

新北市 新泰 國民中學 112 學年度 8 年級第 1,2 學期校訂課程計畫 設計者：王帝皓

一、課程類別：(請勾選並於所勾選類別後填寫課程名稱)

1. 統整性主題/專題/議題探究課程： Science is magic 2. 社團活動與技藝課程： _____
 3. 特殊需求領域課程： _____ 3. 其他類課程： _____

二、學習節數：每週(1)節，實施(40)週，共(40)節。

三、課程內涵：

總綱核心素養	學習目標
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> A1身心素質與自我精進 <input checked="" type="checkbox"/> A2系統思考與解決問題 <input type="checkbox"/> A3規劃執行與創新應變 <input checked="" type="checkbox"/> B1符號運用與溝通表達 <input checked="" type="checkbox"/> B2科技資訊與媒體素養 <input type="checkbox"/> B3藝術涵養與美感素養 <input type="checkbox"/> C1道德實踐與公民意識 <input checked="" type="checkbox"/> C2人際關係與團隊合作 <input checked="" type="checkbox"/> C3多元文化與國際理解 	<p>以英語教授自然科學並配以有趣的科學實驗,達成學習自然科學又能學習英語表達自我的目的</p> <p>上課將以魔術方式,巧妙的將科學原理融入學生生活及課程中,並以英文方式演示,引起學生主動學習的動機,並且將英文融入課程中,學生看完魔術表演之後,也學會了其中所蘊含的科學原理,並加深加廣其英文程度。之後分組討論培養其與他人互動分工之能力,最後各組派人出來表演所學內容,同樣以英文演示。而尚未表演的組別則欣賞他組表演,並記錄其表演狀況,最後寫學習單。</p> <p>在學習自然科學的過程中,學生應培養對自然科學的興趣,成為自發主動的學習者,以符合「自發」的理念。在參與探究與實作的過程中,學生應積極與他人及環境互動,並能廣泛的運用各種工具達到有效的溝通,以符合「互動」的理念。透過對科學本質的了解,學生學習事物的基本道理且能培養欣賞他人表演之美德,善用並珍惜自然資源,以符合「共好」的理念。</p>

四、課程架構：(自行視需要決定是否呈現)

五、素養導向教學規劃：

教學 期程	學習重點		單元/主題名稱與活動內容	節數	教學資源/學習策略	評量方式	融入議題	備註
	學習表現	學習內容						
1	學習如何學找到物體的重心及其運用	學習重心在日常生活中的應用	<p>Center of mass: Pinky Power</p> <p>What You Do 1. Gather an audience and tell them that you will demonstrate the previously unrevealed power of a pinky. Ask a volunteer to sit all the way back in the chair with his hands in his lap. Point and place your pinky finger in the center of his forehead.</p> <p>2. Ask him to stand up without using his hands or arms to help. He can't do it!</p> <p>How It Works The center of gravity, also known as the center of mass, is a point where most of the object's mass is concentrated. For humans, if your center of mass is not over your base of support (like a chair or your feet) you will lose your balance. You can find the center of mass of any object by balancing it on your finger (assuming it's not a refrigerator!). The point where it balances is its center of mass. In this trick, in order to stand from a seated position, you must lean forward to move your center of mass over your feet (the base of</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 	<ul style="list-style-type: none"> ● 觀察記錄 ● 學習單 ● 參與態度 ● 合作能力 ● 5. 上台表演 	多元文化、 閱讀素養	<input type="checkbox"/> 實施 跨領域 或跨科 目協同 教學(需 另申請 授課鐘 點費) 1. 協同 科目： _____ 2. 協同 節數： _____

			support). If a pinky is there to prevent that shift, you can't stand up. 帶領學生學習課程文本內容並認識新單字					
2	利用高分子吸水粉吸水及鹽巴釋放出水	利用高分子吸水粉吸水及鹽巴釋放出水	<p>Water absorbing and releasing(part1)</p> <p>What You Need</p> <ul style="list-style-type: none"> •Moisture-saving pellets (sold at local hardware store or plant nursery) •Measuringspoon •Measuringcups • 2 plastic cups (not clear) • Pitcher of water • Table salt <p>What You Do</p> <p>1.Before you ask anyone to watch you, measure and pour1table spoon of the pellets into the plastic cup. Fill the pitcher with water.</p> <p>2.Tell your audience that you can make the water in the pitcher disappear.</p> <p>3.Pour about 1/4 cup of water into the cup. Ask your audience to agree that it was plain water that splashed into the cup, and that it certainly would be amazing if that water disappeared. Meanwhile, the liquid will transform into a mass that sticks to the sides and bottom of the cup. Show the audience that</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 吸水粉 ● 湯匙 ● 鹽巴 ● 水杯 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>the water is gone by turning the cup upside down. (Don't let them look in the cup.)</p> <p>4. Make ordinary "Water disappear" with a quick sleight of hand and an amazing ingredient.</p> <p>5. Tell the audience that with any luck you can get the water to reappear. Add some table salt to the cup—saying that a sprinkle of salt is good luck—and stir.</p> <p>6. Pour the water from the first cup into the second cup. Act surprised!</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
3	利用高分子吸水粉吸水及鹽巴釋放出水	利用高分子吸水粉吸水及鹽巴釋放出水	<p>Water absorbing and releasing(part2)</p> <p>How It Works Moisture-saving pellets contain a polymer called sodium polyacrylate. It's similar to the polymers in disposable diapers and acts like a sponge. As it absorbs moisture, the polymer expands and turns into a semi-solid gel. Table salt reacts with the gel, releasing the water to its liquid state.</p> <p>帶領學生學習課程文本內容並認識新單字</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 吸水粉 ● 湯匙 ● 鹽巴 ● 水杯 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	
4	每組派兩隊人上台表演前3週所學習內	It is show time	<p>Review 1: It is show time</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 	多元文化、閱讀素養	

