximum Density of Water	To show that water near 4^{o}C is more dense than warmer or colder water	Large fish bowl, thermometer	1. After standing in the freezer for a while, the temperature near the surface is close to 0^{o}C yet at the bottom is around 4^{o}C. What does that tell you about the different densities? 2. Why does the bottom of a lake never freeze?		

4. DENSITY (DVD 1)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
4.1	Introduction	To explain the concept of density		1. What is the difference between heavy and dense? 2. Which is heavier, 1 kg of rock or 1 kg of feathers?		
4.2	Density of Liquids	To determine the density of water and methanol	Balance, graduated cylinders	1. Why does the measurement of density not depend on the volume of liquid used? 2. What are the units for the density of a liquid? 3. What is a 'physical property'?	Measure density of different volumes of water; graph results	Teacher should do density of methanol to avoid spills of methanol
4.3	Density of Solids	To determine the density of some regular solids	Balance, ruler, calipers, various regular solids	1. Why is the density measurement the same for a given material, regardless of size? 2. What is meant by a 'physical property'?	Calculate volume of various regular solids, measure mass, calculate density	Good activity to integrate math and science
4.4	Volume by Displacement	To determine the density of irregular objects	Graduated cylinder, overflow can, irregular shaped objects, balance	1. What is meant by 'displacement'? 2. Could a liquid other than water be used as well? Would the results be the same?	Determine the volume of various irregular objects and calculate density	
4.5	Floating and Sinking Candles	To reinforce the concept of density	Two different sized candles, water, methanol, beakers	1. Does the ability of an object to float in a liquid depend on its size? Explain. 2. Why did the candles float in water but sink in methanol? What does that tell you about the approximate density of the candles?		Be sure to start with large candle in methanol
4.6	Regular vs Diet Coke	To show the difference in density between two cans of Coke	Can of regular Coke and can of diet Coke	1. Do the two cans have the same volume? 2. Why would the regular Coke can sink while the diet Coke can floats?		
4.7	Floating Egg	To prepare a liquid in which an egg floats partway	Egg, water, salt	1. Does an egg normally float in water? Try it! What does that tell you about the density of an egg? 2. What happens to the density of water when salt is dissolved in the water? 3. Why did the salt water and regular water not mix completely?		
4.8	Ice, Water and Oil	To show how ice and water behave in vegetable oil	Ice cube, vegetable oil	1. What does this demonstration tell you about the density of ice and of water relative to that of vegetable oil? 2. Explain why the ice cube floated but the cold water from the melting ice cube sunk.		Be sure to use a large ice cube

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
4.9	Layered Liquids	To show how liquids with different densities can be layered	Water, salt, antifreeze, methanol, vegetable oil, food colouring	1. Why is it important to carefully pour the antifreeze solution over the salt water solution? 2. If you were to shake up the liquids in the graduated cylinder, would they separate again?	Let this stand for several weeks to show how slowly mixing occurs. Cover the top with plastic film to reduce evaporation.	
4.10	Non-Level Liquid	To set up a U-tube containing two liquids with different densities	Plastic tubing, cardboard, stand, salt water, methanol	1. Why are the two liquids not at the same level in the U-tube? 2. Which liquid is denser? Why was salt water used rather than plain water?		
4.11	Convection Currents in Water	To show that warm water will rise in cold water	Clear container, stand, ring clamp, burner, food colouring	1. Why does warm water rise in cold water? Does the density change with temperature? 2. Why does the warm water stay at the surface?		See also: PROPERTIES OF WATER – 3.15, 3.16 HEAT – 7.14, 7.15
4.12	Cartesian Diver	To demonstrate how the depth of an object in water can be controlled	Pipette, plastic bottle	1. Why does the diver sink when the bottle is squeezed and rise when released? 2. How is the depth of a submarine controlled?		

5. SOUND (DVD 1)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
5.1	Sources of Sound	To show that sound is caused by a vibrating object	Bobby pins	1. What is required to produce a sound? 2. Identify other sources of sound	Feel vocal chords Use bobby pin	
5.2	Using a Tuning Fork	How to strike a tuning fork Show that tines vibrate	2 tuning forks with different frequencies, beaker of water, ping pong ball	1. How can you tell that the tuning fork vibrates? 2. Which tuning fork has the highest pitch (frequency), the short one or the longer one?		
5.3	Vibrating Metal	To show that various metals can vibrate	Metal pipes, metal rod (hardware store)	1. Can you identify other examples of vibrating solids?		
5.4	Dancing Salt	To show that loud sounds can cause a membrane to vibrate	Can with both ends removed, membrane (balloon or disposable glove),salt, elastic	1. What caused the salt crystals to dance up and down? 2. Where did the energy come from? How did it get to the salt?	Stand around can and SHOUT	
5.5	Pitch and Frequency	To show that pitch depends on number of vibrations per second	Bobby pin, comb, index card	1. How does the pitch change as you shorten the vibrating bobby pin? 2. How does the pitch change as you run the card faster along the comb?	Use bobby pin and vary its length while plucking it	Could also use a guitar to show relationship between size of wire and pitch
5.6	Sounding Board	To show that a solid can intensify sound	Tuning fork	1. Why did placing the tuning fork on the table affect its sound? 2. How is this principle used in musical instruments?		
5.7	Transmission of Sound	To show that a solid is a better conductor of sound than air	Bobby pin, desk, wooden dowel	1. Why were the sounds much louder when you placed your ear on the desk? 2. Why can you hear better through a wooden dowel than through air?	Use bobby pin; listen to sound by placing ear on desk Listen through dowel	
5.8	Sound Amplifier Using a Funnel	To show how sound can be amplified	Funnel, plastic tubing	1. How does the funnel help to amplify the sound? 2. How does the shape of your ear help you to hear better? 3. Could this be used as a hearing aid?	Speak into funnel with tubing to the ear canal	
5.9	Ringing Church Bell	To listen to the vibrations of common metal objects	Spoons, string, wire coat hanger	1. Why were the sounds much richer and louder when you placed the string against your ear?	Listen to ringing spoon and coat hanger	Prepare several coat hangers so students can do this activity
5.10	String Telephone	To show how sound can be transmitted by a solid	Plastic cups, tooth picks, thin string	1. Why does the string have to be taut? 2. Why can you not hear the other person when the string is held between your fingers? 3. How does the 'party line' work?	Make string telephone and experiment with it	A MUST activity!

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
5.11	Sound Through Bone	To show transmission of sound through a solid	Pen or pencil	1. How do you know that sound is not going through the air? 2. Why can you hear the sound of tapping the pen so clearly?	Hold pen between teeth; tap pen and listen to sounds	
5.12	Listening Through a Solid	To use a wooden dowel to listen to sounds	Wooden dowel	1. Why do sounds appear much louder when the dowel is placed to your ear? 2. Why do mechanics sometimes use this principle to locate a noise in an engine?		
5.13	Measuring Sound Intensity	To explain how sound intensity is measured	Sound meter (if available)	1. How much does the sound intensity increase if the sound level goes from 50 db to 80 db? 2. Why are continuous loud sounds harmful? 3. How can you reduce exposure to loud sounds?	Stress importance of hearing protection to prevent hearing loss	See **PM-4** for Table of Sound Intensity Levels
5.14	Resonating Air Column	To show that sound can be intensified in an air column	Tuning forks Bottles with water Plastic pipe (e.g. 1.5" ABS)	1. Why does the sound change when you pour water into a tall vessel? Try it! 2. What causes the vibrations in an organ pipe?		
5.15	Using a Slinky to Represent a Longitudinal Wave	To demonstration how sound is transmitted	Slinky	1. What is a compression and a rarefaction? 2. Why does a solid (or liquid) transmit sounds much better than air? 3. Why is lightning followed by a loud thunder clap?		

