



TeachEngineering

STEM Curriculum for K-12

Printing Flexible Circuits



Subscribe to our newsletter at TeachEngineering.org to stay up-to-date on everything TE!

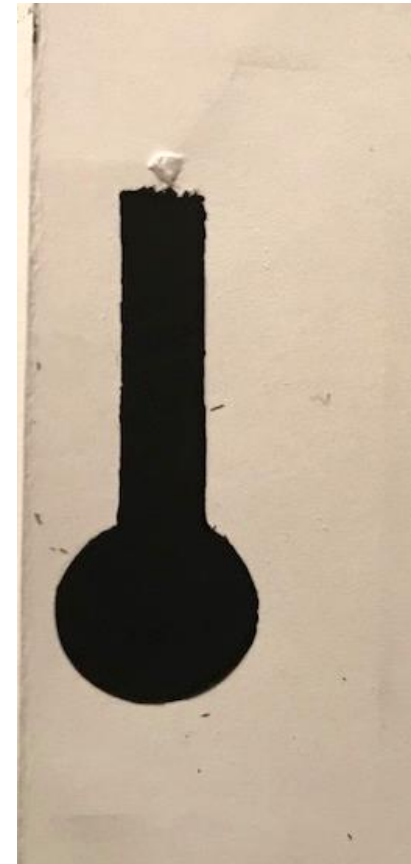
Brought to you by



Stencils



what you did



Brushes



Carbon (graphene)
paint

Electronic Printing in Industry



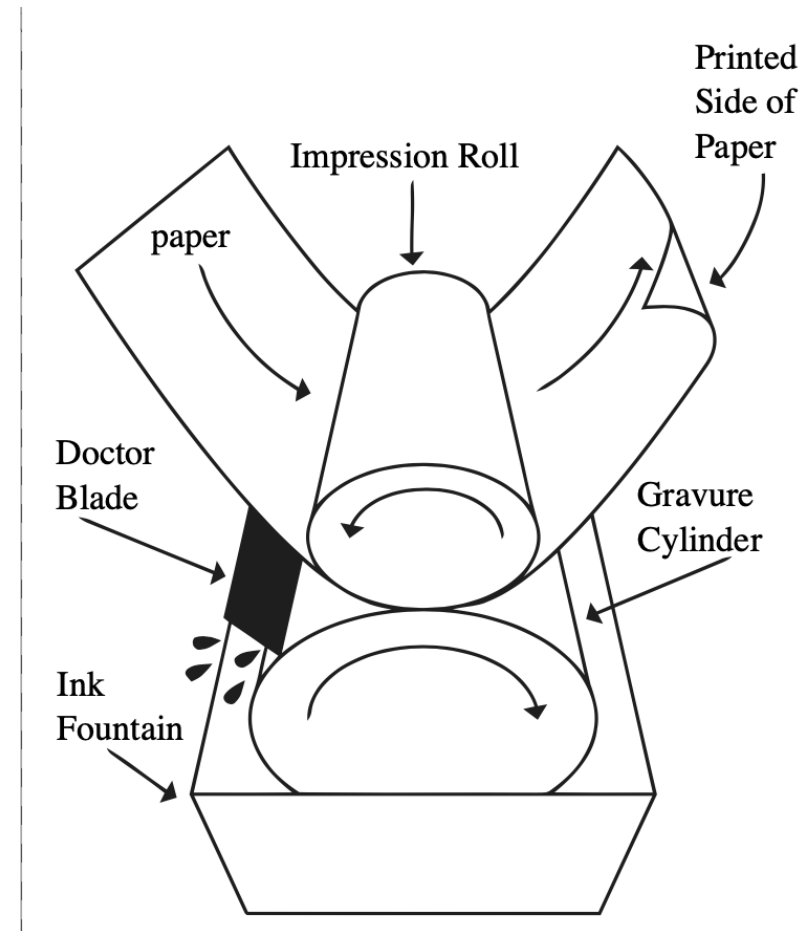
Research is marrying 600 year old Gravure printing