	容, 選擇一個實驗即可		完成學習單內容			<ul style="list-style-type: none"> ● 參與態度 ● 合作能力 		
5	學習Mobius band是只有單邊單面且會無盡循環的特點	了解Mobius band運用	<p>Mobius band (part1)</p> <p>What You Need</p> <ul style="list-style-type: none"> • 8 x 11-inch piece of paper • Scissors • Tape • Pen or pencil <p>What <i>You</i> do</p> <ol style="list-style-type: none"> 1. Show a piece of paper to your audience. Explain that you'll create a ring from it that has only one side and one edge. 2. Cut three strips from the paper, measuring approximately 1-inch wide and 11-inches long. 3. Get three volunteers. Have them make three rings of paper as follows: one with no twist in the end; one with a half twist in one end; and one with a full twist in one end. Have each volunteer tape the ends of his ring together to create three separate rings that resemble those drawn here. 4. Have each volunteer draw a line down the middle of his strip. Notice that each ring has a line that goes all the way around and back to its beginning— even the twisted strips. Ask 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 紙帶 ● 雙面膠 ● 剪刀 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>each volunteer to cut along his line. Your audience will see the surprising results.</p> <p>5. The first one will yield two rings, as you might expect. The second yields a large, endlessly twisting ring. The third will yield two interlocking, endlessly twisting rings!</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
6	延伸Mobius band的各種特色	了解Mobius band運用及其延伸變化	<p>Mobius band (part2)</p> <p>How It Works</p> <p>Astronomer and mathematician August Ferdinand Mobius invented these endlessly twisting paper rings while studying a branch of mathematics called topology. Topology is the study of geometric shapes that do not change when they are stretched or bent. Moebius strips are used in making film strips and conveyor belts because they last longer and get more use. With only one side, they wear equally. Magicians have been using the Moebius strip in their bag of tricks since the 1880s!</p> <p>帶領學生學習課程文本內容並認識新單字</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 紙帶 ● 雙面膠 ● 剪刀 	<ul style="list-style-type: none"> ● 多元文化、閱讀素養 	多元文化、閱讀素養	
7	能表達Mobius band的各種特色及其在生活中的運用	了解Mobius band運用及其延伸變化	<p>Mobius band (part3)</p> <p>Finish the worksheets</p> <p>帶領學生完成學習單</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 紙帶 ● 雙面膠 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

					● 剪刀			
8	學會如何利用表面張力讓散佈在水中的胡椒粉散成一個圓型	了解表面張力的特性	<p>Surface tension(part1): Pepper repelling finger</p> <p>If you always wanted magic powers at your fingertips, this is the trick for you. Knowing the secret of stretchy water enables you to repel, or push away, pepper at will...</p> <p>What You Need</p> <ul style="list-style-type: none"> • Dinner plate • Jug of water • Black pepper grinder • Dish soap • Your finger! <p>What you Do</p> <ol style="list-style-type: none"> 1. Pour some water onto a dinner plate until it's almost at the top of the rim. 2. Grind some black pepper onto the water so it's evenly spread. 3. Tell your friend to put their finger in the water. Nothing happens... because they don't have your magic powers 4. Secretly put some dish soap on the tip of your finger. Dip your finger into the water and watch the pepper zoom away! 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 胡椒粉 ● 水盆 ● 盤子 ● 洗碗精 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>How it works</p> <p>Water has a property called surface tension that makes the top layer stretchy like a balloon.</p> <p>Dish soap reduces the surface tension, so putting a soapy finger in water is like popping a balloon with a pin—the stretchy surface pulls back, carrying the pepper with it.</p> <p>帶領學生學習課程文本內容並認識新單字</p>				
9	利用表面張力原理，每人自行製作一艘會自行移動的小船	了解表面張力的特性	<p>Surface tension(part2): auto sailing boat</p> <p>What you need</p> <ul style="list-style-type: none"> •A foam tray (like the kind meat comes in) or a piece of non-currogated cardboard •A tray, bowl, or cookie sheet full of water •Liquid dish soap •A toothpick <p>What you do</p> <ol style="list-style-type: none"> 1. Cut the foam tray or cardboard into a boat shape as shown here. A good size seems to be about 2 inches long. 2. Dip the toothpick into the liquid soap and use the toothpick to put soap onto the sides of the notch at the back of the boat 3. That's it! Now carefully place the boat onto the surface of the water and watch it scoot across the water for several seconds. You've made a soap-powered 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 塑膠片 ● 水盆 ● 牙膏 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養

