



**WELCOME** to Weekend Science! Every Friday we're going to guide you through some cool experiments that you can do at home. It's a good idea for you to keep a record of what you do in a Science Journal. That way you can record what you learn, compare results and maybe use them to design new experiments! Have a look at the Science Journal box for some ideas to get you started. Remember to always ask a grown-up's permission before trying out an experiment.

歡迎閱讀《週末科學版》！我們每週五都要為你介紹可以在家中進行的有趣科學實驗。你可以在《科學日誌》中記錄自己做了哪些活動，這樣就可以將所學的記錄下來，比較這些結果，也許還可以利用它們來設計新的實驗！先看一下《科學日誌》的點子再開始吧。展開實驗之前，記得要獲得大人許可喔！



## Slippery Slopes 滑溜溜的斜坡



Competitors in a cheese rolling contest in Gloucester, England on May 26, 2008 get to grips with a steep slope. PHOTO: AFP  
五月二十六日，英國格洛斯特一場滾起司大賽的參賽者們得適應陡坡。  
照片：法新社

### THE CHALLENGE: 實驗目標：

Conduct an experiment to find out how surface **texture** on a **slope** effects how far an object rolls.

進行實驗探討斜坡的表面質地對物體滾動距離的影響。

If you're a regular follower of Weekend Science, then you'll know that you can do some pretty cool things in the name of science. Exploding soda bottles, magic balloons and earthquake simulations are just some of the amazing things we've done over the past year. But there's more to science than just doing cool stuff. In fact, we can only do these fun things because real scientists have made discoveries using something called the **scientific method**. Today you will learn about the scientific method, and conduct an experiment using it.

You will need: a piece of wood, some sandpaper, aluminum foil, wax paper, a toy car and a measuring tape. (JOHN PHILLIPS, STAFF WRITER)

如果你是週末科學版的忠實讀者，你就知道你可以接觸一些很酷的科學實驗。過去一年，我們做了許多神奇的實驗，汽水爆炸、神奇的氣球和地震模擬實驗都只是其中一部分。但是科學不只是做一些很酷的實驗而已；事實上，我們都是根據科學家利用科學方法得到的結果，來進行這些有趣的實驗。今天我們要來認識科學方法，並利用它來進行實驗。

你需要準備：一塊木板、砂紙、鋁箔紙、蠟紙、一輛玩具車和捲尺。

(翻譯：袁星塵)



### MAKE A HYPOTHESIS

#### 提出假設

A hypothesis is often the first step of a scientific experiment. It is more than just a guess. You have to predict what will happen based on past experience. So have you ever rolled an object down a slope? What kind of texture made the object move faster and what kind made it move slower?

假設通常是科學實驗的第一個步驟：假設不光是猜測，還得依據過去的經驗預測將發生的結果。你曾經從斜坡上滾落物體嗎？哪種質地會使物體滾動得較快？又哪種質地會使物體滾動得較慢呢？

針對這個實驗，我們的假設為：物體在平滑的斜坡上會比在粗糙的斜坡上滾得更遠。

Our hypothesis for this experiment is: Objects will roll further down a smooth surface than a rough surface.



### RECORD THE RESULTS

#### 記錄結果

| Surface texture<br>表面材質 | Trial 1<br>實驗一 | Trial 2<br>實驗二 | Trial 3<br>實驗三 | Average distance<br>平均滑行距離 |
|-------------------------|----------------|----------------|----------------|----------------------------|
| Sandpaper<br>砂紙         | 76cm           | 82cm           | 71cm           | 76.3cm                     |
| Aluminum foil<br>鋁箔紙    | 98cm           | 101cm          | 94cm           | 97.6cm                     |
| Wax paper<br>蠟紙         | 87cm           | 96cm           | 98cm           | 93.6cm                     |

### CHOOSE THE VARIABLES

#### 選擇操縱變因

By changing one part of the test each time we do it, we can make comparisons. The part we change is known as the **variable**. Because we are trying to test the effect of surface texture, we need materials of different texture. We are going to use sandpaper, wax paper and aluminum foil.

