SECTION 8: Sample Labs – Grade 8 (Chemistry)

Temperature and Solubility

Adapted from *Science in Action 8:* Unit A, p.30

~ This lab has been adapted for students who are **blind** or who have **low visio**n ~

Lab Objectives	By the end of this lab the students will be able to determine how temperature affects the solubility of a substance.
Safety Precautions	• Handle balances with care and use them as instructed by your teacher • Avoid spilling liquids and sand on the balances. • Do not pour substances down the drain; dispose of them as instructed by your teacher.
Standard Equipment	• 2 beakers • Water • Thermometer • Hot plate or access to hot water • Retort stand and clamp • Solute and solvent • Spoon or scoopula • Tongs • Graduated cylinder • Triple beam or electronic balance
Additional Equipment (i.e. adapted or specialized for accessibility)t	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Ohaus **Scout Pro scale** with USB interface • Corning **stirrer/hot plate** • Vernier stainless steel **temperature probe** • Rainin AutoRep M **auto-pipette** • Oversized **cafeteria tray** (white and/or black)
Procedure	Prediction: Write a hypothesis about how the temperature of the solvent affects the amount of solute that can dissolve in it. *Hint: Recall that solubility is the maximum amount of solute (solid) that you can dissolve in a fixed volume of solvent (liquid) at a given temperature. 1. Decide which materials you will need to test the hypothesis. 2. Plan your investigation. a) What variable(s) will change? b) What variable(s) will stay the same? 3. Write a procedure and show it to your teacher. Do not proceed any further until it is approved. 4. Carry out your investigation. Collecting Data 5. Make sure you have recorded at least the following information: the hypothesis, your procedure, the temperature of the liquids used, and the mass of solute added.

	**Place the specialized equipment/software on one cafeteria tray to isolate from potential liquid spills; for students with low vision, select the tray providing him/her with the best contrast. Have the student use the Ohaus Scout Pro scale with USB interface to record the mass data of the solute. They can also use the auto-pipette to get a more accurate reading for their solvent. The Corning hot plate and stirrer can be used to heat the solution. Ensure that the student is using safety precautions with this device, as it can get extremely hot. For instance, the student can use tongs to locate the beaker on the hot plate instead of their hands. Once mixed, the stainless steel temperature probe can be used with the LoggerPro software to allow the student to record the temperature of their solution. Alternatively, the temperature probe can be mounted with a clamp and a stand so that the student does not need to worry about touching it after the experiment has begun.
Assessment	Analyzing and Interpreting 6. Share and compare your results with your classmates. What variables did each group have to keep the same so that you could compare results? Forming Conclusions 7. In a short paragraph, describe your results and how they compared with the hypothesis. Extending 8. A supersaturated solution is one that contains more solute than it normally would be able to dissolve at a certain temperature. How do you think you could make a supersaturated solution with the solute and solvent combination you tested here? Find out how to do this and try it.

Acid Rain and Soil

In this activity, you will use vinegar to simulate acid rain. The liquid that has passed through the soil is called leachate.

Adapted from *Science in Action 9:* Unit C, p.240

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

<table>
<tr><td>Lab Objectives</td><td>By the end of this lab the students will be able to determine the effect that different types of soil have on an acidic solution that passes through them</td></tr>
<tr><td>Standard Equipment</td><td>• Clay/loam potting soil
• Sandy soil
• Vinegar (diluted)
• Graduated cylinder
• Beakers
• Funnel
• Retort Stand with ring
• Filter parer
• Chemical indicators, pH paper or pH meter</td></tr>
<tr><td>Additional Equipment (i.e. adapted or specialized for accessibility)</td><td>• A laptop with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts
• Oversized cafeteria tray (white and/or black)
• Rainin AutoRep M auto-pipette
• Vernier pH sensor– please ensure that the pH sensor is stored in its solution & in an upright position when not in use; be advised to calibrate the pH sensor before use (refer to pH calibration instructions in the APPENDIX)</td></tr>
<tr><td>Procedure</td><td>Restate the following question to be in the form of a hypothesis: What effect does the type of soil have on an acidic solution that passes through it?

