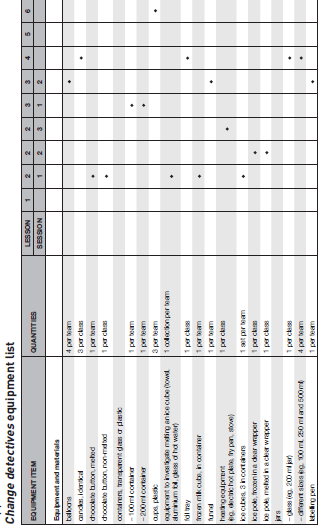
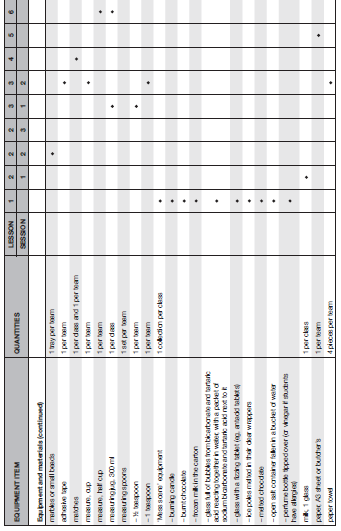
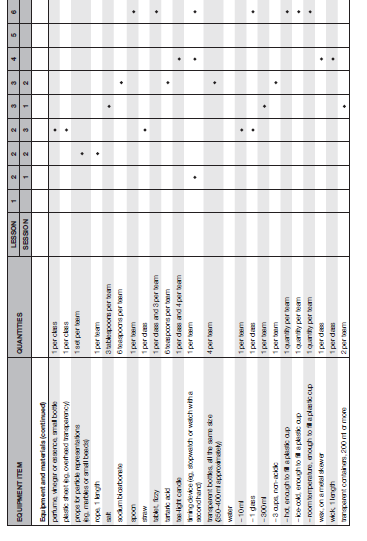
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| **Year 6 Science & Technology Unit 2016**  **Change Detectives**  **Chemical Science (*PC)*** | | | | | | | | | | | | | | | | | | | |
| **Term:** | | **1** | **2** | **3** | **4** | | **Week:** | **1** | | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| **UNIT OVERVIEW** | | | | | | | | | | | | | | | **ASSESSMENT** | | | | |
| What makes things change and what affects how fast they change? Why do some things burn more fiercely, rust more quickly or smell more strongly? The whole world is made up of particles that are constantly moving and reacting with one another in fascinating ways. Science seeks to understand why and how substances change, and this has led to advances in everything from food preservation to fire control.  The *Change detectives* unit provides opportunities for students to explore melting, evaporating, dissolving, burning and chemical reactions. Students’ understanding of the factors that influence the rate of change will be developed through hands-on activities and student-planned investigations. Students become detectives who identify and explain physical and chemical changes in everyday materials. | | | | | | | | | http://cdn.phys.org/newman/gfx/news/hires/2013/experimentsd.jpg | | | | | | Students will be exposed to a number of different types of assessments during this unit.   * **Diagnostic Assessment:** occurs at the beginning of the unit. This assessment is used to elicit students’ prior knowledge so that the teacher can take account of this when planning how the unit will progress.      * **Formative Assessment:** occurs throughout the unit at various points. This assessment type enables the teacher to monitor students’ developing understanding and provide feedback that can extend and deepen students’ learning. * **Summative Assessment:** occurs towards the end of the unit. This assessment type is used determine students’ achievement of Science Inquiry Skills and Science Understanding as developed throughout the unit | | | | |
| **UNIT OUTCOMES** | | | | | | | | | | | | | | |
| ***Values and Attitudes:***  **ST3-1VA –** shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities  **ST3-2VA –** develops informed attitudes about the current and future use and influences of science and technology based on reason  ***Skills: Working Scientifically***  **ST3-4WS –** investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations.  🡪*question, predict and communicate*  *🡪plan and conduct investigations*  *🡪process and analyse data and information*  ***Skills: Working Technologically***  **ST3-5WT –** plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints.  🡪*explore and define a task*  *🡪generate and develop ideas*  *🡪produce solutions*  *🡪evaluate* | | | | | | | | | ***Knowledge and Understanding: Material World***  ***ST3-12MW –*** *identifies the observable properties of solids, liquids and gases, and that changes made to materials are reversible or irreversible*   * *🡪Solids, liquids and gases have different observable properties and behave in different ways.* * *observe and compare the differences in the properties and behaviour of solids and liquids, eg shape and ability to flow* * *demonstrate that air has mass and takes up space, eg in an inflated basketball, bubbles, balloons and beaten egg white* * *Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting.* | | | | | |
| **UNIT AT A GLANCE** | | | | | | | | | | | | | | | | | | | |
| **WEEK** | **CONTENT** | | | | | **OVERVIEW OF TEACHING & LEARNING EXPERIENCE** | | | | | | | | | | | **ASSESSMENT** | | |
| **1**  **ENGAGE** | [**Mess**](#_Discovering_Background_Knowledge) **scene investigation**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | * identify evidence of changes that occur * describe their existing ideas of what causes change * explain why they think changes can or cannot be reversed. * contribute to discussions about changes to common materials * make predictions and record observations in the class science journal | | | | | | | | | | | **Diagnostic Assessment:** Elicit what students know and understand about:  🡪how and why materials change  🡪what influences change in materials  🡪describe physical and chemical changes  🡪safety considerations | | |
| **2 , 3 & 4**  **EXPLORE** | [**Purely**](#_Battery_Operated_Devices) **physical:**  **Mostly melting**  **Playing particles**  **Evocative evaporation**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Mostly melting  Students will:   * test whether melted or frozen objects can be returned to their original state * observe and record the factors that make an ice cube melt the fastest.   Playing particles  Students will:   * represent what happens when a solid melts.   Evocative evaporation  Students will:   * discuss why they can smell evaporated liquids * observe and record the factors that make a liquid evaporate the fastest * describe what happens when a liquid evaporates. | | | | | | | | | | |
| **5 & 6**  **EXPLORE** | [**Slippery**](#_Exploring_How_Batteries) **solutions:**  **Delightful dissolving**  **Gas bags**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Delightful dissolving:  Students will:  • devise and conduct tests to retrieve the salt in its original form.   * observe salt dissolving in water   Gas bags:  Students will:   * observe and record what happens when a sodium bicarbonate solution mixes with a tartaric acid solution. | | | | | | | | | | |
