The following collection of demonstrations does not list safety precautions.
The teacher should carefully review and TEST these demos before using them in class.
These demonstrations are intended for teacher presentation and should not be attempted by students.

QUICKIES - A Collection of Classroom Demonstrations and Devices for the Teaching of Science

by Denman C. Evans

The science teacher often has a need for quick, spectacular, attention-demanding items to enhance a presentation, emphasize a principle, fix a fact, or condition the class for further learning. We hope the following "Quickies" may serve the above needs for you.

1. Spontaneous ignition can be effected with a half teaspoon of sodium peroxide placed on a two-inch cone of starch, sawdust, or finely chopped paper. Lay a small chip of ice on the cone. Sufficient heat and oxygen will be released by the reaction of water from the ice with the sodium peroxide to ignite the material. Kindling temperature and oxidation can be discussed following the demonstration.

2. Structure of a Bunsen flame can be demonstrated by adjusting the flame to above five centimeters and holding a splint horizontally at various levels. Heat intensity for each level will be indicated by the degree of scorch on the splint. This may be varied by using a plain card held perpendicular and slightly tilted in the flame. A scorch pattern will appear showing heat intensities of various areas of the flame. A wire gauze held in the flame will show by its glow the same conditions. Probe the flame with a small thermocouple connected to a sensitive ammeter and interpret.

3. Allow students to check the pH of their own saliva by using Hydroin paper. The color chart (usually on the Hydrion vial) will indicate quite a range of pH through the class.

4. Pass cut strips of cobalt chloride paper directly from the desiccator to some or all of the students. Have them hold paper tightly in the palm of their hand for a minute. They will note a change of color. Various explanations will ensue.

5. Molecules of water have spaces between them as evident when a long test tube or graduate is filled three-fourths full of water and then completely filled carefully to capacity with alcohol. Place thumb over end of container and invert to mix the liquids. The container will no longer be filled to capacity.

6. Using a small container rather than a large one in a gas generator gives a quicker yield of undiluted gas. Carbon dioxide can be made quickly by heating sodium bicarbonate in a test tube generator.

7. Dramatization of valence in simple reactions can be shown by two girls each holding the other's hands (representing oxygen molecules) and four boys, each with one hand in his pocket but holding another boy's hand (representing hydrogen molecules). The three molecules represented will break apart at the introduction of a

9. Is so-called suction a push or a pull? Arrange a flask fitted with a two hole stopper and a glass tube extending well down into the flask which is completely filled with water. A good-natured student is asked to "suck" water through the glass tube while the instructor holds his finger over the other hole of the stopper. On student's failure to get any water out of the flask, the instructor might remark, "Jim is not as big a sucker as we thought." After appropriate comments and removing his finger from the hole, the instructor asks the boy to try again. Suddenly the sucker succeeds. This is followed by explanation, after laughter subsides, showing how the experiment answers the problem.

10. Mix a little concentrated sulfuric acid and potassium permanganate in an evaporating dish. Dip a glass rod into the mixture and immediately touch the rod with attached mixture to the wick of an alcohol lamp. The alcohol ignites.

11. Relative vapor pressures of liquids can readily be shown. Attach manometer tubes to three bell jars of same size. Fill tubes with colored light liquids. Place the bell jars over dishes containing water, alcohol, and ether all at the same temperature. Dishes and bell Jars may need to be set on glass plates in order that air tight seals can be obtained.

12. To demonstrate how water aids chemical reaction, add about a gram of potassium bitartrate with an equal amount of sodium bicarbonate to a test tube. Shake and note no reaction. (Explain that these are the essentials of cream of baking powder which may keep for months on the grocers shelf.) Add a little water and the effect is evident. Ions are more active atoms or molecules and water probably acts as a catalyst or at least promotes ionization.

13. Encourage students to think, speak, and write more precisely. Illustrate by using a meaningless advertising slogan**:** "The Rollsmobile is bigger and better" -than- (a) a kiddie car (b) a freight car (e) last year's model.