			<p>boat! To demonstrate the boat again, you will need to rinse out the tray to remove any soap from the previous demonstration.</p> <p>How it works Soap is a surfactant - that means that it breaks down the surface tension of water. As the surface tension is broken up, it creates enough of a force to push the lightweight boat across the surface.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
10	每組派兩隊人上台表演前5週所學習內容, 選擇一個實驗即可	It is show time	<p>Review 2: It is show time 帶領學生完成學習單</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 		
11	利用白板筆在光滑的瓷盤上畫氣球, 之後慢慢加水, 發現會漂浮在水面上	學會浮力的運用及水溶液與非水溶液的區別	<p>Buoyancy and solution 1: The floating balloon</p> <p>Imagine if you could draw a picture and cast a spell to make it come to life! We'll show you how with a few simple ingredients</p> <p>What You Need</p> <ul style="list-style-type: none"> • Dinner plate • Two dry-erase markers (preferably new) • Jug of water 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 白板筆 ● 瓷盤 ● 化妝鏡 ● 酒精 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>What You Do</p> <ol style="list-style-type: none"> 1. Draw a nice, thick balloon on a plate with dry-erase markers. 2. Slowly pour water onto the plate until the balloon is covered. The balloon will start to lift away from the plate. 3. Watch as the balloon peels off the plate and floats on the surface of the water. If any of the balloon remains stuck on the plate, you can blow on it to bring it to life! <p>How It Works</p> <p>The ink inside most pens is sticky, but not in a dry-erase marker.</p> <p>With a normal pen, you don't want your writing to get rubbed off or smudged. With dry-erase markers, you can wipe the ink off easily. These pens have a special chemical in them that forms a slippery layer between the ink and the writing surface. Once the ink has dried, it can be lifted off in one piece.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
12	要求每組設計不同的圖案，畫在瓷盤上，使其可以轉印在手上，比賽看哪一組最漂亮最完整	學會浮力的運用及水溶液與非水溶液的區別	<p>Buoyancy and solution 2: The floating balloon</p> <p>FLOATING LIKE A CORK</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 白板筆 ● 瓷盤 ● 化妝鏡 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>For this trick to work, the ink needs to float. Luckily, just like a cork, the ink in a dry-erase marker is less dense, or lighter, than water so will rise to the surface.</p> <p>THE INK DOES NOT BREAK UP IN WATER, SO IT STAYS IN ONE PIECE.</p> <p>帶領學生學習課程文本內容並認識新單字</p>		<ul style="list-style-type: none"> ● 酒精 			
13	<p>將裝3/4滿水的氣球，放在燭火上燒，發現氣球不會被燒破，這是因為水有熱傳導和熱對流功能</p>	<p>學會熱傳導的運用</p>	<p>Conduction of heat: Fireproof balloon</p> <p>What You Need</p> <ul style="list-style-type: none"> • 2 balloons • Water • Candle lighter <p>What You Do</p> <ol style="list-style-type: none"> 1.Fill one of the balloons halfway with water. Then blow it up the rest of the way and tie it off. This works best as a trick if the balloon is not see-through. 2.Blow up the second balloon and tie it off. Carefully hold the balloon without the water over the flame. Be prepared for it to pop. This will show that under normal circumstances a flame will pop a balloon. 3. With a teacher nearby, carefully hold the water balloon by the tie and suspend it over the flame. Make sure the bottom part of the 	1	<ul style="list-style-type: none"> ● 氣球 ● 蠟燭 ● 水盆 ● 打火機 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>	

			<p>balloon that contains the water is over the flame. It won't pop!</p> <p>How It Works In the balloon without the water, the intense heat from the flame causes the latex walls of the balloon to weaken. The pressure inside the balloon is then so great that it pops. In the water balloon, however, the water conducts the heat away from the latex so that it does not reach a high temperature. The balloon is able to remain inflated as if the flame were not there.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
14	<p>1. 將一個硬幣包在手帕內，將手帕放在燭火上燒，發覺手帕不易燃燒，是因為硬幣是很好的熱傳導物體</p>	<p>學會熱傳導的運用</p>	<p>Conduction of heat: Magic cloth</p> <p>What You Need</p> <ul style="list-style-type: none"> • Large coin • Cotton handkerchief • Candle lighter <p>What You Do</p> <p>1. Place the coin in the middle of the handkerchief. Wrap the cloth around the coin and hold it together so that the coin is tightly covered.</p> <p>2. Gather an audience and tell them you can put a flame to a normal handkerchief without causing it to burn.</p>	1	<ul style="list-style-type: none"> ● 硬幣 ● 手帕 ● 蠟燭 ● 打火機 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>	

			<p>3.Using the candle lighter, hold the cloth-covered coin over the flame. Be careful not to get the flame close to your hands. The cloth will not burn. If your audience simply thinks you have a piece of fireproof fabric, repeat the demonstration with a coin wrapped in a piece of paper. That will show them!</p> <p>How It Works The metal in the coin is a good conductor of heat. The cloth doesn't reach a temperature high enough to ignite because the coin conducts the heat away from it.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
15	每組派兩隊人上台，表演前4週所學習內容,選擇一個實驗即可	It is show time	<p>Review 3: It is show time 帶領學生完成學習單</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	每組派兩隊人上台表演前4週所學習內容,選擇一個實驗即可	

16	<p>在一試管中先放1/3冰塊, 在加一些鋼絲絨將冰塊固定在下 方, 之後再加水, 將 試管放在燭火下加 熱到上方水沸騰時, 發現冰塊並未融化, 這是因為熱傳導與 熱對流之不同</p>	<p>學會熱傳導與熱 對流之不同</p>	<p>convection and conduction: Boiling ice</p> <p>What You Need</p> <ul style="list-style-type: none"> • Glass test tube (Ask to borrow one from your science teacher or order one from a science supply store.) •Crushed ice •Steel wool (can be purchased at the grocery or hardware store) •Water •Metal tongs or test tube holder • Candle lighter <p>What You Do</p> <ol style="list-style-type: none"> 1. Begin by filling the test tube about one-third full with crushed ice. Pull out a small amount of steel wool from the pad and put it on top of the ice. Press it firmly into the tube. Fill the test tube with cold water 2. Have an adult light the candle lighter and, with the tongs, hold the middle portion of the test tube over the flame. 3. Heat the water until it boils. The ice will not melt. <p>How It Works</p> <p>If the ice was allowed to float in the water and</p>	1	<ul style="list-style-type: none"> ● 酒精燈 ● 冰塊 ● 鋼絲絨 ● 三腳架 ● 石綿心網 ● 投影機 ● 投影片 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、 閱讀素養</p>	
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			<p>then the water was heated, the ice would melt due to convection.</p> <p>This means that as the water warms it would rise because it's less dense and it would melt the ice water at the top. In this trick, however the ice is held at the bottom of the test tube by the steel wool. The cold water in the top of the test tube warms when heated – and even boiled --and becomes less dense. But it's already on top and doesn't circulate to the bottom.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
17	<p>將一乳膠氣球吹氣七分滿綁緊，取一竹籤從綁住的地方穿過氣球，並從最底部穿出，發現氣球並沒有破，原因在於汽球是一高分子物質-有彈性。</p>	<p>明瞭高分子物質及其彈性原理</p>	<p>Elasticity of Polymer: Ballon Kebabs</p> <p>What You Meed</p> <ul style="list-style-type: none"> • Several latex balloons • Bamboo skewers (available at grocery stores) • Cooking oil <p>What You do</p> <p>1. Blow up the balloon about three-quarters full, so that there is still some room for air. Tie it off with a knot. Dip the sharp end of a bamboo skewer into some cooking oil.</p> <p>2. Assemble an audience. Tell them you can put the skewer through the balloon without popping it. Find a spot near the knot of the</p>	1	<ul style="list-style-type: none"> ● 氣球 ● 竹籤 ● 投影片 ● 投影機 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>	

