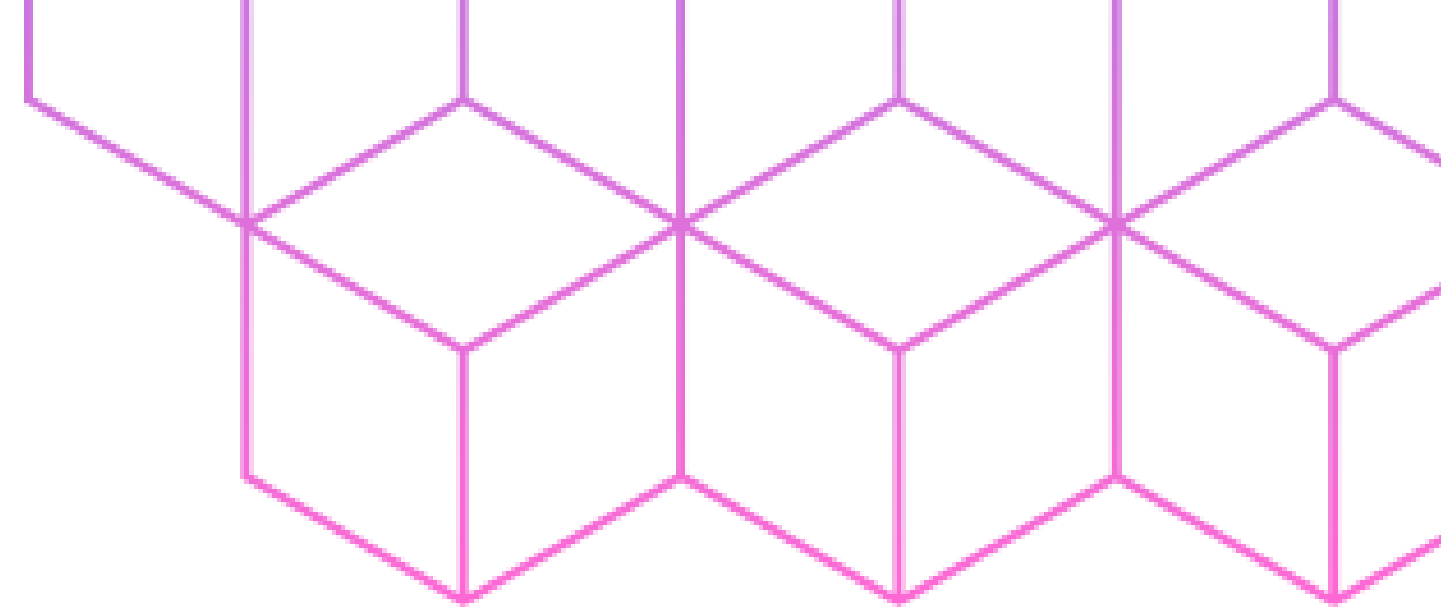


實驗被電神俱樂部



# 半導體元件概述

竹科實中

H10206邱郁茹

H10603林郁辰

---小哥哥小姊姊講半導體

一、什麼是半導體

二、半導體元件有哪些

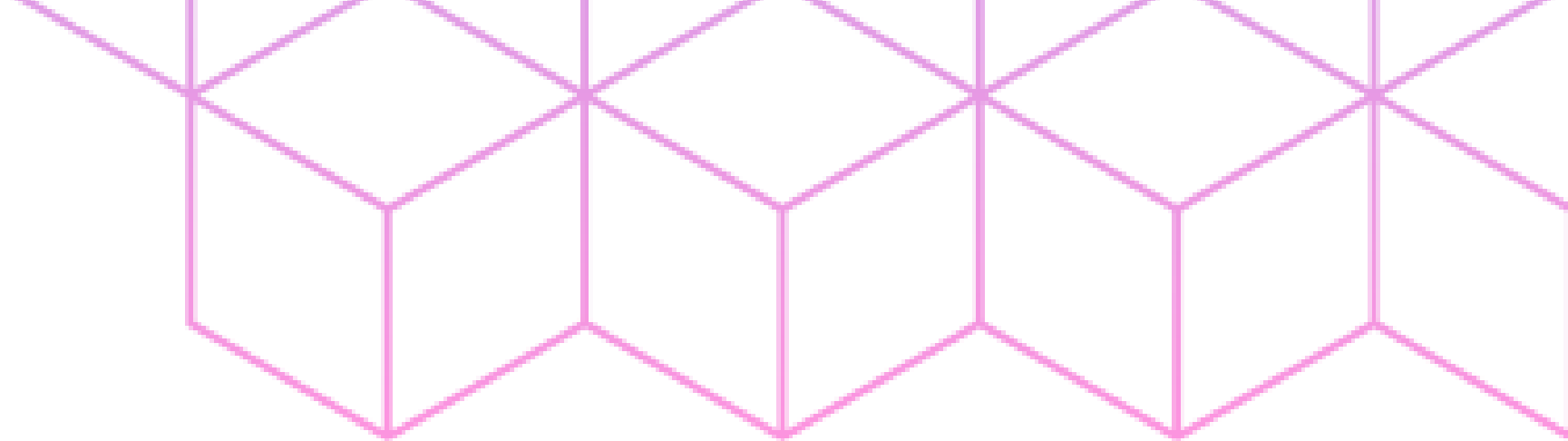
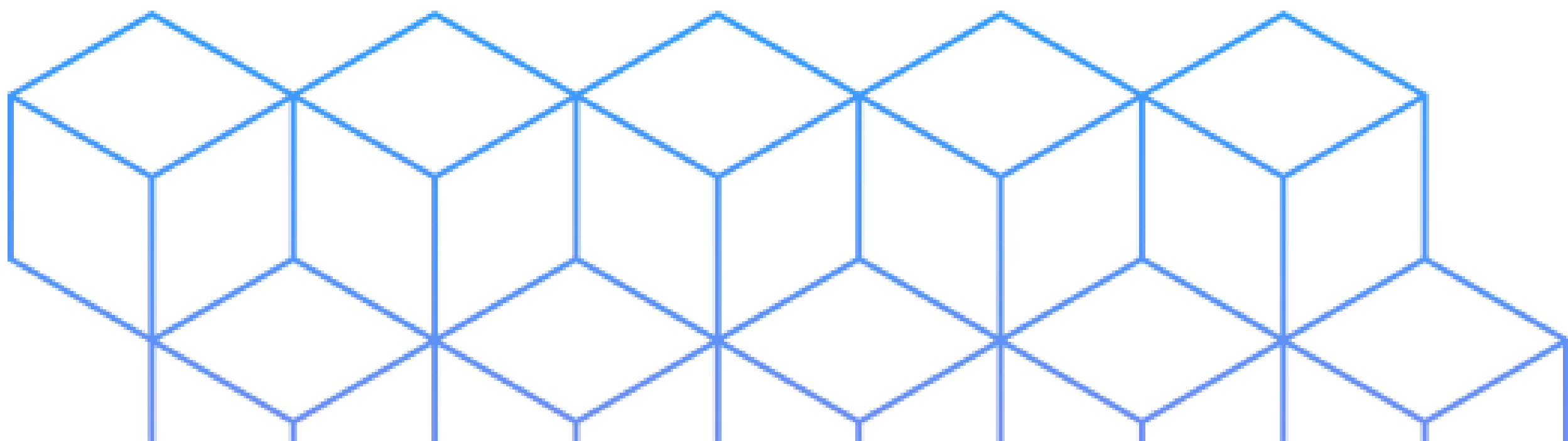
三、主動元件:二極體

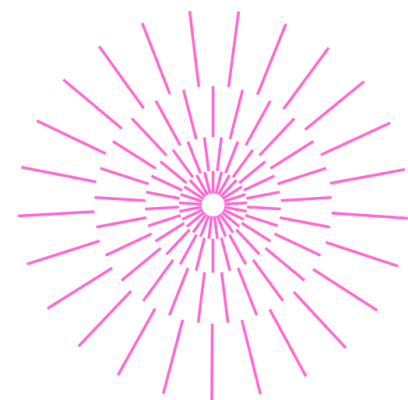
四、主動元件:電晶體

五、被動元件

六、課後Q & A

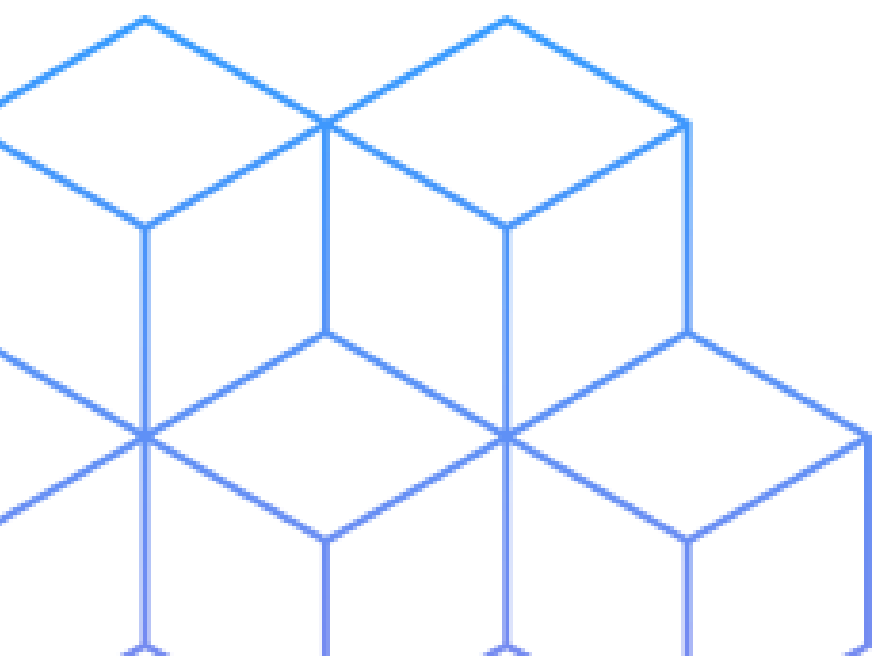
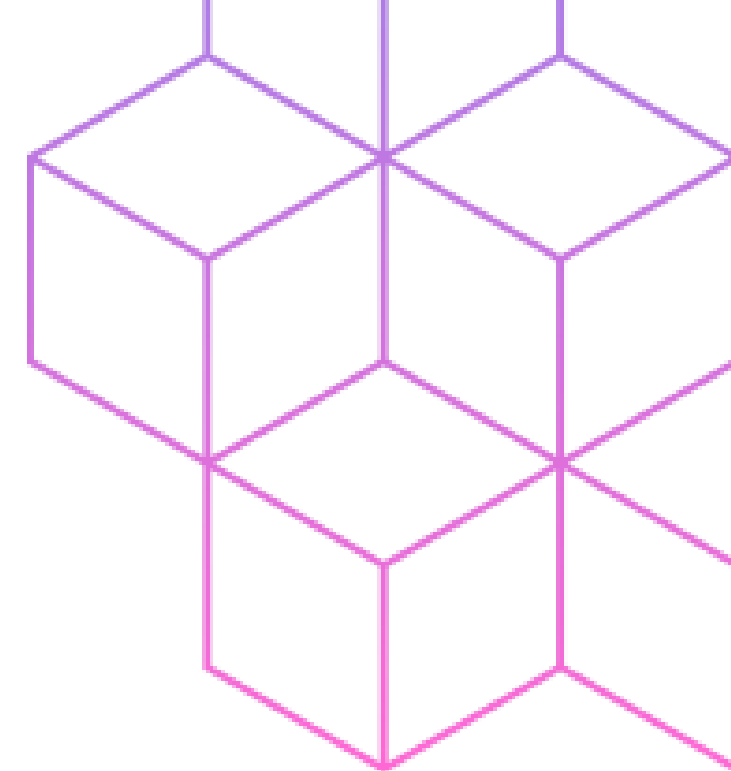
# 目錄

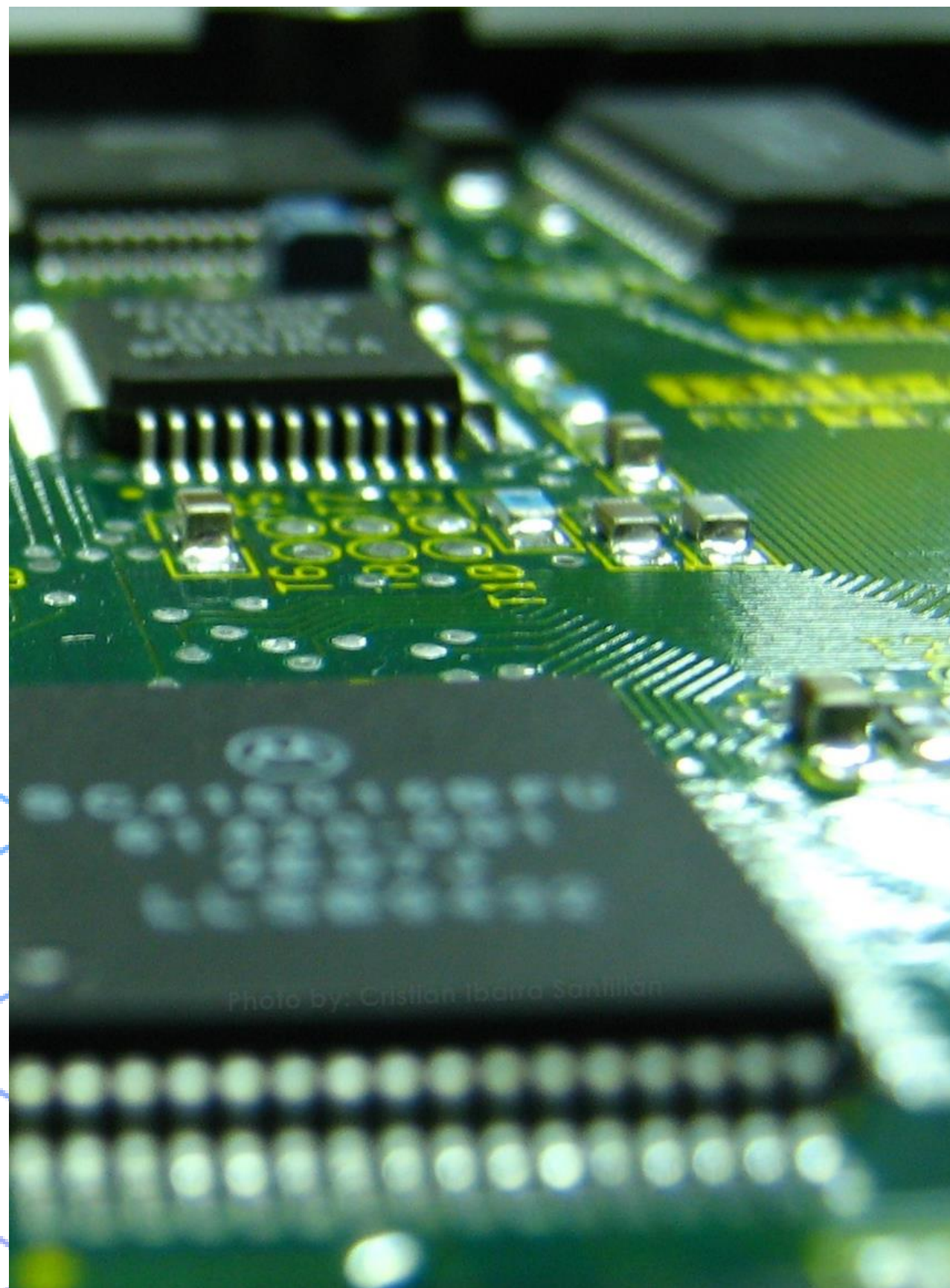




實驗被電神俱樂部

# 什麼是半導體





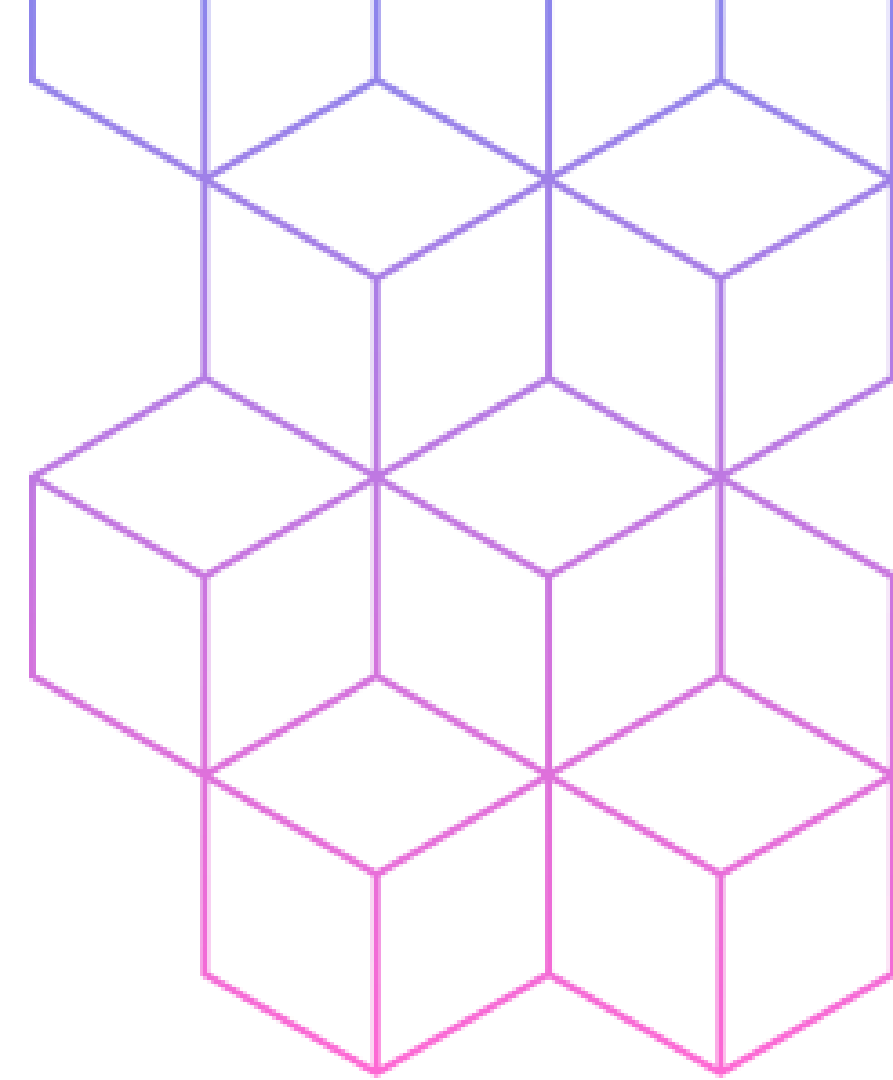
# 半導體

用處

材料

電導率

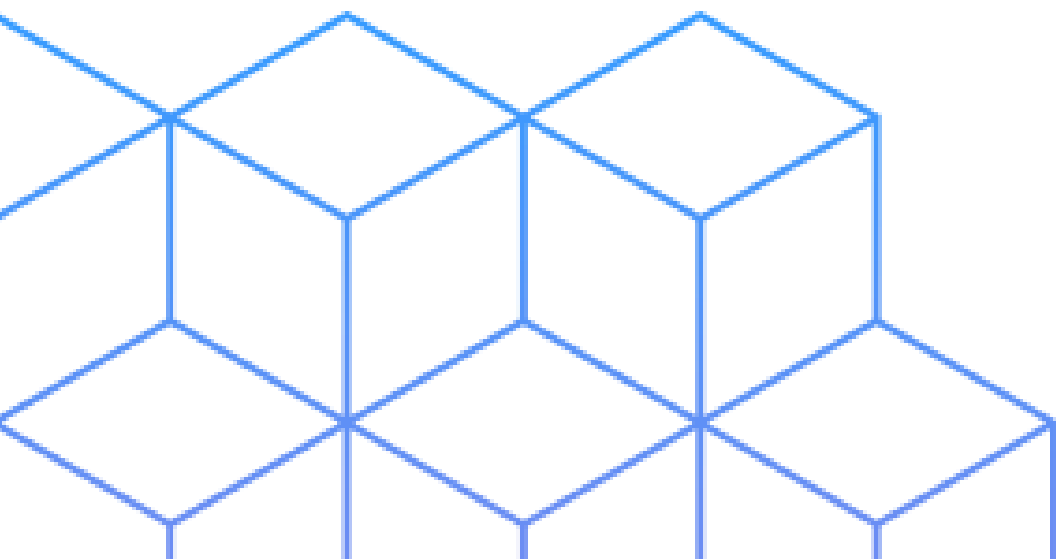
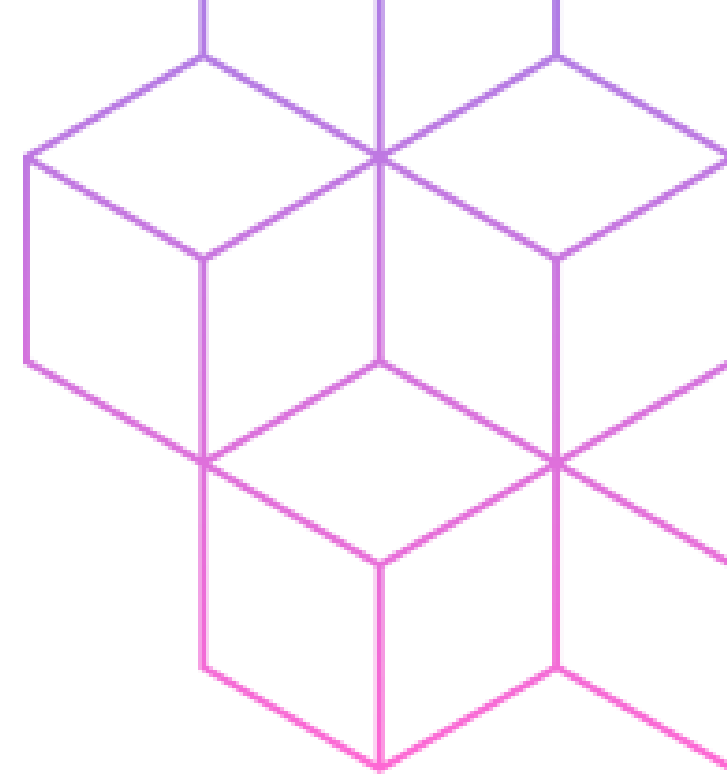
改變材料的導電能力