14. Oxygen may be prepared by the action of enzymes in yeast on six per cent solution of hydrogen peroxide, surface action of manganese dioxide on hydrogen peroxide, heating sodium nitrate, or the interaction of sodium peroxide on water.

15. Show samples of chemicals mentioned in text as they are discussed. The difference in chemical and physical properties of substances is made real to the students by such simple means as, for example, heating separate test tubes of iodine and sulfur.

16. When studying minerals show a simple separation process where coal is separated from shale through flotation-. A zinc chloride solution can be made in which coal will float and the shale sink.

17. Transparent boxes used as containers for samples to be passed around in class can be dressed up with labels to make the specimens attractive.

18. The distinction between mixing and combining can be shown by putting a mixture of two parts hydrogen or natural gas with one part of oxygen into a syrup can equipped with a spark plug. A high frequency coil can be used to furnish the spark which will cause combustion and combine the gases.

19. Match sticks are chemically treated except the tip where they are held by machines during the process of

23. **DANGEROUS** - Mix one part sugar with three parts potassium chlorate. Incorporate Na, Ba, Ca, Sr, Ca, and $B0_3$ with portions of the mixture on a long trough. Light one end and observe the different colors which appear in the flame.

24. The amphoteric nature of aluminum can be demonstrated by reacting aluminum sulfate with sodium hydroxide to obtain aluminium hydroxide precipitate. Treat the aluminum hydroxide precipitate with more sodium hydroxide and get sodium aluminate and water. These last products treated with hydrochloric acid precipitate aluminum hydroxide. This precipitate treated with more hydrochloric acid yields aluminum chloride and water.

25. The green flame characteristic of borax can be shown by burning alcohol to which a little sulfuric acid and borax have been added.

26. Crystallization of a supersaturated solution can be shown easily by adding sodium thiosulfate to hot water and letting it cool slowly. Scratching the test tube causes the contents to become practically a solid in short time. Dissolve sodium acetate in its own water of crystallization by using a double boiler. The resulting supersaturated solution behaves in a spectacular manner.

27. After teaching the method of determining the formulas of a compound from its percentage composition, give the students the compound containing boron 3.6%, uranium 78.9%, nitrogen 4.6%, and potassium 12.9%. See who gets the right answer, B U N K, first.

28. Practice in naming compounds can be obtained by marking 148 cards, four cards for each of the following common

34. Using a fine nozzle blow pipe prepared from a glass tube, blow small bubbles in a pan of water containing "Tide" or 'Joy." The bubbles will arrange themselves in patterns somewhat like molecules, as they form crystals.

35. Form a paste in a small beaker of para-nitroanalin with concentrated sulfuric acid. Heat this mixture over a Bunsen flame. The reaction produces a long sausage like plastic mass which is quite spectacular.

36. The gas laws may be illustrated by a device prepared by drilling holes near each end and in the center of a small board about the size of a yardstick. Label each hole appropriately, Pressure, Temperature and Volume. Show by pivoting at center hole (Temperature) if temperature remains constant and pressure rises the volume will lower (decrease) etc. Other variations will show different aspects of the laws.

37. Fill with natural gas a half gallon syrup can having a hole cut on the side near the bottom and another in center of lid. Ignite the gas as it comes from the hole in the lid. Flame will at first be large and luminous, gradually changing to intensely hot flame as air is drawn in from the bottom hole and mixed with the gas. The gas and air mixture will eventually explode on reaching the proper proportions in mixture.

38. Using a side-arm flask with a small hole in the bottom and a one hole stopper fitted with a ten-inch piece of glass tubing, one is able to demonstrate air burning in an atmosphere of gas inside the flask. At the same time another flame burning in an atmosphere of air can be lighted at the hole in the bottom of the flask. To set up the apparatus,

47. A chemical garden can be grown in a solution of 150 ml of water to which 35 ml of sodium silicate has been dissolved. Growth will start when crystals of compounds containing colored ions such as Cu, Co, Ni, Fe, and Al are added to the solution.