inflated balloon where the latex is thicker and darker than the rest of the balloon. Using the sharp end of the skewer, gently twist it around and around while pushing it through the balloon.

3. Once the skewer is in the balloon on one side, twist and push the skewer through the opposite side of the balloon (near the top). It will come out the other side without popping the balloon. Note: The balloon will slowly deflate as the air leaks out, but this can take a while. See how many skewers you can put through one balloon!

How It Works

Balloons are made of thin of rubber latex. Latex is made up of molecules called polymers, which are in large strands. These strands of molecules are stretchy, which is why you can blow up a balloon.

When you don't blow it up fully, some of the polymer strands are not stretched to their maximum at places, like at the knot or top of the balloon. So, when you puncture the balloon with the skewer at those spots, the polymer strands can stretch around the

Once the skewer is in the balloon on one side, twist and push the skewer the skewer without popping the balloon.

帶領學生學習課程文本內容並認識新單字

18	將一些削尖的鉛筆，穿過裝滿得塑膠袋，但是塑膠袋卻不會漏水，這是因為塑膠袋為高分子，高分子有延展性	明瞭高分子物質及其彈性原理	<p>elasticity of polymer: No-leak bag</p> <p>You have probably seen the famous magic trick where an assistant is poked with swords without being harmed. Here's a similar amazing feat using a plastic bag and some pencils.</p> <p>What you Need</p> <ul style="list-style-type: none"> • Ziplock plastic bag • Water • Sharp pencils <p>What you do</p> <ol style="list-style-type: none"> 1. Fill the bag two- thirds full with water and zip it up. 2. Hold the bag firmly in one hand. Use your other hand to push a sharp pencil through the bag, into the water, and out the other side. If it's easier, have an assistant hold the bag for you—but be careful not to poke them! The pencil goes through the bag... and no water leaks! 3. Keep adding more pencils. The bag will never leak <p>How it works</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 塑膠袋 ● 鉛筆 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	
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			<p>The bag doesn't leak because plastic is stretchy. Let's compare pencils going through a sheet of paper and a plastic bag...</p> <p>When you poke a pencil through paper, it rips, and gaps form around the pencil. If this was a paper bag full of water, the water would leak out through these gaps.</p> <p>Instead of ripping, plastic stretches and moves to make room for the pencil. This creates a tight seal so the water can't leak out.</p> <p>When you stretch an elastic band, it tightens against what's underneath it. This is what the plastic does around the pencil.</p> <p>Plastic is stretchy like an elastic band—when it wraps around something, it squishes it.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
19	將兩本較厚的書，像洗撲克牌般，讓兩書交疊在一起，這時要求兩學生分別拉書的一端，將書分開，發現很難做到，原因就在於摩擦力	學會摩擦力的運用	<p>The force of friction: The great phonebook strength test</p> <p>What You Need 1. Before you begin, have a volunteer flip through the pages of each phone hook to demonstrate that they are ordinary phone books</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 書籍 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>2.Shuffle the phone book pages together as you would a deck of cards, so that the pages overlap each other about halfway. Place the two books that you have shuffled on a table.</p> <p>3.Ask a volunteer to separate the two by pulling them apart. When he struggles, ask him to pull as / hard as he can.</p> <p>4.Ask someone else to help, so that there is one person holding each phone book. They won't be able to pull them apart!</p> <p>How It Works When a leaning pile of papers begins to fall off a desk, each paper slides easily and glides to the floor. That's because there's very little friction. In this trick, the phone book pages are piled upon one another. It's the combined weight of each of the phone book pages, one on top of the other, that creates an enormous amount of friction— enough to hold the books together</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
20	每組派兩隊人上台表演前4週所學習內容,選擇一個實驗即可	It is show time	<p>Review 4: It is show time 帶領學生完成學習單</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 		

下學期課程

教學 期程	學習表現	學習內容	單元/主題名稱與活動內容	節數	教學資源/學習策 略	評量方式	融入議題	備註
1	1空氣本身屬於物質,所以體積是不能疊加,所以無法將小紙片吹進密閉容器中	了解空氣本身佔有體積在及力學中作用力與反作用力之運用	<p>Air pressure 1: Won't do it. Can't make it.</p> <p>What You Need</p> <ul style="list-style-type: none"> • Volunteer • Plastic drink bottle • Small piece of paper <p>What You do</p> <ol style="list-style-type: none"> 1.Remove the paper label from the drink bottle so that you can easily see inside the bottle. Ball up the piece of paper so that it will fit inside the mouth of the bottle. 2.Hold the bottle horizontally with the piece of paper sitting in the mouth of the bottle near the edge. 3.Ask a volunteer to try to blow the paper into the bottle. The paper will jump out! 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 寶特瓶 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、 閱讀素養	