Procedure
1. In your notebook, record a table like the one below to record your observations.
<table><tr><td>Sample</td><td>pH</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>
2. Fold and place a filter paper in a funnel. (Hint: Dampen the paper with tap water and it will stay in place.) Put dampened clay/loam soil into the funnel and tamp it down gently.
3. Support the funnel in a ring attached to a retort stand. Place an empty beaker under the funnel.
4. Measure 20 mL of diluted vinegar into the second beaker. Measure and record the pH of the diluted vinegar</td></tr>
</table>

	5. Pour the vinegar into the soil and collect the leachate. Measure and record the pH of the leachate. 6. Repeat steps 2 to 5 using the sandy soil. **Place the specialized equipment/software on one cafeteria tray to isolate from potential liquid spills; for students with low vision, select the tray providing him/her with the best contrast. The student can use the auto-pipette in order to accurately measure 20 mL. The student with the visual impairment can then use the pH meter, along with the accompanying software, to determine the pH of each of their samples independently.
Assessment	Analyzing and Interpreting 1. Which type of soil allowed the liquids to pass through more easily? Explain why. 2. Was your hypothesis correct? Explain why or why not. Forming Conclusions 3. Explain how the soil affected the pH of the leachate. Applying and Connecting The pH of soil is important for plants because certain nutrients are available to plants only within a specific pH range. For example, phosphorus availability is best between pH 6.0 and 7.0. Ground limestone (calcium carbonate) can be added to acidic soil to make it less acidic. Adding peat or sulfur to basic soil will make it less basic. Extending Design and carry out an experiment to answer this question: What amount of vinegar can pass through a soil sample before the neutralizing ability of the soil is reduced?

Please Note: the adaptations for the Grade 9 lab on "What is the pH of Your Rain?" (see excerpt below) is similar to the above lab, and therefore has (mostly) been omitted from this resource book due to redundancy

What is the pH of Your Rain?

Adapted from *Science Focus 9:* Unit 3, p.200

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **pH sensor**

SECTION 9: Sample Labs – Grade 9 (Physics)

Current and Voltage

In this investigation you will construct a simple circuit and then use an ammeter and voltmeter to find out how the electric current and voltage (potential difference) vary at or across different points within the circuit.

Adapted from *Science Focus 9:* Unit 4, p.276

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Lab Objectives	By the end of this lab the students will be able to determine whether the electric current flowing through a circuit varies at different points within the circuit
Safety Precautions	o Care should be taken when using electrical equipment. o Safety goggles should be worn for this experiment.
Standard Equipment	• Ammeter • Voltmeter • Knife switch • 2 D-cells in battery holder • 2.5 V bulbs (2) in sockets • 3.7 V bulb (1) • 4 copper wires with alligator clips
Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **voltage probe** • Vernier **circuit board** • Low-voltage **buzzers**
Procedure	Part A: Measuring Current Question Does the electric current flowing through a circuit vary at different points within the circuit? Prediction Examine the diagram below and predict whether the electric current at points B, C, and D will be higher, lower, or equal to the current at point A. **You will need to reference the textbook for this image Procedure 1. Substituting the 3.7 V bulb for the buzzer, construct the circuit from the tactile drawing in the textbook. Plan how to place the alligator-clip wires along with the voltage probe into the circuit board. You must force all the current to flow through the probe to get to the rest of the circuit. The positive terminal of the probe must lead to the positive end of the battery. Measure the current at point A with the switch open, and again with the switch closed.

SECTION 9: Sample Labs – Grade 9 (Physics cont'd)

2. Record the voltage readings from the LoggerPro software in a copy of the current observations table.

Current Observations		
Ammeter location	Electric current (mA)	
	Switch open	Switch closed
A		
B		
C		
D		

3. Repeat step 3 at the points labeled B, C, and D on the circuit diagram.

Assessment

Analyze

1. Compare the electric current flowing out of the battery and into the battery (points A and D). Suggest an explanation for your observation.
2. Compare the current on either side of the bulb (points B and C).
3. What effect did opening and closing the switch have on the current?

Conclude and Apply

4. For an electric current to flow in a circuit, what conditions must exist?
5. Hypothesize about factors that affect the strength of an electric current in a circuit. If time permits (and with your teacher's permission), test your hypothesis.