48. A model of a Bunsen burner made from a three-foot piece of one-inch glass tubing is excellent for class demonstration of strike back, gas-air mixtures, flame structure, etc. Mount a large glass tube vertically on a stand. Fit the bottom of the tube with a one-hole stopper equipped with a small glass tube for injection of the gas. Light the burner adjusted for a rich mixture of gas and adjust cork for other effects.

49. **DANGEROUS** - Zinc powder mixed with ammonium nitrate will produce voluminous white smoke when ignited at arms length with a Bunsen burner.

50. The patriotic colors are produced by pouring sodium hydroxide solution into-three beakers containing one each of the following solutions: phenolphthalein, lead acetate, and copper sulfate.

51. Lead ions-combined with iodide ions produce plumbous iodide which, when washed and recrystallized from hot water, produce interesting golden crystals.

52. Antimony trichloride is not soluble in water but will dissolve when chloride ion concentration is increased by adding concentrated hydrochloric acid. Diluting the solution with water precipitates antimony oxychloride and again concentrated hydrochloric acid will put it back into solution.

53. Most solids are more soluble in hot water than in cold water. Calcium acetate is a common exception to the above, showing negative solubility, and is precipitated out when its water solution is heated.

54. **DANGEROUS** - When explaining conductivity, ionization, and their relation, remember that hydrogen chloride (HC1) does not show ionization in benzene, nor does it conduct an electric current. In water, HCl becomes an excellent conductor, glass does not conduct electricity except when hot, plastic or molten. Try it with 115-volt conductivity apparatus.

55. The effect of heat treatment and tempering of metals can be demonstrated by heating bobby pins to redness in a Bunsen flame. Dip one heated pin in cold water to chill. Allow the other pin to cool slowly. Compare these two pins with one that has not been heated by bending each one.

56. **DANGEROUS** - Chemical reaction between gases under water can be shown by bubbling acetylene gas and chlorine gas into water in such a manner that the bubbles come in contact before they surface. As a suggestion for better viewing the reaction, fit a glass tube with a two-hole stopper to make the apparatus.

57. **DANGEROUS** - The difference in degree of solubility of a solid in various liquids can be demonstrated by carefully pouring carbon tetrachloride, water, and ether into a cylinder to layer them. A few crystals of iodine dropped through the layers will dissolve as they fall through the different layers. The degree of color in the liquids will indicate the amounts dissolved.

58. Combustibility of certain dust particles in air can be vividly demonstrated by placing corn starch in a handkerchief or cloth bag and dusting it through the cloth mesh into a flame.

59. **DANGEROUS**

63. A glass filled with water above the rim, being held in by surface tension will float a cork in its center. In a glass only partly filled with water the cork will be pulled to the glass.

64. Hypo will bleach iodine solution or stain.

65. Moth balls placed in a tall cylinder of salt water that contains dilute hydrochloric acid and a small amount of zinc granules will rise and fall in an interesting manner.

66. A handkerchief saturated with 70% alcohol diluted with an equal amount of water will not scorch or burn when the alcohol is ignited. Keep the handkerchief moving.

67 Diesel or fuel oil can be further purified by shaking with concentrated sulfuric acid in a separatory funnel.

68. **DANGEROUS** - An interesting pulsating action, 'mercury heart,' can be observed by placing a small globule of mercury in a 5% solution of sulfuric acid in a shallow watch glass. Touch the mercury with an iron needle fixed in a cork and held steady by some mechanical support.

69. Pierce gelatin or Jell-O with a needle having formic acid on it. The gelatin will form a blister or swill as a person does when stung by a bee.

70. Place in a concentrated sodium hydroxide solution a piece of yellow phosphorus about the size of a bean. Displace air from flask with natural gas. Fit a 1-hole stopper and delivery tube in flask. Pass delivery tube into a container of water. Heat NaOH and P to boiling, then apply heat carefully. Smoke rings the size of donuts emit from the water.

71. **DANGEROUS** - Heat lead tartrate in a test tube, carefully but thoroughly, in a hot Bunsen flame. Pyrophoric lead will be formed. Cork carefully while still hot. When cool, contents, when thrown into the air, will spontaneously catch on fire.