			<p>How It Works</p> <p>Even though you can't see it, the bottle is filled with air. When you blow on the paper, the air in the bottle is pushing back through the mouth of the bottle. A puff of breath is not strong enough to force the paper inside.</p> <p>帶領學生學習課程文本內容並認識新單字</p>				
2	<p>空氣本身屬於物質，所以體積是不能疊加，所以無法在密閉容器中出氣球，除非在其底部挖一個洞。</p>	<p>了解空氣本身佔有體積在及力學中作用力與反作用力之運用</p>	<p>Air pressure 2: Light-headed</p> <p>What You Need</p> <ul style="list-style-type: none"> • 2 Volunteers • Plastic drink bottle(20-ounce or 1-liter bottles work well) • Several latex balloons <p>What You Do</p> <p>1. Before performing the trick, use the thumbtack to make a small hole in the bottom of one of the plastic bottles. The hole should be about the size of a small nail head. It needs to be big enough for air to come out but small enough that you can't easily see it.</p> <p>2. Gather you audience and pick two volunteers. Tell them you're having a contest to see who can blow up a balloon in a bottle the fastest. Ask the volunteers to blow up balloons at the same time. This is to show everyone else they can blow up a balloon outside of a bottle.</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 寶特瓶 ● 氣球 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>

		<p>3. For the “contest,” give one volunteer the bottle with the hole, but don’t tell her about the hole. Give the other volunteer the bottle without the hole.</p> <p>4. Ask the volunteers to place a deflated balloon inside the bottle so that the balloon opening is stretched over the mouth of the bottle. On the count of three, ask both volunteers to blow up their balloon. The person without the hole in their bottle will not do it.</p> <p>5. Take the bottle with the hole in it from your volunteer, secretly put your finger over the hole, and ask the other volunteer to try this one. Replace the balloon with a new one, to avoid sharing germs. Don’t take your finger from the hole. Watch frustration set in. Ask other volunteers to try while your finger is either on or off the hole. (Give each new volunteer a clean balloon.) Only show your audience the hole if you want to.</p> <p>How It Works Air is taking up space in both bottles. In the bottle without the hole, the volunteer is trying to move the air or compress it just by blowing. This is very difficult to do because the pressure from the air inside pushing back at the balloon is greater than the air pressure created by blowing. With a hole in the bottom</p>					
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			<p>of the other bottle, the air is compressed as the balloon inflates and air can escape from the bottle. For more fun, place your finger over the hole once the balloon is inflated and stop blowing into the bottle. The balloon will stay inflated. This is because the air can no longer escape from the hole. Now the air pressure inside the balloon is greater than the air pressure inside the bottle. be able to do it!</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
3	雞蛋會掉入燃燒紙張的密閉容器內是因為內外大氣壓力不同	能運用密閉容器內壓力與大氣壓力之不同來理解這個實驗	<p>Air pressure: In-egg-splicable</p> <p>What You Need</p> <ul style="list-style-type: none"> • Hard-boiled egg • Glass bottle with opening slightly smaller than egg (apple cider or juice bottles work well) • Matches <p>What You do</p> <p>1. Have the adult helper hard-boil an egg. Note: You may want to hard-boil several eggs at a time to do the trick more than once. Remove the pot from the stove and place the pot and egg under cold running water for a few minutes. Let the egg cool.</p> <p>2. Remove the egg from the water and peel the shell. Then gather an audience.</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 大口水瓶 ● 雞蛋 ● 打火機 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>3.Place the egg on the opening of the bottle to show your audience that the egg will not simply fall into the bottle. Tell your audience you can get this egg to go into the bottle in one piece.</p> <p>4.Have the adult light two matches and quickly drop them into the bottle. Quickly place the egg on top of the bottle, wait a few seconds, and watch your egg drop into the bottle.</p> <p>How It Works When you drop matches into the bottle, the air heats up. As the heated air expands, some of it comes out of the bottle. When the match flames go out, the air inside the bottle cools and contracts. The egg on the bottle creates a seal. The pressure inside the bottle is now less than the pressure outside the bottle and, since nature prefers things to be equal, the egg is forced into the bottle. To get the egg out of the bottle, heat the bottle or blow into it. The increased air pressure will force the egg back out.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
4	有破洞氣球不會漏氣的原因，是因為密閉容器內外大氣壓力不同，使得銅板因為壓力差頂住	能運用密閉容器內壓力與大氣壓力之不同來理解這個實驗	<p>Air pressure: Ballon First-aid</p> <p>What You Need</p> <ul style="list-style-type: none"> • Round latex balloon • Penny 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 氣球 ● 銅板 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

