

### 1. Lighting a bulb.

Construct the circuit by clipping all the parts to the base board. Be careful not to use too much force when screwing the bulb into the bulb holder as the glass may break. Slide switch 15 to the on position and the bulb 18 will light up. Switch off and the bulb will go out.

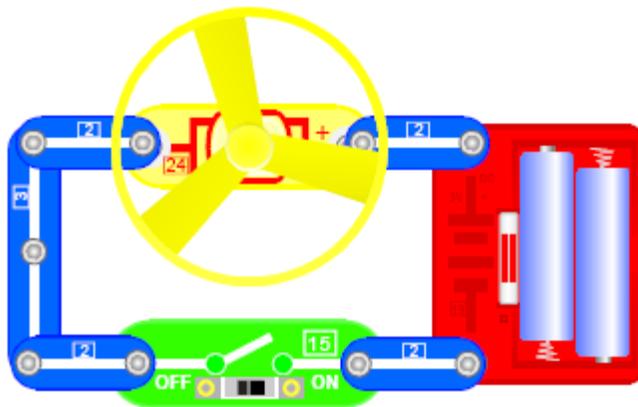
It is easy to follow the flow of electricity around this circuit. The electricity flows out of the positive end of the battery (marked with a + sign), through the bulb, then through the switch and so back into the negative end of the battery. See what happens if you unscrew the bulb and then screw it up again. This happens because the flow of electricity has been temporarily stopped.

### 2. Magnet controlled bulb.

Replace switch 15 with the dry reed switch 13. Bring the magnet close to the dry reed switch and the bulb 18 will light. Remove the magnet and the bulb will go out.

#### How the Dry Reed Switch works.

Inside a glass tube, two thin steel blades are held apart so that they do not touch each other. When a magnet is brought close, the two blades are forced to touch each other so allowing electricity to flow. When the magnet is removed, the blades spring apart again so stopping the flow of electricity.



### 3. Electric Fan.

Assemble as illustrated. The yellow fan should be placed on the motor spigot and not pushed down. Slide switch 15 to the on position and the fan will rotate. Do not lean over the fan as it may fly off! Switch off and the fan will stop rotating.

### 4. Magnet controlled fan.

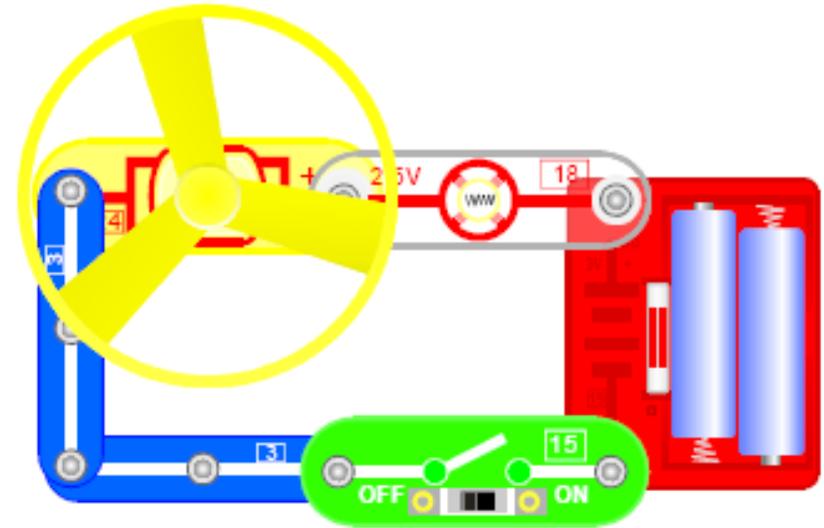
Replace the slide switch 15 with the dry reed switch 13. Bring the magnet close to the dry reed switch and the fan will rotate. Remove the magnet and the fan will stop rotating.

### 5. A bulb and a motor connected in series.

Slide the switch 15 to the on position, the bulb will light dimly and flicker and the motor will turn slowly. Switch off, the bulb will go out and the motor stop rotating.

In a series circuit, the electricity has to flow through the bulb and then through the motor so they both share the voltage. The battery voltage is 3 volts so they get 1.5 volts each.

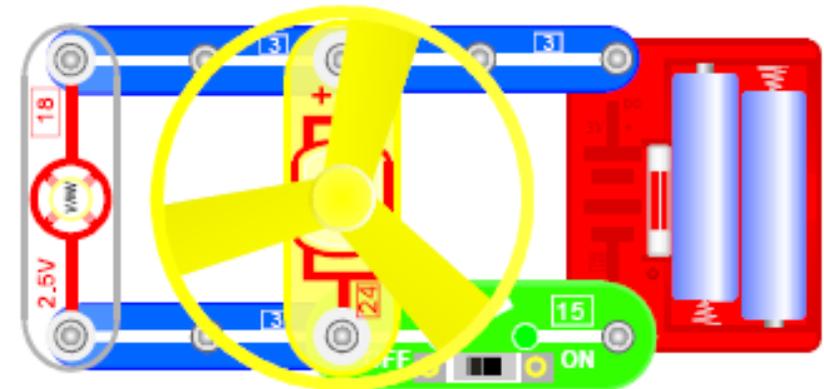
If you remove the bulb, the motor will stop as the electricity can no longer flow. Volts are a measure of electrical pressure rather like the water coming out of a hose pipe. If you put your finger over the end of the pipe the jet of water will travel further but not so much water will flow.

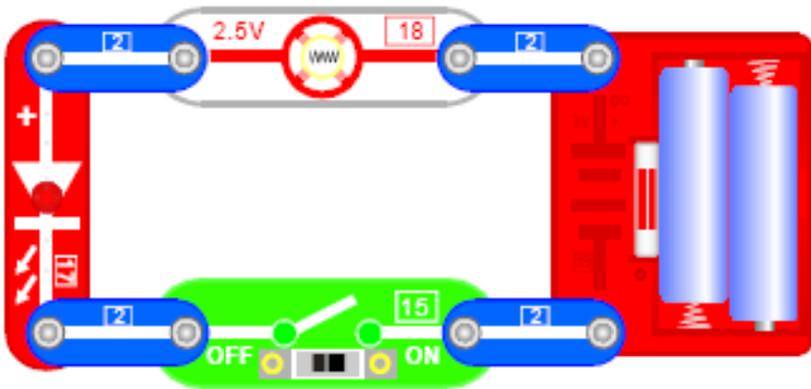


### 6. A bulb and a motor connected in parallel.

Slide the switch 15 to the on position, the bulb 18 will light brightly and the motor will turn much faster. Switch off, the bulb will go out and the motor stop rotating.

In a parallel circuit, the electricity flows directly to the motor and to the bulb. The battery voltage is 3 volts so they both get the full 3 volts. If you unscrew the bulb, the motor will continue to rotate.



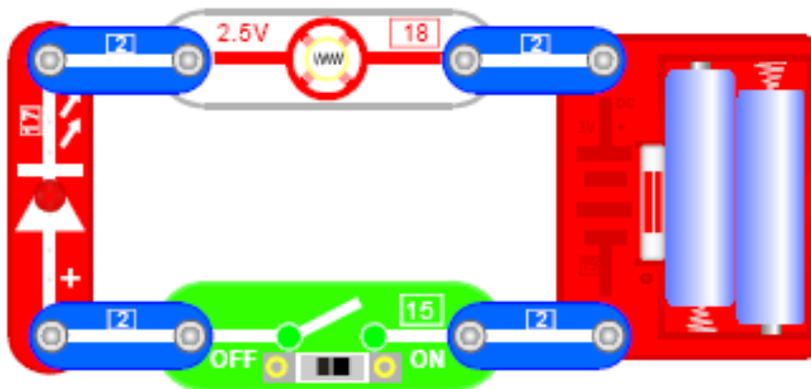


### 7. A light emitting diode. (LED).

The LED 17 and the bulb are connected in series. When you switch on, the LED will light but the bulb does not light. This is because the current required to light the LED is much less than is required to light the bulb. Electricity will still flow through the bulb but not enough to make it light.

If you unscrew the bulb, the LED will go out.

Current is measured in Amps and it is a measure of the amount of electricity flowing. In the hose pipe idea, it is the amount of water flowing through the pipe. If you are filling a watering can, it will fill much more quickly if you do not put your finger over the end to increase the pressure.



### 8. One way conductivity of an LED.

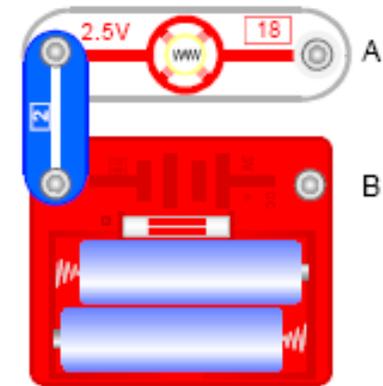
This circuit is the same as number 7 but notice that the LED has been reversed.

When this circuit is switched on, neither the bulb or the LED will light, this is because electricity will only flow through an LED from positive to negative. It is said to be a polarized device.

### 9. Conductivity tester.

With this circuit, you can test out various materials to see if they conduct electricity. Use the material to make contact with points A and B, if the bulb lights then the material conducts electricity.

You could try such things as a metal teaspoon, a plastic ruler, a wooden pencil, a rubber, a piece of paper, a piece of baking foil or silver paper. The more material you test the better. Make a list of them and say if they conduct electricity or not.



### 10. Controlling a bulb or an LED with a magnet.

Switch the circuit on. Only the LED will light. Bring a magnet close to the dry reed relay and the bulb will light up and the LED goes out. This is because the dry reed relay gives an easier path for the electricity to get back to the battery and so it does not pass through the LED.

### 11. Controlling a motor or an LED with a magnet.

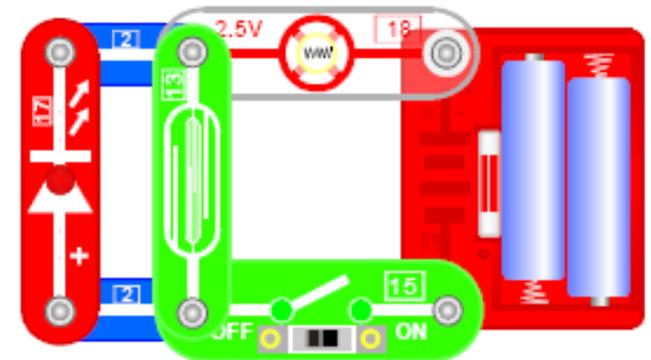
Replace the bulb with the motor and then the motor and the LED will be controlled by the magnet.

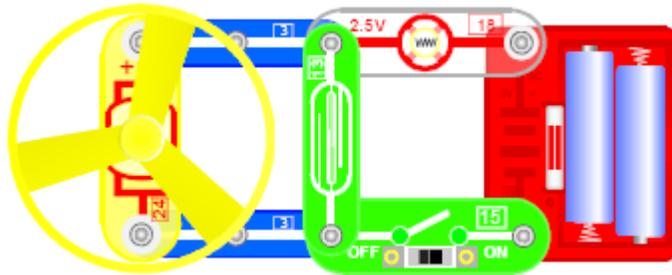
### 12. Controlling a bulb or an LED with a press switch.

Replace the motor with the bulb and the dry reed relay with the press switch 14. When you switch on the LED will light but not the bulb. Press the press switch and the LED will go out and the bulb lights up.

### 13. Controlling a motor or an LED with a press switch.

Replace the bulb with the motor. Now the motor or the LED can be controlled by the press switch.





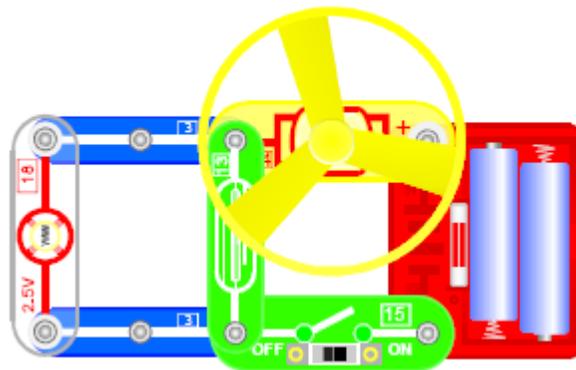
**14. Brightness of a bulb in series controlled by a magnet.**

Switch on and the motor will rotate slowly and the bulb light dimly. Bring a magnet close to the dry reed relay and the motor will stop rotating while the bulb will light brightly. The electricity now passes through the reed relay and does not go to the motor.

**15. Brightness of a bulb in series controlled by a press switch.**

Replace the reed relay with a press switch. Now the operation can be controlled by hand.

In all these circuits, the reed relay allows the switching to take place remotely. Imagine a room where the ventilation fan needs to be on if the window is closed. If the reed relay is mounted on the window frame and the magnet is fixed on the opening part of the window so that if the window is opened, the magnet will be close to the reed relay, then when the window is shut, the fan will rotate but if the window is opened, the fan will stop and the bulb will get brighter. If the ventilation fan should stop working then the bulb will go out and act as a warning.



**16. Speed of a fan in series controlled by a magnet.**

Switch on and the fan will rotate slowly and the bulb light dimly. Bring the magnet close to the reed relay and the bulb will go out and the speed of the fan increase. Do not put you face over the fan as it may fly off!

**17. Speed of a fan in series controlled by a press switch.**

Replace the reed switch with a press switch. Switch on and the fan will rotate slowly and the bulb light dimly. Press the press switch and the bulb will go out and the speed of the fan increase. Do not put you face over the fan as it may fly off!

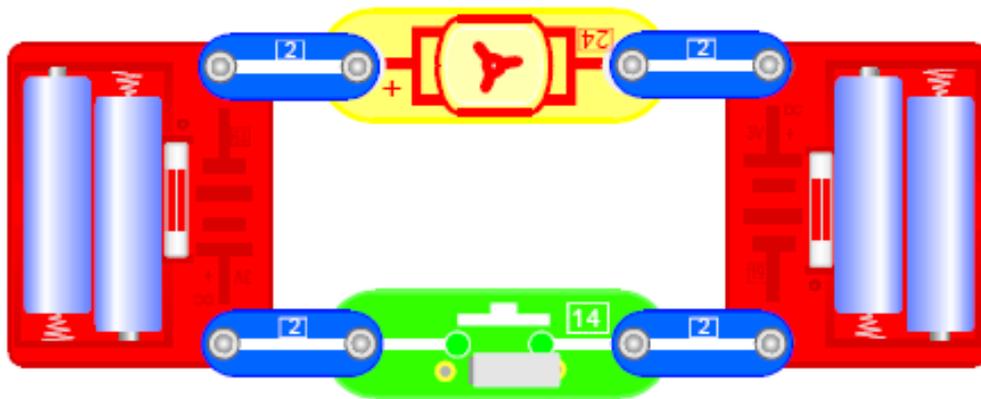
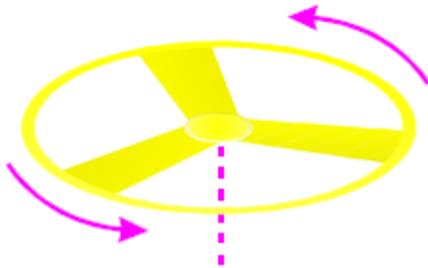
### 18. Flying Fan

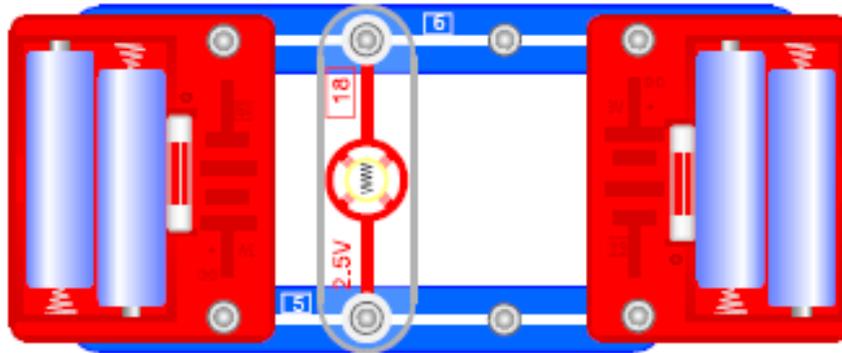
When you make up the circuit, be careful to put the motor in the correct way round with the + sign on the left. The yellow fan should be placed on the motor spigot and not pushed down. **Do not lean over the fan as it will fly off with some force!** Switch on, the fan will rotate and fly up into the air. If the fan does not fly after a few seconds, let go of the switch.

If the spigot gets pushed down on the motor shaft, gently prize it up again using a screwdriver or a key.

### 19. What happens if the motor is reversed?

Turn the motor round so that the + sign is on the right. Put the fan on the motor and switch on. This time the fan will not fly but will give a powerful current of air in an upwards direction.

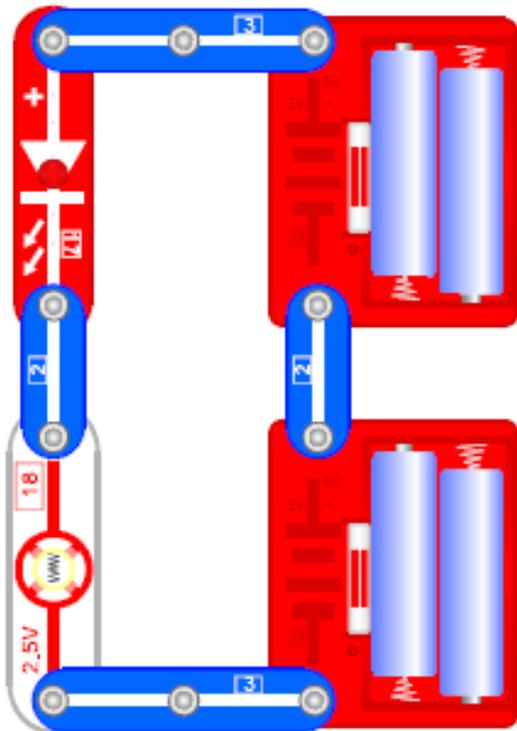




**20. Batteries connected in parallel.**

The circuit at the top of the page shows how batteries can be connected in parallel.

The + terminal of one battery is connected to the + terminal of the other battery and the two – terminals are also connected together. The voltage remains the same but the capacity of the batteries is doubled so they will last twice as long. This arrangement is not used much these days and it is a throwback to the days when batteries were less powerful.

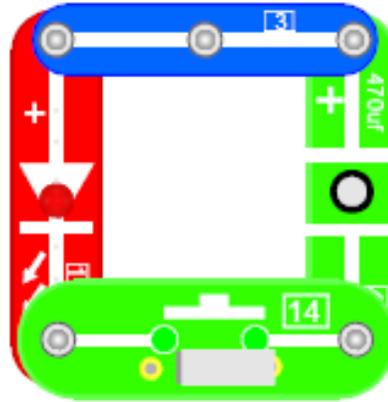
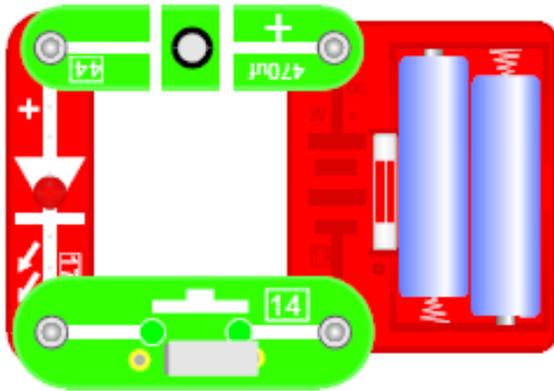


**21. Batteries connected in series.**

The circuit on the left shows the batteries connected in series. It is a folded out version of circuits 18 and 19. When batteries are arranged in this way, the total voltage is the combined voltage of both batteries added together. In this case as both batteries are 3volts, the output to the bulb and the LED is 6volts.

**22. Batteries connected in series but the wrong way round.**

This arrangement is not to be recommended as the voltage is zero and the batteries will be damaged.



### 23. Charging a capacitor.

A capacitor is a short term storage device for electricity. A capacitor is used to supply a short pulse of electricity just when it is required so it can be charged up quickly and the electricity used before it can run out.

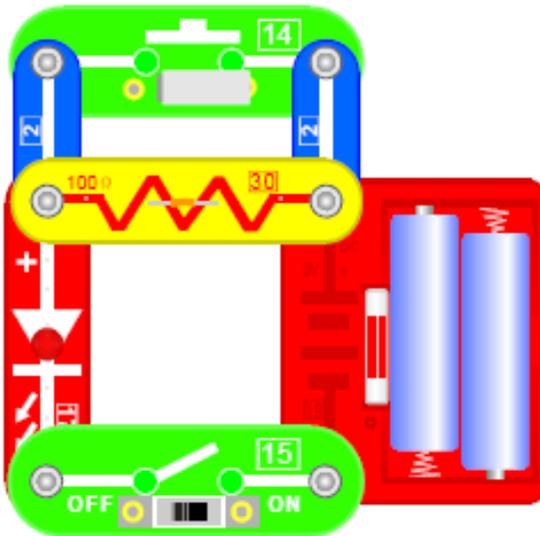
The circuit at the top left of the page shows how a capacitor can be charged. Press the switch and the LED will flash once to show that the capacitor has been charged.

### 24. Discharging a capacitor.

Charge the capacitor as in circuit 23. Very quickly change the circuit as shown on the top right. Press the switch and the LED will flash once as the capacitor discharges.

### 25. The working of a capacitor.

Think of a capacitor as being a bit like a bucket with a hole in it. If you fill the bucket with water, the water will slowly run out of the hole. When a capacitor is charged the electricity will not remain in it for long so it will not hold its charge for a long time.



### 26. The working of a resistor.

A resistor slows the flow of electricity. Try the circuit on the left. When you switch on the LED will light dimly. This is because the resistor 30 is slowing the electricity down. Now press the other switch and notice that the LED gets brighter. The electricity now flows through the switch and not through the resistor so the electricity speeds up and the LED glows brighter.

The next section of experiments all feature module 21. This is a sound module using a multi vibrator integrated circuit to produce a musical tune. All the experiments start with the circuit shown.

**27. Doorbell controlled by a press switch.**

Switch on and music will be played. When the music stops it will restart if you press the press switch.

**28. Doorbell controlled by a magnet.**

Replace the press switch with the dry reed switch, the magnet can be used to control the music.

**29. Doorbell controlled by light.**

Replace the press switch with the photo sensor 16. When the photo sensor is covered, the music will stop and will start again when the photo sensor is uncovered. The photo sensor contains a light sensitive resistor. In the dark the resistance is high and so electricity does not flow but in the light, the resistance is low so electricity flows and the music sounds.

**30. Doorbell controlled by a touch switch.**

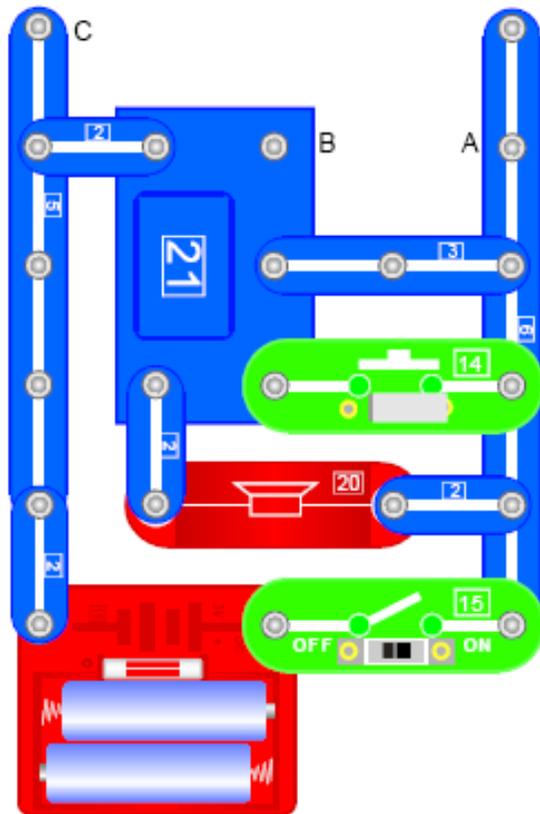
Replace the press switch with the touch plate 12. Put your finger on the touch plate and the music will sound. Remove you finger and the music will stop. The touch switch conducts electricity when the two parts of the plate are connected together. The slight dampness on your finger is enough for this to happen!

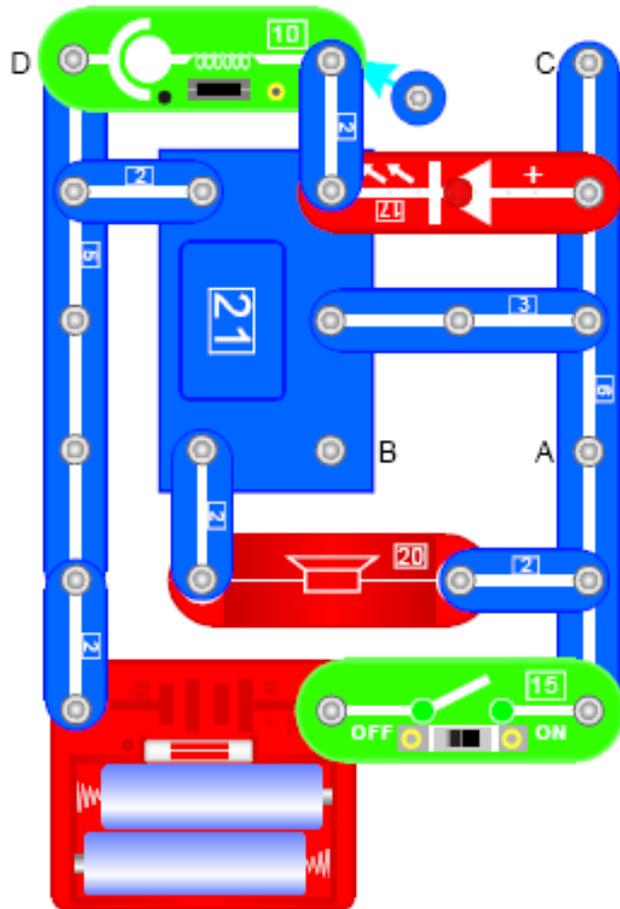
**31. Doorbell controlled by sound.**

Connect the buzzer 11 to terminals A and B. Switch on and when the music stops, clap you hands and the music will start again.

**32. Doorbell controlled by a motor.**

Connect the motor 24 to A and B. When the music stops, gently turn the motor shaft and the music will start again.





**33. Doorbell controlled by vibration (1).**

When you have made up the circuit switch on. When the music stops, gently tap the base board and the music will start again.

**34. Doorbell controlled by a press switch (1).**

Replace vibrating switch 10 with the press switch 14, when the music stops, press the press switch once and the music will start again.

**35. Doorbell controlled by vibration (2).**

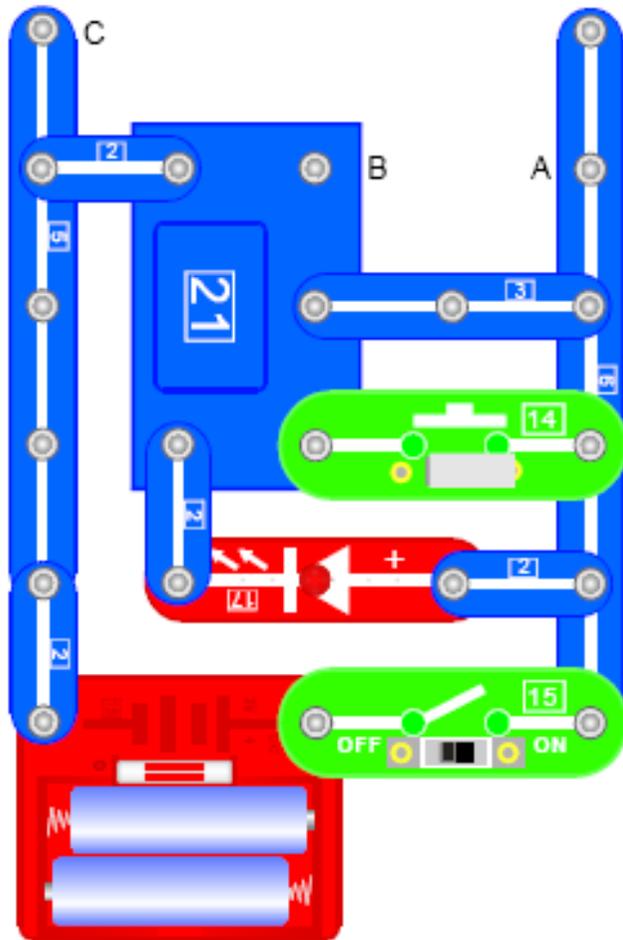
Replace the LED with the vibrating switch 10, when the music stops, gently tap the base board and the music will start again.

**36. Doorbell controlled by a press switch (2).**

Replace the LED with the press switch 14, when the music stops, press the press switch once and the music will start again.

**37. Doorbell controlled by a press switch (3).**

Remove the vibrating switch 10 and replace the LED. Connect the press switch to terminals A and B, when the music stops, press the press switch once and the music will start again.



**38. LED controlled by a press switch.**

Switch on, when the LED goes out, press the press switch and the LED will light up again.

**39. LED controlled by a magnet.**

Replace the press switch with the dry reed switch. Switch on, when the LED goes out, bring the magnet close to the dry reed switch and the LED will light up again.

**40. LED controlled by light.**

Replace the press switch with the photosensor. Switch on and cover up the photosensor, when the LED goes out, uncover the photosensor and the LED will light up again.

**41. LED controlled by the touch switch.**

Replace the press switch with the touch plate. Switch on and when the LED goes out, put your finger on the touch plate and the LED will light up again.

**42. LED controlled by sound (1).**

Connect the buzzer 11 to terminals A and B. Switch on and when the LED goes out, clap your hands and the LED will light up again.

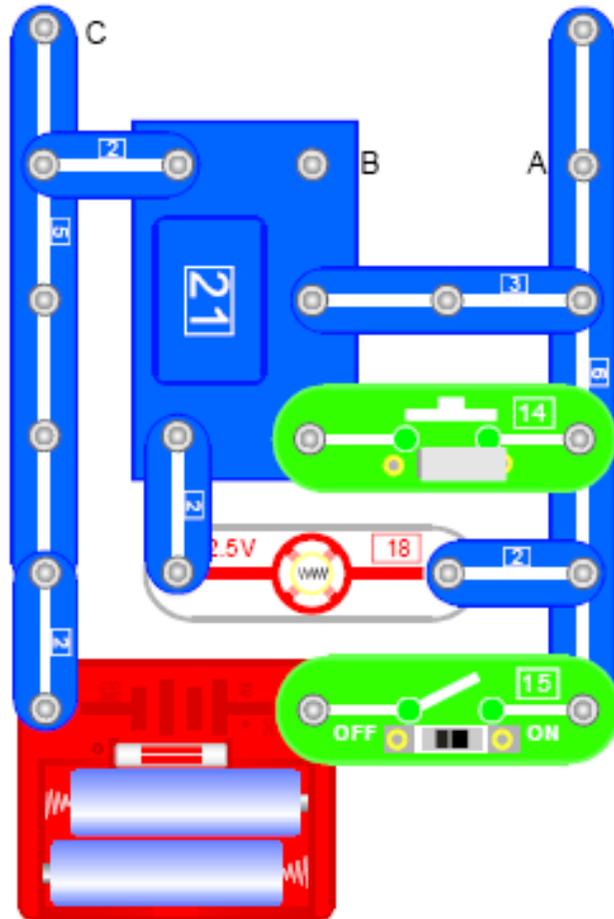
**43. LED controlled by sound (2).**

Connect the speaker 20 to terminals A and B. Switch on and when the LED goes out, clap your hands close to the speaker and the LED will light up again.

**44. LED controlled by a motor.**

Connect the motor to terminals A and B. Switch on and when the LED goes out, turn the motor shaft and the LED will light up again.





**50. Flashing bulb controlled by a press switch.**

Switch on and when the bulb goes out, press the press switch and the bulb will light up again and go out after a period of time.

**51. Flashing bulb controlled by a magnet.**

Replace the press switch with the dry reed switch. Switch on, when the bulb goes out, bring the magnet close to the dry reed switch and the bulb will light up again.

**52. Flashing bulb controlled by light.**

Replace the press switch with the photosensor 16. Switch on and cover up the photosensor, when the bulb goes out, uncover the photosensor and the bulb will light up again.

**53. Flashing bulb controlled by the touch switch.**

Replace the press switch with the touch plate 12. Switch on and when the bulb goes out, put your finger on the touch plate and the bulb will light up again.

**54. Flashing bulb controlled by sound (1).**

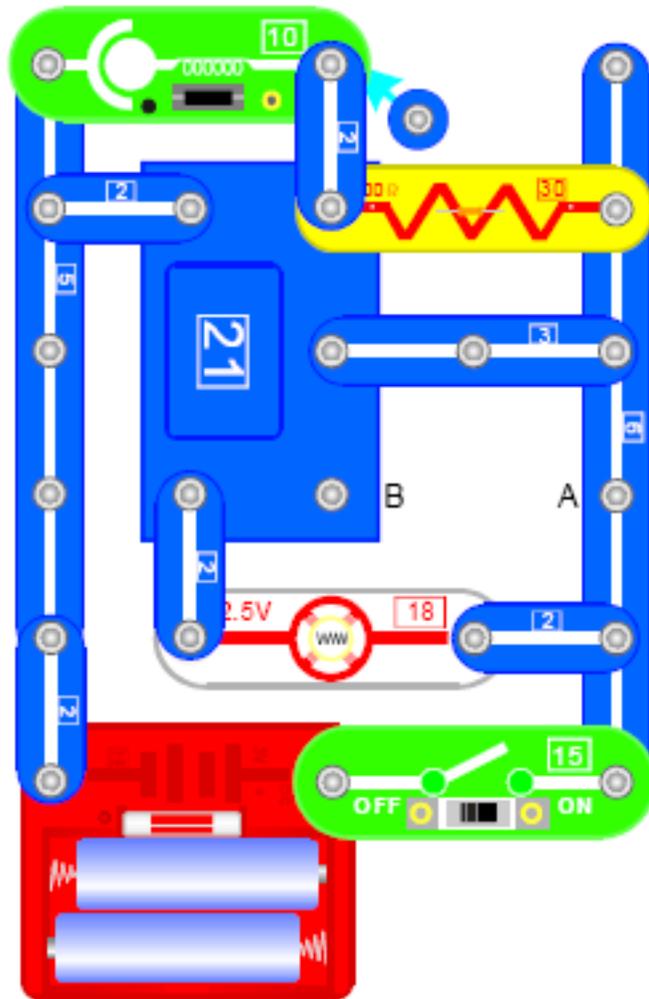
Connect the buzzer 11 to terminals A and B. Switch on and when the bulb goes out, clap your hands and the bulb will light up again.

**55. Flashing bulb controlled by sound (2).**

Connect the speaker 20 to terminals A and B. Switch on and when the bulb goes out, clap your hands and the bulb will light up again.

**56. Flashing bulb controlled by a motor.**

Connect the motor 24 to terminals A and B. Switch on and when the bulb goes out, turn the motor shaft gently and the bulb will light up again.



**57. Flashing bulb controlled by vibration (1).**

Switch on and when the bulb goes out, gently tap the base board, the bulb will light up again and go out after a period of time.

**58. Flashing bulb controlled by a press switch (1).**

Replace the vibration switch with the press switch. Switch on and when the bulb goes out, press the press switch, the bulb will light up again and go out after a period of time.

**59. Flashing bulb controlled by vibration (2).**

Replace the resistor 30 with the vibration switch 10. Switch on and when the bulb goes out, gently tap the base board, the bulb will light up again and go out after a period of time.

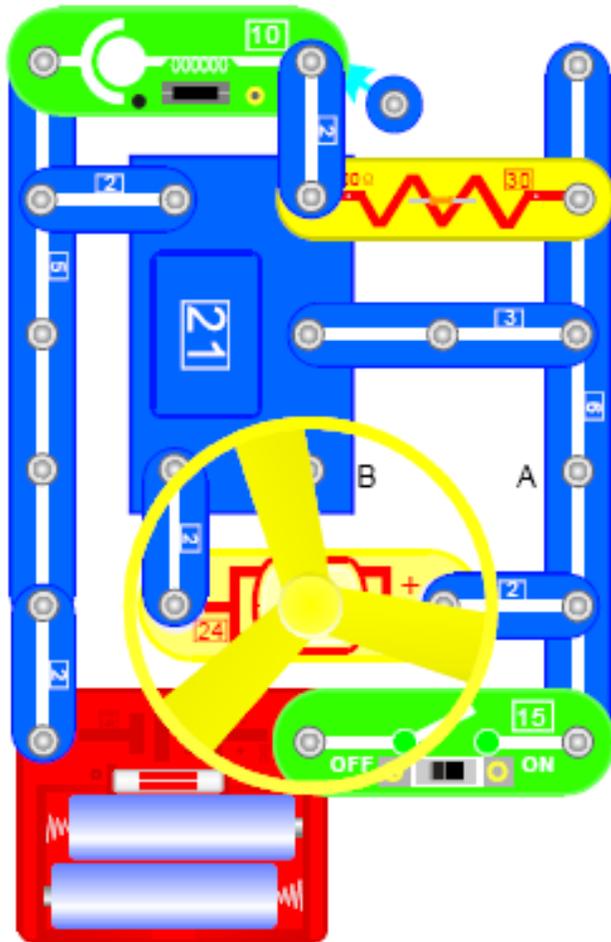
**60. Flashing bulb controlled by a press switch (2).**

Replace the resistor 30 with the press switch. Switch on and when the bulb goes out, press the press switch, the bulb will light up again and go out after a period of time.

**61. Flashing bulb controlled by a press switch (3).**

Remove the vibration switch 10, replace the resistor 30. connect the press switch to terminals A and B. Switch on and when the bulb goes out, press the press switch, the bulb will light up again and go out after a period of time.





**68. Singing motor controlled by vibration (1).**

Switch on and when the music stops, gently tap the base board, the motor will play the music again.

**69. Singing motor controlled by the press switch (1).**

Replace the vibration switch with the press switch. Switch on and when the music stops, press the press switch, the motor will play the music again.

**70. Singing motor controlled by vibration (2).**

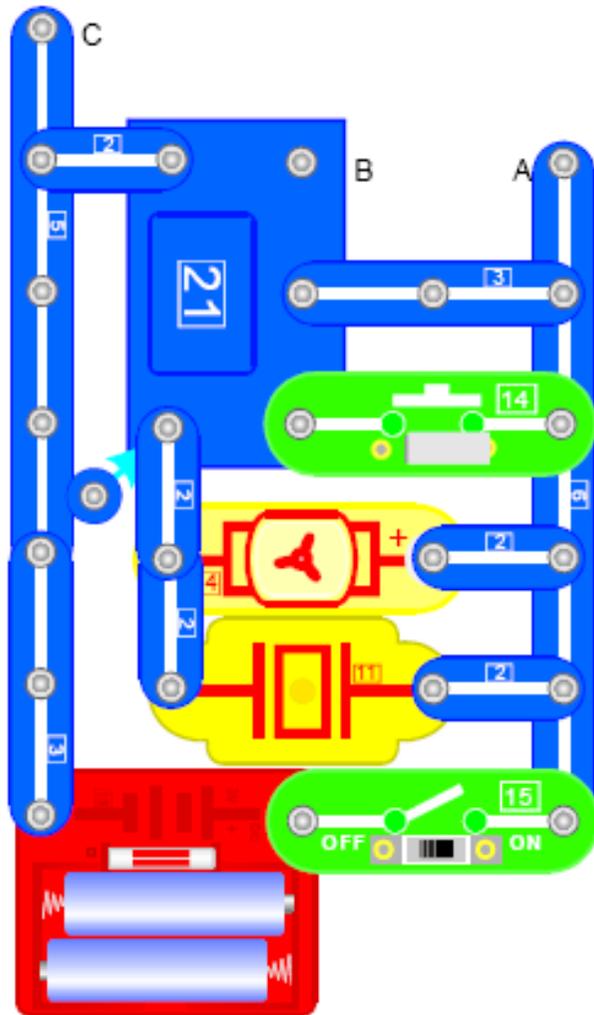
Replace the resistor with the vibration switch 10. Switch on and when the music stops, gently tap the base board, the motor will play the music again.