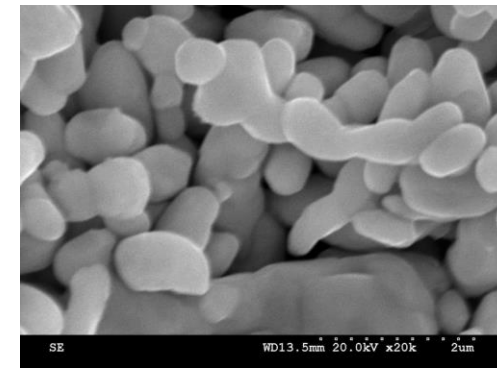
Karel Václav Klíč
Invented photogravure



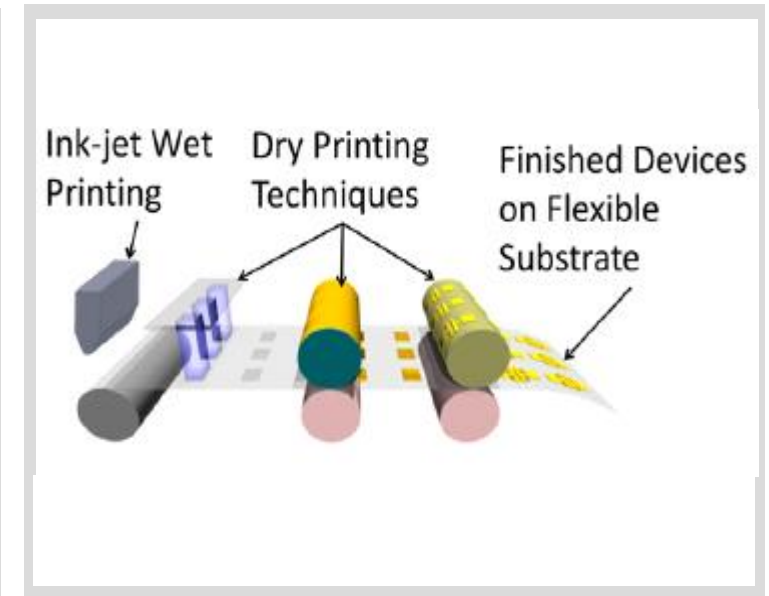
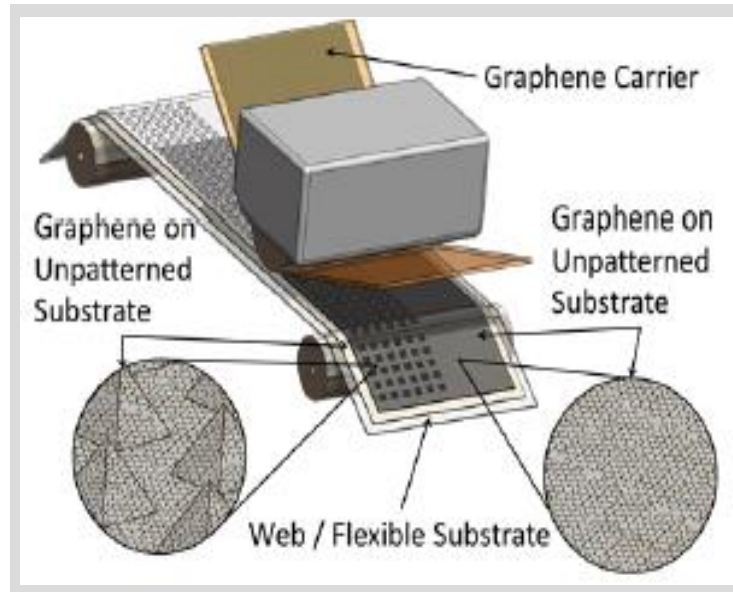
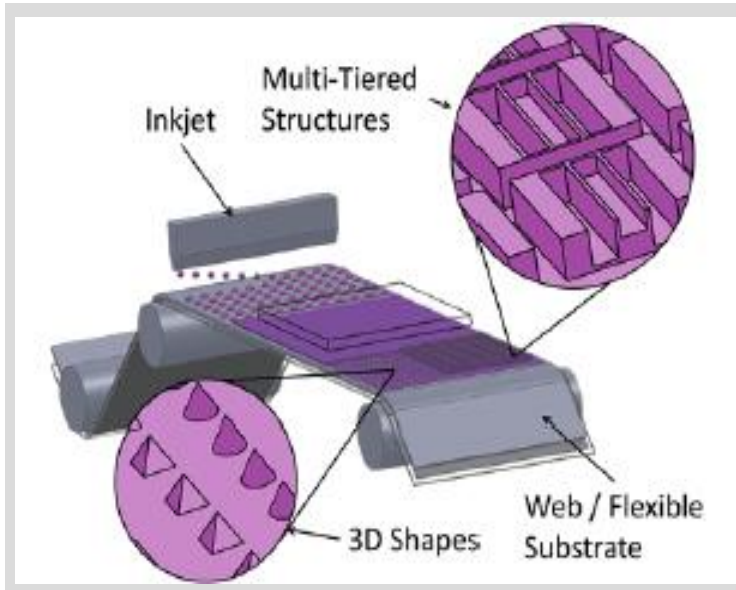
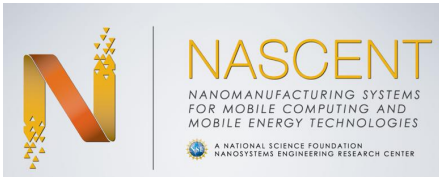
- Newspaper
- U.S. Bureau of engraving and Printing