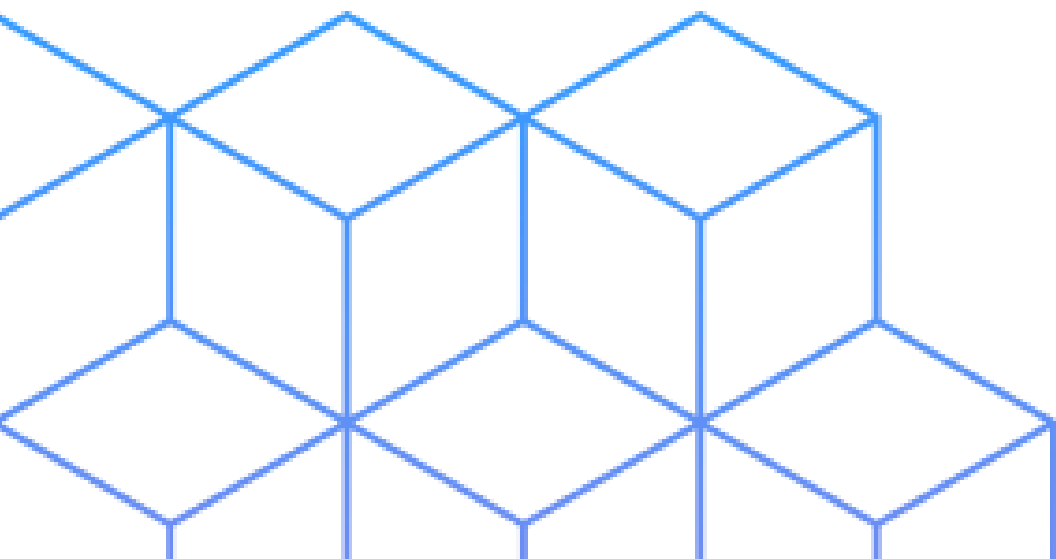
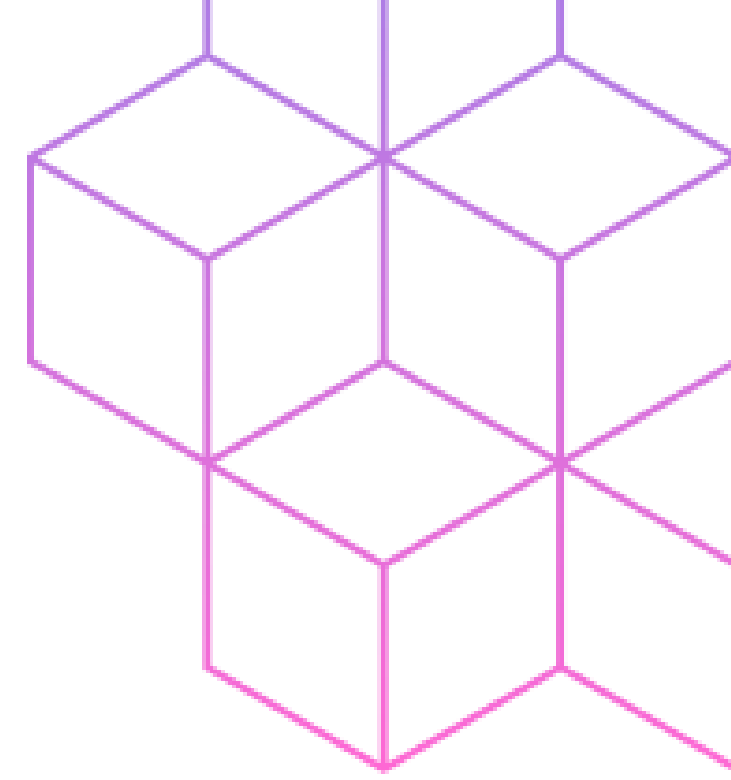
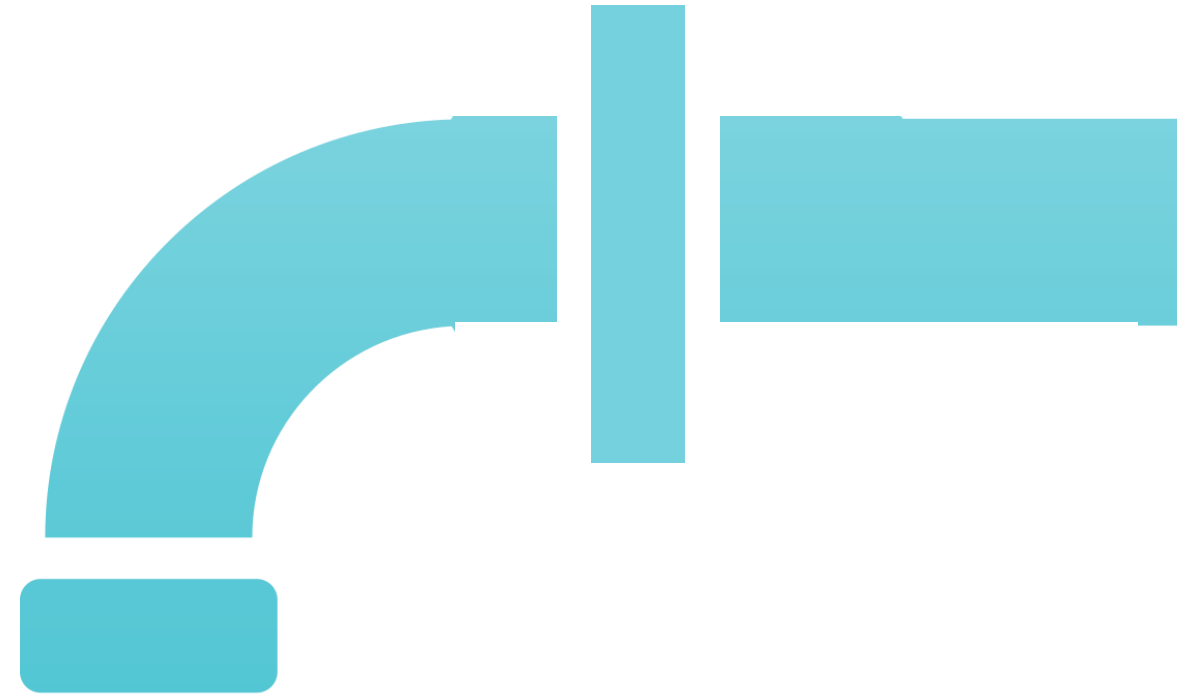
簡單來說：



導體就像水管

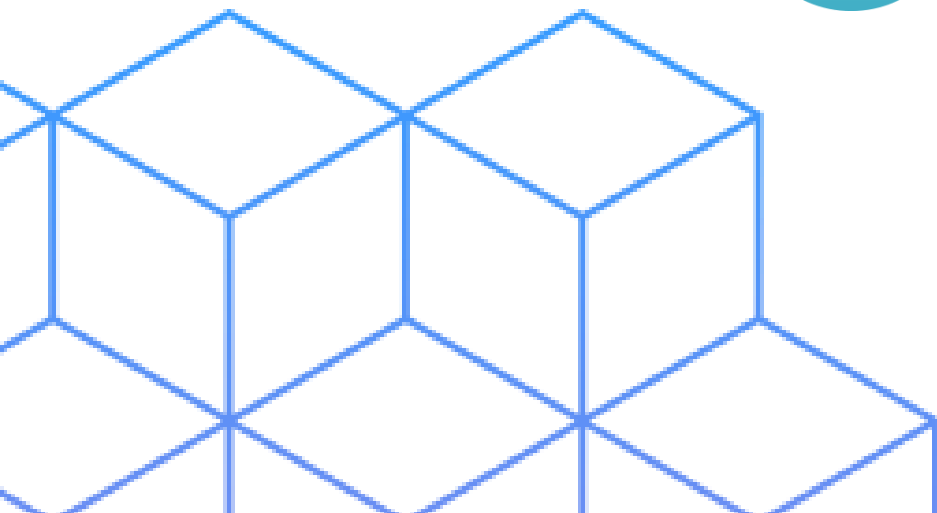
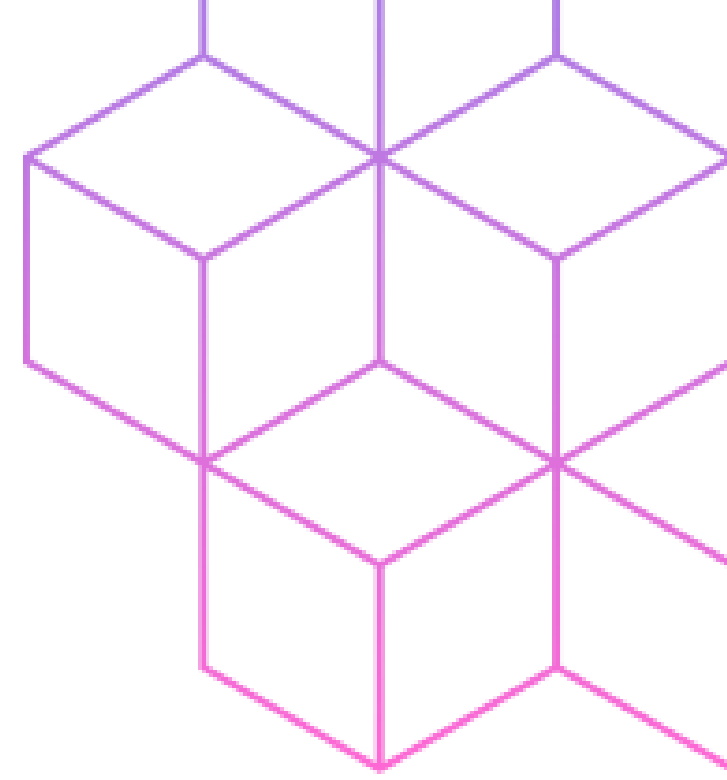
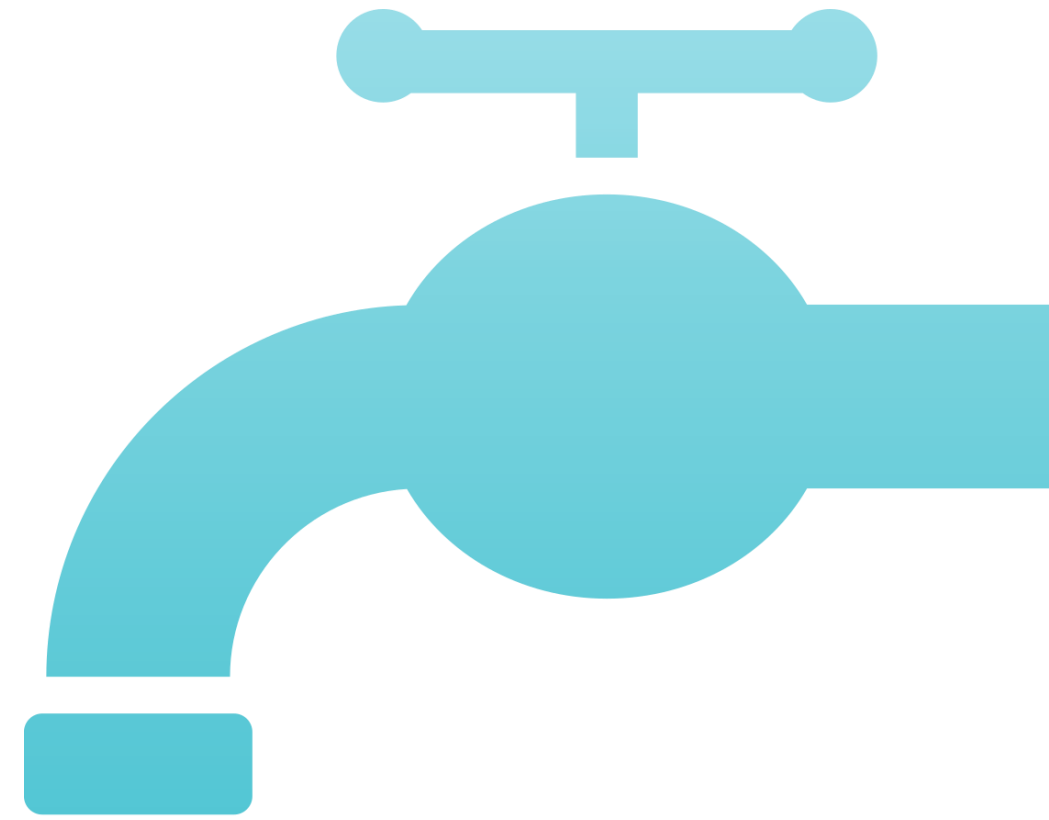
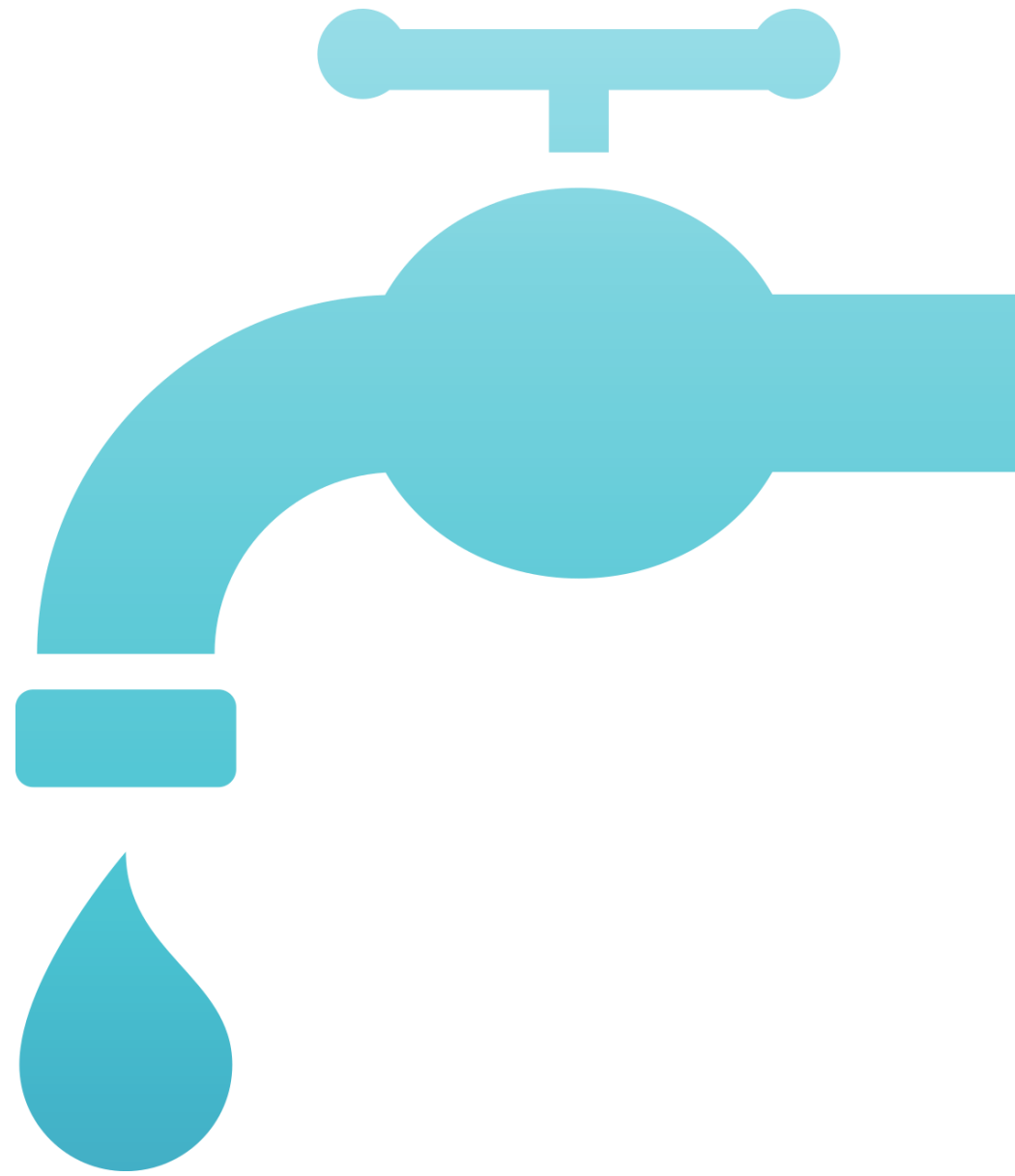


簡單來說：



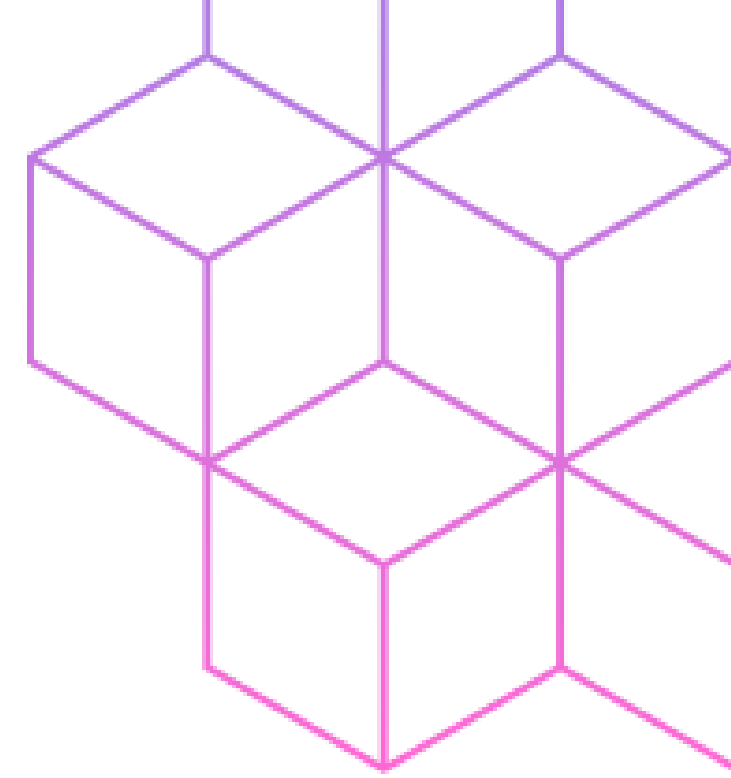
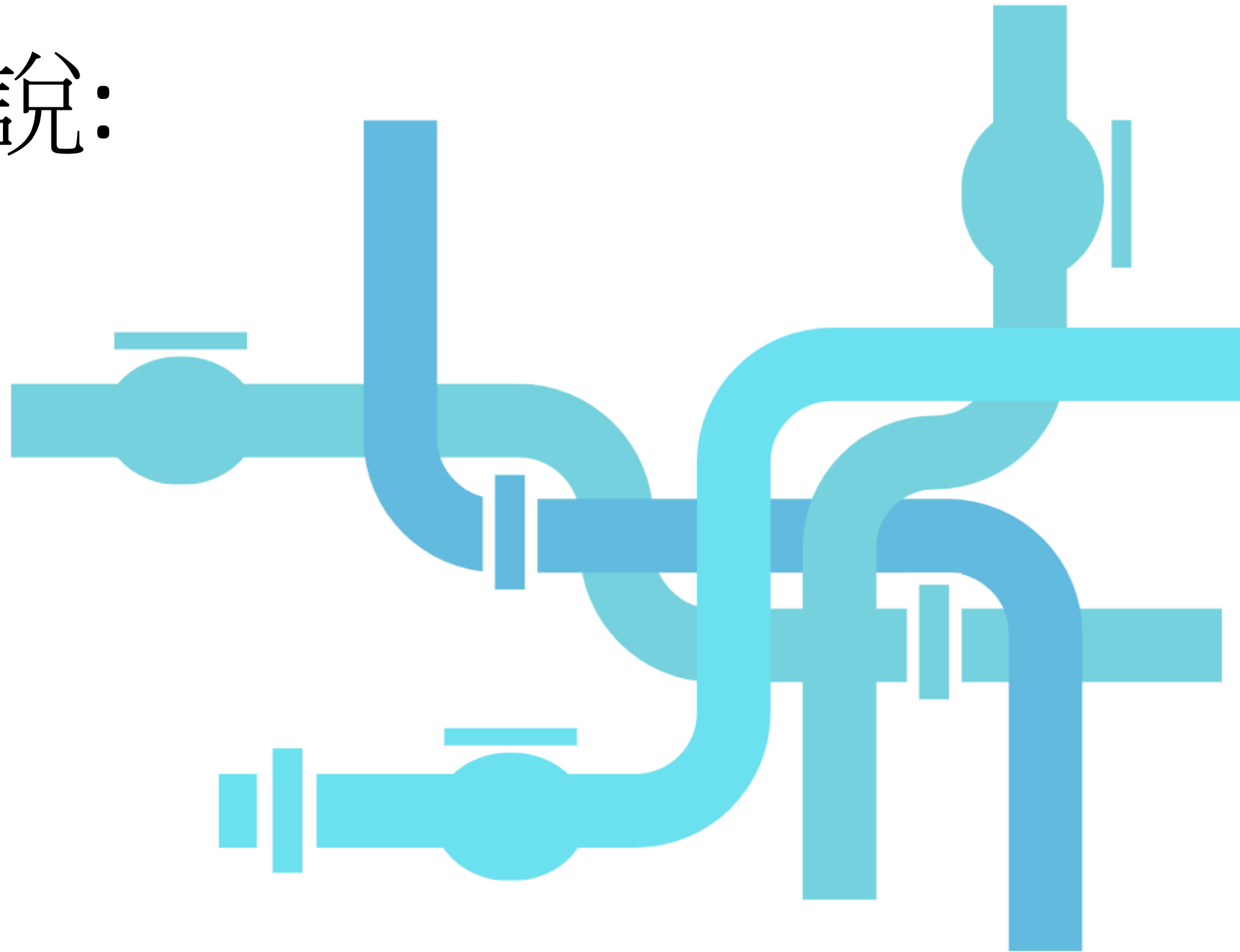
絕緣體就像塞住的水管