	<p>氣球壁，使氣球不會漏氣</p>		<ul style="list-style-type: none"> • Cooking oil • Needle or straight pin <p>What You do</p> <ol style="list-style-type: none"> 1. Put a penny inside the balloon. Blow up the balloon so that it's not fully inflated and tie it off. 2. Hold the balloon with the tied end in your palm. Swirl it around and around by moving your hand back and forth. The penny will orbit inside. This is pretty cool already, but there's more. 3. Dip the end of the needle in the oil to lubricate it. Gently twist the needle into the thickest part of the balloon, the area opposite the knot, to make a small hole. Remove the needle. 4. Again, orbit the penny inside the balloon by moving your hand back and forth. When the penny slows down, allow it to come to rest over the hole. Turn the balloon so that it is right-side up, with the hole on top. The penny will stay in place, patching the hole. <p>How It Works</p> <p>When you blow up the balloon, the air inside is compressed and has more pressure than the air outside the balloon. The air pushes on the penny to keep it in place, sealing the hole and keeping the balloon inflated.</p>					
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			帶領學生學習課程文本內容並認識新單字					
5	每組派兩隊人上台，表演前4週所學習內容,選擇一個實驗即可	It is show time	Review 1: It is show time 帶領學生完成學習單	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	每組派兩隊人上台表演前4週所學習內容,選擇一個實驗即可	
6	了解如何利用氣體難溶於水的特性，使搖晃過的汽水瓶不會噴氣	了解大氣壓力的大小 明白多數氣體難容於水	<p>Atmosphere: Soda squirt</p> <p>What You Need</p> <ul style="list-style-type: none"> •Measuringspoons •Empty aluminum drink can Gas stovetop •Ovenmitts •Metal tongs •Clear bowl of water <p>What You Do</p> <p>1.Place about 2 table spoons of water into the can.</p> <p>2. With an adult nearby, turn on the gas stovetop. Put on the oven mitts.</p> <p>3. With the metaltongs, hold the can over the flame, but not in the flame. You may smell some paint burning off the can.</p> <p>4When you see steam coming out of the can, quickly turn it upside down in the bowl of</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 易開罐汽水 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>water so that just the top of the can touches the top of the water. This will create a seal.</p> <p>Within a few seconds you should see and hear the can crush.</p> <p>How It Works Even though you can't see it, air is all around us—and it has weight. This weight creates what is called air pressure, and at sea level this pressure equals about 15 pounds per square inch. In this science trick, air inside the can has pressure before we heat it that's equal to the pressure outside the can. When you place the can over the open flame, the water in the can begins to boil and creates steam. As the steam rises and exits the opening of the can, some air goes with it. When you turn the can upside down on the bowl of water, you create a seal to stop the air from leaving the can. As the air and water vapor left in the can cool, the air pressure inside the can decreases and the air outside the can crushes the can.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
7	密閉容器內氣體有壓力，使得面紙不會濕掉	學會大氣壓力的運用	<p>Atmosphere: Waterproof paper</p> <p>What you need</p> <ul style="list-style-type: none"> • Paper towel • Small glass • Water • Large mixing bowl or saucepan (deep enough to submerge the glass) 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 水盆 ● 燒杯 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>What You Do</p> <ol style="list-style-type: none">1. Assemble an audience and tell them that you can put the paper towel underwater without getting it wet. Then crumple up the paper towel and place it in the bottom of the glass.2. Pour water into the bowl or saucepan until it is about three-quarters full.3. Turn the glass upside down without the paper towel falling out. You may have to wedge it in the bottom by crumpling it up more.4. Place the upside-down glass into the bowl of water so that it's submerged.5. Do not tilt the glass as you do this. Wait a few seconds. Remove the glass by pulling it straight out of the water. Take the paper towel out to show that it's dry. <p>How It Works</p> <p>This science trick shows that air takes up space. The air pushes down against the water as the glass is inserted into the bowl. The water is forced around the sides of the opening of the glass and does not fill the glass because air is already there taking up the space. If the glass tilts as you do this, the air</p>					
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			has a way to escape and water will fill the glass, wetting the paper towel. 帶領學生學習課程文本內容並認識新單字					
8	將裝少量水的空鋁罐，加熱到水沸騰後產生蒸氣三分鐘，之後將開口向下快速放入冷水中，發現鋁罐迅速被壓扁,是因為內外壓力差的關係	學會大氣壓力的在日常生活中運用	<p>Atmosphere: Can crusher</p> <p>What You Need</p> <ul style="list-style-type: none"> • Volunteers • Cans of unopened carbonated beverages (not “diet” soda) • Outdoor location <p>What You Do</p> <p>1. Gather your volunteers in a circle outdoors. Have each volunteer take a can of soda and shake it. Make sure they shake it a lot.</p> <p>2. Tell them to open their cans close to their faces on the count of “three.” You might also want to mention that even though you’ve shaken your can just as much as they have, you’re not going to get wet.</p> <p>3 Start your countdown, and right before opening your can, tap the side of the can three times with your index finger. Open your can along with everyone else and watch as everyone else gets soaked while you stay dry.</p> <p>How It Works</p> <p>Carbon dioxide gas is dissolved into soda to make it bubbly and as a preservative to make</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 酒精燈 ● 三腳架 ● 石綿心網 ● 空鋁罐 ● 水盆 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>it last longer. To get the gas into the can it must be pressurized. That means the pressure inside the can is greater than outside the can. Opening the can depressurizes the soda, and the gas escapes in the form of bubbles. Shaking a can of soda agitates the gas and makes bubbles form on the insides of the can. If you had opened the can immediately after shaking it, you would have released the pressure and forced the bubbles out of the can, along with the soda blocking their path! Tapping on the side of the can causes all the bubbles to rise to the top. When you open the can, very little liquid is below the bubbles, so the gas can escape without forcing the soda out with it.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
9	<p>用兩支吸管吸飲料，一支放在飲料內，一支放在外面，同時吸時，發現很難將飲料吸起，這是因為沒有大氣壓力差的關係</p>	<p>學會大氣壓力的在日生活中運用</p>	<p>Atmosphere: No-sip straws</p> <p>What You Need</p> <ul style="list-style-type: none"> • Volunteer • Glass • Water • 2straws <p>What You Do</p> <p>1. Gather an audience. Pour the glass about three-quarters full of water. Challenge a thirsty member of your audience to drink the</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 飲料 ● 吸管 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>	

			<p>water from the glass, following some rules of course.</p> <p>2 Place one straw inside the glass of water and one straw outside the glass. Ask the volunteer to drink the water by putting both straws in her mouth and sipping. She won't be able to do it.</p> <p>How It Works A straw works by using the difference in air pressure created between your mouth and the drink. When you pull air into your lungs, the pressure inside the straw is less than the pressure exerted on the water from the atmosphere. Therefore, the water moves up the straw from a high to low pressure. In this trick, as the volunteer tries to "suck up" the water, she's also pulling air from the straw on the outside of the glass. The low pressure needed to pull the water up into the straw is not created, so nothing happens!</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
10	每組派兩隊人上台，表演前面4週所學習內容,選擇一個實驗即可	It is show time	<p>Review 2: It is show time 帶領學生完成學習單</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	
11	將一空的飲料罐放入一馬克杯中，向下吹氣，發現飲料	學會大氣壓力的在在日常生活中運用	<p>Air pressure: Jumping beverage can</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 馬克杯 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 	多元文化、閱讀素養	