**71. Singing motor controlled by the press switch (2).**

Replace the resistor with the press switch. Switch on and when the music stops, press the press switch, the motor will play the music again.

**72. Singing motor controlled by the press switch (3).**

Remove the vibration switch and replace the resistor. Connect the press switch to terminals A and B. Switch on and when the music stops, press the press switch, the motor will play the music again.



**73. Buzzer music controlled by the press switch.**

Switch on and when the music stops, press the press switch, the buzzer 11 will play the music again.

**74. Buzzer music controlled by a magnet.**

Replace the press switch with the dry reed relay. Switch on and when the music stops, press the press switch, the buzzer 11 will play the music again. If the music keeps repeating, stop the motor from rotating.

**75. Buzzer music controlled by light.**

Replace the press switch with the photosensor. Put your finger over the photosensor and switch on. When the music stops, take your finger off the photosensor, the buzzer 11 will play the music again. If the music keeps repeating, stop the motor from rotating.

**76. Buzzer music controlled by touch.**

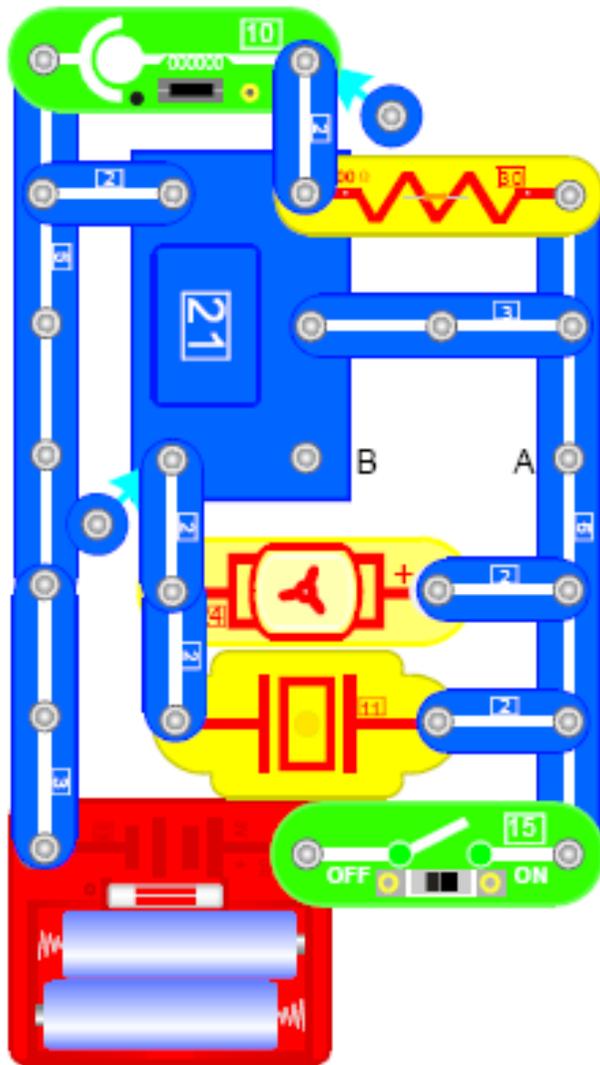
Replace the press switch with the touch plate. Switch on and when the music stops, put your finger on the touch plate, the buzzer 11 will play the music again. If the music keeps repeating, stop the motor from rotating.

**77. Buzzer music controlled by sound.**

Connect the speaker 20 to terminals A and B. Switch on and when the music stops, clap your hands close to the speaker, the buzzer 11 will play the music again. If the music keeps repeating, stop the motor from rotating.

**78. Buzzer music controlled by a motor.**

Replace the motor with the bulb, then connect the motor to terminals A and B. Switch on and when the music stops, turn the motor shaft, the buzzer 11 will play the music again.



**79. Buzzer music controlled by vibration (1).**

Switch on and when the music stops, tap the base board, the buzzer 11 will play the music again.

**80. Buzzer music controlled by a press switch (1).**

Replace the vibration switch with press switch 14. Switch on and when the music stops, press the press switch and the buzzer will play the music again.

**81. Buzzer music controlled by vibration switch (2).**

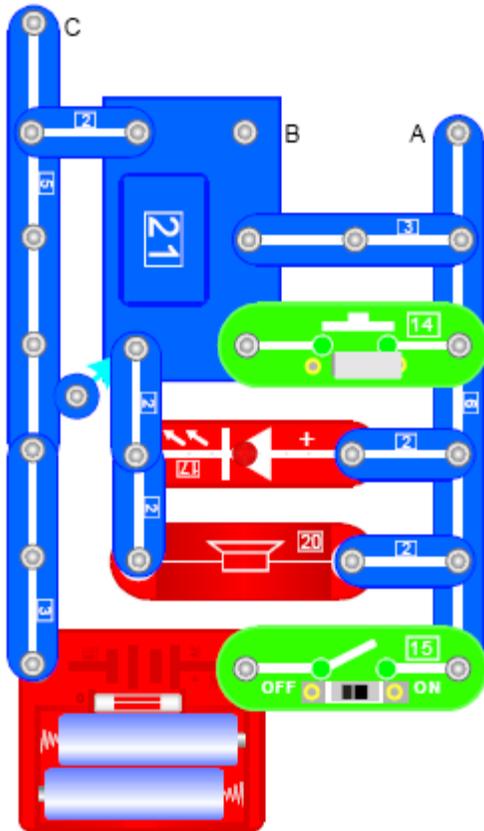
Replace the resistor with the vibration switch. Switch on and when the music stops, tap the base board, the buzzer 11 will play the music again.

**82. Buzzer music controlled by a press switch (2).**

Replace the resistor with the press switch. Switch on and when the music stops, press the press switch, the buzzer 11 will play the music again.

**83. Buzzer music controlled by a press switch (3).**

Remove the vibration switch and replace the resistor. Connect the press switch to terminals A and B. Switch on and when the music stops, press the press switch, the buzzer 11 will play the music again.



In the following experiments 84 to 94, an LED is included in the circuit to give a visual indication that the doorbell is sounding. This would be useful for the hard of hearing.

**84. Acoustic- optic doorbell controlled by a press switch.**

Switch on and music will be played. When the music stops it will restart if you press the press switch.

**85. Acoustic- optic doorbell controlled by a magnet.**

Replace the press switch with the dry reed switch, the magnet can be used to control the music.

**86. Acoustic- optic doorbell controlled by light.**

Replace the press switch with the photosensor 16. When the photosensor is covered, the music will stop and will start again when the photosensor is uncovered. The photosensor contains a light sensitive resistor. In the dark the resistance is high and so electricity does not flow but in the light, the resistance is low so electricity flows and the music sounds.

**87. Acoustic- optic doorbell controlled by a touch switch.**

Replace the press switch with the touch plate 12. Put your finger on the touch plate and the music will sound. Remove you finger and the music will stop. The touch switch conducts electricity when the two parts of the plate are connected together. The slight dampness on your finger is enough for this to happen!

**88. Acoustic- optic doorbell controlled by sound.**

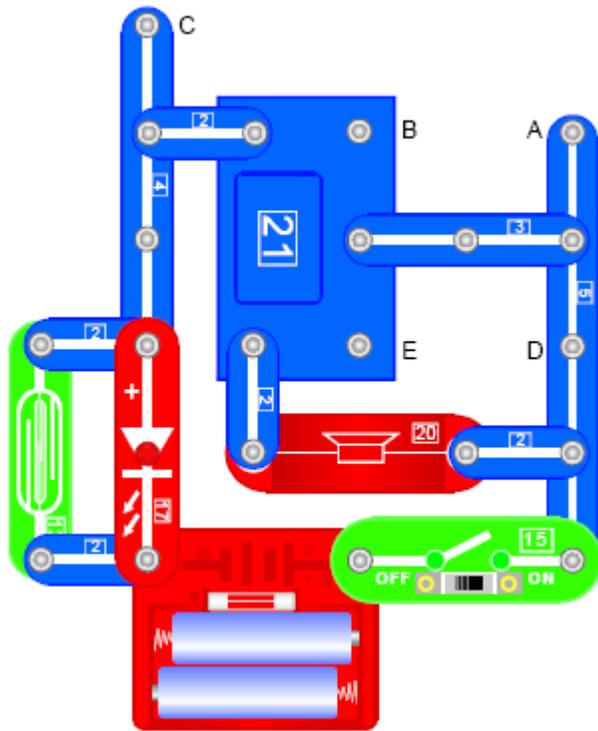
Connect the buzzer 11 to terminals A and B. Switch on and when the music stops, clap you hands and the music will start again.

**89. Acoustic- optic Doorbell controlled by a motor.**

Connect the motor 24 to A and B. When the music stops, gently turn the motor shaft and the music will start again.







**103. Vibration controlled slow rhythm music.**

Connect the vibration switch to terminals A and B. Switch on and when the music stops, tap the vibration switch and the music will start again.

**104. Sound controlled slow rhythm music.**

Connect the buzzer to terminals A and B. Switch on and when the music stops, clap your hands and the music will start again.

**105. Press switch controlled slow rhythm music (1).**

Connect the press switch to terminals A and B. Switch on and when the music stops, press the press switch and the music will start again.

**106. Press switch controlled slow rhythm music (2).**

Connect the press switch to terminals D and E. Switch on and when the music stops, press the press switch and the music will start again.

**107. Vibration controlled slow rhythm music.**

Connect the vibration switch to terminals A and B. Switch on and when the music stops, knock the vibration switch and the music will start again. To speed up the music, bring a magnet close to the reed relay.

**108. Sound controlled slow rhythm music.**

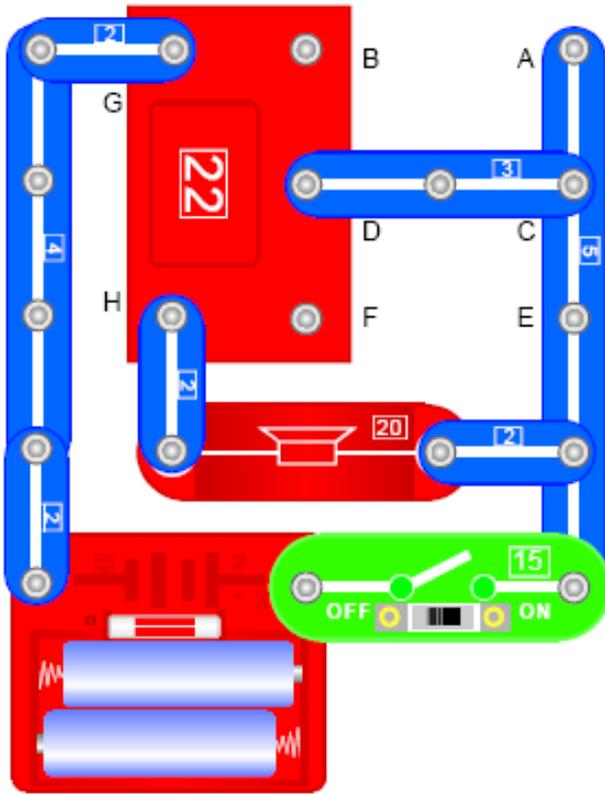
Connect the buzzer to terminals A and B. Switch on and when the music stops, clap your hands and the music will start again. To speed up the music, bring a magnet close to the reed relay.

**109. Press switch controlled slow rhythm music (1).**

Connect the press switch to terminals A and B. Switch on and when the music stops, press the press switch and the music will start again. To speed up the music, bring a magnet close to the reed relay.

**110. Press switch controlled slow rhythm music (2).**

Connect the press switch to terminals D and E. Switch on and when the music stops, press the press switch and the music will start again. To speed up the music, bring a magnet close to the reed relay.



**111. Sound of a police car.**

Switch on and the speaker will make the sound of a police car.

**112. Sound of a machine gun.**

Connect terminals E and F together. Switch on and the speaker will make the sound of a machine gun.

**113. Sound of a fire engine.**

Connect terminals A and B together. Switch on and the speaker will make the sound of a fire engine.

**114. Sound of an ambulance.**

Connect terminals B and G together. Switch on and the speaker will make the sound of an ambulance.

**115. Sound of a gaming machine.**

Remove the connector from terminals C and D. Connect terminals A and B together. Switch on and the speaker will make the sound of a gaming machine.

**116. Sound of intruder alarm.**

Connect terminals B and G together also connect F and H. Switch on and the speaker will make the sound of an intruder alarm.

**117. Sound of vibration (1).**

Connect terminals B and F together. Switch on and the speaker will make the sound of vibration.

**118. Sound of vibration (2).**

Remove the connector from C and D. Connect terminals A and B together. Switch on and the speaker will make the sound of vibration.

**119. High speed flashing LED.**

Replace the speaker with the LED. Remove the connector from C and D. Connect terminals B and G together also connect F and H. Switch on and the LED will flash at high speed.

**120. Low speed flashing LED.**

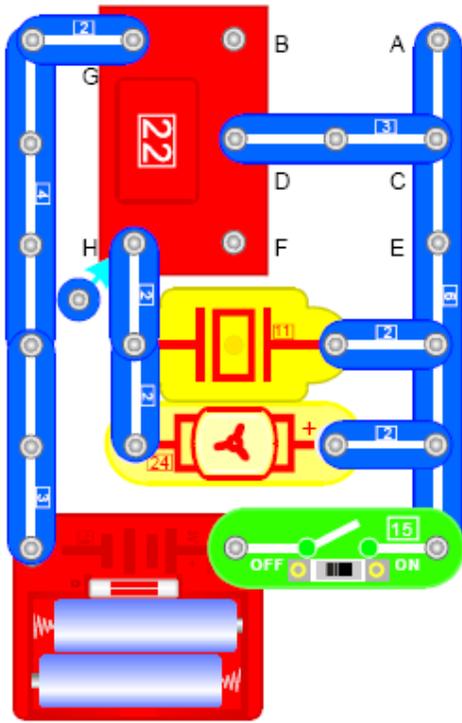
Replace the speaker with the LED. Connect terminals F and E together. Switch on and the LED will flash slowly.

**121. High speed flashing lamp.**

Replace the speaker with the bulb. Remove the connector from C and D. Connect terminals B and G together also connect F and H. Switch on and the bulb will flash at high speed.

**122. Low speed flashing lamp.**

Replace the speaker with the bulb. Connect terminals F and E together. Switch on and the bulb will flash slowly.



**123. Bleeping sound of a police car.**

Switch on and the buzzer will make the bleeping sound of a police car.

**124. Bleeping sound of a machine gun.**

Connect terminals E and F together. Switch on and the buzzer will make the bleeping sound of a machine gun.

**125. Bleeping sound of a fire engine.**

Connect terminals A and B together. Switch on and the buzzer will make the bleeping sound of a fire engine.

**126. Bleeping sound of an ambulance.**

Connect terminals B and G together. Switch on and the buzzer will make the bleeping sound of an ambulance.

**127. Bleeping sound of a gaming machine.**

Remove the connector from terminals C and D. Connect terminals A and B together. Switch on and the buzzer will make the bleeping sound of a gaming machine.

**128. Bleeping sound of intruder alarm.**

Connect terminals B and G together also connect F and H. Switch on and the buzzer will make the bleeping sound of an intruder alarm.

**129. Bleeping sound of vibration (1).**

Connect terminals B and F together. Switch on and the buzzer will make the bleeping sound of vibration.

**130. Bleeping sound of vibration (2).**

Remove the connector from C and D. Connect terminals A and B together. Switch on and the buzzer will make the bleeping sound of vibration.

**131. Sound of a police car produced by a motor.**

Remove the buzzer and replace it with the motor. Switch on and the motor will make the sound of a police car.

**132. Sound of a machine gun produced by a motor.**

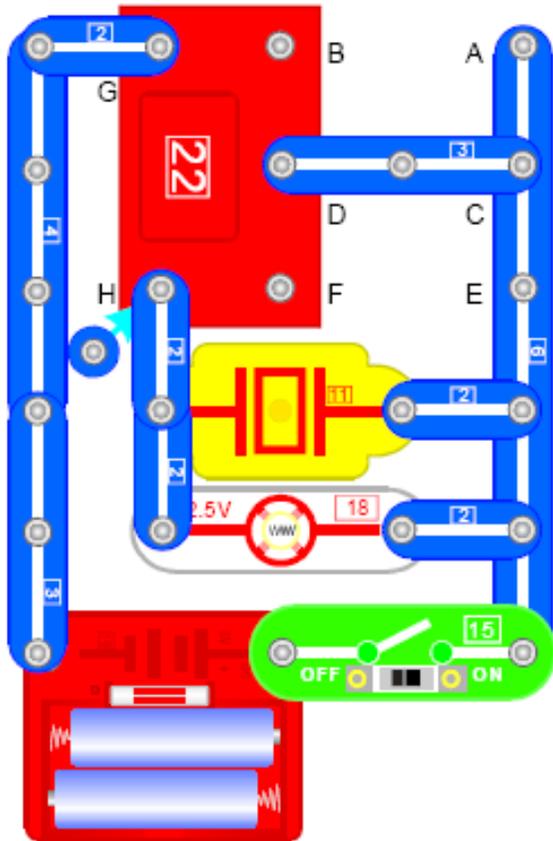
Remove the buzzer and replace it with the motor. Connect terminals E and F together. Switch on and the motor will make the sound of a machine gun.

**133. Sound of a fire engine produced by a motor.**

Remove the buzzer and replace it with the motor. Connect terminals A and B together. Switch on and the motor will make the sound of a fire engine.

**134. Sound of an ambulance produced by a motor.**

Remove the buzzer and replace it with the motor. Connect terminals B and G together. Switch on and the motor will make the sound of an ambulance.



**135. Sound of a police car with light.**

Switch on and the buzzer will make the sound of a police car and the bulb will light up.

**136. Sound of a machine gun with light.**

Connect terminals E and F. Switch on and the buzzer will make the sound of a machine gun and the bulb will flash in time with the sound.

**137. Sound of a fire engine with light.**

Connect terminals A and B. Switch on and the buzzer will make the sound of a fire engine and the bulb will light up.

**138. Sound of an ambulance with light.**

Connect terminals B and G. Switch on and the buzzer will make the sound of an ambulance and the bulb will light up.

**139. Sound of vibration with light.**

Connect terminals B and F. Switch on and the buzzer will make the sound of vibration and the bulb will light up.

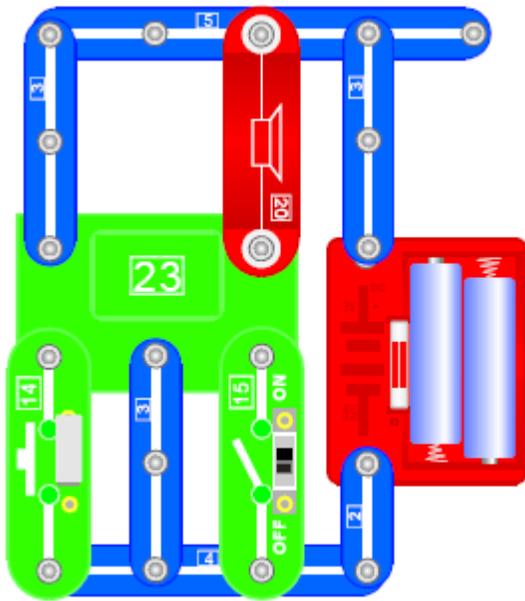
**140. Light controlled sound of a police car.**

Replace the bulb with the photosensor 16. Switch on and the buzzer will make the sound of a police car. Cover the light sensor and the sound will get softer or stop.

**145. Light controlled sound of music.**

Replace the module 22 with the music module 21. Replace the bulb with the photosensor 16. Switch on and the buzzer will play the sound of music. Cover the photo sensor and the sound will get softer or stop.





**160. Hand controlled sounds of space war.**

Operate the two switches separately or together to produce different sounds of space wars.

**161. Magnet controlled sounds of space war.**

Replace switch 15 with the reed relay 13. Operate the two switches separately or together to produce different sounds of space wars controlled by a magnet.

**162. Light controlled sounds of space war.**

Replace switch 15 with the photo sensor 16. Operate the two switches separately or together to produce different sounds of space wars controlled by light.

**163. Touch controlled sounds of space war.**

Replace press switch 14 with the touch plate 12. Touch the plate repeatedly to produce different sounds of space wars.

**164. Knock controlled sounds of space war.**

Replace press switch 14 with the vibration switch 10. Knock the switch repeatedly to produce different sounds of space wars.

**165. Knock controlled LED.**

Replace press switch 14 with the vibration switch 10 and replace the speaker with the LED. Knock the switch to light the LED.

**166. Knock controlled Bulb.**

Replace press switch 14 with the vibration switch 10 and replace the speaker with the bulb. Knock the switch to light the bulb.

**167. Light controlled LED.**

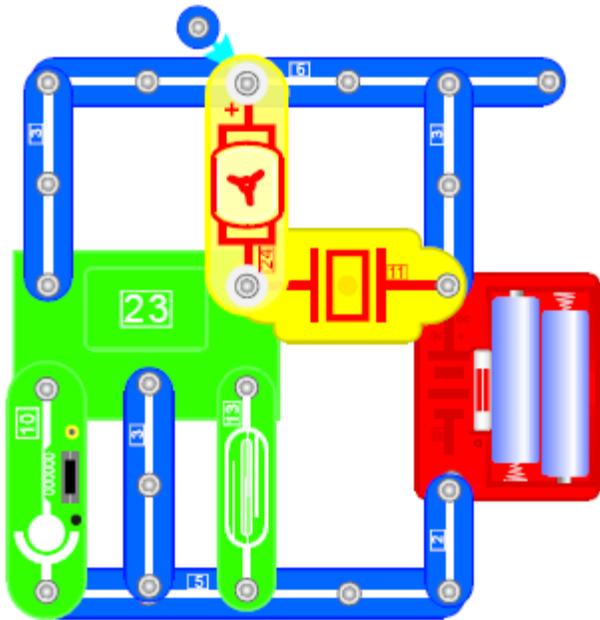
Replace the slide switch 15 with the photo sensor and replace the speaker with the LED. If light falls on the photo sensor, the LED will light up.

**168. Light controlled Bulb.**

Replace the slide switch 15 with the photo sensor and replace the speaker with the bulb. If light falls on the photo sensor, the bulb will light up.

**169. Touch controlled LED.**

Replace the press switch 14 with the touch plate 12 and replace the speaker with the LED. Touch the touch plate and the LED will light up.



**170. Magnet controlled soft sounds of space war.**

Bring a magnet near the dry reed relay and the buzzer will make the soft sounds of a space war.

**171. Light controlled soft sounds of space war.**

Replace the dry reed relay with the photo sensor. When light falls on the sensor, the buzzer will make the soft sounds of a space war.

**172. Hand controlled soft sounds of space war.**

Replace the dry reed relay with the press switch. Press the switch and the buzzer will make the soft sounds of a space war.

**173. Knock controlled soft sounds of space war.**

Knock the base board and the buzzer will make the soft sounds of a space war.

**174. Touch controlled soft sounds of space war.**

Replace the vibration switch with the touch plate. Touch the touch plate and the buzzer will make the soft sounds of a space war.

**175. Magnet controlled motor soft sounds of space war.**

Remove the buzzer. Bring a magnet near the dry reed relay and the motor will make the soft sounds of a space war.

**176. Light controlled motor soft sounds of space war.**

Remove the buzzer. Replace the dry reed relay with the photosensor. When light falls on the sensor, the motor will make the soft sounds of a space war.

**177. Hand controlled motor soft sounds of space war.**

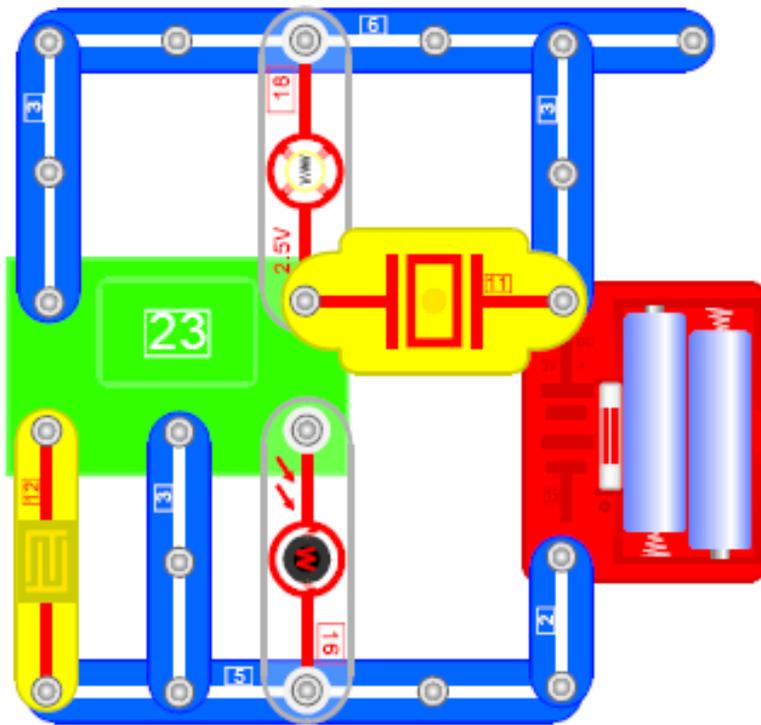
Remove the buzzer. Replace the dry reed relay with the press switch. Press the switch and the motor will make the soft sounds of a space war.

**178. Knock controlled motor soft sounds of space war.**

Remove the buzzer. Replace the dry reed relay with the vibration switch. Knock the base board and the motor will make the soft sounds of a space war.

**179. Touch controlled motor soft sounds of space war.**

Remove the buzzer. Replace the vibration switch with the touch plate. Touch the touch plate and the motor will make the soft sounds of a space war.



**180. Light controlled acousto-optic sound of space war.**

When light falls on the photo sensor, the buzzer will make the sound of a space war and the bulb will light up.

**181. Magnet controlled acousto-optic sound of space war.**

Replace the photo sensor with the dry reed relay. Bring a magnet near the dry reed relay and the buzzer will make the sound of a space war and the bulb will light up.

**182. Hand controlled acousto-optic sound of space war.**

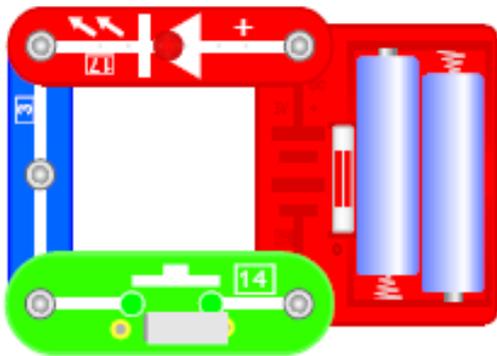
Replace the photosensor with the press switch. Press the press switch and the buzzer will make the sound of a space war and the bulb will light up.

**183. Touch controlled acousto-optic sound of space war.**

Touch the touch switch and the buzzer will make the sound of a space war and the bulb will light up.

**184. Knock controlled acousto-optic sound of space war.**

Replace the touch plate with the vibration switch. Knock the base board and the buzzer will make the sound of a space war and the bulb will light up.



**185. Morse code machine.**

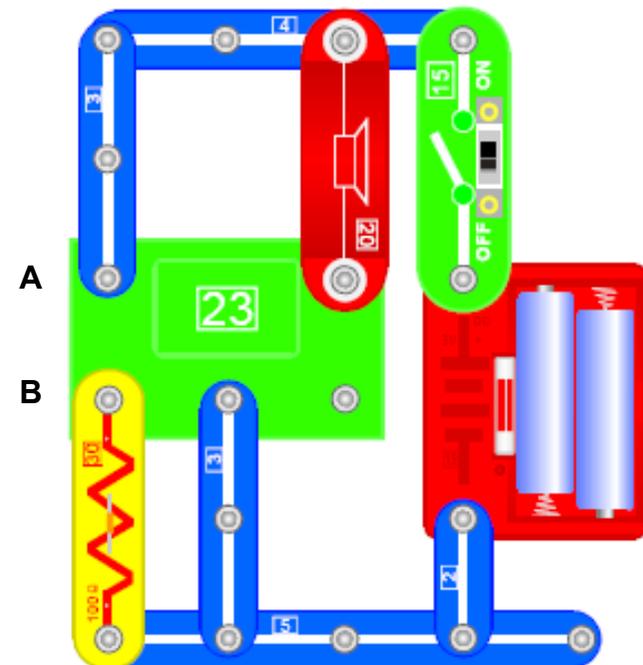
Press the switch to make the LED flash. Use this to send messages in Morse code or even make up your own code!

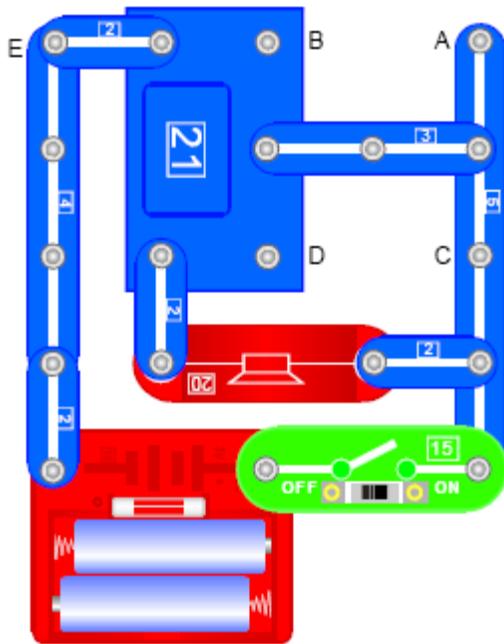
**186. Theft alarm (1).**

Connect a long wire to terminal A. Pass the other end of the wire through the object you wish to protect and then connect the other end of the wire to terminal B. Switch on and if the object is removed, the wire will break and the alarm will sound.

**187. Rain warning alarm.**

Replace the resistor 30 with the touch plate. Connect the touch plate with long wires and hang them out of the window. If it starts to rain, the touch plate will get wet and complete the circuit, this will sound the alarm.





**188. Theft alarm (2).**

Connect a long wire to terminal A. Pass the other end of the wire through the object you wish to protect and then connect the other end of the wire to terminal B. Switch on and if the object is removed, the wire will break and the alarm will sound.

**189. Noise warning.**

Connect the buzzer to terminals A and B. If the noise level gets too high, the music will play.

**190. Musical doorbell.**

Fix the buzzer to a door and connect it to terminals A and B with thin wire. If there is a knock at the door, the music will play.

**191. Theft alarm using the vibration switch.**

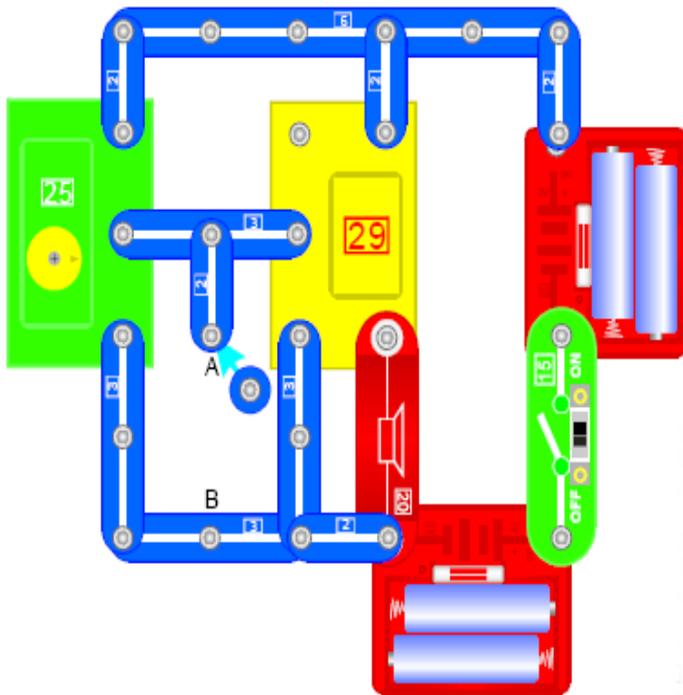
Fix the vibration switch to an object you wish to protect. Connect the vibration switch to terminals A and B with thin wire. If the object is removed, the music will play.

**192. Daybreak alarm.**

Connect the photo sensor to terminals C and D. When it is dark, switch on and when light falls on the sensor, the music will play.

**193. Bath level indicator.**

Connect the touch plate with thin wires to terminals C and D. hang the touch plate over the side of the bath and when the water reaches the touch plate, the music will play.



**194. Medium wave radio.**

Switch on and tune the stations in using the yellow knob. Try rotating the base board for the best reception.

**195. Reduced volume radio (1).**

Replace the speaker with the buzzer, this will reduce the volume level of the sound.

**196. Reduced volume radio (2).**

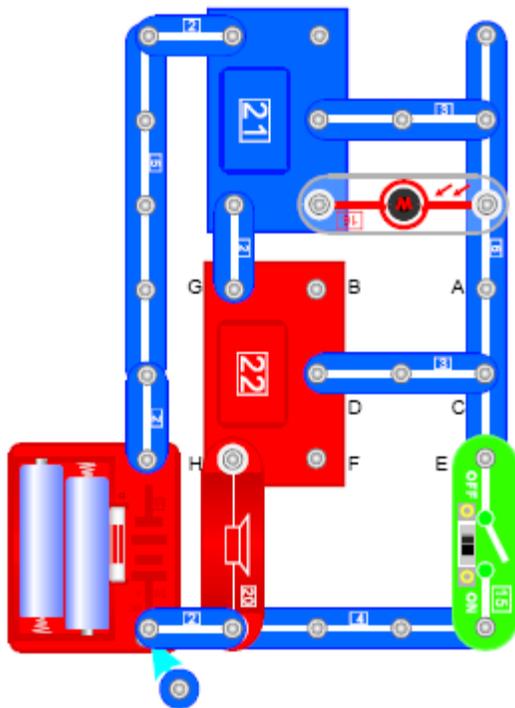
Return the speaker to its original place. Connect a resistor to terminals A and B, the resistor will reduce the volume level of the sound.

**197. Remote speaker.**

Connect the buzzer to terminals A and B. Remove the speaker and connect it with long wires. Speak into the buzzer and the sound will come out of the speaker.

The next series of experiments are designed to show how two sound modules can be connected together and used to produce a mixture of sounds.

The sounds are controlled by module 21 which plays the tune called Happy Birthday. The sound of the police siren etc. will not stop until the tune finishes.



**198. Light controlled loud sound of a police car.**

Switch on and put a finger over the photo sensor. When the sound stops it can be controlled using the photo sensor. If you listen carefully, you will be able to hear the music of happy birthday mixed with the police siren!

**199. Light controlled loud sound of a machine gun.**

Connect terminals E and F, you can control the sound of the machine gun using the photo sensor.

**200. Light controlled loud sound of a fire engine.**

Connect terminals A and B, you can control the sound of the fire engine using the photo sensor.

**201. Light controlled loud sound of an ambulance.**

Connect terminals B and G, you can control the sound of the ambulance using the photo sensor.

**202. Light controlled loud sound of a gaming machine.**

Remove the connector from terminals C and D, and connect terminals H and F. You can control the sound of the gaming machine using the photo sensor.

**203. Light controlled loud sound of vibration.**

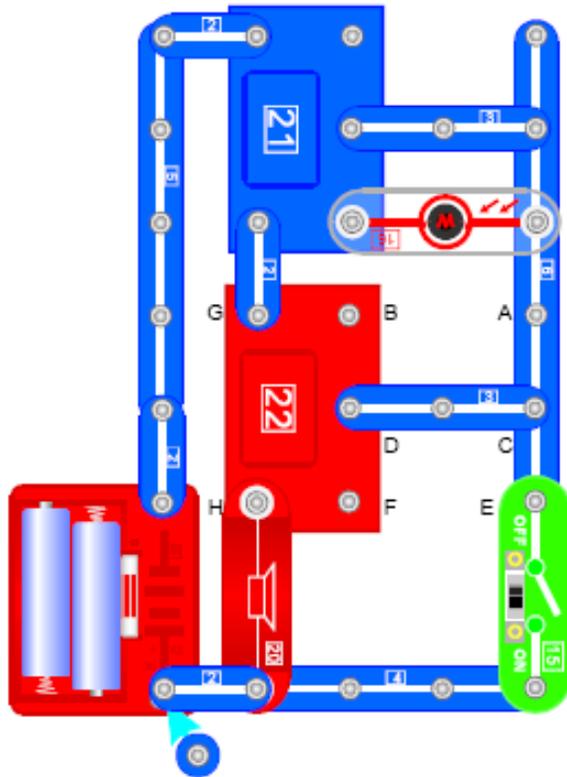
Connect terminals B and F. You can control the sound of vibration using the photo sensor.

**204. Touch controlled sound of a police car.**

Replace the photo sensor with the touch plate. When the sound stops it can be controlled by using the touch plate.

**205. Touch controlled sound of a machine gun.**

Replace the photo sensor with the touch plate. Connect terminals E and F, you can control the sound of the machine gun using the touch plate.



**206. Touch controlled sound of a fire engine.**

Replace the photo sensor with the touch plate. Connect terminals A and B, you can control the sound of the fire engine using the touch plate.

**207. Touch controlled sound of an ambulance.**

Replace the photo sensor with the touch plate. Connect terminals B and G, you can control the sound of the ambulance using the touch plate.

**208. Touch controlled sound of a gaming machine.**

Replace the photo sensor with the touch plate. Remove the connector from terminals C and D, and connect terminals H and F. You can control the sound of the gaming machine using the touch plate.

**209. Touch controlled sound of vibration.**

Replace the photo sensor with the touch plate. Connect terminals B and F. You can control the sound of vibration using the touch plate.

**210. Touch controlled LED.**

Replace the photo sensor with the touch plate. Replace the speaker with the LED. You can control the LED using the touch plate.

**211. Touch controlled Bulb.**

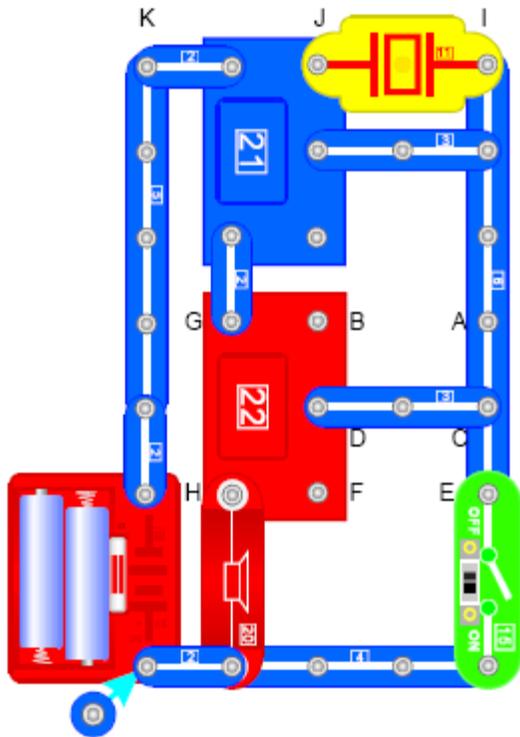
Replace the photo sensor with the touch plate. Replace the speaker with the bulb. You can control the bulb using the touch plate.

**212. Light controlled Bulb.**

Replace the speaker with the bulb. You can control the bulb using the photo sensor.

**213. Light controlled LED.**

Replace the speaker with the LED. You can control the LED using the photo sensor.



**214. Sound controlled sound of a police car (1).**

Switch on and when the sound stops, clap your hands and the sound will start again.

**215. Sound controlled sound of a machine gun (1).**

Connect terminals E and F, you can control the sound of the machine gun by clapping your hands.

**216. Sound controlled sound of a fire engine (1).**

Connect terminals A and B, you can control the sound of the fire engine by clapping your hands.

**217. Sound controlled sound of an ambulance (1).**

Connect terminals B and G, you can control the sound of the ambulance by clapping your hands.

**218. Sound controlled sound of a gaming machine (1).**

Remove the connector from terminals C and D, and connect terminals H and F. You can control the sound of the gaming machine by clapping your hands.

**219. Sound controlled sound of vibration (1).**

Connect terminals B and F. You can control the sound of vibration by clapping your hands.

