Primary STEaM Progression & Scheme of Work Using Crumble Control Board & Accessories (Page 1) (1st Draft)

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Chapter 2 Lights, Lights, Lights

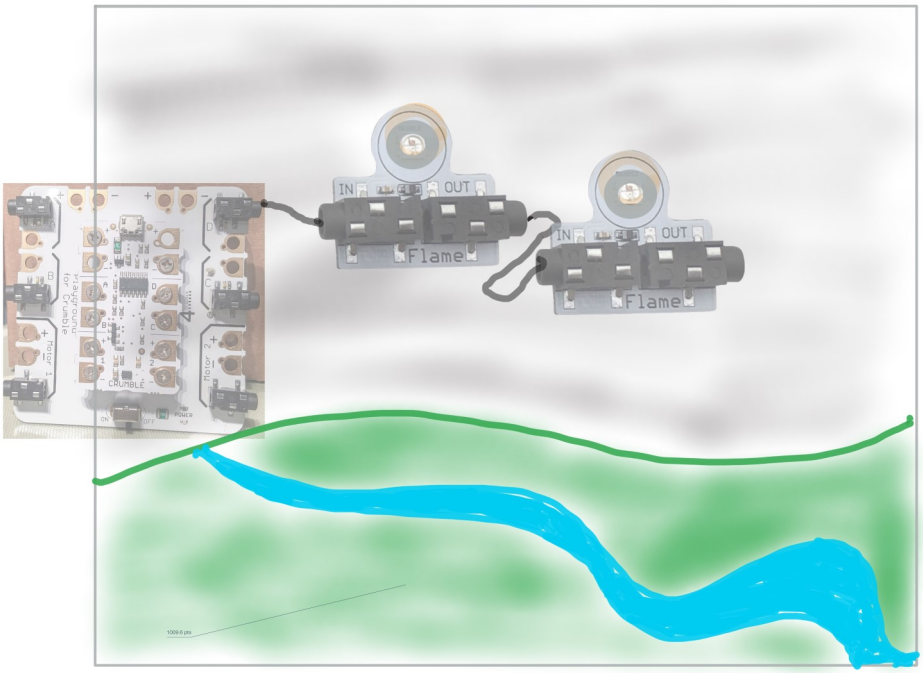
Add programmable light(s) to a pupil created picture

Curriculum links

Literacy & Art -. If you can think of a light in a story you can replace it in the picture with a programmable light or LED. Any book with a cat in it could have either its eyes light up or a scene at night with stars lighting up and twinkling (flashing). Any book with a car could have the headlights and or indicators flashing. Books with fireworks can program the fireworks to briefly go on and then change colours. Better programming experiences will come from the possibility of different colours or flashing lights.

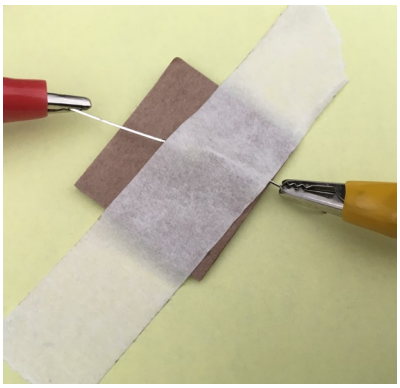
Construction

Pupils of ages 5-7 cope well with the Crumble Playground and Flame lights as shown on the right.



Stars twinkling in the night sky, Crumble Playground and Flame lights

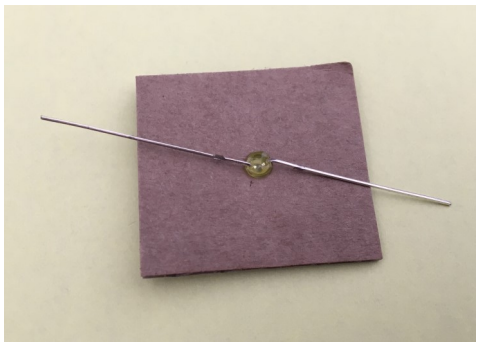
Small holes the size of the bulb need to be poked through the picture although if pupils wish a more diffused light such as in fog or mist then the light can shine through many paper types. The lights can be masking taped onto the back of the paper. If pupils wish the picture to stand up, a card frame can be created although it would need much greater reinforcement to hold the Crumble Playground for wall mounting with the weight of the built in battery pack attached to the back. If the school has purchased the short headphone type cables then care needs to be taken that the distance between lights are not too wide for the cable length.