簡單來說：

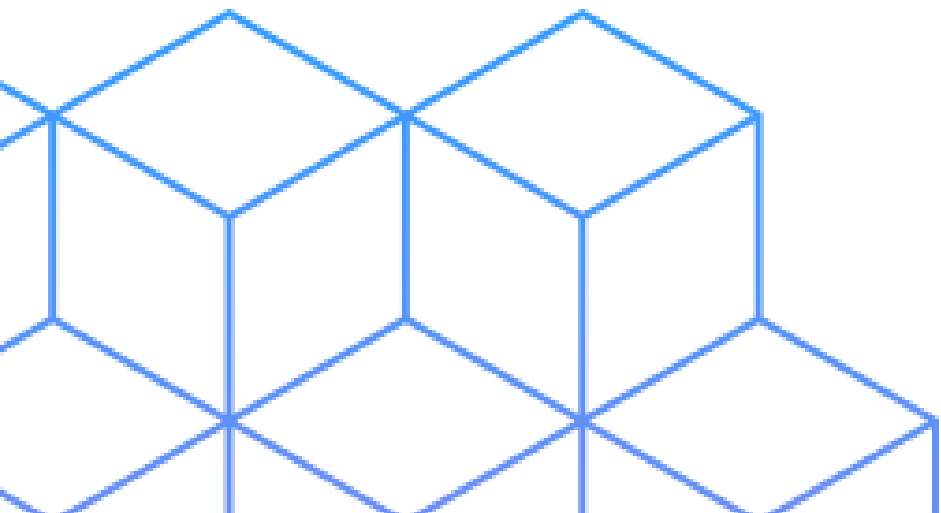


半導體就像裝了水龍頭的水管

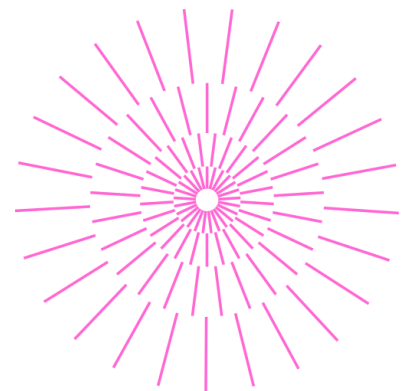
簡單來說：



組合起來就可以組成可以控制的電路







實驗被電神俱樂部

# 半導體元件有哪些

01

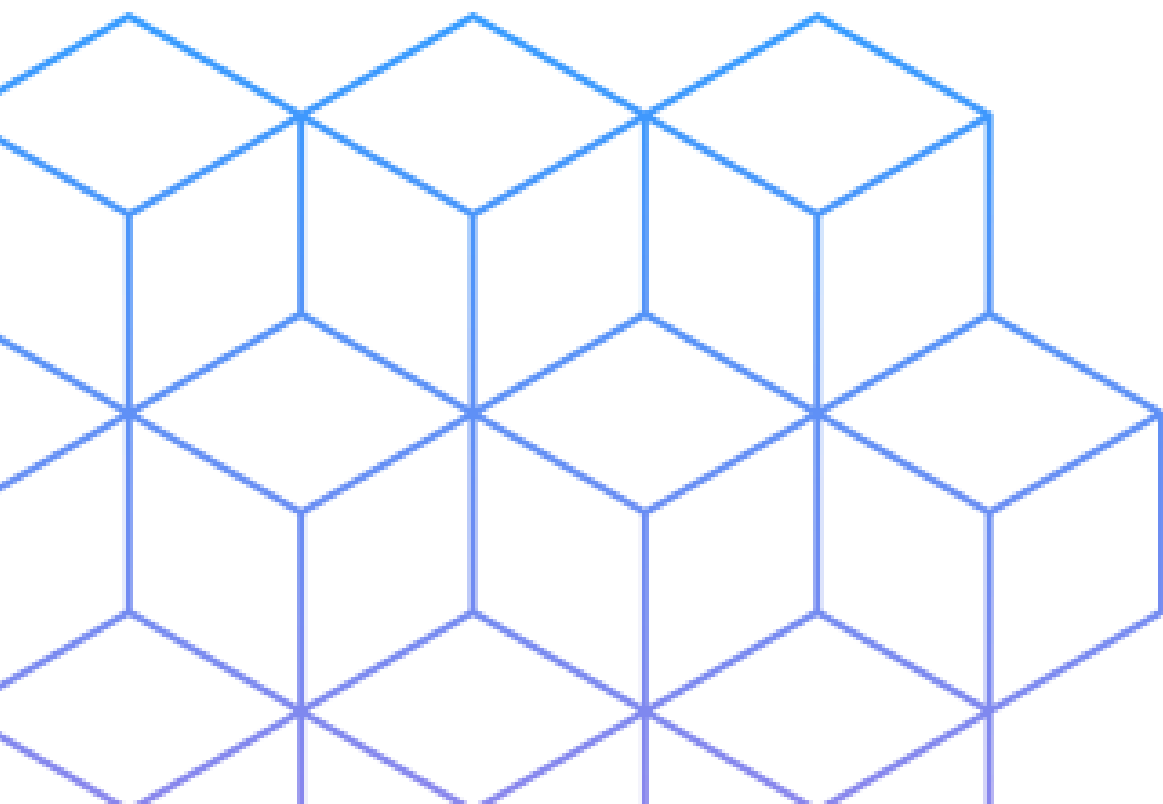
## 主動元件

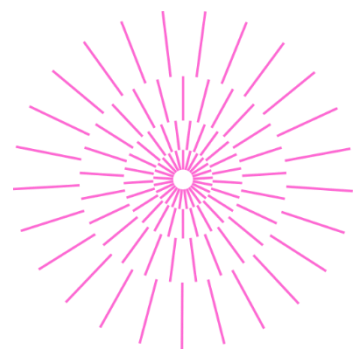
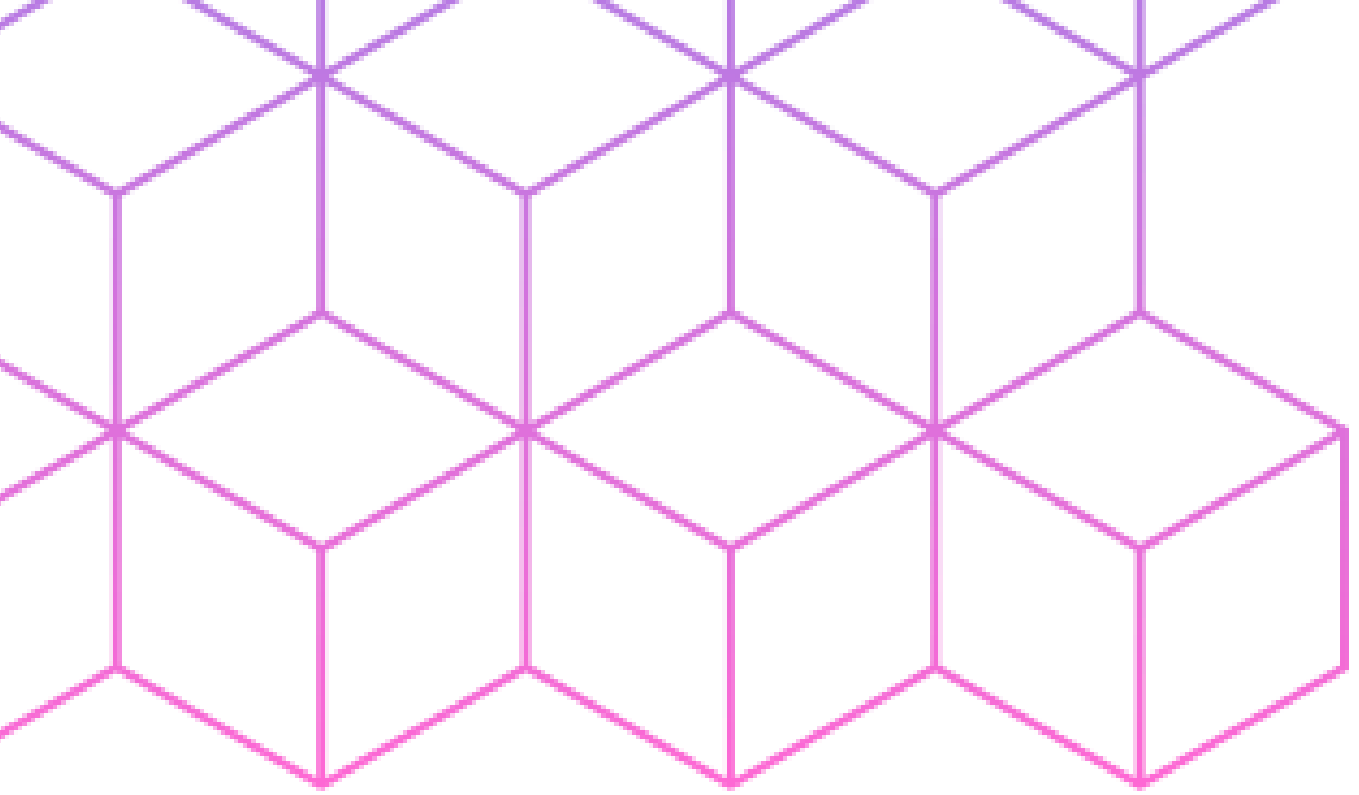
二極體  
電晶體

02

## 被動元件

電容器  
電阻器  
電感器





實驗被電神俱樂部

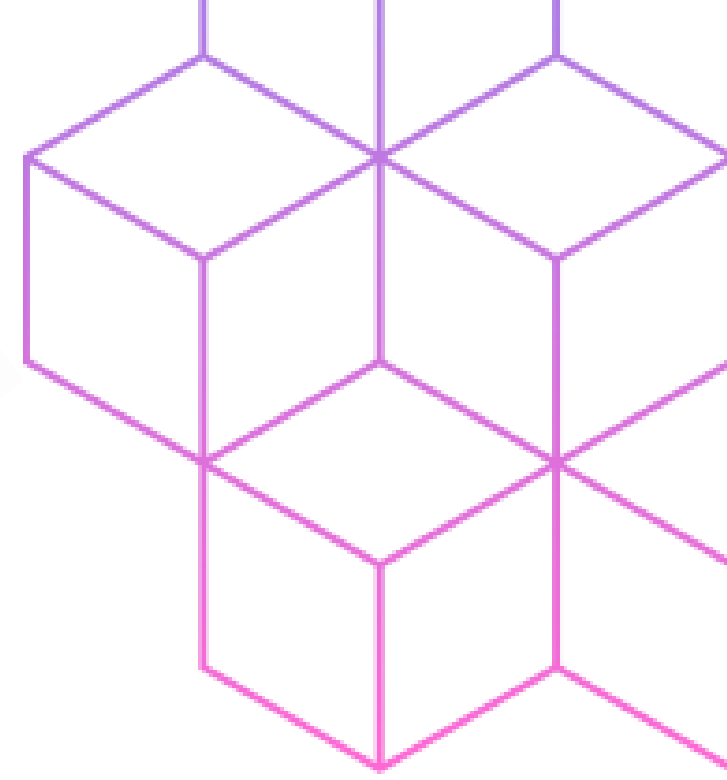
# 主動元件

- 有參與電訊號調變的電子元件
- 具有放大或減小電訊號的功能

二極體 (Diode)  
電晶體 (Transistor)

# 主動元件

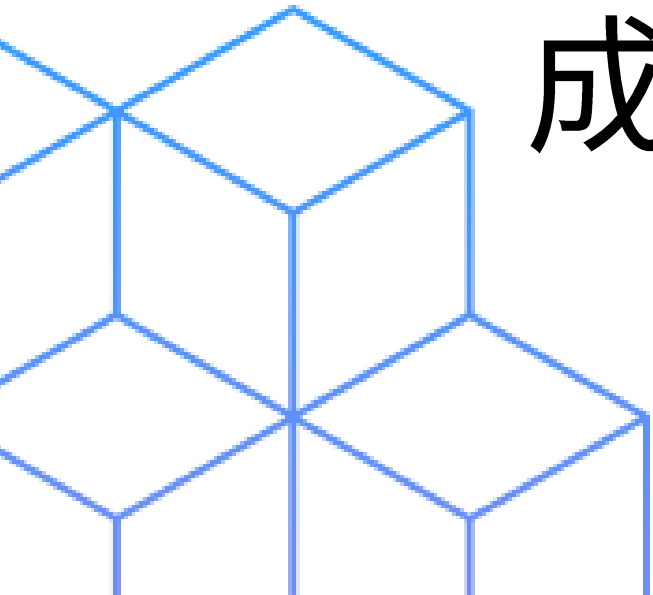
## — 二極體 (Diode)

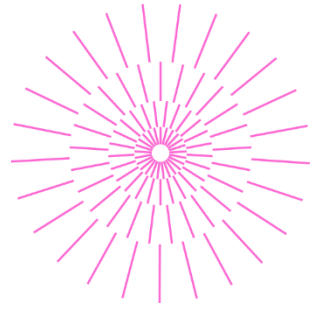


二極體: P 型半導體 + N 型半導體 → 接面

矽晶圓

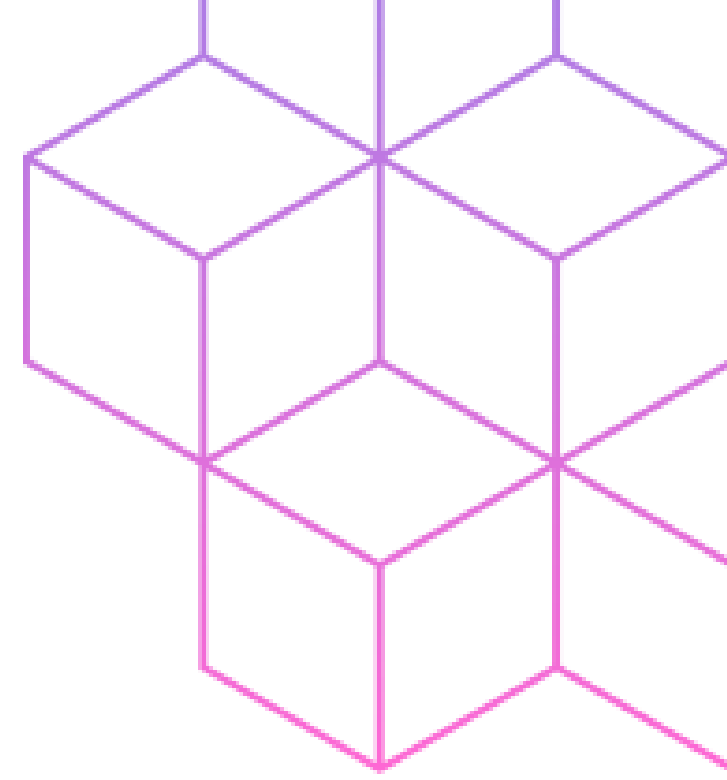
成本較低且製程穩定





實驗被電神俱樂部

# 小...補充



摻雜技術

本質半導體  
(intrinsic semiconductor)



外質半導體  
(extrinsic semiconductor)

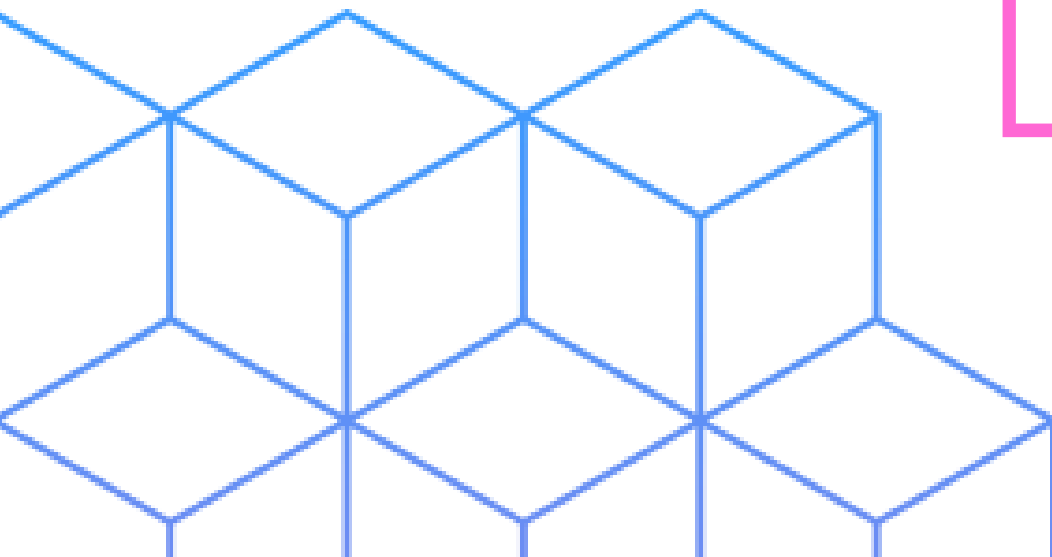
摻雜物

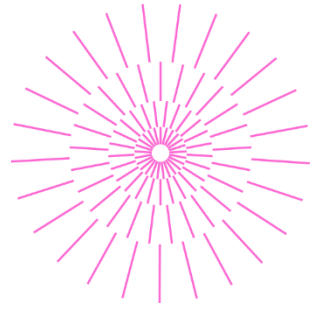
施體 (donor)

負電荷

受體 (acceptor)

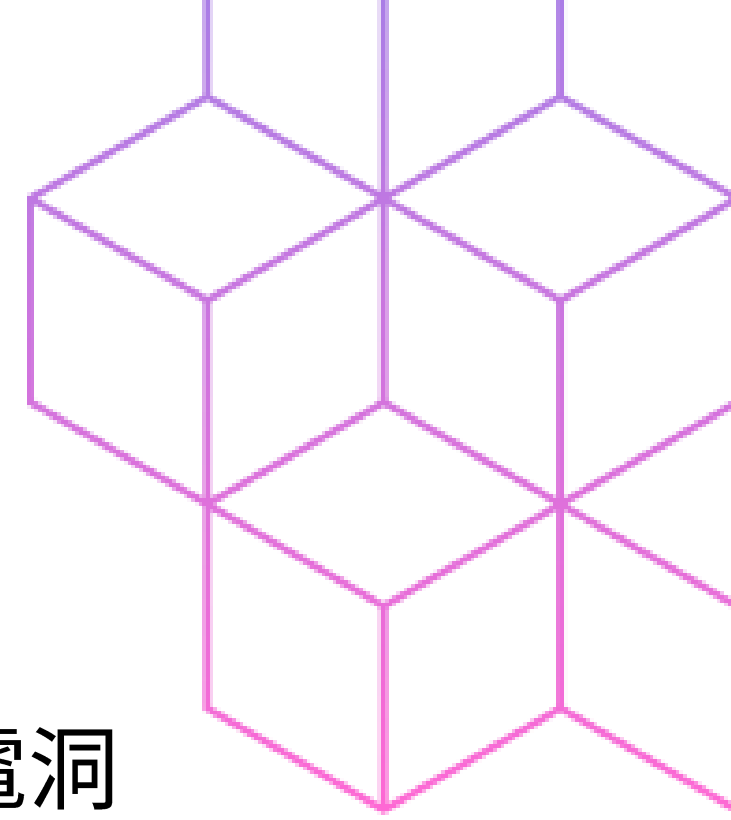
正電荷





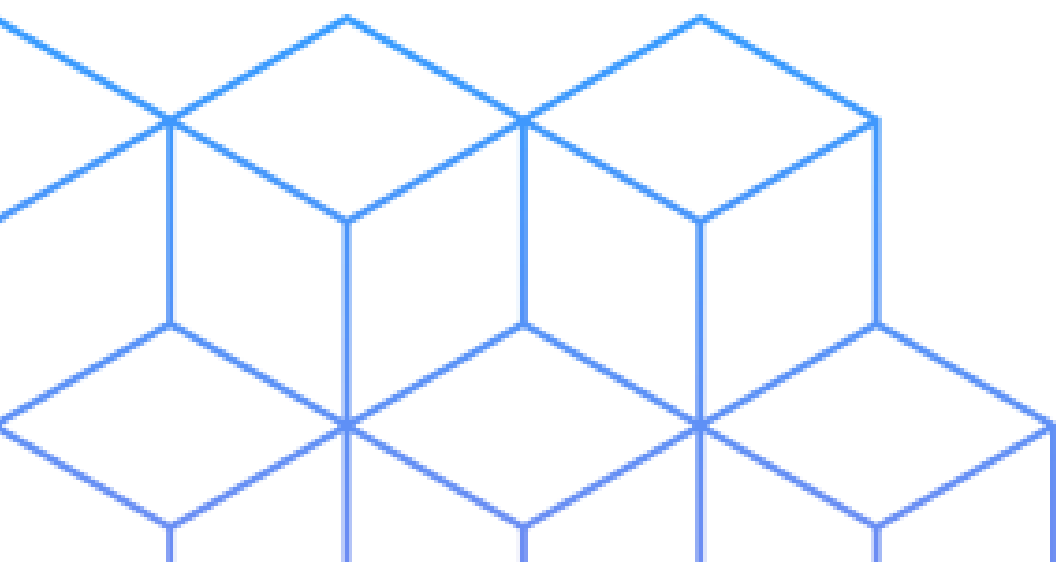
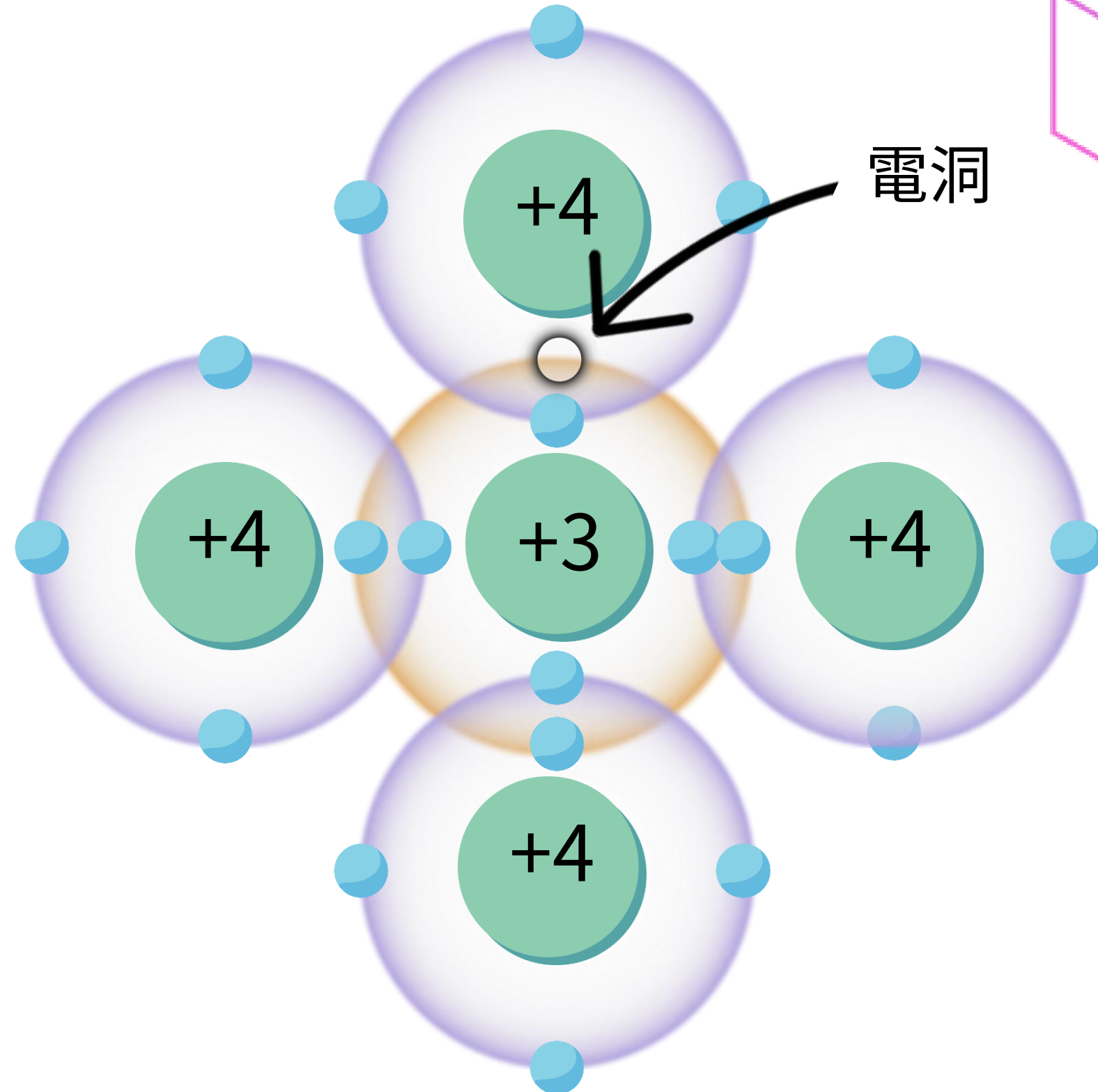
實驗被電神俱樂部

