

amorphous metal

聚合物

ferrofluid

Si

Aerogel

nitinol

氣凝膠

tempered glass

沙

Polymers

Fe₃O₄ + 8NH₄Cl

99.8% air + 0.2% silica

砂

非晶態金屬

神奇物質

strange MATTER

材料科學展

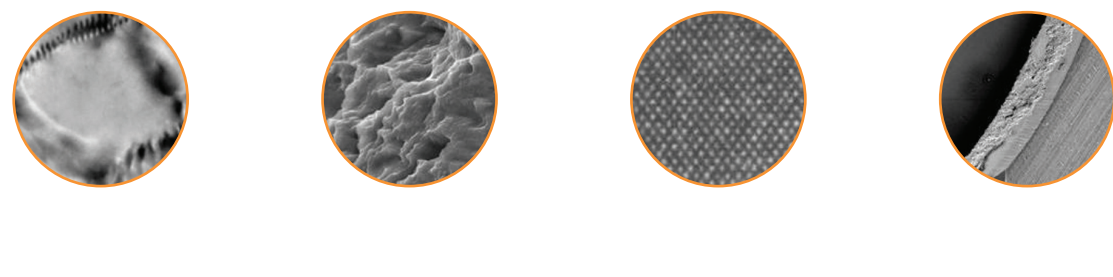
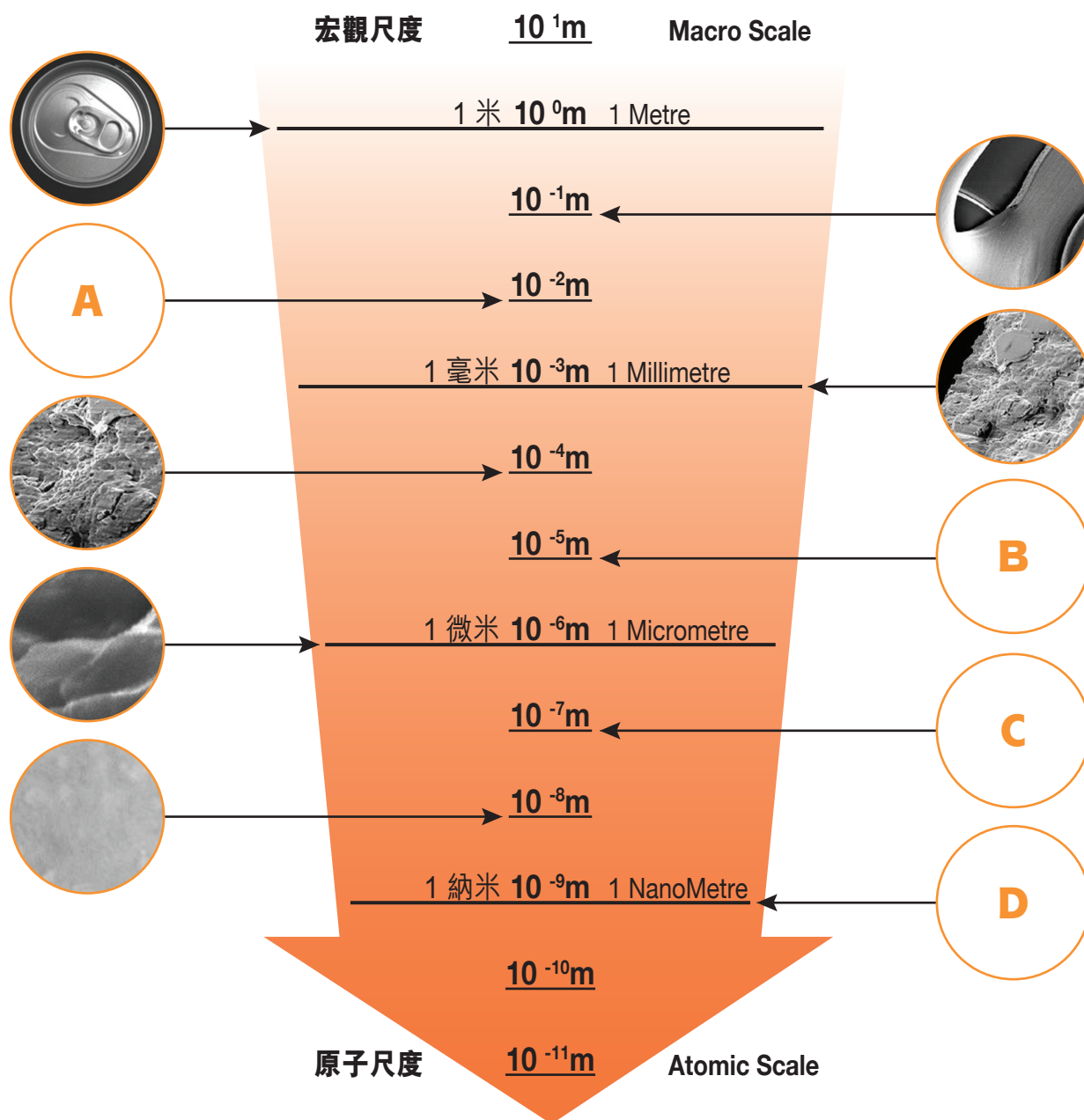
12.12.2014 ▶ 15.4.2015