LED lights on back of picture

Older pupils aged 7-9 cope well with using up to four LED lights.

Smaller holes can be punched where they are needed on the picture. It is worth cutting out small squares of cardboard, boring holes in these so that the LED bulb fits securely into the cardboard helping the bulb sit well and reducing the chance of damage to the LED.



LED set in a cardboard mount

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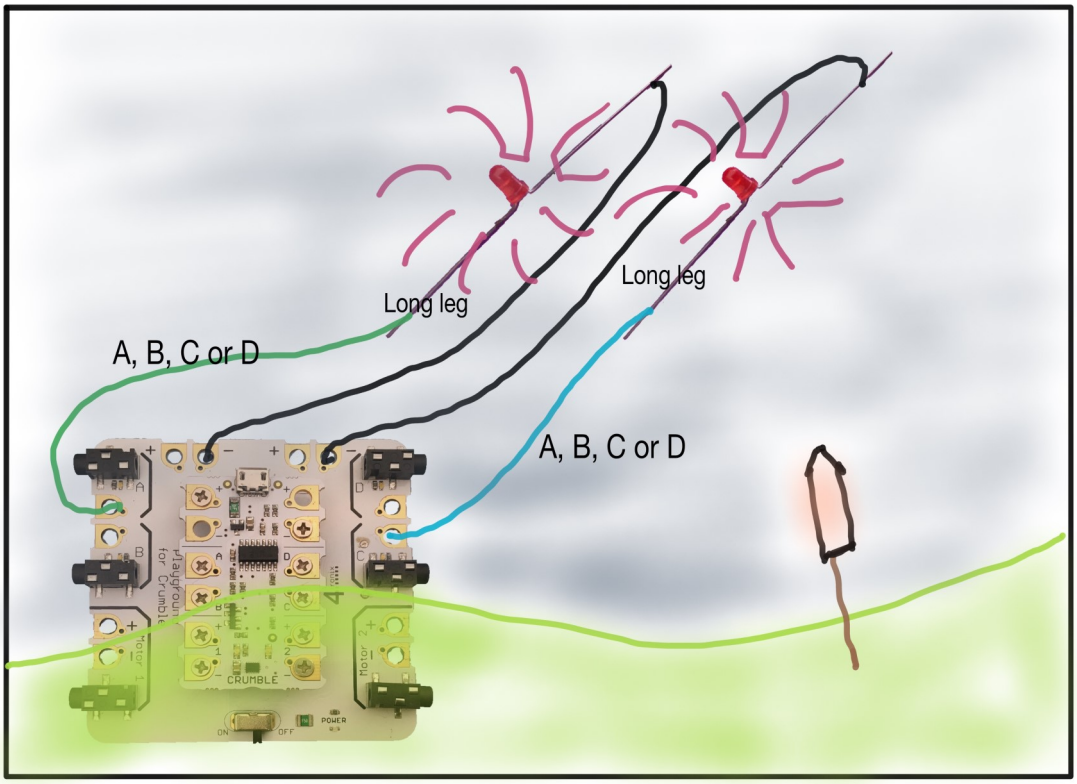
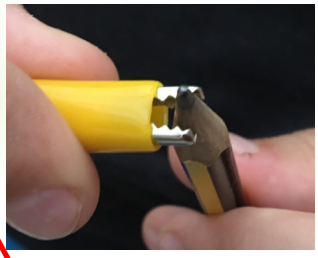
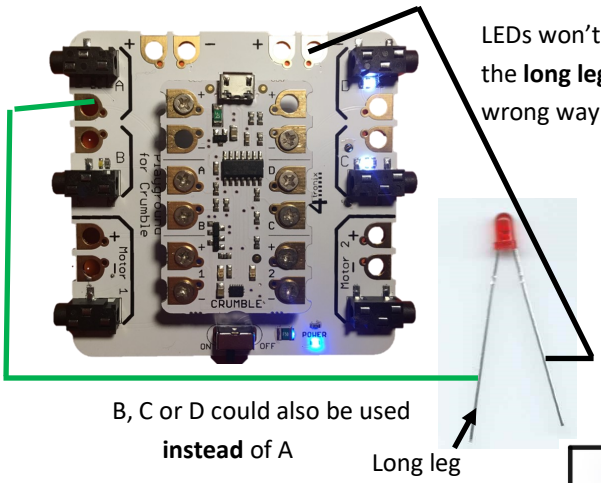