72. Most substances., even glass, are soluble-in water. Grind very fine a small amount of glass and put in a test tube with about 5 cc of distilled water. Add phenolphthalein, and note that it must be dissolving.

73. **DANGEROUS** - Gas densities and flame travel can be demonstrated by taping together two or more large pieces of glass tubing (3/4 to 1 1/2 in. diameter by 4 ft long). With plasticene construct a small dam near the upper end of the tube which is supported somewhat less than the horizontal position. Place a few drops of carbon disulfide or other volatile liquid on the upper side of the dam. Gas ignites as it touches hot plate at lower end, or is contacted with open flame. Flame will travel slowly to top of tube.

74. Equip a flask filled with water with a two-hole stopper having a glass tube reaching the bottom of the flask and drawn to a nozzle at the other end in one of the holes; in the other hole place a long glass tube with a thin.bulb filled with ether on its submerged end. Seal the top of the ether tube. When the bulb is broken inside the flask, the ether vapor will force the water from the nozzle.

75. Solubility of ammonia gas is quickly demonstrated by putting five ml of ammonium hydroxide in a 500 ml. flask equipped with a one-hole stopper, glass tubing drawn to a nozzle on one end, and attached to long heavy rubber tubing. Heat the flask and Ammonium hydroxide until ammonia gas comes from the open end of the tube. Place tube end in water and await action.

76. **DANGEROUS** - Fill a “Coca-Cola” bottle with two parts hydrogen gas to one part oxygen gas. Stopper and wrap bottle with cloth or tape. Hold bottle bottom against chest and bring lighted match to mouth of bottle while removing cork. The sonic boom is in the order of 3-5 electron volts; had it been a nuclear reaction, instead of chemical, the explosion would have been on the order of 212 Mev. and much louder.

77. Magnesium burns in water! Prepare a test tube by blowing a small hole near the bottom. About one inch up the tube from its center place a coil of magnesium ribbon. Fill the test tube about half full of water, stopper and invert so that water does not touch ribbon. Heat top layer of water to boiling, then heat water and ribbon rapidly until ribbon ignites. Ignite hydrogen gas as it comes out of the hole in the test tube.

78. **DANGEROUS** - Catalytic oxidation of methyl alcohol can readily be accomplished by suspending a heated coil of platinum wire in a partly covered beaker of methyl alcohol. The product is recognizable to all former biology students.

79. Effect of gas density on sound can be demonstrated by filling. several balloons with different gases such as air, carbon dioxide, natural gas, helium propane, etc., to about the same pressure. Fix a whistle to be blown to a short piece of glass tubing. Note the pitch as gas from different balloons blows the whistle.

80. Conservation of energy -- support heavy pendulum from ceiling, draw back against nose, with your head against the wall. Release pendulum bob and stand nonchalantly awaiting its return. It cannot rise to greater than height from which it started. You are safe if you do not move!

81. A simple cloud chamber can be made from a gallon jug fitted with a one-hole stopper with a short piece of glass tubing. Blow into the jug through the glass tubing to increase pressure. Put finger over end of tube and pull stopper, suddenly reducing the pressure. No cloud is formed. If a lighted match is dropped into the jug and the performance repeated, a cloud will form.

82. Prepare a soap bubble solution in a shallow dish or pan. Fill a balloon or beach ball with a 2 to 1 mixture of hydrogen and oxygen. Using a small nozzle delivery tube, blow the gas mixture from the balloon through the soap solution to produce copious bubbles. Pick up handful of bubbles and holding them far out in front of you, ignite with match. The explosion will not be felt by you, however someone standing too near may have an ear injured.

83. Call this tubeless television. Project a lantern slide with a few simple words (i.e., That's All) cut in a piece of metal foil so that the image is in mid-air. Direct beam of lantern out through open door so that it does not attract attention. Wave a white wand in the plane of the image. Persistence of vision creates a complete image, apparently materialized in space.

84. Singing flame variation. Hold a four-foot 1-1½ inch glass tube perpendicular. Have inserted in the bottom end at a predetermined resonance point a heavy disc of wire gauze. Heat the wire gauze with burner; remove flame and hear a phenomenon.