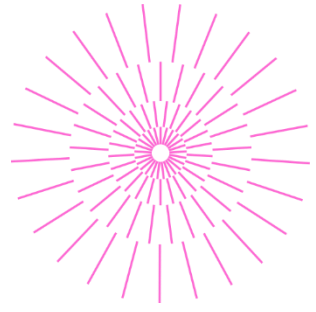
# 小...補充



**P型半導體**  
(P-TYPE SEMICONDUCTOR)

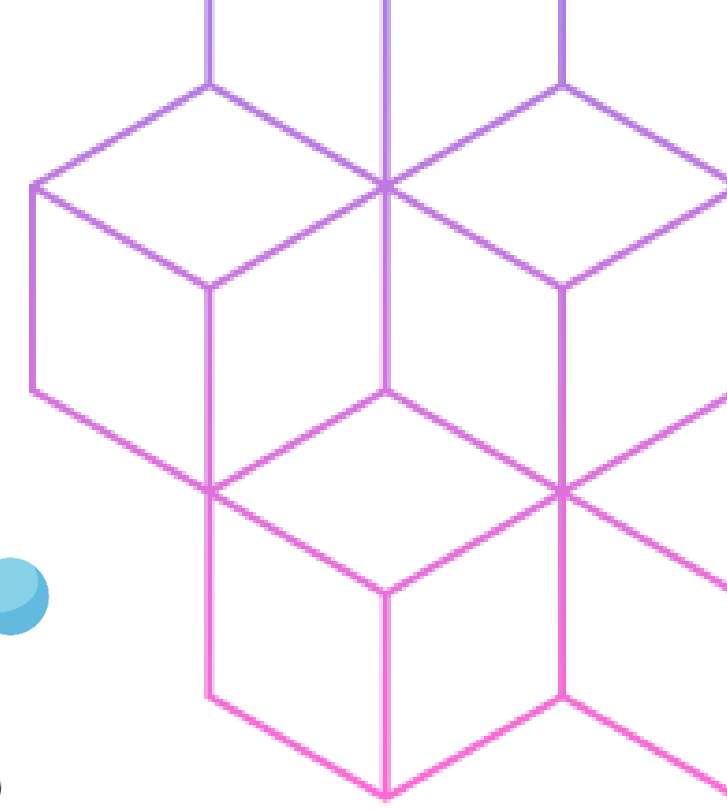
\*p代表帶正電荷的電洞





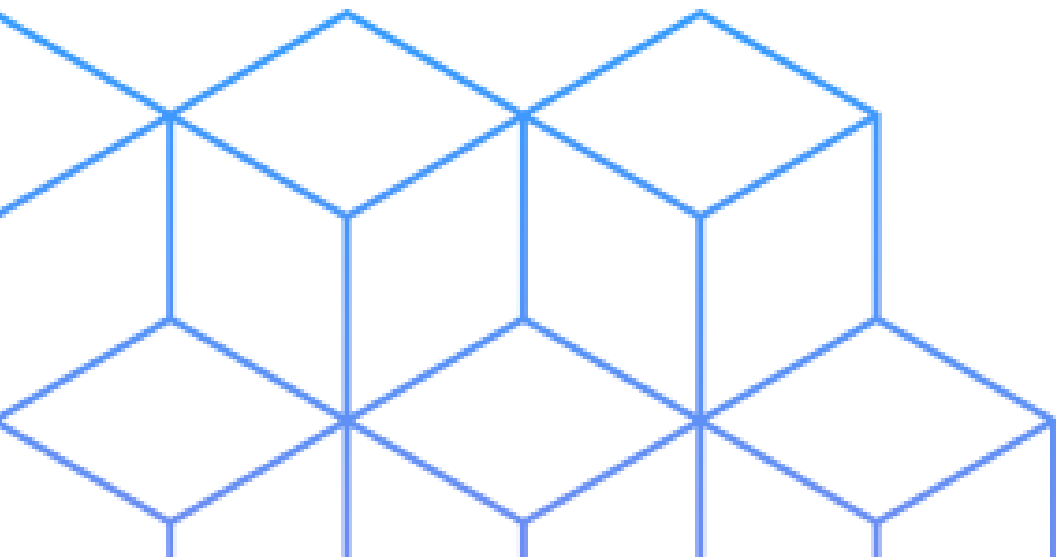
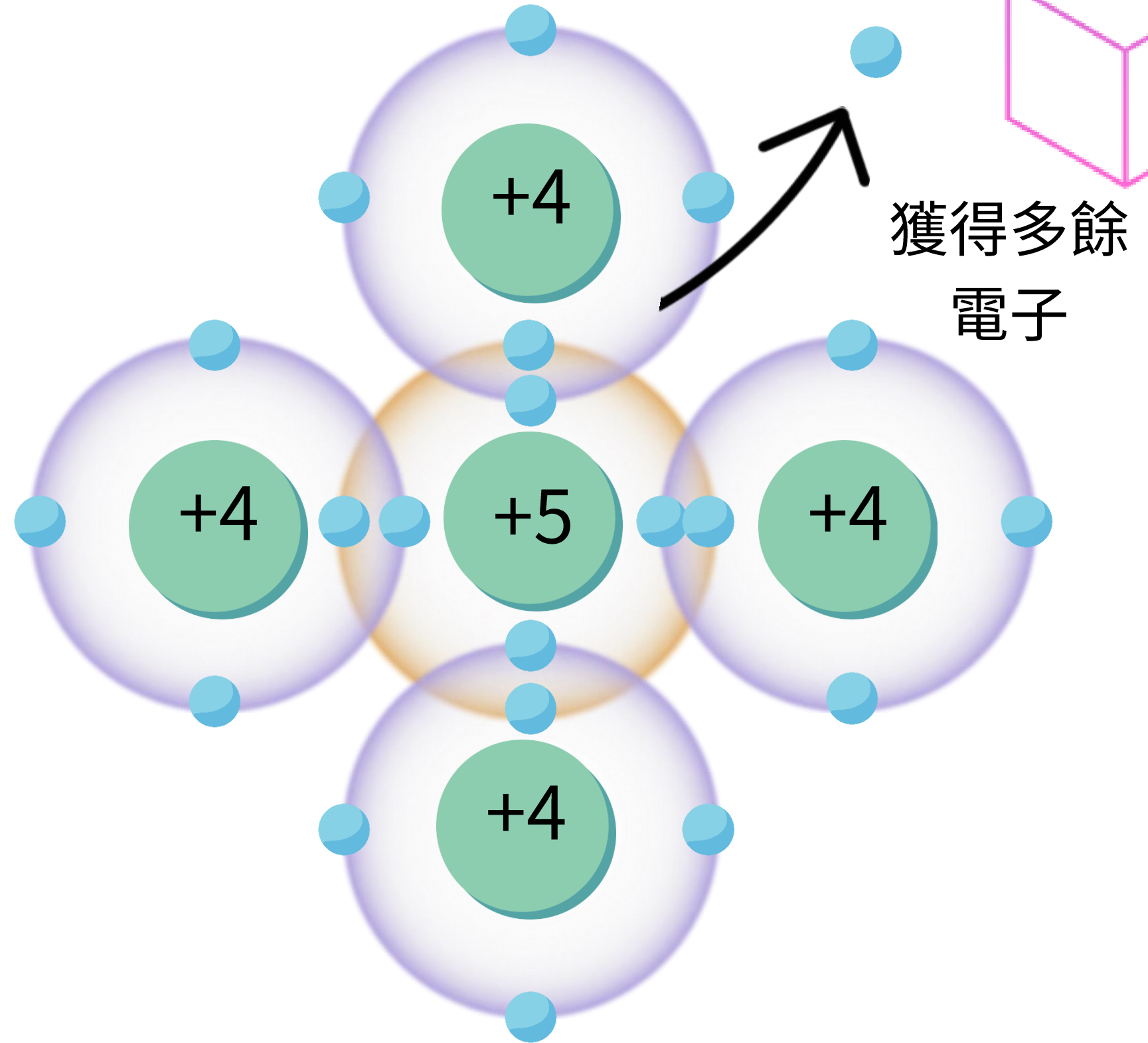
實驗被電神俱樂部

# 小...補充



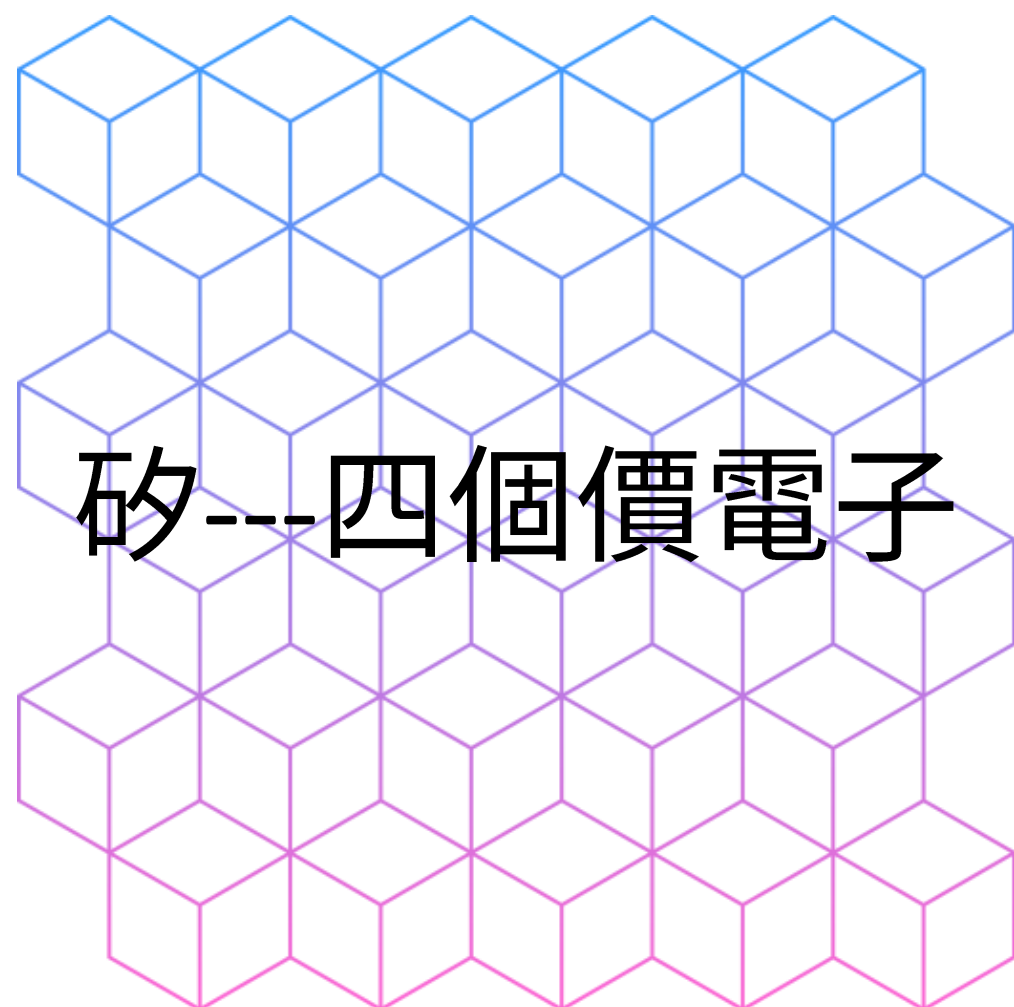
**N型半導體**  
(N-TYPE SEMICONDUCTOR)

\*n代表帶負電荷的電子



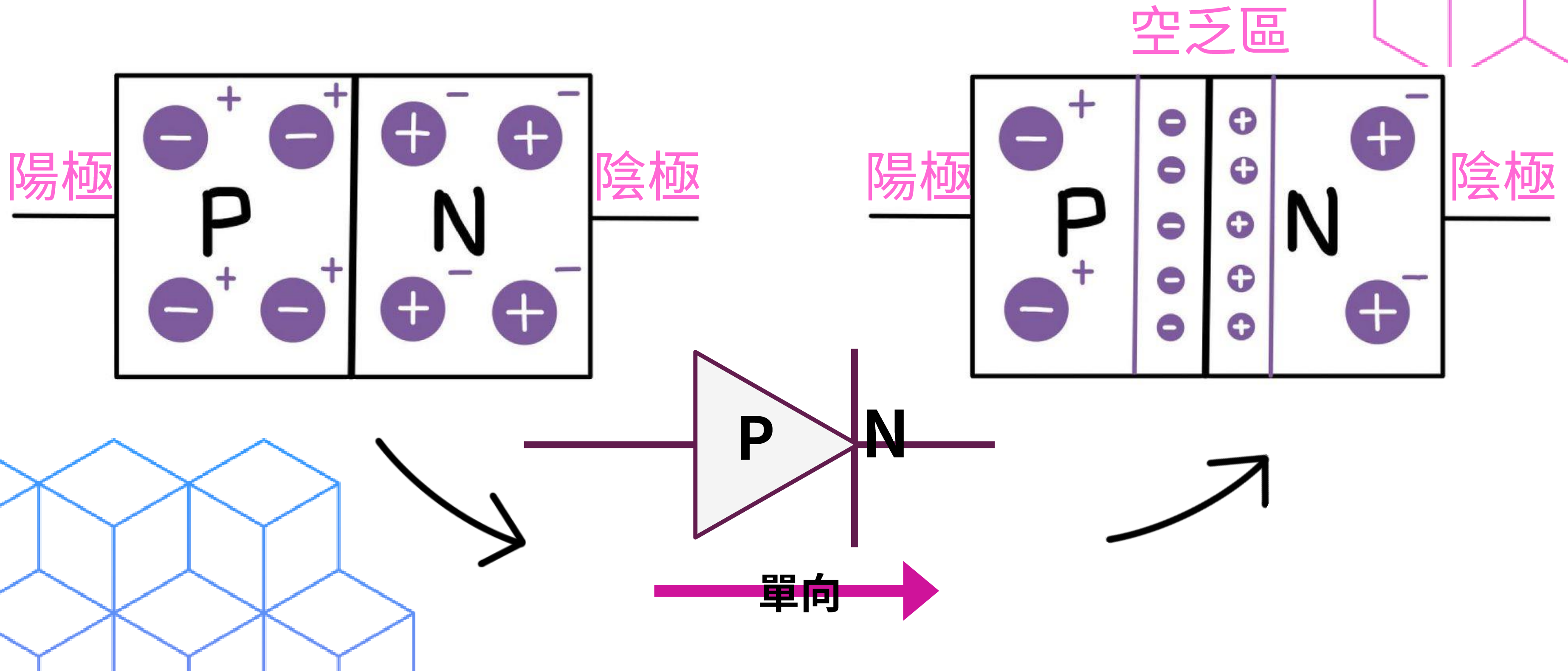
# 不懂嗎？

## 舉個例子---

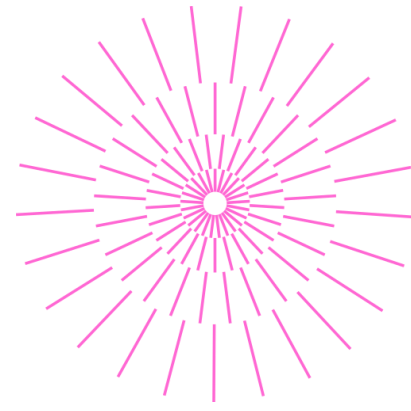


# 主動元件

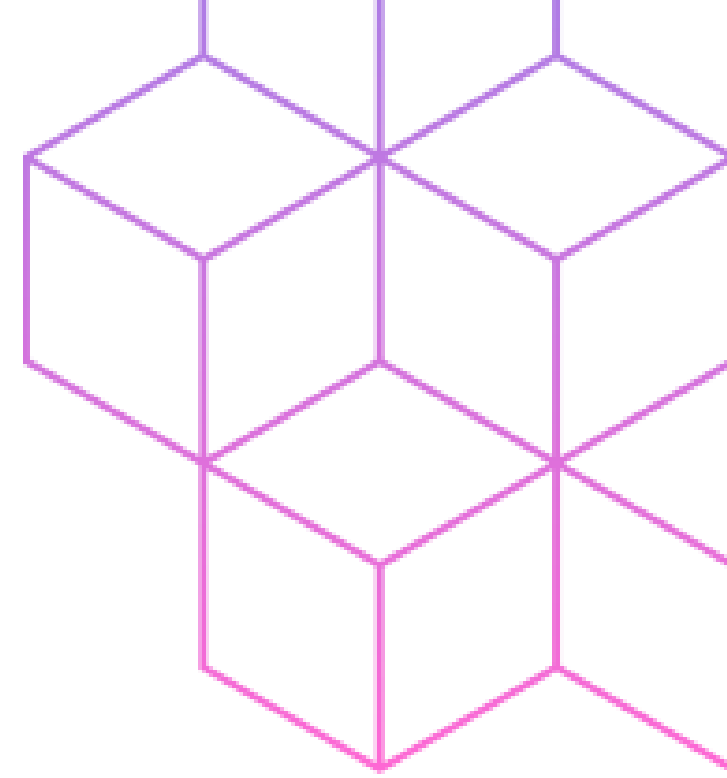
## — 二極體 (Diode)







實驗被電神俱樂部



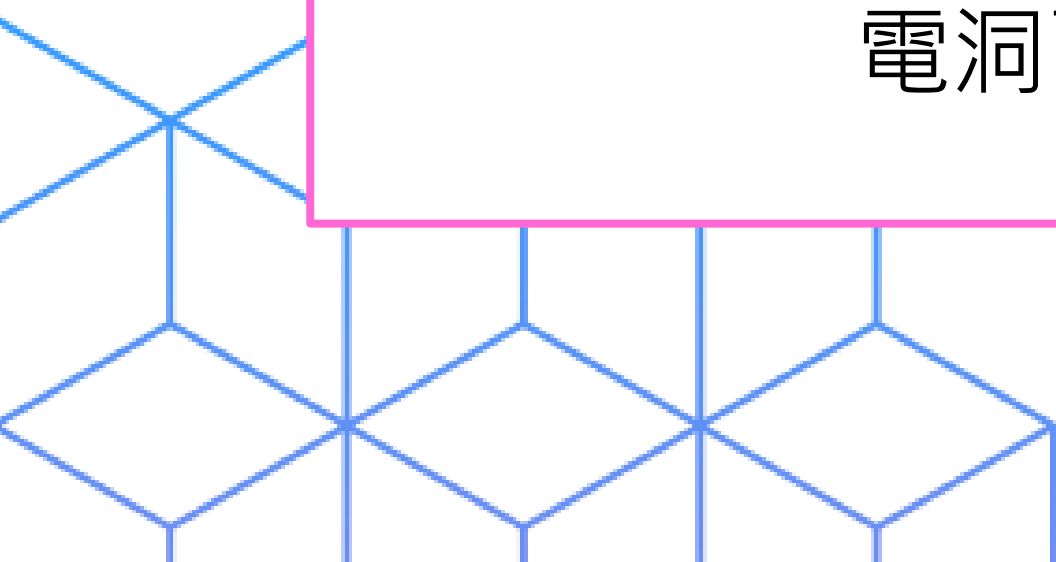
# 偏壓 (Bias)

**順向偏壓**  
(Forward bias)

空乏區變小  
電洞可導通

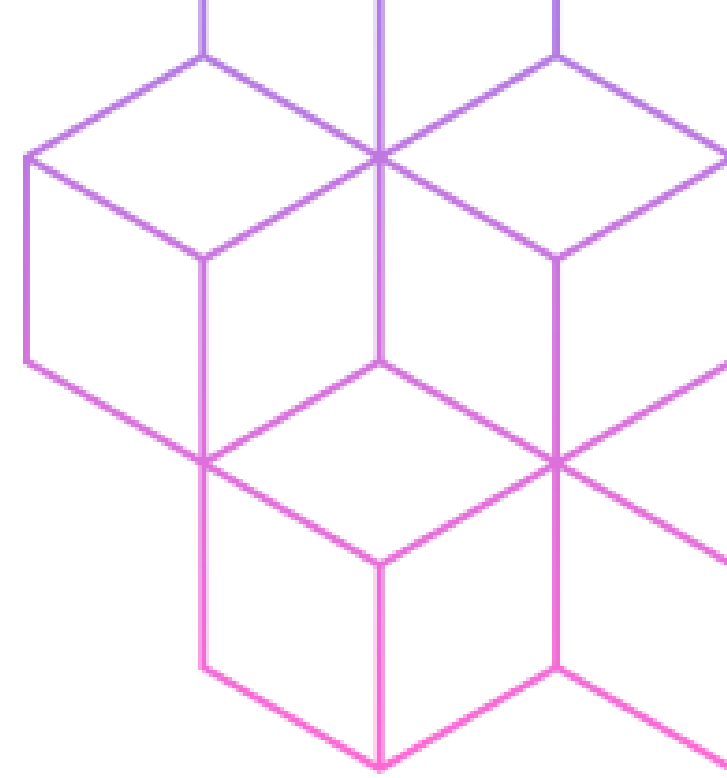
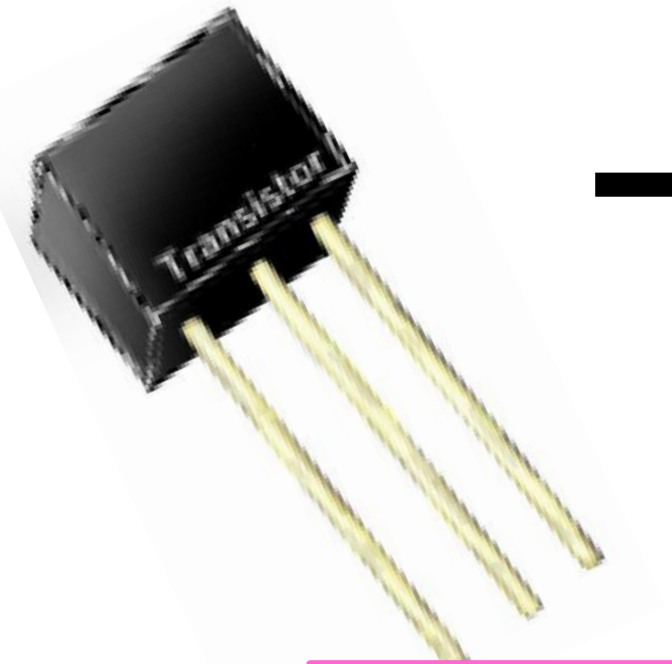
**逆向偏壓**  
(Reverse bias)

空乏區變大  
電子無法導通



# 主動元件

## —電晶體(Transistor)



開關

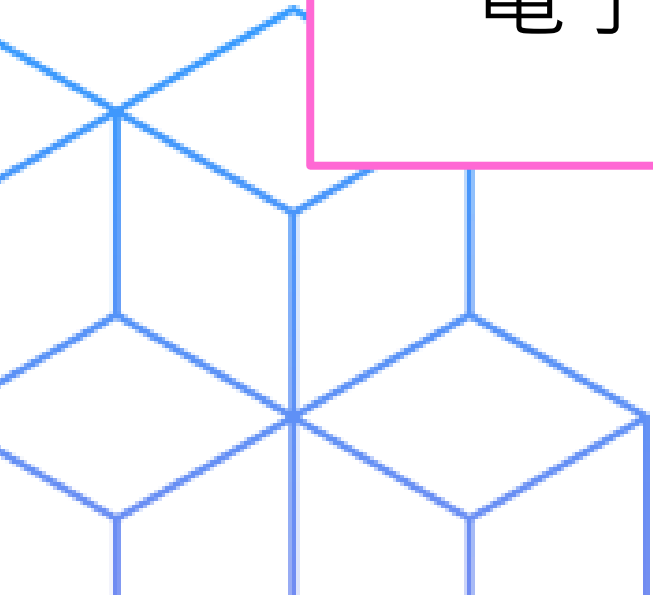
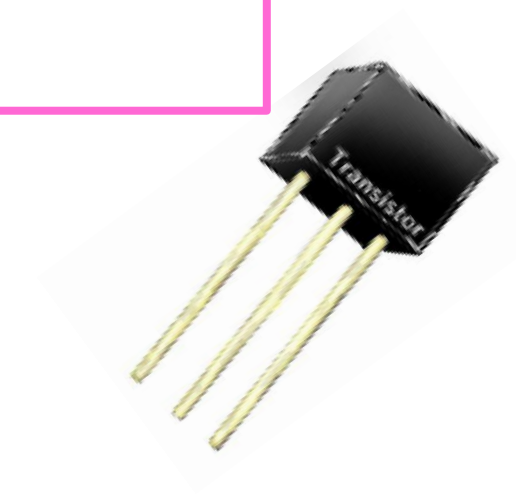
(Switch)