6. AIR PRESSURE (DVD 2)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
6.1	The Plugged Funnel	To show that air occupies space	Funnel, one-hole stopper, bottle	1. Why could the water not be poured into the bottle using the funnel? 2. Why did air bubbles move up through the water? 3. What does this tell you about air?		Use funnel with narrow neck
6.2	Air Occupies Space	To show that air is a substance that occupies space	Drinking glass or beaker, large container of water	1. Why did the water not go into the inverted glass?		
6.3	Dry Paper Under Water	To show that air occupies space	Drinking glass or beaker, large container of water	1. Why did the paper not get wet? 2. What would happen if you left the paper in the inverted beaker in the water overnight? Try it!		
6.4	Transferring Air Under Water	To show that air can be transferred from one container to another	Two glasses or beakers, large clear container of water	1. Why does the air go from the ‘empty’ beaker into the ‘full’ beaker? 2. Can air, a gas, be poured? Explain.		
6.5	Air Candle Snuffer	To show that air can be used to blow out a candle	Pop bottle with hole in cap, candle	1. How do you know that air came out of the bottle when it was squeezed? 2. What do these demonstrations tell you about air?		
6.6	Paper Seal	To show that a sheet of paper can hold water in an inverted bottle	Bottle filled with water, piece of paper	1. Why does the water not come out when the bottle in completely inverted? 2. Why does the water run out when you hold the bottle at an angle? What must come in?	Let students try this with a test tube and piece of paper	See also PROPERTIES OF WATER – 3.13
6.7	Siphon	To show how a liquid can be transferred from one container to another	Two containers, tubing, water	1. Why is it necessary to first fill the tube with water? 2. What causes the water to flow up initially? 3. What happens if the open end of the tubing is higher than the liquid in the upper container? 4. What is a ‘siphon’?		
6.8	Perpetual Fountain	To demonstrate an apparent perpetual flow of water	Special apparatus described in video	1. What initiated the flow of water? 2. What is the purpose of the tube connecting the two jugs? 3. What happens if the lower jug is moved and the water collected in another container?		Good activity to stimulate critical thinking
6.9	Collapsing Pop Can	To demonstrate how air pressure can crush a pop can	Pop can, tongs, heat source, container of water	1. Why was it necessary to add water to the can and then heat it strongly for several minutes? 2. When the can was inverted in the cold water, what happened to the steam inside the can? 3. Why did the can suddenly collapse?		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
6.10	Collapsing Can	To collapse a large metal can using air pressure	4-L metal can with cap, torch, stand and ring clamp	1. Why must the water be added to the can first and then heated strongly? What happens to the air in the can? 2. Why does it take a little while for the can to collapse after the cap is put on tightly?		
6.11	Heavy Newspaper	To show that air can resist motion	Slat of wood, newspaper	1. Why was it important to carefully smooth out the newspaper over the slat of wood? 2. Why did the newspaper not lift up when the wooden slat was given a sharp blow?		
6.12	Self-filling Beaker	To fill an inverted beaker with water by heating the water	Two beakers, burner, stand, ring clamp	1. Why must the water be boiled for several minutes? What happens inside the inverted beaker? 2. Why does the water rise in the inverted beaker after the heat is turned off?		
6.13	Inflating a Balloon Using Reduced Pressure	To 'blow up' a balloon by reducing the external pressure	Special apparatus described in video	1. What happens to the pressure inside the bottle when air is sucked out? 2. Why does the balloon expand?		
6.14	Finger Controlled Water Flow	To control the flow of water in a pop bottle using your finger	Pop bottle with hole in bottom and in cap	1. Why does water not come out of the bottom hole when the hole in the cap is closed? 2. Why is a gasoline container fitted with a vent cap that must be opened when you transfer gasoline to a lawnmower, for example?		
6.15	Air Has Mass	To demonstrate that air has mass	Volleyball, pump, lever and weight, balance	1. Did the ball change its size when it was pumped up? 2. Why did the mass of the ball increase after pumping it up? 3. Is air an example of matter?		
6.16	Fountain in a Flask	To create a fountain in a bottle using the siphon effect	Special apparatus	1. Why is one of the tubes drawn into a thin tube? 2. Why must some water be added to the upper bottle? 3. Why must the end of the drain tube be placed below the desk top?		See 1.10 for making apparatus using glass tubing
6.17	Egg into a Flask	To insert a peeled, hard boiled egg into a flask and remove it again	Flask or bottle with opening just a bit smaller than the peeled egg	1. Is it possible to gently push the egg into the flask? Why not? 2. Why did the egg pop into the flask after putting a piece of burning paper in the flask? 3. How could you get the egg out of the flask again? Try it!		
6.18	Sticky Plungers	To show how air pressure can be used to stick plungers together	Two plungers	1. Why must the plungers be pushed together tightly? Why does it help to wet the flat edge of each plunger? 2. Why is it so difficult to pull the plungers apart? 3. Identify some applications of this demonstration.		

7. HEAT (DVD 2)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
7.1	Conduction of Different Metals	To show that different metals conduct heat at different rates	Conductometer, burner	1. How does the heat energy transfer along the metal? 2. Which metal is best to use for cooking pans?		
7.2	Ball and Ring	To show expansion of a metal when heated	Ball and ring apparatus	1. Why did the heated ball not fit through the ring? 2. Why do train tracks have spaces between the rails? 3. Explain expansion in terms of molecular motion.		
7.3	Bimetallic Strip	To show bending of a metal strip when heated.	Bimetallic strip	1. Why does the strip bend when heated? Would this happen if it consisted of a single metal? 2. Explain how a bimetallic strip can be used as a temperature sensor.		
7.4	Conductivity of Copper and Wood	To show that copper is a better conductors of heat than wood	Wooden dowel and copper pipe	1. Why does the paper wrapped around the wooden dowel scorch but not around the copper pipe? 2. Why do metals feel colder than wood?	Ask students to feel which is colder – their desk top or the metal legs of their desk (or chair).	
7.5	Convection in Air (Smoke Box)	To show a convection current in air using a smoke box	Smoke box	1. What is the purpose of the candle under the one glass chimney? 2. Why does the smoke go down the second chimney?		
7.6	Convection in Air (Pop Bottle)	To show convection currents in air using a pop bottle	Pop bottle, ammonia, hydrochloric acid, alcohol burner	1. Why was it necessary to add ammonia and hydrochloric acid? 2. What is necessary to have a convection current in air? 3. Is wind an example of a convection current? Explain.		$NH_{3(gas)} + HCl_{(gas)} \rightarrow NH_4Cl_{(solid)}$ (forms solid particles = smoke)
7.7	Heat and Molecular Motion	To illustrate the Kinetic Molecular Theory to explain heat.	Petri dish (or other clear container), beads, overheard projector	1. What happens to the particles in matter when a substance is heated? 2. Will all particles have exactly the same kinetic energy?		
7.8	Temperature and Heat	To illustrate and explain the difference between heat and temperature	Two different sizes of iron bolts, water, thermometers	1. Was the temperature of the two iron bolts the same initially? How do you know? 2. Which bolt contained more heat energy? How do you know? 3. Can a cold object contain more heat energy than a hot object? Give an example.		Most students have difficulty understanding the difference between heat and temperature