to 21 Century conductive nano-inks, nano-lithography and nano-imprints to make flexible circuits using roll-to-roll manufacturing.



Scanning electron microscope image of silver nanoparticles in a conductive ink



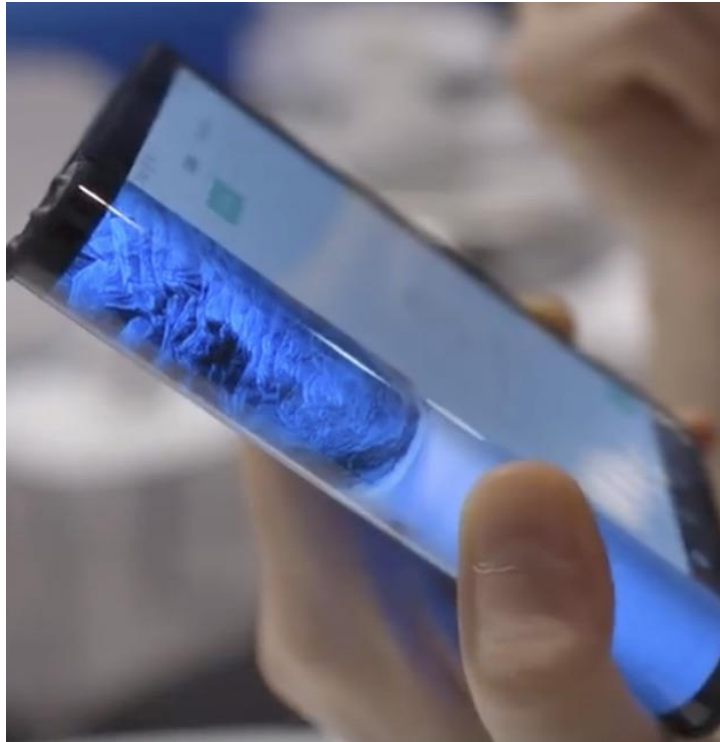
A nanometer is a billionth of a meter!

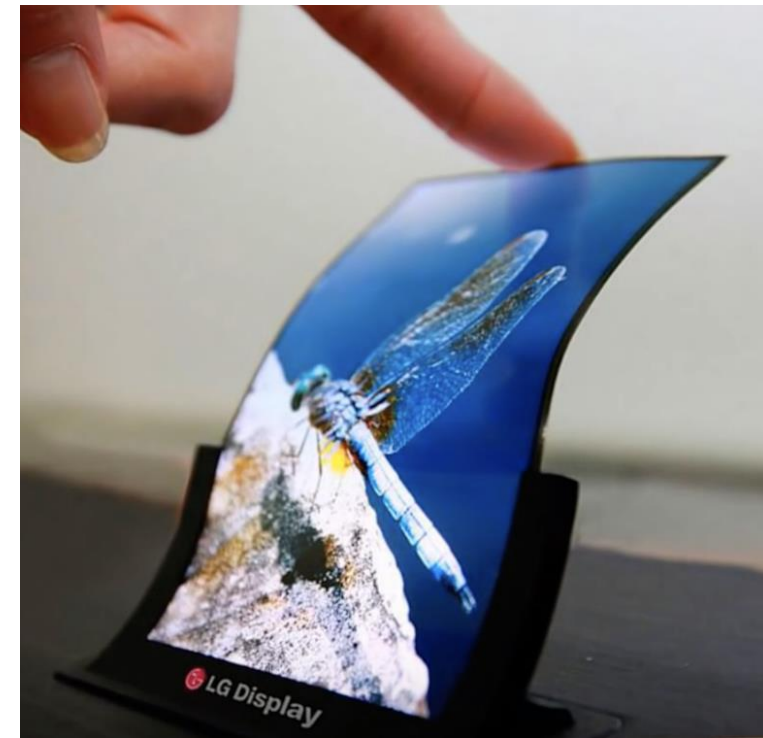
Printing tiny features on a big scale!