趣味習作
Activity Sheets
(適合小四至中三學生)
(Suitable for P4 - S3 students)

放大物質! Zoom in on Matter!

看起來光滑的物件，如果把它放大來看，仍是一樣光滑嗎？下面的圖片由宏觀尺度至原子尺度顯示了一個汽水罐的頂部。請找出不同尺度所看到的圖像並在提供的橫線上填上適當的英文字母。

Things look smooth to the naked eye, but what if you could get a much closer look? Pictures below show the top of a soda can from the macro scale to the atomic scale. Write the letter at the lines provided to match the pictures with appropriate boxes.



非晶態金屬 Amorphous Metal

請進入迷宮走一趟，看看你對非晶態金屬有多少認識！

Go into the maze and see how much you know about amorphous metal!

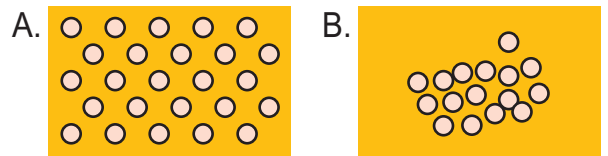
1. 非晶態金屬比晶態金屬更適合製造高質素的高爾夫球棍，因為非晶態金屬...

Amorphous metal is preferable to crystalline metal in manufacturing top-quality golf clubs because amorphous metal...

- A. 可將球擊出較遠的距離
can hit the ball to a farther distance
- B. 容易屈曲
is easier to bend
2. 在彈跳測試中，撞擊Liquidmetal®合金（一種非晶態金屬）的彈珠彈個不停，因為在碰撞過程中...
- In the bounce test, the ball bearing keeps on bouncing on the Liquidmetal® alloy (a type of amorphous metal) because...
- A. 大部份彈珠的能量都傳回彈珠上
most of the bouncing ball's energy is returned to the ball during collision
- B. 極少彈珠的能量傳回彈珠上
very little of the bouncing ball's energy is returned to the ball during collision