Please Note: the adaptations for the Grade 9 lab on "Fruit Cells" (see excerpt below) is similar to the above lab, and therefore has (mostly) been omitted from this resource book due to redundancy

Fruit Cells

Adapted from *Science in Action 9:* Unit D, p.290

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **voltage probe**

SECTION 10: Sample Labs – Grade 10 (Chemistry)

Acid or Base?

Indicators, pH paper, and pH meters can all help distinguish acids and basics from neutral solutions (those that are neither acidic nor basic). Your task is to develop a safe procedure to determine whether a variety of solutions are acidic, basic, or neutral.

Adapted from *Science Focus 10:* Unit 1, p.67

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Lab Objectives	By the end of this lab the students will be able to determine whether of the substances used in this investigation are acidic, neutral or basic by using a variety of pH indicators
Safety Precautions	• Hydrochloric acid and bleach solutions are caustic (note: sodium hydroxide – NaOH – won't corrode metals; only acids do); glass cleaner and bleach can irritate skin and lungs • Phenolphthalein solution contains alcohol, which has flammable vapors; do not use it near open flames • If you spill any of the solutions on your skin, immediately wash the area with lots of cold water; inform your teacher • Be sure to wear gloves, safety glasses, and protective clothing while you are working in the lab.
Standard Equipment	• Phenolphthalein solution • Bromothymol blue indicator solution • Glass plate • 12-well plate or small test tubes and rack Standard Substances • Dilute hydrochloric acid, HCl (acidic) 0.1m HCl (ag) • Dilute sodium hydroxide solution, NaOH (basic) 0.1m NaOH (ag) • Distilled water or pH 7 buffer (neutral) Substances to Test • Grapefruit juice; household glass cleaner; soup solution; tonic water; vinegar; bleach; milk; shampoo; and/or lemon-lime soda
Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **pH sensor** – please ensure that the pH sensor is stored in its solution & in an upright position when not in use; be advised to calibrate the pH sensor before use (refer to pH calibration instructions in the APPENDIX) ** for students with low vision but who have color deficiencies (e.g. Achromatopsia), using the pH sensor will be easier for them to discern the pH level – and be far more accurate – than by them using litmus paper
Procedure	Procedure 1. With your group, design a step-by-step testing procedure using the pH probe. Include rules for interpreting your results; for example, "If the pH is between 6.5 and 7.5, we will consider the solution to be neutral." Also include disposal instructions.

SECTION 10: Sample Labs – Grade 10 (Chemistry cont'd)

	2. Submit your procedure to your teacher for approval 3. Check the accuracy of your procedure by testing the standard substances. If your tests do not give correct results, find and correct the source of the errors. 4. Test the solutions from the list of substances to test and record your observations. 5. Dispose of each sample and clean your workspace and glassware as directed by your teacher. • Place the specialized equipment/software on one cafeteria tray to isolate from potential liquid spills; for students with low vision, select the tray providing him/her with the best contrast. • The student can use the pH sensor and the accompanying LoggerPro software in order to participate independently within his/her lab group. • The student can then compare his/her pH readings with the students who obtained readings via other methods.
Assessment	What Did You Find Out? 1. Based on your observations, classify each test substance as acidic, basic, or neutral. 2. For each substance, describe how consistent your tests were. Did they all agree? If not, how did you decide how to classify the substance? 3. Can you say which of the solutions you identified as an acid was the most or least acidic? 4. Why or why not? 5. Why is it important to be able to identify a very acidic or a very basic solution?

SECTION 10: Sample Labs – Grade 10 (Physics)

Get in Motion!

Motion sensors use pulses of sound that reflect off an object to determine its position. In this activity, you will use a motion sensor connected to a computer to track the motion of an object. By producing a graph of the motion, you will be able to describe when the object is moving, and whether it is moving at a constant speed or is changing speed. In this activity, you will be the moving object.