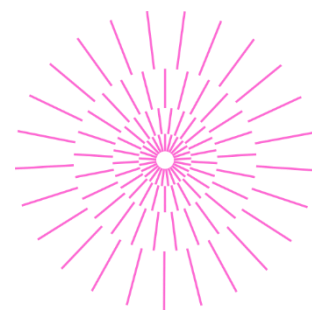
電子或電洞可導通與不可導通

放大器

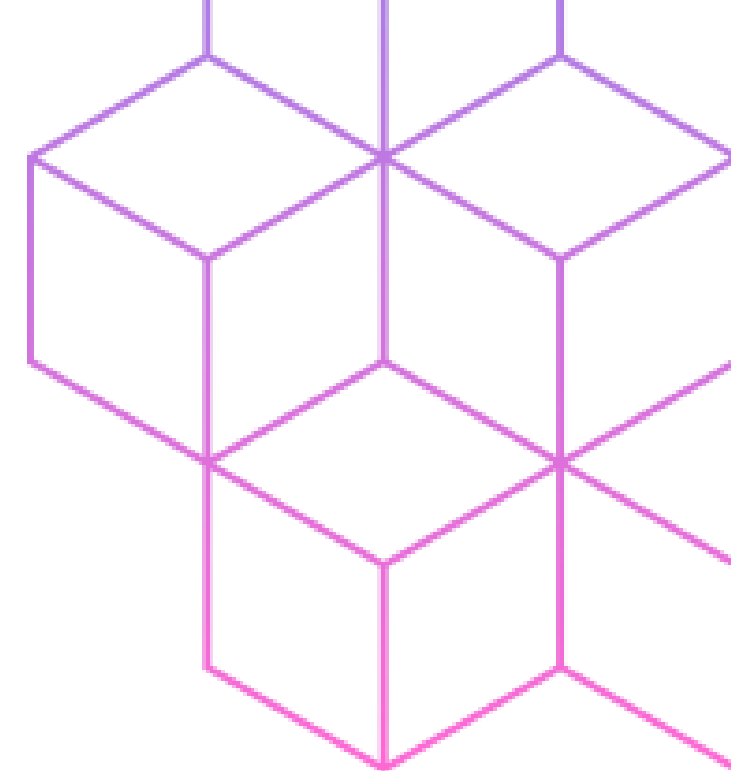
(Amplifier)

使電壓或電流放大





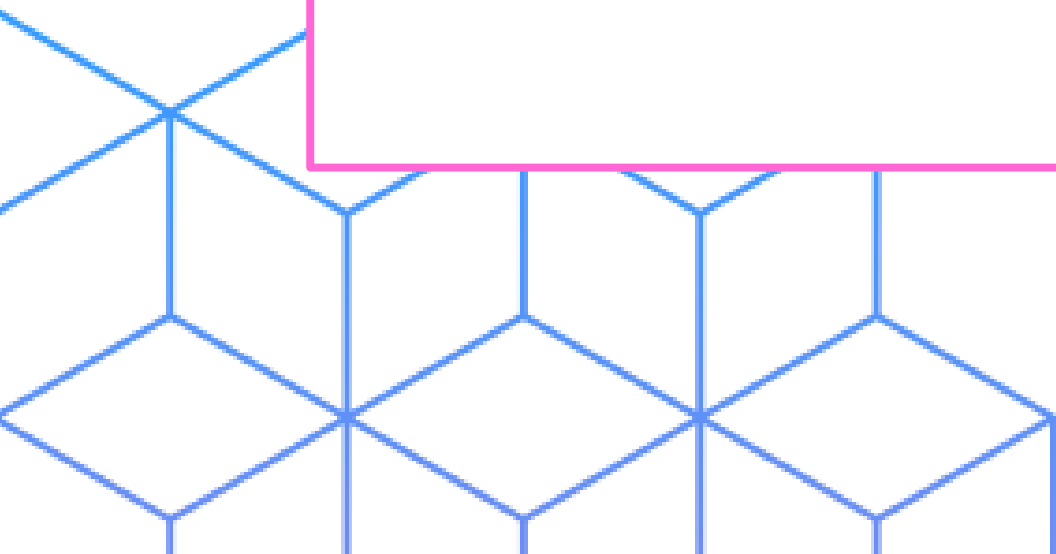
實驗被電神俱樂部

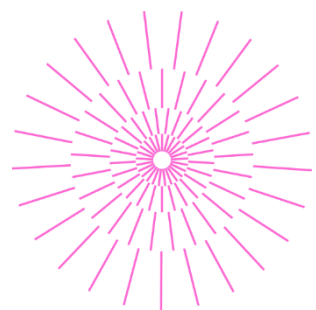


# 電晶體的兩種主要類型

雙極性接面型電晶體  
(BJT)

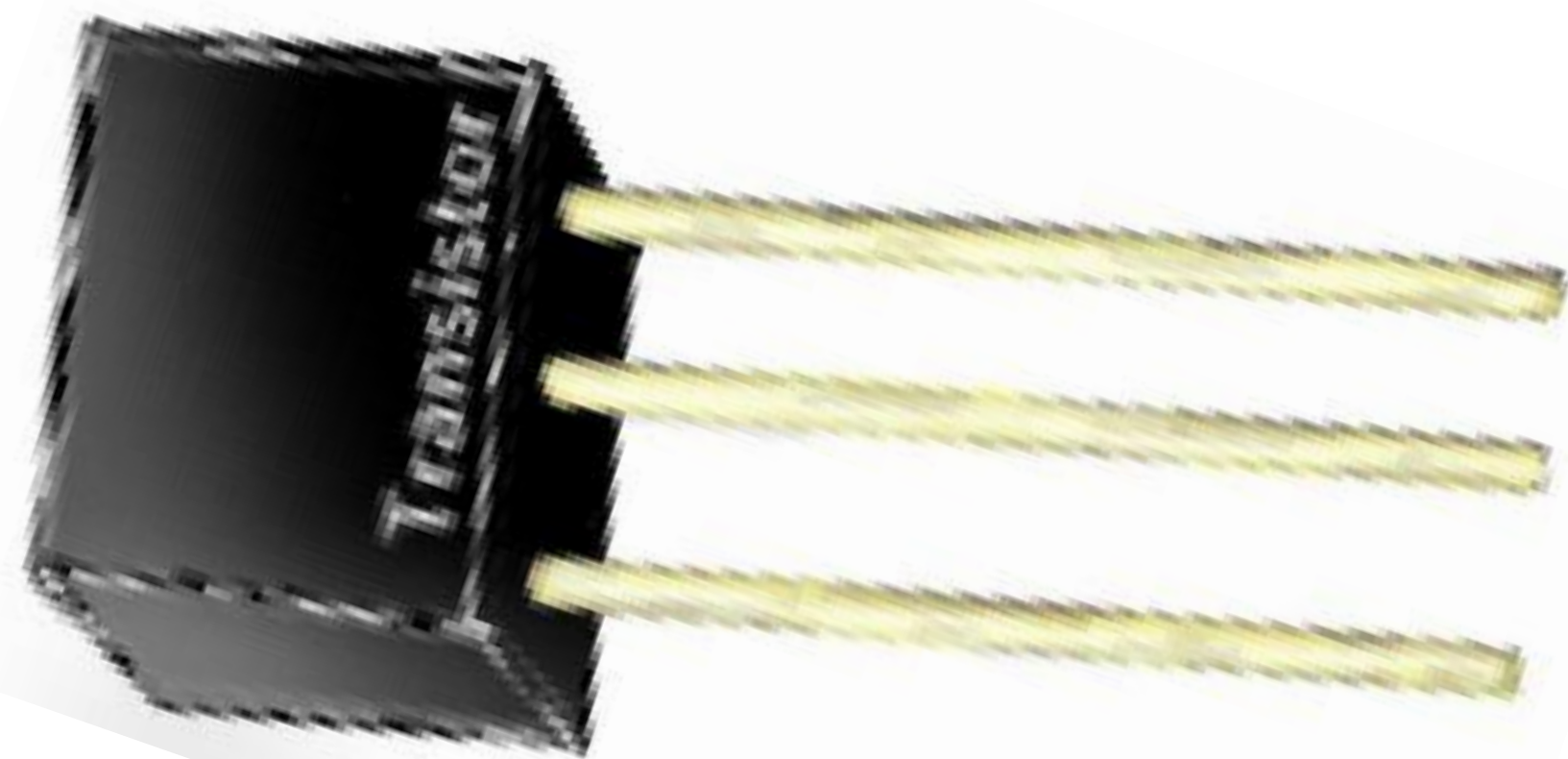
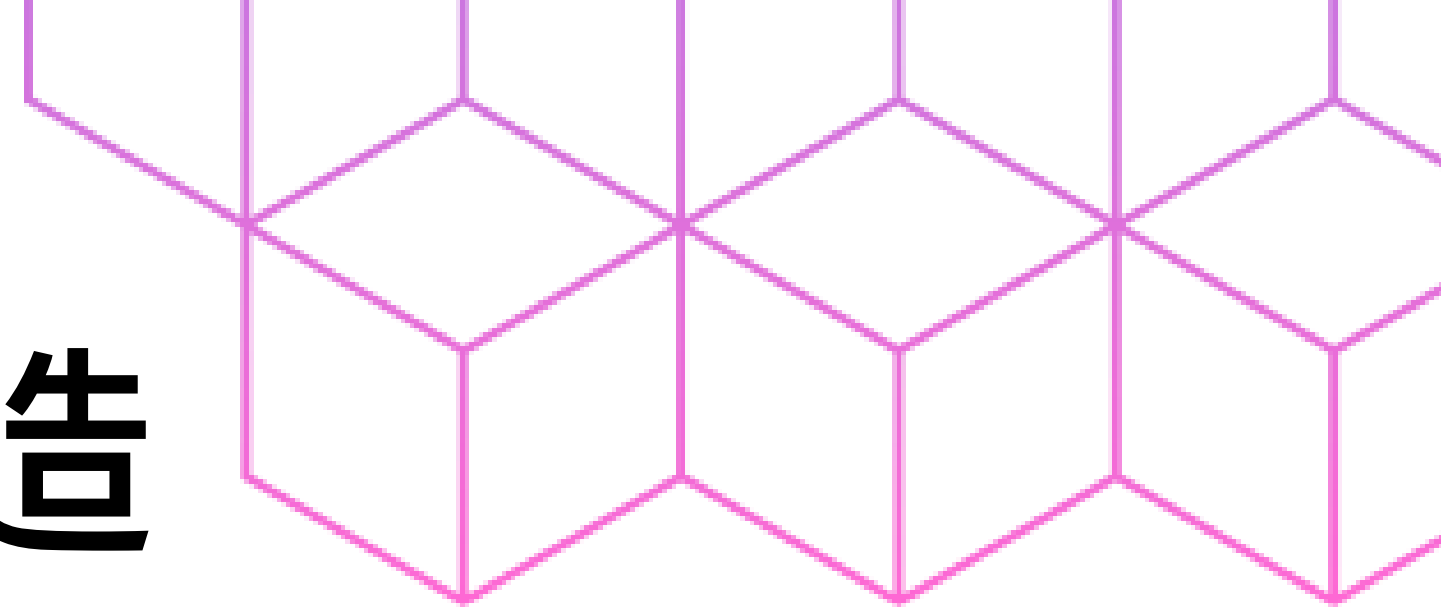
場效電晶體  
(FET)