**220. Sound controlled sound of a police car (2).**

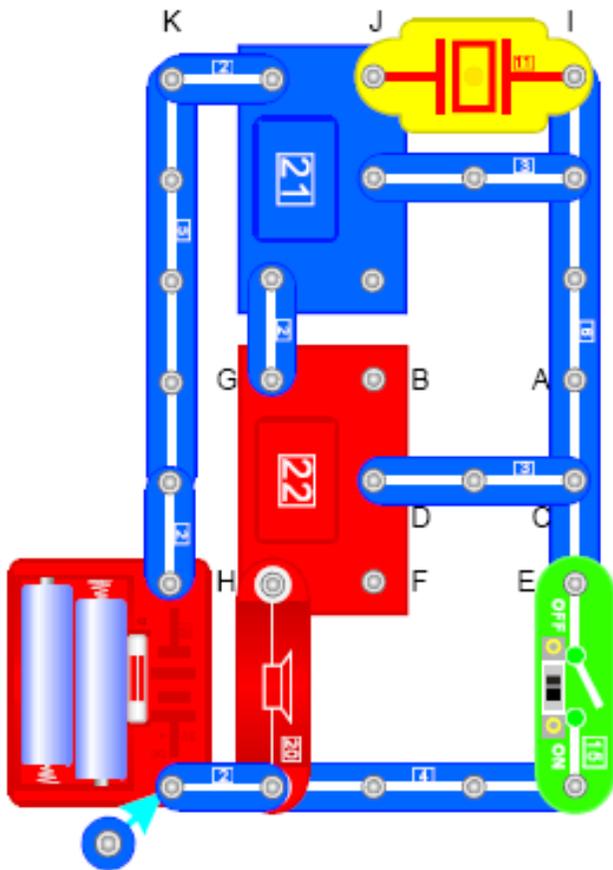
Connect the buzzer to terminals J and K. Switch on and when the sound stops, clap your hands and the sound will start again.

**221. Sound controlled sound of a machine gun (2).**

Connect the buzzer to terminals J and K. Connect terminals E and F, you can control the sound of the machine gun by clapping your hands.

**222. Sound controlled sound of a fire engine (2).**

Connect the buzzer to terminals J and K. Connect terminals A and B, you can control the sound of the fire engine by clapping your hands.



**223. Sound controlled sound of an ambulance (2).**

Connect the buzzer to terminals J and K. Connect terminals B and G, you can control the sound of the fire ambulance by clapping your hands.

**224. Sound controlled sound of a gaming machine (2).**

Connect the buzzer to terminals J and K. Remove the connector from terminals C and D, and connect terminals H and F. You can control the sound of the gaming machine by clapping your hands.

**225. Sound controlled sound of vibration (2).**

Connect the buzzer to terminals J and K. Connect terminals B and F. You can control the sound of vibration by clapping your hands.

**226. Motor controlled sound of a police car (1).**

Replace the buzzer with the motor and connect terminals I and J. Switch on and when the sound stops, turn the motor shaft and the sound will start again.

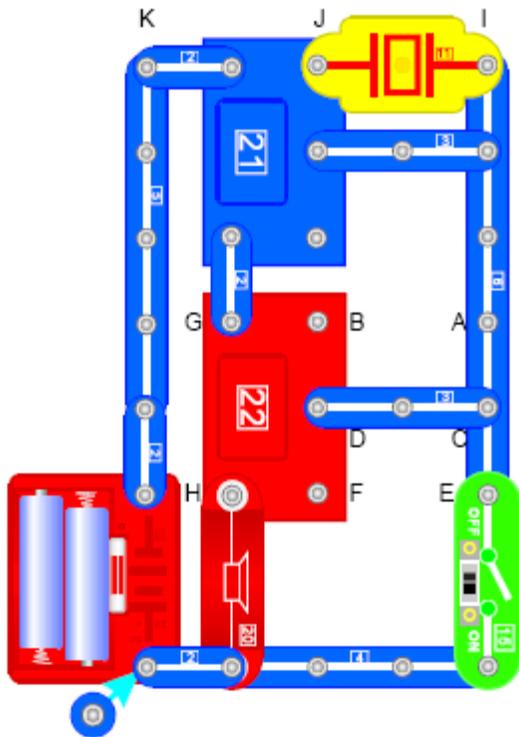
**227. Motor controlled sound of a machine gun (1).**

Replace the buzzer with the motor and connect terminals I and J. Connect terminals E and F, Switch on and when the sound stops, turn the motor shaft and the sound will start again.

**228. Motor controlled sound of a fire engine (1).**

Replace the buzzer with the motor and connect terminals I and J. Connect terminals A and B, Switch on and when the sound stops, turn the motor shaft and the sound will start again.





**236. Motor controlled sound of a gaming machine (2).**

Connect the motor to terminals J and K. Remove the connector from terminals C and D, and connect terminals H and F. Switch on and when the sound stops, turn the motor shaft and the sound will start again.

**237. Motor controlled sound of vibration (2).**

Connect the motor to terminals J and K. Connect terminals B and F. Switch on and when the sound stops, turn the motor shaft and the sound will start again.

**238. Vibration controlled sound of a police car (1).**

Replace the buzzer with the vibration switch. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**239. Vibration controlled sound of a machine gun (1).**

Replace the buzzer with the vibration switch. Connect terminals E and F, Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**240. Vibration controlled sound of a fire engine (1).**

Replace the buzzer with the vibration switch. Connect terminals A and B, Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**241. Vibration controlled sound of an ambulance (1).**

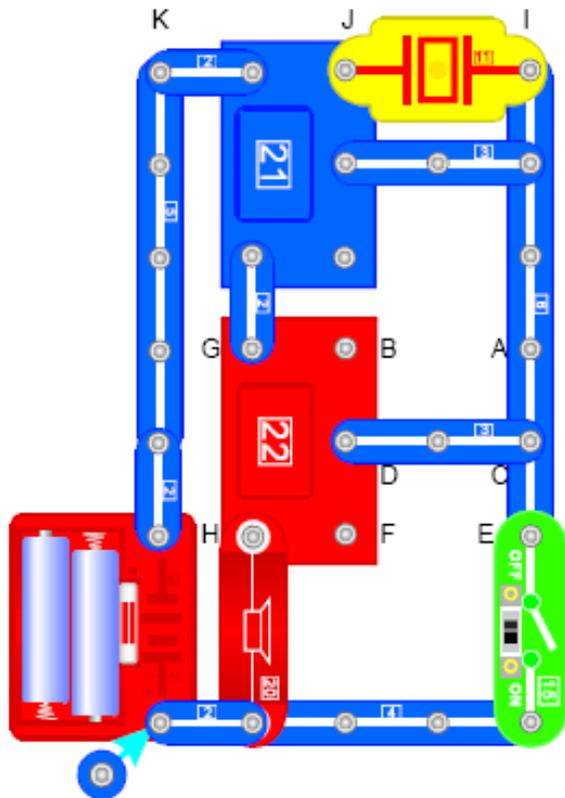
Replace the buzzer with the vibration switch. Connect terminals B and G, Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**242. Vibration controlled sound of a gaming machine (1).**

Replace the buzzer with the vibration switch. Remove the connector from terminals C and D, and connect terminals H and F. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**243. Vibration controlled sound of vibration (1).**

Replace the buzzer with the vibration switch. Connect terminals B and F. Switch on and when the sound stops, tap the vibration switch and the sound will start again.



**244. Vibration controlled sound of a police car (2).**

Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**245. Vibration controlled sound of a machine gun (2).**

Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Connect terminals E and F. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**246. Vibration controlled sound of a fire engine (2).**

Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Connect terminals A and B. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**247. Vibration controlled sound of an ambulance (2).**

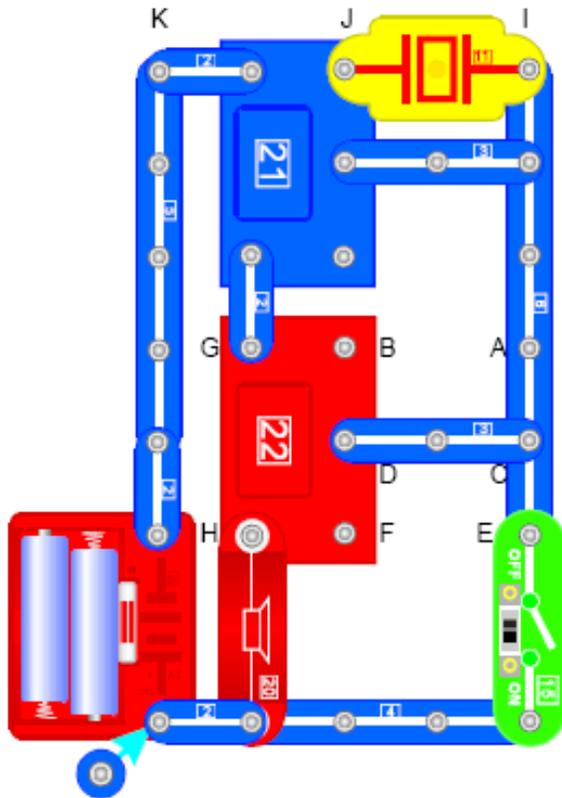
Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Connect terminals B and G. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**248. Vibration controlled sound of a gaming machine (2).**

Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Remove the connector from terminals C and D, and connect terminals H and F. Switch on and when the sound stops, tap the vibration switch and the sound will start again.

**249. Vibration controlled sound of vibration (2).**

Connect the vibration switch to terminals J and K. Connect the resistor 30 to terminals I and J. Connect terminals B and F. Switch on and when the sound stops, tap the vibration switch and the sound will start again.



**250. Hand controlled sound of a police car (1).**

Connect the press switch to terminals I and J. Switch on and when the sound stops, press the switch and the sound will start again.

**251. Hand controlled sound of a machine gun (1).**

Connect the press switch to terminals I and J. Connect terminals E and F, Switch on and when the sound stops, press the switch and the sound will start again.

**252. Hand controlled sound of a fire engine (1).**

Connect the press switch to terminals I and J. Connect terminals A and B, Switch on and when the sound stops, press the switch and the sound will start again.

**253. Hand controlled sound of an ambulance (1).**

Connect the press switch to terminals I and J. Connect terminals B and G, Switch on and when the sound stops, press the switch and the sound will start again.

**254. Hand controlled sound of a gaming machine (1).**

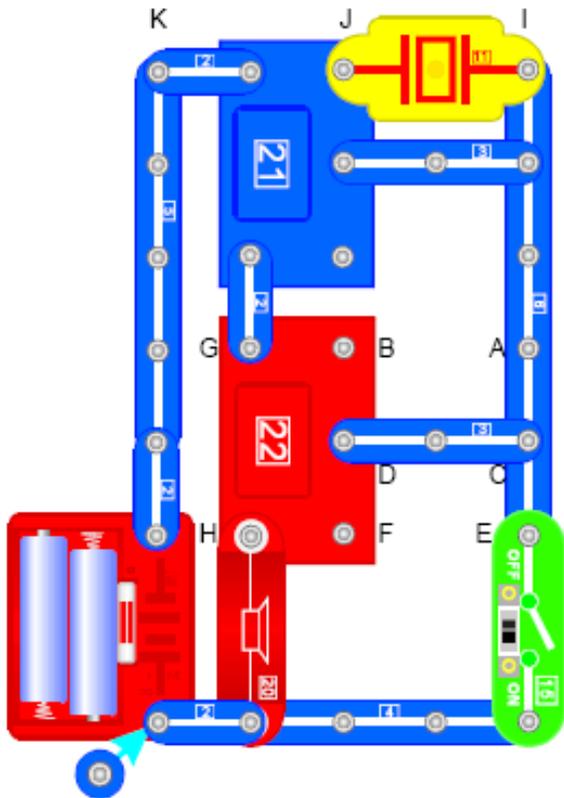
Connect the press switch to terminals I and J. Remove the connector from terminals C and D, and connect terminals H and F. Switch on and when the sound stops, press the switch and the sound will start again.

**255. Hand controlled sound of vibration (1).**

Connect the press switch to terminals I and J. Connect terminals B and F. Switch on and when the sound stops, press the switch and the sound will start again.

**256. Hand controlled sound of a police car (2).**

Connect the press switch to terminals I and J. Switch on and when the sound stops, press the switch and the sound will start again.



**257. Hand controlled sound of a machine gun (2).**

Connect the press switch to terminals I and J Connect terminals E and F. Switch on and when the sound stops, press the switch and the sound will start again.

**258. Hand controlled sound of a fire engine (2).**

Connect the press switch to terminals I and J Connect terminals A and B, Switch on and when the sound stops, press the switch and the sound will start again.

**259. Hand controlled sound of an ambulance (2).**

Connect the press switch to terminals I and J Connect terminals B and G, Switch on and when the sound stops, press the switch and the sound will start again.

**260. Hand controlled sound of a gaming machine (2).**

Connect the press switch to terminals I and J Remove the connector from terminals C and D, and connect terminals H and F. Switch on and when the sound stops, press the switch and the sound will start again.

**261. Hand controlled sound of vibration (2).**

Connect the press switch to terminals I and J Connect terminals B and F. Switch on and when the sound stops, press the switch and the sound will start again.

**262. Sound controlled flashing LED (1).**

Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**263. Sound controlled flashing LED (2).**

Connect the buzzer to terminals J and K. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**264. Sound controlled flashing LED (3).**

Remove the buzzer and connect the speaker to terminals I and J. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**265. Sound controlled flashing LED (4).**

Connect the speaker to terminals J and K. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**266. Motor controlled flashing LED (1).**

Remove the buzzer and connect the motor to terminals I and J. Switch on and when the LED goes out, turn the motor shaft and the LED will flash for a period of time.

**267. Motor controlled flashing LED (2).**

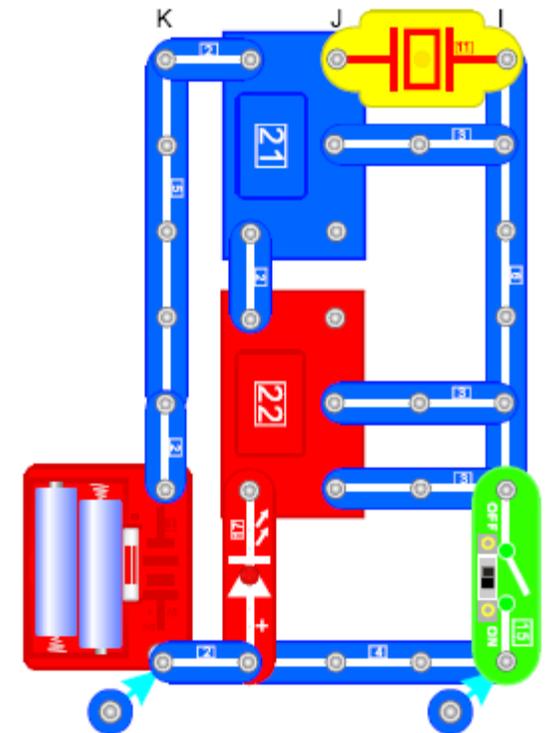
Remove the buzzer and connect the motor to terminals J and K. Switch on and when the LED goes out, turn the motor shaft and the LED will flash for a period of time.

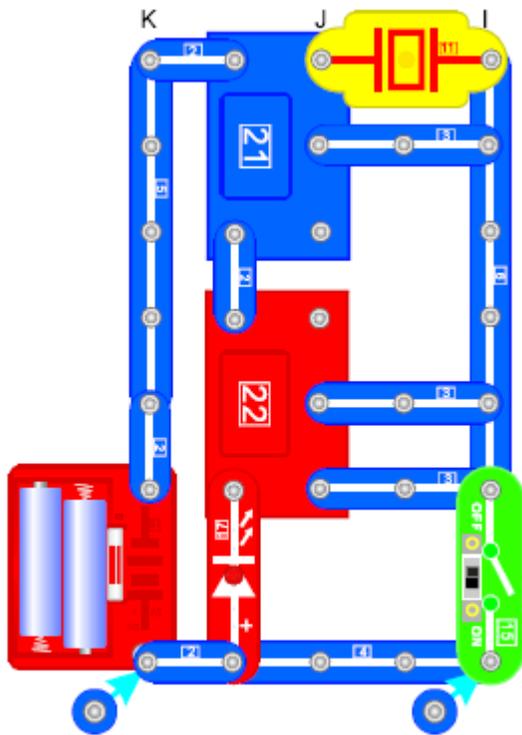
**268. Hand controlled flashing LED (1).**

Replace the buzzer with the press switch. Switch on and when the LED goes out, press the press switch and the LED will flash for a period of time.

**269. Hand controlled flashing LED (2).**

Remove the buzzer and connect the press switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the LED goes out, press the press switch and the LED will flash for a period of time.





**270. Sound controlled flashing bulb (1).**

Replace the LED with the bulb. Switch on and when the bulb goes out, clap your hands and the bulb will flash for a period of time.

**271. Sound controlled flashing bulb (2).**

Replace the LED with the bulb. Connect the buzzer to terminals J and K. Switch on and when the bulb goes out, clap your hands and the bulb will flash for a period of time.

**272. Sound controlled flashing bulb (3).**

Replace the LED with the bulb. Remove the buzzer and connect the speaker to terminals I and J. Switch on and when the bulb goes out, clap your hands and the bulb will flash for a period of time.

**273. Sound controlled flashing bulb (4).**

Replace the LED with the bulb. Connect the speaker to terminals J and K. Switch on and when the bulb goes out, clap your hands and the bulb will flash for a period of time.

**274. Motor controlled flashing bulb (1).**

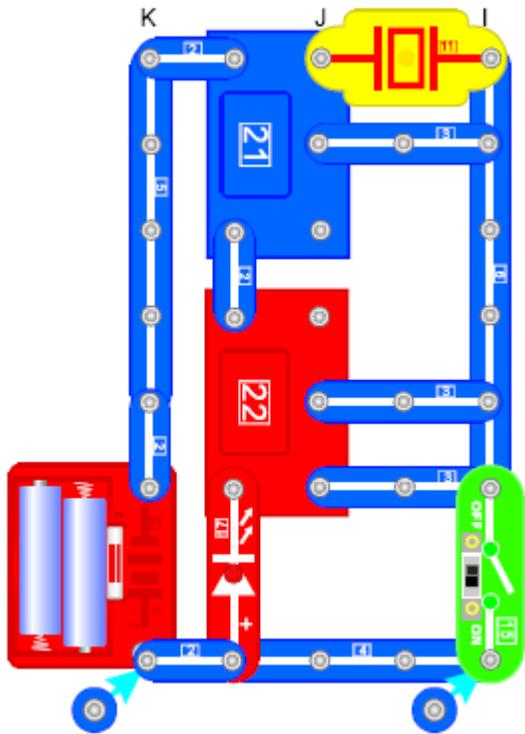
Replace the LED with the bulb. Remove the buzzer and connect the motor to terminals I and J. Switch on and when the bulb goes out, turn the motor shaft and the bulb will flash for a period of time.

**275. Motor controlled flashing bulb (2).**

Replace the LED with the bulb. Remove the buzzer and connect the motor to terminals J and K. Switch on and when the bulb goes out, turn the motor shaft and the bulb will flash for a period of time.

**276. Hand controlled flashing bulb (1).**

Replace the LED with the bulb. Replace the buzzer with the press switch. Switch on and when the bulb goes out, press the press switch and the bulb will flash for a period of time.



**277. Hand controlled flashing bulb (2).**

Replace the LED with the bulb. Remove the buzzer and connect the press switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the bulb goes out, press the press switch and the bulb will flash for a period of time.

**278. Vibration controlled flashing LED (1).**

Replace the buzzer with the vibration switch. Switch on and when the LED goes out, knock the vibration switch and the LED will flash for a period of time.

**279. Vibration controlled flashing LED (2).**

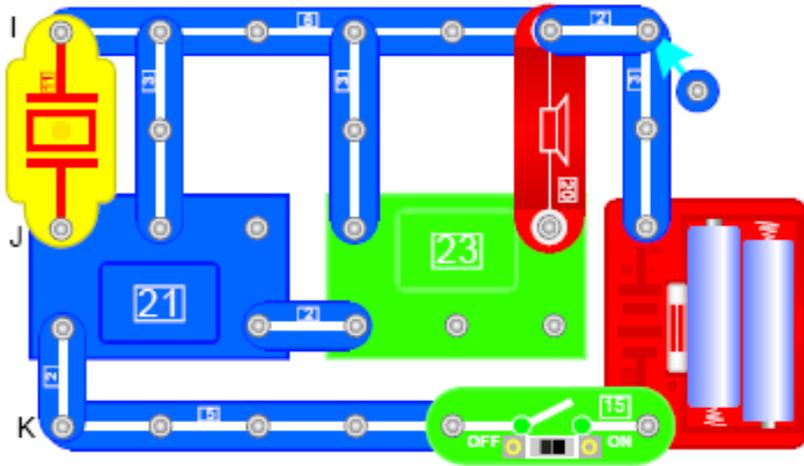
Remove the buzzer and connect the vibration switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the LED goes out, knock the vibration switch and the LED will flash for a period of time.

**280. Vibration controlled flashing bulb (1).**

Replace the LED with the bulb. Replace the buzzer with the vibration switch. Switch on and when the bulb goes out, knock the vibration switch and the bulb will flash for a period of time.

**281. Vibration controlled flashing bulb (2).**

Replace the LED with the bulb. Remove the buzzer and connect the vibration switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the bulb goes out, knock the vibration switch and the bulb will flash for a period of time.



**282. Sound controlled space war sounds (1).**

Switch on and when the sound stops, clap your hands and the sound will start again.

**283. Sound controlled space war sounds (2).**

Connect the buzzer to terminals J and K. Switch on and when the sound stops, clap your hands and the sound will start again.

**284. Vibration controlled sound of space war (1).**

Replace the buzzer with the vibration switch. Switch on and when the sound stops, knock the vibration switch and the sound will start again.

**285. Vibration controlled sound of space war (2).**

Replace the buzzer with the resistor 30. Connect the vibration switch to terminals J and K. Switch on and when the sound stops, knock the vibration switch and the sound will start again.

**286. Hand controlled space war sounds (1).**

Replace the buzzer with the press switch. Switch on and when the sound stops, press the switch and the sound will start again.

**287. Hand controlled space war sounds (2).**

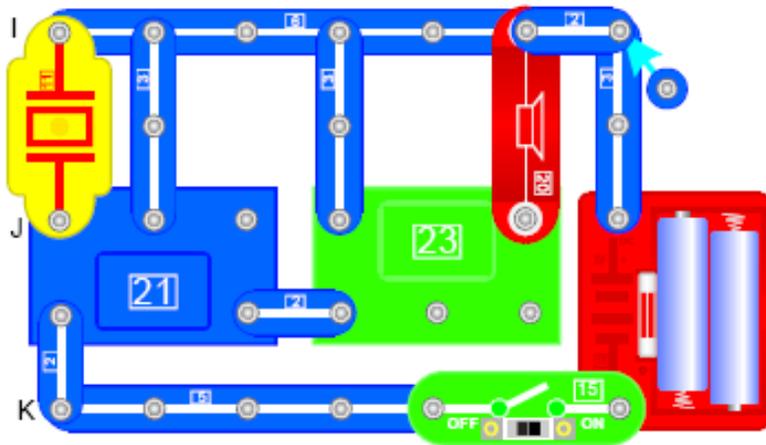
Replace the buzzer with the resistor 30. Connect the press switch to terminals J and K. Switch on and when the sound stops, press the switch and the sound will start again.

**288. Motor controlled space war sounds (1).**

Replace the buzzer with the motor. Switch on and when the sound stops, turn the motor shaft and the sound will start again.

**289. Motor controlled space war sounds (2).**

Connect the motor to terminals J and K. Switch on and when the sound stops, turn the motor shaft and the sound will start again.



will flash for a period of time.

**293. Sound controlled flashing LED (4).**

Connect the speaker to terminals J and K. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**294. Vibration controlled flashing LED (1).**

Replace the buzzer with the vibration switch. Switch on and when the LED goes out, knock the vibration switch and the LED will flash for a period of time.

**295. Vibration controlled flashing LED (2).**

Remove the buzzer and connect the vibration switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the LED goes out, knock the vibration switch and the LED will flash for a period of time.

**296. Hand controlled flashing LED (1).**

Replace the buzzer with the press switch. Switch on and when the LED goes out, press the press switch and the LED will flash for a period of time.

**290. Sound controlled flashing LED (1).**

Replace the speaker with the LED with the + end connected to the 6 connector. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

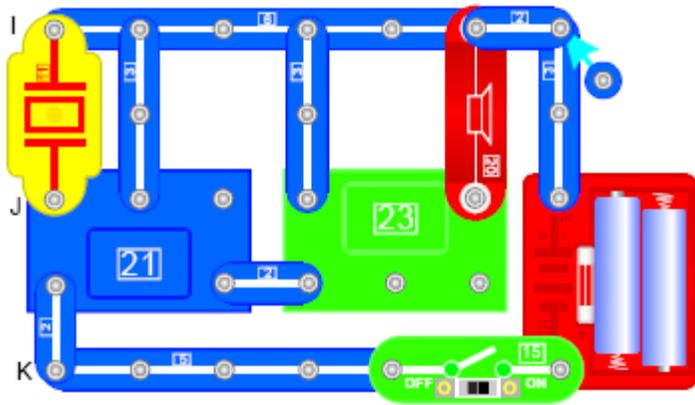
**291. Sound controlled flashing LED (2).**

Connect the buzzer to terminals J and K. Replace the speaker with the LED with the + end connected to the 6 connector. Switch on and when the LED goes out, clap your hands and the LED will flash for a period of time.

**292. Sound controlled flashing LED (3).**

Remove the buzzer and connect the speaker to terminals I and J. Switch on and when the LED goes out, clap your hands and the LED





**304. Vibration controlled flashing bulb (1).**

Replace the buzzer with the vibration switch. Switch on and when the bulb goes out, knock the vibration switch and the bulb will flash for a period of time.

**305. Vibration controlled flashing bulb (2).**

Remove the buzzer and connect the vibration switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the bulb goes out, knock the vibration switch and the bulb will flash for a period of time.

**306. Hand controlled flashing bulb (1).**

Replace the buzzer with the press switch. Switch on and when the bulb goes out, press the press switch and the bulb will flash for a period of time.

**307. Hand controlled flashing bulb (2).**

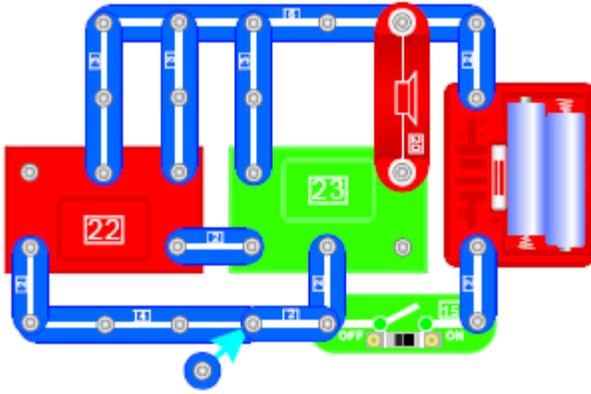
Remove the buzzer and connect the press switch to terminals J and K. Connect the resistor to terminals I and J. Switch on and when the bulb goes out, press the press switch and the bulb will flash for a period of time.

**308. Motor controlled flashing bulb (1).**

Remove the buzzer and connect the motor to terminals I and J. Switch on and when the bulb goes out, turn the motor shaft and the bulb will flash for a period of time.

**309. Motor controlled flashing bulb (2).**

Remove the buzzer and connect the motor to terminals J and K. Switch on and when the bulb goes out, turn the motor shaft and the bulb will flash for a period of time.



**310. Sound of space warfare.**

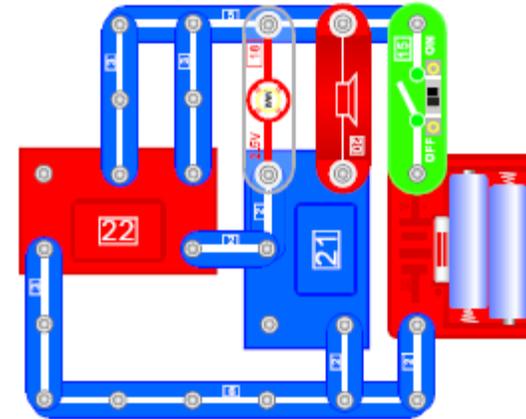
Switch on and the speaker will make the sound of space warfare.

**311. Flashing LED.**

Replace the speaker with the LED. Switch on and the LED will flash.

**312. Flashing bulb.**

Replace the speaker with the bulb. Switch on and the bulb will flash.

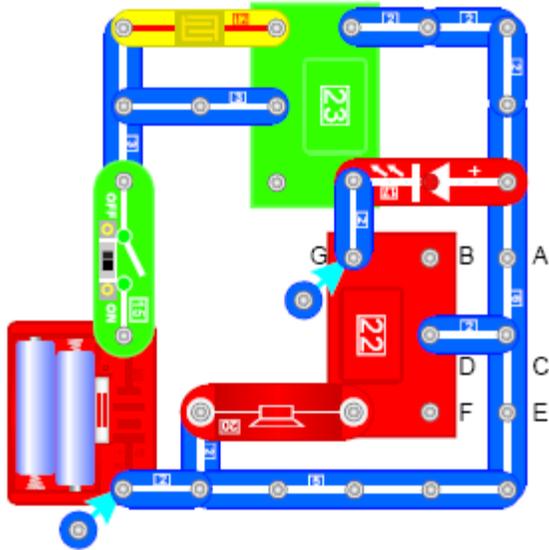


**313. Intermittent bleep.**

Switch on and the bulb will flash and the speaker will give out a bleep sound. This is the result of using the sound of a machine gun from the music IC to control the alarm IC.

**314. Flashing bulb and LED.**

Replace the speaker with the LED. Switch on and the bulb and the LED will flash.



**315. Touch controlled sound of an acousto-optic police car.**

Switch on and touch the touch plate, the speaker will give out the sound of a police car and the LED will flash.

**316. Touch controlled sound of an acousto-optic machine gun.**

Connect the terminals E and F. Switch on and touch the touch plate, the speaker will give out the sound of a machine gun and the LED will flash.

**317. Touch controlled sound of an acousto-optic fire engine.**

Connect terminals A and B, Switch on and touch the touch plate, the speaker will give out the sound of a fire engine and the LED will flash.

**318. Touch controlled sound of an acousto-optic ambulance.**

Connect terminals B and G, Switch on and touch the touch plate, the speaker will give out the sound of an ambulance and the LED will flash.

**319. Touch controlled sound of an acousto-optic gaming machine.**

Remove the connector from terminals C and D. Switch on and touch the touch plate, the speaker will give out the sound of a gaming machine and the LED will flash.

**320. Touch controlled sound of acousto-optic vibration.**

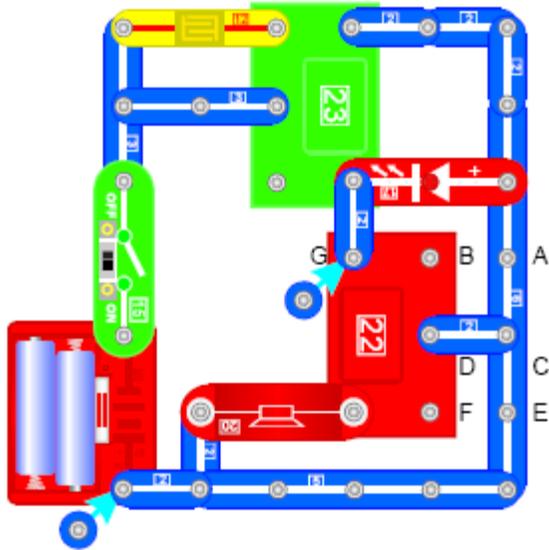
Connect terminals B and F. Switch on and touch the touch plate, the speaker will give out the sound of vibration and the LED will flash.

**321. Vibration controlled sound of an acousto-optic police car.**

Replace the touch plate with the vibration switch. Switch on and tap the vibration switch, the speaker will give out the sound of a police car and the LED will flash.

**322. Vibration controlled sound of an acousto-optic machine gun.**

Replace the touch plate with the vibration switch. Connect the terminals E and F. Switch on and tap the vibration switch, the speaker will give out the sound of a machine gun and the LED will flash.



**323. Vibration controlled sound of an acousto-optic fire engine.**

Replace the touch plate with the vibration switch. Connect terminals A and B, Switch on and tap the vibration switch, the speaker will give out the sound of a fire engine and the LED will flash.

**324. Vibration controlled sound of an acousto-optic ambulance.**

Replace the touch plate with the vibration switch. Connect terminals B and G, Switch on and tap the vibration switch, the speaker will give out the sound of an ambulance and the LED will flash.

**325. Vibration controlled sound of an acousto-optic gaming machine.**

Replace the touch plate with the vibration switch. Remove the connector from terminals C and D. Switch on and tap the vibration switch,, the speaker will give out the sound of a gaming machine and the LED will flash.

**326. Touch controlled sound of acousto-optic vibration.**

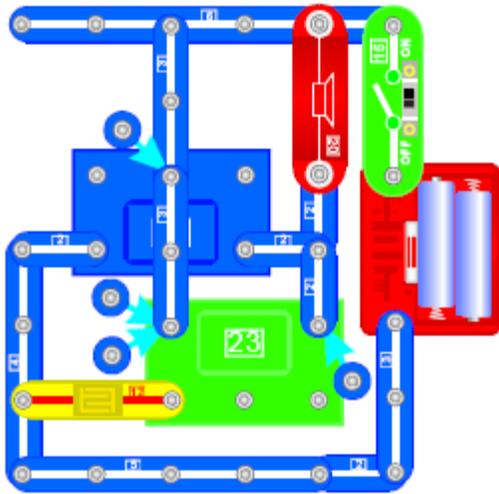
Replace the touch plate with the vibration switch. Connect terminals B and F. Switch on and touch the touch switch, the speaker will give out the sound of vibration and the LED will flash.

**327. Vibration controlled sound of acousto-optic noise.**

Replace the alarm IC with the music IC. Switch on and tap the vibration switch, the speaker will give out noise and the LED will flash.

**328. Touch controlled sound of acousto-optic noise.**

Replace the alarm IC with the music IC and the vibration switch with the touch plate. Switch on and touch the touch switch, the speaker will give out noise and the LED will flash.

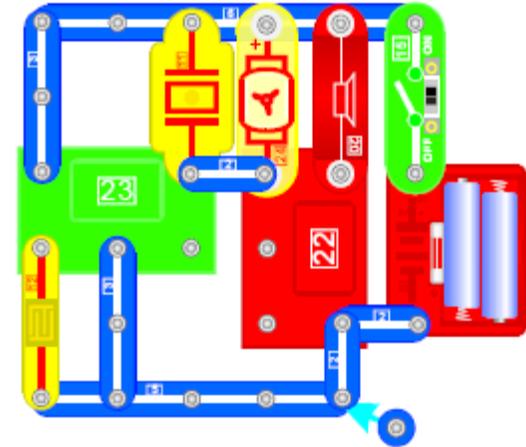


**329. Touch controlled sound of space music.**

Switch on and only music plays, touch the touch switch, the speaker will give out the music mixed with the sound of space wars.

**330. Hand controlled sound of space music.**

Replace the touch plate with the press switch. Switch on and only music plays, press the press switch, the speaker will give out the music mixed with the sound of space wars.



**331. Vibration controlled sound of space music.**

Replace the touch plate with the vibration switch. Switch on and only music plays tap the vibration switch, the speaker will give out the music mixed with the sound of space wars.

**332. Touch controlled sound of space machine gun.**

Switch on and the machine gun sounds. Touch the touch plate, the speaker will make the sound of the machine gun mixed with the sound of space wars.

**333. Vibration controlled sound of space machine gun.**

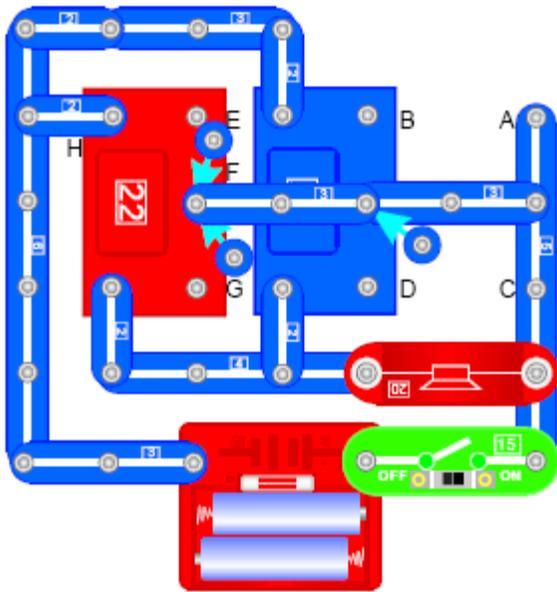
Replace the touch plate with the vibration switch. Switch on and the machine gun sounds. Tap the vibration switch, the speaker will make the sound of the machine gun mixed with the sound of space wars.

**334. Vibration controlled sound of space machine gun.**

Replace the buzzer with the LED, + end to the 6 connector. Switch on and tap the vibration switch, the speaker will make the sound of the machine gun mixed with the sound of space wars and the LED will flash.

**335. Touch controlled sound of space machine gun.**

Replace the buzzer with the LED, + end to the 6 connector. Switch on and touch the touch switch, the speaker will make the sound of the machine gun mixed with the sound of space wars and the LED will flash.



**336. Hand controlled musical sound of a police car.**

Connect the press switch to terminals C and D. Switch on and when the music stops, press the press switch and the music and sound will start again.

**337. Light controlled musical sound of a police car.**

Connect the photosensor to terminals C and D. Put your finger over the photosensor, switch on and when the music stops, take your finger off the photosensor, the music and sound will start again.

**338. Touch controlled musical sound of a police car.**

Connect the touch plate to terminals C and D. Switch on and when the music stops, touch the touch switch, the music and sound will start again.

**339. Hand controlled musical sound of a police car.**

Connect the press switch to terminals A and B. Switch on and when the music stops, press the press switch, the music and sound will start again.

**340. Vibration controlled musical sound of a police car.**

Connect the vibration switch to terminals A and B. Switch on and when the music stops, tap the vibration switch, the music and sound will start again.

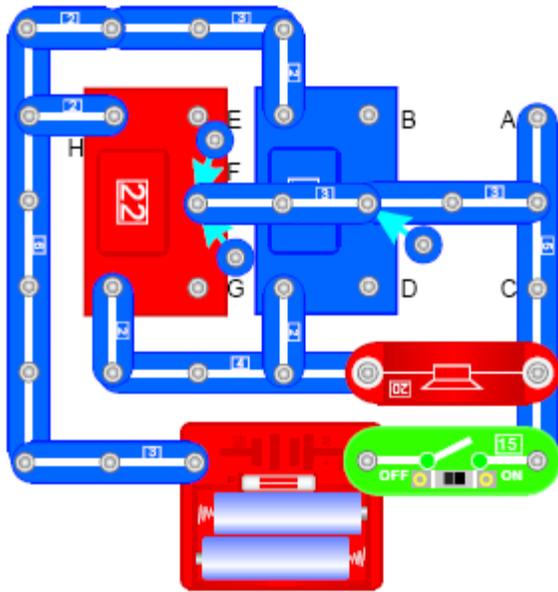
**341. Motor controlled musical sound of a police car.**

Connect the motor to terminals A and B. Switch on and when the music stops, turn the motor shaft, the music and sound will start again.

**342. Hand controlled musical sound of a machine gun.**

Connect the press switch to terminals A and B and connect terminals F and G. Switch on and when the music stops, press the press switch, the music and sound will start again.





**351. Hand controlled musical sound of a fire engine.**

Connect the press switch to terminals A and B and connect terminals E and F. Switch on and when the music stops, press the press switch, the music and sound will start again.

**352. Vibration controlled musical sound of a fire engine.**

Connect the vibration switch to terminals A and B and connect terminals E and F. Switch on and when the music stops, tap the vibration switch, the music and sound will start again.

**353. Motor controlled musical sound of a fire engine.**

Connect the motor to terminals A and B and connect terminals E and F. Switch on and when the music stops, turn the motor shaft, the music and sound will start again.

**354. Hand controlled musical sound of an ambulance.**

Connect the press switch to terminals A and B and connect terminals E and H. Switch on and when the music stops, press the press switch, the music and sound will start again.