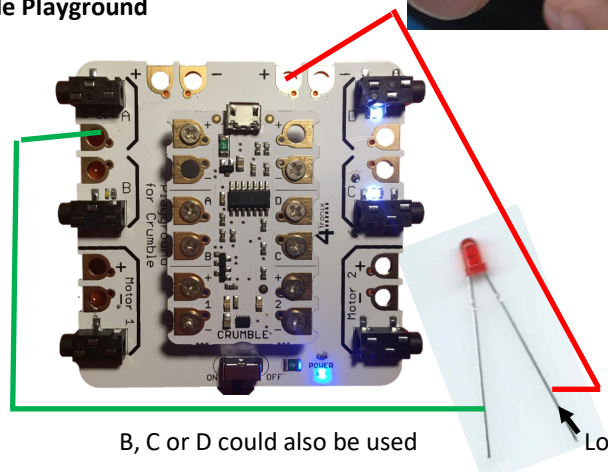
Fireworks picture using LED lights and Crumble Playground

Pupils often pull the crocodile sheath away from the metal so they can get a better grip on the clip. Unfortunately this can leads to wires touching and shorting. A pencil can be a great way of getting the plastic sheath back on.





LEDs won't work if the **long leg** is the wrong way round



B, C or D could also be used **instead** of A

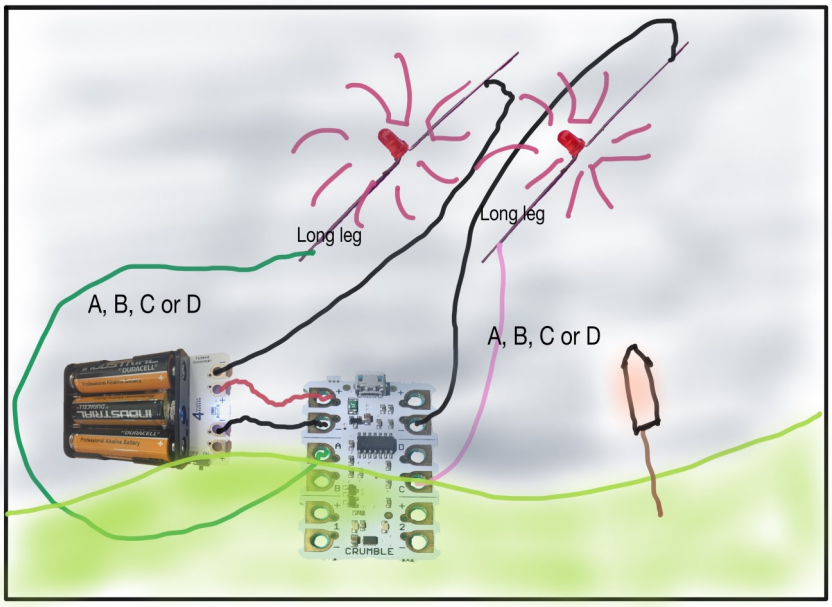
Long leg

B, C or D could also be used

Long leg

LEDs can be wired to negative or positive power out but the long LED leg must be swapped over. It doesn't harm the LED if it is wired the wrong way round it just won't light up.

Users could also wire one leg of the Classic Crumble through the extra power outputs found on the Redfern Electronic or 4Tronix power pack as shown in the diagram opposite.



Fireworks picture using LED lights and Classic Crumble

Primary STEaM Progression & Scheme of Work Using Crumble Control Board & Accessories (Page 3) (1st Draft)

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Design NCD1B Younger pupils could tell their teacher what picture they would draw and what the light or lights would be and where they would be on their picture. Older pupils could sketch an outline of their picture, showing where the components would be and which connects they would use on the Crumble. Teachers might also choose to forego formal design as this is a very simple idea.

Picture Design Teachers might choose artistic materials and techniques that fit in with the Art National Curriculum to make the most of cross curricular links.