實驗被電神俱樂部

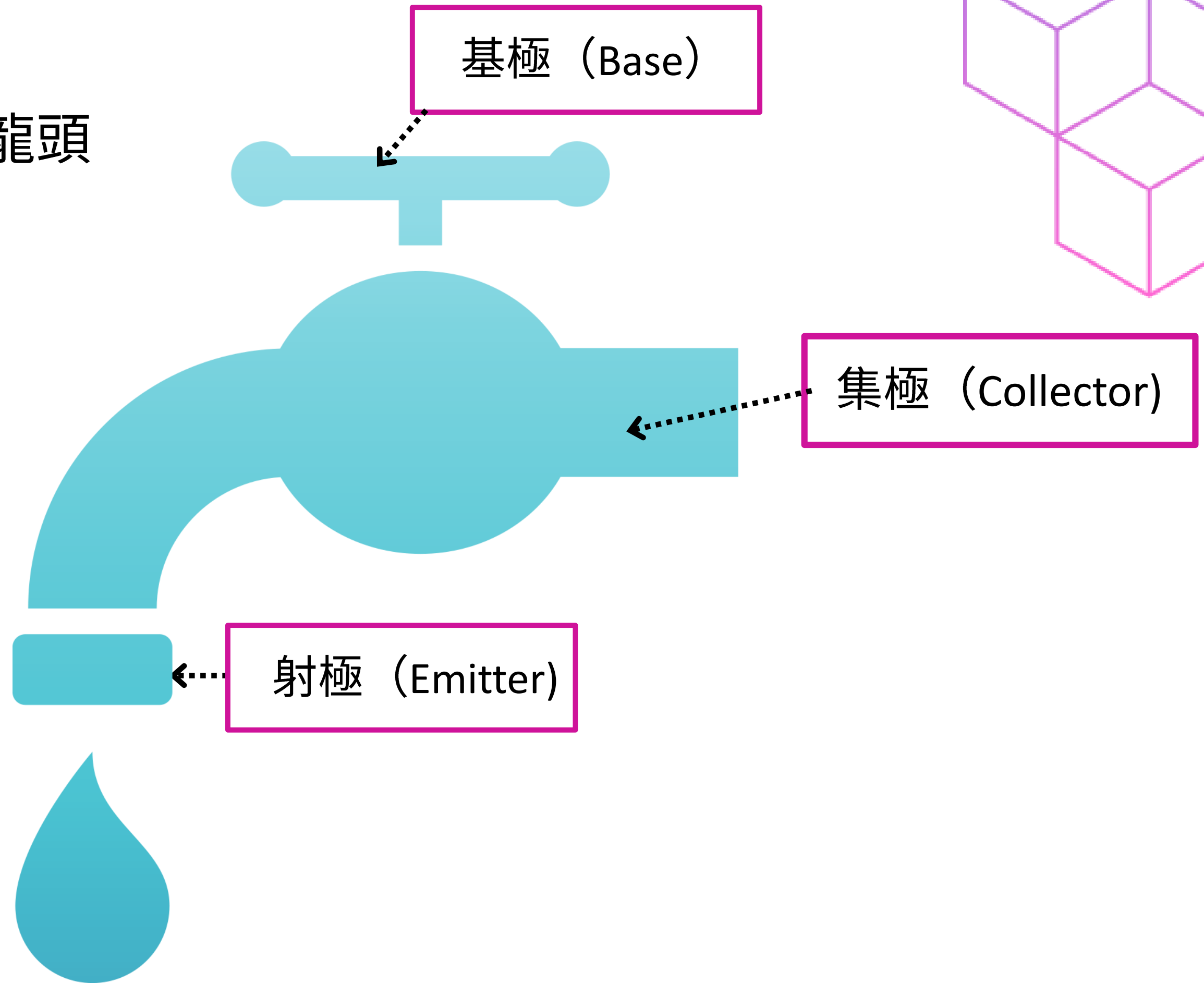
# BJT電晶體的構造

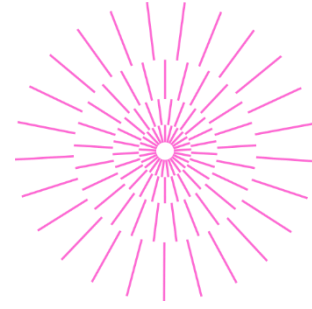


射極 (Emitter) —  
基極 (Base)  
集極 (Collector) +

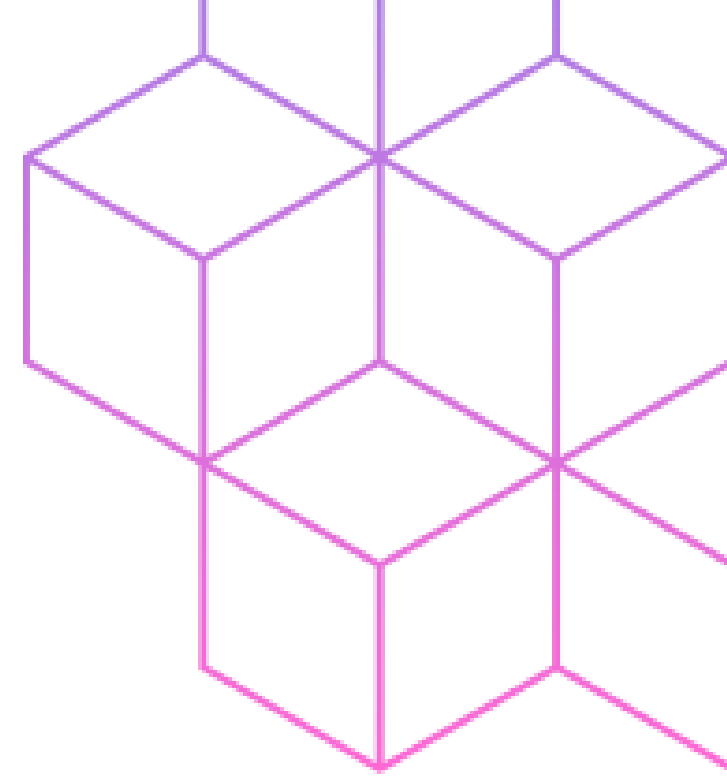
# 簡單來說：

我們可以想回前面的水龍頭





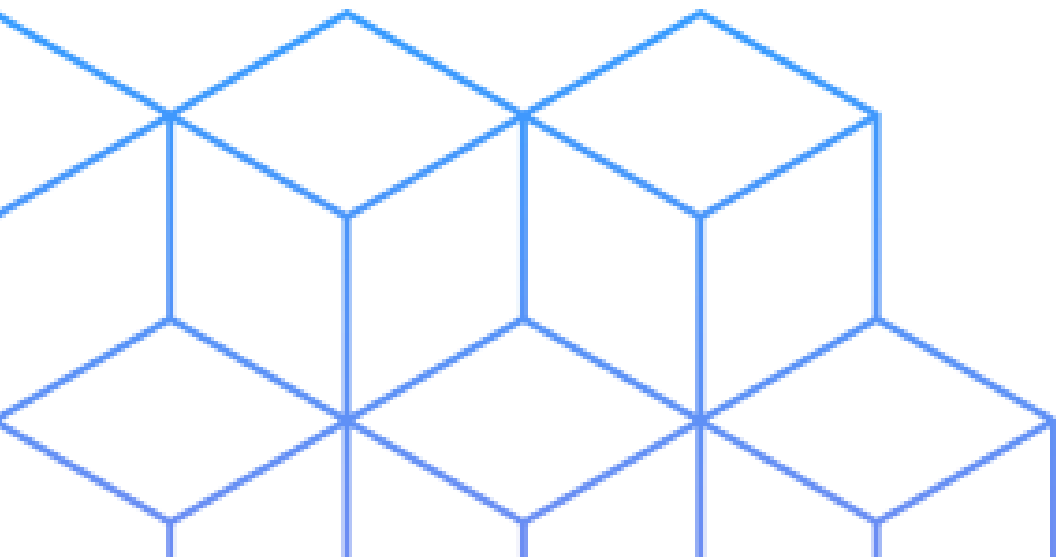
實驗被電神俱樂部



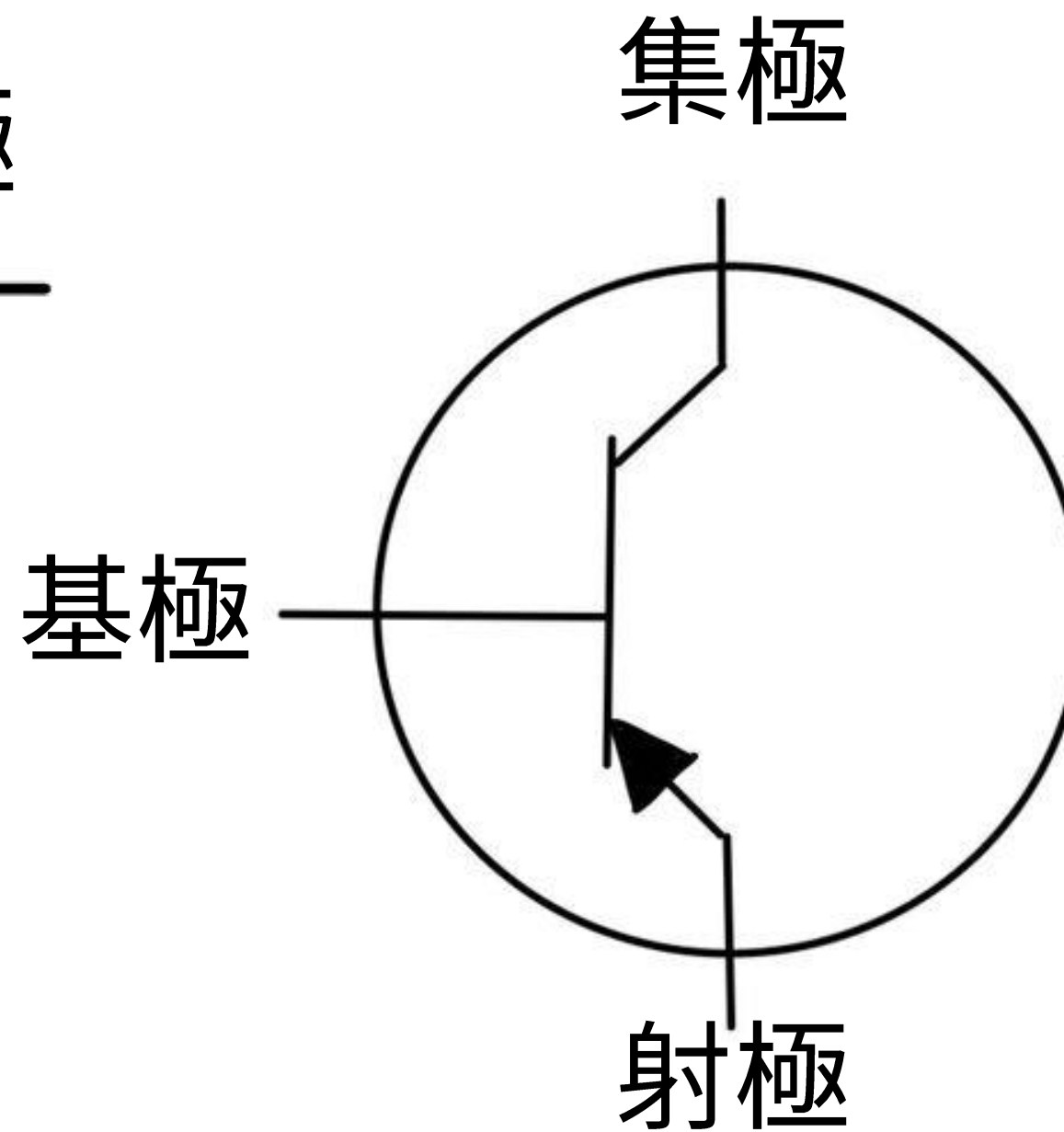
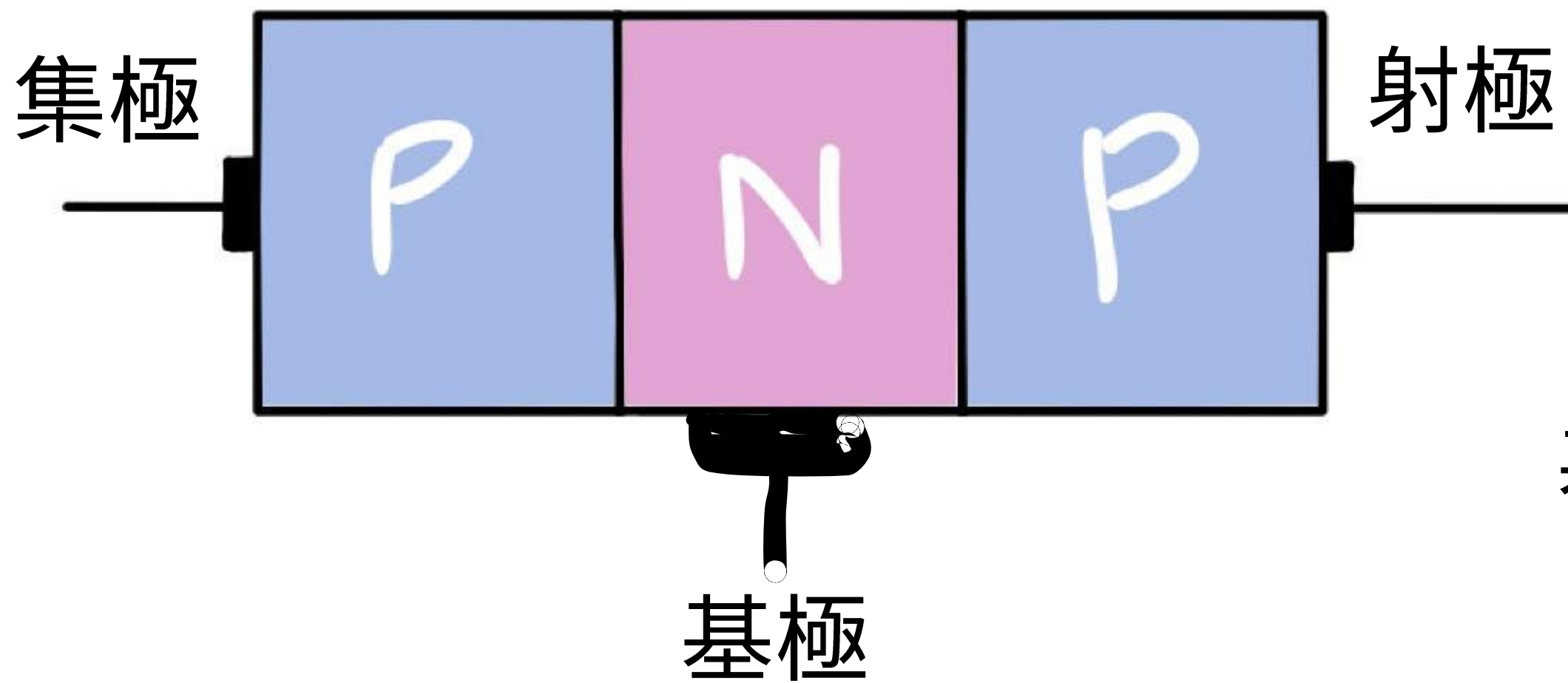
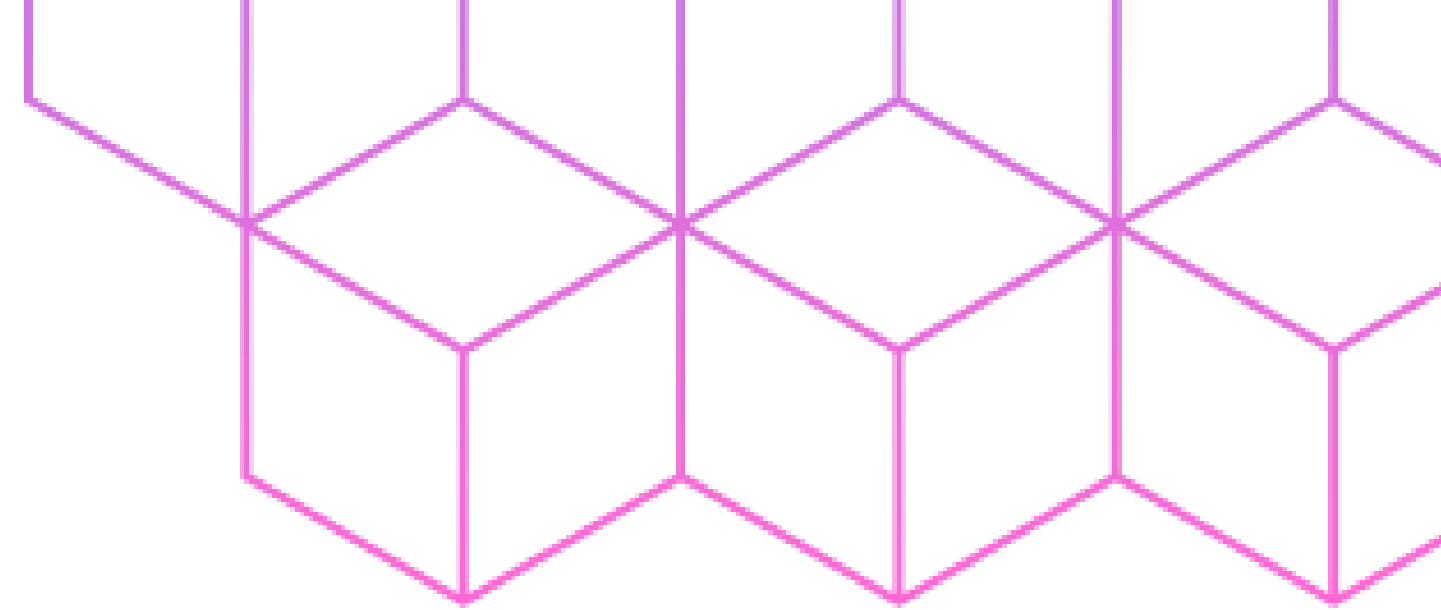
# BJT的兩種類型

**P-N-P電晶體**

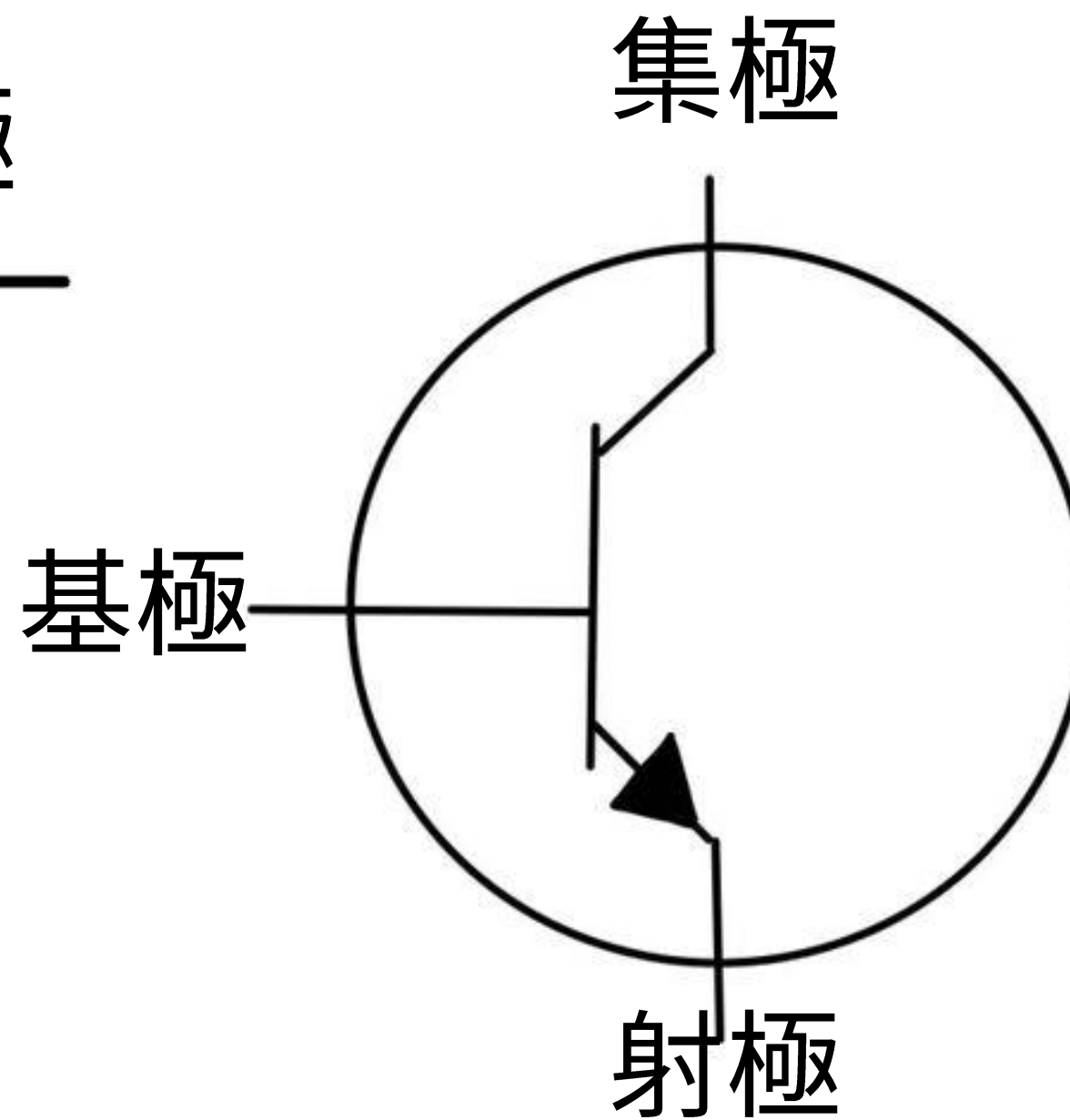
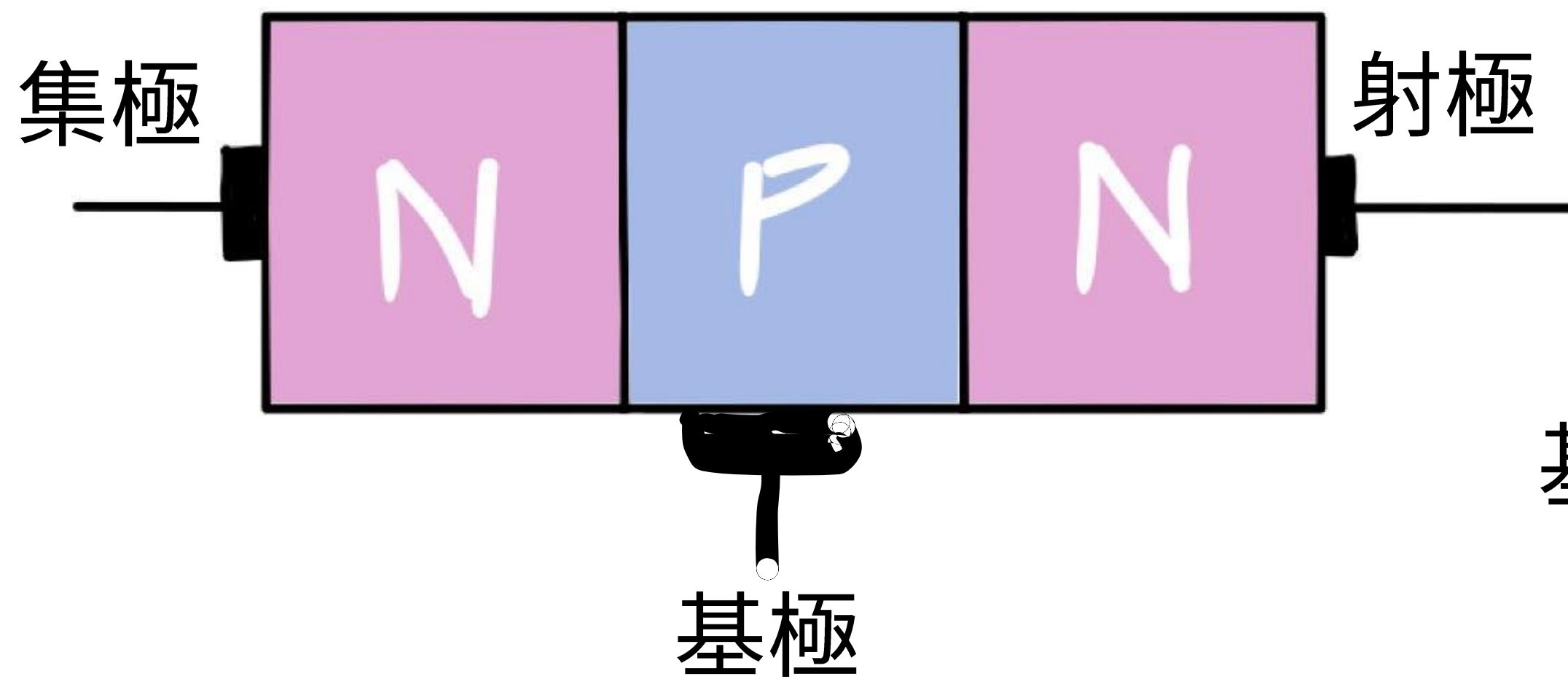
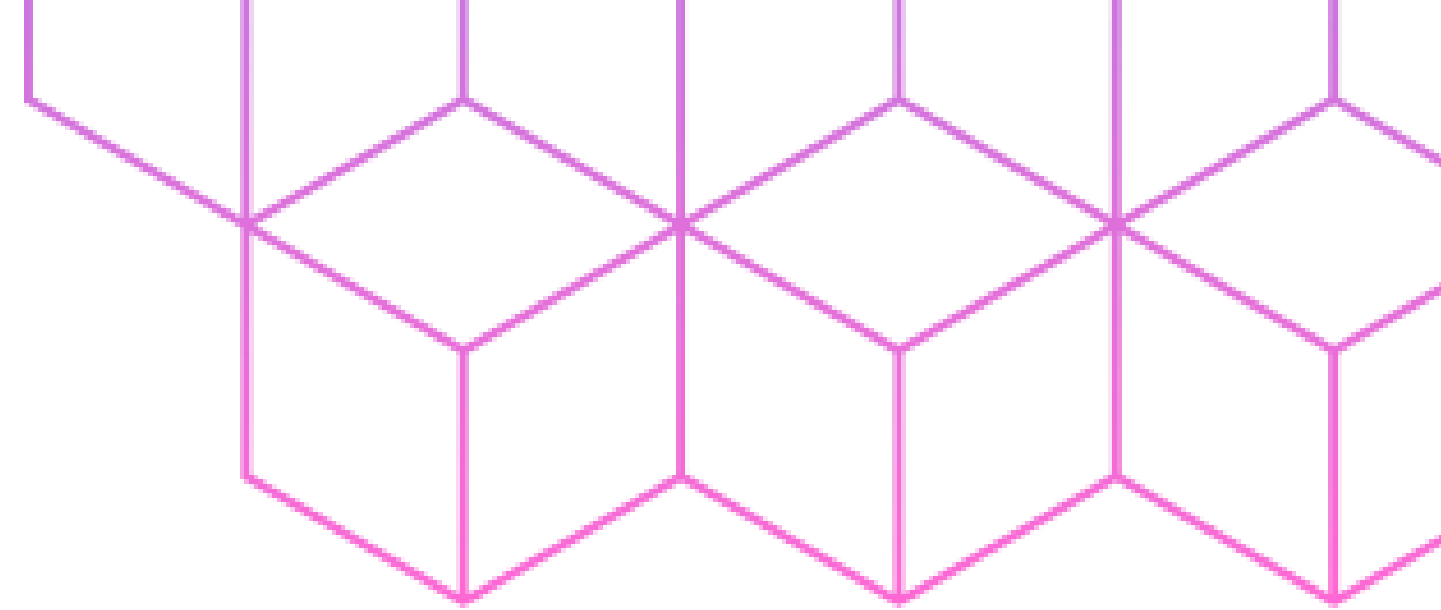
**N-P-N電晶體**



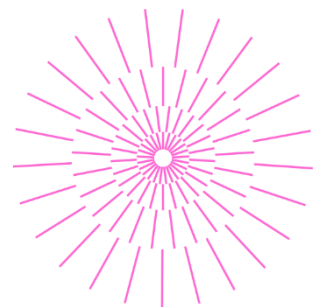
# P-N-P電晶體



# N-P-N電晶體

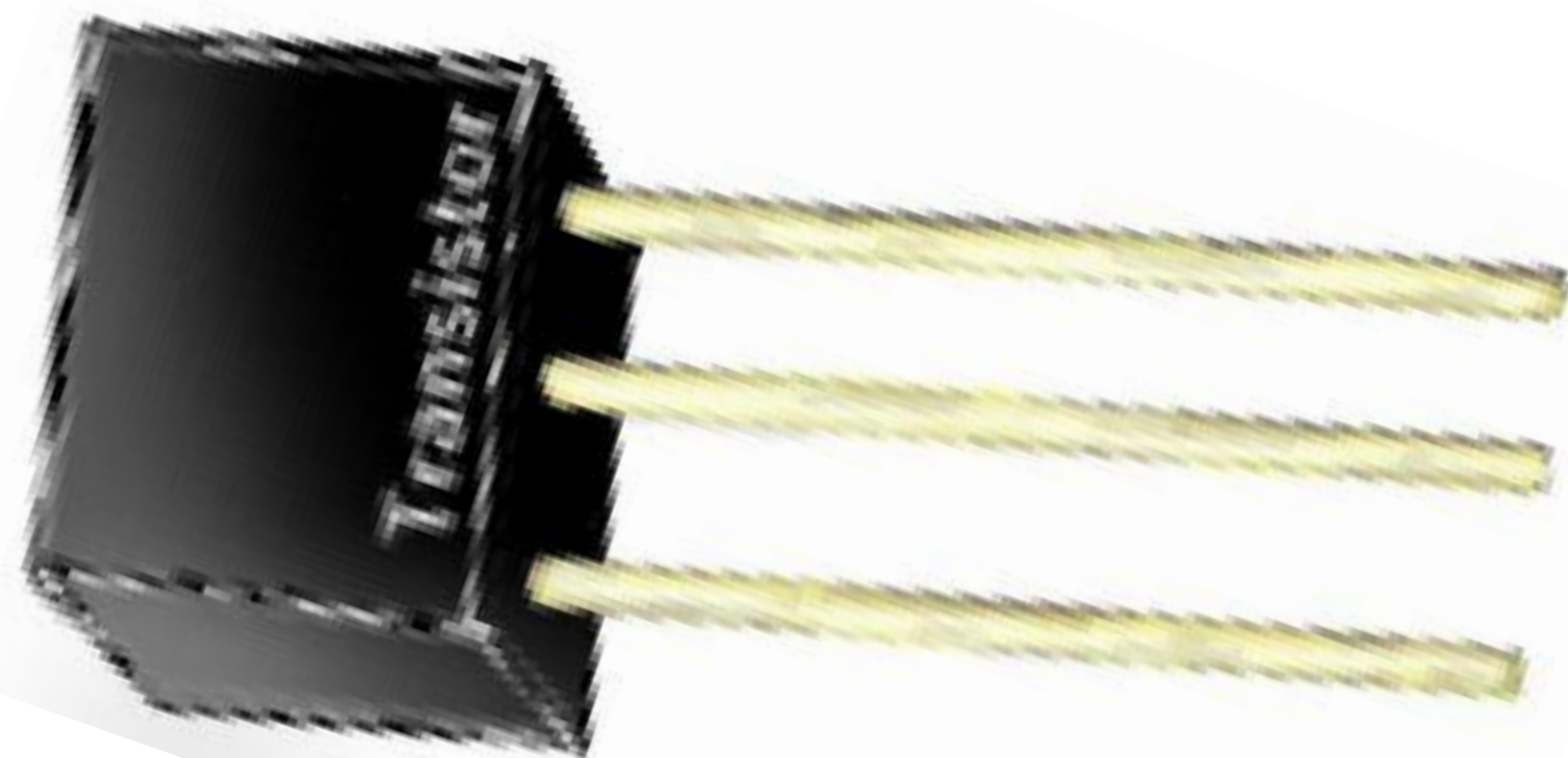






實驗被電神俱樂部

# FET電晶體的構造



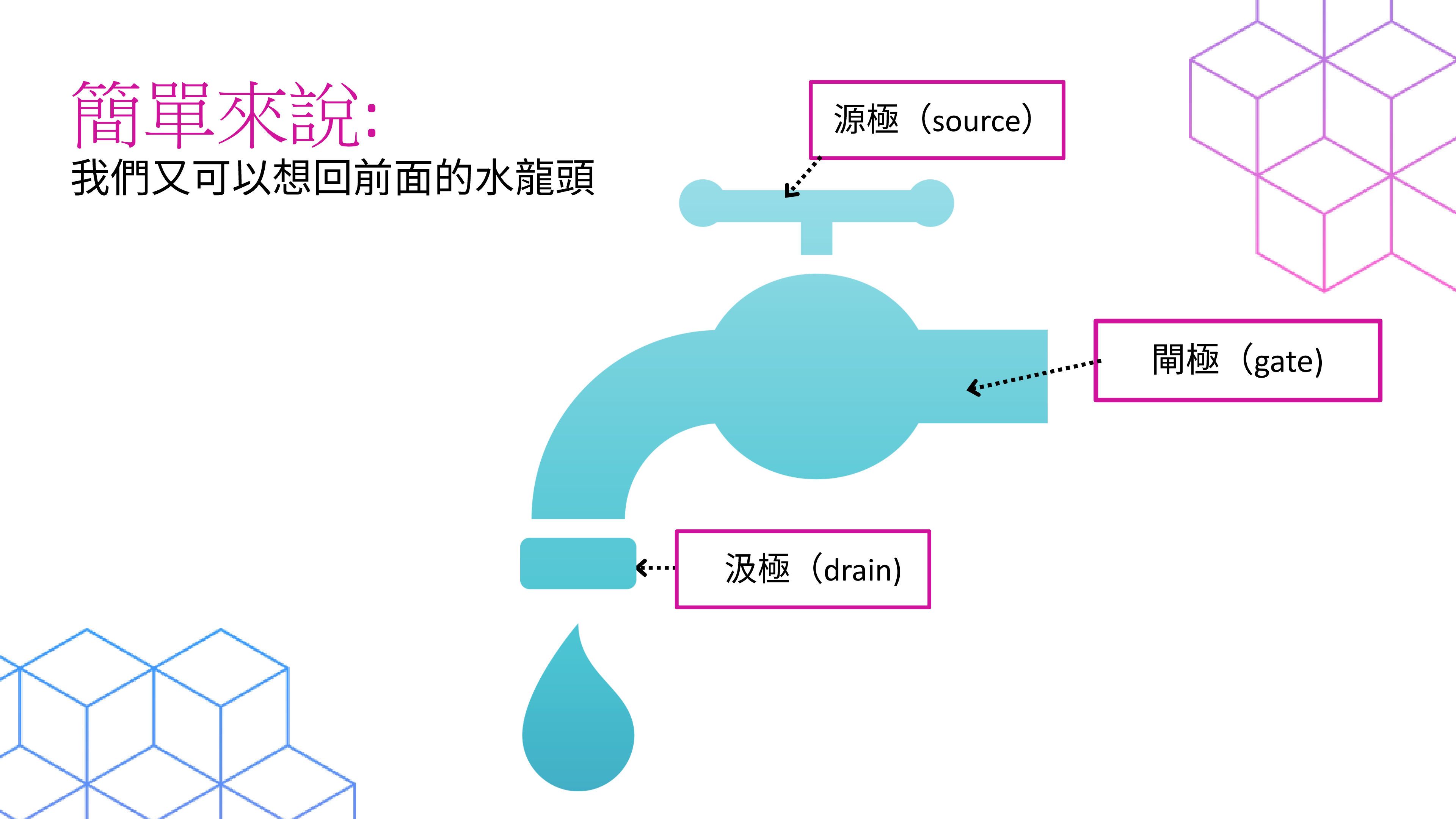
汲極 (drain)