3. 下列哪圖正確展示非晶態金屬的粒子排列方式？

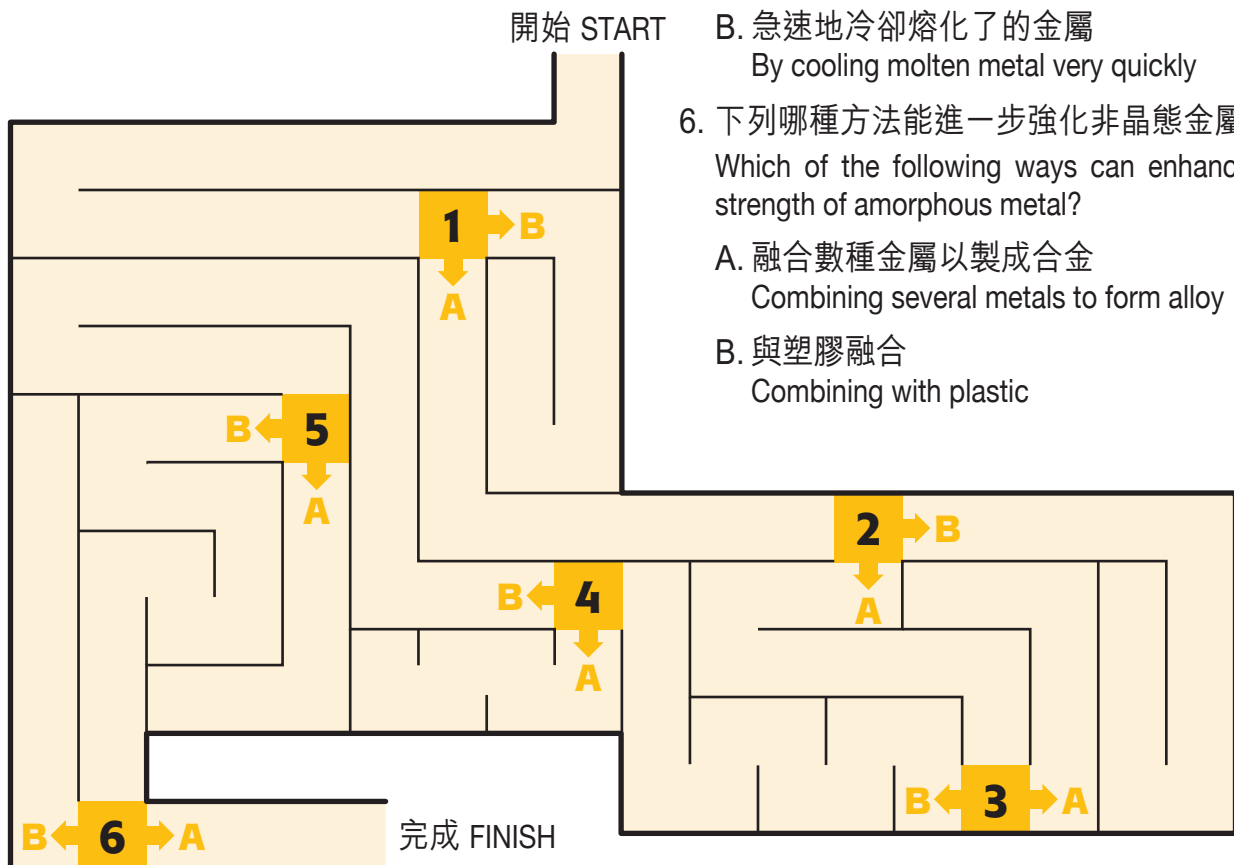
Which diagram below depicts the particle arrangement of amorphous metal?



4. 下列哪句句子正確描述非晶態金屬的原子排列方式？

Which statement below correctly describes the atomic structure of amorphous metal?

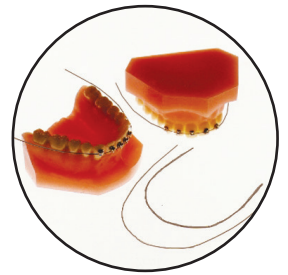
- A. 原子有序地排列
The atoms are orderly arranged
- B. 原子排列雜亂無章
The atoms are randomly arranged
5. 如何製作非晶態金屬？
How is amorphous metal made?
- A. 緩慢地冷卻熔化了的金屬
By cooling molten metal slowly
- B. 急速地冷卻熔化了的金屬
By cooling molten metal very quickly
6. 下列哪種方法能進一步強化非晶態金屬？
Which of the following ways can enhance the strength of amorphous metal?
- A. 融合數種金屬以製成合金
Combining several metals to form alloy
- B. 與塑膠融合
Combining with plastic