**355. Light controlled musical sound of a fire engine.**

Connect the photosensor to terminals C and D and connect terminals E and H. Put your finger over the photosensor, switch on and when the music stops, take you finger off the photosensor, the music and sound will start again.

**356. Touch controlled musical sound of a fire engine.**

Connect the touch plate to terminals C and D and connect terminals E and H. Switch on and when the music stops, touch the touch switch, the music and sound will start again.

**357. Hand controlled musical sound of a fire engine.**

Connect the press switch to terminals A and B and connect terminals E and H. Switch on and when the music stops, press the press switch, the music and sound will start again.

**358. Vibration controlled musical sound of a fire engine.**

Connect the vibration switch to terminals A and B and connect terminals E and H. Switch on and when the music stops, tap the vibration switch, the music and sound will start again.

**359. Motor controlled musical sound of a fire engine.**

Connect the motor to terminals A and B and connect terminals E and H. Switch on and when the music stops, turn the motor shaft, the music and sound will start again.

**360. Hand controlled musical sound of a police car (1).**

Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**361. Hand controlled musical sound of a police car (2).**

Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**362. Sound controlled musical sound of a police car (1).**

Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**363. Sound controlled musical sound of a police car (2).**

Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**364. Vibration controlled musical sound of a police car (1).**

Connect the vibration switch to terminals I and J, connect the motor to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**365. Vibration controlled musical sound of a police car (2).**

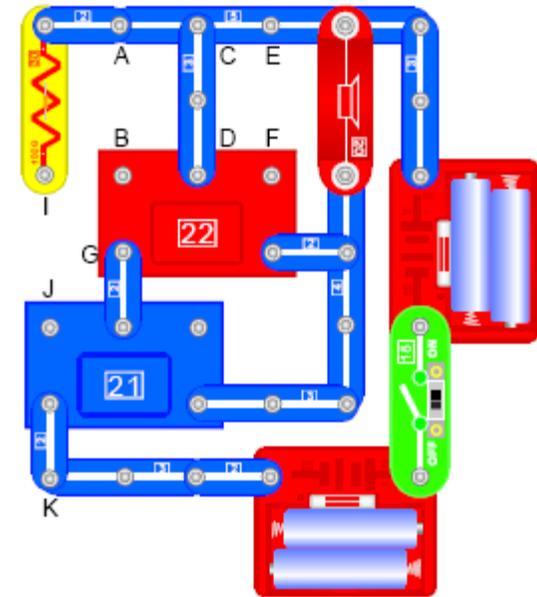
Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**366. Motor controlled musical sound of a police car (1).**

Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**367. Motor controlled musical sound of a police car (2).**

Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.



**368. Hand controlled musical sound of a machine gun (1).**

Connect terminals D and F. Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**369. Hand controlled musical sound of a machine gun (2).**

Connect terminals D and F. Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**370. Sound controlled musical sound of a machine gun (1).**

Connect terminals D and F. Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**371. Sound controlled musical sound of a machine gun (2).**

Connect terminals D and F. Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**372. Vibration controlled musical sound of a machine gun (1).**

Connect terminals D and F. Connect the vibration switch to terminals I and J, connect the motor to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**373. Vibration controlled musical sound of a machine gun (2).**

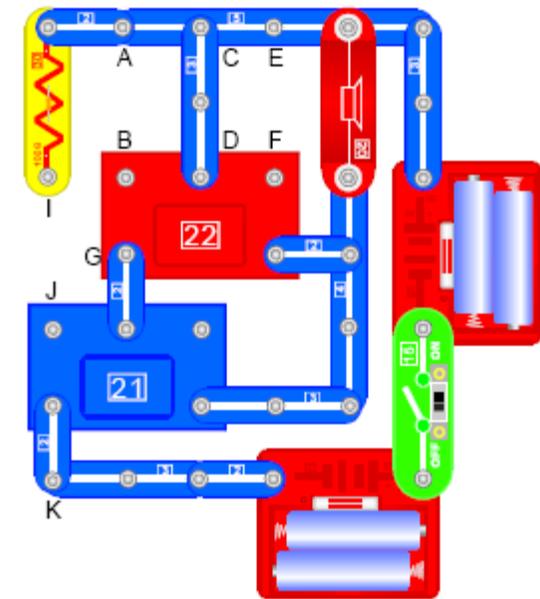
Connect terminals D and F. Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**374. Motor controlled musical sound of a machine gun (1).**

Connect terminals D and F. Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**375. Motor controlled musical sound of a machine gun (2).**

Connect terminals D and F. Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.



**376. Hand controlled musical sound of a fire engine (1).**

Connect terminals B and D. Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**377. Hand controlled musical sound of a fire engine (2).**

Connect terminals B and D. Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**378. Sound controlled musical sound of a fire engine (1).**

Connect terminals B and D. Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**379. Sound controlled musical sound of a fire engine (2).**

Connect terminals B and D. Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**380. Vibration controlled musical sound of a fire engine (1).**

Connect terminals B and D. Connect the vibration switch to terminals I and J, connect the motor to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**381. Vibration controlled musical sound of a fire engine (2).**

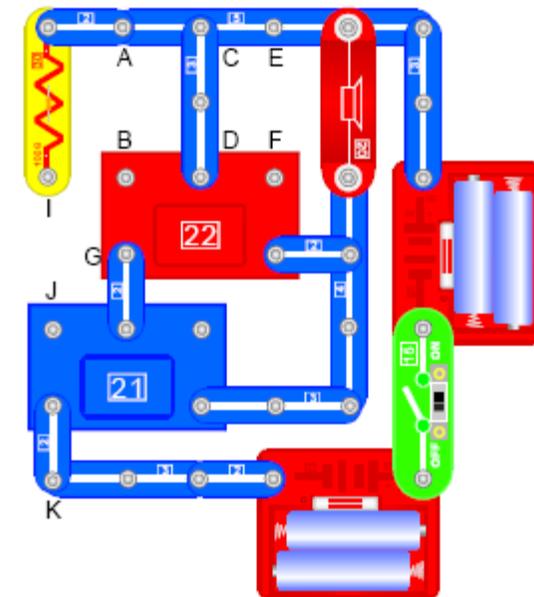
Connect terminals B and D. Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**382. Motor controlled musical sound of a fire engine (1).**

Connect terminals B and D. Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**383. Motor controlled musical sound of a fire engine (2).**

Connect terminals B and D. Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.



**384. Hand controlled musical sound of an ambulance (1).**

Connect terminals B and G. Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**385. Hand controlled musical sound of an ambulance (2).**

Connect terminals B and G. Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**386. Sound controlled musical sound of an ambulance (1).**

Connect terminals B and G. Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**387. Sound controlled musical sound of an ambulance (2).**

Connect terminals B and G. Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**388. Vibration controlled musical sound of an ambulance (1).**

Connect terminals B and G. Connect the vibration switch to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**389. Vibration controlled musical sound of an ambulance (2).**

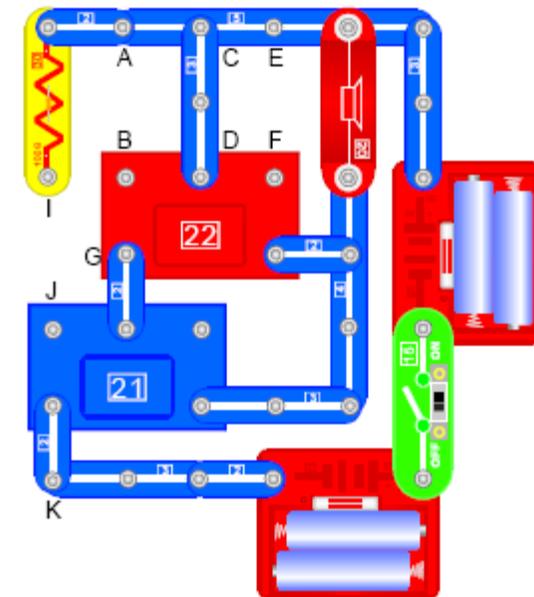
Connect terminals B and G. Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**390. Motor controlled musical sound of an ambulance (1).**

Connect terminals B and G. Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**391. Motor controlled musical sound of an ambulance (2).**

Connect terminals B and G. Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.



**392. Hand controlled musical sound of a gaming machine (1).**

Remove the connection from C and D. Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**393. Hand controlled musical sound of a gaming machine (2).**

Remove the connection from C and D. Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**394. Sound controlled musical sound of a gaming machine (1).**

Remove the connection from C and D. Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**395. Sound controlled musical sound of a gaming machine (2).**

Remove the connection from C and D. Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**396. Vibration controlled musical sound of a gaming machine (1).**

Remove the connection from C and D. Connect the vibration switch to terminals I and J, connect the motor to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**397. Vibration controlled musical sound of a gaming machine (2).**

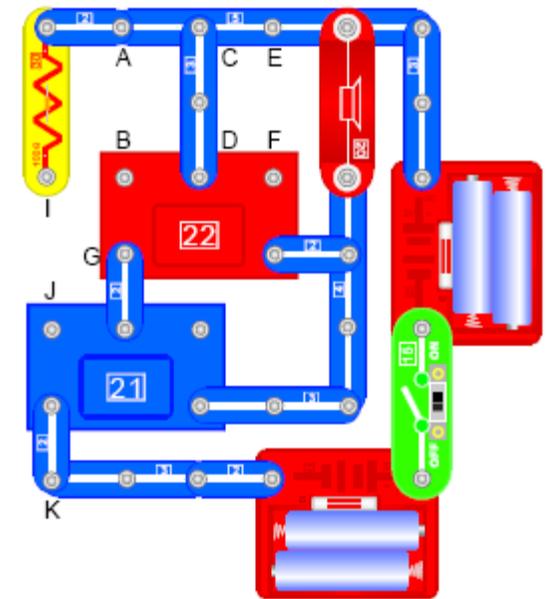
Remove the connection from C and D. Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**398. Motor controlled musical sound of a gaming machine (1).**

Remove the connection from C and D. Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**399. Motor controlled musical sound of a gaming machine (2).**

Remove the connection from C and D. Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.



**400. Hand controlled musical sound of vibration (1).**

Connect terminals B and F. Connect the press switch to terminals I and J. Switch on and when the music stops, press the press switch and the music and sound will start again.

**401. Hand controlled musical sound of vibration (2).**

Connect terminals B and F. Connect the press switch to terminals K and J, connect the motor to terminals I and K. Switch on and when the music stops, press the press switch and the music and sound will start again.

**402. Sound controlled musical sound of vibration (1).**

Connect terminals B and F. Connect the buzzer to terminals I and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**403. Sound controlled musical sound of vibration (2).**

Connect terminals B and F. Connect the buzzer to terminals K and J. Switch on and when the music stops, clap you hands and the music and sound will start again.

**404. Vibration controlled musical sound of vibration (1).**

Connect terminals B and F. Connect the vibration switch to terminals I and J, connect the motor to terminals I and J. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

**405. Vibration controlled musical sound of vibration (2).**

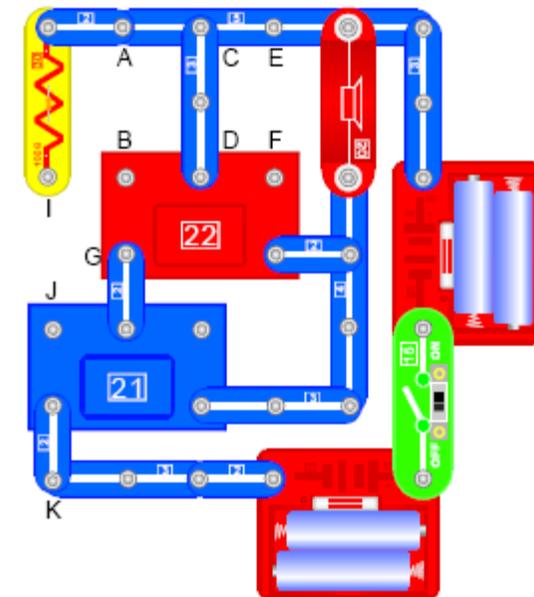
Connect terminals B and F. Connect the vibration switch to terminals J and K. Switch on and when the music stops, tap the vibration switch and the music and sound will start again.

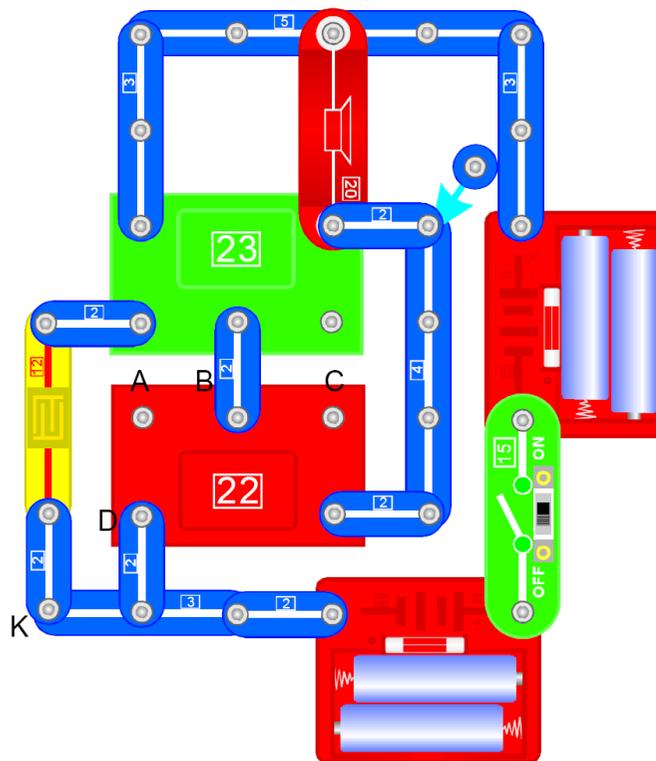
**406. Motor controlled musical sound of vibration (1).**

Connect terminals B and F. Connect the motor to terminals I and J also connect terminals J and K. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.

**407. Motor controlled musical sound of vibration (2).**

Connect terminals B and F. Connect the motor to terminals J and K also connect terminals I and J. Switch on and when the music stops, turn the motor shaft and the music and sound will start again.





**408. Touch controlled sound of space police car.**

Switch on and then touch the touch plate and the speaker will make the sound of a space police car.

**409. Touch controlled sound of space machine gun.**

Connect terminals B and C. Switch on and then touch the touch plate and the speaker will make the sound of a space machine gun.

**410. Touch controlled sound of space fire engine.**

Connect terminals A and B. Switch on and then touch the touch plate and the speaker will make the sound of a space fire engine.

**411. Touch controlled sound of space ambulance.**

Connect terminals A and D. Switch on and then touch the touch plate and the speaker will make the sound of a space ambulance.

**412. Touch controlled sound of space vibration.**

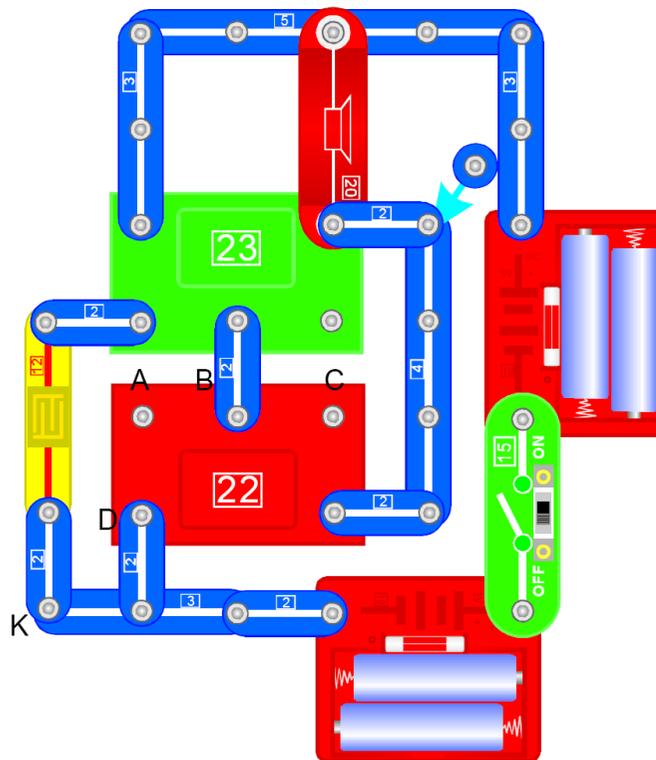
Connect terminals A and C. Switch on and then touch the touch plate and the speaker will make the sound of a space vibration.

**413. Vibration controlled sound of space police car.**

Replace the touch plate with the vibration switch. Switch on and then tap the vibration switch and the speaker will make the sound of a space police car.

**414. Vibration controlled sound of space machine gun.**

Replace the touch plate with the vibration switch. Connect terminals B and C. Switch on and then tap the vibration switch and the speaker will make the sound of a space machine gun.



**415. Vibration controlled sound of space fire engine.**

Replace the touch plate with the vibration switch. Connect terminals A and B. Switch on and then tap the vibration switch and the speaker will make the sound of a space fire engine.

**416. Vibration controlled sound of space ambulance.**

Replace the touch plate with the vibration switch. Connect terminals A and D. Switch on and then tap the vibration switch and the speaker will make the sound of a space ambulance.

**417. Vibration controlled sound of space vibration.**

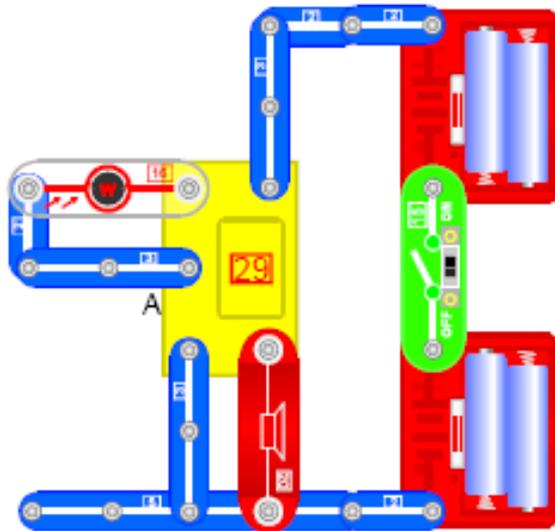
Replace the touch plate with the vibration switch. Connect terminals A and C. Switch on and then tap the vibration switch and the speaker will make the sound of a space vibration.

**418. Vibration controlled flashing bulb.**

Replace the touch plate with the vibration switch and the speaker with the bulb. Connect terminals B and C. Switch on and then tap the vibration switch and the bulb will light up.

**419. Touch controlled flashing bulb.**

Replace the speaker with the bulb. Connect terminals B and C. Switch on and then touch the touch plate and the bulb will light up.



**420. Light controlled sound of space vibration.**

Switch on. To stop the sound, put your finger over the photosensor, The light seal must be good to completely stop the sound, a bottle top works well!

**421. Touch controlled sound of space vibration.**

Replace the photosensor with the touch plate. Switch on and put your finger on the touch plate.

**422. High pitched sound of space.**

Replace the photosensor with the buzzer. Switch on and the speaker will make a high pitched space sound.

**423. Hand controlled sound of space buzz.**

Replace the photosensor with the press switch. Switch on and press the press switch.

**424. Light controlled sound of space buzz.**

Replace the speaker with the buzzer. Switch on. To stop the sound, put your finger over the photosensor, The light seal must be good to completely stop the sound, a bottle top works well!

**425. Touch controlled sound of space noise.**

Replace the photosensor with the touch plate. Replace the speaker with the buzzer. Switch on and put your finger on the touch plate.

**426. Hand controlled sound of space buzz.**

Replace the photosensor with the press switch. Replace the speaker with the buzzer. Switch on and press the press switch.

**427. Touch controlled sound of space buzz.**

Replace the photosensor with the touch plate. Switch on and put a finger on the touch plate and on point A, remove and replace the finger on point A to vary the sound.

**428. Touch controlled sound of howling.**

Switch on and put your finger on the touch plate, the speaker will give out a howling sound.

**429. Light controlled sound of howling.**

Replace the touch plate with the photosensor. Switch on and the speaker will give out a howling sound. To stop the sound, put your finger over the photosensor.

**430. Hand controlled sound of howling.**

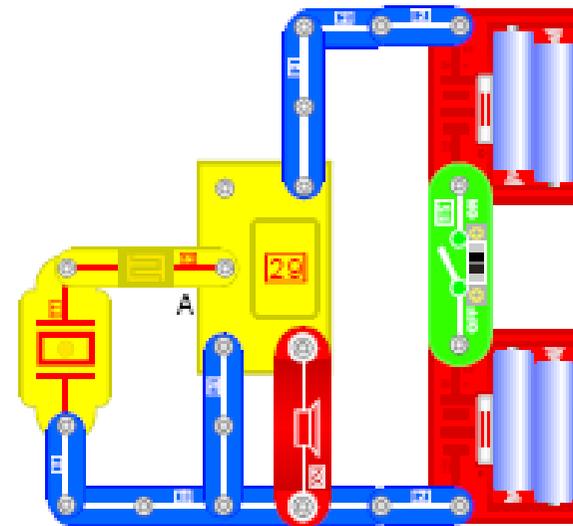
Replace the touch plate with the press switch. Switch on and press the press switch, the speaker will give out a howling sound.

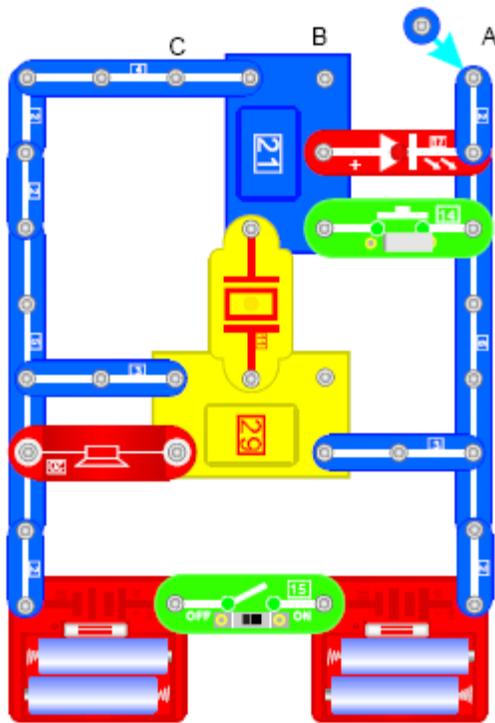
**431. Touch controlled sound of squeaking.**

Switch on and put a finger on the top speaker connection then rub the touch plate with another finger, the speaker will give out a squeaking sound.

**432. Touch controlled loud sound of squeaking.**

Switch on and put a finger on the top connection of module 29 then rub the touch plate with another finger, the speaker will give out a loud squeaking sound.





**433. Hand controlled varied tone music.**

Switch on and press the press switch, the speaker will give out varied tone music.

**434. Magnet controlled varied tone music.**

Replace the press switch with the dry reed relay. Switch on and bring a magnet close to the dry reed switch, the speaker will give out varied tone music.

**435. Light controlled varied tone music.**

Replace the press switch with the photosensor. Switch on and the speaker will give out varied tone music. To stop the music, put your finger over the photosensor.

**436. Vibration controlled varied tone music (1).**

Replace the press switch with the vibration switch. Switch on and tap the vibration switch, the speaker will give out varied tone music.

**437. Vibration controlled varied tone music (2).**

Connect the vibration switch to terminals B and C. Connect the resistor switch to terminals A and B. Switch on and tap the vibration switch, the speaker will give out varied tone music.

**438. Touch controlled varied tone music.**

Replace the press switch with the touch plate. Switch on and put a finger on the touch plate, the speaker will give out varied tone music.

**439. Hand controlled high volume music.**

Replace the buzzer with the capacitor. Switch on and the speaker will give out high volume music.

**440. Magnet controlled high volume music.**

Replace the buzzer with the capacitor and replace the press switch with the dry reed switch. Switch on and bring a magnet close to the dry reed switch, the speaker will give out high volume music.



**445. Dual sound of a police car.**

Switch on and the speaker will make the dual sound of a police car.

**446. Dual sound of a machine gun.**

Connect terminals B and C. Switch on and the speaker will make the dual sound of a machine gun.

**447. Dual sound of a fire engine.**

Connect terminals A and B. Switch on and the speaker will make the dual sound of a fire engine.

**448. Dual sound of an ambulance.**

Connect terminals A and D. Switch on and the speaker will make the dual sound of an ambulance.

**449. Dual sound of vibration.**

Connect terminals A and C. Switch on and the speaker will make the dual sound of vibration.

**450. Power amplified sound of a police car.**

Replace the buzzer 11 with the capacitor 44. Switch on and the speaker will make the power amplified sound of a police car.

**451. Power amplified sound of a machine gun.**

Replace the buzzer 11 with the capacitor 44. Connect terminals B and C. Switch on and the speaker will make the power amplified sound of a machine gun.

**452. Power amplified sound of a fire engine.**

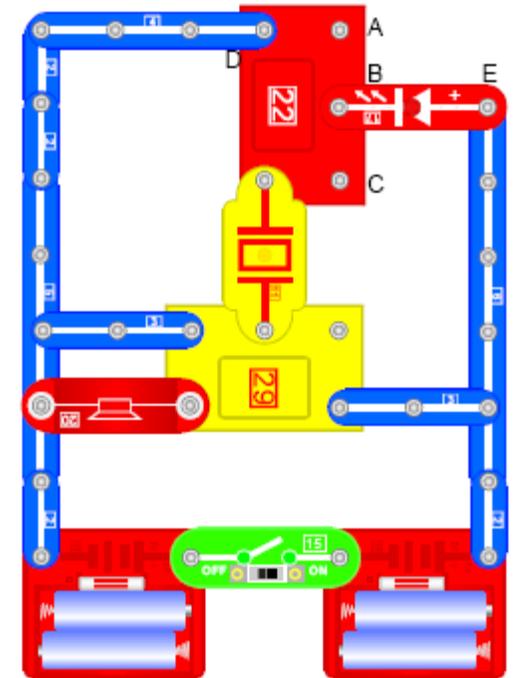
Replace the buzzer 11 with the capacitor 44. Connect terminals A and B. Switch on and the speaker will make the power amplified sound of a fire engine.

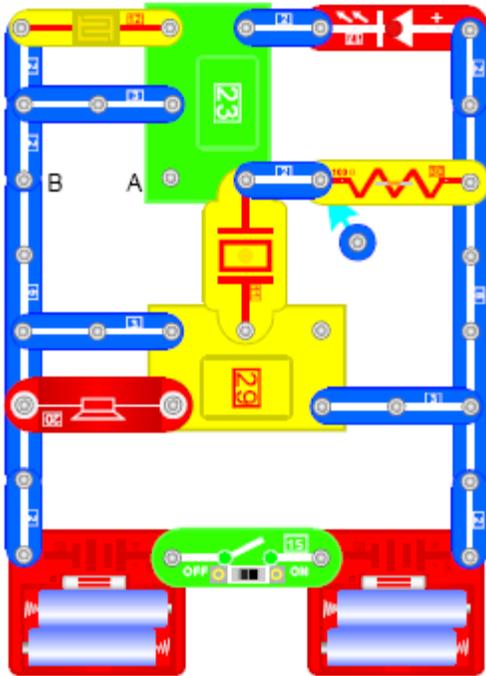
**453. Power amplified sound of an ambulance.**

Replace the buzzer 11 with the capacitor 44. Connect terminals A and D. Switch on and the speaker will make the power amplified sound of an ambulance.

**454. Power amplified sound of vibration.**

Replace the buzzer 11 with the capacitor 44. Connect terminals A and C. Switch on and the speaker will make the power amplified sound of vibration.





**455. Hand controlled varied tone sound of space war.**

Connect the press switch to terminals A and B. Switch on and press the press switch, the speaker will make varied tone sound of space war.

**456. Light controlled varied tone sound of space war.**

Connect the photosensor to terminals A and B. Switch on and press the press switch, the speaker will make varied tone sound of space war. To stop the sound, cover up the photosensor.

**457. Touch controlled varied tone sound of space war.**

Switch on and touch the touch plate, the speaker will make varied tone sound of space war.

**458. Vibration controlled varied tone sound of space war.**

Replace the touch plate with the vibration switch. Switch on and tap the vibration switch, the speaker will make varied tone sound of space war.

**459. Magnet controlled varied tone sound of space war.**

Replace the touch plate with the dry reed switch. Switch on and bring the magnet close to the dry reed switch, the speaker will make varied tone sound of space war.

**460. Hand controlled power amplified sound of space war.**

Replace the buzzer with the capacitor and connect the press switch to terminals A and B. Switch on and press the press switch, the speaker will make power amplified sound of space war.

**461. Light controlled power amplified sound of space war.**

Replace the buzzer with the capacitor and connect the photosensor to terminals A and B. Switch on and the speaker will make power amplified sound of space war. To stop the sound, cover up the photosensor.

**462. Touch controlled power amplified sound of space war.**

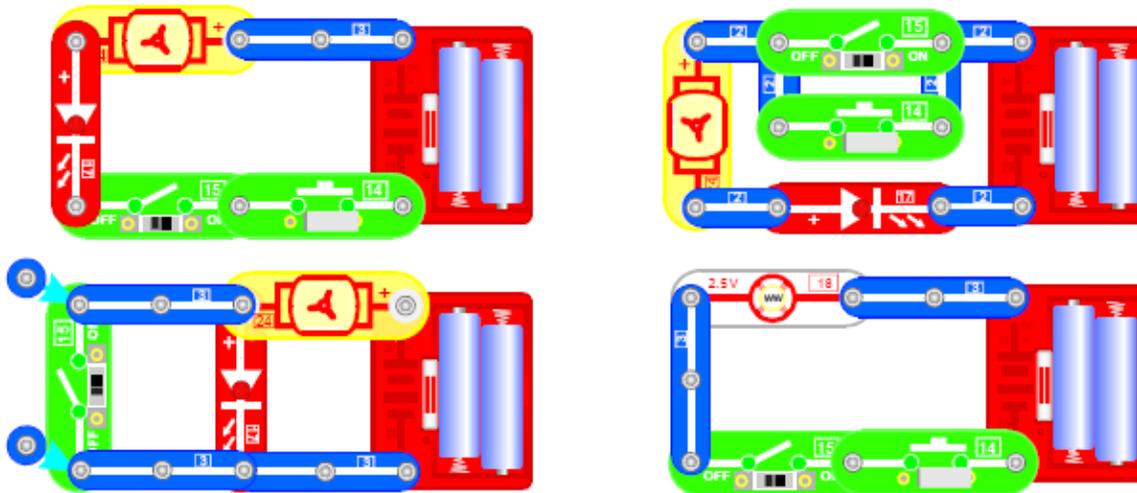
Replace the buzzer with the capacitor and connect the touch plate to terminals A and B. Switch on and touch the touch switch, the speaker will make power amplified sound of space war.

**463. Vibration controlled power amplified sound of space war.**

Replace the buzzer with the capacitor and connect the vibration switch to terminals A and B. Switch on and tap the vibration switch, the speaker will make power amplified sound of space war.

**464. Magnet controlled power amplified sound of space war.**

Replace the buzzer with the capacitor and connect the dry reed switch to terminals A and B. Switch on and bring the magnet close to the dry reed switch, the speaker will make power amplified sound of space war.



**465. The 'AND' gate.**

In the upper left diagram, both switches must be closed at the same time if the LED is to light. It is called the AND gate because switch 1 **and** switch 2 must be used.

The AND gate might be used on a missile site. Two people each have a switch to fire the missile so that one person alone can not fire the missile. Both people must use their switch if the missile is to be launched.

**466. The 'OR' gate.**

In the upper right diagram, either of the switches can be used at the same to light the LED. It is called the OR gate because switch 1 **or** switch 2 can be used.

The OR gate is used in many homes to light the stairs. There are two switches, one at the top and one at the bottom of the stairs. Either the switch at the top or the switch at the bottom can be used to switch the light on or off.

**467. The 'NOT' gate.**

In the lower left diagram, the LED will light and the motor will run. It will go out when the switch is closed. The LED is **not** lit when the switch is closed.

This type of circuit could be used in a room where the ventilation fan must be run all the time but the light can be turned off when not required.

**468. The 'NAND' gate.**

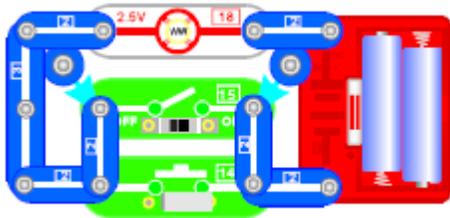
This is short for NOT AND. In the lower left diagram, Swap the top 3 connector for the press switch. The LED will light. It will only go out when both of the switch are closed.

**469. The 'NOR' gate.**

This is short for NOT OR. In the lower left diagram, Connect the press switch in parallel with the Slide switch, i.e connect it across the two 3 connectors. The LED will light. It will go out if either of the switch are closed.

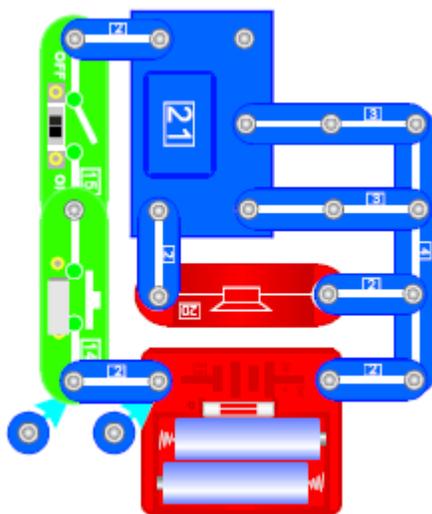
**470. The 'AND' gate (2).**

In the lower right diagram, both switches must be closed at the same time if the lamp is to light. It is called the AND gate because switch 1 **and** switch 2 must be used.



**471. Dual switched lamp (OR gate).**

In the upper left diagram, the light can be switched on by either of the two switches. This circuit would be useful in a room with two doors so that the light can be switched on or off from either of the doors. This is called an OR gate because the lamp can be switched on by either switch 1 OR switch 2.

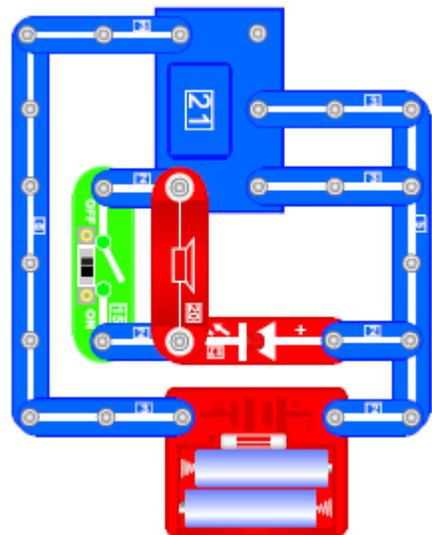


**472. Musical AND gate.**

In the right hand diagram, both of the switches must be closed for the music to play.

**473. Musical OR gate.**

In the right hand diagram, connect the switches in parallel. Either of the switches can be used to play the music.



**475. Machine gun controlled by an OR gate.**

In the right hand diagram, swap the music IC 21 with the IC 22. Either of the switches can be used to play the machine gun sound.

**476. Machine gun controlled by a NOT gate.**

In the lower left diagram, the sound will stop when the switch is closed.

**477. Machine gun controlled by a NAND gate.**

In the lower left diagram, connect the press switch in series with the slide switch. The sound will stop when both of the switches are closed.

In the lower left diagram, connect the press switch in series with the slide switch. The sound will stop when both of the switches are closed.

**478. Machine gun controlled by a NOR gate.**

In the lower left diagram, connect the press switch in parallel with the slide switch. The sound will stop when either of the switches is closed.

**479. Musical NOT gate.**

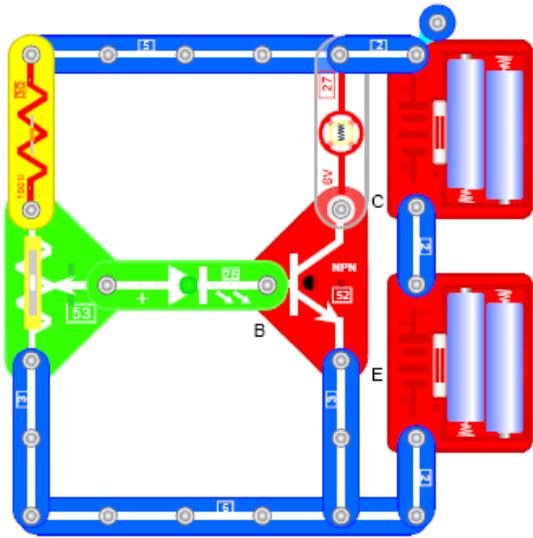
In the lower left diagram, the sound will stop when the switch is closed.

**480. Musical NAND gate.**

In the lower left diagram, connect the press switch in series with the slide switch. The sound will stop when both of the switches are closed.

**481. Musical NOR gate.**

In the lower left diagram, connect the press switch in parallel with the slide switch. The sound will stop when either of the switches is closed.

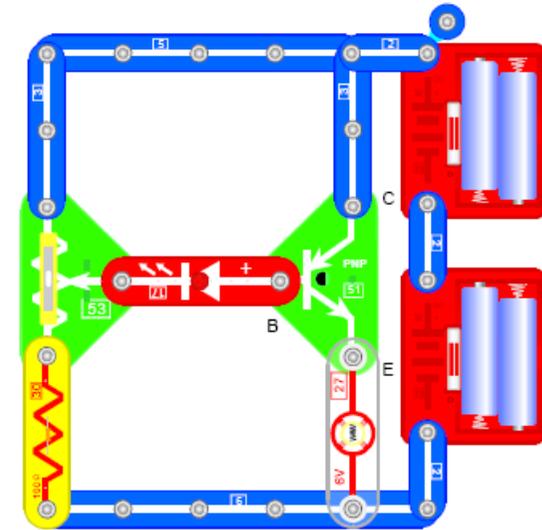


### The direction of current flow

Up to this point, the flow of current around a circuit has been accepted as flowing from positive to negative.

Unfortunately this is not the case, we now know that electron flow is from negative to positive.

We need to know this to understand how the transistor is used in a circuit.



#### 482. The NPN transistor.

A transistor has three electrodes, called Emitter (E), Base (B) and Collector (C). The transistor can be used to amplify a current.

The transistor is made from three layers of semi conducting material. The base is a very thin layer in the middle.

In the NPN transistor, the base is positive and the emitter and collector are both negative, hence the name NPN.

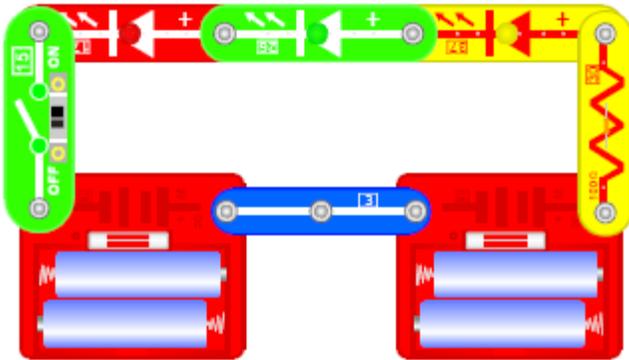
If a very small current is passed through base, then a very large current can be passed through the emitter and collector junction. This is how the transistor amplifies a current.

To see this in action, connect up the circuit and push the variable resistor upwards, when the LED lights up, this shows that a small current is flowing through the base, the lamp will also light up at the same time. The lamp requires a large current to make it light and this is being provided by the transistor..

#### 483. The PNP transistor

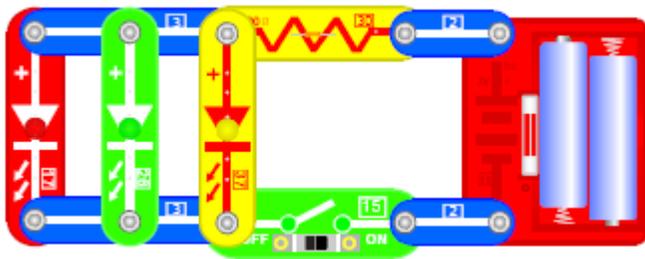
In the PNP transistor, base is negative and the emitter and collector are positive. In use, the base is connected to the negative battery terminal. Compare this with the circuit for the NPN transistor.

Connect up the circuit and set the variable resistor at half way. Move the variable resistor downward, when the LED lights up, the lamp will also light up at the same time. The small current passing through the base, allows a much larger current to flow through the emitter and collector junction.