The foldable phones are coming

Samsung's device is just the beginning

By Tom Warren | @tomwarren | Nov 8, 2018, 7:50am EST





CES 2019
Consumer
Technology
Association™ LAS VEGAS
JANUARY 08 - 11, 2019

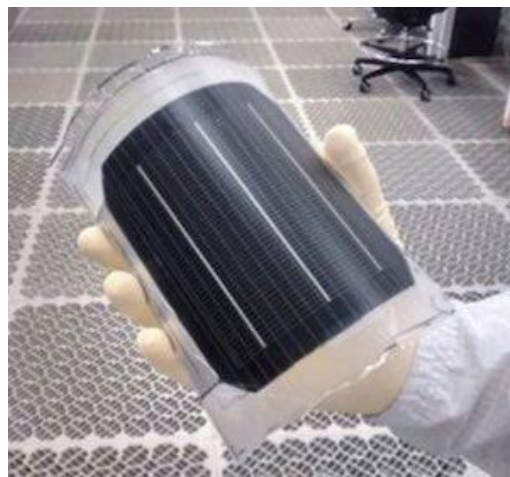






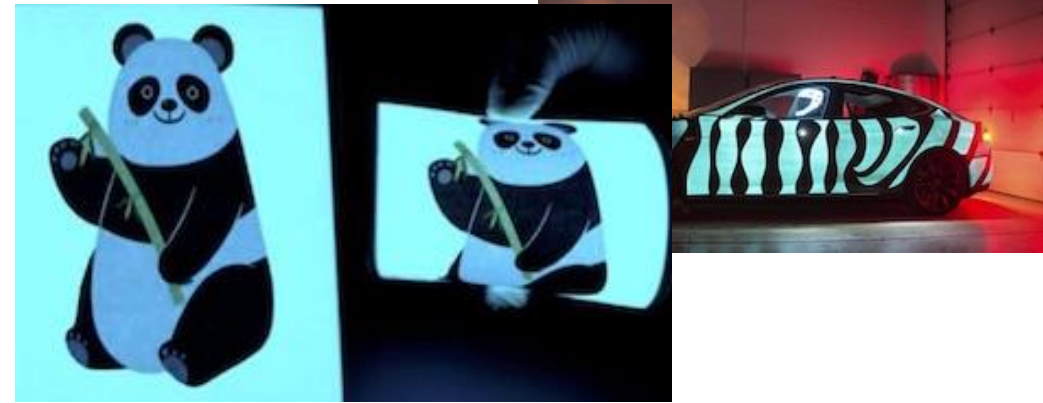


Lighting (organic LEDs)



Arizona State University

Solar Cell



Electroluminescent panels



Smart packaging



Batteries



Nadi X yoga pants



Haptic vibrations pulse at knees, ankles hips to move or hold positions

AIO smart sleeve



Heart rate data, sleep and fitness, body temperature, air quality, UV rays



Ralph Lauren

Heated jackets 2018 Olympics;
Flag: carbon and silver paint inside,
Temperature set with cell phone.