記憶金屬 Memory Metal

1. 牙箍是由記憶金屬製作，它能夠自動變回原狀。你知道是甚麼令牙箍變回原狀嗎？請圈出正確答案。

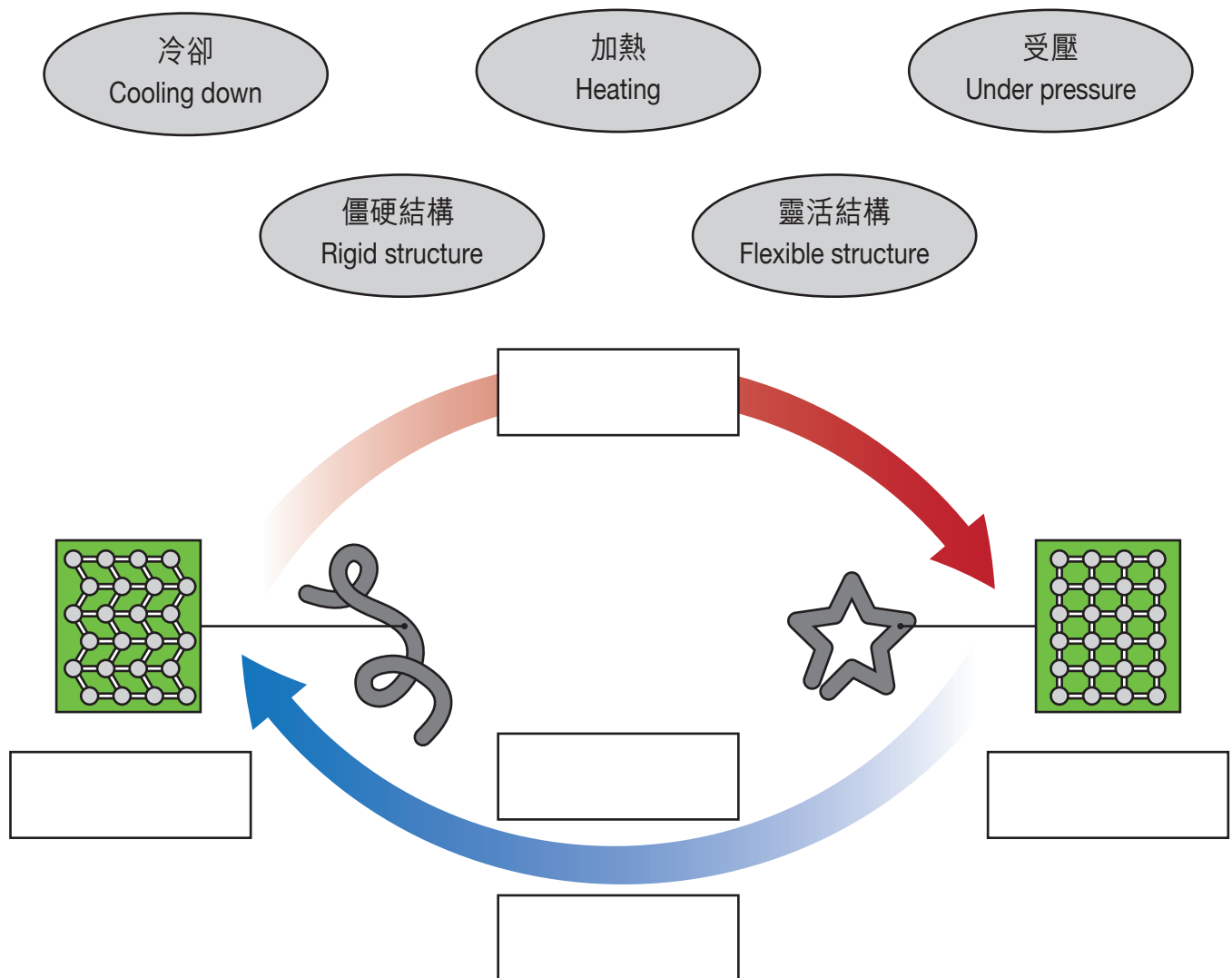
Dental braces are made of memory metal as it can automatically revert to its original shape. What is the cause of such reversion? Please circle the correct answer.