85. Fill a large cylinder with carbon dioxide. Float a soap bubble on it. When done in perfectly still air, explain what you see.

86. DANGEROUS - Catalytic oxidation of ammonium hydroxide is spectacular. Suspend a coiled platinum wire in an English graduate Just above the surface of some ammonium hydroxide. Bubble a fine jet of oxygen gas through the ammonium hydroxide. Violent explosions!

87. Sometimes it helps to point out that the sine of a triangle is the opposite over the hypotenuse: O/H, "oh"! The cosine is "ah"!

88. Activation of nucleus to fission may be demonstrated by catching a soap bubble between two wire rings with handles. When caught, puncture the top and bottom areas leaving a cylinder between the rings. Carefully pull the rings apart, noticing the shape of the film, until it breaks in two films over each circle.

89. Place a copper penny on glass slide on micro-projector. Put silver nitrate solution around copper and watch silver crystals form on screen. Note many peculiar characteristics they exhibit.

90. Action and reaction. Place plank on rollers (dowlings). Mount massive load on small cart on plank. Attach rubber bands to plank and cart, stretching and tying back with thread or string. Burn thread to release system. Road goes one way, cart goes other'.

91. Build rotating platform from front-wheel and spindle of automobile. Rigidness, coupled with small friction and small play in bearings is amazing.

92. Show action and reaction by standing on rotating platform and swinging a baseball bat vigorously at a pitched ball.

93. Turn around by swinging baseball bat in circles over head. Reversal of swing reverses motion of body. (Standing on rotating platform).

94. Again on the rotating platform, pirouette. Hold heavy weights at arms length, have someone to rotate you slowly. Bring weights close to body. Explain marked increase in speed.

95. Weld bicycle axle nuts in end of iron pipes. Screw the pipes on wheel axle for handles. This makes an excellent gyroscope; better when the rim is weighted by winding it with iron wire.

96. Holding gyro axis horizontal stand on the rotating platform. What happens when the axis is rotated to a perpendicular position to right? To left?

97. Fix six or seven metal nuts on a string at distances in proportion to $\frac{1}{2}gt^2$ where t is 1, 2, 3, 4, etc. Hold string perpendicular and still and let drop. Note there is no difference in the time intervals as nuts strike the floor.

98. **DANGEROUS** - Cover the bottoms of two beakers with gasoline in one and kerosene in the other. With asbestos squares for covers to beakers handy, pitch lighted match into the gasoline. Smother flame with asbestos square and repeat procedure on beaker of kerosene. Heat kerosene and try again. Do not heat gasoline!

99. Tune two metal dog whistles to unison or absence of beats. Heat one whistle with flame. Beats reappear as pitch of heated whistle rises.

100. Drill a brass rod for a screw in one end. Insert screw about half way. Balance rod at its center on a pivot. Throw off balance by moving small screw on one end. Heat one end of rod and it will come to balance again.

101. Into a small box place small objects and seal box closed. Students can examine box, blindfolded, and tell you: (a). How many pieces are in the box. (b). The shape of the pieces. (c). How heavy the pieces are (density). (d). How big the pieces are. (e). The color of the pieces. By doing this the student has reason to believe that scientists may know something about the atom even though it has never been seen, as he has not seen the objects in the box.

102. Units of work can be visualized with this device. Mount on a single base two pieces of 2 x 2 inch wood, one 12 inches long and the other slightly over nine inches long. Using a pound weight, lifting it from the base to the top of the one foot tower represents one foot pound of work. Lifting the weight to the top of the 0.76 foot tower represents one joule of work. A penny lifted from the table top on to a piece of paper laying on the table represents an erg of work. The next unit, electron volt, is 1.6×10^{-23} OR 1.6E-23 ergs.

103. **DANGEROUS** - Heat of oxidation is evident when a piece of aluminum foil is wrapped around the bulb of a thermometer and the preparation immersed in $HgCl_2$ solution.