Useful Maker Cards

- Crumble Playground Programmable Light or Programmable Lights (if you are using more than one)
- Crumble Playground LED Lights
- Crumble Classic LED Lights

Suggested Module Outline for Younger Pupils

1, In an earlier lesson create a picture with clear lights in it. Stipulate how many lights if more than one.

2, Introduce the idea of adding lights to shine through the picture or poking holes in the picture to show the lights

2, Model writing a scaffolded question with the whole class

What will your lights do (turn on/flash/change colour)?

My program will _____ by replacing _____ with programmable lights.

What will your lights replace in the picture?

3, Give pupils time to complete their own program question on worksheet x (example answers on next page x)

Due to the simplicity of this project you may wish to skip steps 2 & 3 with younger pupils

4, Show pupils how to wire up their Crumble Playground and Flame(s) as shown above

5, Give pupils time to wire up their Crumble Playgrounds in pairs

6, Check pupils wiring and give hints if it is incorrect. Common errors are the flames wired into **out** instead of **in,** plugged into A, B or C instead of D & plugs not pushed all the way in.

7, Demonstrate how to attach Crumble to a computer via USB and drag out the following code. Send it to the Crumble Playground using the green triangle. Explain that the program is now inside the black chip on the Crumble. We can start the program by switching on the battery and switch it off by switching off the battery. Pupils will observe that only the last col-

our lights up. This happens because there is no instruction to wait between lights. Ask them why they think this happens? Let them investigate why and drag out a **wait 1 second** as a hint if no one gets it. Now give them time to experiment with the light(s) before creating their picture program.

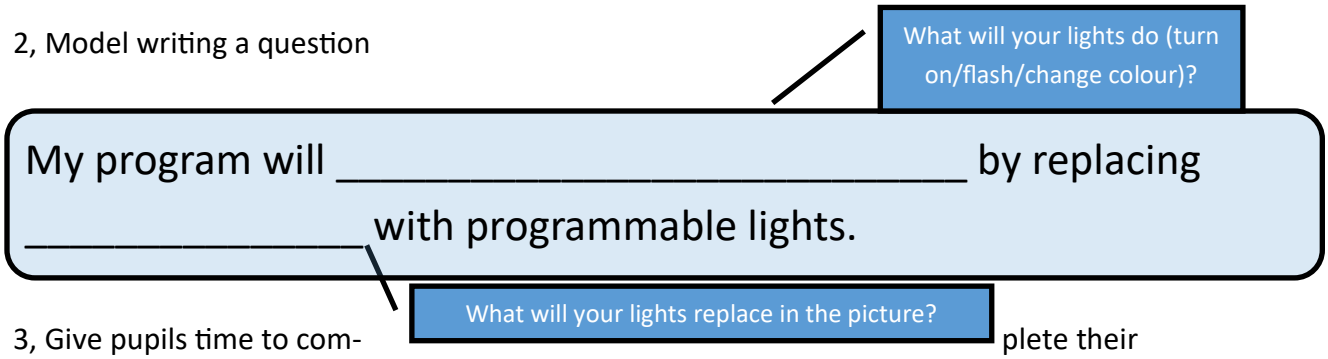
8, Pupils turn the batteries off and masking tape their lights onto the back of their pictures to test and display them.

Suggested Module Outline Older Pupils

1, In an earlier lesson create a picture with clear lights in it. Stipulate how many lights so pupils can plan properly.

2, Introduce the idea of adding lights to shine through the picture or poking holes in the picture to show the lights

2, Model writing a question



3, Give pupils time to complete their own question

4, Model what the user will see and what the outputs will do

I connected an _____LED_____ to output (A, B, C or D) ____A___ and programmed it to _Flash continuously__.

The user will see ____

The stars twinkling yellow in the sky and the moon lit up with a bright white light

5, Give pupils time to complete the user and outputs sections on their worksheet

6, Hand out the equipment needed and the maker cards. Instruct pupils to, orientate their Crumble as shown in the card and follow the card wiring diagrams carefully. Remind them, if using crocodile clips, that they must keep the wire plastic cover on the end to avoid short circuits. If they have finished they can show their circuits to you before coding.