- A. 空氣溫度
Air temperature
- B. 體溫
Body heat
- C. 濕度
Moisture

2. 記憶金屬擁有甚麼神奇特質？試用提供的文字填在適當的空格內。

What amazing characteristics does memory metal possess? Fill in the boxes with the words provided.



3. 如何讓記憶合金「記得」一個新的形狀？請圈出正確答案。

How does memory metal 'memorise' a new shape? Please circle the correct answer.

- A. 屈曲
When bent
- B. 緩緩加熱至大約 50°C
When gradually heated to about 50°C
- C. 猛烈加熱至大約 500°C
When intensely heated to about 500°C

強化玻璃 Tempered Glass

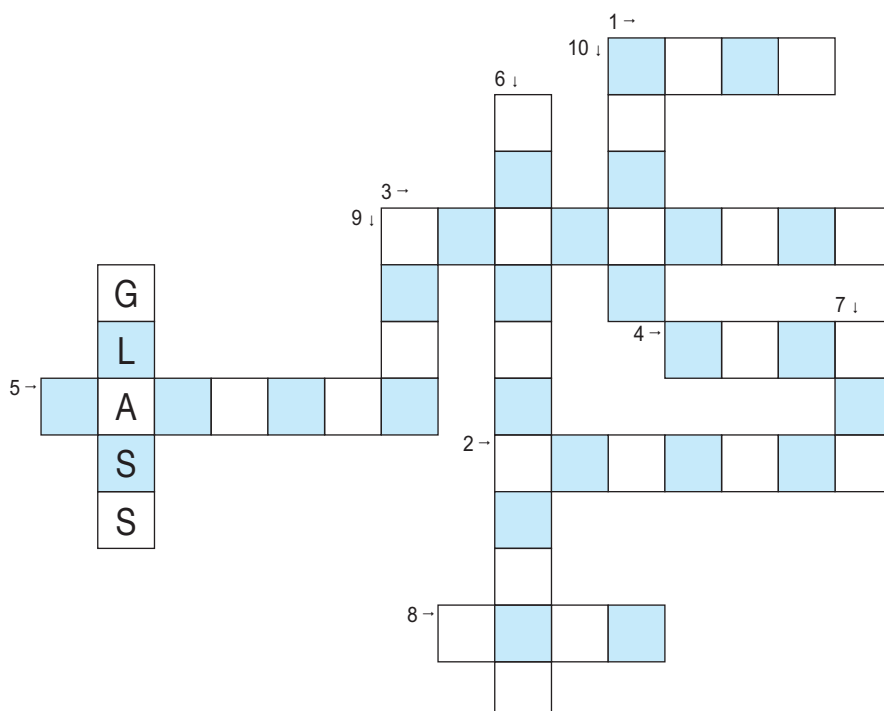
以下是一篇有關強化玻璃的文章。試於下表圈出文章缺少了的詞語。(提示：除第一個答案外，每一個答案都在前一個的附近。)

玻璃是由 1 製作而成，故此主要成分為 2。時至今天，3 玻璃大行其道。其製作方法是將普通玻璃 4 至轉化溫度，使其變成流質，然後用 5 急速冷卻。雖則表層立即冷卻成形，但內核依然灼熱。及後，隨着玻璃內核冷卻定形，表層便會被 6，令整塊玻璃被強大的應力鎖緊。製成品承受着至少每平方英吋 7 磅力的表面壓力，並較普通玻璃強至少 8 倍。此外，一般玻璃往往碎裂成大塊而銳利的碎片；但強化玻璃卻會碎成沒有尖角的 9，大大提高其 10 性。

沙	金	石	加	空	氣
矽	強	化	熱	冷	壓
酸	蝕	合	疊	水	縮
彈	百	小	四	一	萬
可	二	粒	微	十	千
燃	安	全	塵	耐	用

Complete the crossword puzzle by filling in the blanks of the following description of tempered glass.

