Name:_____

GCSE
Electronic Products

Revision Workbook

Name:_____
Teacher:_____
Form:_____
Form Tutor:_____
My target grade is_____

EJC2018

Question 1:
State the advantages and disadvantages of these sources of power

Type	Advantages	Disadvantages
Solar panel 		
Zinc-Carbon batteries 		
Alkaline batteries 		
Ni-Cad batteries 		
Lead-Acid batteries 		
Mains power supply 		

This page is all about deciding which power supplies are best for particular products.

Select the most suitable power supply (from those shown below) for the different products.

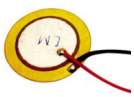
				
Solar Panel	*Zinc-Chloride Battery*	*Alkaline Battery*	*Nickel-Cadmium Battery*	*Lead-Acid Battery*

Product	**Choice of power supply**
Garden path lights 	*Hint: Must work outside without the need of batteries to be replaced.* Name of power source: _____ Why would you use this type? _____
Remote control car 	*Hint: Draws a large current and needs to be rechargeable.* Name of power source: _____ Why would you use this type? _____
Mobility Scooter 	*Hint: Draws a large current and needs to be rechargeable.* Name of power source: _____ Why would you use this type? _____
Small torch 	*Hint: Draws a medium amount of power but for short times only.* *Name of power source:* _____ *Why would you use this type?* _____
Wall clock 	*Hint: Draws very little current over a long period of time.* Name of power source: _____ Why would you use this type? _____

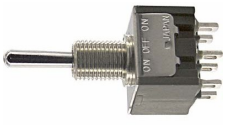
Remember:

An output is a component that produces light, heat, sound or movement.

An input is a component that converts one form of energy into an electrical energy.

Photograph	Name	Symbol	Input or Output?	What it does
				
				
				
				
				
				
				
				
				
				
				
				
				
				

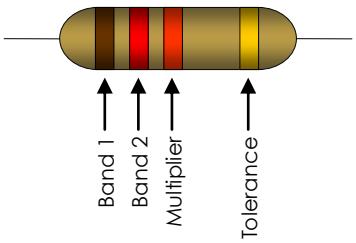
Question 1:
Complete this table below

Switch Type	Stands for	Symbol	What it can be used for
PTM 			
PTB 			
SPST 			
SPDT 			
DPST 			
DPDT 			

Black =	0
Brown =	1
Red =	2
Orange =	3
Yellow =	4
Green =	5
Blue =	6
Violet =	7
Grey =	8
White =	9

Gold = 5% Tolerance

Silver = 10% Tolerance



Use the colour code to work out these resistances:

Band 1	Band 2	Band 3 (Multiplier)	Band 4 (Tolerance)	Resistance	Tolerance
Brown	Black	Brown	Gold		
Brown	Black	Red	Gold		
Brown	Black	Orange	Gold		
Brown	Black	Yellow	Gold		
Brown	Blue	Red	Silver		
Red	Red	Red	Silver		
Brown	Green	Blue	Silver		
Red	Violet	Orange	Gold		
Black	Brown	Brown	Gold		
Blue	Green	Brown	Gold		
Blue	Green	Black	Silver		
				56K	5%
				220R	5%
				32K	5%
				1M2	10%
				10R	5%
				120R	5%
				560K	10%
				3K3	10%
				4K7	5%
				560R	10%

Labelling Resistors

Resistance is measured in Ohms but we usually label them using either R,K or M.
Convert these resistance values into how you would see them on a circuit diagram:

Resistance	How it would look on a diagram
1 Ohm	
10 Ohms	Example 10R
100 Ohms	
1000 Ohms	*Example: 1K*
10,000 Ohms	
1,000,000 Ohms	
10,000,000 Ohms	

Resistance	How it would look on a diagram
1200 Ohms	*Example: 1K2*
5600 Ohms	
6800 Ohms	
1500 Ohms	
2200 Ohms	
3200 Ohms	
120 Ohms	
560 Ohms	
10,000 Ohms	
22,000 Ohms	
170,000 Ohms	
120,000 Ohms	
1,500,000 Ohms	
10,000,000 Ohms	

Preferred Values: E12 Series

Real resistors are only available in certain values, these are known as preferred values. Complete the table showing what resistors are available to us in the E12 range:

E12 Preferred value *(10s)*	***E12 Preferred Value*** *100s Ohms*	***E12 Preferred Value*** ***1****000s*	***E12 Preferred Value*** *10,000*	***E12 Preferred Value*** *100,000*	***E12 Preferred Value*** *1,000,000*
10	100	1K	10K	100K	1M
12					
15					
18					
22					
27	270	2700 (2K7)	27K	270K	2M7
33					
39					
47					
56	560	5600 (5K6)	56K	560K	5M6
68					
82					

Convert these resistance values into ones that you can actually buy:

Resistance Value	***E12 Preferred Value***
13R	
122R	
11K	
123K	
986R	
99K	

Resistance Value	***E12 Preferred Value***
564K	
555R	
11K	
104R	
44K	
1M3	

Preferred Values: E24 Series

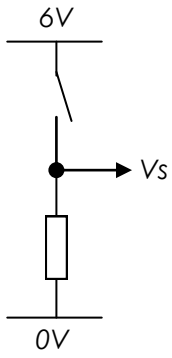
Real resistors are only available in certain values, these are known as preferred values. Complete the table showing what resistors are available to us in the E24 range:

E24 Preferred value *(10s)*	***E24 Preferred Value*** *100s Ohms*	***E24 Preferred Value*** ***1****000s*	***E24 Preferred Value*** *10,000*	***E24 Preferred Value*** *100,000*	***E24 Preferred Value*** *1,000,000*
10	100	1K	10K	100K	1M
11					
12					
13					
15					
16					
18					
20					
22					
24					
27	270	2700 (2K7)	27K	270K	2M7
30					
33					
36					
39					
43					
47					
51					
56	560	5600 (5K6)	56K	560K	5M6
62					
68					
75					
82					
91					

Convert these resistance values into ones that you can actually buy:

Resistance Value	***E24 Preferred Value***
13R	
122R	
11K	
123K	
986R	
99K	

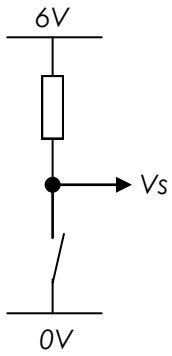
Resistance Value	***E24 Preferred Value***
564K	
555R	
11K	
104R	
44K	
1M3	



Question 1:

When the switch is open the output voltage is:_____

When the switch is closed the output voltage is:_____

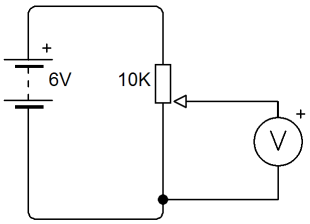


Question 2:

When the switch is open the output voltage is:_____

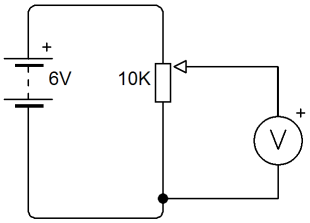
When the switch is closed the output voltage is:_____

Question 3:



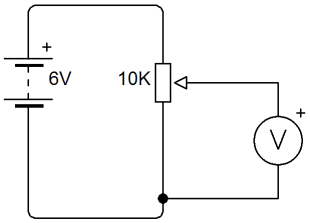
When the potentiometer is turned fully anticlockwise the output voltage will be:

_____ Volts



When the potentiometer is turned fully clockwise the output voltage will be:

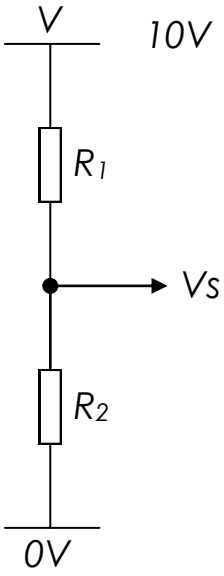
_____ Volts



When the potentiometer is in the centre position the output voltage will be:

_____ Volts

$$Vs = \frac{R2}{R1 + R2} \times V$$



$$Vs = \frac{200}{100 + 200} \times 10$$

$$Vs = \frac{200}{300} \times 10$$

$$Vs = 0.67 \times 10$$

$$\mathbf{Vs = 6.7V}$$

Question 1:

R1 = 220R
R2 = 220R
V = 12V

Vs =

Question 2:

R1 = 100R
R2 = 300R
V = 12V

Vs =

$$Vs = \frac{R2}{R1 + R2} \times V$$

Question 3:

R1 = 1K
R2 = 1K
V = 12V

Vs =

Question 4:

R1 = 1K
R2 = 20K
V = 6V

Vs =

Question 5:

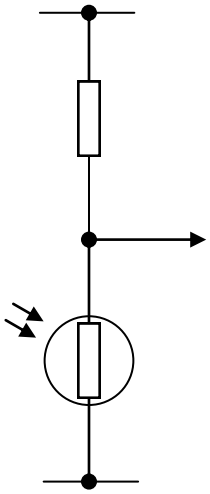
R1 = 20K
R2 = 1K
V = 6V

Vs =

Question 6:

R1 = 560R
R2 = 680R
V = 10V

Vs =



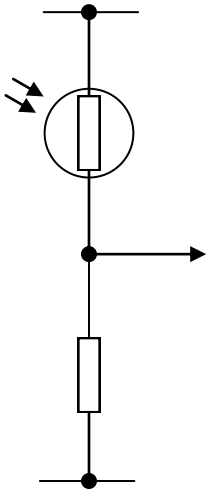
Question 1—Light Dependent Resistors:

a) When is dark the LDR has a ***high / low*** resistance

b) When it is dark the output voltage is therefore ***high / low***

c) When it is light the LDR has a ***high / low*** resistance

d) When it is light the output voltage is therefore ***high / low***



Question 2—Light Dependent Resistors:

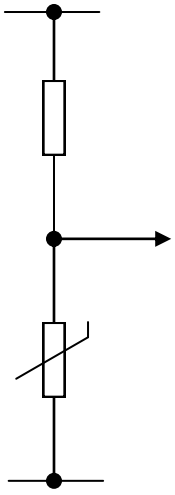
In this circuit the LDR and resistor have been switched over

a) When is dark the LDR has a ***high / low*** resistance

b) When it is dark the output voltage is therefore ***high / low***

c) When it is light the LDR has a ***high / low*** resistance

d) When it is light the output voltage is therefore ***high / low***



Question 3—Thermistors:

a) A positive temperature coefficient (PTC) thermistor:

When it is hot the resistance is ***high / low***

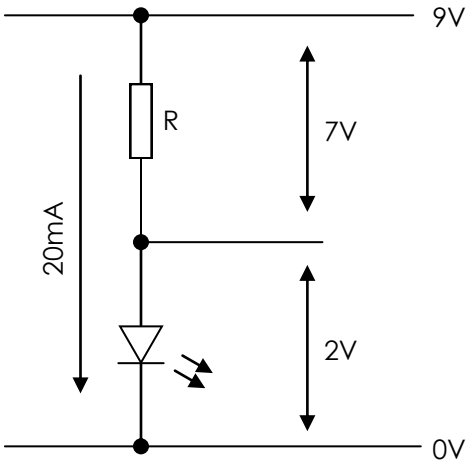
When it is cold the resistance is ***high / low***

b) A negative temperature coefficient (NTC) thermistor:

When it is hot the resistance is ***high / low***

When it is cold the resistance is ***high / low***

When using an LED a current limiting resistor must be added to stop it from being damaged. In the exam you may be asked to work out what value the resistor should be. For this you will need a calculator.

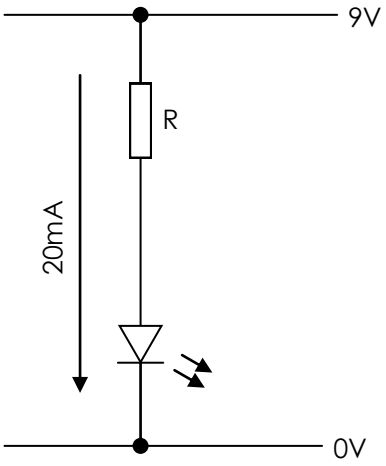


Resistance = $\frac{\text{Supply voltage - 2}}{\text{Current through LED}}$

Usually the current through the LED should be 20mA

20mA = 20×10^{-3}

= 0.02

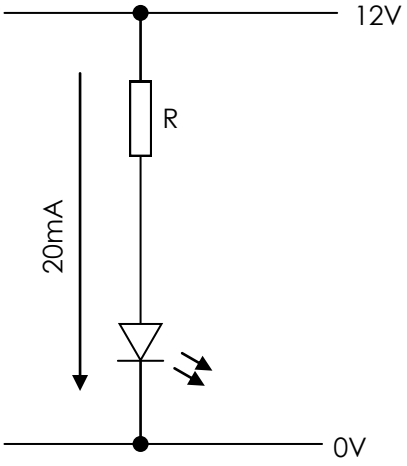


Question 1:

Supply voltage = 9V

Current through LED = 20mA

Resistance =



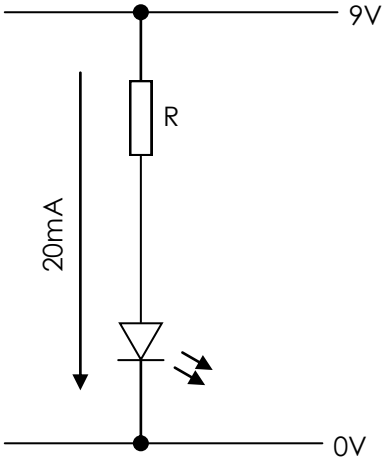
Question 2:

Supply voltage = 12V

Current through LED = 20mA

Resistance =

Work out what resistor you will need to connect to these circuits:



Resistance = $\frac{\text{Supply voltage - } V_D}{\text{Current through LED}}$

Usually the current through the LED should be 20mA

20mA = 20×10^{-3}

= 0.02

Question 1:

Supply voltage = 4.5V

Current through LED = 20mA

Resistance =

Question 2:

Supply voltage = 6V

Current through LED = 20mA

Resistance =

Question 3:

Supply voltage = 24V

Current through LED = 20mA

Resistance =

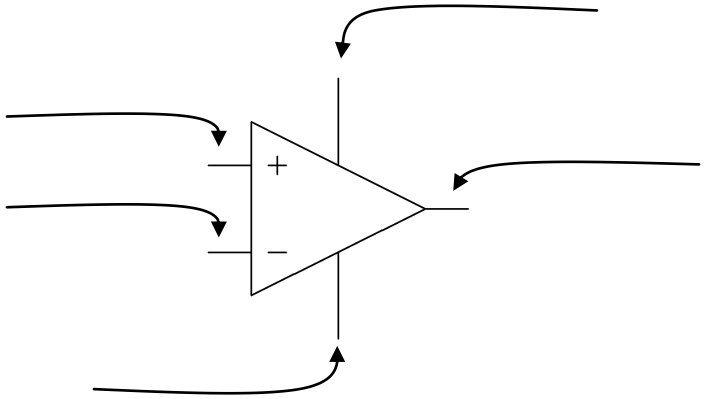
Question 4:

Supply voltage = 3V

Current through LED = 20mA

Resistance =

Question 1: Label the circuit symbol below:

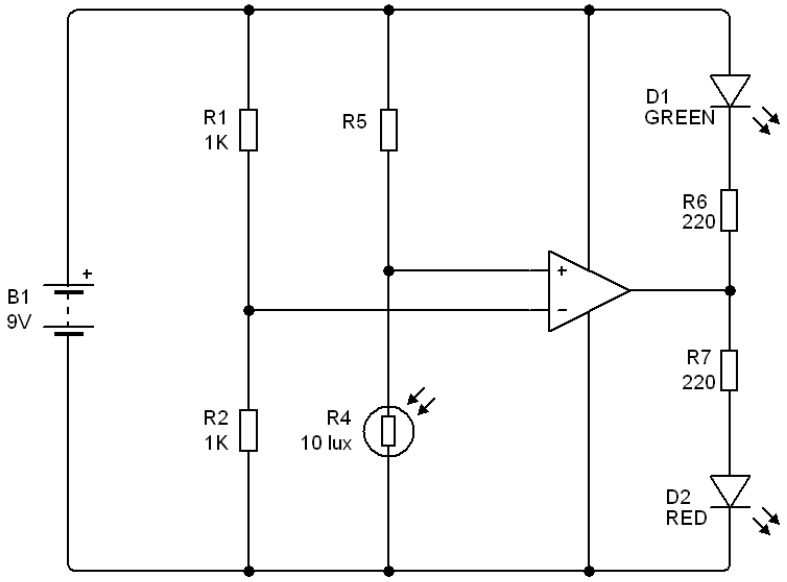


Question 2: Complete the following.

When the voltage on the non-inverting input is larger than that on the inverting input the output voltage will be ***positive / negative / 0V***.