	<p>罐一下就因內外壓力差由飛走</p>	<p>Challenge a friend to remove an empty beverage can from a mug without touching the can or turning the mug upside down. They'll find it tricky! The secret? It has to do with the science of air pressure.</p> <p>What you need</p> <ul style="list-style-type: none"> • Empty beverage can • Mug <p>What You Do</p> <p>1. Place the can inside the mug. Make sure the mug is big enough to leave a little gap around the sides. Make sure the can is empty.</p> <p>2. Blow down hard into the gap between the can and the mug—the can will shoot out! Blow slightly from the side so you don't get hit.</p> <p>How it works</p> <p>When you blow into the gap between the can and the mug, the force of the air squeezes the air that's already down there.</p> <p>When you try to squeeze air like this, the air pushes back in all directions. In other words, you're making the air pressure increase. This high-pressure air then pushes against the bottom of the can, which results in it rising up and flying out of the mug.</p> <p>帶領學生學習課程文本內容並認識新單字</p>		<ul style="list-style-type: none"> ● 空鋁罐 	<ul style="list-style-type: none"> ● 合作能力 		
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12	裝有米粒底部面紙，因壓力被空氣吸收，使得面紙不容易破掉。	學會固體壓力的基本定義及運用	<p>Solid Pressure: Tough tissue</p> <p>What You Need</p> <ul style="list-style-type: none"> • Facial tissue or tissue paper • Empty paper towel tube • Rubber band • Rice • Broom handle or dowel <p>What You Do</p> <p>1.Place a piece of tissue over one end of the paper towel tube. Carefully secure it with the rubber band. Rest the end of the tube with the tissue on a table. Fill the tube about three-quarters full with rice.</p> <p>2.Holding the tube off the table, push as hard as you can inside the tube with the broom handle. No matter how hard you try, you won't be able to rip the tissue.</p> <p>How It Works</p> <p>As the rice fills the paper towel tube, pockets of air become trapped between the pieces of rice. When you push down with the broom handle, the air spaces become smaller, and the rice grains move closer. The rice absorbs the pressure and the tissue does not tear.</p> <p>帶領學生學習課程文本內容並認識新單字</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 米粒 ● 寶特瓶 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	
13	將兩玻璃瓶，瓶口相對放在桌上，中	理解慣性在生活中的用用	<p>Inertia: The balance bottles</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 	多元文化、閱讀素養	

	<p>間夾一張紙，快速抽出紙張，而玻璃瓶不會倒下，這是因為慣性。</p>		<p>What You Need</p> <ul style="list-style-type: none"> • 2 glass soda bottles • Flat surface or table • Dollar bill <p>What You Do</p> <ol style="list-style-type: none"> 1. Tell your audience that after you perform this trick you'll invite them each to try and whomever gets it right on the first try can keep the dollar. 2. Put one glass soda bottle on the table. Place one end of the dollar bill on top of the bottle's mouth so that most of the dollar bill hangs down. 3. Balance the second bottle upside down on top of the first bottle, with the dollar bill sandwiched between their mouths. It may take several tries to balance them. You're now ready to begin your trick. 4. Hold the dollar bill with one hand and steady the bottle on top with the other hand. 5. Let go of the bottle and quickly jerk the dollar bill from between the bottles. The dollar bill should slide out without knocking the bottles over. Now let the audience try! 6. You may have to practice several times before showing off this trick. Don't give up! If you move the dollar bill too slowly, it 	<ul style="list-style-type: none"> ● 寶特瓶 ● 雞蛋 ● 紙筒 ● 淺水盤 ● 燒杯 	<ul style="list-style-type: none"> ● 參與態度 ● 合作能力 		
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			causes the bottles to be pulled along with the dollar bill 帶領學生學習課程文本內容並認識新單字					
14	利用毛皮摩擦PVC管，使其排斥錫箔紙，讓其在空中飛舞	學會靜電力互相吸引或排斥	<p>Stactic electricity: Hovering tinsel</p> <p>A floating silver ball might sound like the stuff of science fiction, but this trick relies on pure science fact</p> <p>What you need</p> <ul style="list-style-type: none"> • Thin strands of silver Mylar® tinsel (also called icicle tinsel or angel hair tinsel) • Scissors • PVC pipe • Microfiber cloth <p>What you do</p> <p>1. Tie at least ten strands of tinsel together at one end with a single knot. Tie another knot about 4 in (10 cm) down from the first knot and use scissors to cut off any extra tinsel at the ends.</p> <p>The strands are very thin, so you will have to really concentrate when tying the knot.</p> <p>2. Use the microfiber cloth to rub up and down the PVC pipe for around thirty seconds. Rub hard until you can hear the pipe start to crackle.</p>	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● PVC管 ● 鋁箔紙 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、 閱讀素養	

			<p>3. Drop the tinsel onto the pipe, releasing it before it touches the pipe. It may take a few tries, but it will eventually pop into a ball and float above the pipe. Keep moving the pipe under the tinsel so the ball stays in the air.</p> <p>How it works</p> <p>Tiny particles called electrons on both the pipe and tinsel are repelling or pushing away from each other.</p> <p>At the beginning of the trick, electrons on the cloth are passed onto the pipe when you rub it. When the tinsel touches the pipe, some of these electrons jump onto the tinsel. Because electrons repel each other, the tinsel pushes away from the pipe, while the electrons in the individual strands also repel against each other to turn the tinsel into a ball.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
15	每組派兩隊人上台，表演前4週所學習內容，選擇一個實驗即可	It is show time	<p>Review 3: It is show time 帶領學生完成學習單</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	每組派兩隊人上台表演前4週所學習內容,選擇一個實驗即可	
16	人的眼睛看物體時，是藉由兩眼所看到的內容重疊在	理解眼睛立體成像。	Stereoscopic vision: Umm. There is a hole in your hand	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 白紙 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 	多元文化、閱讀素養	