| **7**  **EXPLORE** | **Candle capers**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Students will:   * observe candles and their separate parts   • investigate how candles need air (oxygen) to keep burning. | | | | | | | | | | | **Formative Assessment:**  monitoring students’ developing understanding of:  changes to materials from dissolving and through a chemical reaction. You will also monitor their developing science inquiry skills | | |
| **8**  **EXPLAIN** | [**Classifying**](#_Light_Bulb_Explorers) **change**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Students will:   * discuss descriptions of physical and chemical change   • classify changes as physical or chemical changes. | | | | | | | | | | |
| **9**  **ELABORATE** | [**Fizz**](#_Alessandro_Volta:_Battery) **whiz**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Students will:   * formulate a question for investigation   • plan and set up an investigation to determine factors that affect the rate of reactions  • observe, record and share results. | | | | | | | | | | |
| **10**  **EVALUATE** | [**Intrepid**](#_Forms_of_Renewable) **reports**  ST3-1VA ST3-2VA ST3-4WS ST3-5WT *ST3-12MW* | | | | | Students will:   * create a final report of their ‘Mess scene’ findings   • reflect on their learning during the unit. | | | | | | | | | | |







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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **ONE:** **Mess scene investigation: Discovering Background Knowledge and Spark Interest** ST3-1VA  ST3-4WS  ST3-6PW | * Explain what they know about changes that occur to materials in their everyday lives. (can these changes be reversed?) Record.   Preparation:  Create a ‘Mess scene’ for students to examine. Introduce the ‘Mess scene’ and invite students to become ‘Change detectives’. Discuss the role and skills of a ‘Change detective’, such as, observing the scene and using evidence to investigate what they think has happened.  Allow students to explore the ‘Mess scene’ and ask questions, such as:   * What can you observe about each example? * What changes have occurred to the original objects and materials? * Do you think the changes can be reversed? Why? How? Why not   MESS SCENE:   * salt in a glass of water with open salt container beside it * melted chocolate * burnt chocolate (heat the chocolate beyond melting point until it takes on a crusty texture, burnt appearance and stronger smell) * ice-poles melting in their clear wrappers * a glass full of bubbles from sodium bicarbonate and tartaric acid reacting together in water, with a packet of sodium bicarbonate and tartaric acid next to it * frozen milk in the carton * a burning candle * a perfume bottle tipped over (or vinegar if students have allergies) * glass of water with a fizzing tablet, for example, antacid tablets (which will also be used in the Elaborate lesson). * In science journal with the title ‘First thoughts’.   **Cooperative Learning Task:**   * Working in collaborative learning teams to share their observations, discuss what they think has happened at the scene and create a team summary of their ideas in each team member’s science journal.   Discuss the purpose and features of a summary.  **PLENARY:**   * Discuss findings and draw conclusions * Introduce and add vocabulary to word wall | **Diagnostic Assessment:**  🡪use the KWL chart to show prior knowledge and wonderings about materials that change.  🡪reversible and irreversible changes to everyday materials and how to summarise team observations about common changes to materials. |  | Mess scene   * salt in a glass of water with open salt container beside it * melted chocolate * burnt chocolate * ice-poles melting in their clear wrappers * a glass full of bubbles from sodium bicarbonate and tartaric acid reacting together in water, with a packet of sodium bicarbonate and tartaric acid next to it * frozen milk in the carton * a burning candle * a perfume bottle tipped over * glass of water with a fizzing tablet * science journals |

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| **Materials That Change** | | | | |
| **What materials change?** | | | | |
| **What materials never change back?** | | | | |
| **Why do you think some materials never change back?** | | | | |
| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **TWO** **Purely physical: Mostly Melting** ST3-1VA  ST3-4WS  ST3-6PW | * **Session 1: Mostly melting**   **Preparation**  Freeze 1 milk and 3 water cubes for each team. Ensure the size of the water cube is small enough to fit into a student’s mouth.  Melt one chocolate button for each team, such as, placing them in an oven or by placing chocolate buttons on pieces of grease proof paper and microwaving them.   * Introduce the non-melted chocolate button and the glass of milk to the class and ask students to describe the chocolate button and the milk. * Team work to test their ideas about how the melted chocolate and the frozen milk can be returned to their original state.   **Cooperative Learning Task:**   * Allow time for teams to discuss how to return the melted chocolate bud and the frozen milk to their original state. * Managers collect team equipment. Teams to perform their tests and record t observations in their science journals.   **Note:** The investigations might take some time. Continue the session, allowing students to return and check on the state of their chocolate and/or milk at regular intervals.   * Teams brainstorm ways to quickly melt an ice cube, such as, wrap it in a towel or blanket, put it in the Sun or put it in their mouth. * Each team Speaker shares their team’s ideas. Record the ideas in the class science journal, tallying the number of times each idea is suggested. * Use (PROE) strategy. Record the investigation question ‘How can we make the ice cube melt the fastest?’   Predict: Record one of the predicted ways the ice cube might melt the fastest, such as, wrap it in a towel or blanket.  Reason: Ask for reasons to support the predictions and record in the class science journal, for example, a blanket makes things warm so I think it will melt the ice cube fastest.  Observe: Explain that teams will observe an ice cube melting for each prediction and record their results for each prediction in their science journal. Such as:  Wrapped in a towel—after 30 minutes the ice cube still hadn’t   1. melted much. 2. In the Sun—the ice cube melted in 10 minutes. 3. In their mouth—the ice cube melted in 5 minutes.  * Explain: Teams compare their predictions with their observations, and explain why the results did or did not match their predictions, * How they can keep the test fair, asking questions such as:  1. What will each team measure? 2. When will each team start recording?  * Teams observe and time how long it takes the ice cube to melt and record their results using Resource sheet 1.   **PLENARY:**   * Ask students to summarise what they have learned about melted chocolate, frozen milk and ice cubes in their original and melted states in their science journal.  1. What I have learned about changes is … 2. I know this because … 3. I want to know more about … 4. My final report might include information about …  * Update word wall. | **Diagnostic Assessment:**  🡪observe student understanding of:  reversible changes to materials, such as melting, freezing and evaporating. You will also monitor their developing science inquiry skills |  | * 1 copy of ‘PROE record: Purely physical’ (Resource sheet 1) per each team member * 1 frozen milk cube in a container * 1 melted chocolate button * 3 ice cubes in separate containers * 1 timing device (eg, a stopwatch or a watch with a second hand) * equipment to investigate melting an ice cube (eg, towel, aluminium foil, glass of hot water) |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **THREE:** **Purely physical: Playing particles** ST3-1VA  ST3-4WS  ST3-6PW  **FOUR** **Purely physical: Evocative evaporation** ST3-1VA  ST3-4WS  ST3-6PW | **Session 2: Playing Particles**   * Introduce the frozen ice pole and the melted ice pole. Ask questions, such as: * Are these the same object? Why/Why not? * Are these made of the same things? * How do we get one from the other? * What are the similarities between these items? * What are the differences between these items?   Record answers in the table in the class science journal. Discuss the features and purpose of a table.   * Introduce the terms ‘substance’ and ‘particle’. Ask students to describe what they think substances and particles are. Explain that scientists think that substances are made of particles * Explain that scientists think that particles in a solid like a frozen ice pole are all packed together and only wobble around a fixed position, whereas in a liquid, they have more energy and can move more freely and slide over each other. When the particles gain heat energy they move more energetically. * Ask students to use the idea of particles to represent what they think is happening when an ice cube melts. Several different modes of representation can be used, such as: Students participate in a whole-class role-play to represent what happens to the particles in a melting ice pole. Particles that were very tightly packed together in the solid state start to move faster and move past each other. Discuss the features and purpose of a role-play. * Explain that students are all going to role-play being particles of water. Explain that they are low in energy and so are not moving much and are all packed together. Ask students to stand close to each other, not moving from the spot, swaying backwards and forwards. Discuss what name could be given to the students now, such as, an ice pole, a solid. * Explain that you will ‘add heat energy’ to students by tapping them on the shoulder. Ask students that have become heated particles to sway backwards and forwards more energetically and to start moving slowly near the other students while staying close. Walk around the group of students, adding heat to the students at the outside first. When all students are moving slowly together, discuss what name could be given to the students as whole, such as, a puddle of water, a liquid. * Introduce a tray filled with marbles or small beads. Discuss what the marbles represent (particles of water). Give a tray to each cooperative learning team and ask them to arrange the marbles to represent a block of ice, for example, by compacting them in a corner of the container. Ask teams to give reasons for their representation. Ask teams to arrange the marbles to represent a puddle of water, for example, by spreading the marbles out in the container, and give reasons for their representation. * Discuss the limits of the models used to represent solids and liquids, for example, particles might not look or act like marbles or people. Particles are much smaller— too small to see even with a microscope. Explain that using models also helps scientists explore ideas.   **PLENARY:**   * Record how solids and liquids are different. * Add vocabulary to word wall   **Session 3 Evocative evaporation**   * Produce a small, sealed bottle of perfume, vinegar or an essence. Explain that you are going to open the bottle and pour some out onto a surface. Ask students to spread out around the room. * Open the bottle and pour a very small puddle (about half the size of your palm) on a sheet of plastic on a flat surface. Quickly draw a line around the puddle. * Ask students to raise their hand when they smell the perfume. Wait for all students to be able to smell the perfume. Ask questions, such as:   • Why couldn’t we smell it when the bottle was sealed?  • Which people in the room could smell the perfume first? Why do you think they smelled it first?  • Where is the smell coming from?  • What do you think is happening?   * Discuss students’ ideas of how the smell gets to their noses. Ask questions, such as:   • Could you tell me more about that?  • Well, if that is right, what about …?  • Do others agree with that idea?  • Scientists think that smell is particles getting into our nose. What do you think?   * Remember that you would find it difficult to smell if your nose is blocked or the container is sealed shut. How does that fit with your idea? How does that fit with the ideas that scientists have about smell? Discuss food smells, odours at home, natural body odours and outdoor smells, for example, gum leaves. * Ask students to draw a picture of what they think they would see if they looked at the edge of the puddle through an (imaginary) super-strong microscope. Record in their science journals. * Explain that students will be working in their collaborative learning teams to explore how they can make 10 ml of water evaporate as fast as possible. * Review the PROE strategy. Record the investigation question   ‘How can we evaporate the water the fastest?’ and review each step of the PROE strategy.   * Ask teams to complete the ‘Predict’ and ‘Reason’ sections of the PROE strategy in their science journal. Discuss ways they could measure and record the water evaporating.   **Plenary**   * Ask Speakers to share their team’s results with the class and record findings in the class science journal. Discuss the similarities of things melting and things evaporating. Focus the students’ attention on the fact that heat makes liquids evaporate. Ask students why they think evaporation occurs, referring them to the role-play. * Blow bubbles with a straw into a glass of water. Ask students what they think is inside the bubbles (air). Ask students what they think a gas is. Explain that scientists think a gas is made of particles (such as water, oxygen, carbon dioxide) that have lots of energy and are bouncing off each other all the time. | **Diagnostic Assessment:**  🡪observe student understanding about how electrical circuits provide means of transferring and transforming electricity |  | * 1 melted ice pole in a clear wrapper * 1 frozen ice pole in a clear wrapper * tray of marbles or small beads for each team   + a clock   a small bottle of perfume, vinegar or essence   * + 1 sheet of plastic   + 1 glass of water   + 1 straw   heating equipment, such as: electric hot plate, hairdryer   * + 10 ml water |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **FIVE** **Slippery solutions: Delightful dissolving** ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE | **Slippery solutions: delightful dissolving**   * Explain that students will be working in collaborative learning teams to investigate how much salt can be dissolved in 100 ml and 200 ml of water. * Discuss how students will measure how much salt will dissolve, for example, by measuring with half teaspoons. Ask students how they will know if the salt is no longer dissolving and discuss the importance of proceeding slowly in stirring and waiting for the salt to dissolve. * Introduce the enlarged copy of ‘Salt dissolving table’ (Resource sheet 2). Review the purpose and features of a table (see Lesson 2, Session 2). Discuss how to complete the table to record observations. * Students to give reasoned predictions about how much salt can be dissolved in each glass of water and record their predictions and reasons in their science journals.   **Collaborative Learning Task:**   * Allow time for students to dissolve the salt, and complete the resource sheet. Ask teams to reflect on questions, such as: * Is the salt still there when you dissolve it? * How do you know? (You can taste it, if you evaporate the * water again you can see it.) * Where do the salt crystals go? (The salt particles go in * between the water particles.) * How do you know when the salt is no longer dissolving? * (It remains on the bottom of the container.) * Speakers to share their team’s results and thoughts about the questions asked. * Ask questions such as: * What advantage is there in analysing the results from all * groups? (Comparing groups allows us to know if the result * is consistent.) * Why are the different groups’ results not all the same? * How does the average help