104. There are many invisible inks. Write with solutions of the following chemicals and ' develop as indicated: $AgNO_3$ – light; $CoCl_2$ $Pb(C_2H_3O_2)_2 – H_2S$; $Co(NO_3)_2$ - oxalic acid: starch – I_2; $CuSO_4 – NH_4$.

105. Let the students explain why one can pick a coin from the bottom of a beaker of water which has been dusted with lycopodium powder and not wet a finger.

106. Bubble CH_4 through a solution of H_3BO_4 in CH_3

109. Place equal amounts of calcium carbonate solution into two cylinders. Buffer one cylinder with a sodium acetate solution before putting equal amounts of two normal acetic acid into each. Explain the difference in the rate of reaction.

110. **DANGEROUS** - Collect ammonia over mercury. Allow a single drop of water or $CuSO_4$ (H_2O) to rise through the mercury to the gas. Explain the absorption of the gas in each.

111. Prepare a tincture of iodine and potassium iodide solution. Place a drop on a microscope slide and project on a screen with a microprojector. The heat from the lamp will produce beautiful color and crystallization effects.

112. Use $K_2Cr_2O_7$ as a catalyst in $KClO_4$ instead of the usual MnO_2. Less is required.

113. When copper and cobalt ions are used to harden water, the ion exchange area is visible in a zeolite column. Copper and cobalt are analogous to magnesium and calcium in most natural hard water.

114. Lenz's law may be demonstrated with any toy wheel of nonmagnetic material and low friction attached to a convenient holder. Wheel should have spokes for clearest understanding. Spin wheel in air then between poles of a reasonably strong horseshoe magnet. Spokes cut lines of force, induced current field opposes motion.

115. Student feels heat of hydration when a small amount of anhydrous copper sulfate is placed on hand and a drop of water is added to it. The heat involved is large. Have water handy to cool off the hand.

116. **DANGEROUS** - Alcohol, carefully floated on concentrated sulfuric acid in a test tube exhibits flecks of fire at the intersurface when potassium permanganate crystals are allowed to fall through the liquids.

117. Natural acid-base indicators can be had in such common foods as blue-berry juice, red cabbage, carrot, beet, etc. Determine over what range of pH they operate.

118. Paper chromatography can be quickly demonstrated by placing a spot of most any ink near one end of a strip of filter paper which touches water.

119. Find the center of gravity of a stick held horizontally across the fingers of both hands. Center of gravity will be at the point where the fingers come together.

120. Mark the center of gravity of a hammer with a spot of color. Toss the hammer into the air with a spin and note that the spot is the most stationary point.

121. Clamp a iron rod to a broom handle near its center. Hold broom handle in both hands with rod extended horizontally. Attach a weight at different distances from the handle and note how torque increases. Lever arm has real meaning here.

122. Show conservation of energy in a swinging pendulum by noting that it returns to the same level each time. Place an obstruction below the point of rotation so that the arc of swing will be changed. Change the obstruction to a point one half the distance between the lowest and highest levels and again below this point. Explain why the bob loops over the obstruction.

123. Evidence that one may see the sun below the horizon can be visualized by looking at a penny in a bowl filled with water. Note that the penny can not been seen over the rim of the bowl unless there is water in the bowl.

124. Select two test tubes so that one barely fits inside the other. Partly fill the larger with water and float the smaller one on the water. Invert tubes and see the water spill out but the smaller tube falls up!

125. A coiled platinum wire suspended from a rubber stopper in a flask filled with a gas and air will glow for about ten minutes. Blow over the mouth of flask to replenish oxygen.

126. Place an object on the bottom of a metal pan so that its shadow may be measured. Fill the pan with water and remeasure shadow. Refraction is evident if pan, object, and light source are kept stationary.

127. Attach one lead from a spark coil to foil surrounding a glass tube of about one-inch diameter. Extend a wire from the other terminal of the spark coil through the tube, insulated from the foil. Place a small amount of hydrochloric acid in one flask and some ammonium hydroxide in a second flask. With glass tubing connect the flasks and large glass tubing in train. Blow air into the first flask. Causing ammonium chloride to be forced into the Cottrell precipitator. Activate spark coil and see "smoke" consumed.