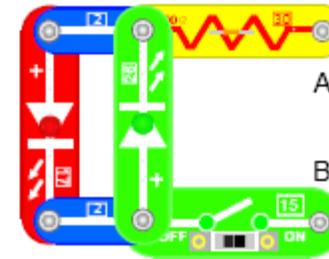
**484. LED's connected in series**

Close the slide switch, the brightness of the three LED will be the same. When connected in series, the current is shared between them.



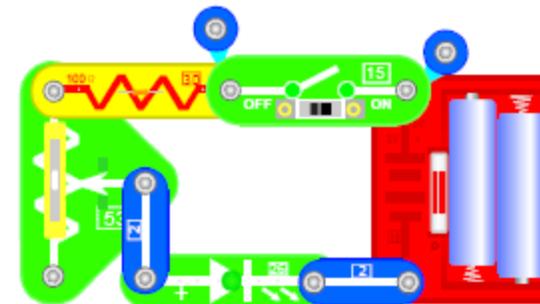
**486. LED's connected in parallel**

Switch on, the three LED's will all have the same brightness. This is because each LED has the same voltage.



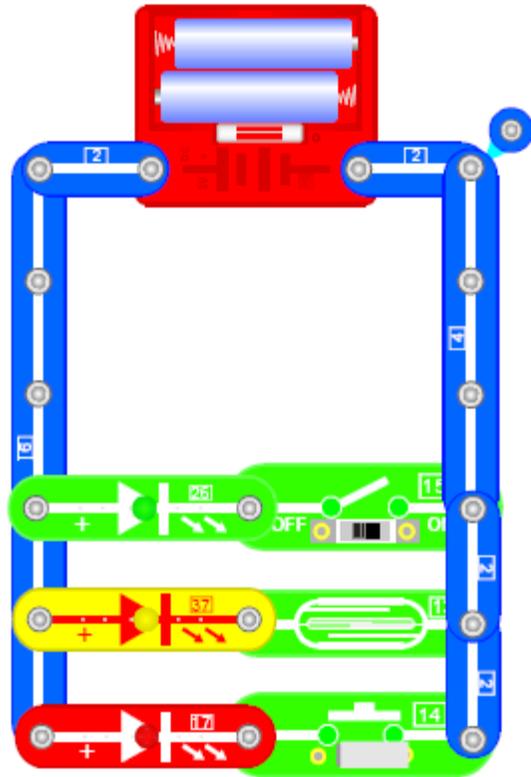
**485. Test for the positive and negative poles of a battery**

Connect the positive terminal of a battery unit to A and the negative to B, only the red LED lights up. Take out the batteries and turn them round, this time the green LED lights up but not the red. This shows that when the red LED lights up, the terminal A is positive.



**487. Adjusting the brightness of an LED**

Switch on and adjust the variable resistor to change the brightness of the LED.



**488. Green traffic light means 'go'**

Close the slide switch, only the green lamp is lights up, so it is safe to cross the road .

**489. Yellow traffic light means 'look before you cross'**

Open the slide switch, use a magnet to close the dry reed switch. The green lamp will go out and the yellow lamp will light up, look before you cross.

**490. Red traffic light means 'stop'**

Take away the magnet, press the press switch, the yellow lamp will go out and the red lamp will light up, do not cross the road .

**491. Three lamps all lit up**

Close the slide switch and press the press switch , bring the magnet close to the dry reed switch, all three lamps will light up .

**492. Red and yellow lamp lit up**

When three lamps are all lit up , open the slide switch , only red and yellow lamp will remain alight.

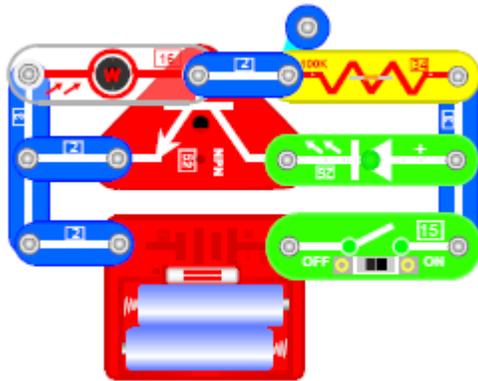
**493. Red and green lamp lit up**

When three lamps are all lit up, take away the magnet, only red and green lamp will remain alight.

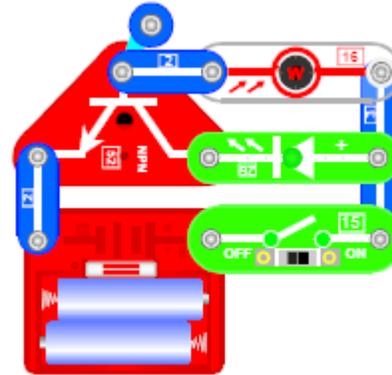
**494. Yellow and green lamp lit up**

When three lamps are all lit up, release the press switch , only the yellow and green lamps will remain alight.

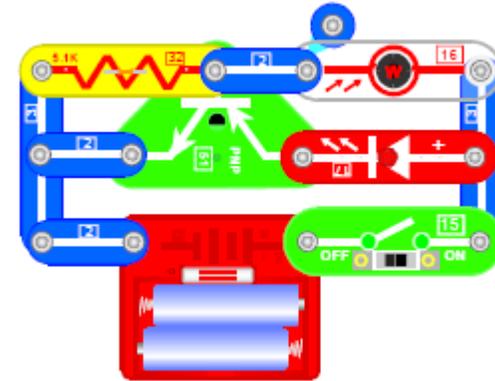
These next four circuits show how a light can be made to switch on either when it gets dark or when it gets light. The arrangements are shown for NPN and PNP transistors.



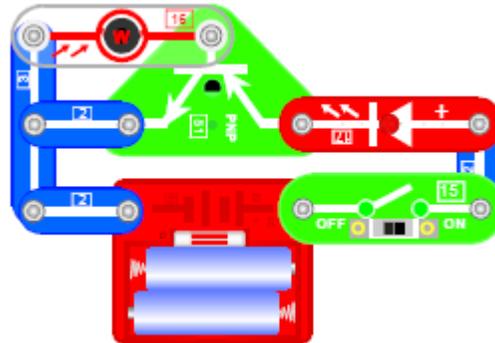
**495. LED lights up when it gets dark**  
Switch on, the LED will light up when it is dark, and go out when it is light.



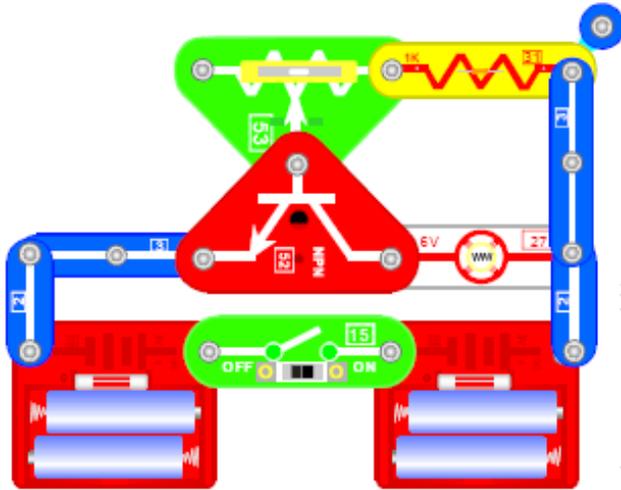
**496. LED lights up when it gets light.**  
Switch on, the LED will light up when there is light, and go out when it gets dark



**497. LED lights up when it gets dark**  
Switch on, the LED will light up when it is dark, and go out when it is light.



**498. LED lights up when it gets light.**  
Switch on, the LED will light up when there is light, and go out when it gets dark



**499. Single NPN transistor variable brightness lamp**

Switch on and adjust the variable resistor slowly, the brightness of lamp will be changed.

**500. Single NPN transistor variable speed fan**

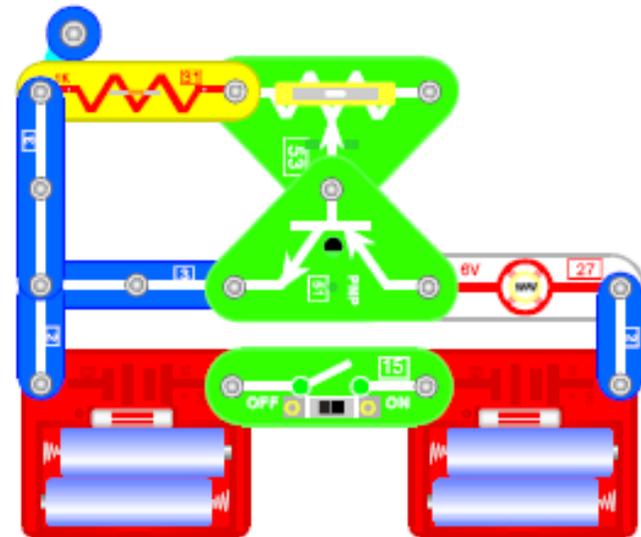
Replace the lamp with motor and yellow fan, switch on and adjust the variable resistor slowly. The speed of the fan will be changed.

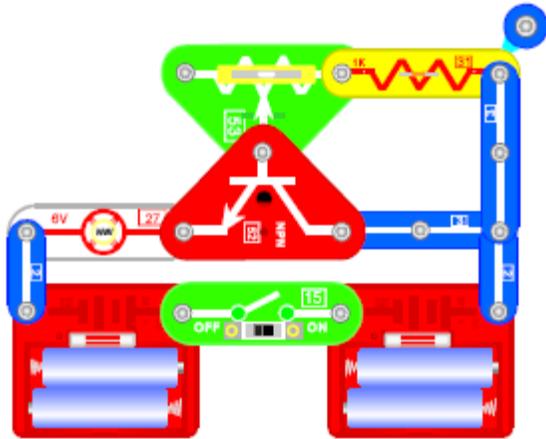
**501. Single PNP transistor variable brightness lamp**

Switch on and adjust the variable resistor slowly, the brightness of lamp will be changed.

**502. Single PNP transistor variable speed fan**

Replace the lamp with motor and yellow fan, switch on and adjust the variable resistor slowly. The speed of the fan will be changed.



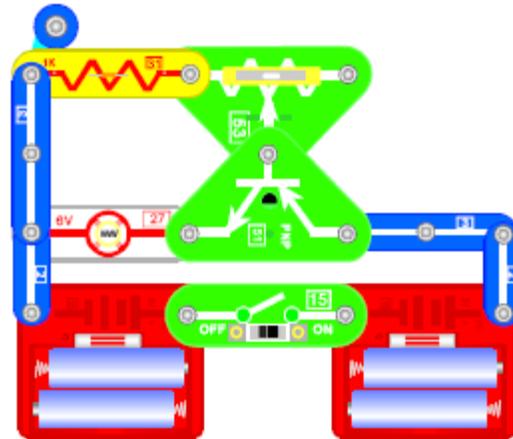


**503. Single NPN transistor variable brightness lamp (2)**

Switch on and adjust the variable resistor slowly, the brightness of lamp will be changed.

**504. Single NPN transistor variable speed fan (2)**

Replace the lamp with motor and yellow fan, switch on and adjust the variable resistor slowly. The speed of the fan will be changed.

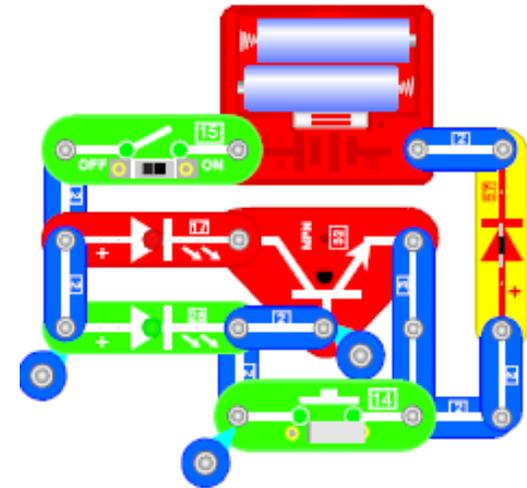


**505. Single NPN transistor variable brightness lamp (2)**

Switch on and adjust the variable resistor slowly, the brightness of lamp will be changed.

**506. Single NPN transistor variable speed fan (2)**

Replace the lamp with motor and yellow fan, switch on and adjust the variable resistor slowly. The speed of the fan will be changed.

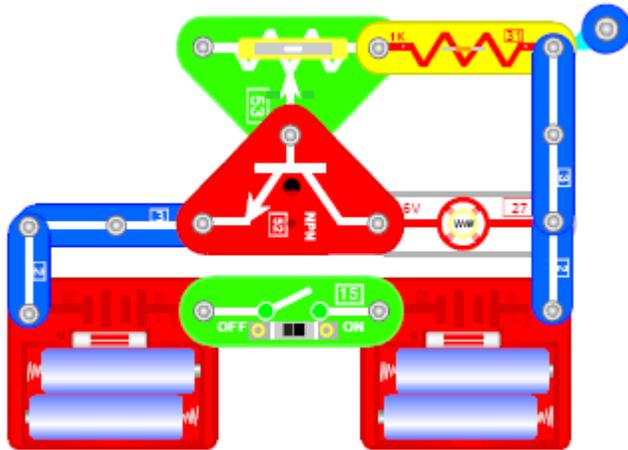


**507. Stop/Go Traffic light**

Switch on and the red lamp will light up. Press the press switch, the red lamp will switch off and the green lamp will switch on.

Release the press switch, the red lamp will light up again. Press the press switch again, the green lamp will light up.

These next few experiments show that touch sensors or magnetic switches can be used instead of conventional switches.



**508. Magnet controlled variable brightness light.**

Replace the slide switch with the dry reed switch.  
Bring a magnet close to the dry reed switch and control the brightness of the lamp with the variable resistor.

**509. Water controlled variable brightness lamp.**

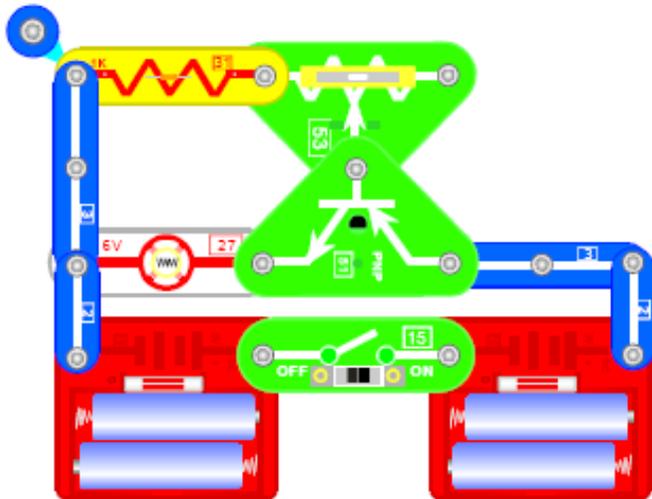
Replace the 1K resistor with the touch plate.  
Switch on and put a few drops of water on the touch plate. Control the brightness of the lamp with the variable resistor.

**510. Magnet controlled variable speed fan.**

Replace the slide switch with the dry reed switch and replace the lamp with the motor and yellow fan.  
Bring a magnet close to the dry reed switch and control the speed of the fan with the variable resistor.

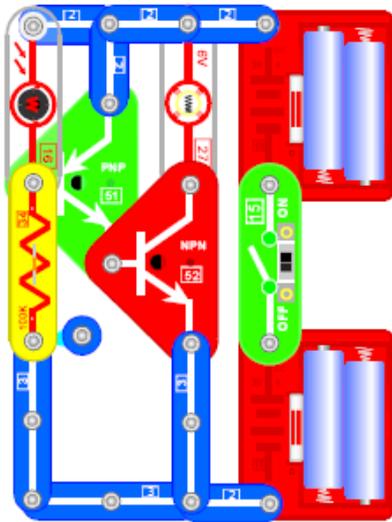
**511. Water controlled variable speed fan.**

Replace the 1K resistor with the touch plate and the lamp with the motor and yellow fan.  
Switch on and put a few drops of water on the touch plate. Control the speed of the fan with the variable resistor.



These experiments have all used the NPN transistor. They can all be done using the PNP transistor using the circuit shown opposite.

Remember to dry any components that got wet before you put them away.



### 512. Automatic street light (1)

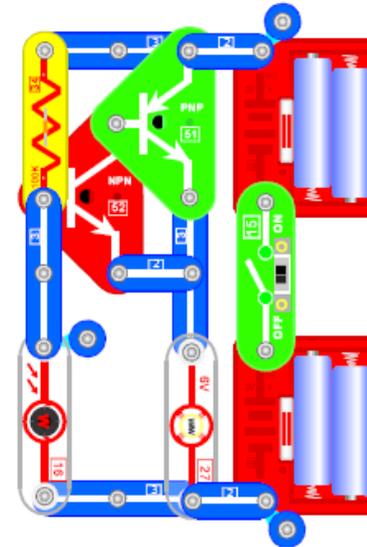
Switch on, if light falls on the photosensor, the lamp will not light up. Cover the photosensor with your hand, the lamp will light up. This is how the automatic street light works which lights up at night and goes out in the morning.

### 513. Light controlled fan (1)

Replace the lamp with motor and the yellow fan. In the light, the fan will not rotate but when it is dark, the fan will rotate.

### 514. Simple light-controlled lamp(1)

Change the place of resistor and photosensor, the lamp will light up when there is light, and will go out when there is no light.



### 515. Simple light-controlled fan (1)

Swap the positions of resistor and photosensor. Replace the lamp with motor and fan. The fan will rotate in the light, and will stop in the dark.

### 516. Automatic street light (2)

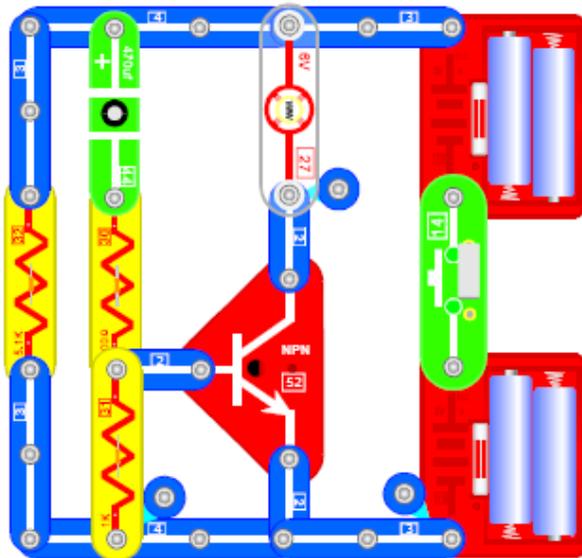
Switch on, if light falls on the photosensor, the lamp will not light up. Cover the photosensor with your hand, the lamp will light up.

### 517. Light controlled fan (2)

Replace the lamp with the motor and the yellow fan. In the light, the fan will not rotate but in the dark, the fan will rotate.

### 518. Simple light-controlled lamp(2)

Swap the positions of the resistor and the photosensor, the lamp will light up when there is light, and will go out when there is no light.



These circuits use a capacitor to store energy from the battery. The capacitor can be thought of a bucket with a hole in it. When the bucket is full of water, the water will run out through the hole and the bucket will need to be filled up again. In the same way, the capacitor does not hold its charge for long, so it has to be recharged.

In these two circuits, the capacitor charges up when the switch is pressed.

When the switch is pressed, the lamp will light and get progressively dimmer as the capacitor charges up. With the rather small capacitor we are using this is difficult to see as it charges very quickly so the lamp only appears to flash.

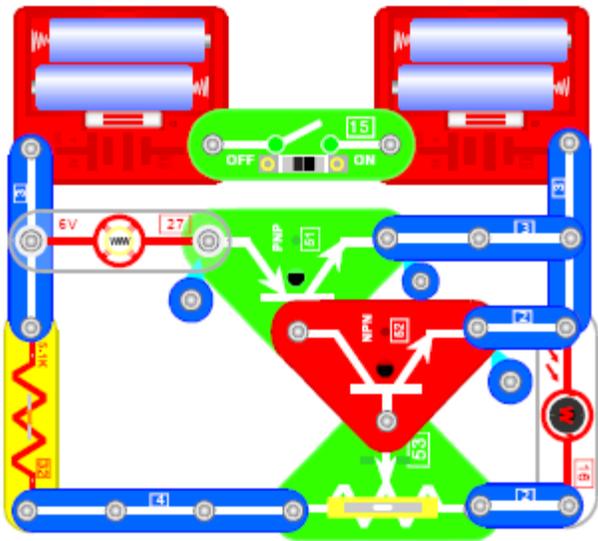
#### 519. Capacitor used to light a lamp

Press the press switch and the lamp will flash, wait a few seconds and press the switch again, the lamp will flash once more. The few seconds wait is to allow the capacitor to fully discharge.

#### 520. Capacitor used to run a fan

Replace the lamp with the motor and yellow fan. Press the press switch, the fan will rotate for a short time and then stop. Wait a few seconds, press the switch again and it will rotate again for a short while and then stop.

In each of these experiments, the use of a very large capacitor would enable the fully charged capacitor to light the lamp or run the fan for several seconds without the use of batteries.



### 562. Light adjustable automatic street lamp(1)

Switch on and shade the photosensor with your hand. Adjust the variable resistor so that the lamp just lights. This is an automatic street lamp which can be adjusted to switch on and off according to the light level selected. It comes on when it gets dark and goes off when it gets light.

### 563. Light adjustable automatic fan (1)

Replace the lamp with the motor and the yellow fan. Shade the photosensor with your hand. Adjust the variable resistor so that the fan just rotates. The fan will rotate in the dark but will stop when light hits the photosensor.

Please note that the motor will be running on 6 volts so do not leave it running for too long or it may be damaged.

### 564. Light adjustable automatic lamp (2)

Change the place of resistor and the photosensor, the lamp will now light up when there is light and go out when it is dark. The sensitivity can be adjusted with the variable resistor. This is the opposite circuit to experiment 562.,

### 565. Light adjustable automatic fan (2)

Replace the lamp with motor and yellow fan. The fan will now rotate when there is light and go off when it gets dark. The sensitivity can be adjusted with the variable resistor. This is the opposite circuit to experiment 563.

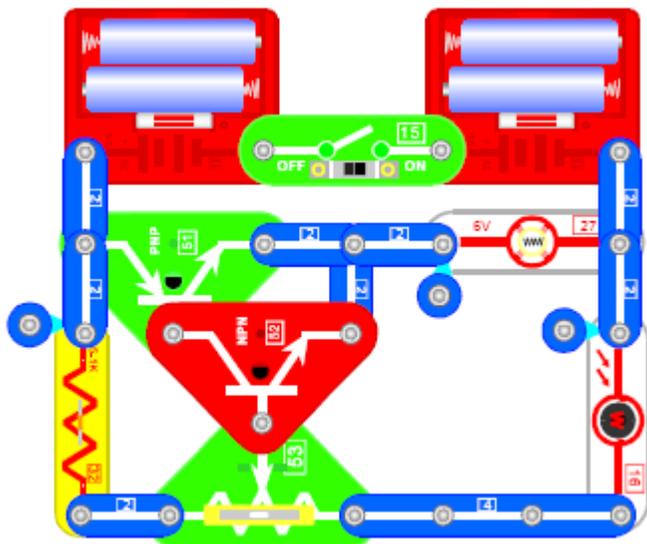
The next four experiments are the same as the above but with the light and motor in the negative line.

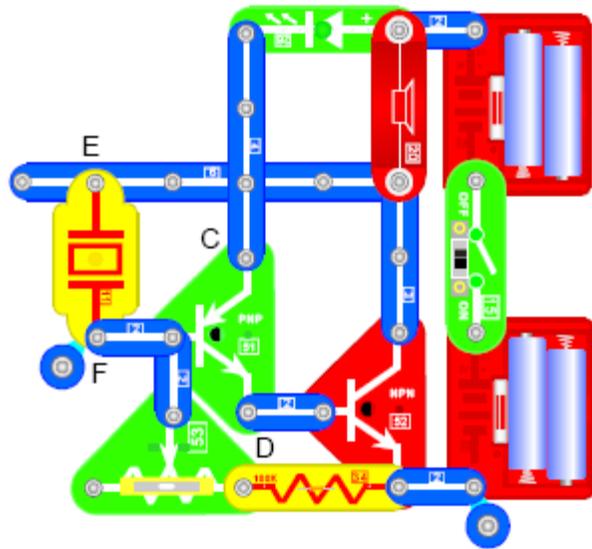
### 566. Light adjustable automatic street lamp(3)

### 567. Light adjustable automatic fan (3)

### 568. Light adjustable automatic lamp (4)

### 569. Light adjustable automatic fan (4)





**570. Sound of Police car**

Switch on, the LED will light up and you can make the sound of a police car by sliding the variable resistor up and down.

**571. Light controlled sound of police car**

Connect the photosensor in parallel with the buzzer 11. You will need an extra 1 connector placed under the one end of the photosensor. You can vary the tone of the police car by putting your hand over the photosensor. Try it with the slider of the variable resistor in different places.

**572. Variable sound of mosquito.**

Connect C and D with the 10uf capacitor 42. When you switch on, the speaker will make the sound of a mosquito. The variable resistor can be used to vary the sound.

**573. Touch sensitive buzzer**

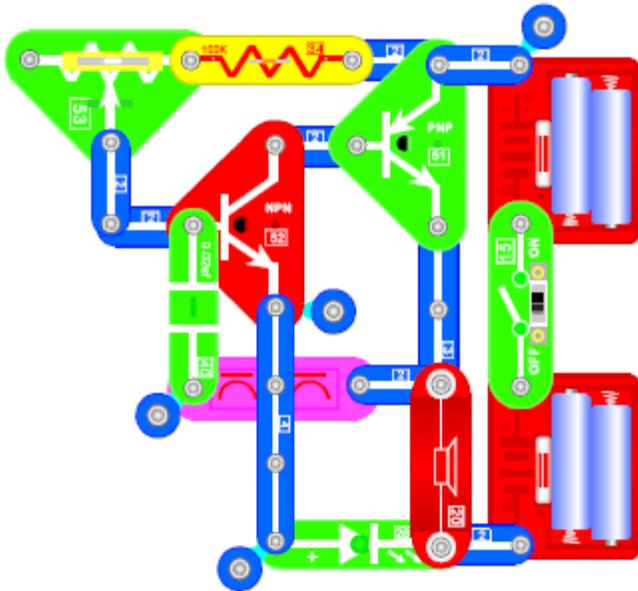
Replace resistor 34 with the touch plate. Switch on and try rolling a finger over the touch plate. You should be able to go from a very slow clicking to a full buzzer sound. If you moisten your finger, the buzzer will be very high pitched and can be controlled by the variable resistor.

**574. Light sensitive buzzer.**

Replace the buzzer 11 with the photosensor. Put a finger over the photosensor and switch on. Carefully roll the finger over the top of the photosensor and the volume of the buzzing sound can be controlled. This will not work in bright light.

**575. Flashing light with bleep.**

Replace the buzzer 11 with the 10uf capacitor 42. Switch on and the LED will flash on and off and the speaker will give out a bleep. The speed can be partially controlled by the variable resistor.



**576. Multi-tone generator**

Switch on and adjust the variable resistor to make many different sounds.

**577. Light-controlled tone generator**

Replace the resistor with photosensor, the sounds can be adjusted by the amount of light falling on the photosensor and/or the variable resistor. Some interesting sounds can be made by opening the fingers of one hand and moving these across the photosensor.

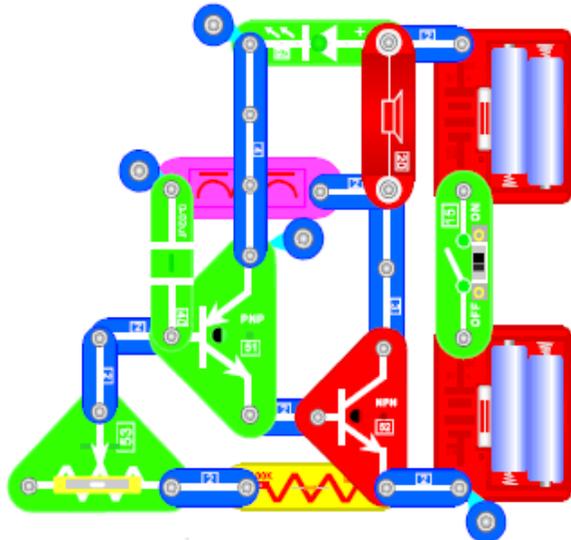
**578. Lie detector**

Replace the resistor with touch plate. Get your suspect to place a finger on the touch plate, wait for the sound to settle down and then ask them a question. If the suspect makes an untruthful reply, the steady clicking sound will rise considerably in pitch.

This happens because when someone tells a lie, they sweat slightly and this causes better conduction of the touch plate.

**579. Hearing tester**

Replace the 100k resistor with the 5.1k resistor. Slide the variable resistor slowly to the right and see how long it is before you can no longer hear the sound.



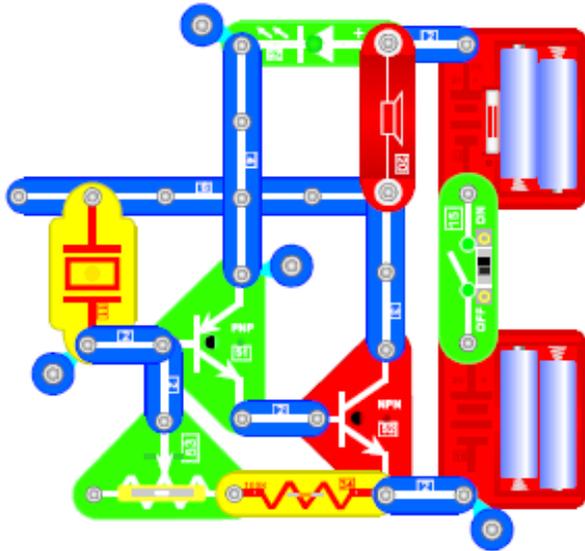
All the experiments can also be done using the transistors configured as shown in the lower diagram.

**580. Multi-tone generator**

**581. Light-controlled tone generator**

**582. Lie detector**

**583. Hearing tester**

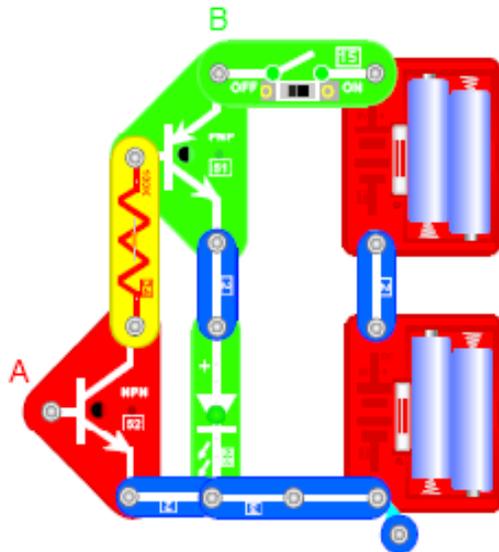


**584. Sound of a ships foghorn**

Connect a 0.1uF capacitor 41 across the buzzer. Use a 1 connector under one end. Switch on and the loudspeaker will make the sound of a ships foghorn. The pitch can be changed by the variable resistor.

**585. Light control bleeper.**

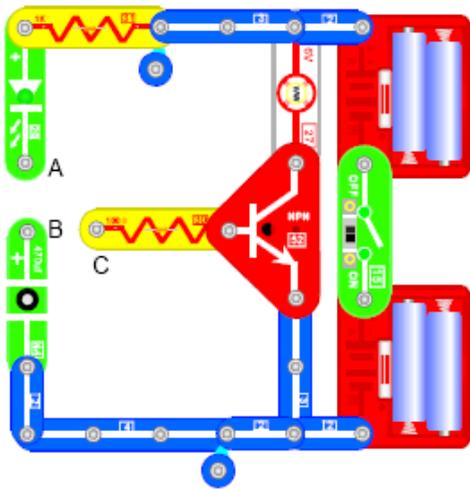
Leave the capacitor in place and swap the resistor for the photosensor. This time the bleep can be controlled by shielding the light from the photosensor.



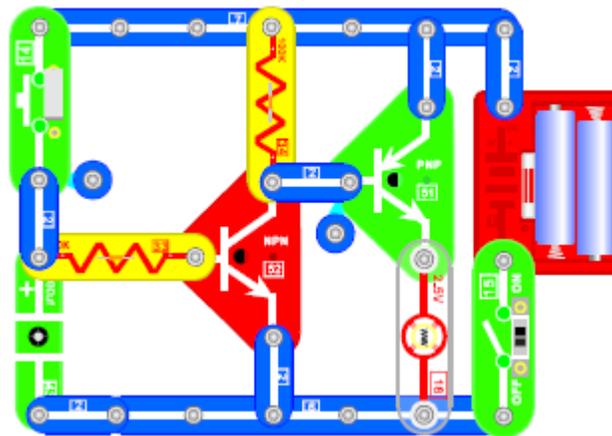
**586. LED lit up by hand**

Switch on and the LED will not light up, place a finger on terminal A and touch terminal B with another finger of the same hand. The LED lights up. Try using a finger from each hand and also try touching other terminals.

This shows that the body allows electric currents to pass through it. The current is very small but the transistor only requires a very small amount to flow into the base to switch it on.

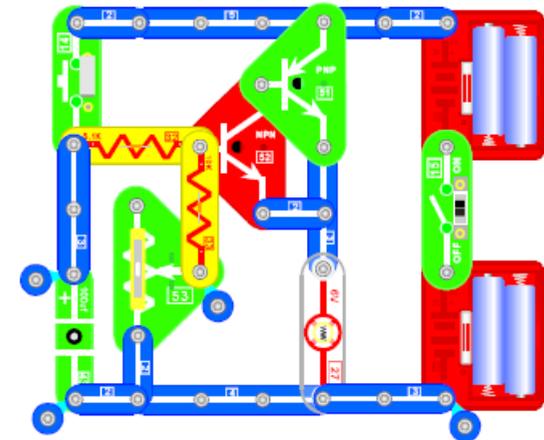


**587. Using a capacitor to light a lamp**  
 Switch on. Connect terminals A and B with 2 connector, the green LED will light up and slowly fade out showing that the capacitor has charged up. Remove the 2 connector and use it to connect B and C. The capacitor will discharge through the base of the transistor causing the emitter/collector junction to conduct. This is shown by the 6 volt lamp lighting up for a short while.

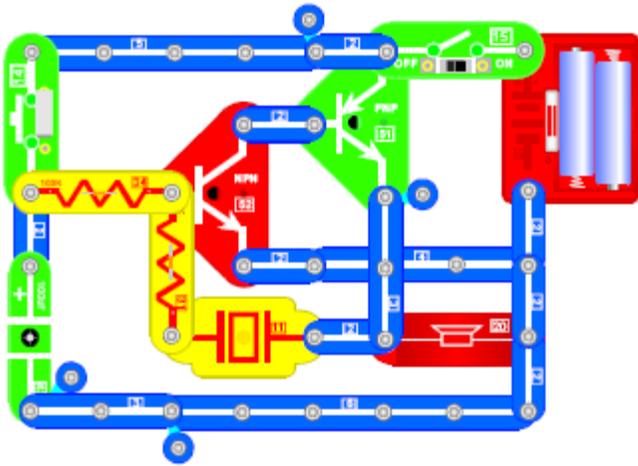


**588. Timed bed light**  
 Switch on, press the press switch and the lamp will light up and go out after a few seconds. This could be used for checking the time at night.  
**589. Timed electric fan**  
 Replace the lamp with the motor and yellow fan. Switch on and press the press switch. The fan will rotate for a short while and then stop.

To make the light or the fan run for longer, swap the 100uf capacitor 43 for the 470uf capacitor 44.



**590. Variable delay timed bed light**  
 Switch on, press the press switch and the lamp will light up and go out after a few seconds. Adjust the variable resistor to set the time delay.  
**591. Variable delay timed electric fan**  
 Replace the lamp with the motor and yellow fan. Switch on and press the press switch. The fan will rotate for a short while and then stop. Adjust the variable resistor to set the time of rotation.



**592. Fading doorbell**

Switch on and press the press switch, the sound will slowly fade away.

**593. Fading metronome**

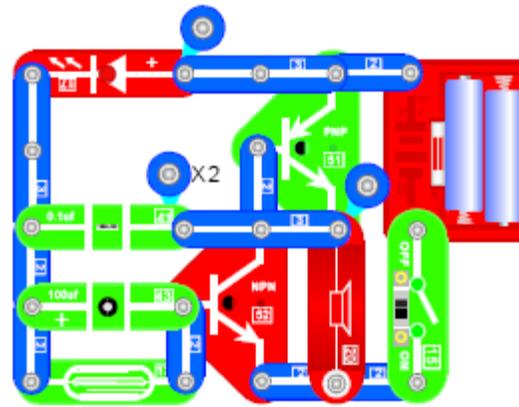
Connect the capacity 42 in parallel with the buzzer. Press the press switch and the speaker will make a clicking sound that slows to a stop.

**594. Fading flashing lamp**

Replace speaker with lamp, press the press switch and the flashing lamp will fade out.

**595. Sound of sick motorcycle**

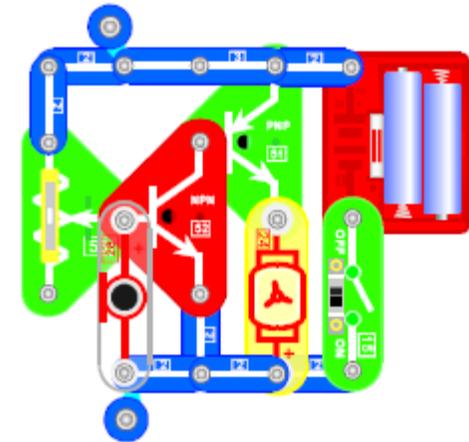
Connect capacity 41 in parallel with the buzzer. Switch on and press the press switch, the speaker will make the sound of a sick motorcycle .



**596. Fishing game**

Make a fishing rod and line. Fix the magnet to the end of the fishing line. Then make up this circuit and go fishing!

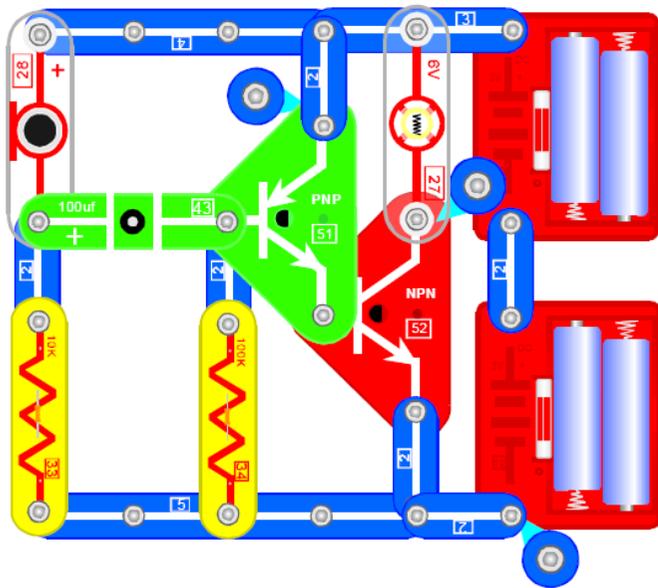
The aim is to get the magnet on to the dry reed switch. If you are successful, the loudspeaker will make a sound and the red LED will light up.



**597. Sound controlled fan.**

Place the yellow fan on motor and switch on. Adjust the variable resistor and blow or speak to microphone until the fan just begins to rotate. Stop making a noise and the fan will stop.

The speed of the fan can be controlled by the volume of sound.



**598. Noise dimming light**

Connect up the circuit, the lamp will light up but if you blow into the microphone, the lamp will become less bright.