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
7.9	Expansion of Liquids	To show that liquids expand at different rates when heated.	Water, methanol, test tubes, stoppers with glass tubes	1. Which liquid expanded more when heated? 2. Why does a liquid expand when heated? 3. If the ocean warm up slightly, how will that affect the water level?		
7.10	Squeezing a Glass Bottle	To demonstrate that air expands when heated.	Large bottle, stopper with glass tube, water	1. Why did bubbles of air come out of the glass tube? Where did the heat come from? 2. Could a plastic pop bottle be used for this demonstration?		
7.11	Air Thermometer	To show how changes in temperature can be measured using expansion of air	Large bottle, stopper with glass tube, water	1. What causes the water level to move up or down in the glass tube? 2. How could a change in the atmospheric pressure affect the water level?	Record water level over a few days and graph results.	If a barometer is available, also record the air pressure
7.12	Liquid Thermometer	To use water to show changes in temperature.	Large bottle, stopper with glass tube, water	1. Why does this apparatus take a long time to respond to temperature changes in the room? 2. Is this apparatus affected by air pressure?	Record water level over a few days and graph results.	
7.13	Radiant Heat Energy	To show that a black surface absorbs radiant heat more readily than a shiny surface.	Cans, thermometers, light source	1. Why is it important to place the cans the same distance from the light source? 2. Why did the black surface get warmer? 3. What colour of clothes should you wear in the summer to stay cooler? Why?	Record temperature every minute and graph results	See also: MOTION –13.9 (Radiometer)
7.14	Convection Currents in Water	To demonstrate the presence of currents in water when heated.	Clear container, dye, water, alcohol burner	1. Why did the water rise where it was heated? 2. Why was a dye added to the water? 3. Why did the coloured water stay near the surface?		See also: PROPERTIES OF MATTER 3.15
7.15	Convection in Water	To set up a convection current in a loop filled with water	Plastic tubing with T-connector, food colouring, stand	1. Why is it important not to have any air trapped in the loop? 2. What is the purpose of lowering the loop into the warm water bath? 3. How are convection currents set up in the ocean?		
7.16	Heating Water in a Paper Container	To show that a paper container can be used to heat water	Stand, ring clamp, wire mesh, burner	1. Why does the paper not burn when heated? 2. How does water help to put out a fire? 3. Could water be boiled in a bark container?		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
7.17	Ice in Boiling Water	To demonstrate that water is a poor conductor of heat	Ice, test tube, test tube clamp, weight, burner	1. Why does the ice at the bottom of the test tube not melt? 2. Is water a good conductor of heat? What about glass? 3. Could heat not be conducted to the bottom by convection currents in the test tube?		This demo also demonstrates all three phases of water at the same time
7.18	Wire Candle Snuffer	To control a candle flame using a copper wire coil	Candle, copper wire (14 gauge)	1. What causes the white smoke that comes off a candle when it is blown out? 2. Why is the 'smoke' given off by the candle when the coil is partially placed over the flame? 3. Why does the copper coil extinguish the flame? Would iron work as well? Try it!		
7.19	Burning Money	To show that paper can burn with pure methanol but not with a methanol/water solution	Methanol, water, tongs	1. Why does the paper burn with pure methanol? 2. What happens with the methanol/water solution? Why did the paper not burn? 3. What is meant by 'ignition temperature'?		
7.20	Thermos Bottle	To show how a thermos bottle is designed to keep heat in or out	Thermos bottle that can be disassembled	1. Describe the three ways by which heat is transferred. 2. Explain how the thermos bottle is designed to minimize heat transfer. 3. What happens if the little tip in the bottom is broken?		
7.21	Insulation	To demonstrate different types of insulation and explain how they work	Samples of different types of insulation	1. If insulation is compressed, would it still be a good insulator? 2. How can windows reduce heat loss or gain? 3. Would a vacuum be a good insulator? Explain.		
7.22	Expansion of Wire	To show that a wire expands when heated.	Special apparatus, torch	1. Why does a metal expand when heated? 2. Why are overhead electric wires not strung tight?		
7.23	Drinking Bird	To determine how the drinking bird works To demonstrate energy changes during evaporation	Drinking bird, beaker of water	1. Why is the liquid drawn up the tube (bird's neck)? 2. What is the purpose of the water? 3. Would the bird work if the relative humidity was 100%? Devise an experiment to test your answer!		This science novelty is available from a science supply company