Adapted from *Addison Wesley 10:* Unit B, p.150-151

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Lab Objectives	By the end of this lab the students will be able to chart what movement of an object looks like on a position-time graph
Standard Equipment (as an alternative to the motion sensor)	• Meter-sticks • Adding machine tape • Marker • Tape • Stopwatch • Grid paper
Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **motion detector** with **clamp** • Vernier **photogate** with **bar tape** (and **tape guide**)
Procedure	Plot the motion of an object look like on a position-time graph; review Step 2 from the procedure and form a hypothesis for this investigation. State the manipulated, responding, and controlled variables in this investigation. Method 1: Using a Motion Detector 1. Clamp the Vernier motion detector to a pole or desk/table top, then connect to the computer and activate the LoggerPro data-collection software. Configure the software to display a position-time graph 2. Have a partner activate the motion detector (spacebar). Stand in front of the sensor, as shown in Figure B1.27. Perform the following sequence. • Stand still for 5 seconds. • Move slowly away from the sensor at a steady rate. • When you are about 2-3 m away from the sensor, gradually come to a stop. • Stand still for a few seconds. 3. When you have completed the sequence, your partner should stop recording (spacebar again). 4. Once you have your graph scaled correctly on screen, print it out. 5. Repeat the sequence in step 2, but move more quickly\

SECTION 10: Sample Labs – Grade 10 (Physics cont'd)

Procedure	Method 2: Using ~~Meter-Sticks~~ bar tape ~~1. Lay out the meter-sticks end-to-end and tape down a long strip of paper (adding machine tape) next to the sticks.~~ ~~2. Stand at the beginning of the path, and start the stopwatch. Begin the motions described in step 2, but while you are moving, call out "Now!" every second. (If you find this difficult, have someone else control the stopwatch.)~~ ~~3. Have a partner follow you and mark your position on the paper or at each time interval indicated by "Now."~~ Instead of steps 1-3, attach bar tape to one student's waist, or have him/her hold one end. The other is fed through the tape guide on the photogate, with the gate connected to the computer's LoggerPro software. Set data collection to be automatic with the start of tape movement / student walking. 4. Repeat the above as many times as necessary to obtain a good result. (It may take practice!) 5. Measure the positions of consecutive marks on the paper, and record the position–time data in a table. Use the data to construct a position–time graph. 6. Repeat the procedure, but do the movements more quickly. The student with the visual impairment will be able to participate independently in this lab by working within a group that is following the procedure in Method 1. If necessary, he/she can be given information about how far they have traveled from the sensor from their group members. Group members should all take turns being the 'object'. If you only have access to one motion detector, students working in other groups can use the original metre-stick method, or the bar tape method, and compare their findings with the motion-sensor group.
Assessment	1. Label the following on the position–time graph you have printed or created: areas of no movement; areas of constant speed; areas of acceleration 2. Explain why you labeled the areas as you did in step 1 of Analyzing and Interpreting. For example, what characteristic of the line on the graph indicates no motion? Constant speed? Acceleration? $a=\Delta v / \Delta t$ 3. How are different speeds indicated on your graphs? Explain. 4. Write a few summary sentences that answer the question: "What does the movement of an object look like on a position–time graph?" 5. Did your results match your hypothesis? 6. Imagine a car leaving the school parking lot, slowly accelerating in a straight line away from the school, and then traveling at a constant slow speed for a period of time. The car then slows down as it approaches a stop sign, and remains motionless for a period of time. Then it continues in the same straight line, accelerating rapidly to a high speed, continuing at that high speed for a period of time before abruptly halting. Sketch a position-time graph of the car's position.

	Refer back to the motion graphs you created in this activity. For the areas of the graph that indicate constant speed, calculate the actual speed you were traveling. Speed is calculated by dividing distance by time. In the case of the graph, this can be done for the line indicating constant speed, by calculating the *slope* of the line (how much the line *rises* or *falls*, divided by how much it *runs*). **The student who is visually impaired should be given a tactile version of his/her graph from the experiment. When generating a graph of their own, provide the student with the appropriate materials to do so: tactile materials such a wiki sticks for the student who is blind and/or high contrast materials (graph paper, felt marker, etc.) for the student who has low vision

SECTION 10: Sample Labs – Grade 10 (Chemistry)

Ionic or Molecular?

Scientists often work in the same way as detectives. Like detectives searching for clues, chemists classify substances by matching observations against theories about ionic and molecular compounds. In this investigation, you will try to determine the type of bonding in several common substances by observing their properties.