源極 (source)

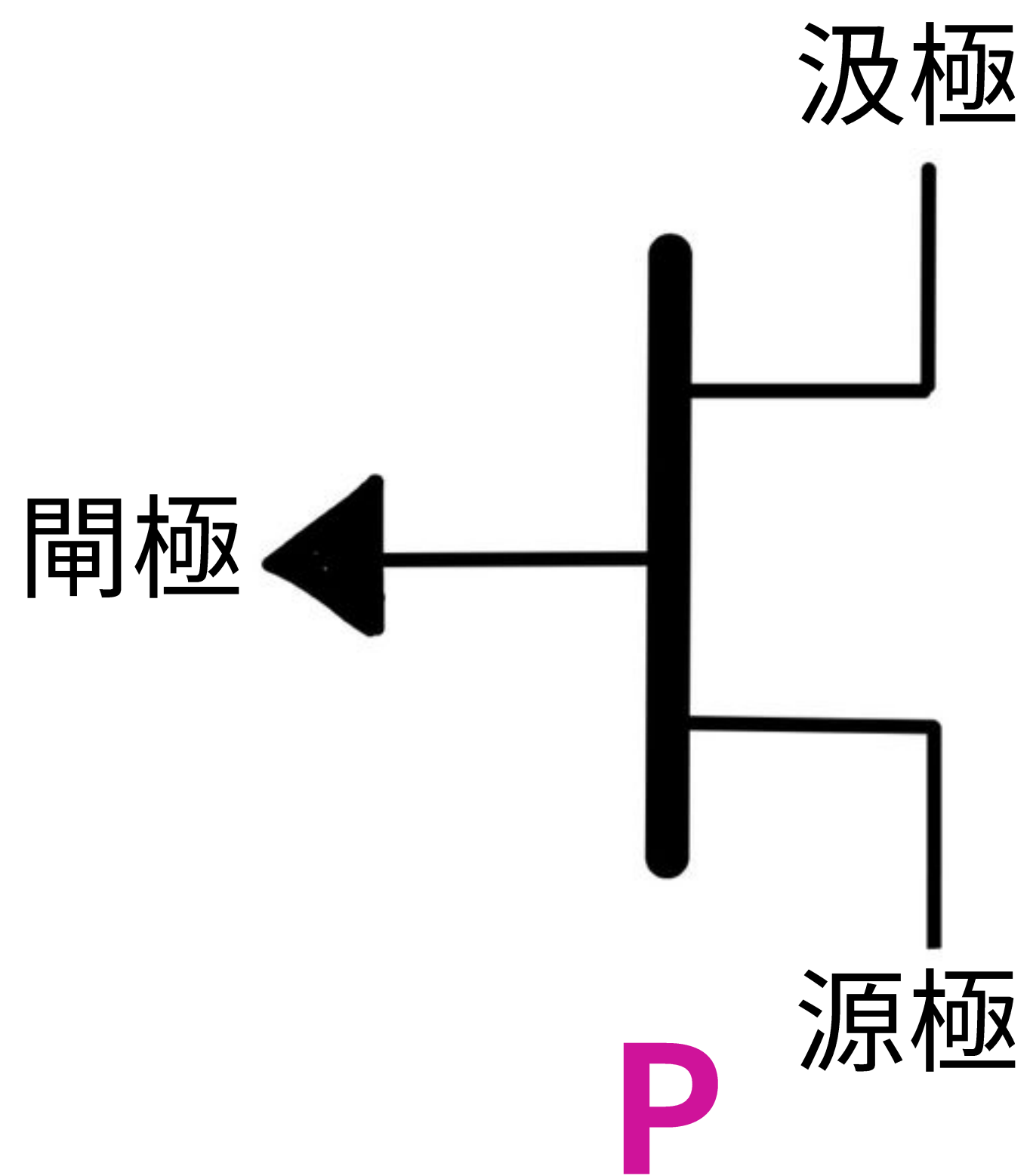
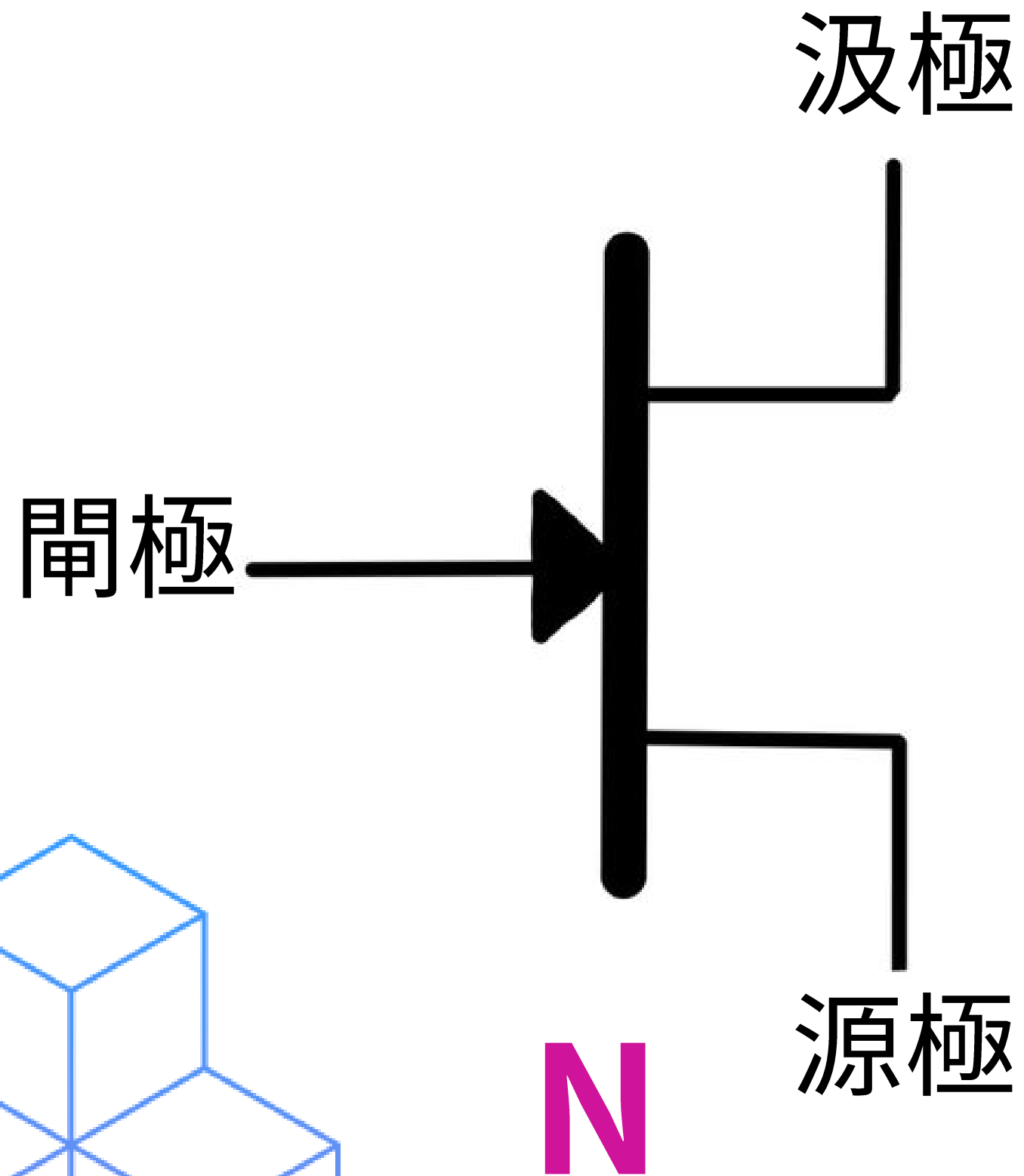
閘極 (gate)

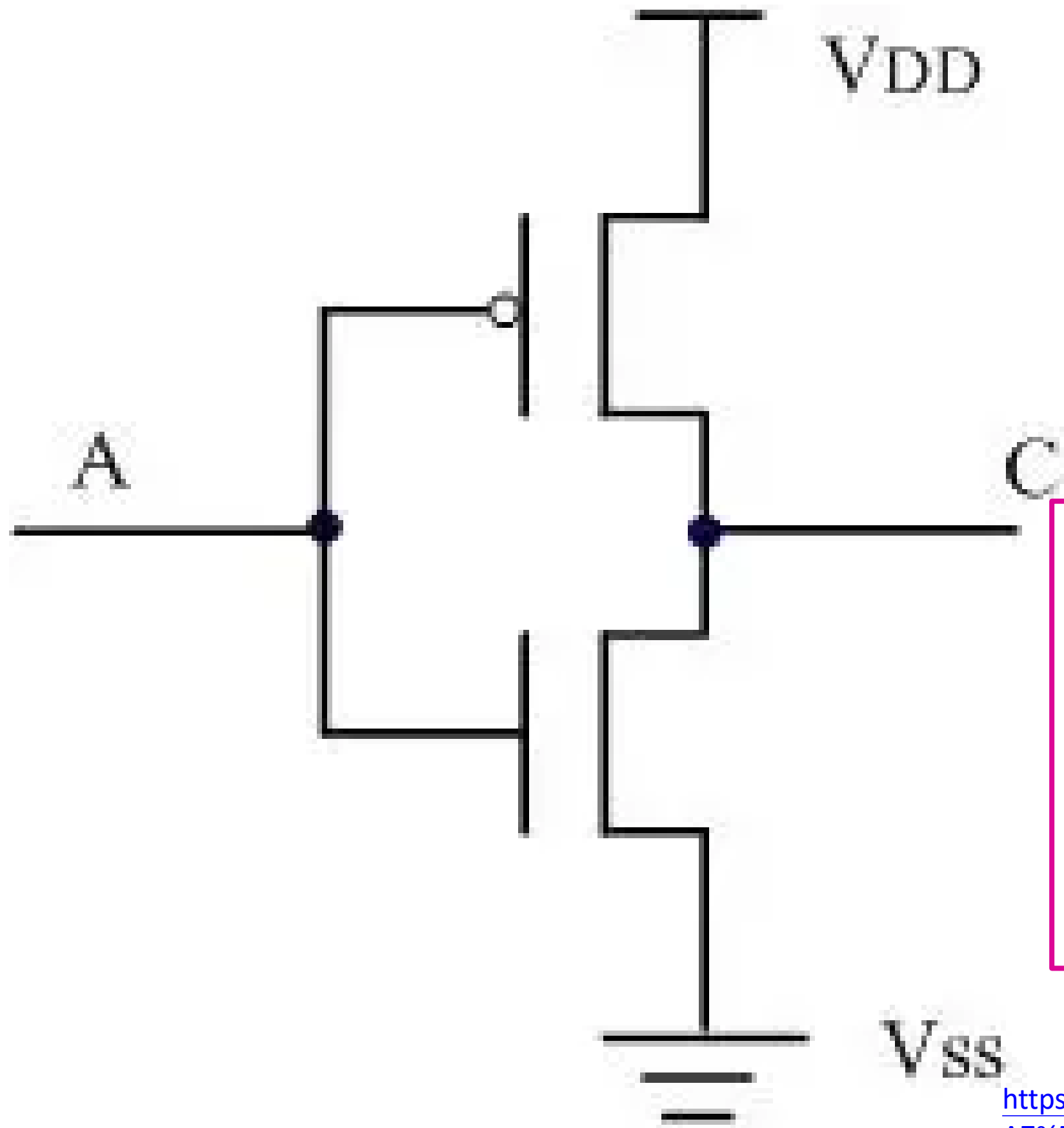
# 簡單來說：

我們又可以想回前面的水龍頭



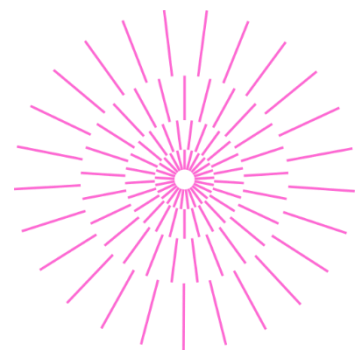
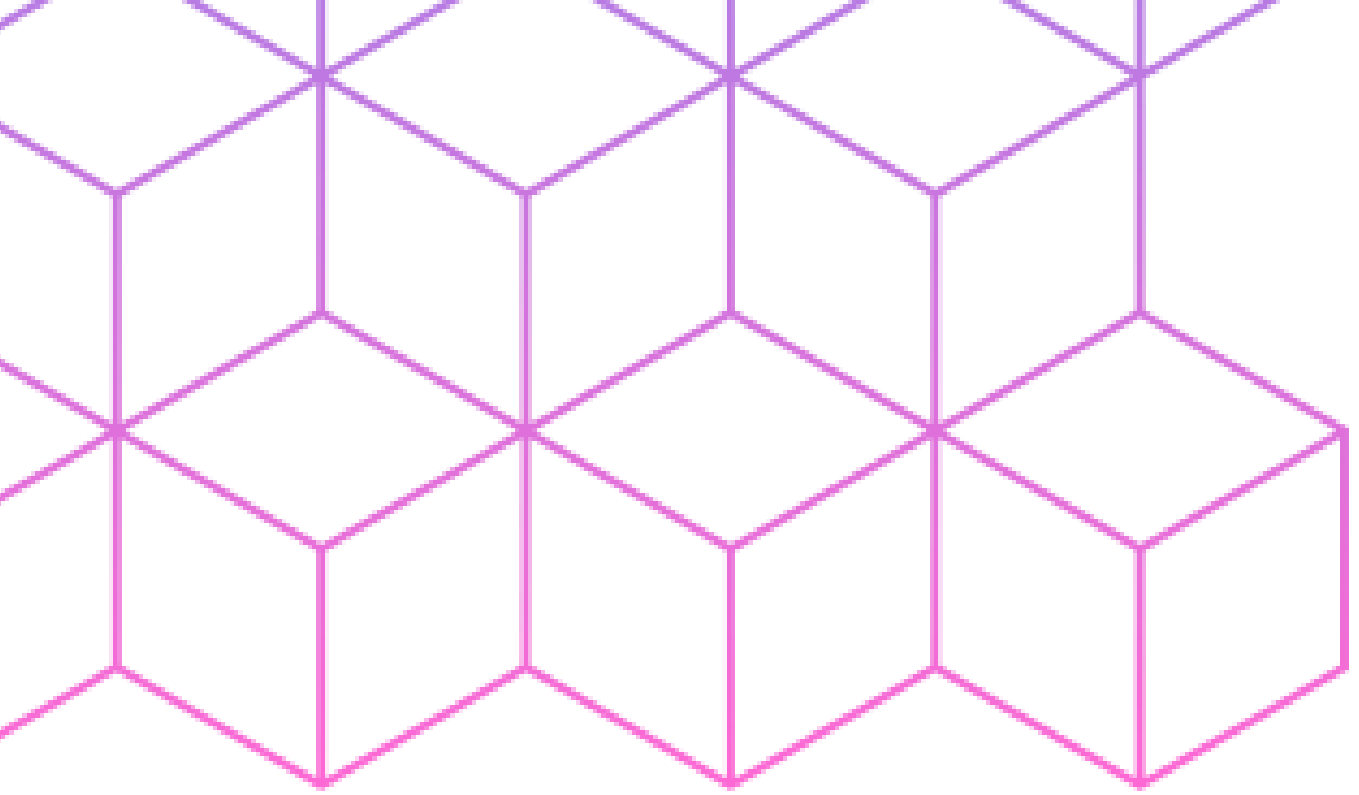
# FET電晶體的N型與P型





兩種類型的水龍頭，一種向上拉才會出水、另一種向下壓才會出水。

<https://takako042.wordpress.com/2008/09/11/%E9%9B%BB%E8%B7%AF%E5%B8%B8%E8%AD%98%E6%80%A7%E6%A6%82%E5%BF%B5%EF%BC%888%EF%BC%89-mos%E7%AE%A1%E5%8F%8A%E7%B0%A1%E5%96%AEcmos%E9%82%8F%E8%BC%AF%E9%96%80%E9%9B%BB%E8%B7%AF%E5%8E%9F%E7%90%86%E5%9C%96/>

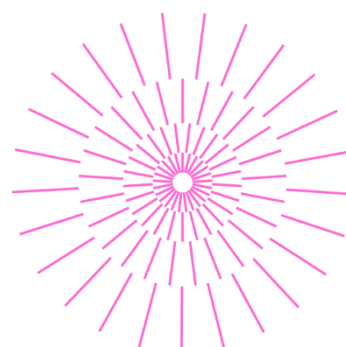
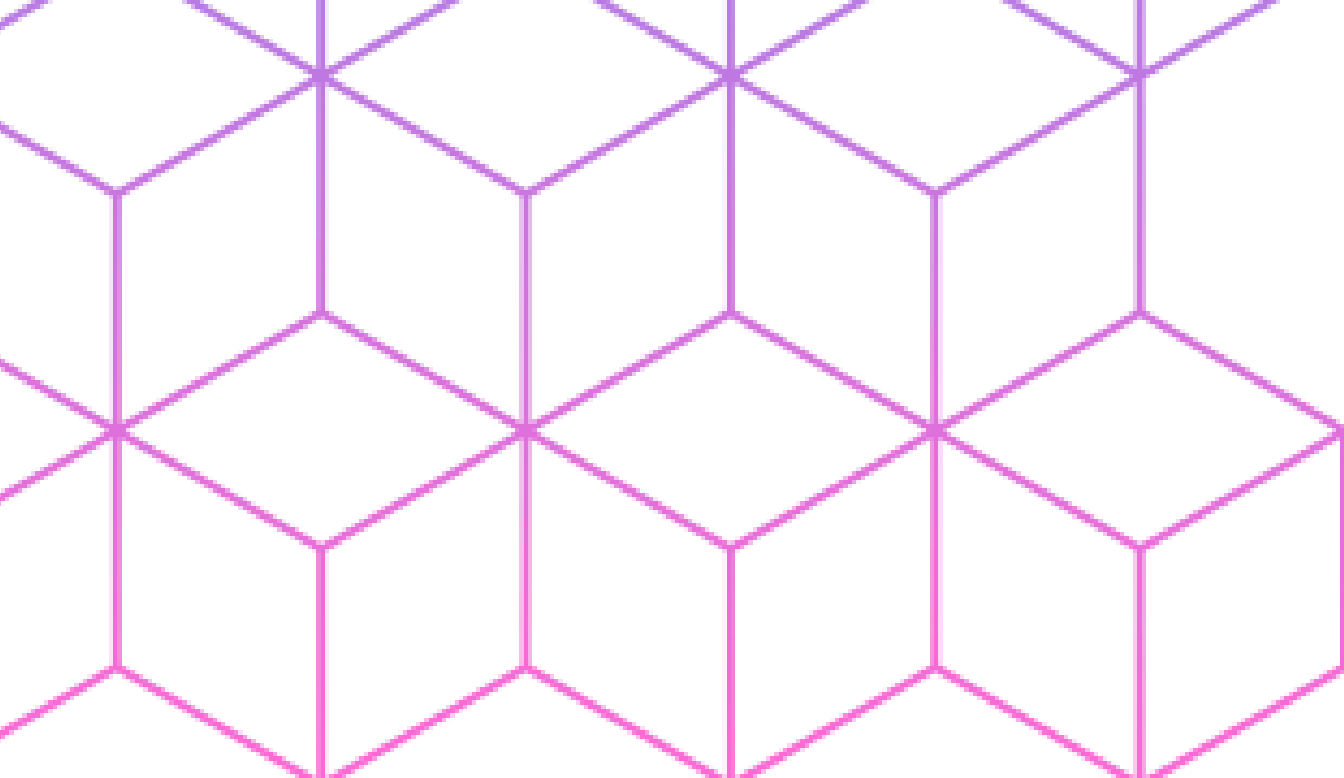


實驗被電神俱樂部

# 被動元件

- 不會產生電力
- 會儲存或釋放電力
- 配合電子主動元件運作

電容器(Condenser)  
電阻器(Resistor)  
電感器(Inductor)



實驗被電神俱樂部

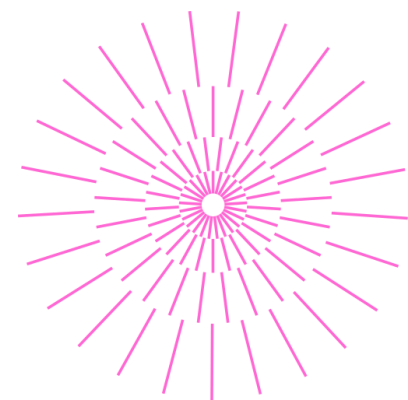
# 被動元件

電容器

電阻器

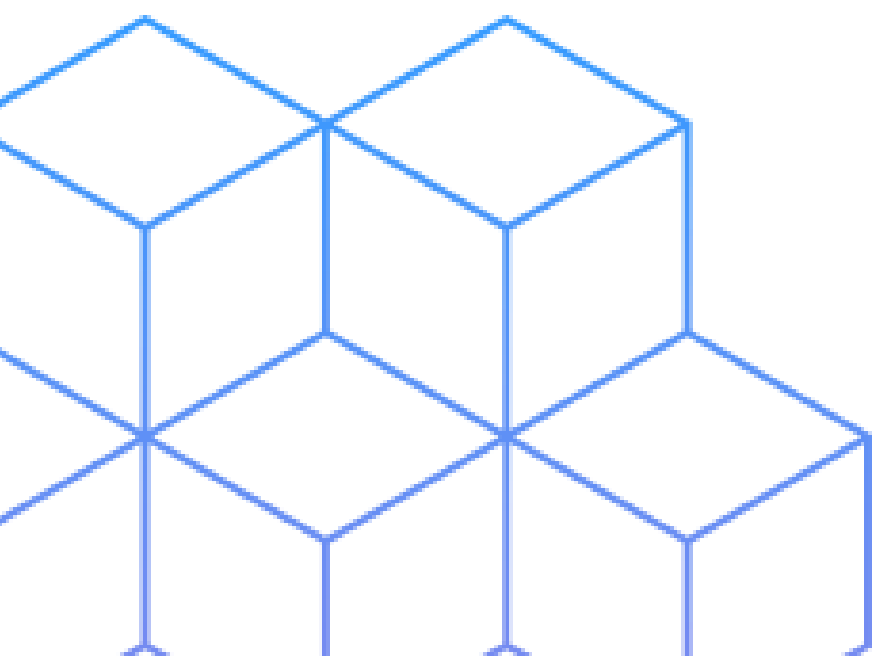
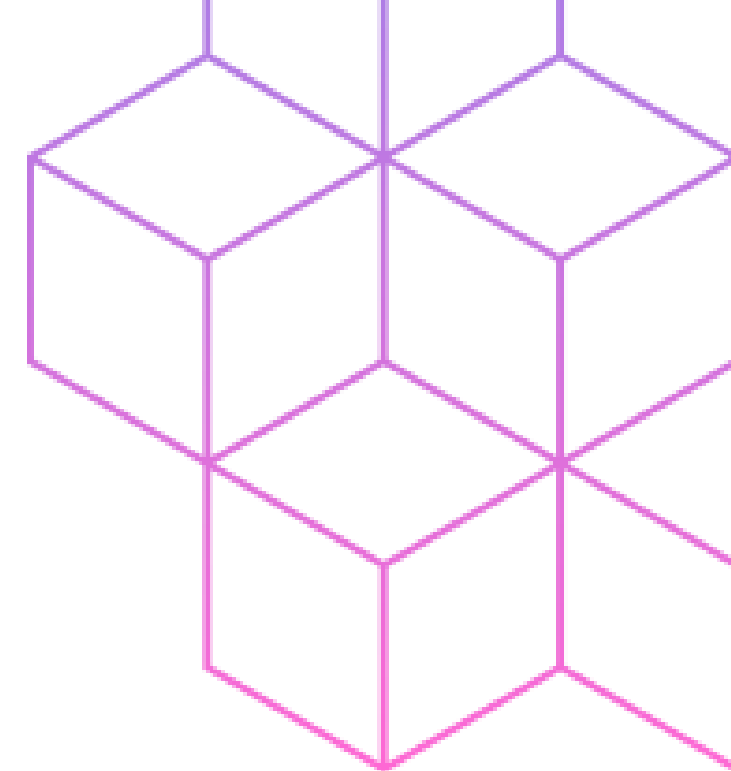
電感器