	一起，當兩眼看的內容不同時就會產生其貴重疊的影像		<p>What You Need</p> <ul style="list-style-type: none"> • Paper tube <p>What You Do</p> <ol style="list-style-type: none"> 1. Look at your hands. Make sure there's not a hole in one of them. Then hold the paper tube up to one of your eyes and look through it at an object in the distance. 2. Hold your other hand up next to the paper tube so that it touches the side of it. Keep both eyes open. What do you see? (It will appear that you have a hole in your hand!) <p>How It Works</p> <p>Your brain receives visual information from both of your eyes but merges the signals because it's usually the same field of view. This is called stereoscopic vision. In this trick, your brain gets confused because each eye is viewing something different. The two images, one of the distant object and one of your hand, are superimposed (layered) over each other. This makes it appear that you have a hole in your hand!</p> <p>帶領學生學習課程文本內容並認識新單字</p>			● 合作能力		
17	利用作用力與反作用力原理，製作一個氣球光碟氣墊船	學會作用力與反作用力原理	Law of action and reaction : Balloon hovercraft	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 光碟片 ● 氣球 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、 閱讀素養	

			<p>When two surfaces rub against each other, the force between them is friction. If you're on the move, friction can slow you down. To reduce friction and move faster, a hovercraft glides on a cushion of air</p> <p>What You Need</p> <ul style="list-style-type: none"> • Balloon • Pop-up top from a drink bottle Old CD • Glue <p>What You Do</p> <ol style="list-style-type: none"> 1. Remove the pop-up top from the bottle and glue it over the hole in the CD. Leave it until it has set. 2. Place the pop-up top in the closed position. Inflate a balloon and, pinching the neck so the air can't escape, stretch it over the pop-up top. 3. Place your hovercraft on a smooth surface and open the pop-up top. Give the CD a little push and watch it glide. <p>How it works</p> <p>Friction is the force that acts between any surfaces that rub together. Molecules in their surfaces bond (stick together), making it harder for the surfaces to slide past each other. A balloon hovercraft reduces friction by blowing air between the CD and the table to hold them apart. The friction caused by the air is much less than with a solid object.</p>		<ul style="list-style-type: none"> ● 強力膠 			
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18	利用白色蠟筆在白紙上做一幅畫，原本看不到東西，之後塗上水彩，就能現形	學會水溶液與非水溶液的區別	<p>Water and wax interact: Send a secret message</p> <p>If you've ever wanted to pull a rabbit out of a hat like a real magician, here's your chance. Once you learn this invisible ink trick, you will be able to send your friends any drawing or message in secret.</p> <p>What You Need</p> <ul style="list-style-type: none"> • Sheet of paper • White wax crayon or candle • Permanent marker (optional) • Paintbrush • Watercolor paint <p>What You Do</p> <ol style="list-style-type: none"> 1. Draw a picture or write a message on white paper using the white crayon. It will be invisible. 2. Send or give the sheet of paper to your friend. To reveal the picture, they should start at the top of the paper and paint over it with watercolor paint. 3. Ta-da! The picture is revealed. The strange thing is that it's made up of all the parts where the paint <i>didn't</i> go! 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 蠟筆 ● 水彩 ● 白紙 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

			<p>How It Works</p> <p>It's about how water and wax interact.</p> <p>In a water-based paint like watercolor, tiny water particles are attracted to particles in the paper, so they soak into it. However, water particles are not attracted to wax particles. In fact, the water particles are more attracted to each other! The water sticks together in droplets that roll off the wax. This is why the wax parts of the drawing do not absorb the paint and stay white.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
19	<p>拿兩杯子，一杯裝八分滿水，一杯空著，將兩杯子放在桌上，中間放一條手帕，手帕兩端各放在杯子內，經過一天後，會發現一杯水減少了，另一杯水增加了，這是利用毛細管原理</p>	<p>學習毛細管作用如何發生</p>	<p>Capillary action: Tightrope walking water</p> <p>What You Need</p> <ul style="list-style-type: none"> • 2 glass jars (or a similar see-through container) • Handkerchief made of silk, linen, or cotton <p>Water</p> <p>What You Do</p> <ol style="list-style-type: none"> 1.Fill one of the jars with water, and then take the hand kerchief and place one end in each jar. Let the jars sit overnight. 2.The more daring water molecules will walk their way from the fulljar to the empty one. 	1	<ul style="list-style-type: none"> ● 投影機 ● 投影片 ● 水杯 ● 手帕 	<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	<p>多元文化、閱讀素養</p>	

			<p>How It Works Water molecules have an attraction to other water molecules, which is called cohesion, and an attraction to other substances, which is called adhesion. This enables something called capillary action to occur. The water is pulled up into the spaces in between the fibers in the handkerchief because of cohesion and adhesion. The water soaks up the handkerchief, and then gravity pulls it down into the other jar. This continues until the glasses have equal amounts of water.</p> <p>帶領學生學習課程文本內容並認識新單字</p>					
20	每組派兩隊人上台表演前4週所學習內容, 選擇一個實驗即可	It is show time	<p>Review 4: It is show time 帶領學生完成學習單</p>	1		<ul style="list-style-type: none"> ● 上台表演 ● 學習單 ● 參與態度 ● 合作能力 	多元文化、閱讀素養	

六、本課程是否有校外人士協助教學

否, 全學年都沒有(以下免填)