Adapted from *Science Focus 10:* Unit 1, p.58-59

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Lab Objectives	By the end of this lab the students will be able to determine which substances in this investigation are composed of molecules and which are composed of ions
Safety Precautions	• Review the MSDS information for these chemicals, and use recommended handling and disposal procedures. • If you have medical conditions, such as allergies or asthma, inform your teacher and find out appropriate precautions to take before beginning the investigation. • Be sure to wear gloves, safety glasses, and protective clothing while you are working in the lab.
Standard Equipment	• Magnifying lens • 5 beakers (100 mL) • Scoopula • Test tube rack, 4 test tubes, and a test tube holder • 9 labels • Distilled water • Solid honey (or paraffin wax) • Epsom salts • Lauric acid • Washing soda
Adapted or Specialized Equipment	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria tray** (white and/or black) • Vernier **conductivity probe** • Corning **stirrer/hot plate** with Teflon **stir bar**
Procedure	1. With your group, decide on a set of at least five observations, including a conductivity test, which will help you determine whether each substance is ionic or molecular. You may include tests using any of the apparatus listed. Qualitative observations are fine, too. For example, you can describe the melting point as “low” or “high,” depending on whether the substance melts in a beaker sitting on a hot plate at low heat. You can also describe the odour of the substances. 2. Write a step-by-step procedure for your tests. CAUTION: If you are going to use smell as one of your tests, be sure to include the correct procedure for doing so. CAUTION: Never taste any substances in the laboratory.

SECTION 10: Sample Labs – Grade 10 (Chemistry cont'd)

	3. Design a data table to record your observations. Use a grid format, with space for observations of each substance in a separate row. 4. Have your procedure and data table approved by your teacher. 5. Perform each test and record your observations. If you decide to test the substance after it has been dissolved, be sure to include observations of a control sample of distilled water. 6. When your tests are finished, dispose of each sample and clean your workspace and apparatus as directed by your teacher. Wash your hands thoroughly. **Place the specialized equipment/software on one cafeteria tray to isolate from potential liquid spills; for students with low vision, select the tray providing him/her with the best contrast. The student who is visually impaired will use the LoggerPro interface/software along with the conductivity probe and the Corning hot plate in order to participate in this experiment alongside their peers. In addition, classmates can describe any relevant qualitative changes or observations to the student.
Assessment	1. What do the relative melting points suggest about the bonding within each substance? 2. Classify each substance as an electrolyte or a non-electrolyte. On which test do you base this classification? 3. What is the purpose of testing a control, as you did in Procedure step 5? Did all your observations require a control? Explain why or why not. 4. Which of the compounds in this investigation are made of ions? Which compounds are made of molecules? Explain why you classified each substance the way you did. 5. Which substances were the most difficult to classify? Describe any inconsistencies in your observations. For example, perhaps one test suggests that the substance is ionic even though all the other tests suggest that it is molecular. 6. Choose one of your tests and evaluate it in detail. Identify the manipulated and responding variables. Which variables (if any) were controlled? Were the results clear and easy to interpret? Based on your experience, how could the testing procedure be improved or made more precise? 7. Share your results with others in your class. Discuss any classifications about which you disagree and suggest a method of resolving the disagreement. 8. Discuss how this investigation would change if you made quantitative, rather than qualitative, observations. Which of your observations or tests could be made in a quantitative fashion? Would your confidence in your classification be improved by using quantitative observations? Would there be any disadvantages to making this investigation quantitative?

SECTION 11: Sample Labs – Grade 11 (Chemistry)

Redox Titration

Adapted from *Inquiry in Chemistry* (McGraw Hill): Lab 12.4 (page unknown)

~ This lab has been adapted for students who are **blind** or who have **low vision** ~