Glass is mainly made of 1. In other words, its main composition is 2. Nowadays, glass has been tremendously strengthened via a method called heat 3. 4 ordinary glass to approximately its softening temperature and then cool down the glass surface by air very 5. This creates a relatively hotter centre than the surface of the glass. Delayed cooling at the centre of the glass ultimately leads to strong 6 of glass surface, thus building up strong internal stress. This product is called tempered glass. It has a surface pressure of at least 7 thousand psi and its strength is at least 8 times stronger than that of ordinary glass. In case of breakage, ordinary glass smashes into large pieces while tempered glass manifests a hallmark pattern of 9 grains. This 'dicing' phenomenon remarkably prevents the formation of sharp shards during breakage and hence makes glass 10.



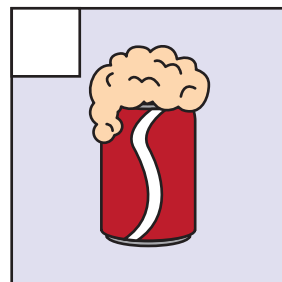
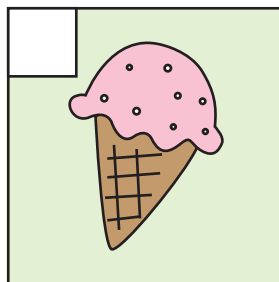
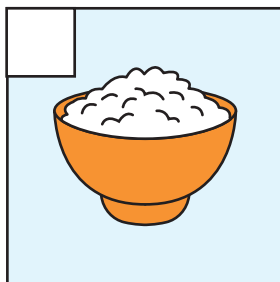
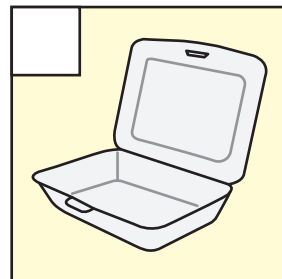
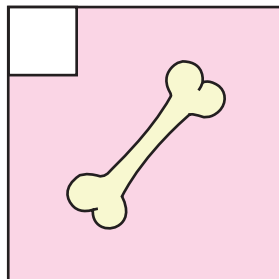
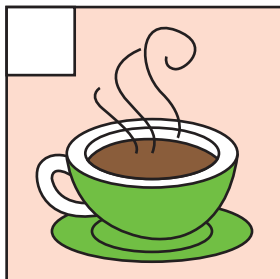
泡沫 Foam

1. 泡沫在日常生活中是非常普遍的。你能分辨出下列哪些物品是泡沫嗎？請在適當的空格內填上✓號。

Foam is common in our lives. Can you identify which of the following are examples of it? Tick the appropriate boxes.

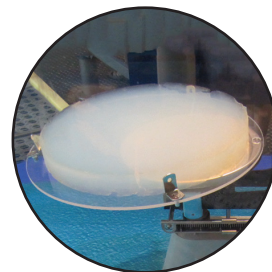
科學小知識
Know More About Science

泡沫由困於液體或固體中的氣泡或氣囊(通常是空氣)組成。
 Foam consists of bubbles or cells of gas (often air) trapped within a liquid or a solid.

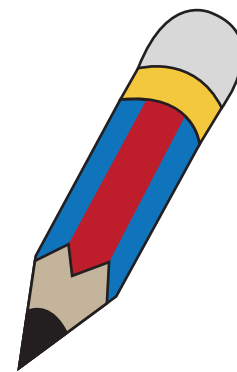


2. 泡沫當中，有一種空氣成分高達99.8%的新型材料，外表上幾乎隱形！你對它有多了解呢？

In foam, there is a new material that is barely there because it contains up to 99.8% air. Do you know much about it?