us? (It should provide us with a * value that is closer to the real value.) * How do the results differ from the predictions made before * the investigation? * Ask students to explain what they think is happening. Ask questions such as: * Why does the salt stop dissolving? (The water cannot * hold any more salt particles.) * Why is it cloudy when you mix the final solution instead * of clear like before? (Because there are solid particles of * salt being swirled around.) * Which holds more salt, 200 ml of water or 100 ml of * water? Why? * Ask students to suggest ways to get the salt (and/or water) back. * *Optional:* Students can further explore dissolving and reversible and irreversible changes on online digital resources such as http://www.bbc.co.uk/schools/ scienceclips/ages/10\_11/rev\_irrev\_changes.shtml * Ask students to represent what they think is happening when the salt dissolves in the water, by representing particles as in Lesson 2, Session 2, lesson step 6. For example, half the class moves slowly around in a designated space (representing particles of water in a container). The other students represent particles of salt that disperse among the water particles when added.   **PLENARY:**   * Discuss what happens when a liquid becomes saturated. * Add vocabulary to word wall | **Formative Assessment:**  monitoring students’ developing understanding of:  changes to materials from dissolving and through a chemical reaction. You will also monitor their developing science inquiry skills |  | 1 enlarged copy of ‘Salt dissolving table’    • 1 x 300 ml measuring jug  • each team member’s science journal  • 1 copy of ‘Salt dissolving table’ (Resource sheet 2)  • 1 x 100 ml transparent container  • 1 x 200 ml transparent container  • 300 ml of water  • 3 tablespoons of salt  • 1 x ½ teaspoon measuring spoon |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **SIX:** **Slippery solutions:** **Gas bags** ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE  ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE | **Gasbags**  **Preparation:**  Enlarge a copy of ‘Fizzing investigation’ (Resource Sheet 3).  • Check if your local tap water is acidic. Pour a glass of water and add some sodium bicarbonate. If it fizzes the water is acidic and the reaction is already starting.  **Lesson:**   * Review Lesson 1, focusing students’ attention on the glass full of bubbles in the ‘Mess scene’. Review students’ first thoughts recorded in the class science journal. * Explain that students will be working in collaborative learning teams to investigate the glass full of bubbles, by investigating what happens when combinations of water, sodium bicarbonate and tartaric acid are mixed. * Ask students to predict what they think would happen if they combine water, sodium bicarbonate and tartaric acid. Discuss how students can test their predictions and how they can keep the test fair while investigating. * Introduce an enlarged copy of the ‘Fizzing investigation’ and discuss the purpose and features of procedural texts.      * Ask questions, such as: * Why do you label the bottles? (To keep track of each since the solutions are all clear and colourless.) * Why do you label the balloons? (To keep track of each since the powders are both white.) * Why do you put the powder in the balloons? (To make sure that the powders are added at the same time, after the balloon is upended.) * Why do you wipe the funnel each time? (So you don’t accidentally add some powder into the wrong bottle.) * Why do you discard the paper towel? (To make sure you don’t accidentally wipe powder onto the funnel.) * Introduce the idea of a fair test and the need for a control. Ask students what things they might need to keep the same to ensure that it is a fair test, such as, the same size bottle and amount of ingredients in each bottle. * Write their predictions for each bottle in their science journals. Discuss predictions as a class. * Students are going to use observation (focusing carefully on one aspect of an event to be able to notice precisely what is happening) and record the results. * Draw attention to the sodium bicarbonate, the tartaric acid powder and the water on the equipment table.   **Collaborative Learning Task:**   * Form teams and allocate roles. * Teams to record their observations and discuss their findings. Remind students to use note-taking to record the information. * Speakers to share their team’s findings and conclusions. Encourage students to think about the bubbles created in Bottle 4, by asking questions, such as: * What are the bubbles? (A gas.) * Do the bubbles come from the sodium bicarbonate? Why do you think that? (No, because then they would appear when the sodium bicarbonate dissolved.) * Do the bubbles come from the tartaric acid? Why do you think that? (No, because then they would appear when the tartaric acid dissolved.) * When do the bubbles appear? (When both solutions are mixed together.) * Why do you think that they only appear then? (Because all three substances are needed for the reaction.) * *Optional:* Predict what will happen if you mix Bottle 2 and Bottle   **PLENARY:**   * Record answers.   Ask students what they think has inflated the balloon. Explain that the bubbles are a gas called carbon dioxide and discuss what students might already know about carbon dioxide (such as, fizzy drinks have carbon dioxide bubbles, and animals breathe out carbon dioxide). Explain that the gas is mixing with the air at the top of the bottle and is taking up space which is why the balloon is inflating.   * Update the word wall with words and images. | **Formative Assessment:**  🡪monitor student understanding of:  - the structure & function of a light bulb  - how it connects to an electric circuit  - scientific understandings that can solve problems that directly affect people’s lives |  | 1 enlarged copy of ‘Fizzing investigation’ (Resource sheet 3)  *• optional:* digital camera to record students’ findings  • each team member’s science journal  • 1 copy of ‘Fizzing investigation’ (Resource sheet 3)  • 6 teaspoons of sodium bicarbonate  • 6 teaspoons of tartaric acid  • 3 cups of non-acidic water (see ‘Preparation’)  • 1 cup measure  • 1 teaspoon  • 4 transparent bottles of the same size (350–400 ml approximately)  • 4 balloons  • 1 labelling pen  • 1 funnel  • adhesive tape  • 4 pieces of paper towel |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **SEVEN:** **Candle capers** ST3-1VA  ST3-4WS  ST3-6PW  ST3-14BE | **Candle capers**  **Preparation:**  • Use three identical candles for the class, such as, tea-light candles, birthday candles, table candles.  Keep one intact, burn one until it is only a stub and melt one, for example, by putting it in an oven in a foil tray.   * Collect 4 glass jars of different sizes for each team, for example: 120 ml, for example, baby food jar   + 250 ml, for example, tartare sauce jar   + 330 ml, for example, salsa jar   + 500 ml, for example, pasta sauce jar.   **Lesson:**   * Review Lesson 1, focusing students’ attention on the burnt chocolate. Review students’ first thoughts recorded in the class science journal. Ask questions, such as:   Is the chocolate melted? What makes you say that?  How do you know the chocolate has been burnt? (It now has black charcoal.)   * Introduce the intact candle, the melted candle and the candle stub. Explain that all three candles were originally identical. Ask questions such as: * What has happened to this candle? Why do you think that? * Why is there only a stub left? Where has the wax gone? * What do I need to light the intact candle? * Record answers in the class science journal. * Introduce the intact candle to the class and ask questions such as: * What do you need for a candle to burn? * Where does the wax go when the candle is burning? * What happens when a candle is burning? * Write the questions on the board or in the class science journal. * Light the candle and ask students to carefully observe the candle burning and discuss possible answers to the questions.. * Introduce the separate wick, the wax, a candle and a jar and ask students to record, in their science journal, their predictions and supporting reasons about: * What will happen if I light this wick? * What will happen if I light this wax? * What will happen if I put a jar over a lighted candle? * Ask students to observe closely and record as you:   Light the wick without wax.  Light the wax without a wick.  Place a lighted candle under an inverted glass jar.   * Pose the question: ‘What things will affect the time the candle stays alight?’. Record students’ suggestions in the class science journal. Introduce the term ‘variables’ as things that can be changed, measured or kept the same in an investigation.   **Collaborative learning Task:**   * Investigation into the effect of the amount of air on the time the candle stays alight. Discuss and record in the class science journal what teams will: * Change: the size of the jar * Measure/Observe: how long the candle stays alight * Keep the same: the size of the candle, the wax of the * candle, the air around. * Discuss how to make it a fair test, by only changing one variable and keeping all others the same. * Discuss how to measure how much air is contained in each jar, for example, by measuring the amount of water each jar holds. * Allow time for students to complete the investigation. Ask teams to observe their jars carefully and draw and describe what they see in their science journal. * Speakers to share their findings with the class. Discuss the purpose and features of a line graph. Create a class line graph using the data from the teams and record in the class science journal.      * Ask students to use the graph to predict how long a candle will burn under a 400 ml jar. * **Note:** In order to use the graph to make this prediction the intervals on the x axis need to be equal (see the sample graph). It is best to have at least three experimental data points to make an accurate prediction (see Appendix 5). * Discuss why the candle goes out under the jar, and why the candle takes longer when the jar is bigger. Ask questions, such as: * Why do you think that? * Tell me more about the word ‘air’. * Well, if that is right, what about …? * Scientists say that fires use oxygen in the air as fuel. How does that fit with your idea? * Discuss where the wax might have gone (changed into carbon dioxide and water). Ask students to describe what they found inside the jar after burning candles in them (water droplets). Ask questions, such as: * I hadn’t thought about it like that before. Where did you get that idea? * What do you mean by that? * I wonder what would happen if …? * Here’s another idea about that: scientists think that the wax turns into a gas and combines with the oxygen when there is heat, and that this becomes water and carbon dioxide (this reaction produces more heat). What do you think?   **PLENARY:**   * Ask students to summarise what they have learned in their science journal. * Update the word wall with words and images. | **Formative Assessment:**  🡪 monitor students understanding of the role of Alessandro Volta in the development of the first battery. |  | class science journal  • word wall  • 3 identical candles (see ‘Preparation’)  • matches  • lump of wax on a metal skewer  • length of wick  • 1 foil tray  • 1 tea-light candle  • 1 glass jar (eg, 250 ml) |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **EIGHT:** **Classifying changes** ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE | **Classifying changes**  **Preparation**  Prepare an enlarged copy of ‘Changes card sort’ (Resource sheet 4) and cut it into the separate cards.  **Lesson**   * Ask questions, such as: * Why classify things? (To help us make sense of the world, and recognise the similarities and differences between things.) * What if we didn’t classify things? (We would have difficulty communicating, since simple words like ‘tree’ are a classification.) * Explain that as ‘Change detectives’ students will group the changes they have investigated. Explain that students will be working in collaborative learning teams to group the different changes using a card sort. * Introduce the set of cards produced from the enlarged copy of ‘Changes card sort’. Discuss how to represent classification, for example, by placing the cards in a Venn diagram. Discuss the purpose and features of a Venn diagram.      * **Collaborative Learning Task:** * Form teams and allocate roles. Ask students to decide on categories, for example, students might decide to put all changes producing gas into one group, and all the non-gas producing changes in another group. As teams are deciding on their categories ask questions, such as: * Could you tell me more about that? * I hadn’t thought about it like that before. Where did you get that   idea?   * Well, if that is right, what about …? * Ask Speakers to share their team’s categorisations with the class. * Discuss how classifying all things into categories can be difficult. For example, if a librarian had a section called ‘History’ and another called ‘Science’, where would they put a book called ‘History of Science’? * Explain that students are going to work in their teams to classify the changes on the cards using these new categories. Ask students to **provide reasons** and evidence for their choices. * Re-form teams and ask students to complete the card sort using the new categories.   **PLENARY:**   * As a class, discuss each team’s classifications. Discuss whether the descriptions of physical and chemical change are adequate to reflect the real world. Present information to the class on renewable energy (group) * Add vocabulary to word wall + word meanings | **Formative Assessment:**  Monitor students understanding of:  the classification of physical and chemical changes to materials, such as melting and burning.  How scientific understandings, such as classification, are used to help people all over the world communicate through a shared discourse.  . |  | • each team member’s science journal  • 1 copy of ‘Changes card sort’ (Resource sheet 4)  • A3 sheet of paper or butcher’s paper |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **NINE:** **Fizz whiz** ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE | **Preparation:**  Enlarged copy of ‘Tablet investigation planner’  • Set up a ‘Safety zone’ where you can prepare.  Lesson:   * Review Lesson 1, focusing students’ attention on the glass of water with a tablet fizzing in it. Ask if any students have ever taken a medicine or vitamin supplement that fizzed in water. * Discuss what kind of change a tablet fizzing in water is. Discuss why the tablets are designed to fizz. * Explain that as ‘Change detectives’ students have been asked to provide some additional evidence for the ‘Mess scene’ investigation. Crime detectives need to know whether the state of the tablet (fully dissolved, half dissolved or not dissolved) can be used as a reliable indicator of when the crime was committed. * Ask students to brainstorm what things (variables) might affect the rate of this reaction, such as: * size of the tablet * surface area of the tablet * type of tablet * temperature of the liquid the tablet is in * amount of liquid. * Record.      * Model how to use the variables grid to plan a fair test by only changing one variable and keeping all others the same. For example, if they investigate the effect of water temperature on the rate of the reaction, students might: * Change: the temperature of the liquid * Measure/Observe: how long the tablet fizzes * Keep the same: the size of the tablet, the amount of liquid, the type of liquid, the type of tablet, the type of container, the size of the container and the surface area of the tablet. * Discuss why replication is necessary to produce reliable results and list possible reasons for variation (for example, the tablets are not identical). Ask questions, such as: * Do you think it will happen the same way every time? * How will that affect the result? * How will that affect what we think? * Introduce students to the process of writing questions for investigation. Model the development of a question, for example ‘What happens to the rate of the reaction when we change the temperature of the liquid?’ Ask questions, such as: * What do we want to know? * How can we find this out? * Introduce the enlarged copy of ‘Tablet investigation planner’ (Resource sheet 5).   **Collaborative Learning Task:**   * Each team will conduct a test using liquids of each temperature. **Each team will then join with two other teams** to discuss their results and calculate and plot their averages on the graph in the ‘Presenting results’ section of the ‘Tablet investigation planner’ (Resource sheet 5). * Form teams, allocate roles and plan their investigation on the ‘Tablet investigation planner’(Resource sheet 5). * Ask Managers to collect team equipment and allow time for students to conduct the investigation, record their results, discuss them with two other teams and present them in the ‘Presenting results’ section of the ‘Tablet investigation planner’ (Resource sheet 5). * Analyse and compare graphs as a class and look for patterns and relationships, asking questions such as: * What is the story of your graph? * Do the data in your graph reveal any patterns? * When did the tablet fizz for the shortest time? * At which temperature did the chemical reaction go fastest? * Can you use the graph to make predictions? * Ask students to reflect on the investigation and respond to the questions in the ‘Explaining results’ and ‘Evaluating the investigation’ sections of the ‘Tablet investigation planner’ (Resource sheet 5). * Review the ‘Mess scene’ and ask students to use their understanding of the tablet fizzing to discuss what they know about the scene. Ask questions, such as: * What did you observe about the tablet in the ‘Mess scene’? * What do you think the tablet can tell us about when the perpetrator left the scene? * Why do you think that? What reasons and evidence can you give to support your ideas?   **PLENARY:**   * Ask students to summarise what they have learned in their science journal. Update the word wall with words and images. | **Summative Assessment:**  of the Science Inquiry Skills is an important focus of the *Elaborate* phase (see page 2). Rubrics available on the website to help monitor students’ inquiry skills. |  | class science journal  • word wall  • 1 enlarged copy of ‘Tablet investigation planner’ (Resource sheet 5)  • 1 fizzy tablet  • 1 glass of water  • 1 jug  • 1 timing device (eg, a stopwatch or a watch with a second hand) |

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| **WEEK** | **LEARNING AND TEACHING ACTIVITIES** | **ASSESSMENT TASK** | **EVALUATION** | **RESOURCES** |
| **TEN:** **Intrepid reporters** ST3-1VA  ST3-2VA  ST3-4WS  ST3-5WT  ST3-6PW  ST3-14BE | **Intrepid reporters**   * Remind students that their final role as ‘Change detectives’ will be to present a comprehensive yet concise report on the ‘Mess scene’ for a selected audience. * Review the purpose and features of a report (see Lesson 1), for example, the need to include the evidence from their investigations that led them to their conclusions. * Explain that the report will have two sections. The first section includes information on each change present in the original ‘Mess scene’, such as: * whether the change was chemical or physical, and reasons supporting this conclusion * a brief description of why the change might have occurred * whether the original object is recoverable or not. If it is recoverable, how can this be achieved? If it is not, why not? * The second section includes a brief summary of investigations completed and the conclusions reached, for example, how long ago the mess was made. * **3** Describe the features you will be looking for to assess the quality of students’ reports: * well-organised information * clear, concise communication * evidence of knowledge of the topic * use of evidence and reasoning to support conclusions * quality/creativity of the presentation. * Provide students with time to plan, prepare and publish their reports. Allow time for students to discuss the mode of their report, for example, a printed report, a PowerPoint presentation, a Kahootz presentation or a poster. * Ask students to conduct a self-assessment of learning by completing sentences in their science journal such as: * I really enjoyed … * I learned a lot about … * I could improve … * I’m still wondering about … * Next time we work in teams I will … * In the future I would like to … | **Summative Assessment:**  Assessing students’ ability to:  🡪formulate a question for investigation and make predictions  🡪plan for the investigation showing some awareness of the need for fair testing  🡪summarise and explain observations |  | 🡪science journal  🡪containers  🡪bean bags  🡪***Making Switches: Paperclip switch*** sheet  🡪battery  🡪bulb  🡪insulated wires  🡪A4 card  🡪paper clip  🡪2 thumbtacks or split pins |

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| **P.R.O.E Strategy** | |
| **Task:** Your team’s task is to explore how to light up a light bulb using a battery and one or two wires. Draw your predictions and then record your reasons, observations and explanations on this record sheet using writing and drawings. | |
| **Predict:**  Draw how you could connect the equipment. |  |
| **Reason:**  Why do you think it will work? |  |
| **Observe:**  What happened? What did you see? |  |
| **Explain:**  Did the results fit the prediction? Why do you think that is? |  |