Wearables

Owlet Smart Sock 2



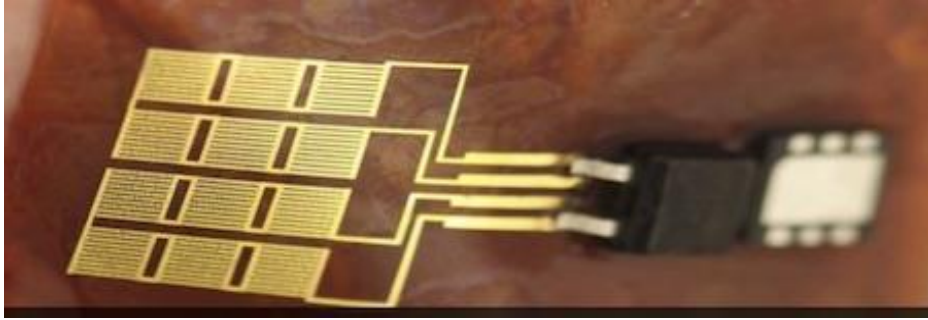
Hospitals monitor baby's pulse oximetry

Siren



Diabetes socks monitor temperature,
an indicator of inflammation

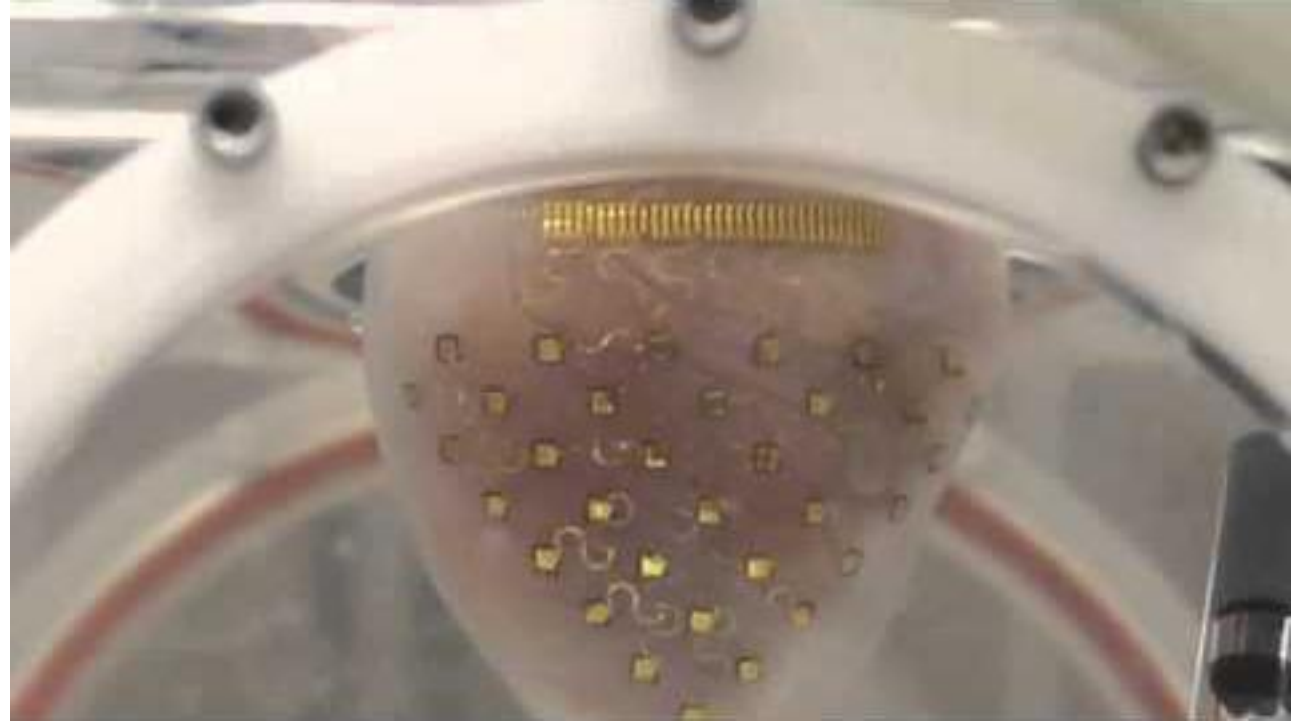
Medical Devices



Energy harvester from heart to replace batteries in pacemaker



Tattoo that analyses sweat



3D printed stretchy, flexible monitor that wraps around the heart

John Rogers' Group at Northwestern

Gold leaf tattoos



Touchpad for your computer