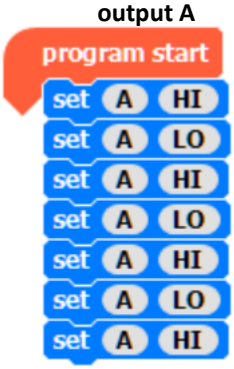
7, Give pupils time to wire up their Crumble Playgrounds in pairs

8, Check pupils wiring and give hints if it is incorrect. Common errors are the flames wired into **out** instead of **in,** plugged into A, B or C instead of D & plugs not pushed all the way in.

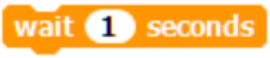
7, Demonstrate how to attach to a computer via USB and drag out the code on the right. Send it to the Crumble using the green triangle. Explain that the program is now inside the black chip on the Crumble. We

If using Sparkles /Flames

If using LED attached to output A



can start the program by switching on the battery and switch it off by switching off the battery. Ask pupils what they think the code will do? Run the code, pupils will observe that only the last colour lights up or with the LED the light goes straight on and stops. This happens because there is no instruction to wait between lights. Ask them why they think this happens? Let them investigate why and drag out a wait 1 second as a hint if no one gets it.



Now give them time to experiment with the light(s) before creating their picture program.

8, Pupils turn the batteries off and masking tape their lights onto the back of their pictures to test and display them.

Depending on pupil ability and the nature of the project you may want to drag out the wait 100 milliseconds block and explain how they can't use decimal numbers for less than 1 second in the wait one second block but can break the second up into 1000s.

Adaptations for Lights, Lights, Lights

- Pupils can cut out a **Christmas Tree** shape out of rigid card, punch holes where the lights will go and tape the lights to the back. Pupils can experiment with trying to program different light patterns such as all flashing or the lights following each other. This works best with the programmable lights.
- **Diwali Light Pattern**. Pupils look up Diwali lights on Google Images and look for the type of patterns that people make. They then design their own and cut out the holes to show where the lights will go. They either use black card to represent the night or paint the backdrop black. The lights could be combined with Rangoli sand decorations. This works best with the programmable lights.
- **Name or initial in lights**. Pupils investigate the least number of lights that their name or initial could be created using. They draw this out on card before punching holes for the lights. This works best with the programmable lights.

Summative Assessment Grid for Lights, Lights, Light

This will depend on the age of the child and the complexity of the projects (number of lights, what the lights did etc) The teacher and pupil would be looking for a number of problem solving skills and computing, DT and Art outcomes. These are listed in the project assessment sheet at the end of the module. Teachers would then use this knowledge coupled with their knowledge of the child to determine if they are operating above, within or below age expectations.

Name _____ Class/Form _____

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Thinking about and designing my picture program

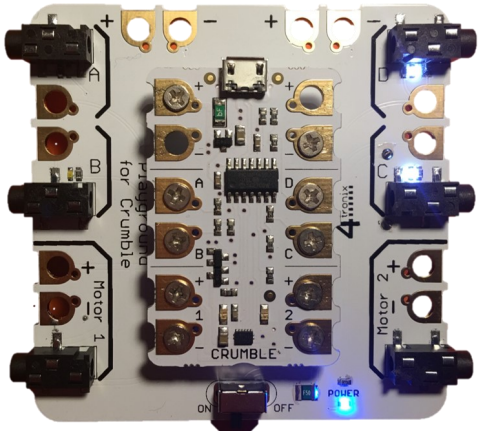
What will your lights do (turn on/flash/change colour)?

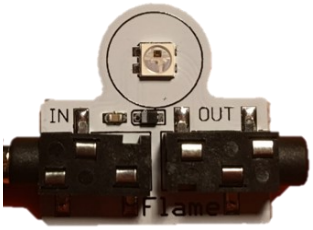
My program will _____ by replacing _____ with programmable lights.

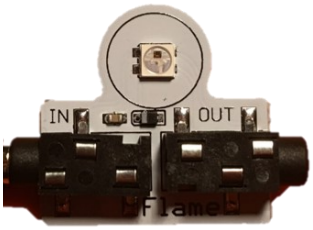
What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and where would your lights go?

Draw in the lines to show how your Crumble Playground connects together.