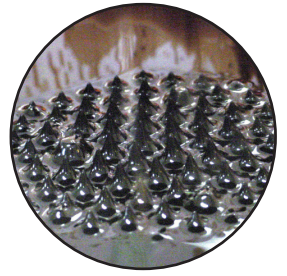
○	材料名稱：	
○	Name of the material:	
○	它通常由甚麼組成？	
○	What is it usually made of?	
○	它擁有很多神奇屬性，試說出其中三項。	
○	Write down three amazing properties of the material.	
○	它哪一項神奇屬性，使圖中的蠟筆不被燃起？	
○	Which amazing property of the material allows the protection of the crayons from the flame?	



鐵磁流體 Ferrofluid

1. 當磁鐵靠近鐵磁流體時，鐵磁流體形成尖刺，為甚麼？

Ferrofluid responds to bar magnets and forms the characteristic hedgehog shape. Why?



2. 對鐵磁流體來說，微粒大小很重要！鐵磁流體裏的微粒大小只有10納米。如果鐵粒大小轉變，鐵磁流體會發生甚麼變化？

For ferrofluids, size matters! Particles in ferrofluid are barely 10 nanometres across. What would happen if the particle size is changed?

3. 鐵磁流體用途廣泛。試配對以下物品及鐵磁流體在該物品中的用途。

Ferrofluids are widely used in different industries. Match the following roles of ferrofluids with the corresponding application.

太空船的液態燃料
Spacecraft liquid fuel



操控液態燃料
Controls liquid fuel



擴音器
Loudspeaker



形成不透氣的液體密封間隔
Creates airtight liquid seals



電腦硬碟
Computer hard drive



在癌症患者的血管中輸送治療藥物
Delivers drug treatment through a cancer patient's bloodstream



抗癌藥
Cancer drug



減少不必要的震動以改善音質
Improves sound quality by reducing unwanted vibrations



由沙粒到矽微晶片 From Sand to Silicon Microchips

矽錠是製造矽微晶片的基本材料，而矽錠是由非常簡單的材料製成：沙粒！請在橫線上填上適當的文字，從而了解如何把沙粒製成矽微晶片。

The first building block for silicon microchips is a silicon ingot which can be made from a very simple material: Sand! Fill in the blanks below with appropriate words and learn more about how silicon microchips are manufactured from sand.



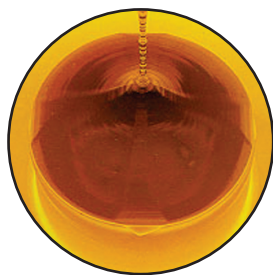
沙粒(二氧化矽)
Sand (Silicon dioxide)

透過一系列的化學「浸泡」把二氧化矽中所有的 _____ 和雜質去除，最終使矽的純度達到 99.99999%。

A series of chemical 'baths' remove all _____ and impurities in silicon dioxide. In the end, the purity of silicon is 99.99999%.

然後在攝氏 _____ 度 (°C) 的溫度下將矽化成液體。

Then melt the silicon at a temperature of _____ °C.



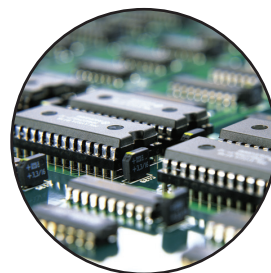
矽錠
Silicon ingot

將純矽「種子」晶體放入熔化了的 _____ 中，然後結晶成矽錠。

A 'seed' crystal of pure silicon is dipped into the _____ for crystallisation to form a silicon ingot.

經一連串步驟如 _____、拋光、光罩和蝕刻，將矽錠製作成矽微晶片。

The silicon ingot is further processed by _____, polishing, masking and etching to become a silicon microchip.



矽微晶片
Silicon microchip