When the voltage on the inverting input is larger than that on the non-inverting input the output voltage will be ***positive / negative / 0V***.

When the voltage on the inverting input is the same as the voltage on the non-inverting input the output voltage will be ***positive / negative / 0V***.



Question 3: The circuit on the left is that of a light sensitive switch. Describe how it works by completing the sentences.

Resistors R1 and R2 form a circuit called a _____ _____.

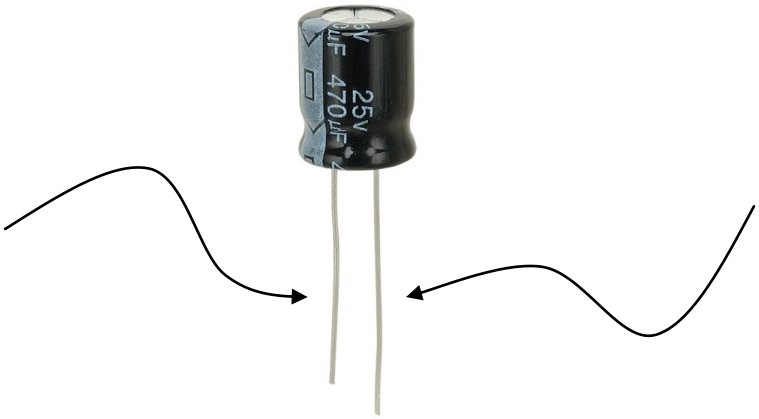
Because R1 and R2 have the same resistance the voltage on the inverting input will be _____ volts.

The voltage on the non-inverting input depends on how much light shines on the LDR.

Question 4: When it is dark the resistance of the LDR is ***high / low***, therefore the voltage on the non-inverting input will be ***high / low***. If the voltage on the non-inverting input is higher than the inverting input then the output will be ***high / low***. The ***red / green*** LED will light.

When it is light the resistance of the LDR is ***high / low***, therefore the voltage on the non-inverting input will be ***high / low***. If the voltage on the non-inverting input is higher than the inverting input then the output will be ***high / low***. The ***red / green*** LED will light.

Question 1: Label the positive and negative leads of this capacitor:



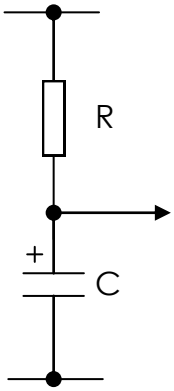
Question 2: Complete the table below:

	*Type* ..... *Is it polarised?* *(Does it need to be connected the right way around?)*	*Circuit Symbol*	*What it does:*

	*Type* ..... *Is it polarised?* *(Does it need to be connected the right way around?)*	*Circuit Symbol*	*What it does:*

Charging up a capacitor

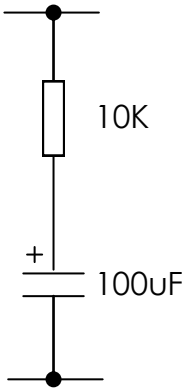
Charging a capacitor up through a resistor can be used to create a time delay. The time delay can be worked out with the formula:



Time Constant = Capacitance x Resistance

Or

T = C x R

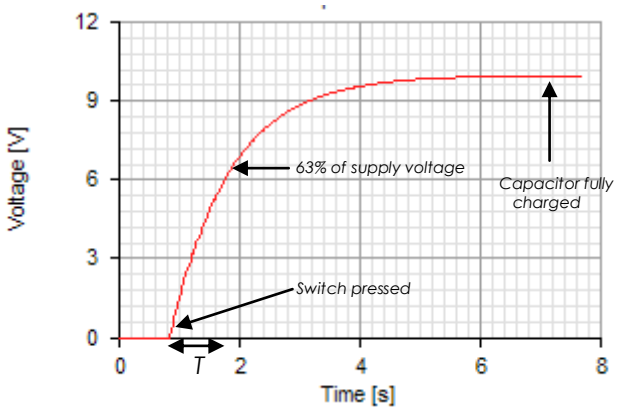


For example if:
C = 10K
R = 100uF

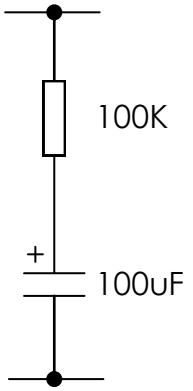
T = C x R

T = 100x10^{-6} x 10000

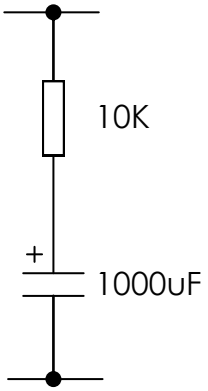
T = 1 Second



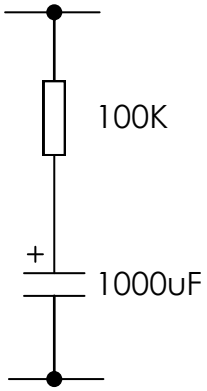
Question 1: Calculate how long it takes to charge the capacitor up.



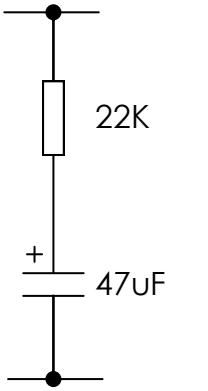
T =



T =

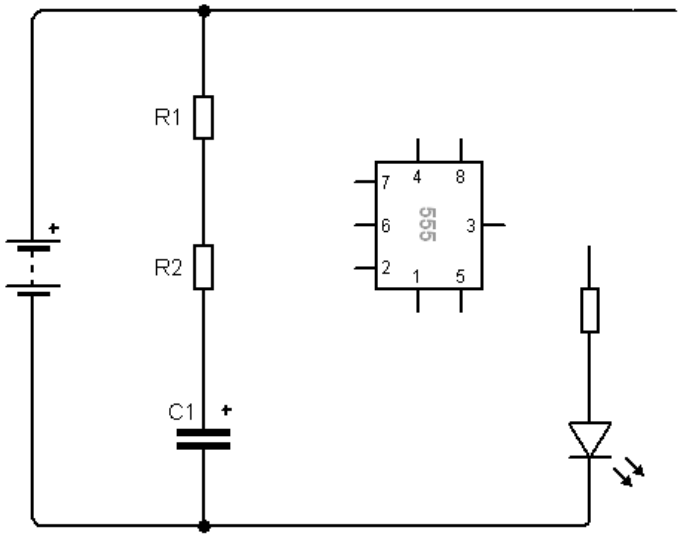


T =



T =

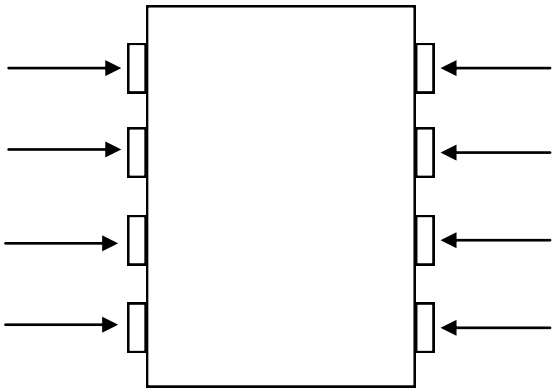
Question 1: Complete the circuit diagram of a 555 astable circuit.



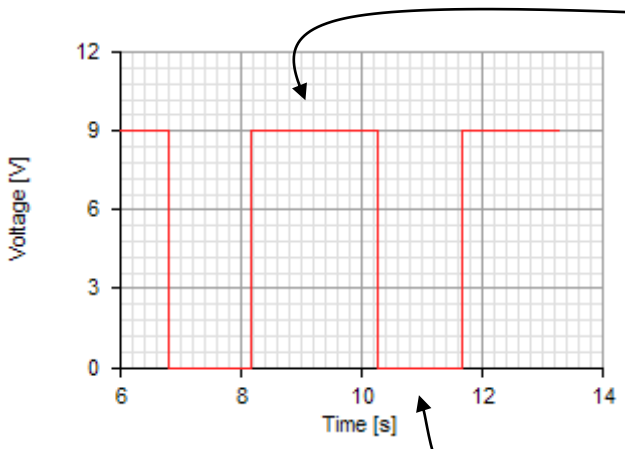
Question 2: The diagram below shows a diagram of an 8pin DIL socket:

a.) Add the pin numbers to the diagram.

b.) Add the two things that show which is pin 1.