8. LIGHT (DVD 2)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
8.1	Light Sources	To demonstrate some of the common sources of light	Variety of different types of lights	1. What is meant by the term 'incandescent'? 2. Which light source is the least efficient? Why?		
8.2	Making Laser Light Visible	To show that light is only visible when it is reflected To show that light travels in a straight line	Laser pointer, chalk dust	1. Could you see the laser light as the light travels from the pointer to the wall? 2. Why does the light beam become visible when chalk dust is in its path? 3. Why can you sometimes see a sunbeam coming into a room through a window?		Works best in a darkened room
8.3	Transparent, Translucent, Opaque	To classify different materials as transparent, translucent or opaque	Variety of materials, light source	1. Define the terms transparent, translucent, opaque. 2. Give additional examples of each type of optical medium.		
8.4	Supplies for Student Activities	To describe what students need for doing experiments on light				
8.5	Law of Reflection Using a Laser	To measure the angles of incidence and reflection	Laser pointer, mirror	1. Define: angle of incidence, angle of reflection 2. What can you conclude about the angle of incidence and angle of reflection?		Works best in a darkened room
8.6	Law of Reflection Using Pins	To demonstrate the law of reflection in a plane mirror	Mirror, pins, paper, cardboard	1. Why is it necessary to close one eye when lining up the pins? 2. Why did you use four pins? 3. State the Law of Reflection.	Good student activity	
8.7	Locating the Image in a Plane Mirror	To find the location of the image of a candle in a plane mirror	Candle, mirror	1. Why is it important to close one eye when positioning the candle behind the mirror? 2. What happens to the candle and the image of the candle as you view from different positions if the two are not at the correct position? 3. What can you conclude about the location of the image in a plane mirror?	Good student activity	
8.8	Reflection Using a Concave Mirror	To show how two beams of light are reflected by a concave mirror	Two lasers, make-up mirror, chalk dust	1. Describe where the two reflected beams of light meet. What is this point called? (Focal point) 2. Describe some applications of this type of mirror.		
8.9	Refraction (using a laser)	To show that a beam of light refracts when it passes through a different medium	Laser, square bottle, chalk dust, drop of milk	1. Why were a few drops of milk added to the water? 2. Trace the path of the laser beam through the bottle. What happened to the beam of light as it passed from the air into the bottle? From the bottle into the air again? 3. Define 'refraction'.		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
8.10	Refraction Through a Bottle	To trace the path of light through a different medium using pins	Square bottle, pins, paper, cardboard	1. Why is it necessary to close one eye when lining up the pins? 2. Why is it necessary to use four pins? 3. Describe what happens to the light as it passes from air into the bottle and into the air again. 4. What happens if the pins are placed perpendicular to the bottle? Try it!		
8.11	Refraction Through a Convex Lens	To show how two beams of light pass through a lens	Two lasers, magnifying glass, chalk dust	1. What happens to the two beams after they pass through the lens? 2. Why do the beams change direction? 3. Why are lenses curved?		
8.12	Disappearing Coin	To show that a coin under a glass is no longer visible as the glass is filled with water	Tall glass, coin, water	1. Why does the coin become invisible as water is poured into the glass? What must happen to the light reflected from the coin? 2. Is the coin visible when you look straight down into the glass and then fill it with water? Try it!	Good group activity	
8.13	Apparent Depth	To show that the bottom of a container appears less deep when fill with water than with air	Tall container, water	1. How deep does the container appear to be when viewed through the water? 2. Why does a swimming pool appear less deep than it actually is?	Good group activity	Could also use a graduated cylinder or even a test tube
8.14	Spectrum of White Light	To show that white light is composed of many different colours	Overhead projector, beaker, cardboard	1. Identify the colours of the spectrum. 2. Are the colours in the same order as those found in a rainbow?		The beaker should be nearly full
8.15	Scattering of Light: Why is the Sky Blue?	To show that, when white light is scattered, the blue component is scattered the most	Overhead projector, beaker, sodium thiosulfate, acid	1. What happens to the sodium thiosulfate solution when an acid is added? 2. What colour of light is scattered the most by the finely divided sulfur in the beaker? 3. What is the colour of the light transmitted through the solution onto the screen? 4. Why does the sky appear blue?		If sodium thiosulfate is not available, you can also use milk (see Demo 14)
8.16	Scattering of Light Using Milk	To show that, when white light is scattered, the blue component is scattered the most	Overhead projector, beaker	1. Why is milk added to the water? 2. Why does skim milk appear slightly blue in colour? 3. Why does a major volcanic eruption often lead to spectacular sunsets?		
8.17	Optical Illusions Using Two Mirrors	To look at your image in two plane mirrors perpendicular to each other	Two plane mirrors, modeling clay	1. What happens to your image if the mirrors are not quite perpendicular? 2. Describe your image when you look at yourself in the two mirrors. How is it different from a single mirror? Why?	Good student activity	
8.18	Optical Illusions	To demonstrate a few optical illusions		1. What is meant by an ‘optical illusion’? 2. Try to explain the optical illusions.		

9. STATIC ELECTRICITY (DVD 3)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
9.1	Sticky Balloons	To show how charged balloons can be stuck to a surface	Balloons	1. Why is it necessary to rub the balloons first? 2. What makes them stick to a surface? 3. Why does the charge not transfer to the surface and cause repulsion?		Could be used to introduce unit
9.2	Bending a Stream of Water	To show that a charged object can bend a stream of water	Pop bottle with hole in bottom, stand, ring clamp	1. Why was the pen or glass rubbed against a cloth? 2. Why was the stream of water deflected or bent by the charged pen or glass rod? 3. What would happen to the charge if the water touched the pen? Try it!		If a water tap is available in the room, it could be used instead of the pop bottle
9.3	Charged Objects: Attraction and Repulsion	To show that there are two kinds of charges To show that similarly charged objects repel	Wire holder, stand, clamp, pens, test tubes, cloth	1. Why do similar objects rubbed with the same cloth repel each other? 2. What causes a negative chare on an object? A positive charge? 3. Would the cloth used to charge a pen be attracted or repelled by the pen? Try it!	Students could do many of the demos in this topic as group activities; minimal equipment is needed.	
9.4	Suspended Aluminum Ball	To use a small ball of aluminum foil as a detector of charge	Thread, aluminum foil, stand, clamp	1. Sometimes you observe the ball first attracted to the charged pen and then suddenly jump away. Why does that happen?		
9.5	Jumping Bits of Paper and Foil	To show how a charged object may attract and repel bits of paper or foil	Paper, aluminum foil	1. Why were the bits of paper and foil attracted to the charged pen? Which were attracted more strongly? 2. Sometimes bits of foil jumped to the pen and then off again. Why?		
9.6	Jumping Salt and Pepper	To cause salt and pepper to jump in a Petri dish	Two Petri dishes, salt and pepper	1. Why did the salt and pepper jump when the lid of the Petri dish was rubbed? 2. How could the effect of a charged pen or test tube pass through the lid? Do you think it would work with an aluminum foil cover? Try it!		
9.7	Rolling Can	To show how a metal can may be attracted by a charged pen	Empty pop can	1. Why does the can roll towards the charged pen? 2. Does it matter whether an object that is being attracted is a metal or non-metal?	Try other round objects as well	See also FORCES – 16.5
9.8	Simple Electroscope	To construct and test a simple electroscope	Conical flask, copper wire, aluminum foil	1. Why is it best to hang two foil pieces on the wire rather than a single piece? 2. What is an ‘electroscope’? 3. Why is it enclosed in a flask?		Best done as a teacher demo

10. CURRENT ELECTRICITY (DVD 3)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
10.1	Measuring an Electric Current	To show how an electric current may be detected	Compass, wire, multimeter	1. Why does the compass needle move when a current passes through the wires? 2. Would more coils of wire around the compass make the detector more sensitive? Why?		An inexpensive digital multimeter is the best detector
10.2	A Lemon Cell	To build a simple electrochemical cell	Lemon, copper wire, galvanized (zinc-coated) nail, connectors	1. What is required for making a cell? 2. Why is this cell not able to cause a light bulb to glow? 3. What is the purpose of the lemon? What could be used instead of the lemon?		
10.3	Clock Powered by an Electrochemical Cell	To operate a battery powered clock with an electrochemical cell	Drain cleaner, copper wire, aluminum foil, beaker	1. Examine the aluminum foil after being in the solution (rinse off first). Describe what has happened to it. 2. Could this cell be used for a long time period?		Magnesium and copper electrodes in orange juice work better
10.4	Using a Magnet to Generate Electricity	To show that when a magnet is moved inside a coil of wire, an electric current is induced in the coil	Coil of wire, strong magnet	1. What is necessary to induce a slight voltage in the coil, as shown by the multimeter? 2. How could this device be made more efficient?		
10.5	A Circuit Board – Parallel and Series Circuits	To construct a simple circuit board for students To build series and parallel circuits using two batteries and two lamps	Circuit board (lamp socket, Fahnestock clips, wires), batteries, battery holders, lamps	1. What is meant by a circuit? 2. Define parallel and series as applied to circuits. 3. What is the effect of placing (a) batteries and (b) lamps in series and in parallel?	Allow students to put together parallel and series circuits	
10.6	A Circuit Board for Teacher Demos	To construct various circuits using three lamps	Circuit board with three (or more) lamps, batteries	1. Describe the flow of electrons in each of the circuits. 2. Explain why the lights vary in intensity.		
10.7	A Simple Fuse	To make and show the operation of a simple fuse	Steel wool, aluminum foil, tape	1. What is the purpose of a fuse in a circuit? 2. What happens to a fuse if the circuit is overloaded? 3. Why should you never replace a fuse with one at a higher rating?		Several fuses can be made ahead of time
10.8	Conduction Tester	To test different materials for their ability to conduct electricity	Circuit board, batteries	1. Define the terms ‘conductor’ and ‘insulator’ as they apply to electricity. 2. Classify the things you tested.	Allow students to test a variety of common objects in the classroom	