Communication

Display responsive to
body temperature



Foresight: printed tactile, conductive, interactive maps for blind people



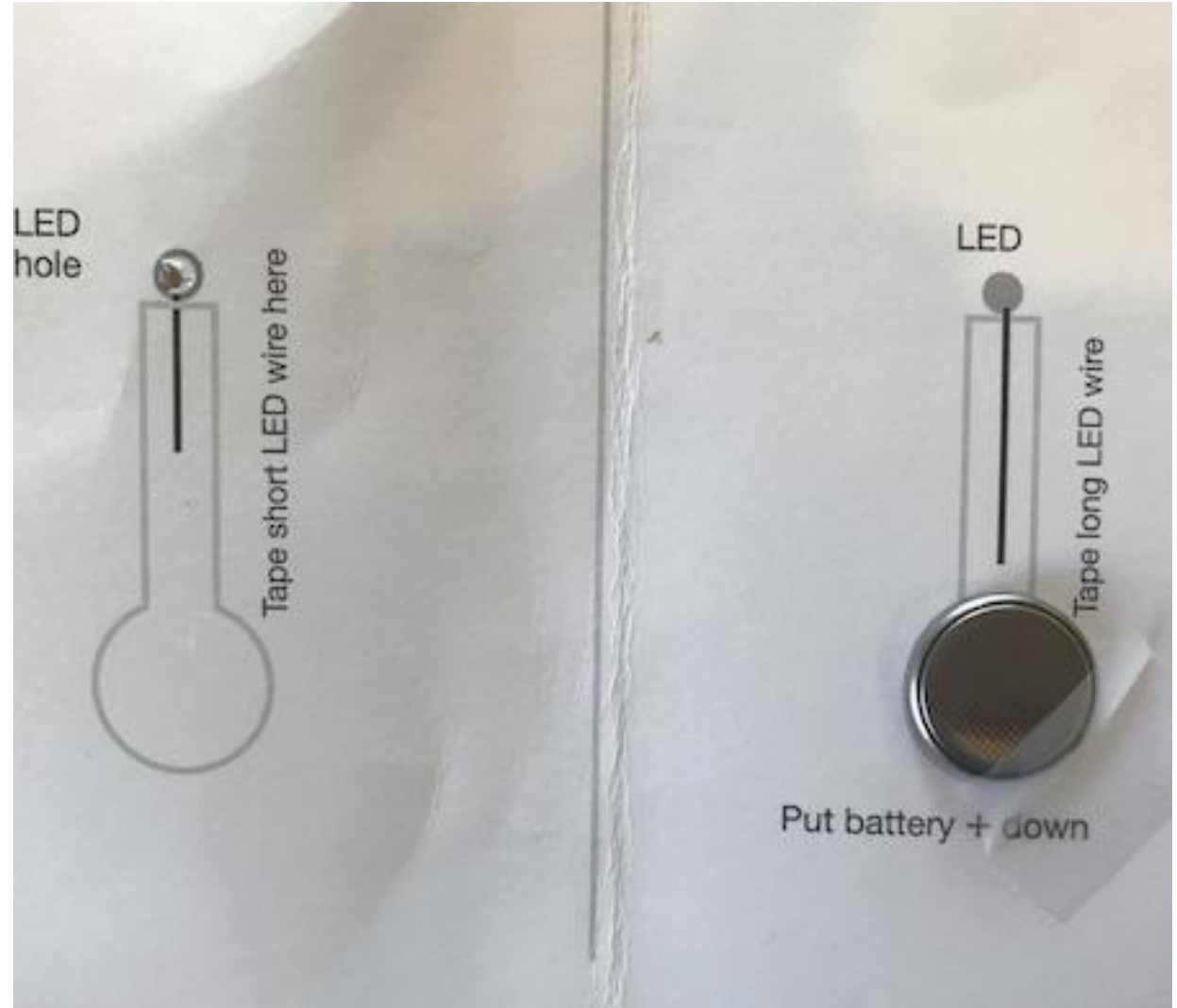


Detour's (Thomas Evans) interactive sound paintings use Bareconductive paint



Put your circuit together

- Open the card
- Check the paint is dry
- Carefully take off stencils
- Place the battery with the **POSITIVE SIDE DOWN** on the **RIGHT** battery pad
- Tape it down, but **LEAVE** as much of the battery exposed as possible