Name _____ Class/Form _____

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Thinking about and designing my picture program

What will your lights do (turn on/flash/change colour)?

My program will *Make the stars flash* by replacing *stars* with programmable lights.

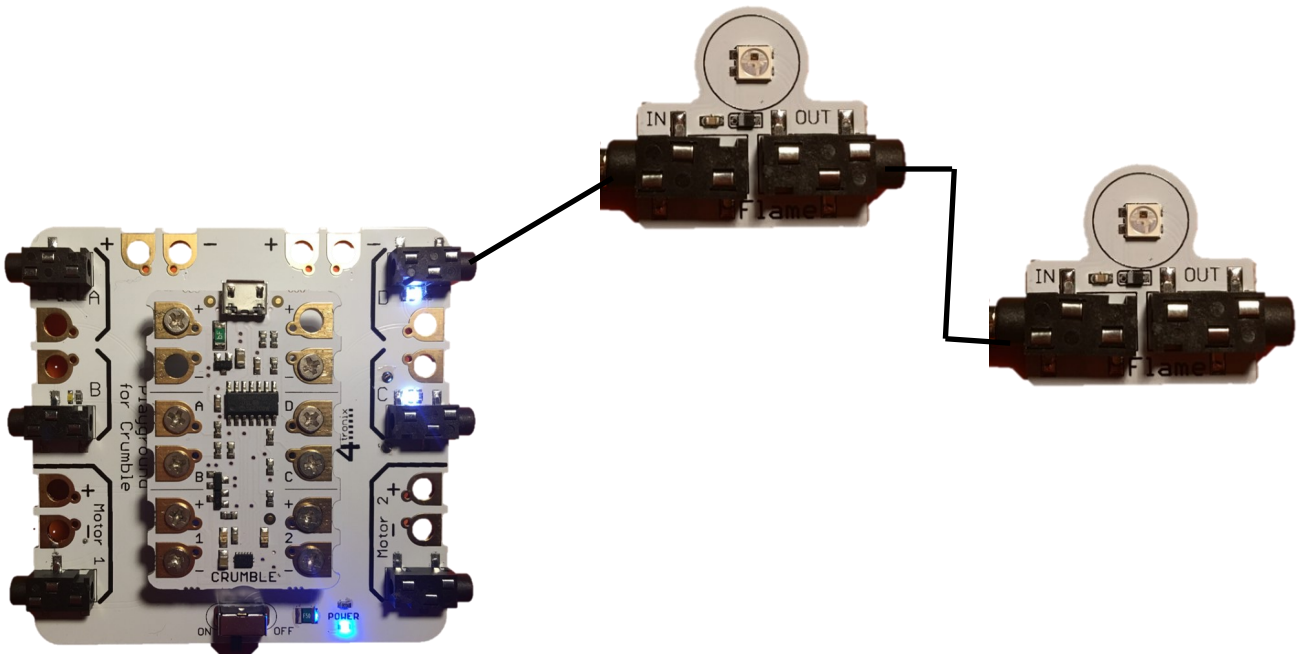
What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and what lights would you wire up?

Very rough picture showing clearly where lights are. Stick people etc

ANSWER PAGE

Draw in the lines to show how your Crumble Playground connects together.



Name _____ Class/Form _____

Thinking about and designing my picture program

What will your lights do (turn on/flash/change colour)?

My program will _____ by replacing _____ with programmable lights.

What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and where would your lights go?

Complete the sentences

The user will see _____

_____

_____

_____

_____

_____

Connect a _____ to output (A, B, C or D)_____

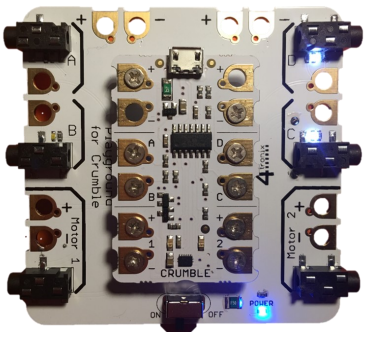
and program it to _____.

Write a similar sentence for any other lights

_____

_____

_____



Draw the lights and the lines to show how your Crumble Playground connects to the light(s)

Name _____ Class/Form _____

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Thinking about and designing my picture program

What will your lights do (turn on/flash/change colour)?