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
10.9	Electric Heat	To show how an electric current can generate heat	Steel wool, batteries	1. Why might the length of the steel wool fiber affect its ability to conduct electricity? Which work better, a short or a long strand? 2. Why would iron not be a good metal to use in an electric heater used at home?		Also see: CHEMISTRY – 13.18
10.10	Electromagnet	To make an electromagnet and test its ability to pick up paper clips	Large nail, long piece of wire (2-3 m), batteries	1. Does the iron nail retain its magnetism after the battery is disconnected? 2. What does the strength of an electromagnet depend on?	Have students make and test an electromagnet	
10.11	Drawing Circuit Diagrams	To show how some circuit diagrams can be drawn using simple symbols		1. Give the symbol for each of the following: battery (or dry cell), lamp, switch, fuse. 2. Draw a diagram of a circuit with three batteries in series with three lamps in series. Include a fuse and a switch.	Let students draw a circuit diagram of each circuit constructed earlier	
10.12	A Battery-less Flashlight	To show a device using ideas discussed in this unit	Flashlight that requires shaking to light it	1. What moves back and forth when you shake the flashlight? How does that create an electric current? 2. What is an LED lamp? What other applications use such a lamp? Does the lamp get hot?		

11. MAGNETISM (DVD 3)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
11.1	Types of Magnets	To identify different types of magnets	Assortment of magnets	1. What type of magnet would a fridge magnet be? 2. Why are keepers used on bar magnets? 3. Why must magnets never be dropped or heated?	Many of these activities can be done by students or as teacher demos	
11.2	Suspended Magnets: Attraction and Repulsion	To show how magnets can attract or repel each other	Bar magnets, magnet holder	1. How do you know that a bar magnet has ends with different polarity? 2. Why is one end called North and the other South?		
11.3	Making a Needle into a Magnet	To magnetize a needle	Strong magnet, sewing needle, dish with water	1. Why is it important to stroke the needle in one direction only? What happens if it is stroked back and forth? Try it! 2. How can you identify the N and S poles of the needle?		
11.4	Testing for Magnetic Property	To test different materials to determine which are magnetic	Magnet, variety of different substances	1. Which substances were attracted to the magnet? 2. What general conclusion can you make about substances that are magnetic?	Test various things in the classroom for magnetic property	Include an assortment of coins
11.5	Magnetic Forces Using Iron Filings	To make the magnetic field surrounding a magnet visible	Various magnets, iron filings	1. Explain why N and S poles attract and N—N or S—S poles repel each other 2. Where is the magnetic field the strongest around a bar magnet? A horseshoe magnet?		
11.6	Magnetizing Iron Filings	To show how iron filings can be magnetized To explain why magnetism occurs	Test tube filled with iron filings, strong magnet	1. Why is it important to first stroke the test tube with a strong magnet? 2. What evidence is there that the iron filings are magnetized? 3. Why does shaking the test tube result in a loss of magnetism? 4. How does this model what happens in a bar magnet?		The filings can represent iron atoms; lining them up causes a magnet. Shaking them up results in loss of magnetism
11.7	Induced Magnetism	To show how magnetism can be induced in another object	Strong magnet, nail, paper clips	1. Does the strength of the induced magnet depend on how close the nail is held to the magnet? Try it! 2. Explain how the nail becomes magnetized when held near the magnet. 3. Define 'induced magnetism'.	Let students experiment with different types of magnets and sizes of nails	

12. SOLUTIONS (DVD 3)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
12.1	Solutions and Mixtures	To distinguish between solutions and mixtures	Water, methanol, vegetable oil, sugar, salt	1. Name some properties of solutions and of mixtures. 2. What is meant by ‘phase’? How many phases are there for a solution? A mixture? 3. Could you separate the components of a solution by filtration?	Many of these demonstrations could also be done as student activities	
12.2	Types of Solutions	To consider examples of different types of solutions	Variety of solvents and solutes, examples of solutions	1. Is it possible to have a solution involving a solid in a gas? 2. What would be correct – a mixture of gases or a solution of gases? 3. What gas is found in water?		
12.3	Rate of Dissolution	To determine what factors affect the rate at which a solid solute dissolves in water	Test tubes or beakers, sugar, water, heat source	1. What factors affect the rate at which a solid dissolves? 2. Explain why, based on the Kinetic Molecular Theory, the factors mentioned in (1) affect the rate of dissolving.		
12.4	Unsaturated, Saturated, and Supersaturated	To prepare solutions having different amounts of solute	Magnesium sulfate, beaker, heat source	1. Can a solution be saturated at 25^{o}C, unsaturated at 80^{o}C and supersaturated at 0^{o}C? 2. How can you tell what a solution is saturated? 3. Why does a supersaturated solution of magnesium sulfate eventually form a solid?		
12.5	Identification of Gas in Pop	To determine what gas is found in soda pop	Pop, limewater	1. Describe the limewater test for carbon dioxide. 2. Why is carbon dioxide added to pop?		See CHEMISTRY 13.1 for preparing limewater
12.6	Amount of Carbon Dioxide in Pop	To determine the quantity of carbon dioxide dissolved in pop	Pop, heat source, tubing, stopper	1. Why do you hear a gas escaping when you open a container of pop? 2. Why was the pop warmed up? 3. Why does shaking help to ‘undissolve’ the carbon dioxide?		
12.7	Concentration of Solutions	To understand the significance of ppm (part per million)	Food colouring, gasoline, dropper	1. Could you see the presence of food colouring at a concentration of 1 ppm? 2. Would you want to drink this solution if you knew it contained a toxic chemical at this level? 3. Could you still smell the gasoline at the ppm level?		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
12.8	Cleaning Dirty Water Using Alum	To show how alum can be used to clean dirty water	Alum, water, test tubes, soil, laser pointer	1. Which sample looked cleaner after 30 minutes? 2. Which sample transmits the laser light better? Why is that? 3. Carefully examine the deposit at the bottom. Describe any differences between the two samples. 4. Which sample could be filtered more easily? Why? 5. At what stage do you think alum should be added in a water treatment system?		Let samples stand overnight Filter both water samples to see which sample filters best