**599. Delaying light**

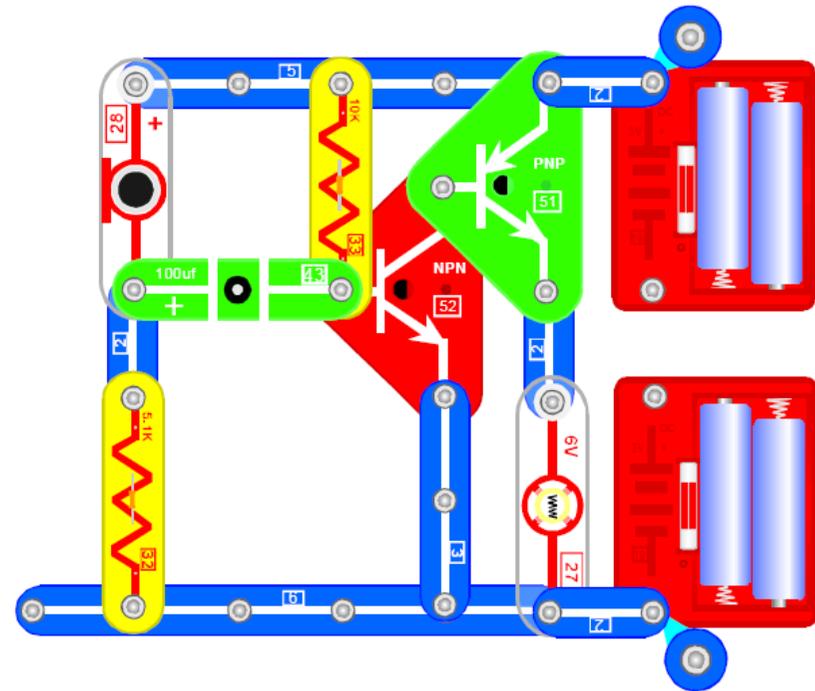
Replace the microphone with slide switch and switch on, the lamp will go out , but it will light up again after a while. Switch on and off again to repeat.

**600. Blow out lamp**

After connecting the circuit, the lamp will light up. Blowing on the microphone will blow the lamp out temporarily . After a while, the lamp will light up again.

**601. Electrical fan controlled by blowing**

Replace the lamp with the motor and the yellow fan, the fan will begin to rotate. Blow to microphone and the fan will rotate, blow harder and the fan will rotate faster.



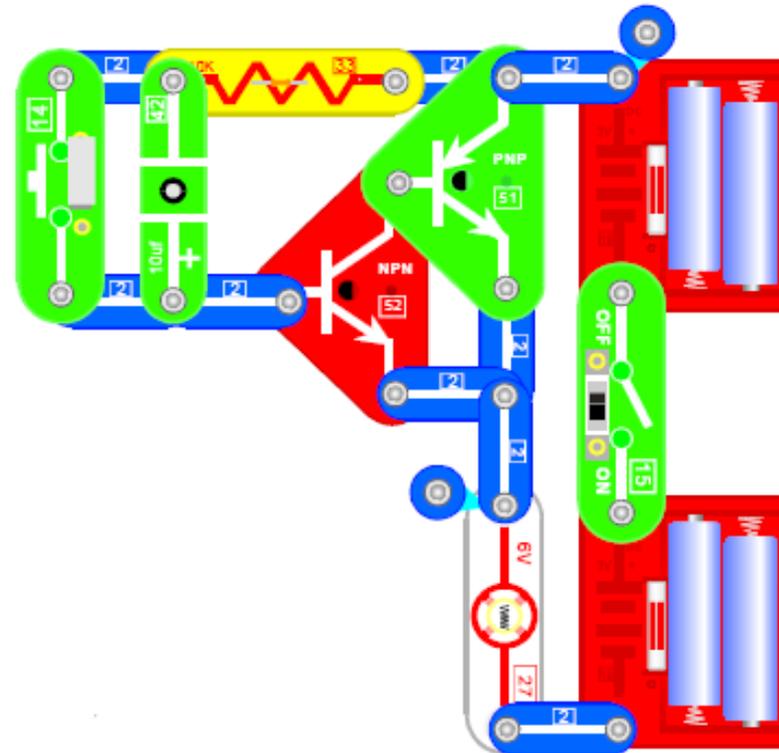
### 602. Time-delay lamp

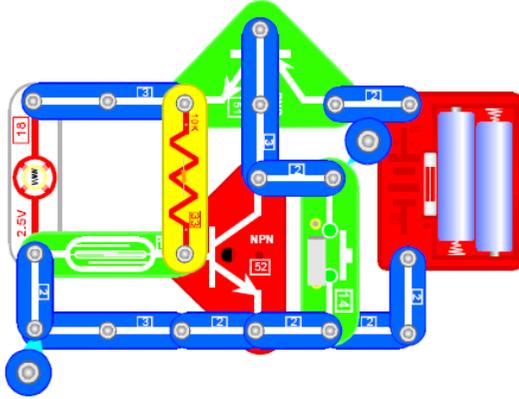
Switch on and then press the press switch, the lamp will light up and go after a while.

### 603. Time-delay electrical fan

Replace the lamp with the motor and yellow fan. Switch on and press the press switch, the fan will start rotating and stop after a while.

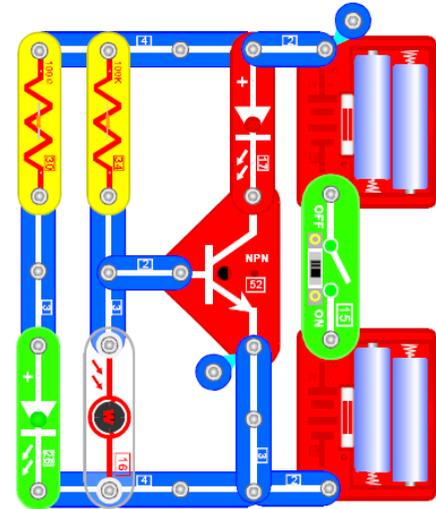
To change the time delay, try experimenting with different value capacitors. Higher values like 100uf and 470uf will increase the time delay so the light will stay on longer.





**604. Trigger with memory**

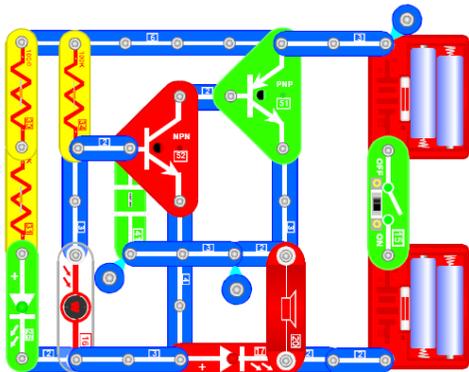
Connect the circuit as shown in the left diagram. Press the press switch and the lamp will light up. Release the press switch, the lamp will stay alight. If you touch the dry reed switch with a magnet, the lamp will go out. Press the press switch again, the lamp will light up again.



**606. Optical light detector**

Switch on and when light hits the photosensor, the red LED will not light up.

Shade the photosensor from the light, the red LED will light up. The green LED will continue shining to indicate that the circuit is switched on.



**605. Acousto-optic light detector**

Switch on. When light falls on the photosensor, the speaker will not sound. If the photosensor is shaded from the light, the speaker will sound.

### 607. Plant pot water detector

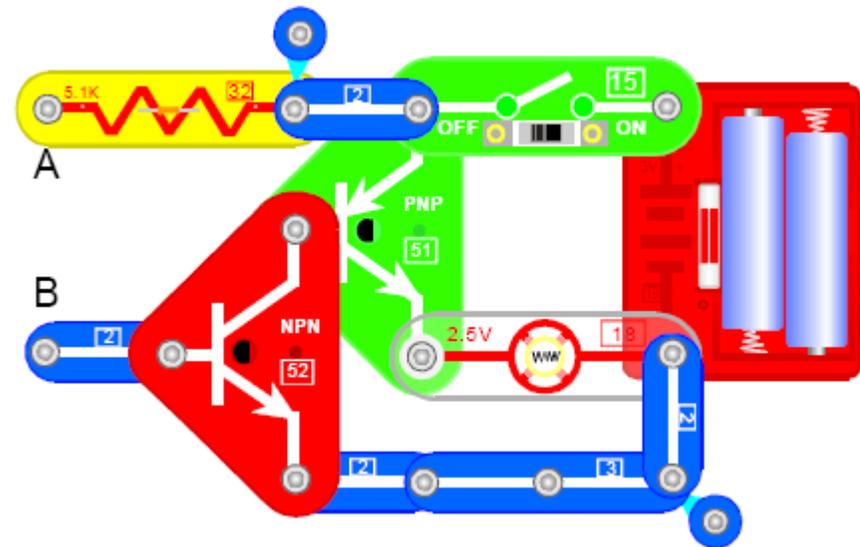
You will need two copper nails or thick pieces of copper wire long enough to penetrate about 4cm in to the soil in the flower pot and placed about 3cm. apart.

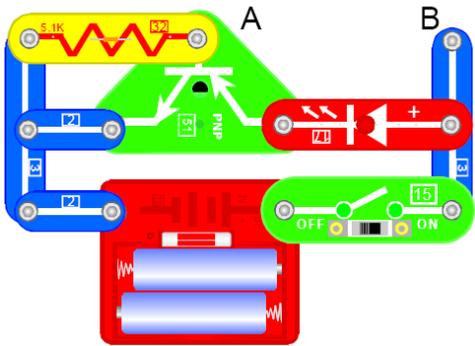
Attach the nails to points A and B on the circuit with some insulated wire.

If the earth in the flower pot is dry, the lamp will not light up, so its time to get out the watering can.

If the earth is wet the lamp will light up. The wetter the earth, the brighter the lamp will shine.

In time, you should be able to judge when to water by the brightness of the bulb.



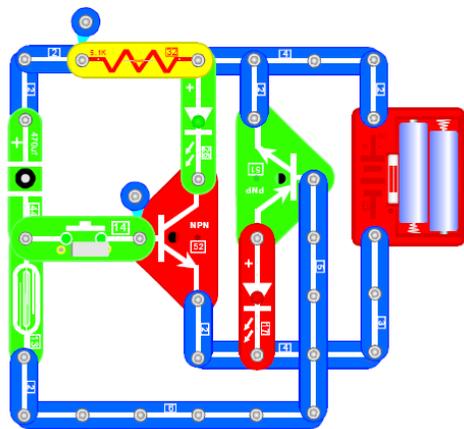
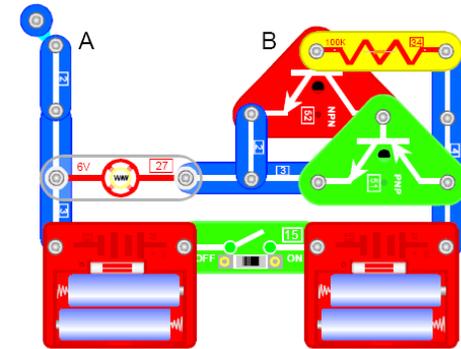


**608. Single transistor theft alarm**

Pass a thin wire through the wheel of a bicycle and join the ends to terminals A and B. then switch on. If the bicycle is taken, the wire will break and the LED will light up.

**609. Two transistor theft alarm**

This circuit operates in just the same way as 608 but because of the two transistors, the circuit reacts faster.

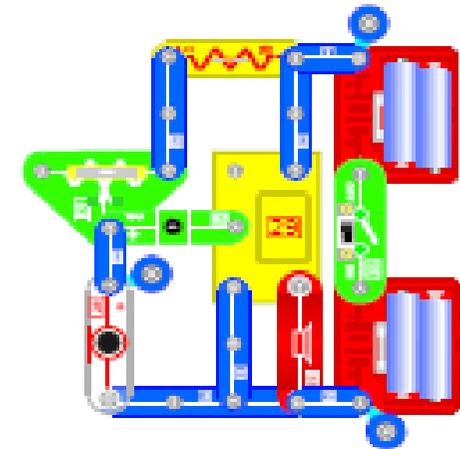


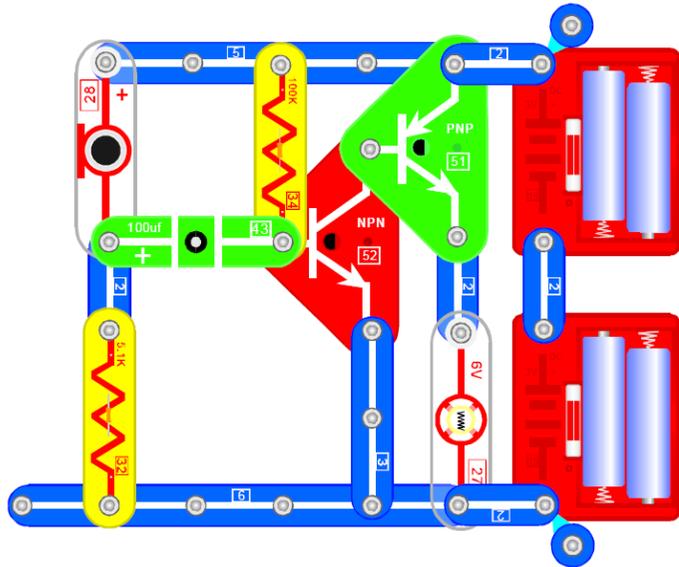
**610. Charging and discharging of a capacitor**

Press the press switch and the capacity will charge up and the green LED will light up. Release the press switch and put a magnet near to the dry reed switch, the capacitor will begin to discharge and the red LED will light up.

**611. Amplified microphone**

Switch on. Adjust the variable resistor slowly so that when you blow or speak into the microphone, the sound has a loud volume without hiss or crackling. As the microphone is very near to the speaker, it is easy to get feedback or a howling sound. For best results, connect the speaker with long wires some way from the microphone.





**612. A lamp that relights(1)**

Replace the microphone with photosensor, the lamp will light up. Cover the photosensor with a hand, the lamp will go out but will light up after a while.

**613. Light controlled fan(1)**

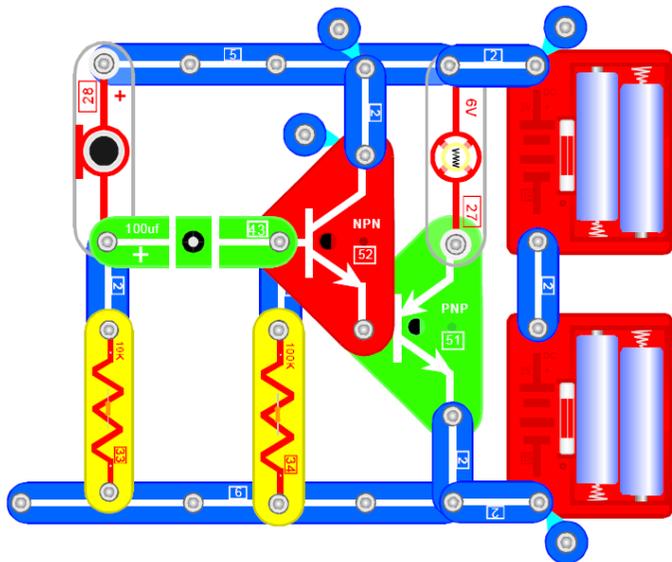
Replace the lamp with the motor, when the motor is rotating, cover the photosensor with a hand and the motor will slow down but will speed up again after a while.

**614. The relighting lamp(2)**

Replace the microphone with press switch. Press the press switch and release it. The lamp will go out and light up again after a while.

**615. Noise controlled fan(1)**

Replace the lamp with the motor and the yellow fan. When the fan is rotating, blow into the microphone and the speed of rotation will slow down. Blow harder and the rotating speed will get even slower.



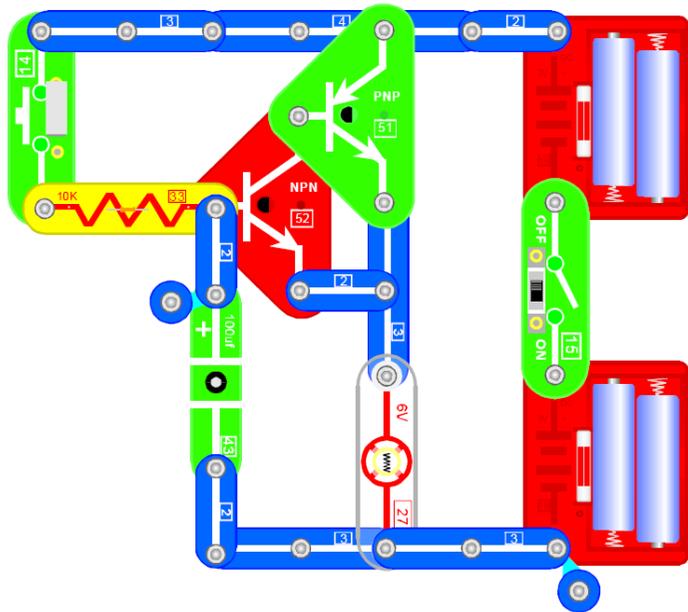
These next four experiments use this circuit but operate as the ones above.

**616. A lamp that relights(2)**

**617. Light controlled fan(2)**

**618. The relighting lamp(3)**

**619. Noise controlled fan(2)**



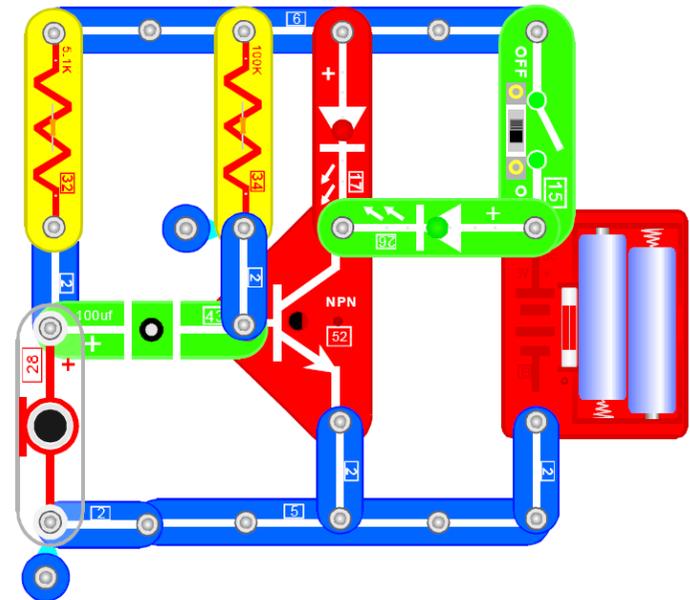
### 620. Timed delay lamp

Switch on and press the press switch, the lamp will light up for a while. Release the switch and the lamp will continue shining for a while .

When you first press the switch, the voltage of the capacity is too low for the transistor to conduct. After a short time, the voltage of the capacity becomes high enough to allow the transistor to conduct.

### 621. Timed delay motor

Replace the lamp with the motor and the yellow fan . Operate as above.



### 622. Sound-controlled flashing LED's

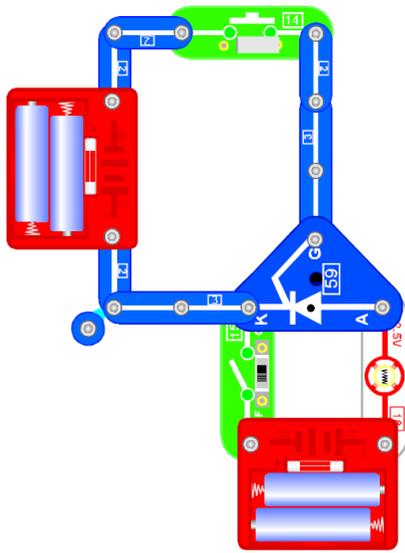
Switch on and the red and green LED's will light dimly. Blow into the microphone or put the microphone near to a TV or radio, and the brightness of the LED's will be controlled by the volume of sound.

### 623. Light-controlled flashing LED's

Replace the microphone with the photosensor. Switch on and this time the LED's brightness will be controlled by the amount of light falling on the photosensor.

### 624. Electricity-controlled flashing LED's

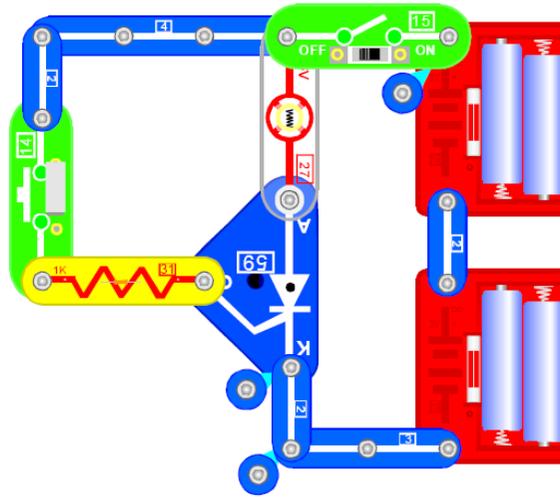
Replace the microphone with motor. Switch on and turn the motor shaft slightly, the LED's will light up.



### 625.Using a thyristor(1)

If you think back to the transistor, you will remember that to make it conduct, a small continuous current was required at the base. The thyristor has three electrodes, the anode A, cathode K and gate G. The gate is like the base in a transistor, the real difference being that when a small current is passed through the gate and then removed, the thyristor continues to conduct. To stop the conducting, the circuit must be switched off.

Try this with the circuit above. Switch on and the lamp will not light. Press the press switch, the thyristor will conduct and the lamp will light up. Release the press switch, the lamp will stay alight. To make the lamp go out, switch off.

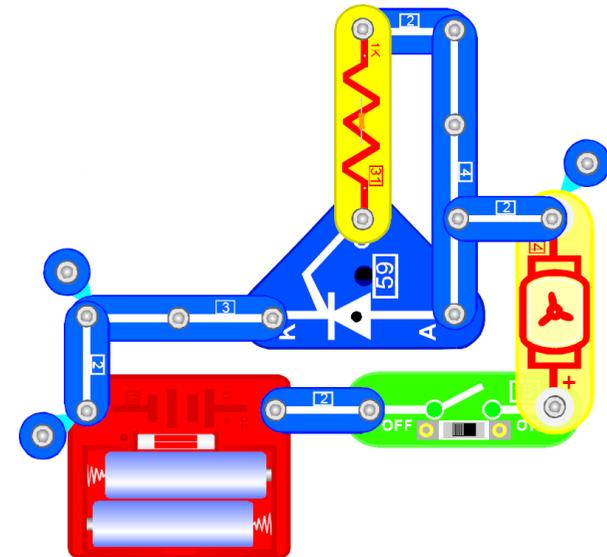


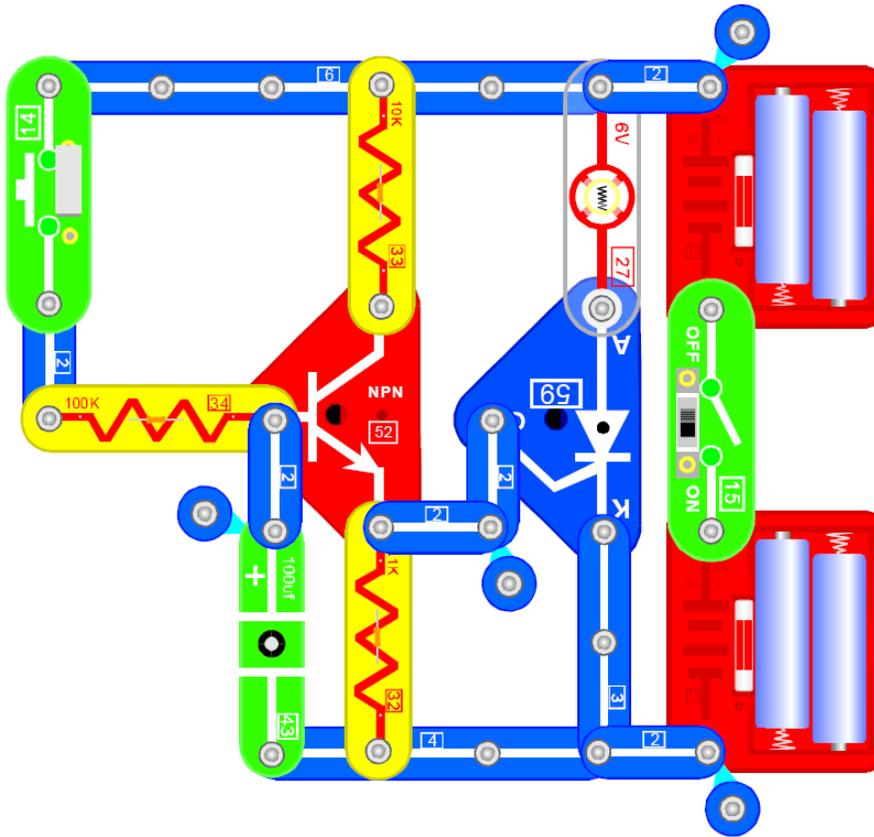
### 626.Using a Thyristor (2)

The circuit opposite is a more conventional layout and works in just the same way as the first circuit.

### 627. A motor operated by a Thyristor

In the circuit below, switch on and the motor will rotate. If you unclip the resistor, the motor will continue to rotate.





**628. Time-delay lighting up using a thyristor**

Switch on and the lamp does not light up. Press the press switch and hold it down after a short delay, the lamp will light. Release the press switch and the lamp will continue to light.

**629. Time-delay fan using a thyristor**

Replace the lamp with the motor and the yellow fan. Press the press switch and hold it down after a short delay, the fan will start to rotate. Release the press switch and the fan will continue to rotate.

**630. Light controlled time delay**

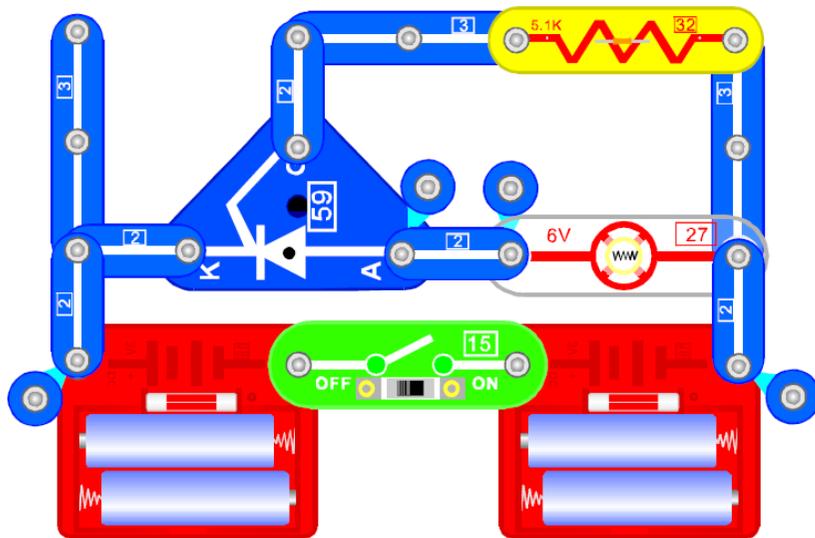
Replace the 10k resistor with the photosensor. Now the motor or light will only work when its light.

**631. Touch controlled time delay**

Replace the 10k resistor with the touch plate. To switch the lamp or motor on, the touch plate must be touched and the press switch pressed.

This would be an extra safety measure to prevent the lamp or motor being switched on by mistake.

In these experiments the time delay is caused by the capacitor. If the 100uf capacitor is replaced with a larger value, the delay will be greater as it takes longer to charge up.



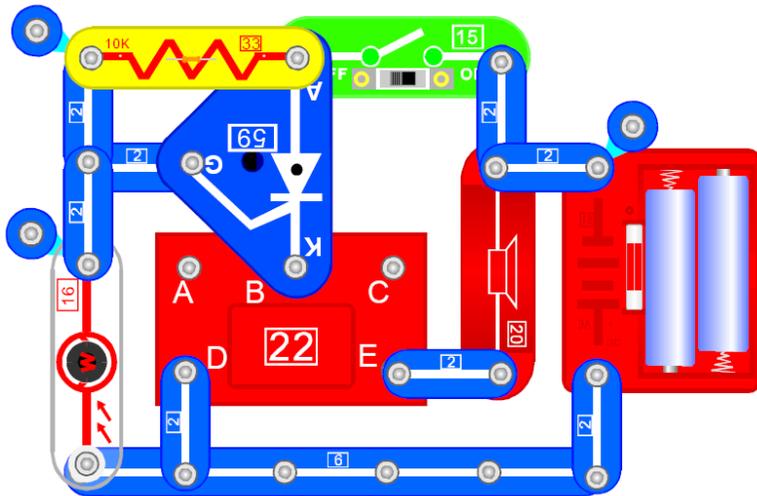
### 632. Rain alarm using a thyristor

Build up this circuit. Test it out by switching on and the lamp should light. Remove the resistor and the lamp should continue to light. Switch off.

Remove the top 3 snap connector, (the one joined to the resistor) and attach the touch plate by two long wires, long enough to hang out of the window. Curl the ends around the terminals and hold them in place with a snap connector. Hang the touch plate out of the window and switch on. If rain falls on the touch plate, the light will come on.

### 633. Bathroom humidity control fan

Use the circuit as above but replace the lamp with the motor and yellow fan. Hang the touch plate in the bath. When the bath fills with water, the fan will come on and ventilate the bathroom.



#### 634. Thyristor controlled warning system

This circuit could be used in a room where the lights must be on all the time. If the lights fail, the resistance of the photosensor will fall and allow current to pass into the gate of the thyristor causing it to conduct and sound the alarm. Even if the lights come back on, the alarm will continue to sound until the circuit is reset by switching off.

If a thyristor was not used, the alarm would stop sounding when the lights came back on.

This circuit uses the sound of a police car as its alarm sound. The next few experiments show how to change the sound.

If this experiment does not work, try connecting the Cathode K to the negative supply rail with a 100Ω resistor.

#### 635. Thyristor controlled warning system (Machine gun sound)

Connect terminals B and C, the alarm will now be the sound of a machine gun.

#### 636. Thyristor controlled warning system (Fire engine sound)

Connect terminals A and B, the alarm will now be the sound of a fire engine.

#### 637. Thyristor controlled warning system (Ambulance sound)

Connect terminals A and D, the alarm will now be the sound of an ambulance.

#### 638. Thyristor controlled warning system (Buddha laugh)

Connect terminals A and C, the alarm will now be the sound of a Buddha laugh.

#### 639. Magnetic cancelling of police car sound

Replace the photosensor with the dry reed switch. Switch on and the speaker will make the sound of a police car. Place a magnet close to the dry reed switch and the sound will stop.

#### 640. Magnetic cancelling of machine gun sound

Connect terminals B and C and follow instructions for 639.

#### 641. Magnetic cancelling of fire engine sound

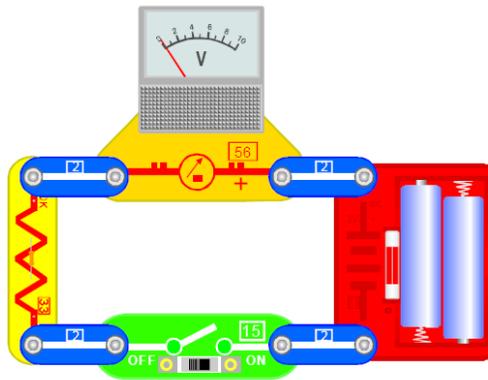
Connect terminals A and B and follow instructions for 639.

#### 642. Magnetic cancelling of ambulance sound

Connect terminals A and D and follow instructions for 639.

#### 643. Magnetic cancelling of laughing Buddha sound

Connect terminals A and C and follow instructions for 639.



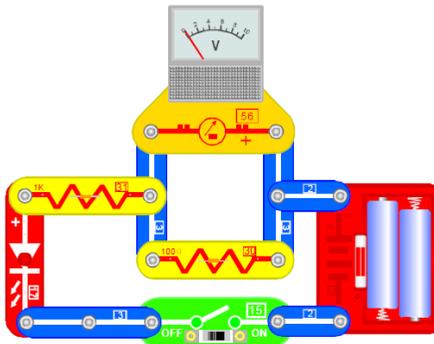
The meter provided in this kit will measure Volts or Amps according as to how it is used. It is for use only with this kit and is not suitable for use elsewhere.

**645. Function of the ammeter**

Close the slide switch and the pointer of the ammeter will deflect to indicate a current flowing in the circuit, the larger current, the larger the deflection.

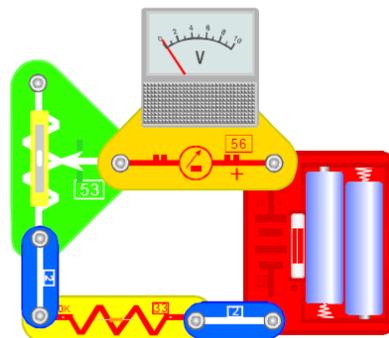
**646. Current-limiting function of a resistance**

Replace the resistor 33 with resistor 34, as the resistance becomes larger, the deflection angle will become smaller, this shows that the resistor is limiting the current.



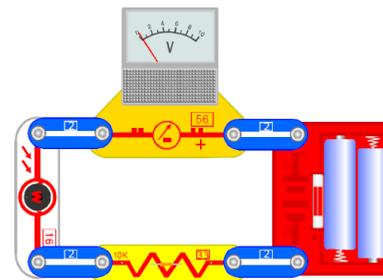
**647. 0-1mA ammeter**

Connect a 100Ω resistor in parallel with the meter as shown. This will extend the range of the meter to read smaller currents. The ammeter will now read up to 1mA, originally the ammeter would read up to 0.3A. If the value of the parallel resistor is smaller, the range of ammeter will become wider.



**648. Using the variable resistor**

Adjust the variable resistor and note how the meter reading changes.



**649. Using the photosensor**

Connect up the circuit and point the photosensor towards the light, the pointer of the ammeter will read about 4 in direct sunlight. Cover the photosensor and note how the reading falls. Remember, the photosensor has a high resistance in the dark and a low resistance in the light.

These experiments show how to use the meter to measure Volts. The range is 0 -10 Volts but by using resistors, the range can be extended.

Only the batteries used in this kit should be used for these experiments.

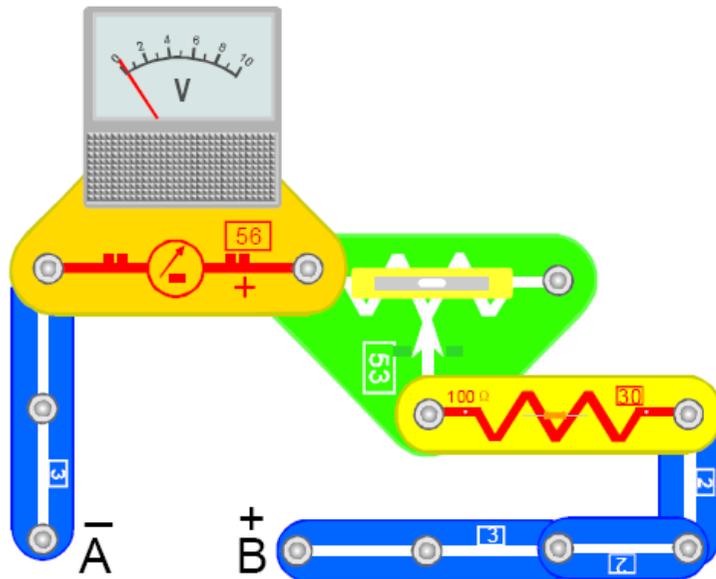
DO NOT try to measure voltages of more than 6 volts.

### 650. Using the voltmeter.

Clip the meter directly across a battery unit and note the reading of about 3volts. We know that fresh batteries should be exactly 3volts so in the next experiment will show how to adjust this reading.

### 651. Adjusting the voltmeter.

Make up the circuit below and adjust the variable resistor so that the meter shows exactly 3volts. Now the meter reading should be accurate for all other readings.



### 652. The effect of resistance on voltages of 0 - 3V

In this circuit, the 100Ω resistor is connected in series with the meter via the variable resistor. Connect a battery between terminals A and B and adjust the slider on the variable resistor to about half way. The meter should give a small reading of about 0.5volts. Move the slider left or right and note how the meter reading gets larger or smaller according to how much resistance is in the circuit.

### 653. The effect of a large resistance (1)

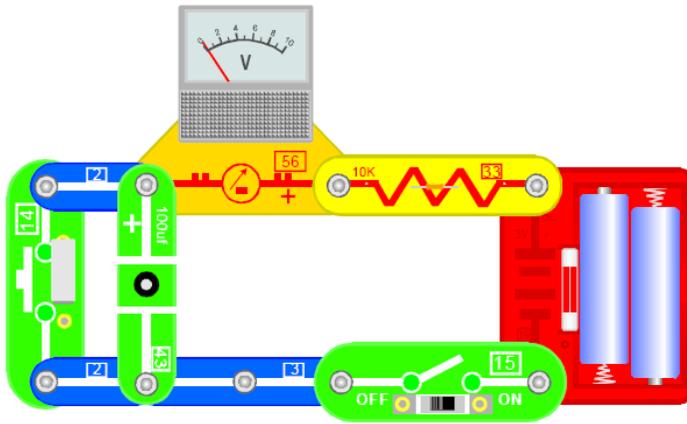
Replace the 100Ω resistor with the 5.1K resistor. Do the same as in the last experiment and note how the maximum reading has been reduced.

### 654. The effect of a large resistance (2)

This time replace the 100Ω resistor with the 10K resistor and note how much less the pointer moves.

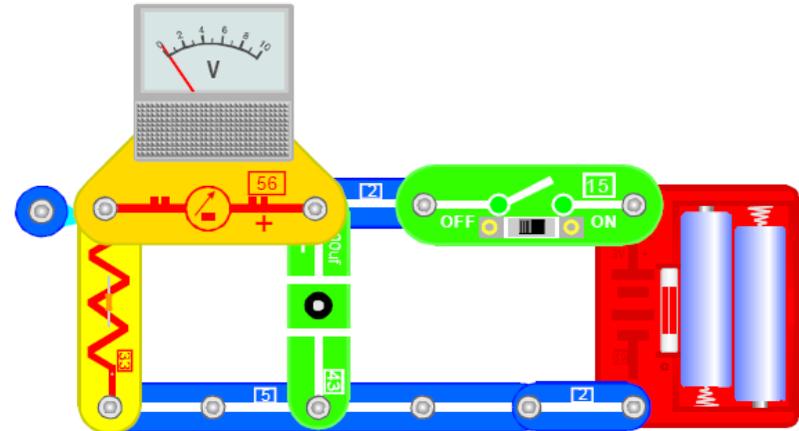
So by adding resistance to the circuit, larger voltages can be measured.

To test this idea, repeat the experiments above using 6volts.



**655. Charging a capacitor.**

Switch on and note how the meter reading rises and then falls as the capacitor charges. Press the press switch to discharge the capacitor.

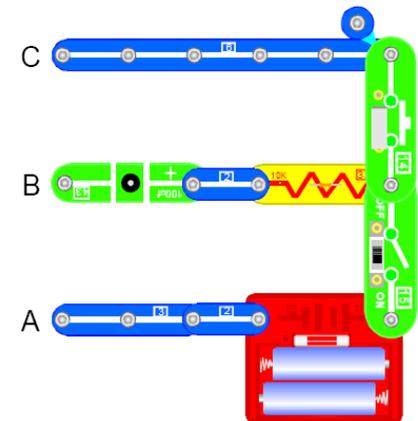


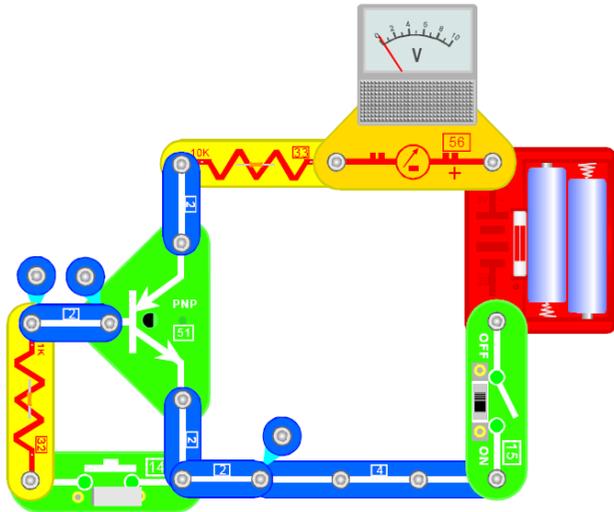
**656. Discharging a capacitor.**

Switch on and note how the meter reading rises and stays steady while the capacitor charges. Switch off after about five seconds and the meter reading will fall steadily as the capacitor discharges.

**657. Charging and discharging a capacitor.**

Connect the meter across terminals A and B. Switch on and note how the meter reading rises and fall as the capacitor charges. Switch off and reconnect the meter to terminals B and C. Press the press switch and note how the meter reading rises and falls as the capacitor discharges.