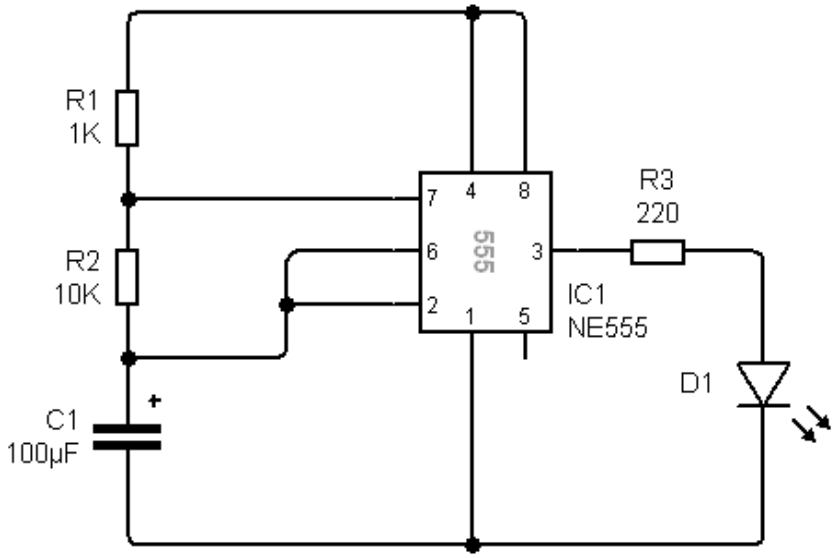
Question 3: The circuit shown above will make the LED flash on and off. If we plotted a graph of the output voltage it would look like that shown below. Label which part is called the *mark* and which is called the *space*.



This part of the signal is called the ***mark / space***

This part of the signal is called the ***mark / space***

In an exam you may be asked to calculate the frequency (how often the output turns on and off per second) for a 555 astable.



$$F = \frac{1.44}{(R_1 + 2R_2) \times C}$$

$$F = \frac{1.44}{(1000 + 2 \times 10000) \times C}$$

$$F = \frac{1.44}{(1000 + 20000) \times 100 \times 10^{-6}}$$

$$F = \frac{1.44}{20100 \times 100 \times 10^{-6}}$$

$$F = \frac{1.44}{2.01} = \textbf{0.7Hertz}$$

Question 1:

R1 = 1K
R2 = 10K
C1 = 10µF *(10×10^{-6} or 0.00001)*

Question 2:

R1 = 1K
R2 = 10K
C1 = 1µF *(1×10^{-6} or 0.000001)*

$$F = \frac{1.44}{(R_1 + 2R_2) \times C}$$

Question 1:

R1 = 2K2
R2 = 12K
C1 = 220µF *(220×10^{-6})*

Question 2:

R1 = 4K7
R2 = 22K
C1 = 10µF *(10×10^{-6})*

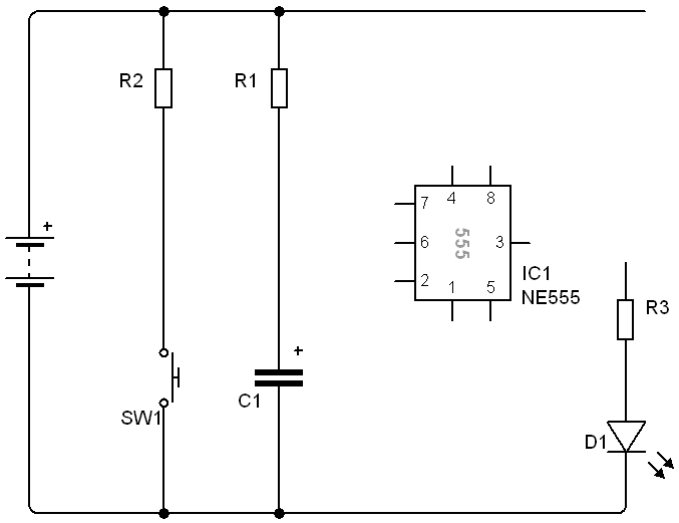
Question 3:

R1 = 22K
R2 = 47K
C1 =10µF *(10×10^{-6})*

Question 4:

R1 = 1k2
R2 = 2K2
C1 = 47µF *(47×10^{-6})*

Question 1: Complete the circuit diagram of a 555 monostable circuit.