13. CHEMISTRY (DVD 3)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
13.1	Preparation of Limewater	To show how a solution of limewater can be prepared To test for carbon dioxide	Lime, straws	1. Why is it important to let the mixture of lime and water stand overnight? 2. What is a common test for carbon dioxide? 3. Is limewater a mixture or solution?	Blow through a solution of limewater in a test tube	
13.2	Physical and Chemical Changes	To be able to identify physical and chemical changes	Variety of chemicals, test tubes, rack	1. What is a physical change? A chemical change? 2. Identify other physical and chemical changes.	Students could be asked to perform the activities in groups	
13.3	Foam Production	To show how a foam can be made	Baking soda, detergent, acid, graduated cylinder	1. What happens when an acid is added to baking soda? 2. Why was the detergent added? 3. What is Styrofoam?		
13.4	Blowing up a Balloon	To use baking soda and an acid to blow up a balloon To test for the gas produced	Balloon, bottle, baking soda, acid, limewater, straw	1. Is this a physical or chemical change? 2. What is the gas produced?		
13.5	Carbon dioxide as a Fire Extinguisher	To show that CO_2 does not support combustion To show that CO_2 is more dense than air	Baking soda, acid, large bottle, candle	1. How do you know that CO_2 is denser than air? 2. Does CO_2 burn? Does it support combustion? 3. Why does the candle go out? 4. Why does the candle smoke?		Could also be done under PROPERTIES OF MATTER
13.6	Products of Combustion	To show that CO_2 and water vapour are produced when a fuel burns	Air sampler (to be constructed), limewater, beaker with ice water	1. What caused the fogging of the cold beaker? 2. Can heat cause the fogging? (Try it with a hot plate) 3. What did the limewater test tell you?		Hold hand over flame – you can feel the high humidity from the water vapour
13.7	Phenolphthalein Indicator	To prepare a phenolphthalein solution To test this solution with acids and bases	Phenolphthalein powder (or prepared solution), various acids and bases	1. What colour would phenolphthalein be in a neutral solution? 2. Describe what you would do to test whether an unknown liquid is an acid or a base.		
13.8	Invisible Ink	To show how an indicator can be used to make invisible ink	Phenolphthalein solution, ammonia, sprayer	1. Why did the letters not show up initially? 2. What type of substance is ammonia? 3. Why does the colour slowly fade?		Ammonia is a gas and will be slowly released into the air
13.9	Red Cabbage Indicator	To show how an extract from red cabbage changes colour at different pH levels	Red cabbage, various acidic and basic compounds	1. How could you use red cabbage extract to tell whether a solution is acidic or basic? 2. Why is this substance not commonly used as an indicator in chemistry? 3. What would be the effect of adding	Students could test various substances with the cabbage juice and classify them	

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
				vinegar to red cabbage?		
13.10	Mystery Colour Changes	To have students explain why some solutions change colour but not others	Phenolphthalein, 1 M NaOH, 1 M HCl, 6 test tubes, rack, Styrofoam cup	1. Why did the colour of some solutions turn pink? 2. What could cause the pink colour to turn colourless? 3. What was in each container at the beginning of this demonstration?		
13.11	Percentage of Oxygen in Air	To determine the percentage of oxygen in air	Steel wool, vinegar, 100 mL graduated cylinder, beaker, stand, clamp	1. Why did the water move up in the graduated cylinder? 2. Did you notice a colour change in the steel wool? What caused that?		
13.12	Methanol Cannon	To explode a mixture of methanol and air in a plastic bottle	Modified detergent bottle with cork stopper, igniter, wires, methanol, stand with clamp	1. Why did the cork shoot out? 2. Why did the mixture not ignite the second time? 3. What are some safety precautions?		Stress safety with this demonstration
13.13	Testing Common Household Powders	To perform chemical and physical tests on common household powders To identify an unknown powder	Various household powders, iodine solution, acid solution, aluminum foil, alcohol burner	1. Describe the results of each test. Determine whether the change is physical or chemical. 2. How were you able to identify your unknown?	Test each powder and use results to identify one or more unknowns	Charts for tests and student observations are found in **PM-5**
13.14	Oxygen Gas from Hydrogen Peroxide	To decompose hydrogen peroxide and test the gas released	3% hydrogen peroxide, manganese dioxide (or potato slices), wood splint	1. What did you observe when the manganese dioxide powder (or potato slices) was added to the hydrogen peroxide solution? 2. What happened to the glowing splint? 3. What is a test for oxygen gas? 4. Why does the glowing splint not burst into flame in normal air? 5. Is oxygen gas flammable? Does it support combustion?		
13.15	Hydrogen Gas from Aluminum Foil and Drain Cleaner	To react aluminum foil with sodium hydroxide, collect the gas released and test it with a flame	Drain cleaner or sodium hydroxide, aluminum foil, wood splint	1. Why was the gas collected in the second test tube placed over the test tube with the reagents? 2. What does this tell you about the density of hydrogen gas? 3. Is hydrogen gas flammable? 4. Could hydrogen be used in balloons?		Could also be done under PROPERTIES OF MATTER
13.16	Flubber	To prepare a polymer having some interesting properties	White glue, Borax, disposable containers	1. Is flubber a solid? Is it a liquid? 2. Why does it break if you pull it apart quickly but stretch if you pull it slowly?	Give students small amounts of flubber and let them experiment with it	Could also be done under PROPERTIES OF MATTER

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
13.17	Dust Explosion	To show how surface area can affect the rate of a reaction To understand what is meant by a 'dust explosion'	Corn starch, funnel with tubing, candle or burner	1. What makes the starch burn so rapidly when it is blown into a flame? 2. Why should only a small quantity of starch be used? 3. Would road dust cause the same effect? Explain. 4. Give examples of where a dust explosion might occur.		
13.18	Burning Steel Wool	To show how surface area affects the rate of a reaction To demonstrate the rapid rusting (oxidation) of iron	Super fine steel wool, sparker (or 9 V battery or even a match), metal plate or aluminum pie plate	1. Why does the steel wool burn so readily but not a steel nail (or car, or…)? 2. Why does a rusting nail not feel hot? 3. How can you prevent iron from rusting (oxidizing)?		Super fine steel wool (0000) must be used
13.19	Absorbent Polymer	To demonstrate how certain polymers can absorb water	Disposable diaper Beaker, water	1. How is this polymer able to absorb so much water? 2. Why does the water not just flow through the polymer?		Could also be done under PROPERTIES OF WATER
13.20	Skewered Balloon	To study characteristics of polymers To insert a needle through an air-filled and a water-filled balloon	Sharpened knitting needle, balloons, Ziploc bag	1. Why must the needle be inserted into the end of the balloon? 2. Why does the balloon break if the needle is inserted into the stretch part of the balloon? 3. Why does the Ziploc bag not break when the needle is inserted through it?		