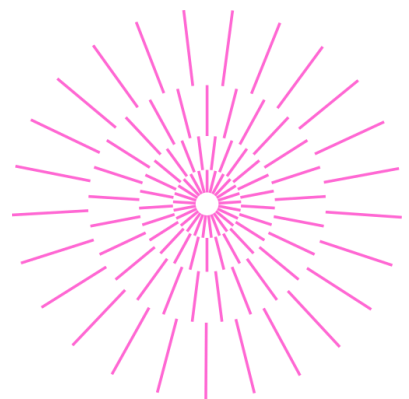
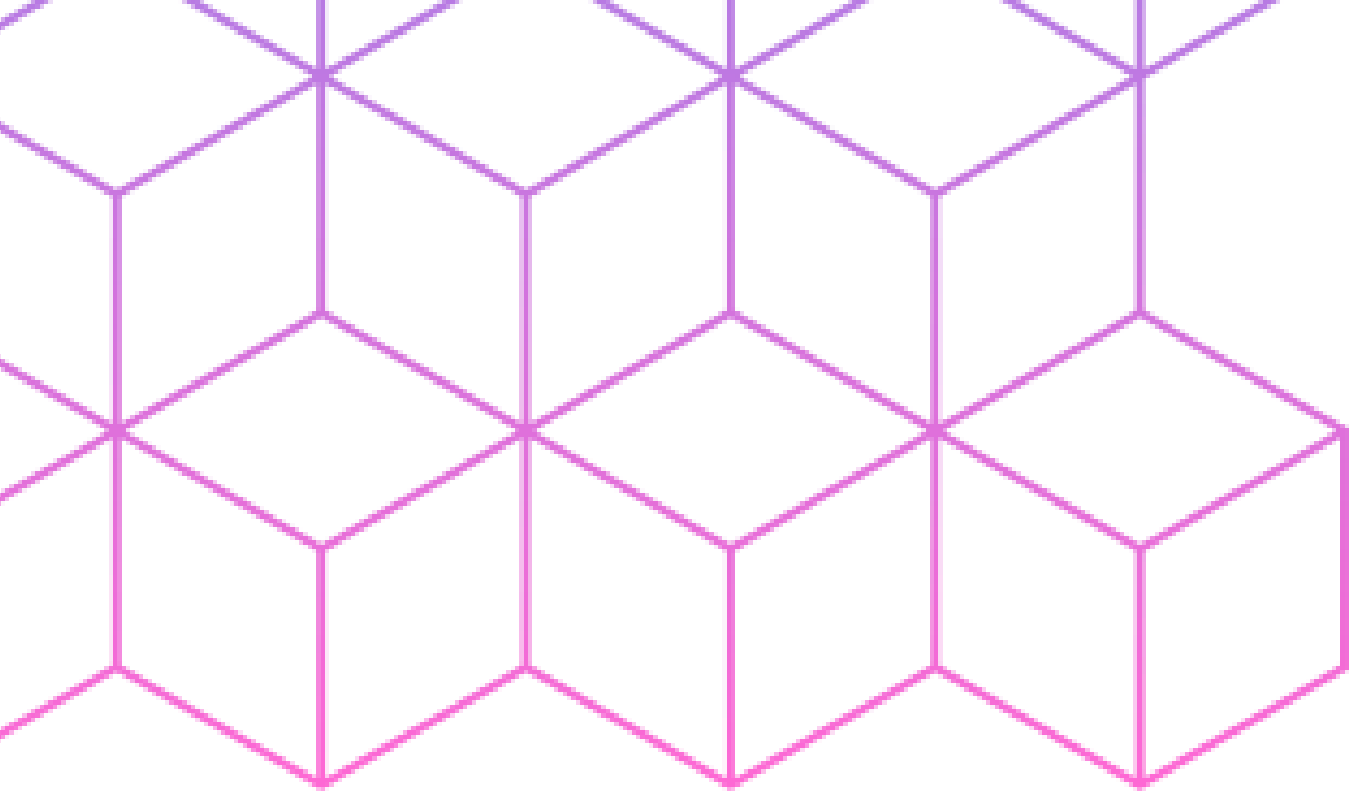
應用?



實驗被電神俱樂部

# 課後Q & A時間



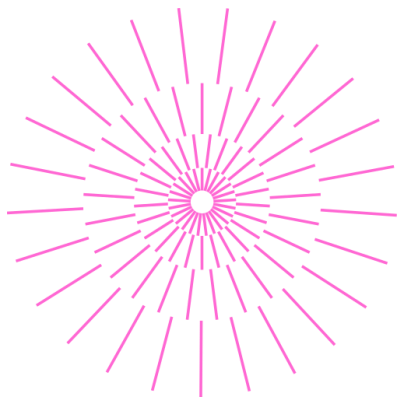
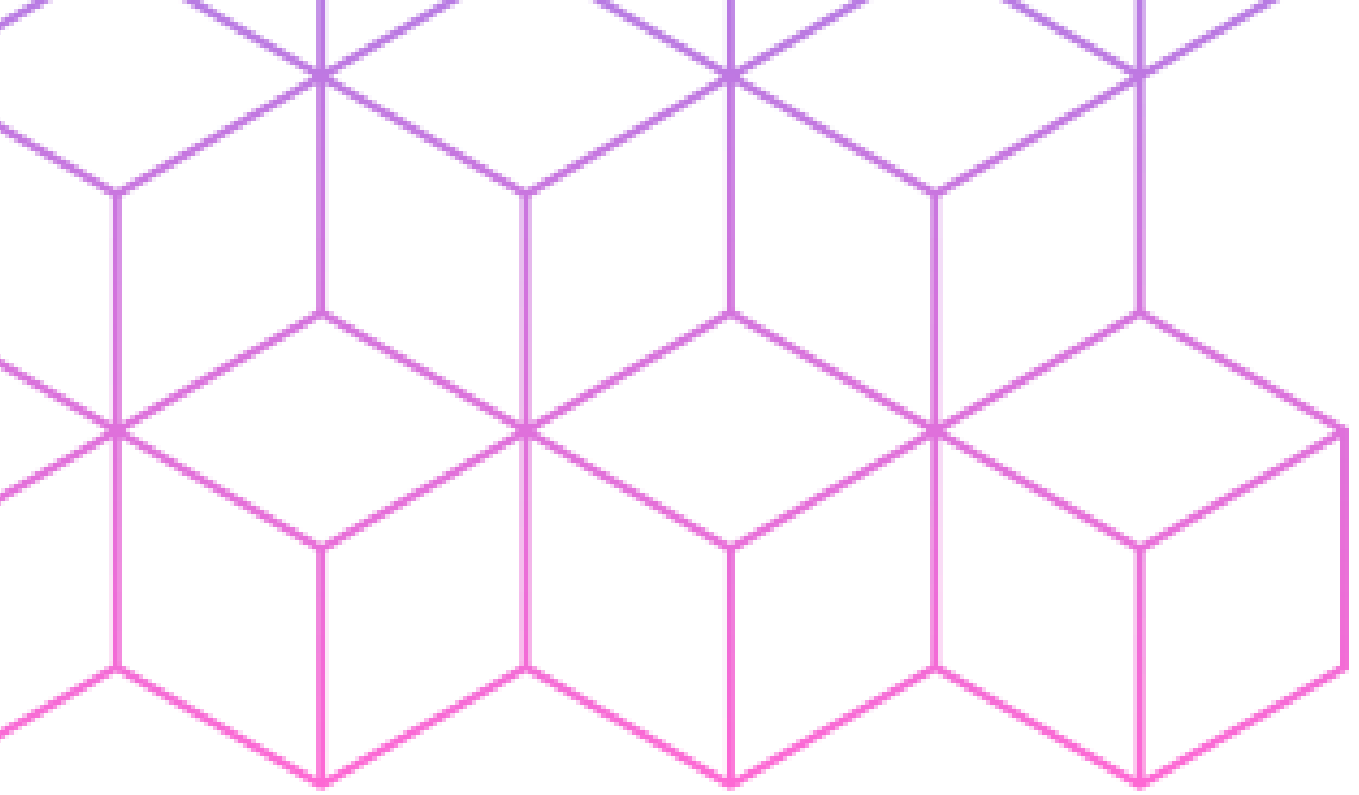


實驗被電神俱樂部

# Question 1

**Q:半導體可以透過甚麼控制電的通過與否?**

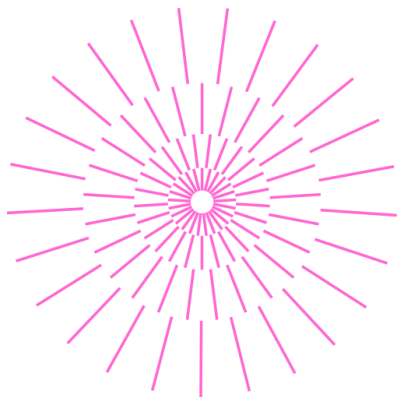
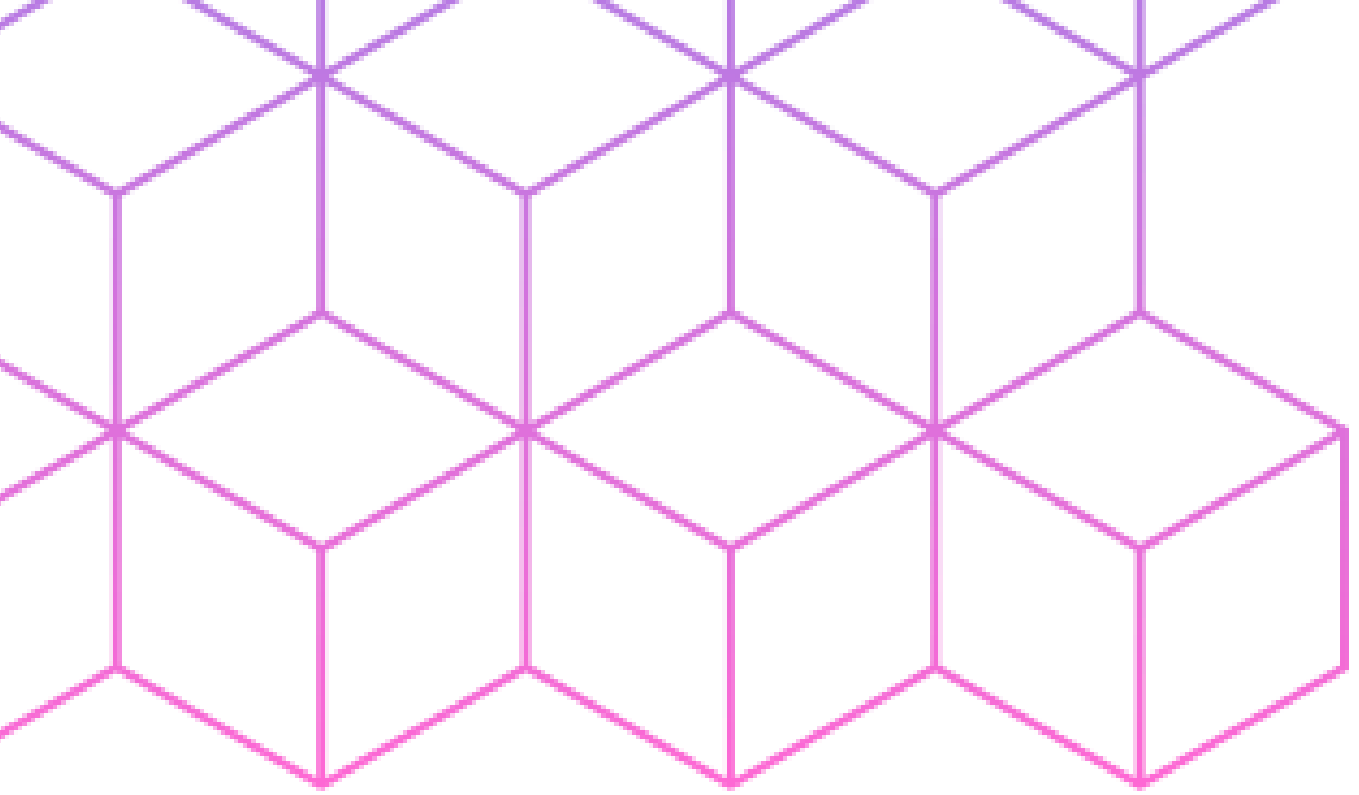




實驗被電神俱樂部

# Answer 1

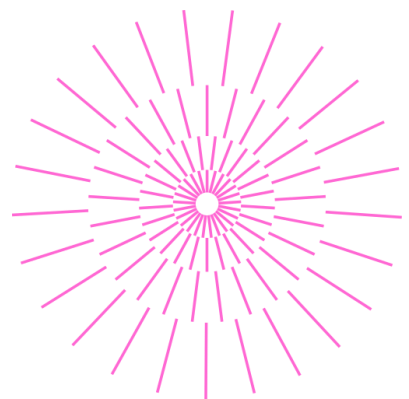
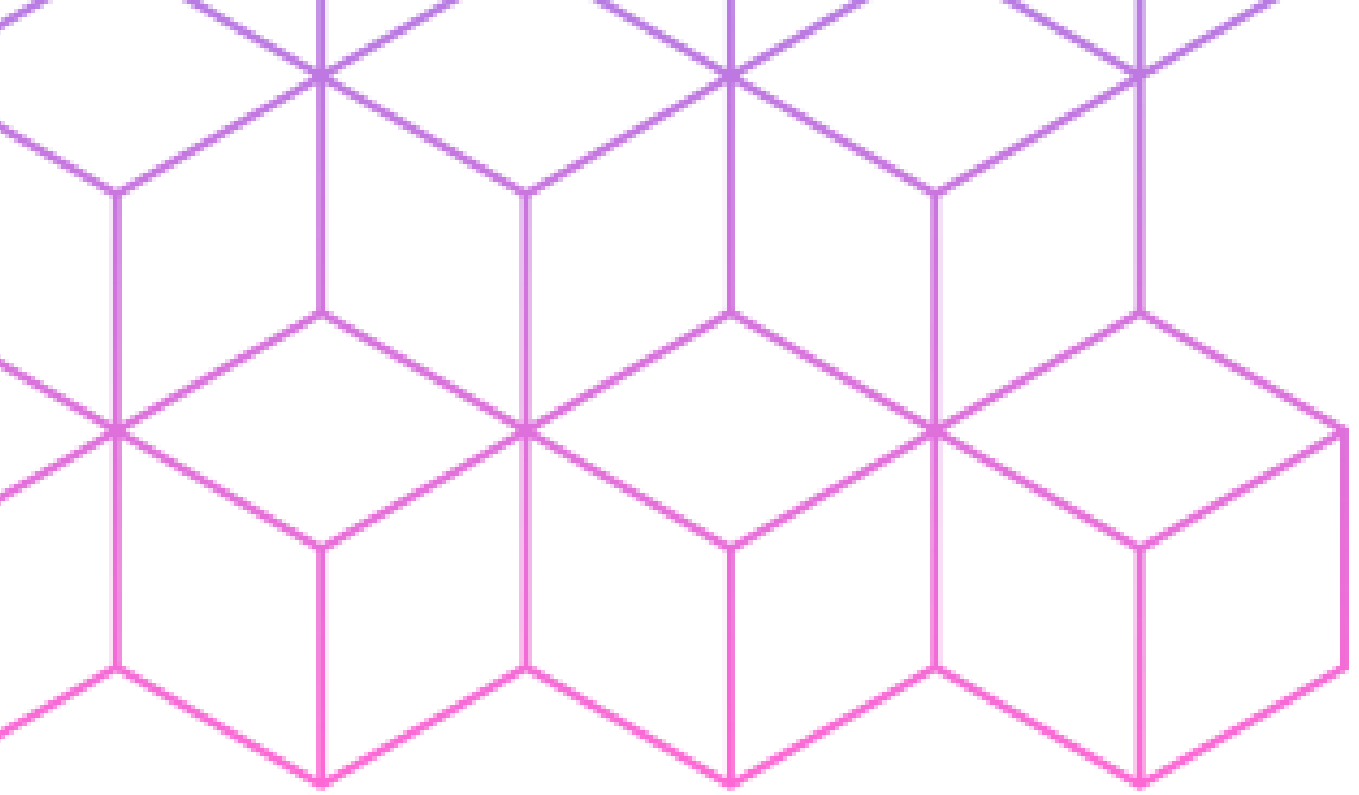
**A:從外部施加電壓**



實驗被電神俱樂部

# Question 2

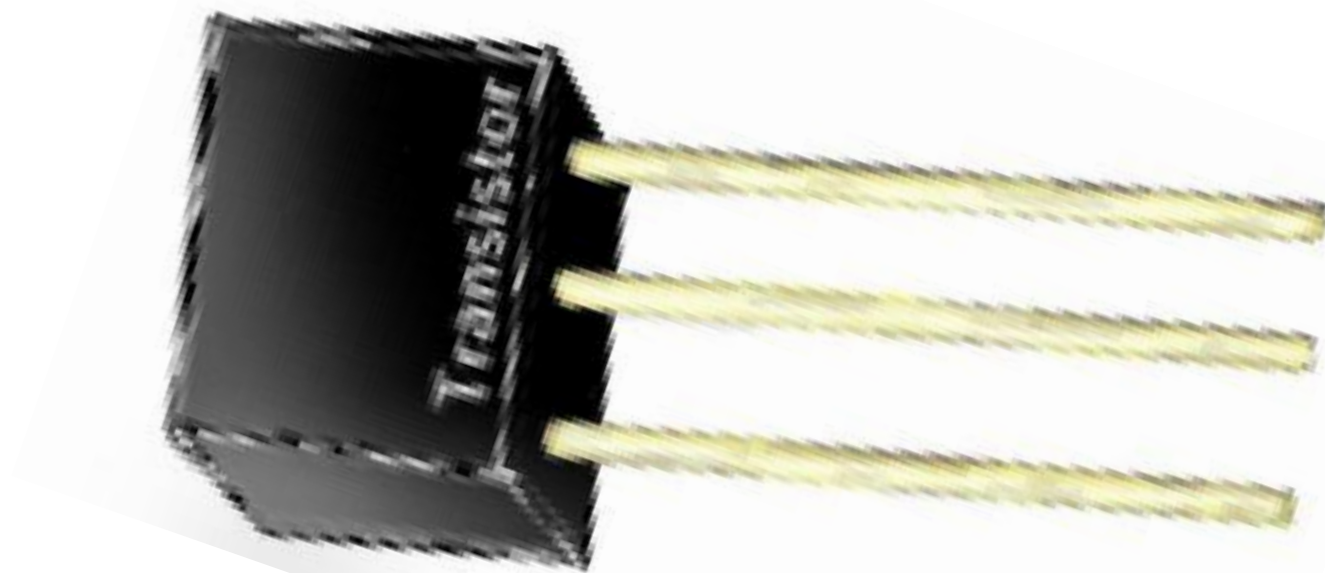
**Q:BJT跟FET的端子各有哪些?**



實驗被電神俱樂部

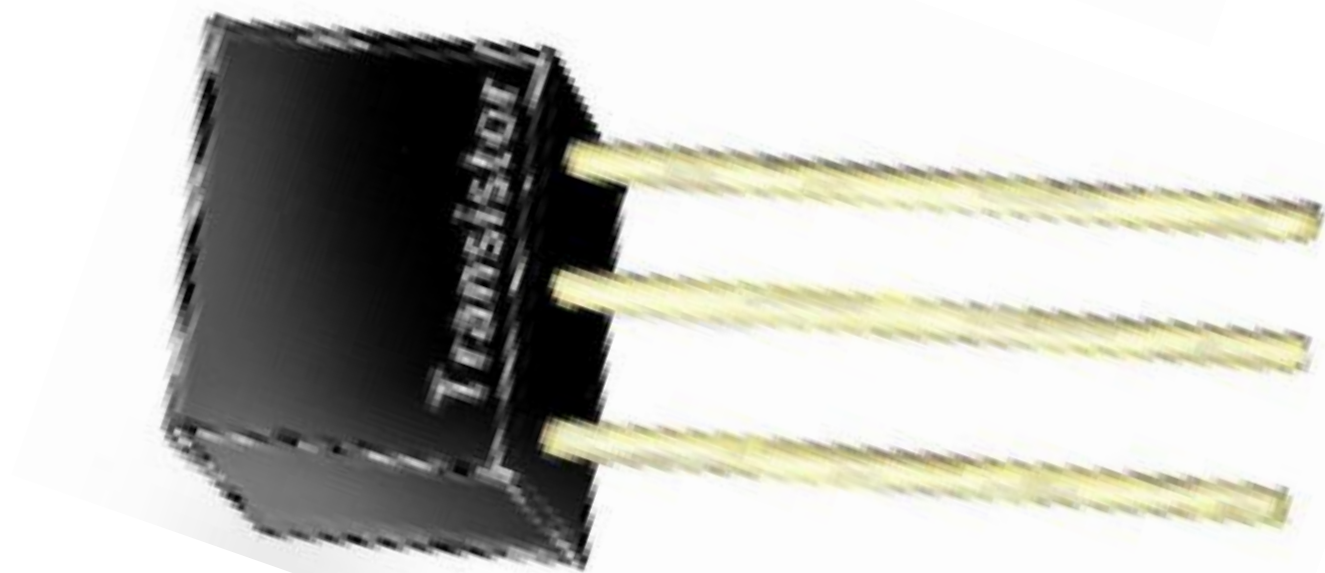
# Answer 2

## FET



汲極 (drain)  
源極 (source)  
閘極 (gate)

## BJT



射極 (Emitter) —  
基極 (Base)  
集極 (Collector) +



**THANKS FOR LISTENING**





看完介紹後，有更了解半導



體元件了嗎