128. Dissolve a few crystals of cobaltous chloride and potassium thiocyanate in a graduate one-third filled with ether. Add an equal volume of water to separate red and blue colors. A few drops of silver nitrate solution in the mixture completes the patriotic colors.

129. **DANGEROUS** - Interesting intermittent explosions and flame travel can be demonstrated by placing a four-foot by one and one-fourth inch glass tube in a vertical position with a lighted burner at the top and a source of methane gas induced at the bottom.

130. Cut three discs from plywood; diameters about eight to twelve inches . Cut a three-inch circle out of the center of one piece and another circle of the same size within an inch of the outside circumference. Remove the intervening wood between tangent lines to the circles. Make a lead disc to fit the slot and sandwich the pieces between the other discs. When thrown into the air it can be made to rotate smoothly about its geometric center, or about another center of gravity in an eccentric manner. It can also be made to run up an incline, or down and then reverse to roll up. The same apparatus can be made with cardboard and a half-dollar.

131. Have pupils move around the room as sun, moon, and earth to show effect of rotation, revolution, tilt of earth on axis, etc

132. A burning match head pressed against a silver coin shows direct combination between sulfur and silver.

133. Suspend a bar magnet on a string. Rotate another magnet under it to show transfer of magnetic energy to mechanical energy. What changes the direction of poles? How can the change be effected without human movement?

134. Carry a glass brim full of water up a ladder and press it to the ceiling. Ask the “sucker” to push against the bottom of the glass with a long pole while you climb down and put away the ladder and go on about other business. If the ceiling is smooth, the student need not fear that the glass will fall.

135. A Cartesian diver can be made with a Coca-Cola bottle full of water and a match head. Keep breaking off the match stick until the head barely floats. Thumb pressure on the mouth of the bottle makes these little divers zip up and down in the bottle.

136. Flame analysis can be done without the expensive platinum wire and without the necessary cleaning before each

141. Select a large spool and wrap several turns of ribbon or twine around it. With the spool an a flat surface and the ribbon coming up from the underneath, by pulling on the ribbon at different angles to the surface, applications of torque, friction, and motion can be demonstrated.

142. Submerge a beaker in a glass container of water filling the beaker with water. Invert beaker to up-side down position under water. Invert another beaker and submerge so that air is trapped in it. Pour air from one beaker into the other, pouring up. Note fluid nature of the gas.

143. Fill a flask two-thirds full of water and bring to boiling. Cork, the flask and invert. Place ice cube on bottom of

156. **DANGEROUS** - Suspend a coiled platinum wire just below the lip and inside an English graduate containing a few milliliters of ammonium hydroxide (concentrated). Bubble oxygen through the ammonium hydroxide. Violent explosions occur.

157. **DANGEROUS** - Cotton or filter paper saturated with turpentine and put into a quart fruit jar or wide mouth bottle of chlorine gas will spontaneously react. Have jar cover handy to prevent soot from covering the room.

158. Scrape clean two one by three inch strips of lead and submerge them in a 5 normal solution of sulfuric acid. Charge the cell by connecting the strips to a three volt battery for a couple of minutes. Discharge by connecting the cell to a bell or light bulb.

159. A Copper strip or wire suspended in a silver nitrate solution produces a "silver tree" by the replacement reaction.

160. A dry plastic sponge can be measured for volume. Ask how much water you can pick up with it. When wet, it may pick up more than its initial volume! It expands slightly and is mostly a “lot of air holes fastened together.”

161. Arrange wood matches closely an a soft board by means of straight pins placed through them at their midpoint. Hold the board upright and ignite the bottom match. The others will follow in turn to demonstrate a chain reaction.

162. Three students each holding a rod of a different substance in a flame, will demonstrate the difference in conductivity of heat by their object from the flame. Use about the same sized rods of iron, aluminum, glass and copper.

163. Colored crayon marks on white paper viewed through colored bits of glass shows color filter. Make drawing of bird in cage with appropriate colored chalk and let bird out of cage by viewing through colored glass.