14. FLUIDS IN MOTION (DVD 4)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
14.1	Smoke Ring Box	To build a box to produce smoke rings To demonstrate Bernoulli’s Principle	Box, plastic sheet, pieces of wood, hooks, elastics, ammonia, muriatic acid, shallow dishes (large lids)	1. What caused the candle to go out when the box was directed at the burning candle? 2. What is Bernoulli’s Principle? 3. What causes the smoke ring to form? 4. What happens if you place your hand in the path of the smoke ring? Try it!		
14.2	Lifting by Blowing	To show that when you blow over a sheet of paper, the paper is lifted up	Sheet of paper	1. Explain why the sheet of paper lifts up when you blow over its surface. 2. Why is it important to hold the paper just right?	Let students try this.	
14.3	Blowing into a /\-Shaped Paper	To illustrate the differences in air pressure between moving air and still air	Sheet of paper	1. Describe what happens when you blow into the /\ formed by the paper. 2. What does this tell you about the pressure of the moving air in the /\ relative to the still air above the paper?	Let students do this demo.	
14.4	Blow Together	To show what happens when you blow between two suspended balls	Ping pong balls, string, stand, clamp	1. What happened when you blew between the balls? Why does that happen? 2. Does it depend on how hard you blow? Try it!		
14.5	Anti-Gravity Funnel	To suspend a ping pong ball in an inverted funnel by blowing	Ping pong ball, funnel, plastic tubing	1. Why can you not blow the ping pong ball out of the funnel? 2. Explain why the ball stays in the inverted funnel as long as you keep blowing. 3. Why is a ping pong ball used instead of a golf ball, for example?		Make sure the funnel does not have ribs inside
14.6	Filling a Large Bag with One Breath of Air	To use Bernoulli’s Principle to assist in filling a large plastic bag with air	Large plastic bag	1. How many breaths would it take to fill up the bag if you were to blow it up by holding it against your mouth? 2. Why does it fill up so much faster when you hold the open bag a little ways in front of your mouth?		
14.7	Suspended Ping Pong Ball in a Stream of Air	To show how a ping pong ball can be suspended in an air column	Air blower (vacuum cleaner in reverse), ping pong ball	1. What forces are acting on the ping pong ball? 2. What prevents the ball from moving out of the air stream? 3. Does the air stream have to be vertical? What happens if it is non-vertical? Try it!		Use a straight pipe at the end of the hose so the air blows out straight; it reduces turbulence

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
14.8	Water Sprayer	To show how a stream of air can cause water to rise in a tube	Air blower, short tube, water, funnel	1. Why does the water rise in the tube when air passes over it? 2. What happens to the speed of the air stream when it is directed through a funnel? 3. What causes the water to spray out? 4. Give some other examples of how Bernoulli's Principle is used.		
14.9	Blowing Through a Bottle	To blow out a candle positioned behind a bottle	Candle, bottle	1. Why does it appear that the person is blowing through the bottle? 2. Explain how the air flows when you blow against the bottle.		
14.10	Coloured Rings in Water	To show that a drop of coloured water added to a basin of water will form rings	Food colouring, dropper, basin	1. Describe what happens to the drop of coloured water when it is dropped into the water. 2. Why must the water in the basin be very still? 3. How does this relate to the smoke ring generated from the smoke box? 4. What is meant by a fluid?		
14.11	Hydraulics	To show how a forces can be transferred through a fluid	Several syringes, tubing	1. Why is it important to completely fill the syringes and tubing with water? 2. If small and large syringes are connected together, which is easier to push in? Why? 3. Give samples of how hydraulic systems are used in construction equipment. 4. Why is oil used instead of water as a fluid in hydraulic equipment?		
14.12	Transfer of Ping Pong Ball	To use air to transfer a ping pong ball from one container into another	Beaker, margarine tub, ping pong ball	1. Why does the ping pong ball move up when you blow across the open beaker? 2. What happens if you blow really hard? Try it!		

15. MOTION (DVD 4)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
15.1	Inertia	To explain and demonstrate the concept of inertia	Ball	1. What is required to cause a change in motion? 2. If there were no frictional forces, what would happen to a rolling ball? 3. Why is it so hard to push a car by hand?		
15.2	Simple Examples of Inertia					
15.3	Fresh or Boiled Egg?	To use rotation to distinguish between a fresh and a boiled egg	Two eggs, one fresh, the other boiled	1. Explain why the fresh egg does not rotate easily at first. 2. Why does the boiled egg rotate so much easier? 3. Why does the fresh egg start to rotate again after it was stopped momentarily?		
15.4	Falling Ball and Paper	To show the effect of air resistance on a falling object	Ball and sheet of paper	1. Why did the sheet of paper fall much slower than the ball? 2. Why was there no noticeable difference in the rate of falling of the ball and crumpled sheet? 3. How does a parachute slow a person's fall?		
15.5	Falling Pennies	To show that horizontal and vertical motion are independent	Two coins, index card	1. What do you observe about the two pennies – the one that dropped straight down and the other that was shot out horizontally? 2. Why did both coins hit the floor at the same time?		
15.6	Action and Reaction – Water Rocket	To demonstrate the principle of a rocket engine	Toy water rocket	1. Why was the rocket only half-filled with water and then compressed air? 2. What caused the rocket to shoot up? 3. What is fired out of a rocket in space?		This demo is best done outside
15.7	Alka-Seltzer Rocket	To use an Alka-Seltzer tablet to propel a plastic bottle	Plastic bottle with small opening, rubber stopper	1. What gas is produced when the Alka-Seltzer tablet is added to water? 2. What would happen if the stopper were put on loosely? Try it! 3. What would happen if the container were not inverted? Try it!		This demo is best done outside
15.8	Action and Reaction – Balloon Rocket	To move a balloon along a long string	Balloons, nylon fishing line	1. What was the purpose of attaching the balloon to the line? 2. What force caused the balloon to travel along the string? 3. What were the action and the reaction?	Have groups of students compete for distance the balloon travels	

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
15.9	Action and Reaction - Radiometer	To demonstrate how radiant energy can cause rotational motion	Radiometer, light source	1. Which side of each vane rotates away from the light source – the dark side or the light side? 2. Which side of the vane would get hotter? 3. Explain why the vanes rotate. 4. Would the vanes rotate if there were no air in the glass globe? Why or why not?		See also: HEAT – 7.13
15.10	Rotating Water Bottle	To show how flowing water can cause rotation	Water bottle with holes in bottom	1. What would happen if the bottle had only one hole in the bottom? Try it! 2. What would happen if the holes were on opposite sides of the ridges? 3. What is the action and the reaction?		

16. Forces, Work and Simple Machines (DVD 4)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
16.1	Mass and Weight	To distinguish between mass and weight; to define force	Spring scales, weights	1. Why does weight vary but mass always stays constant? 2. Why does weight have a different unit than mass?		
16.2	Buoyant Force	To show that a liquid exerts an upward force on an object	Spring scales, various objects, water	1. Does the water level change when an object is placed in a container with water? 2. How can an iron ship float? 3. What forces act on a floating piece of wood?		See also demonstrations in DENSITY
16.3	Magnetic Force	To show how a magnet can exert a force of attraction or repulsion	Magnets	1. Is the magnetic force a ‘contact force’ or an ‘action-at-a-distance force’? 2. Does attraction to a magnetic object depend on the pole? Try it!		See also demonstrations in MAGNETISM
16.4	Force of Friction	To demonstrate the force of friction and show how it can be reduced	Spring scales, heavy book, straws	1. In what direction does the force of friction act with respect to motion? 2. Is friction always a ‘bad’ force? 3. How can friction be reduced?		See also demonstrations in MOTION
16.5	Electrostatic Force	To demonstrate how a charged object can exert a force	Meter stick, pen	1. Why is it necessary to rub the pen first? What does that do?		See also demonstrations in STATIC ELECTRICITY
16.6	Centrifugal and Centripetal Forces	To show different forces associated with a rotating object	Different masses, string, plastic tubing	1. Define centrifugal force. 2. What force keeps the rotating mass from flying off? 3. What force keeps the moon in its orbit?		
16.7	The Weird Meter Stick	To demonstrate the force of friction and gravity	Meter stick	1. Explain the behaviour of the meter stick. 2. Why does the frictional force between the meter stick and fingers change?	Let a few students try this as well	
16.8	Work: A Scientific Definition	To explain what is meant by the terms work and energy		1. What two conditions are required for work to be done on an object? 2. What is the relationship between force, work and energy?	Ask students to write down what they think ‘work’ means in science	
16.9	A Cart to Study Work	To describe a low-friction cart that can be used in the study of work		1. Why should the cart have a large mass and low friction? 2. Suggest other things that could be used for the study of work.		