My program will _Make the stars flash_ by replacing _stars_ with programmable lights.

What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and where would your lights go?

Very rough picture showing clearly where lights are. Stick people etc

ANSWER PAGE

Complete the sentences

The user will see _____

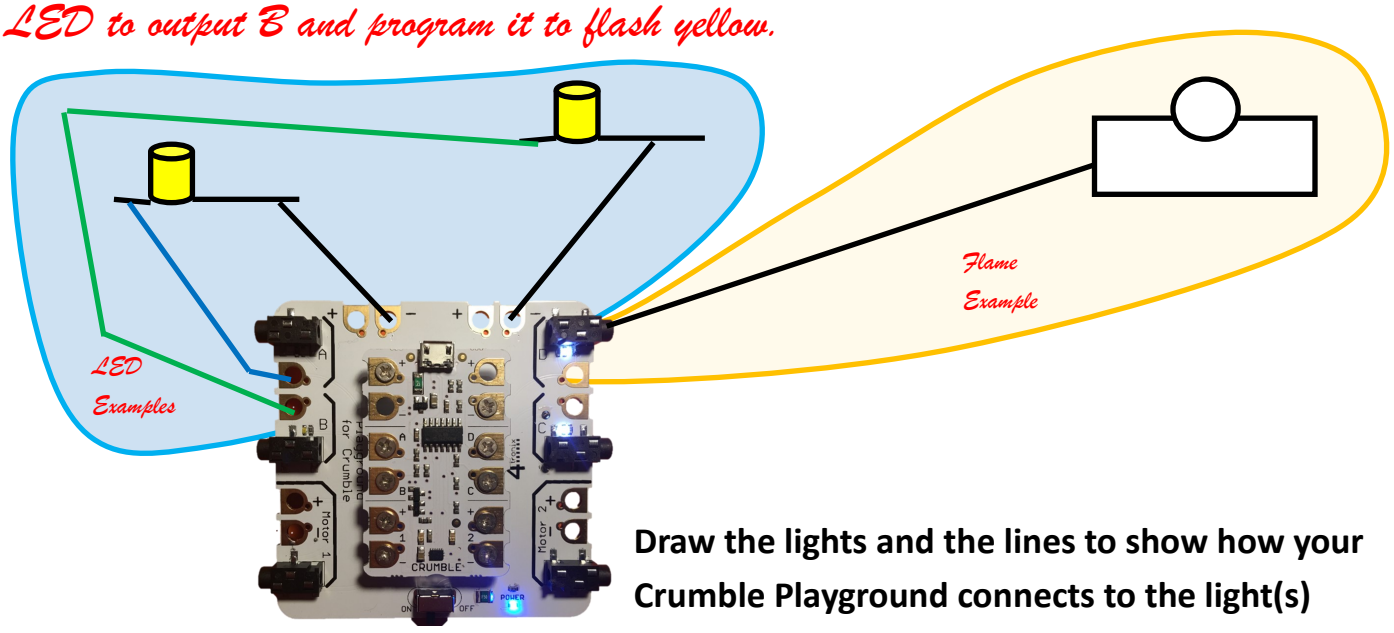
The stars twinkling yellow in the sky and the moon lit up with a bright white light

Connect an _LED_ to output (A, B, C or D)_A_

and program it to _flash yellow_.

Write a similar sentence for any other lights

Connect a flame to output D and program it to shine with a white light. Connect an LED to output B and program it to flash yellow.



Draw the lights and the lines to show how your Crumble Playground connects to the light(s)

Name _____ Class/Form _____

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Thinking about and designing my picture program

What will your lights do (turn on/flash/change colour)?

My program will _____ by replacing _____ with programmable lights.

What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and where would your lights go?

Complete the sentences

The user will see _____

_____

_____

_____

_____

_____

Connect a _____ to output (A, B, C or D)_____

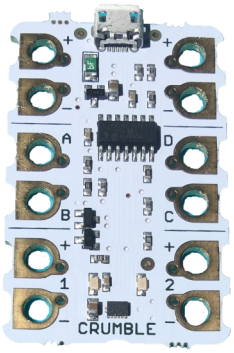
and program it to _____.