Lab Objectives	By the end of this lab the students will be able to determine the concentration of an aqueous hydrogen peroxide solution
Safety Precautions	Not indicated
Standard Equipment	• Various solutions (as outlined in the Procedure) • Distilled water • Balance scale • Volumetric flask • Stopper • Beakers • Burette • Erlenmeyer flask
Additional Equipment (i.e. adapted or specialized for accessibility)	• A **laptop** with the LoggerPro software & LabPro interface; laptop software should include either a magnification program (such as ZoomText, for students with low vision), or the JAWS software & JAWS/LoggerPro scripts • Oversized **cafeteria trays** (white and/or black) • Ohaus d • Rainin AutoRep M **auto-pipette** with tips • Vernier **light sensor** • **Task light** • Ohaus **Scout Pro scale** with USB interface • Corning **stirrer**/hot plate with Teflon **stir bar**
Procedure	Part A: Preparation of a primary standard solution: 1. Calculate the mass of $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H2O_{(s)}$ required to make 100 mL of a 0.0500 mol/L solution. 2. Using a paper boat (or coffee filter), weigh out the desired amount of $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H_2O_{(s)}$ on the Ohaus scale (reading the display using the LoggerPro interface). 3. Using the auto-pipette, add approximately 40-50 mL of 2.0 mol/L $H_2SO_{4(aq)}$ to the salt in a beaker, and mix until dissolved using the Teflon stir bar on the stirrer/hot plate. 4. Transfer the acidic solution into a 100.00 mL volumetric flask 5. After rinsing carefully, dilute the solution with distilled water up to the calibration mark. 6. Stopper and mix thoroughly. 7. Transfer the solution into a labeled beaker for pipetting. Part B: Titration of the $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H_2O_{(aq)}$ with the unknown $KMnO_{4(aq)}$ 1. Add the permanganate solution to a clean dry ~~buret~~. 2. Pipet 10.0 mL of the $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H_2O_{(aq)}$ solution into an Erlenmeyer flask. 3. ~~Titrate~~ the $FeSO_4 \cdot (NH_4)2SO_4 \cdot 6H_2O_{(aq)}$ with the $KMnO_{4(aq)}$ until the endpoint is reached.

4. Repeat the titration for several trials and record the data on the following table. Record all volumes to 1 decimal place. You need to have 3 trials within 0.2 m L

Please note: what has been successfully trialed with students – even those who are blind – instead of using a burette to titrate (which requires a great deal of vision to complete successfully), use the auto-repeating manual pipette instead.

Procedure for Titrating using the Manual Pipette:

- Set up the beaker with stir bar on the stirrer/hot plate on a white tray. Backlight this with the task lighting, and introduce the light sensor (encased in a test tube) into the solution, suspended in the liquid but above the bottom of the beaker
- Take illumination readings before and after each amount of solution is added; begin adding a small measured amount to the beaker using the manual pipette
- Remember the number of dispensations to the solution; when the illumination readings indicate a significant decrease in the light absorption in the beaker, it is likely due to a colour change. Record the final total of dispensations

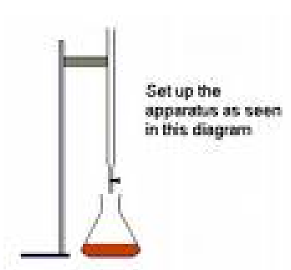
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Volume of Fe^{2+}(aq)						
Final volume (mL)						
Initial volume (mL)						
Volume $KMnO_4$ (mL)						

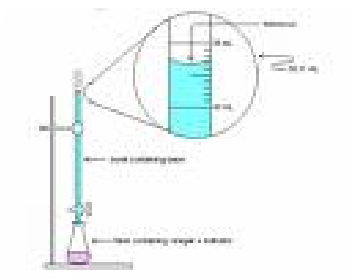
Part C: ~~Titration~~ of hydrogen peroxide with the potassium permanganate solution. (*Note: follow the above procedure for using the manual pipette)*

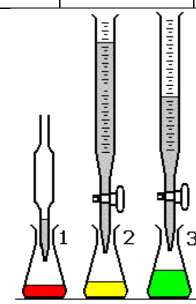
1. Pour approximately 40-50 mL of the unknown H_2O_2(aq) into a beaker for pipetting.
2. Pipet a 10.0 mL sample of the H_2O_2(aq) solution into a Erlenmeyer flask
3. Add about 5.0 mL of the H_2SO_4(aq)
4. Using the previously standardized $KMnO_4$(aq) from part B, titrate the H_2O_2(aq)
5. Repeat the titration for several trials and record the data on the following table. Record all volumes to 1 decimal point. You need 3 trials within 0.2 mL

SECTION 11: Sample Labs – Grade 11 (Chemistry cont'd)

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Volume of H_2O_2(aq)						
Final volume (mL)						
Initial volume (mL)						
Volume $KMnO_4$ (mL)						







Note: the diagrams above illustrate how visual an experiment is when using a burette; please follow the previously described procedure for titrating using the manual pipette method instead!