我們每次實驗都改變一個因素，藉此比較實驗結果，我們改變的部份就稱作「操縱變因」。因為我們要測試的是表面材質的影響，所以需要準備不同質地的材料：我們將使用砂紙、蠟紙和鋁箔紙。

### CHOOSE THE CONSTANTS

#### 選擇控制變因

If we are going to make a fair comparison between the surfaces, some things must stay the same. These are known as the **constants**. Constants are very important because the experiment would tell us nothing if we used a different object, or we set the slope to a different angle each time.

如果我們要公平比較各種表面的實驗結果，有些部份必須維持不變，而這正是我們所謂的「控制變因」。控制變因很重要，因為如果我們每次實驗都使用不同的物體或設定不同的斜坡角度，那實驗結果就沒有任何意義了。

Our constants will be the object and the angle of the slope. The angle of the slope will be 45 degrees and the object will be a toy car.

這次實驗的控制變因為物體及斜坡角度。我們將斜坡的角度固定為四十五度；物體則使用玩具車。

### DO THE EXPERIMENT

#### 進行實驗

Step 1: Set up the slope by propping up the piece of wood at a 45° angle. Cover the wood with aluminum foil.  
Step 2: Release the car from the top of the slope. Measure how far it travels. Repeat two times.  
Step 3: Repeat step two, first covering the wood with wax paper, then with sandpaper. Note: Make sure you release the car from the same position and with the same force each time.

步驟一：把木板架設成四十五度角的斜坡，用鋁箔紙包住木板。  
步驟二：從斜坡頂端放開車子，測量它跑了多遠，重複測量兩次。  
步驟三：重複步驟二，先後分別以蠟紙和砂紙包覆木板。注意：務必在同一個位置放開車子，每次用的力道也要相同。

### CONCLUSION AND APPLICATION

#### 結論與應用

Every good experiment should have a **conclusion**. Did the results match the hypothesis? If not, why not? We predicted that an object would travel further down a smooth surface than a rough one, and the results back that up. Clearly, the sandpaper caused the object to move the shortest distance.

每個好的實驗都該有個結論，這次的實驗結果符合你原先的假設嗎？如果不符合，原因是什麼？我們預測物體在平滑表面上的滑行距離會比在粗糙表面遠，實驗結果證明了我們的假設是對的。很明顯地，物體在砂紙上移動的距離最短。

We can find a real world **application** for the results. When cars travel down steep, winding roads there is sometimes an escape lane for them to drive into if they are in danger of losing control. The purpose of the escape lane is to stop the car as quickly as possible. We can confidently say that the surface of the escape lane should be rough and cause plenty of friction, like sand or gravel.

我們可以將此實驗結果應用在現實生活中，當車子行駛在蜿蜒道路的下陡坡時，駕駛有時可以把車子開入緊急減速道來避免失控的危險。緊急減速道的作用就是讓車子儘快停下來；我們可以肯定地說，緊急減速道的表面應該使用如沙子或小石子等粗糙的材質，來增加摩擦力。



### VOCABULARY 今日單字

- scientific method** /sa n t f k m d/ n. 科學方法 (ke1 xue2 fang1 fa3)
- texture** / t k s / n. 質地 (zhi2 di4)
- slope** /slop/ n. 斜坡 (xie2 po1)
- variable** / v r bl/ n. 可變因素 (ke3 bian4 yin1 su4), 操縱變因 (cao1 zong1 bian4 yin1)
- constant** / k nst nt/ n. 不可變因素 (bu4 ke3 bian4 yin1 su4), 控制變因 (kong4 zhi4 bian4 yin1)
- conclusion** / k n klu n/ n. 結論 (jie2 lun4)
- application** /,æpl ke n/ n. 應用 (ying4 yong4)

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Did you have fun with today's experiment? Why don't you e-mail us and let us know. We're always happy to hear from our readers!

喜歡今天的實驗嗎？歡迎來函指教！  
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