### 658. Testing a PNP transistor

Close the switch, the ammeter does not deflect, press the press switch, and the ammeter will deflect, showing that the transistor is working, because the transistor is conducting across the collector/emitter junction.

### 659. Lie detector

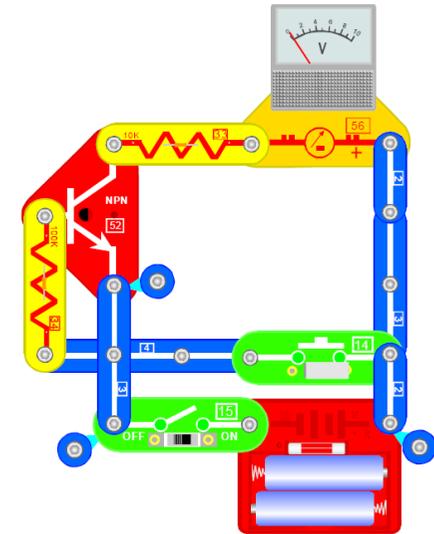
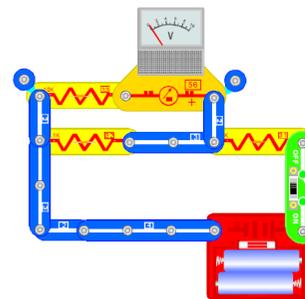
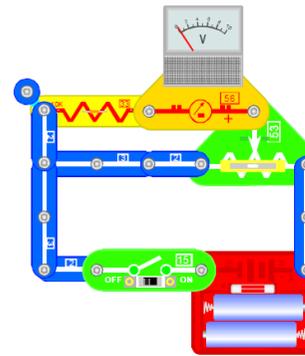
Replace the press switch with the touch plate. Switch on and put a finger on the touch plate, the ammeter will measure any small change in body resistance.

### 660. Amplified illuminometer

Replace the press switch with photosensor. Switch on and the ammeter will indicate the brightness of the light. The stronger the light, the greater will be the ammeter reading.

### 661. Testing a NPN transistor

Close the switch, the ammeter does not deflect, press the press switch, and the ammeter will deflect, showing that the transistor is working, because the transistor is conducting across the collector/emitter junction.

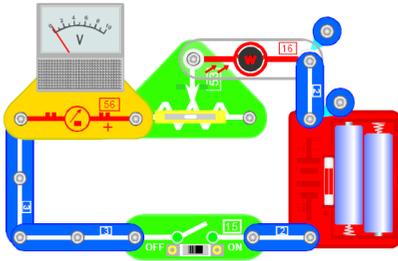


### 662. Adjustable voltage divider

Close the slide switch then adjust the variable resistor, the pointer of the ammeter can be adjusted from zero to a maximum of 3 volts.

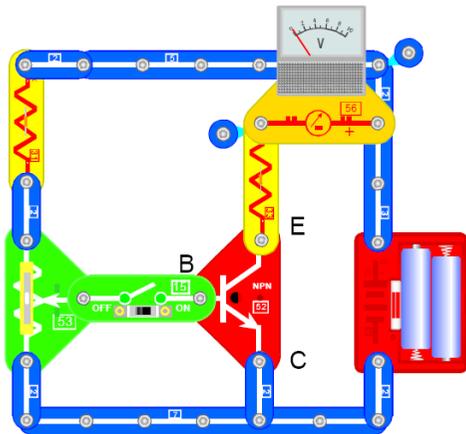
### 663. Fixed voltage divider

Close the slide switch, pointer of ammeter is at a fixed place, it indicates a fixed voltage.



**664. Simple illuminometer**

Close the slide switch, and point the photosensor towards the light. The pointer of ammeter will deflect according to how strong the light is. The stronger light, the more the pointer will deflect. The variable resistor can be used for calibrating the scale.

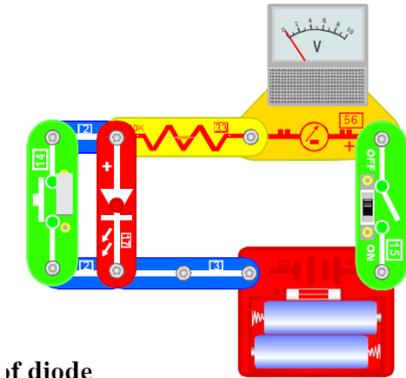


**665. Ammeter-indicated amplification of NPN transistor**

With the switch in the open position, current does not flow through the base and so the transistor does not conduct. The pointer of the ammeter will not deflect. Close the switch and adjust the variable resistor to provide a small current to base electrode B, the transistor will then conduct and amplify the current as indicated by the ammeter.

**666. Voltage drop of diode**

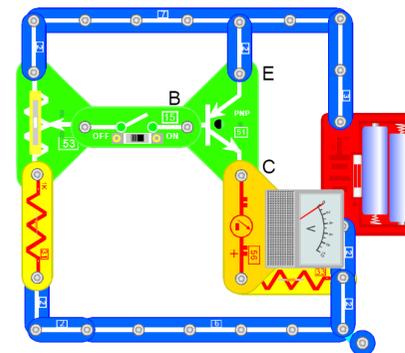
Close the slide switch, the pointer will deflect, then press the press switch, and the pointer will deflect further, the difference between the two readings is the voltage drop of diode.

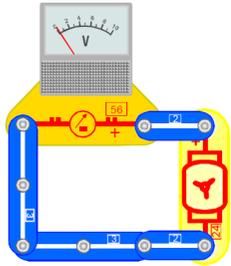


of diode

**667. Ammeter-indicated amplification of PNP transistor**

With the switch in the open position, current does not flow through the base and so the transistor does not conduct. The pointer of the ammeter will not deflect. Close the switch and adjust the variable resistor to provide a small current to base electrode B, the transistor will then conduct and amplify the current as indicated by the ammeter.



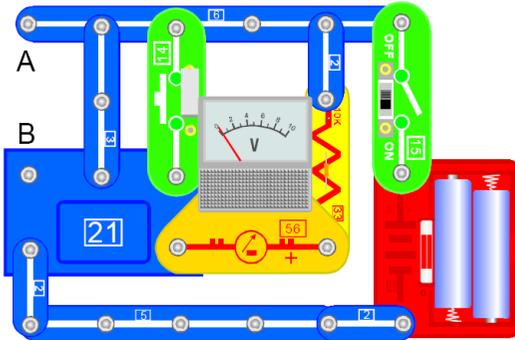


**668. Generating electricity with the motor**

Rotate the motor quickly by hand and the pointer of the ammeter will deflect showing that electricity is being produced.

**669. Generating electricity with a coil and a magnet**

Replace the motor with the aerial coil and move a magnet back to forth over the coil, the pointer of ammeter will deflect slightly showing that electricity is being produced. Move the magnet quickly and close to the coil.



**670. Hand-controlled ammeter**

Close the slide switch, the pointer of the ammeter will swing along to the rhythm of the music. When the pointer returns to zero, you can control the deflection with the press switch.

If you connect the loudspeaker across the 10k resistor, not only is the movement greater but you can hear the tune.

**671. Magnet-controlled ammeter**

Replace the press switch with the dry reed switch, you can control the deflection with a magnet.

**672. Light-controlled ammeter**

Replace the press switch with the photosensor, you can control the deflection by light. When light falls on the photosensor, the pointer deflects and when there is no light, the pointer returns to zero.

**673 .Touch-controlled ammeter**

Replace the press switch with the touch plate. The pointer can be controlled by touching the touch plate.

**674. Sound-controlled ammeter**

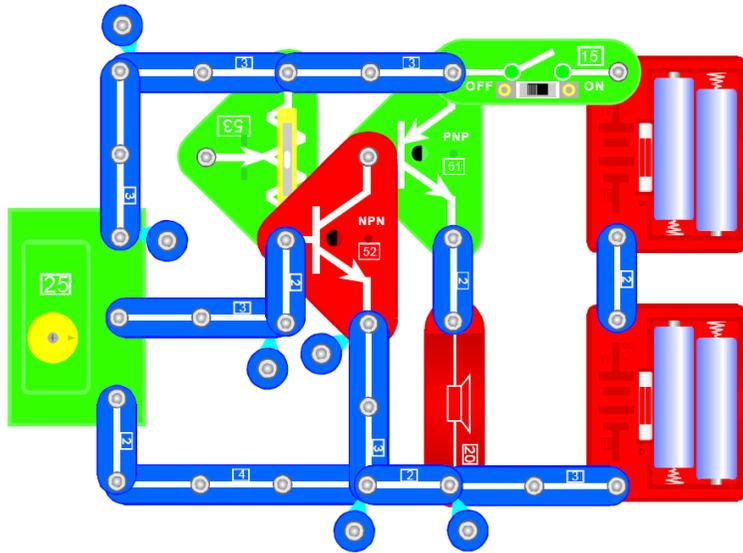
Connect the buzzer to terminals A and B, when the pointer of the ammeter returns to zero, clap you hands and the pointer will deflect again.

**675. Motor-controlled ammeter**

Connect the motor to terminals A and B, when the pointer of the ammeter returns to zero, turn the motor shaft slightly, the pointer will deflect again.

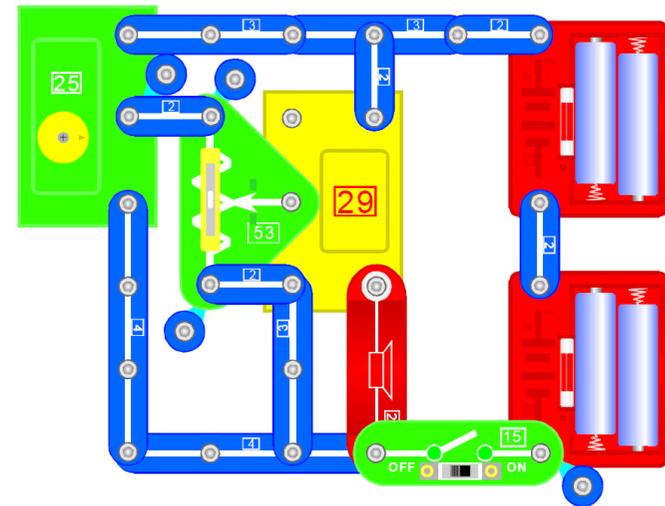
**676. Vibration-controlled ammeter**

Connect the vibration switch to terminals A and B, when the pointer of the ammeter returns to zero, knock the switch and the ammeter will deflect.



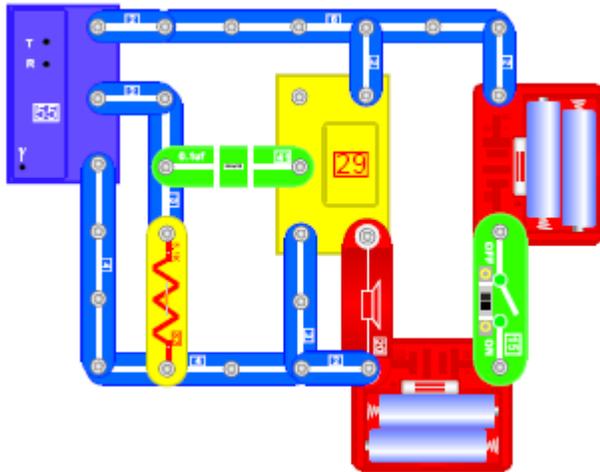
### 677. Twin transistor radio

Close the slide switch and tune the radio by rotating the knob on module 25. To get the best reception, rotate the whole board. The volume will not be very loud as the circuit only uses two transistors.



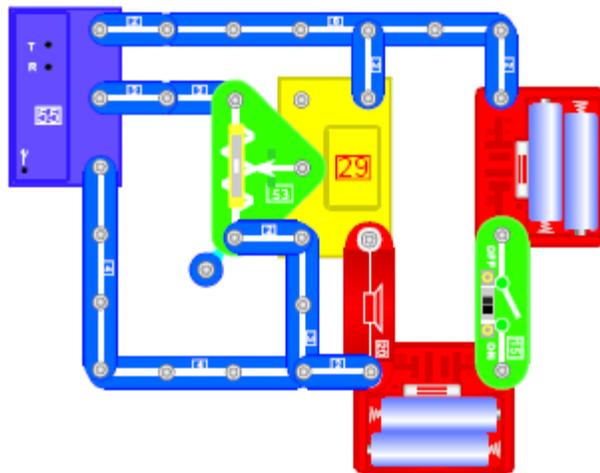
### 678. Radio with adjustable volume

Tune the radio as for 677 and then adjust the variable resistor to alter the volume.



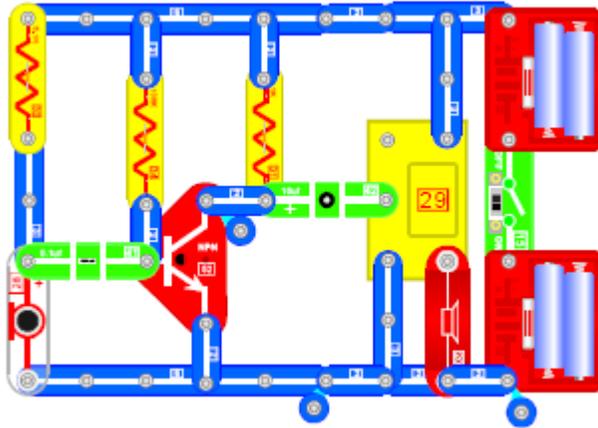
### 679. FM radio

Close the slide switch, then press channel-choosing switch T and release it immediately. Usually the channel will lock it automatically. Continue to press the T' switch to select all the channels from 88M to 108M. To start again, press the reset button R.



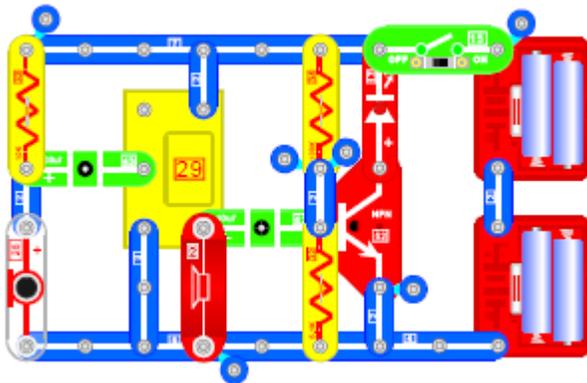
### 680. Volume adjustable FM radio

Tune in as for 679 and adjust the variable resistor to control the volume.



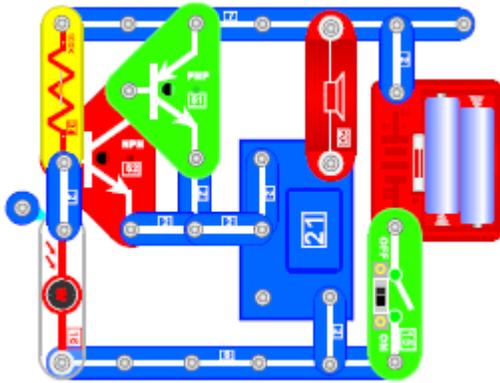
### 681. Amplified microphone

Connect the microphone with long wires. Switch on and speak into the microphone and the speaker will amplify the sound.



### 682. Speaker with volume indicating lamp

Close the slide switch and blow or speak into the microphone. The speaker will amplify the sound and LED will flash along with the sound.



**683. Playing music in the dark**

Close the slide switch and the music will play if the photosensor is covered with a hand.

This circuit could be used to warn of failing light or the onset of darkness.

**684. Playing music when it is light**

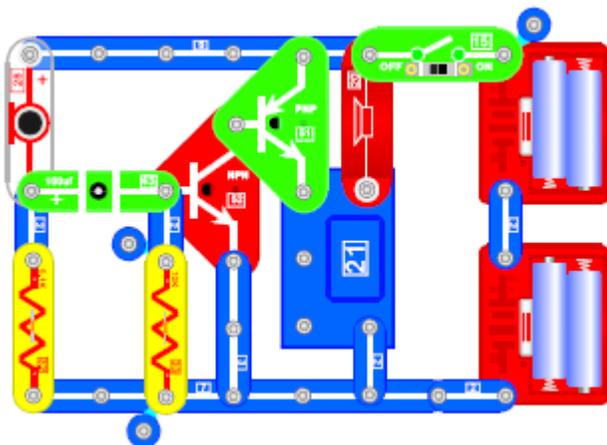
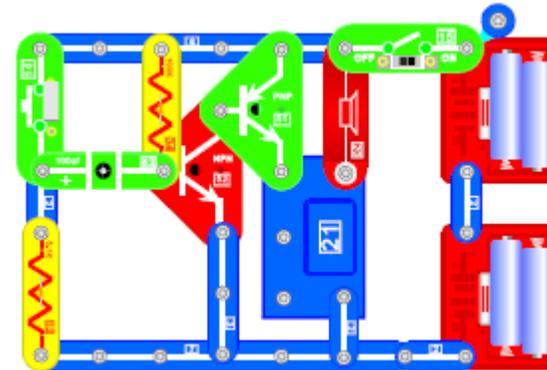
Swap the positions of the photosensor and the resistor. Now the music will only play when it is light.

**685. Music doorbell**

Close the slide switch and the music will start. Press the press switch and the music will stop. Release the press switch, music will start again and then stop.

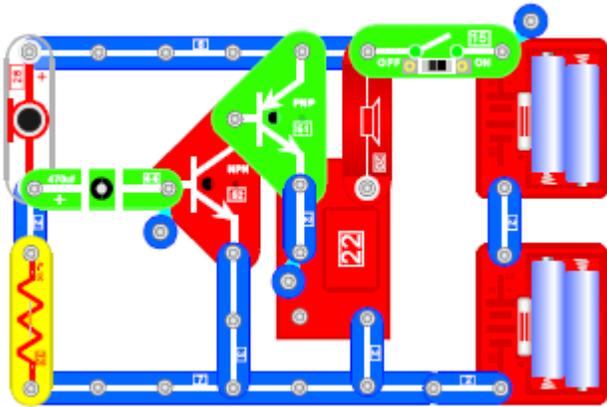
**686. LED doorbell**

Replace the speaker with green LED ( positive pole upward ), when the press switch is pressed, the LED will go out and then come on again.



**687. LED controlled by sound**

Replace the speaker with green LED ( positive pole upward ). Close the slide switch and blow into the microphone, LED will light up. Try clapping you hands or speaking into the microphone.

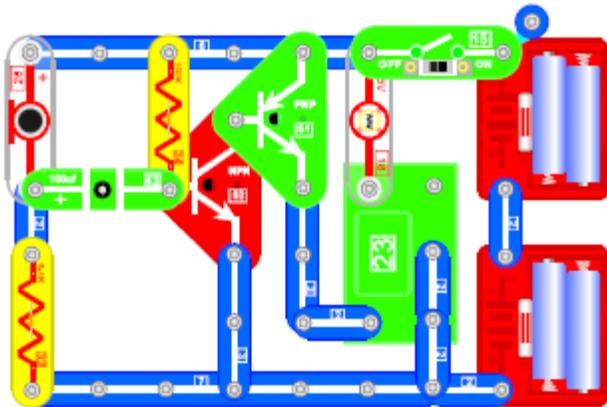


**688. Sound of machine gun controlled by sound**

Close the slide switch, speaker will make the sound of a machine gun. After a moment, open the slide switch, then close it again. Blow into the microphone and the sound will start again.

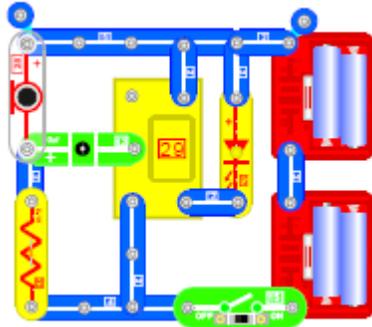
**689. LED controlled by sound**

Replace the speaker with green LED ( positive pole upward) . Close the slide switch and blow into the microphone, the LED will light up.



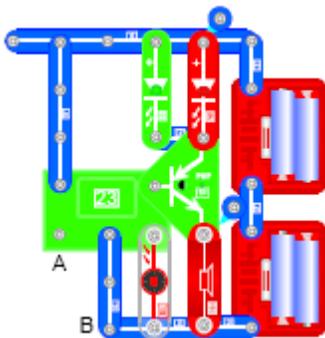
**690. Flashing lamp controlled by sound**

Close the slide switch and lamp will flash. Blow into the microphone, the lamp will go out and then come back on again.



**691. LED volume indicator**

Close the slide switch and speak into the microphone or put the microphone near to the speaker of a radio, TV etc., The brightness of LED will be change according to the volume level.



**692. Amplified light controlled acoustic-optic space war**

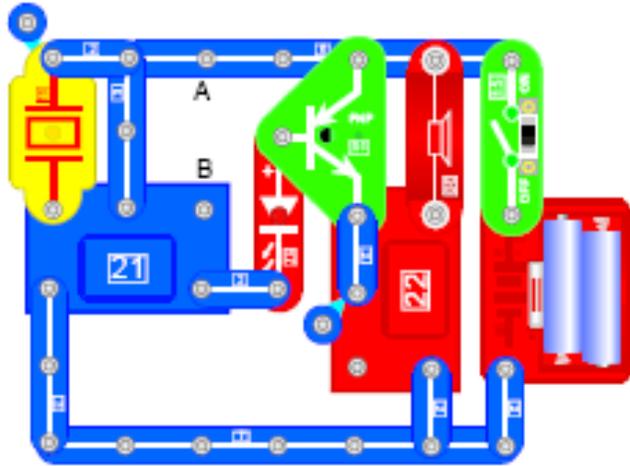
When light hits the photosensor, the speaker will make the sound of space wars and the two LED's will flash at the same time .

**693. Amplified touch controlled acoustic-optic space war**

Replace the photosensor with touch plate, you can control the space war sound by touch.

**694. Amplified magnet controlled acoustic-optic space war**

Replace the photosensor with dry reed switch, you can control the space war sound with a magnet.



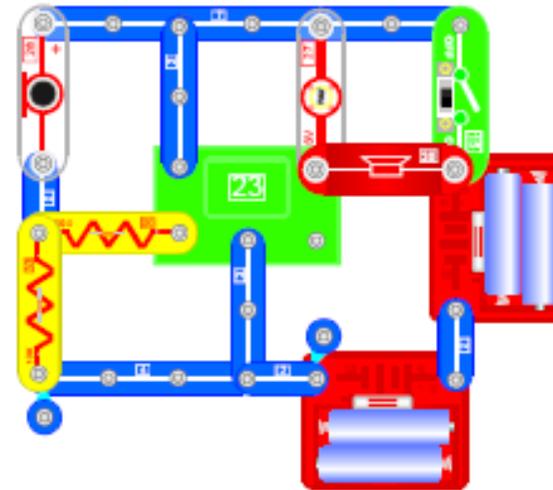
The following circuits show how two sound modules can be used together to give sound effects and music.

**695. Intruder warning controlled by sound**

Switch on and when music stops the circuit is armed and ready for use. If an intruder comes into the room, any loud noise will cause the circuit to make the sound of a machine gun.

**696. Intruder warning controlled by light**

Connect the photosensor to terminals A and B. If an intruder comes into the room, any light will cause the circuit to make the sound of a machine gun.



**697. Sound controlled space wars (1)**

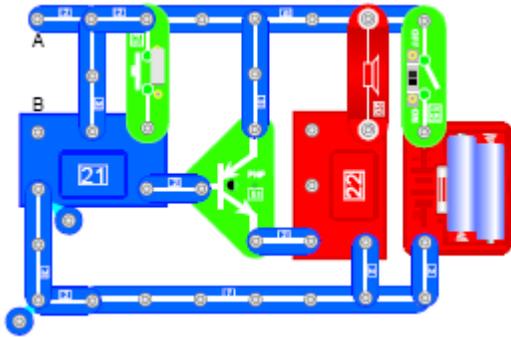
Close the slide switch and blow or speak into the microphone, the speaker will make the sound of space wars and the lamp will flash at the same time.

**698. Sound controlled space wars (2)**

Replace the lamp with buzzer. Blow or speak into the Microphone and the speaker and buzzer will make the sound of space wars.

**699. Sound controlled flashing lamps**

Replace the speaker with green LED (positive pole on the right) and connect the lamp to its original position. Blow or speak into the microphone and the lamp and the LED will both flash.



### 700. Sound of gaming machine with music

Close the slide switch and the speaker will make the sound of a gaming machine along with music. When one song finishes, press the press switch, and the music will start again .

### 701. Motor-controlled sound of gaming machine with music

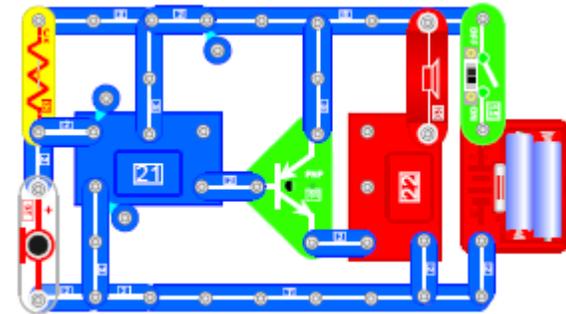
Connect the motor to terminals A and B, close the slide switch, speaker will make the sound of gaming machine along with music .When one song finishes, turn the motor shaft, the music will start again .

### 702. Touch-controlled sound of gaming machine with music

Replace the press switch with touch plate. Touch the touch plate and the speaker will make the sound of gaming machine along with music.

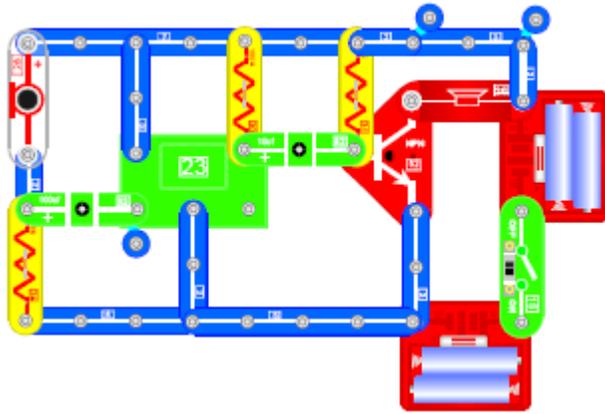
### 703. Light-controlled sound of gaming machine with music

Replace the press switch with photosensor, now you can control the sound of a gaming machine with light.



### 704. Sound-controlled of gaming machine with music

Close the slide switch, the speaker will make the sound of a gaming machine along with music. When one song finishes, blow or clap into the microphone, and the music will start again .

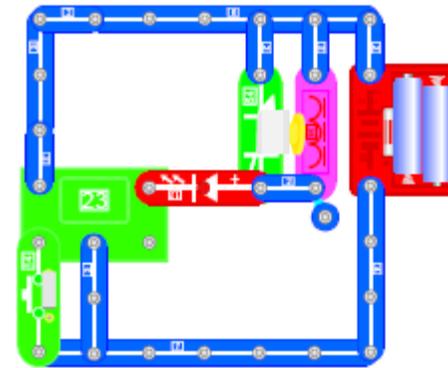


**705. Sound-controlled space war with amplification**

This circuit uses a one transistor amplifier to increase the sound level.  
Close the slide switch, blow or speak into the microphone and speaker will make an amplified sound of space war.

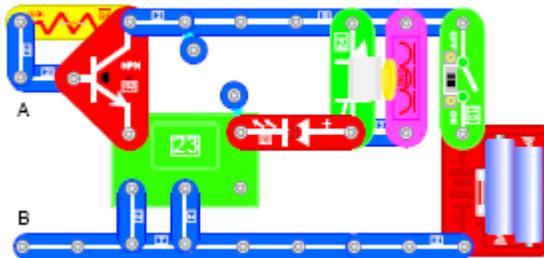
**706. Lamp becomes less bright with sound**

Replace the speaker with lamp. Blow or speak into the microphone and the flashing light will become dimmer and dimmer



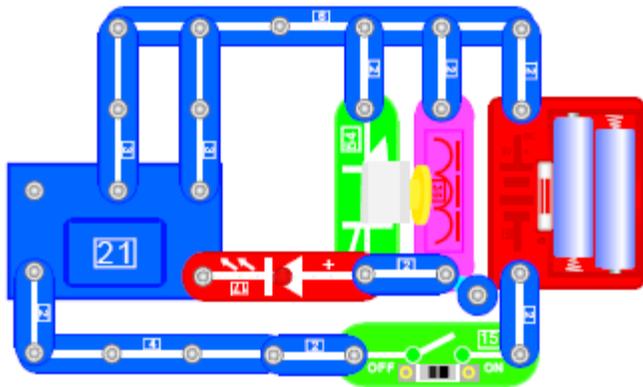
**707. Space war sounds on your radio**

Build the circuit and put it near to a medium wave radio. Tune the radio to an empty channel. Press the press switch and adjust the variable capacitor with the other hand until the radio receives the loudest sound of space war. The radio picks up the signal coming from the aerial coil.



**708. Theft alarm on your radio**

Adjust the radio as for 707. Connect a wire through a bicycle wheel, across a door or window to terminals A and B. Close the slide switch. The alarm will not sound unless the wire is broken, when you will hear the sound of space war coming from your radio.

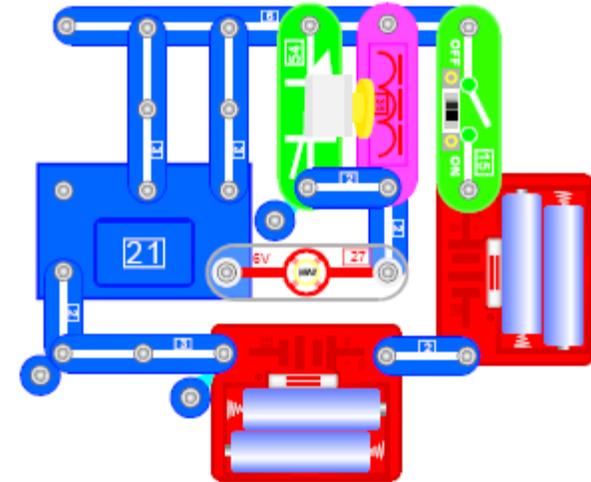


### 709. Wireless radio station

Switch on and put the circuit near to a good medium wave radio. Adjust the radio to a free channel and adjust the variable capacity until the radio gives out the maximum sound. The radio picks up the signal coming from the aerial coil.

### 710. Magnet controlled wireless radio station

Replace the slide switch with the dry reed switch. Tune the radio as in 709. Bring a magnet close to the dry reed switch and you will hear music from the radio because the radio picks up the signal coming from the aerial coil.

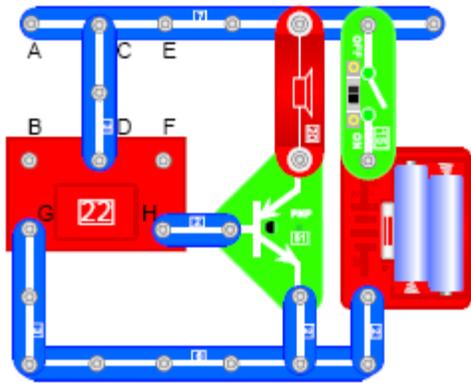
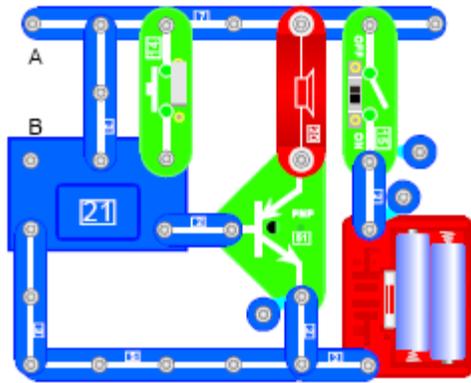


### 711. Wireless music lamp monitor

Switch on and put the circuit near to a good medium wave radio. Adjust the radio to a free channel and adjust the variable capacity until the radio gives out the maximum sound and lamp lights normally. If the lamp is damaged, the radio will not receive any sound.

### 712. Wireless flashing lamp monitor

Replace the music IC with alarm IC, and operate as for 711. The radio will broadcast the sound of a machine gun and the lamp will flash.



**713. Amplified musical doorbell**

The output signal of the music IC is amplified by the transistor so the volume from the loudspeaker is greater. Press the press switch to hear the music.

**714. Magnet-controlled musical doorbell**

Replace the press switch with the dry reed switch , you can now control the sound with a magnet.

**715. Light-controlled amplified music doorbell**

Replace the press switch with the photosensor, you can now control the music by light.

**716.Touch-controlled amplified musical doorbell**

Replace the press switch with touch plate, touch the plate to play the music.

**717. Sound-controlled amplified music doorbell**

Connect the buzzer to terminals A and B , when music stops , clap or speak aloud, music will resume.

**718. Motor controlled amplified musical doorbell**

Connect the motor to terminals A and B, when the music stops, rotate motor shaft and the music will start again.

**719. Amplified sound of police car**

Close the slide switch, the speaker will make the sound of a police car .

**720. Amplified sound of machine gun**

Connect terminals C and D, E and F, the speaker will make the sound of a machine gun.

**721. Amplified sound of fire engine**

Connect terminals A and B and C and D, the speaker will make the sound of a fire engine.

**722. Amplified sound of ambulance**

Connect terminals C and D and B and G, the speaker will make the sound of an ambulance.

**723. Amplified sound of a gaming machine**

Connect terminals A and B, the speaker will make the sound of a gaming machine.

**724. Amplified sound of deflation**

Connect terminals C and D, B and G and F and H, the speaker will make the sound of deflation.

**725. Amplified sound of vibration**

Connect terminals A and B and F and H, the speaker will make the sound of vibration.

**726. Amplified sound of a heavy machine gun.**

Connect terminals F and H, the speaker will make the sound of a heavy machine gun.

**727. Magnet controlled amplified sound of a police car.**

Replace the switch with the dry reed switch. Bring a magnet close to the dry reed switch and the speaker will make the sound of a police car.

**728. Magnet controlled sound of a machine gun.**

Replace the switch with the dry reed switch. Connect terminals C D, E F, bring a magnet close to the dry reed switch and the speaker will make the sound of a machine gun.

These experiments refer to the right hand circuit on page 114

**729. Magnet controlled sound of a police car.**

Replace the switch with the dry reed switch. Bring a magnet close to the dry reed switch and the speaker will make the sound of a police car.

**730. Magnet controlled sound of a machine gun.**

Replace the switch with the dry reed switch. Connect terminals C and D together and E and F. Bring a magnet close to the dry reed switch and the speaker will make the sound of a machine gun.

**731. Magnet controlled of fire engine**

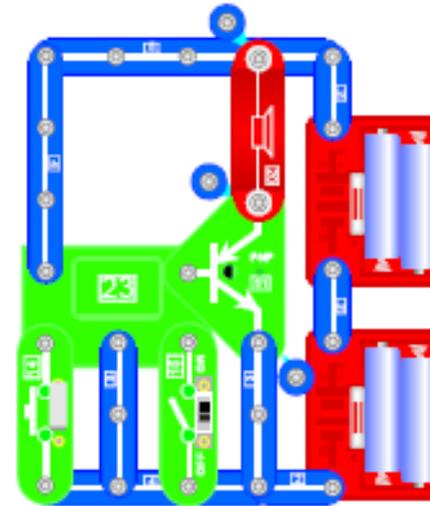
Replace the switch with the dry reed switch. Connect terminals A and B together and C and D. Bring a magnet close to the dry reed switch and the speaker will make the sound of a fire engine.

**732. Magnet controlled of ambulance**

Replace the switch with the dry reed switch. Connect terminals C and D together and B and G. Bring a magnet close to the dry reed switch and the speaker will make the sound of an ambulance.

**733. Magnet controlled sound of a gaming machine**

Replace the switch with the dry reed switch. Connect terminals A and B. Bring a magnet close to the dry reed switch and the speaker will make the sound of a gaming machine.



**734. Hand controlled amplified space war**

Press the press switch, the speaker will make the amplified sound of a space war .

**735. Magnet controlled amplified space war**

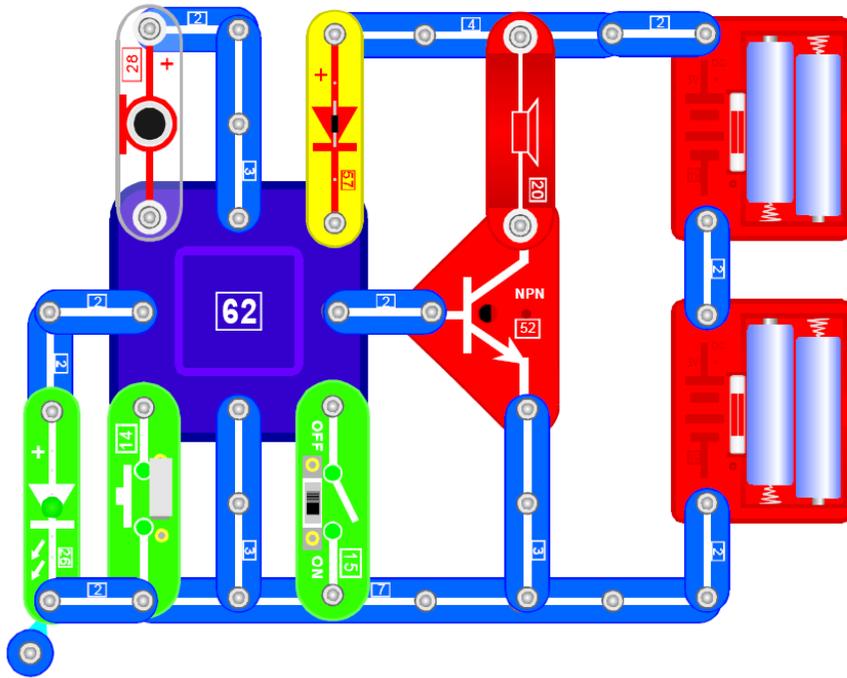
Replace the press switch with the dry reed switch, now you can control the sound using a magnet.

**736. Light controlled amplified space war**

Replace the press switch with the photosensor, now you can control the sound using light.

**737. Touch controlled amplified space war**

Replace the press switch with the touch plate, touch the touch plate with a finger, the speaker will make the amplified sound of a space war.



### 738. Playing music

Leave the slide switch in the off position and press the press switch. The speaker will make the sound of music. The green LED will flash along with the rhythm of the music. When the music stops, the LED will also go out. Press the switch again to play the second piece of music. There are three different pieces of music.

### 739. Recording

Close the slide switch, you will hear bleep, and the module will begin to record. You can speak or sing into microphone. After 6 seconds, there will be a double bleep, this means the recording time is up. Open the slide switch again.

### 740. Playback

To playback the recording, press the press switch and the speaker will play the recorded sound followed by the music.

### 741. Light-controlled playback

Replace the press switch with photosensor, you can control the playback using light.

### 742. Magnet-controlled playback

Replace the press switch with the dry reed switch, you can control the playback using a magnet.

### 743. Touch-controlled playback

Replace the press switch with PNP transistor, emitting electrode upward, collector electrode downward. Touch the base electrode and collector electrode at the same time to control the playback.

In these next circuits, the loudspeaker has been replaced with the buzzer and an LED has been mounted in parallel with it. When the music plays, the LED will flash. In a noisy environment a visual indicator could be useful.

#### **744. Playing the music**

Open the slide switch, press the press switch, buzzer will play three pieces of music in turn, and red LED will light up at same time.

#### **745. Recording your own sounds**

Close the slide switch, you will hear a bleep, the LED will flash and the recording can start. Speak or sing to microphone. After 6 seconds, it will make a double bleep, the LED will flash twice to indicate that the recording time has finished and you should open the slide switch.

To play back the recording, press the press switch, the buzzer will play whatever sound was recorded and then play the music.

#### **746. Controlling playback with light**

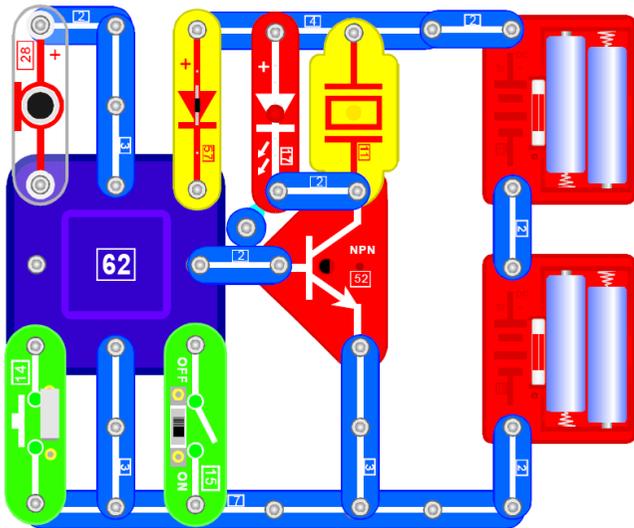
Replace the press switch with the photosensor, you can now control the playback with light.