Assessment

1. Write a balanced net ionic equation for the reaction of acidic $FeSO_4{\cdot}(NH_4)_2SO_4{\cdot}6H_2O_{(aq)}$ and a solution of $KMnO_{4(aq)}$
2. Using your balanced net ionic equation from the previous question, calculate the concentration of the potassium permanganate solution.
3. Write the balanced net ionic equation for the reaction between the potassium permanganate solution from part B and the acidified hydrogen peroxide solution.
4. Calculate the concentration of the hydrogen peroxide solution.
5. a) Write the net ionic equation for the addition of $H_2SO_{4(aq)}$ to the $KMnO_{4(aq)}$
   b) Using your answer above to guide you, explain why it would not be a good idea for us to add the $H_2SO_{4(aq)}$ to the $KMnO_{4(aq)}$ before titrating.
6. What is a primary standard solution? What was the primary standard in this lab?
7. Why couldn't $KMnO_{4(aq)}$ be used as the primary standard?
8. In part B, the $KMnO_{4(aq)}$ was "standardized" – what does this mean?
9. What chemical species allowed for the determination of the endpoint in Part B and Part C?
10. What is the manipulated variable in this lab? (Systematically changed by you or the procedure)
11. What is the responding (measured) variable?

APPENDIX I: Accessible Science References & Websites

compiled by Linda Stirrett MEd

"Access & Technology: Making Science Accessible to Blind Students" by Marc Krizack, *Disability World*
http://www.disabilityworld.org/June-July2000/access/Science.html

“Accessible Science Labs” by Karen Milchus, Center for Assistive Technology and Environmental Access, Georgia Tech., Atlanta, GA
http://www.colorado.edu/ATconference/Milchus-Colorado1.htm

“Adapting Hands-On Science Programs for Students with Disabilities” by Nicholas Simone, Erin Vozzola, and Lynn Worobey (25 April 2007)
http://www.wpi.edu/Pubs/E-project/Available/E-project-042907-213933/unrestricted/IQP-HXA-A073-CSIRO.pdf

"Adapting Science for Students with Visual Impairments – A Handbook for the Classroom Teacher and Teacher of the Visually Impaired” American Printing House for the Blind, 7-08855-00
http://www.perkins.org/accessiblescience/resources/books.html

“Blind Kids Do Science Too”. *The Braille Monitor*, October 2005.
http://www.nfb.org/Images/nfb/Publications/bm/bm05/bm0509/bm050904.htm

“Blind Students And Practical Science” by Kathryn E. Hill, *Future Reflections*, NFB Press, Fall 1995, Vol. 14 No. 3
http://www.nfb.org/images/nfb/Publications/fr/fr14/Issue3/f140308.html

“Dennis Fantin – Full Interview” by Scott Roark, *Cal Poly Magazine Online*
http://www.calpolynews.calpoly.edu/magazine/fall-07/Chemistry-Fantin.html

“Feeling the Chemistry”, by Scott Roark, *Cal Poly Magazine Online*
http://www.calpolynews.calpoly.edu/magazine/fall-07/Chemistry.html

“Low-Cost Laboratory Adaptations for Precollege Students Who Are Blind or Visually Impaired” by Cary A. Supalo et.al. *Journal of Chemical Education,* Vol. 85 No. 2 February 2008,
http://research.chem.psu.edu/mallouk/articles/JCE2008p0243.pdf

Penn State University:

“Independent Laboratory Access for the Blind” http://ilab.psu.edu

“Techniques and Tools to Enhance Blind and Visually Impaired Students’ Participation in High School Level and General Chemistry Laboratory Classes”
http://ilab.psu.edu/labtools.html

APPENDIX I: References & Websites (cont'd)
compiled by Linda Stirrett MEd

Perkins School for the Blind:

"Teaching Accessible Science: Engaging students who are blind or visually impaired" http://perkins.org/accessiblescience/

"Science Education" http://perkins.org/clearinghouse/science/

Royal National Institute for the Blind:

"Advice for a mainstream science teacher" http://www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_cssciencelv.hcsp

"Making use of other senses to help teach science" http://www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_csscienceeos.hcsp

"Teacher tips: essential science equipment" http://www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_csscienceeq.hcsp

"The Teaching of Science and Mathematics to the Blind" http://www.rnib.org.uk/xpedio/groups/public/documents/Visugate/public_teachsci.hcsp

"Topic spotlight: teaching light" http://www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_ccsciencelight.hcsp

"Working safely in science - experiments with blind and partially sighted pupils" http://www.rnib.org.uk/xpedio/groups/public/documents/publicwebsite/public_ccsciencesafe.hcsp

Sci-Train: a Website dedicated to barrier-free science and math instruction. http://www.catea.gatech.edu/scitrain/

"Science Activities for the Visually Impaired/Science Enrichment for Learners with Physical Handicaps" http://www.lawrencehallofscience.org/cml/saviselph/

"Science for Students with Visual Impairments: Teaching Suggestions and Policy Implications for Secondary Educators". Kumar, Ramasamy, and Stefanich. *Electronic Journal of Science Education*, Vol. 5, N3, March 2001. http://wolfweb.unr.edu/homepage/crowther/ejse/kumar2etal.html

APPENDIX I: References & Websites (cont'd)

compiled by Linda Stirrett MEd

"Seeing the Possibilities: Blind chemistry students get a taste of independence in the lab" by Linda Wang, *Chemical & Engineering News*, July 23, 2007, Volume 85, Number 30, pp. 36-40. http://pubs.acs.org/cen/education/85/8530education1.html

"Strategies for Teaching Students with Vision Impairments". *Eberly College of Arts & Sciences, West Virginia University*. http://www.as.wvu.edu/~scidis/vision.html

"Teaching Chemistry to Students with Disabilities: A Manual for High Schools, Colleges, and Graduate Programs" 4th Edition by Dorothy L. Miner et.al., *American Chemical Society Committee on Chemists with Disabilities,* 2001, ISBN 0-8412-3817-0 http://membership.acs.org/c/cwd/TeachChem4.pdf

"Teacher's Manual for Adapting Science Experiments for Blind and Visually Impaired Students" by Dion, Hoffman, and Matter, *Worcester Polytechnic Institute*, May 5, 2000. http://www.tsbvi.edu/Education/Manual2.doc

Texas School for the Blind and Visually Impaired, http://www.tsbvi.edu/recc/science.htm

APPENDIX II: LoggerPro Set-up & Quick Tips

Equipment Setup:

Step 1: Turn on the computer and login

Step 2: Plug into the computer the USB cords for both the Ohaus scale and the LabPro interface; turn both on

Step 3: Plug into the LabPro the various sensors and probes as needed

Step 4: Turn on JAWS (e.g. WindowsKey+M, then J – if a Desktop shortcut exits)

Step 5: Turn on the LoggerPro3 software (e.g. WindowsKey+M, then L – if Desktop shortcut exits)

Step 6: All the probes should be found automatically; however, the scale may not automatically register…

If the scale display does not appear on the LoggerPro screen: in the menus, go to "Experiment", then the "Connect Interface" submenu, and finally the "Ohaus" submenu. There should be a list of communication ports (e.g. COM1)… select one of them (if the first did not work, try a different COM listed until the scale reading appears on the display)

Operating Quick Tips:

Tip 1: To start collecting data, press Spacebar; press again to stop

Tip 2: To change the intervals between data samples, press Ctrl+D for the Data Collection menu, and tab down to the Sampling Rate (not the first entry of “samples/second” but rather the next entry “seconds/sample”)

Tip 3: To navigate the cursor focus between the various readouts of the sensors/data graphs on the LoggerPro screen, press Ctrl+Tab. To listen specifically to one sensors, press Ctrl+Shift+1 (or 2, 3 etc. for the various sensors plugged in). Note that the Ohaus scale is typically listed as the last sensor.