164. Games can make both learning and instruction a pleasure. Build puzzle of jumbled letters for other students to solve. An example: (word definition)

Regical	--	Great ice sheet	(glacier)
Isosfel	--	Traces of past in rocks	(fossils)

165. Show properties of air by bursting paper bag filled with air, upsetting brick by blowing up bag, drop sheet of paper horizontal then on edge, put paper over tumbler full of water and invert, etc.

166. Some properties of water make interesting conversation pieces. Demonstrate that ice is lighter than water by placing large icicle in milk bottle (ice cube may be used). Add cold water to fill jar while holding ice under the water. Let ice float and observe what happens as the ice melts.

167. The effect of tobacco smoke on fish can be demonstrated by arranging a train of two flasks, each filled with water and one containing a fish. A cigarette is smoked through the water containing the fish by siphoning the water from the other flask.

168. Heat strongly some protein in a test tube having pieces of litmus paper and lead acetate paper over the lip. Blackening of protein shows its carbon content; litmus turns blue, indicating ammonia; lead acetate paper turns black, indicating the presence of hydrogen sulfide; water condenses on side of the test tube.

169. "Moth balls" rolled in sodium bicarbonate and put into a cylinder of very dilute hydrochloric acid will rise and fall with regularity.

170.

172. An interesting conversation piece can be made from a salt box. In the center of one end punch one hole with a sharp needle. About the center of the other end punch three holes at the corners of an equilateral triangle about two millimeters apart. Look through the one hole and see the three holes. Look through the other end at the one hole and explain what is seen. Label the box 'Drunk-O-Meter' and list the following directions: 1 hole - sober, 2 holes - nippin, 3 holes - dog drunk, 4

186. Mnemonics are useful memory devices and should be used with emphasis on the facts rather than on the device for remembering. CREAM may mean the five kinds of energy - chemical, radiant, electrical, atomic, and mechanical. Its plural might suggest the most profitable source of future supply.

187. Analogous inference, although not true or real, may be a hitching star for some philosophy that affords a solid foundation for work. A triangle can be used to show relative importance of study and application to one's future. What you "is" today was determines what you "was" from any future date. Both what you "is" and what you "was" determines the length of your "will be" or future base line.

188. Rubber bands or strips can be tied together in bundles and charged by stroking with fur or by other means. A lighted match near the repelling strands will cause them to collapse.

189. A dust explosion may be made from a syrup bucket or any can with a tightly fitting friction lid. Punch a hole in the bottom large enough to admit the small end of a funnel. Attach a length of rubber tubing to the extended funnel. Place a single thickness of Kleenex in the funnel to support a teaspoon of lycopodium powder. Place a six-inch lighted candle on the opposite side of the can from the funnel. Close the lid firmly and give a quick puff on the rubber tube. The lid usually hits the ceiling.

190. A straight metal blow pipe connected to a gas supply is fixed in an upright position on the demonstration desk and lighted. A thirty to sixty centimeter glass tube of large diameter is lowered over the flame until at a certain position a sound is heard.

191. Done with a lot of flourish, this brings down the house! The mechanics of the friction, forces, and inertia involved make interesting conversation. Set a glass two-thirds full of water about three inches from the edge of a table. On the glass place a pie tin. On the pie tin and directly over the glass place a spool on end. Place an egg (fresh if you are confident) on the spool. With one foot on the bristles of a springy broom, pull back the handle and aim at the pie tin. The spool rolls on the table, the pie tin scoots to the floor, the glass and water remain unmoved on the table with the egg unharmed in the water.

202. Demonstrate the nature of percolator action with a glass funnel inverted in a beaker of water that is being heated.

203. Float a needle or razor blade on water by aid of its surface tension. Weaken the surface tension with a speck of detergent.

204. Scrape flecks of gum camphor on to a water surface and see the pieces propel themselves over the surface. A drop of olive oil on the surface stops the action.

205. Mount a pendulum on a rotating platform. Start pendulum swinging, then rotate platform to illustrate Foucault's discovery.

206. Identify a fresh egg from one that has been boiled by spinning them on a flat surface. One stops motion sooner.

207. Invent "Quickies" from the INDEX of any science book.