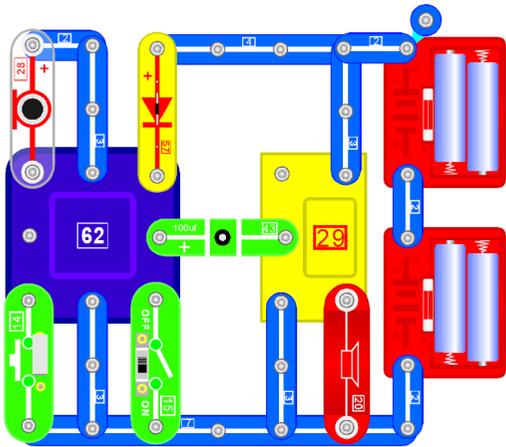
#### **747. Controlling playback with a magnet**

Replace the press switch with the dry reed switch, you can control the playback with a magnet.

#### **748. Controlling playback with touch**

Replace the press switch with the PNP transistor, emitter electrode upward, collector electrode downward. Touch the base and collector electrodes at the same time to control the playback.





In this next set of experiments, the single transistor amplifier has been replaced with the power amplifier to increase the sound output.

**749. Playing the music.**

Open the slide switch and press the press switch, speaker will play three pieces of music in turn.

**750. Recording your own sounds**

Close the slide switch, you will hear a bleep and the recording can start. Speak or sing in to the microphone. After 6 seconds, it will make a double bleep to indicate that the recording time has finished and you should open the slide switch.

To play back the recording, press the press switch, the loudspeaker will play whatever sound was recorded and then play the music.

**751. Controlling playback with light**

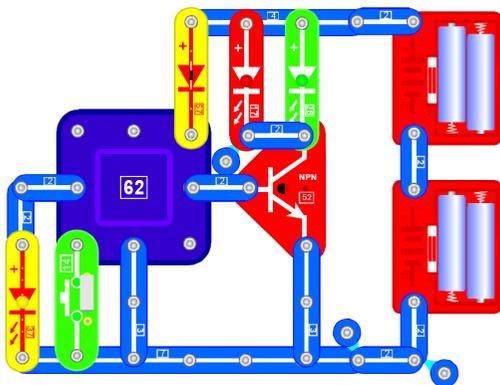
Replace the press switch with the photosensor, you can now control the playback with light.

**752. Controlling playback with a magnet**

Replace the press switch with the dry reed switch, you can control the playback with a magnet.

**753. Controlling playback with touch**

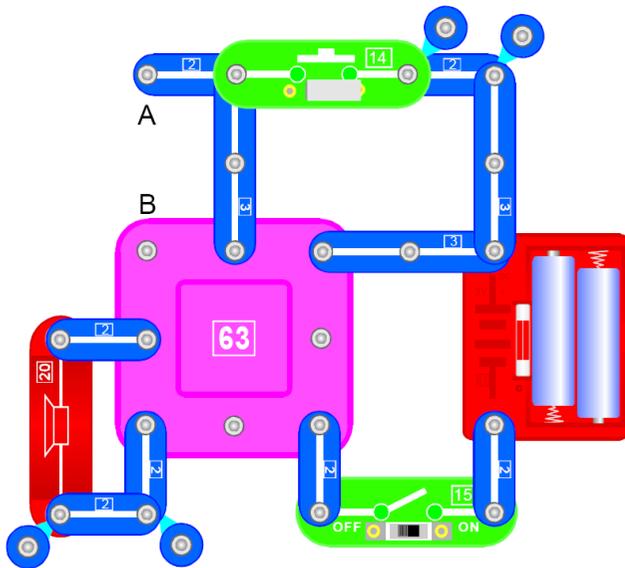
Replace the press switch with the PNP transistor, emitter electrode upward, collector electrode downward. Touch the base and collector electrodes at the same time to control the playback.



This circuit shows how the music module could be used to make lights light for different lengths of time.

**754. Time delayed lights**

Press the press switch, the lights will light up and go out after a while. Press the switch again and the lamps will light up again. After different time delay, the lamps will go out again. There are three different time delays each controlled by the length of the tune. This could be used to make the game of 'pass the parcel' more difficult!



**755. The World Cup song module**

Switch on the slide switch and the speaker will play the song of the 98' world cup. When music stops, press the press switch and music will resume.

**756. Controlling the song with a magnetic**

Replace the press switch with dry reed switch. bring a magnet near to the dry reed switch and music will start.

**757. Controlling the song with light**

Replace the press switch with the photosensor, when light falls on the photo-sensor, the song will play.

**758. Controlling the song by touch**

Replace the press switch with the touch plate. To play the song, put a finger on the touch plate.

**759. Controlling the song with sound**

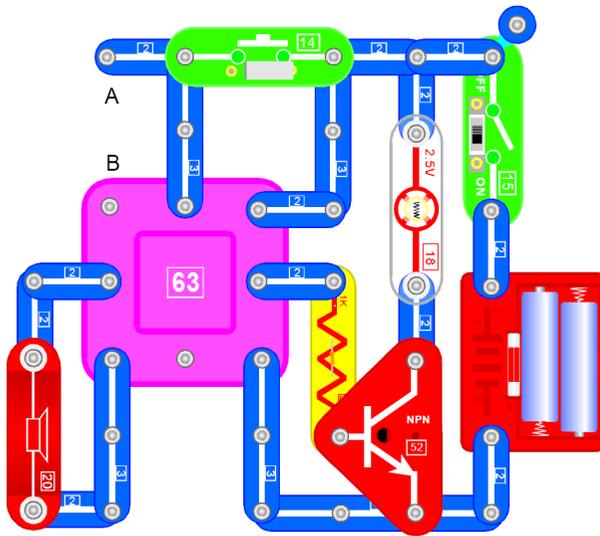
Connect the buzzer to terminals A and B. To play the song, clap your hands near the buzzer.

**760. Controlling the song with a motor**

Connect the motor to terminals A and B. To play the song, turn the motor shaft.

**761. Controlling the song with vibration**

Connect the vibrating switch to terminals A and B. To play the song, tap the vibration switch.



**762. The World Cup song module with lamp**

Switch on the slide switch and the speaker will play the song of the 98' world cup and the lamp will light up. When music stops, press the press switch and music will resume.

**763. Controlling the song and the lamp with a magnetic**

Replace the press switch with dry the reed switch. bring a magnet near to the dry reed switch and music will start and the lamp light up.

**764. Controlling the song and lamp with light**

Replace the press switch with the photosensor, when light falls on the photosensor, the song will play and the lamp light up.

**765. Controlling the song and lamp by touch**

Replace the press switch with the touch plate. To play the song, put a finger on the touch plate, the lamp will also light up.

**766. Controlling the song and lamp with sound**

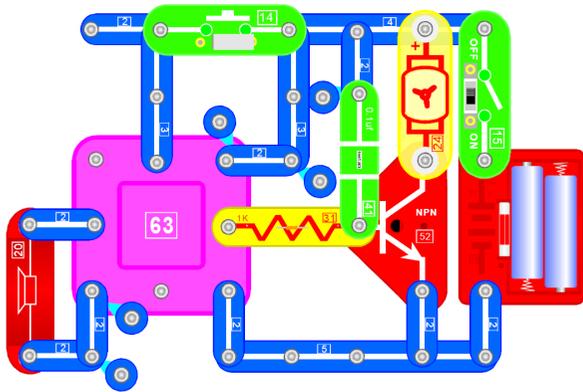
Connect the buzzer to terminals A and B. To play the song and light the lamp, clap your hands near the buzzer.

**767. Controlling the song and lamp with a motor**

Connect the motor to terminals A and B. To play the song and light the lamp, turn the motor shaft.

**768. Controlling the song and lamp with vibration**

Connect the vibrating switch to terminals A and B. To play the song and light the lamp, tap the vibration switch.



### 769. Hand controlled world-cup music and fan

Place the yellow fan on the motor and close the slide switch. The speaker will play the song of world the cup and the fan will rotate.

When the music stops, the fan also stops. Press the press switch, the music will resume and the fan will rotate again .

If the music plays but the fan does not rotate, give the fan a push.

### 770 Magnet controlled world cup music and fan.

Replace the press switch with the dry reed switch, you can control music and fan with a magnet.

### 771. Light controlled world-cup music and fan

Replace the press switch with photosensor , when light falls on the photosensor, the music will resume and the fan will rotate again.

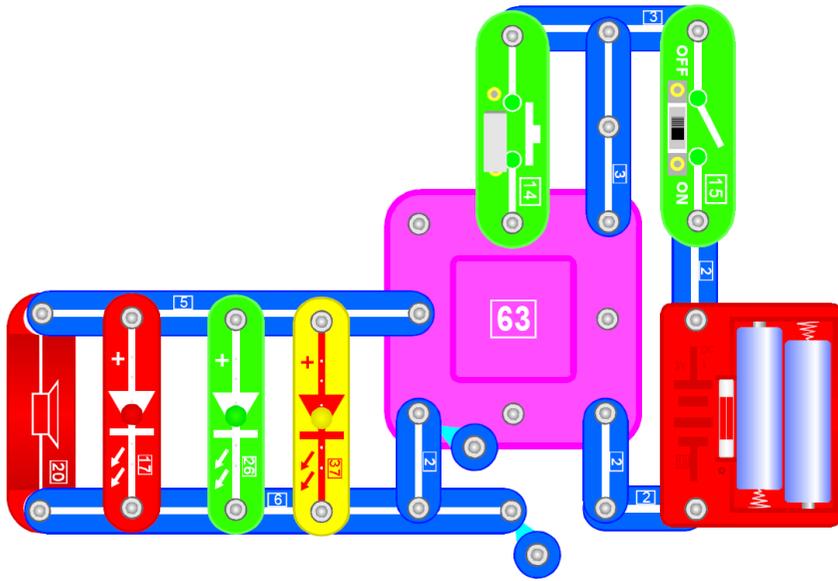
### 772. Touch controlled world-cup music and fan

Connect the touch plate to terminals A and B, touch the plate with a finger, music will resume and the fan will rotate again.

### 773. Vibration controlled world-cup music and fan

Connect the vibration switch to terminals A and B, knock the switch, music will resume and fan will rotate again.

With these experiments, there may not be enough current to start the motor rotating so it may require a push. Once rotating, it will continue to rotate as the current required to keep the rotation going is lower than the current required to start the rotation in the first place.



**774. Hand controlled world-cup music with tricolour flashing lamp**

Close the slide switch and the speaker will play the song of 98' world cup, and the three LED's will flash colourful along with the rhythm of music. When music stops, press the press switch again and music will resume along with the flashing LED's.

**775. Hand controlled world-cup music with bicolour flashing lamp**

Take away the yellow LED, the red and green LED's will flash when music plays.

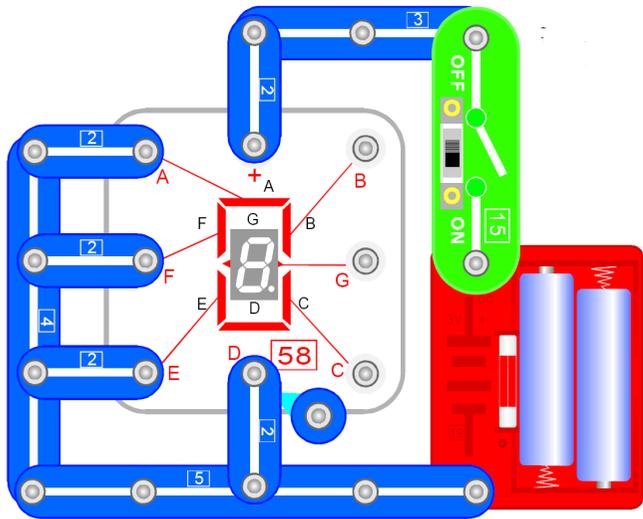
**776. Hand controlled world-cup music green flashing lamp**

Take away the red and yellow LED's, only the green LED will flash when music plays.

**777. Hand controlled world-cup music yellow flashing lamp**

Take away the red and green LED's, only the yellow LED will flash when music plays.

The ideas shown here might be used to produce you own Christmas light display. Take away the loudspeaker to prevent overkill of the world cup song!



## The seven segment display

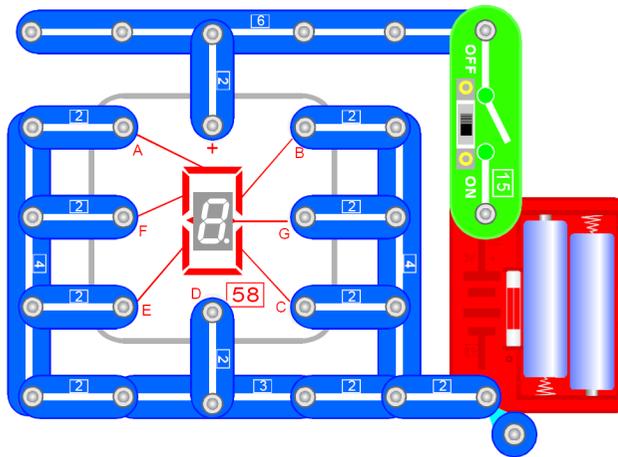
### 778. An Introduction to the seven segment display

The package, as its name implies, is made up of seven LED's called segments. Each segment is identified by a letter A, B, C, D, E, F and G going clockwise from the top segment.

The positive pole of each segment is connected to the + terminal and the negative pole is brought out to a separate press stud.

Each segment is switched on by connecting its stud to the negative pole of the battery. If the connections are made as in the diagram, then a C will be displayed.

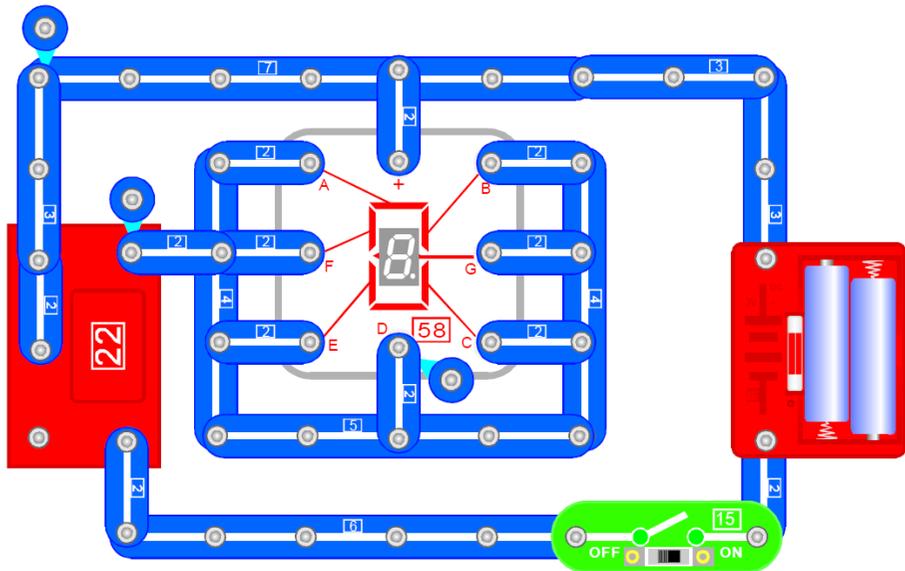
The main use for the display is to show numbers as in a digital thermometer, car speedometer or cricket scoreboard etc.



- 779. To display '1'**  
Connect B and C
- 780. To display '2'**  
Connect A, B, G, E and D
- 781. To display '3'**  
Connect A, B, G, C and D
- 782. To display '4'**  
Connect C, B, G, and F
- 783. To display '5'**  
Connect A, F, G, C and D

- 784. To display '6'**  
Connect A, C, D, E, F and G
- 785. To display '7'**  
Connect A, B and C
- 786. To display '8'**  
Connect A, B, C, D, E, F and G
- 787. To display '9'**  
Connect A, C, D, F and G
- 788. To display '0'**  
Connect A, C, D, E and F
- 789. To display an upper case 'C'**  
Connect A, D, E, and F
- 790. To display an upper case 'E'**  
Connect A, D, E, F and G
- 791. To display an upper case 'F'**  
Connect A, E, F and G
- 792. To display an upper case 'H'**  
Connect B, C, E, F and G
- 793. To display an upper case 'P'**  
Connect A, B, E, F and G

- 794. To display an upper case 'S'**  
Connect A, F, G, C and D
- 795. To display an upper case 'U'**  
Connect B, C, D, E and F
- 796. To display an upper case 'L'**  
Connect D, E and F
- 797. To display a lower case 'b'**  
Connect C, D, E, F and G
- 798. To display a lower case 'c'**  
Connect A, F and G
- 799. To display a lower case 'd'**  
Connect B, C, D, E and G
- 800. To display a lower case 'e'**  
Connect A, B, D, E, F and G
- 801. To display a lower case 'h'**  
Connect E, F, G and C
- 802. To display a lower case 'o'**  
Connect C, D, E and G



Module 22 can be used to make the display flash. The flash is controlled by the sound produced by the module.

**803. To display a flashing '1'**

Connect B and C

**804. To display a flashing '2'**

Connect A, B, G, E and D

**805. To display a flashing '3'**

Connect A, B, G, C and D

**806. To display a flashing '4'**

Connect C, B, G, and F

**807. To display a flashing '5'**

Connect A, F, G, C and D

**808. To display a flashing '6'**

Connect A, C, D, E, F and G

**809. To display a flashing '7'**

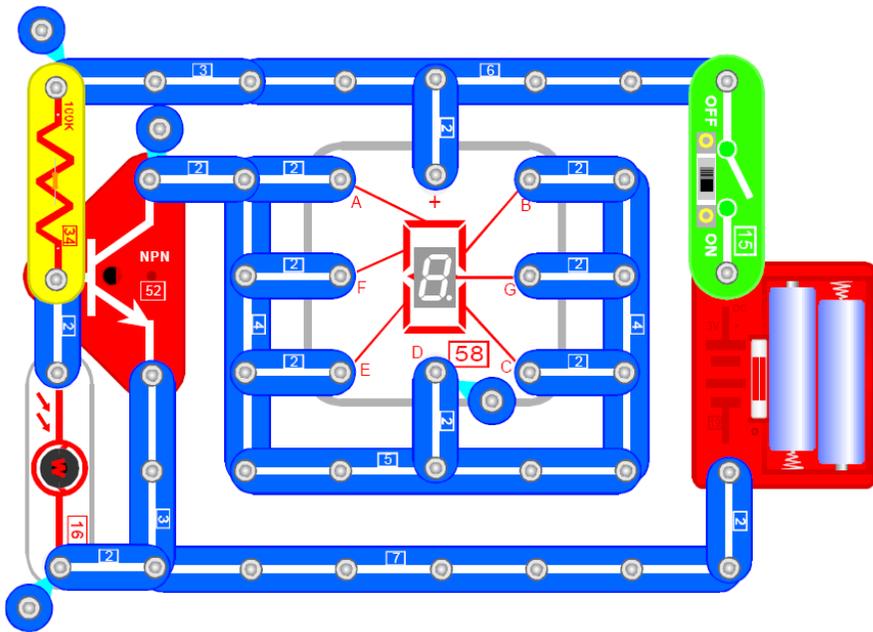
Connect A, B and C

**810. To display a flashing '8'**

Connect A, B, C, D, E, F and G

**811. To display a flashing '9'**

Connect A, C, D, F and G



This circuit will switch on the numbers when the ambient light falls below the level set by the photosensor. A typical connection would be,

**812. To display '1'**

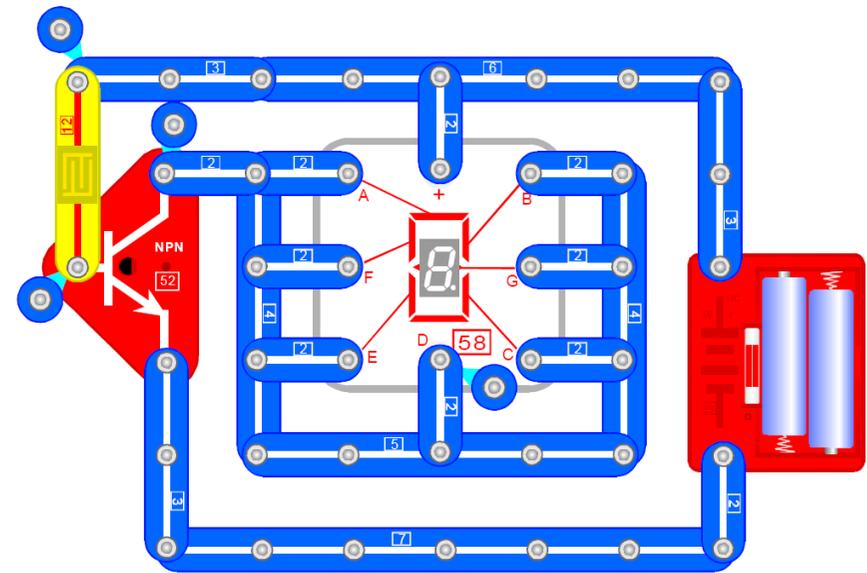
Connect B and C

**813. To display '2'**

Connect A, B, G, E and D

**814. To display '3'**

Connect A, B, G, C and D



This circuit allows the numbers to be switched on by touch. Just put a finger on the touch plate to switch on.

Typical connections would be,

**815. To display an upper case 'E'**

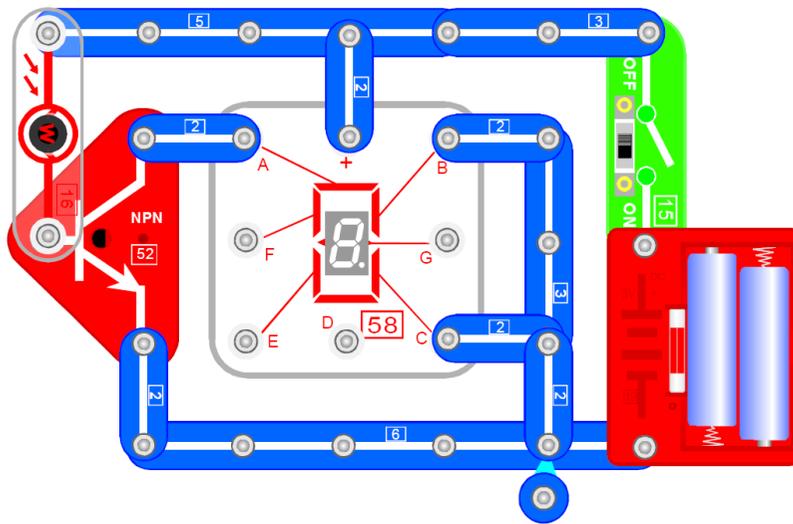
Connect A, D, E, F and G

**816. To display an upper case 'F'**

Connect A, E, F and G

**817. To display an upper case 'H'**

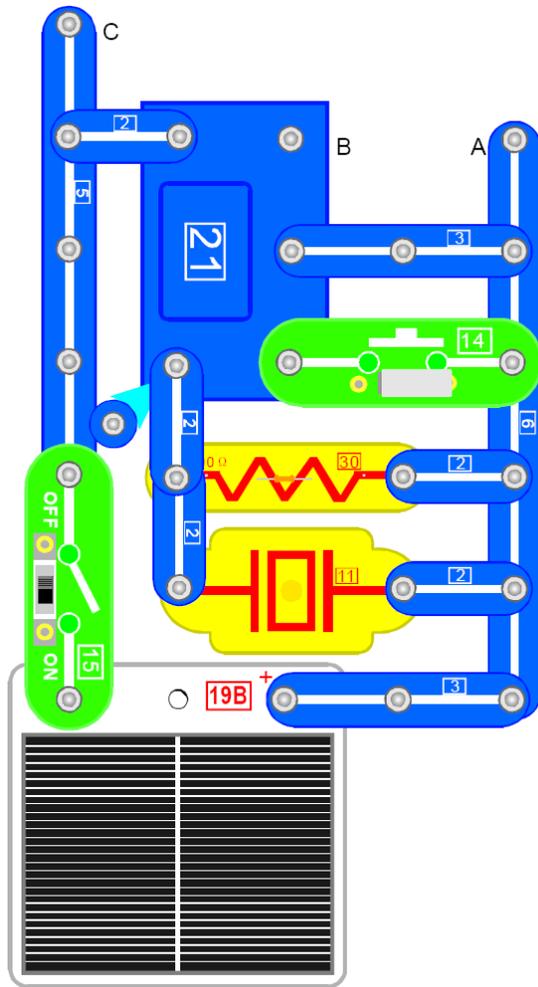
Connect B, C, E, F and G



### 818. Principle of counting by light

Switch on and when light falls on the photosensor, the display shows the number '7'. Shade the photosensor with your hand, the display shows the number '1'.

In the light, the resistance of the photosensor is low allowing electricity to flow into the base of the transistor. The transistor then conducts across the collector/emitter junction and lights up segment A, the top of the 7. In the dark, the resistance of the photosensor is high so the transistor does not conduct and segment A is not lit up. Segments B and C are lit up while the switch is in the on position.

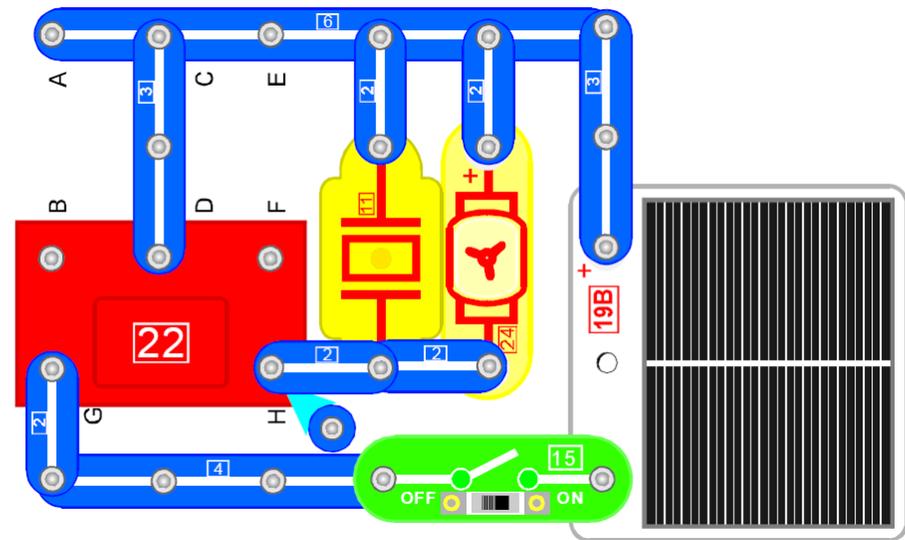


### 819 Music controlled by a press switch.

Close the slide switch, when the music stops, press the press switch and the music will start again.

## Using the Solar Cell

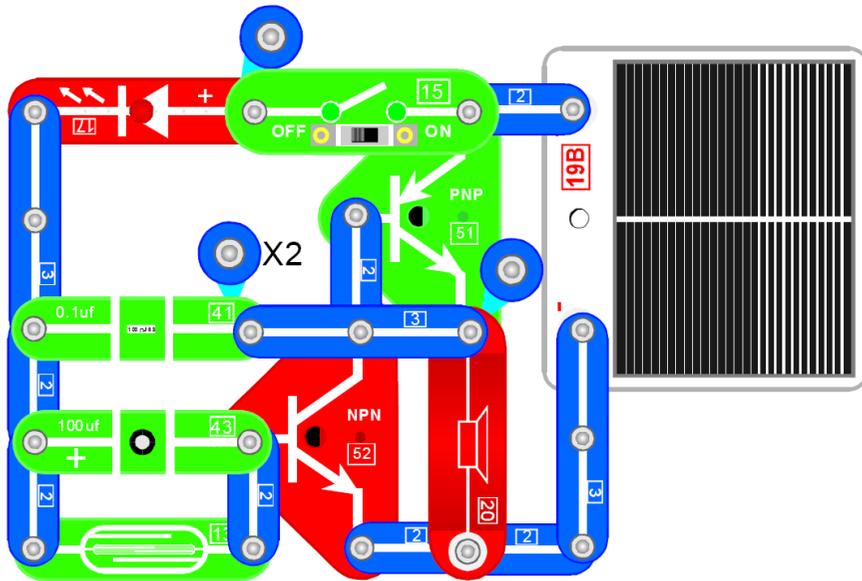
The solar cell converts the energy of light into electrical energy. In bright sunlight, the cell will produce enough energy to power the circuits and replace the batteries. Any of the circuits may be powered with the solar cell, but here are some examples.



### 820. Sound of a police car

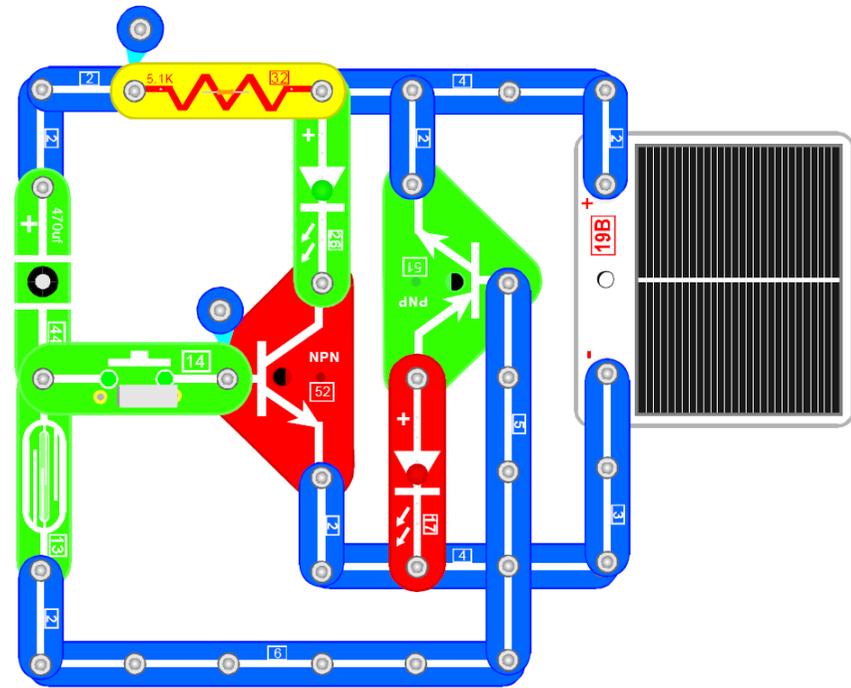
Close the slide switch, the buzzer will make the sound of police car.





### 823. Fishing game

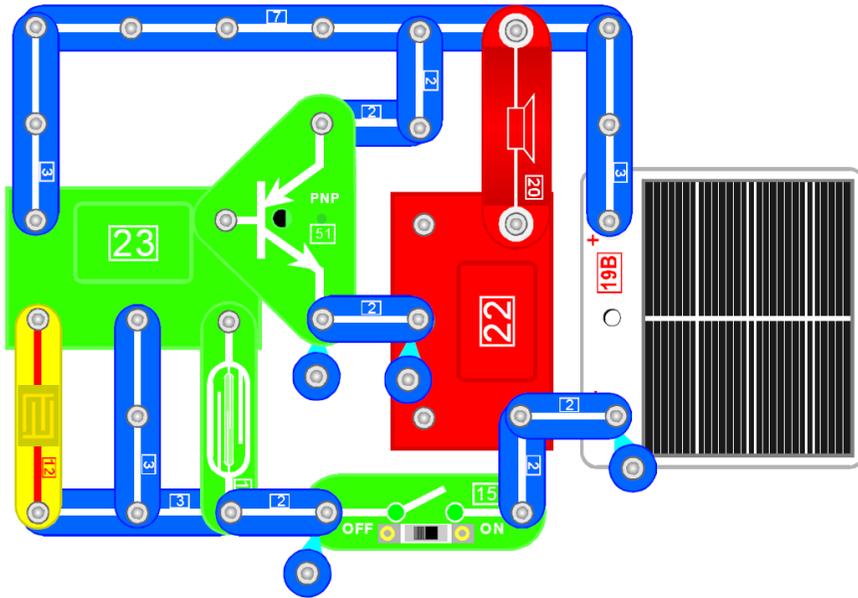
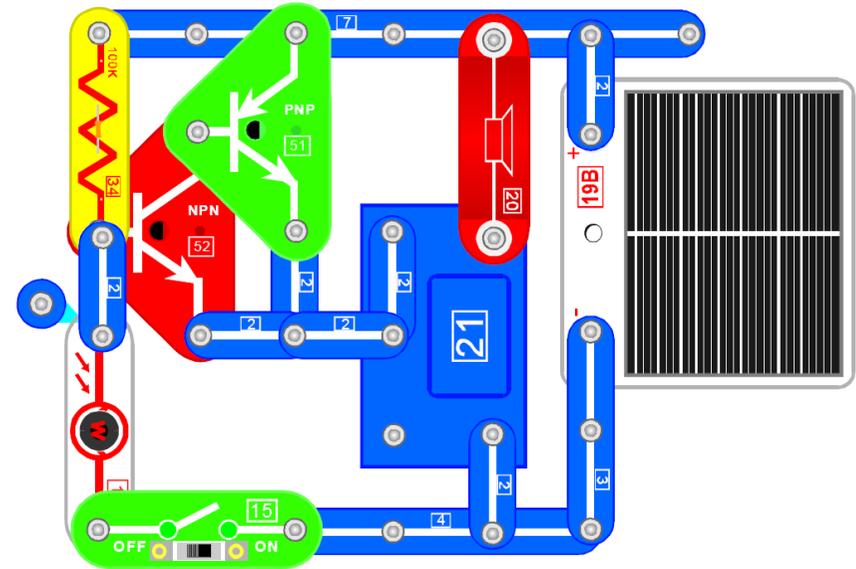
Make a fishing rod using the little magnet as its hook. The fish is the dry reed switch. Switch on and try to get the magnet close to the dry reed switch. If you catch a fish, the speaker will make a sound of congratulations and the LED will light up.



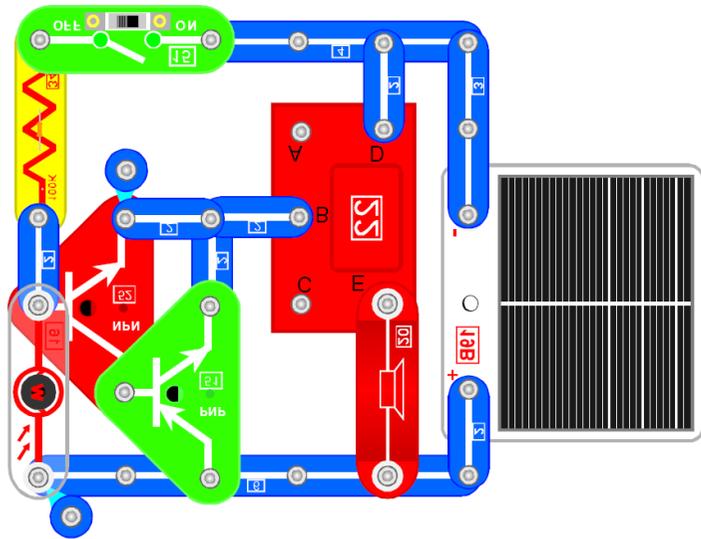
### 824. Charge and discharge of a capacitor

Press the press switch, the capacitor begins to charge and green LED will light up. Release the press switch. Put a magnet near to the dry reed switch, the capacitor will discharge and the red LED lights up.

**825. Playing music when light levels fall**  
 Switch on and shade the photosensor with your hand. The music will play until you remove your hand.

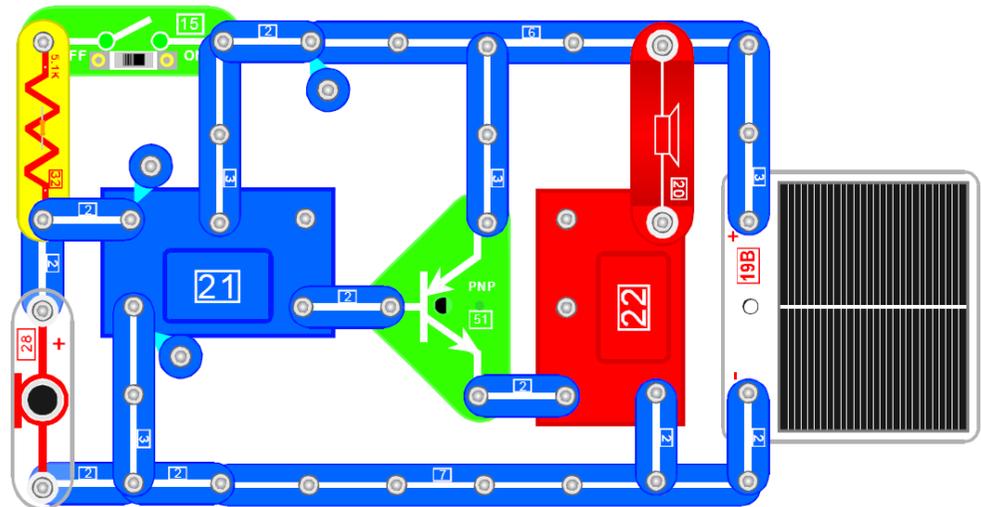


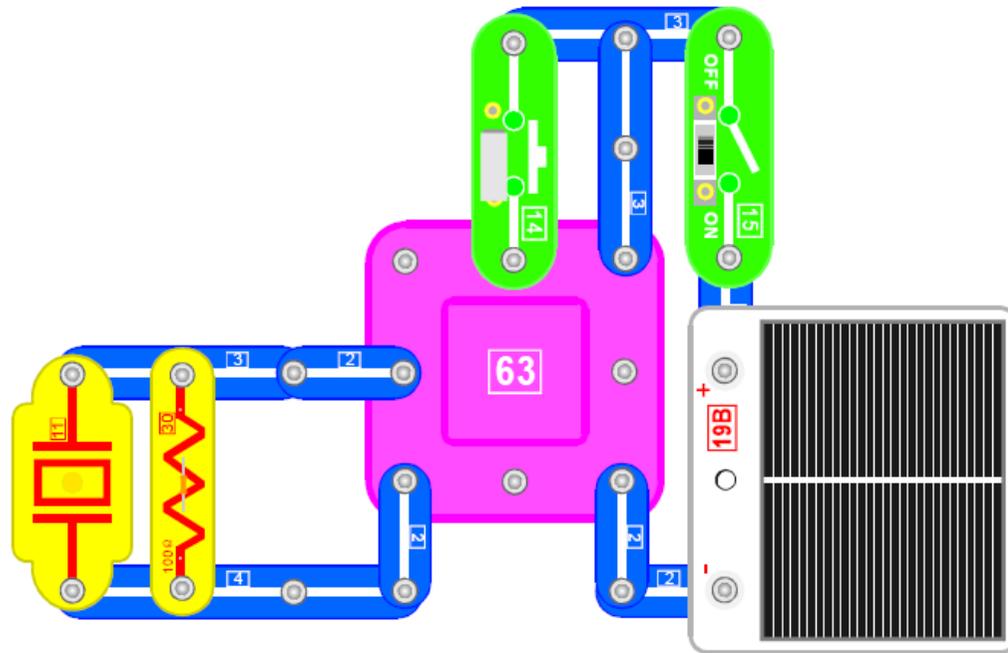
**826. Touch-controlled space sound of a police car**  
 Switch on and put a finger on the touch plate. The speaker will make the space war sound of a police car.



**827. Warning sound of police car controlled by light**  
 Switch on and when light hits the photosensor the speaker will make the sound of a police car. Cover the photosensor with your hand and the sound will stop.

**828. Sound-controlled mystery music**  
 Switch on and the speaker will make the sound of mysterious music. When the music finishes, blow or clap into the microphone and the music will start again.





**829. Hand-controlled world-cup music**

Switch on and the speaker will play the song of the 98' world cup. When the music stops, press the press switch and the music will start again.