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
16.10	Inclined Plane	To measure the work done in moving an object vertically by lifting or by an inclined plane	Cart, spring scale, board	1. Why does it take more work to use an inclined plane to more the cart up? 2. What is the advantage of using an inclined plane? 3. What is another name for an inclined plane? 4. Give additional examples of inclined planes.		
16.11	Levers: An Introduction	To show how a simple lever can be made for student activities To make measurements on each class of lever To derive an expression for the Law of the Lever	Stand, meter stick, spring scales, weights, hooks	1. Why is it important to locate the meter stick over the base of the stand? 2. What are some sources of errors associated with the measurements? 3. State the Law of the Lever.	Perform measurements on each class of lever	See **PM-6 A Study of Levers** for chart to record data
16.12	First Class Lever					
16.13	Second Class Lever					
16.14	Third Class Lever					
16.15	Law of the Lever					
16.16	Classes of Levers – Some Examples	To illustrate different types of levers in the home and school	Variety of devices employing levers	1. Give examples of different types of levers found on a bicycle. 2. Are there any devices in the classroom that are based on a lever?	Identify type of lever in each device	
16.17	Pulleys	To show how various combinations of pulleys can be used in changing forces	Stands, clamps, pulleys, string, weights	1. What is a simple way to determine the mechanical advantage of a pulley system? 2. Give examples of where pulleys are used.	Measure forces with different pulley arrangements	
16.18	Wheel and Axle	To demonstrate variations of the wheel and axle	Cardboard, pencil, wire, string	1. How is the wheel and axle used on a bicycle? 2. What is a winch? How does it relate to the wheel and axle?		
16.19	Screw	To show how an inclined plane can generate a screw To show applications of the screw	Paper and pencil, devices that use a screw	1. Which type of vice could develop a greater force for a given effort – one with a fine screw or one with a course screw? 2. Identify some common tools that use the screw.		
16.20	Wedge	To show how a wedge is derived from the inclined plane		1. What type of force does a wedge exert? In what direction? 2. Why is it necessary to swing an axe hard to split wood?		
16.21	Obedient Can	To demonstrate a can that rolls back when rolled down the floor	Large can, elastics, weight, glue gun	1. Without touching or opening the can, try to explain the can's behaviour.	This demo can also be done as a fun activity to get students to think about the scientific principles.	
16.22	Balancing Nails	To balance 12 nails on a stand	12 large nails, stand with long screw or nail	1. Why must the nails have large heads? 2. Where is the centre of gravity?	You could set this up as a puzzle for students to solve	

See also FLUIDS IN MOTION – 14.11 for a demonstration on hydraulic forces

17. EARTH SCIENCE (DVD 4)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
17.1	Day and Night	To explain how the earth rotates on a daily basis	Globe, light source	1. When looking at a globe, determine where N, S, E and W lie. 2. In what direction does the earth rotate? 3. What is the relative position of the earth and sun at midnight? At noon?	There are some excellent web sites relating to daily and seasonal changes and eclipses http://kids.msfc.nasa.gov/earth/seasons/EarthSeasons.asp (neat video) http://en.wikipedia.org/wiki/Seasons http://www.exploratorium.edu/eclipse/	
17.2	Seasonal Changes	To explain how seasonal changes occur	Globe, light source	1. What does it mean that the earth's axis is tilted at 23^{o} to its orbit? 2. Does the N-pole always point in the same direction relative to the sun? 3. Using the globe, what is the position of the earth relative to the sun to give the longest day in North America? The shortest day?		
17.3	Eclipse by the Moon	To show the position of the moon, sun and earth to observe an solar eclipse	Globe, light source, ball	1. Where does the moon have to be relative to the sun and earth to give an eclipse? 2. Why is the eclipse only visible in certain regions of the earth? 3. Why don't we observe an eclipse more frequently? 4. What is the difference between a solar eclipse and a lunar eclipse?		
17.4	Leaching of Soil	To show how water is able to leach minerals from soil	Soil sample, salt, filter	1. Why was salt mixed in with the soil? 2. Why was the salt present in the water after the water leached through the soil? 3. Where do the minerals in groundwater come from? 4. What eventually happens to all the minerals in water? 5. Why is ocean water salty?		
17.5	Model of a Geyser	To demonstrate how a geyser works To demonstrate how a coffee percolator works	Funnel, beaker, stand, heat source	1. Why does the water have to boil vigorously before water starts to shoot out of the funnel? 2. What is the purpose of the funnel? 3. What causes water to boil in a geyser?		

18. WEATHER (DVD 4)

Demo	Title	Purpose	Materials	Questions	Student Activity	Comments
18.1	Cloud Formation in a Bottle	To demonstrate what is necessary for clouds to form	Clear pop bottle, bicycle pump, needle to inflate balls	1. Why did the presence of smoke make such a difference? What role does the smoke play? 2. What does a cloud consist of?		
18.2	Measuring Air Pressure using a Barometer	To show how changes in air pressure can cause a column of water to rise or fall To demonstrate an aneroid barometer	Special apparatus to vary pressure in a container, Aneroid barometer	1. Why does the water level change when the pressure is changed? 2. What causes changes in air pressure? 3. Why is the bottle barometer not a good instrument to measure changes in air pressure?		
18.3	Relative Humidity	To show how relative humidity can be measured	Two thermometers, gauze	1. Why does the wet bulb thermometer cool down? What determines how much it cools? 2. Define ‘humidity’, ‘relative humidity’. 3. How can a low relative humidity (as occurs inside in the winter) make you feel chilly?	Measure the relative humidity in different parts of the school or at different times of the day.	See **PM-7** for Table to Determine Relative Humidity
18.4	Hair Hygrometer	To construct a hygrometer based on properties of a hair	Water bottle, long hair, toothpick, tape	1. What is the purpose of making holes near the bottom and top of the bottle? 2. Why does the pointer change position as the humidity in the air changes?	Have students note the position of the pointer over a period of several days	
18.5	Dew Point	To show how the dew point can be measured	Beaker, crushed ice	1. How does the dew point relate to relative humidity? 2. What weather conditions favour the formation of dew?		
18.6	Frost Formation	To show the formation of frost	Beaker or metal can, crushed ice, salt	1. Why is salt added to the ice? 2. What change in state is observed as frost forms? 3. What weather conditions favour frost formation?		
18.7	Temperature Inversion	To demonstrate what is meant by the temperature inversion of an air mass	4 Juice bottles, food colouring,	1. What is the normal temperature gradient in the atmosphere? Why? 2. How could an abnormal situation occur? 3. Why would air pollutants accumulate in air experiencing a temperature inversion?		
18.8	Tornado Cloud	To demonstrate a tornado funnel cloud using water	Two clear pop bottles, connector with hole	1. What is a funnel cloud? Why is it often so destructive? 2. What causes a funnel cloud to form?		