# ELECTRONICS TRANSITION WORK
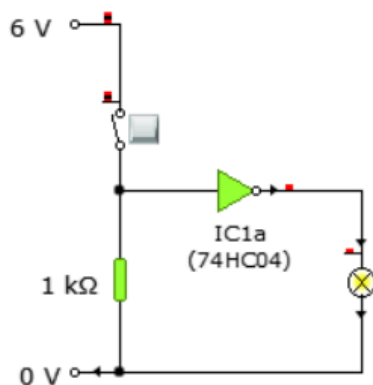
SUMMER TASK FOR STUDENTS STARTING SEPTEMBER 2024
We look forward to seeing you in our Science Department this September!

## PLEASE COMPLETE THE FOLLOWING TASKS:

1.  My fridge has a light that comes on automatically when I open the door. One way to achieve this is to use a digital circuit as shown below.



This circuit has a switch and a resistor in series, this is known as a 'pull down resistor'. Research what a pull down resistor and switch do. What are the possible voltages at the point between the switch and resistor where the lines meet at the dot? Ignore the other components for now.

2.  The component in the middle of the circuit is a logic gate. Research to find out which one it is.

3.  In reality, logic gates do not get sold individually, they come on chips called integrated circuits, research what the 7404 IC is, how many logic gates are on it? How many pins in total are there? Are there any other pins other than the inputs and outputs of the logic gates? Note, if your research tells you they are called 'hex inverters' do not worry, it is the same thing as your answer to question 2.

4.  Suggest which pins of the 7404 IC you would use in this circuit as the input and output. There is more than one correct answer.

5.  Based on your answer to questions 2 and 3, what is missing from the circuit diagram? Hint: it is to do with the logic gate.

6. I called the circuit a 'digital' circuit. What makes a circuit digital? What else could a circuit be other than digital? Give an example of a circuit which is not digital (the name or use of the circuit, not a circuit diagram or description).
7. My fridge also has a feature where if it is left open for a minute, it starts a buzzer to make noise. To time one minute, it uses the circuit below.
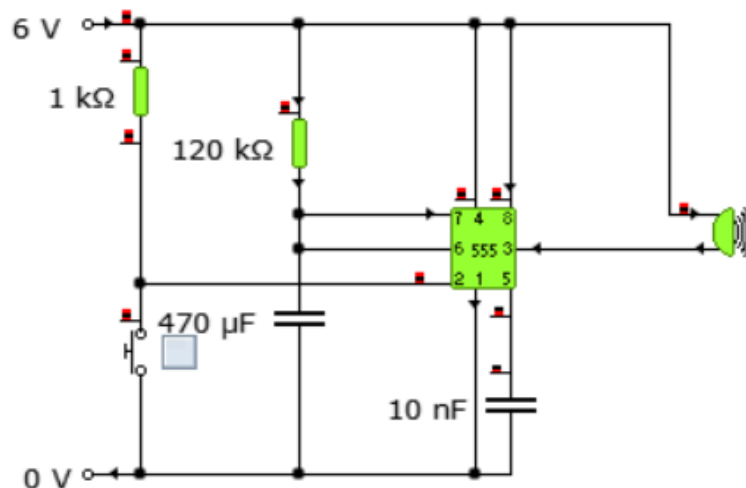


The mathematics of this circuit is that the buzzer comes on after a delay when the switch is pressed, the delay is $T = 1.1 \times R \times C$ where C is the 470µF capacitor and R is the resistor in series with that capacitor. Show that the time delay after the switch is pressed until the buzzer turns on is just over one minute. Be careful with what the µ symbol means, µ stands for 'micro'.
8. This circuit is known as a monostable, find out or deduce from the name what a monostable timing circuit is. The one above uses the 555 monostable.
9. There is also an astable circuit that can be created by changing some components on the left of the diagram and what it connects to on the 555 timer. Find out what an astable timing circuit is, again, you can use the 555.
10. This circuit has a huge flaw, the buzzer only stops for about one minute when the door to the fridge opens. This means the buzzer is going off before the fridge door opens, then stops for a minute, then sounds again after a minute. One solution is to connect the output of the logic gate in the diagram from Q6 and the output of the 555 timer (labelled 3 on the diagram) to a logic gate, then the output of that goes to the buzzer. Based on your previous research, which logic gate should you use and why? Assume the logic gate from Q2 outputs logic 1/high/6V when the fridge door opens, also assume that the timing circuit outputs logic 1/high/6V approximately one minute after the fridge door is opened, and logic 0/low/0V before opening and for the first minute after it is opened.

Want to know more before the course starts? Have a look at the GCSE Electronics content, you can find it at https://resources.wjec.co.uk/pages/ResourceSingle.aspx?rlid=2352