Write a similar sentence for any other lights

_____

_____

_____



Draw the lights and the lines to show how your Crumble connects to the light(s)

Name _____ Class/Form _____

Thinking about and designing my picture program

What will your lights do (turn on/flash/change colour)?

My program will _____*Make the stars flash*_____ by replacing _____*stars*_____ with programmable lights.

What will your lights replace in the picture?

If you wanted to make your own picture with real lights what would it look like and where would your lights go?

Very rough picture showing clearly where lights are. Stick people etc

ANSWER PAGE

Complete the sentences

The user will see _____

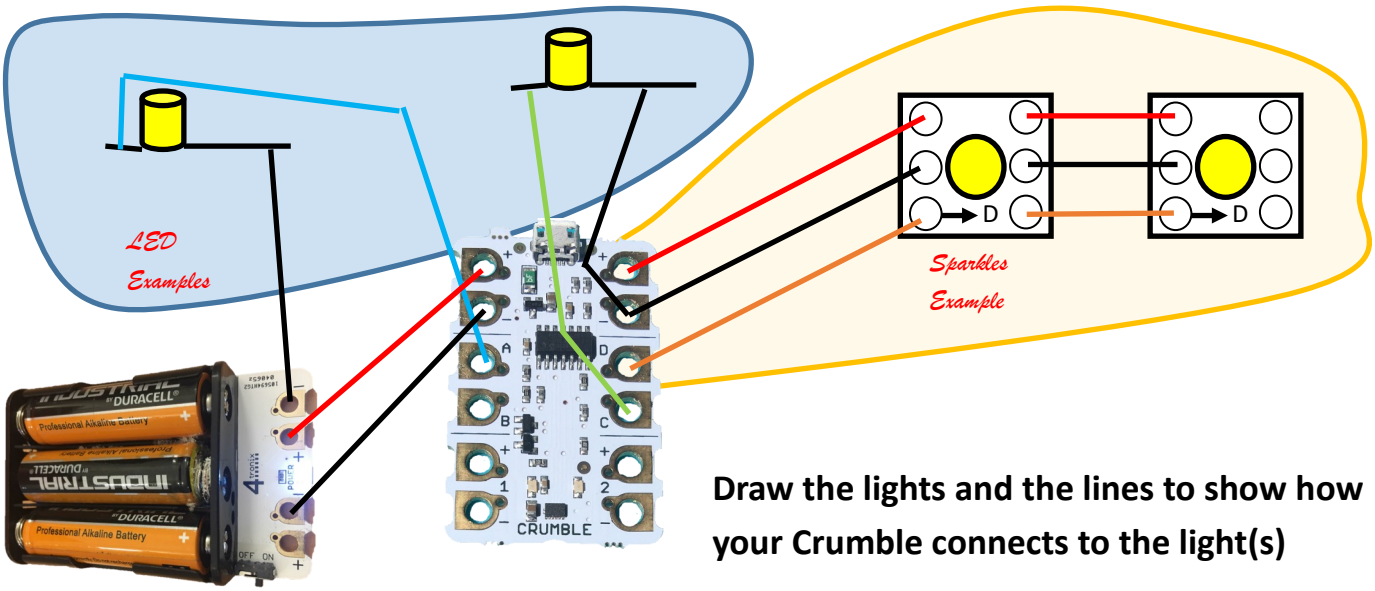
The stars twinkling yellow in the sky and the moon lit up with a bright white light

Connect an _____*LED*_____ to output (A, B, C or D)_____*A*_____

and program it to _____*flash yellow*_____.

Write a similar sentence for any other lights

Connect a sparkle to output D and program it to shine with a white light. Connect an LED to output B and program it to flash yellow.



Draw the lights and the lines to show how your Crumble connects to the light(s)

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Lights, Lights, Lights Assessment Sheet

Name Group

I did this well

I did this ok or I did this a little

I tried this but it didn't work or I didn't do this at all

I created a picture with lights	
I wired up my lights so that they shone	
I replaced my picture lights with real lights	
I programmed my lights	
I drew a picture to show how I might use this idea with another picture	
I drew a picture to show how my wiring connects	
I listened to my partners ideas	
I contributed good idea to my partner	
I persevered when the wiring or programming didn't work	

If you got given a sticker, stick it in one of the spaces below and write underneath what you got it for