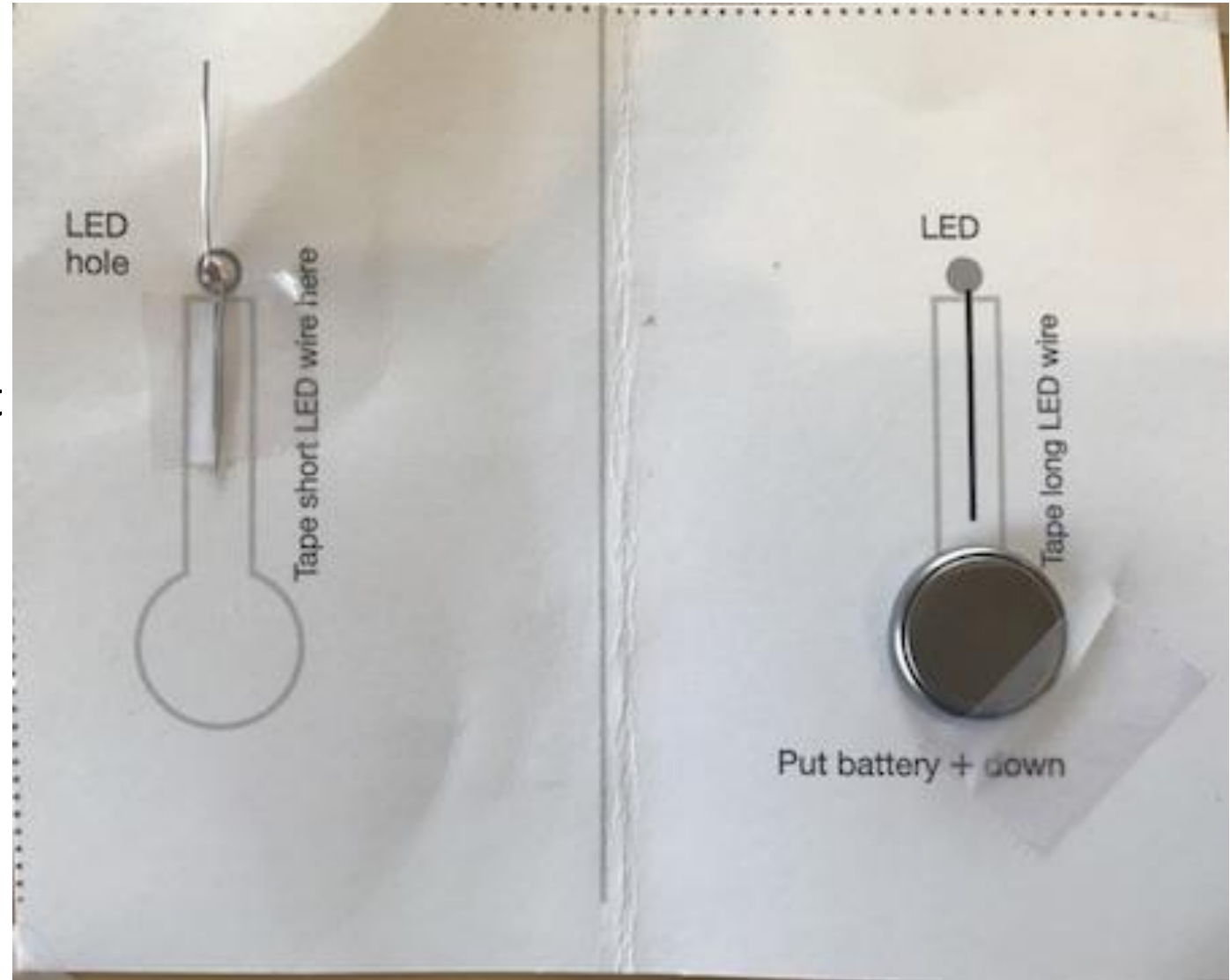
Put your circuit together

- Check the paint is dry
- Carefully take off stencils
- Hold the LED horizontally, with the LONG wire on top
- Stick the wires ONLY (not the bulb) through the hole to the inside of the card



Put your circuit together

- Bend the **SHORT** wire **DOWN** flat
- Cut a piece of tape the length of the short wire and cover the wire
- Leave as much of the rest of the paint line exposed as possible.



Put your circuit together

- Cut a piece of tape the length of the long wire.
- Place the piece of tape **STICKY SIDE UP** on top of the **SHORT** wire
- Bend the **LONG** wire **DOWN** on top of the short wire.
- Carefully close the card