$$T = 1.1 \times C_1 \times R_1$$

Seconds

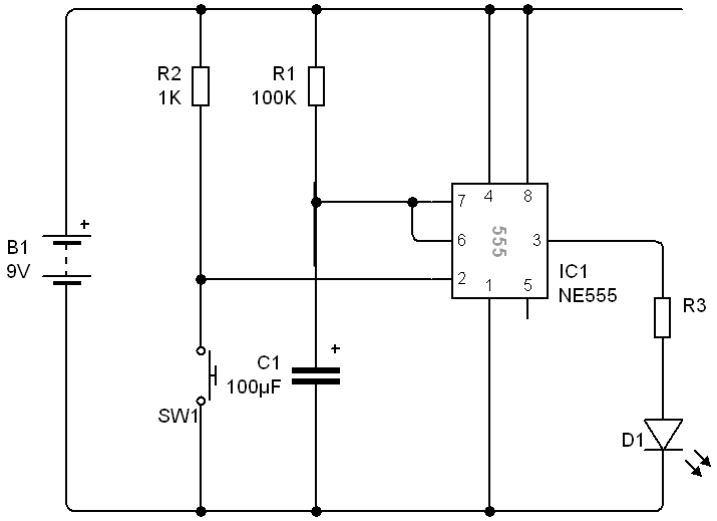
Question 1: Describe what a 555 monostable circuit does by completing the following.

A monostable is a circuit that can turn an output on for a certain amount of time and then turn it off again. The amount of time the output is switched on is set by two components: _____ and _____.

When the circuit is first switched on the LED will be ***on / off.***

Normally the voltage on pin2 is ***high / low*** but when the switch is pressed the voltage on pin2 will go ***high / low***. This triggers the circuit and the output will be switched ***on / off*** and so the LED will be ***on / off.*** After a period of time the output will ***switch on / switch off.***

Question 1: Complete the circuit diagram of a 555 monostable circuit.



Example:

$T = 1.1 \times C_1 \times R_1$

$T = 1.1 \times 100x10^{-6} \times 10000$

T =1.1 Seconds

Question 1:

R1 = 100K
C1 = 100µF *($100x10^{-6}$)*

Question 2:

R1 = 100K
C1 = 470µF *($470x10^{-6}$)*

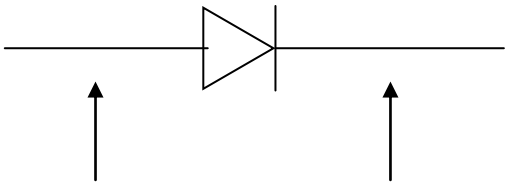
Question 3:

R1 = 100K
C1 = 1000µF *($1000x10^{-6}$)*

Question 4:

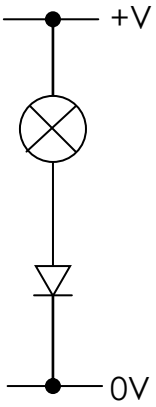
R1 = 47K
C1 = 1µF *($1x10^{-6}$)*

Question 1: Label the circuit diagram and picture of a diode showing the anode and cathode connections.



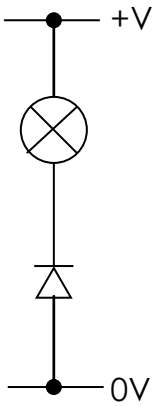
Question 2: Complete the following.

This circuit shows a ***reverse-biased / forward-biased*** diode.
The lamp ***will / will not*** light up.

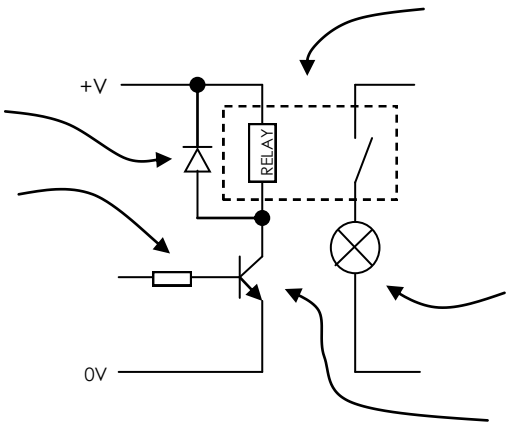


Question 3: Complete the following.

This circuit shows a ***reverse-biased/forward-biased*** diode.
The lamp ***will / will not*** light up.

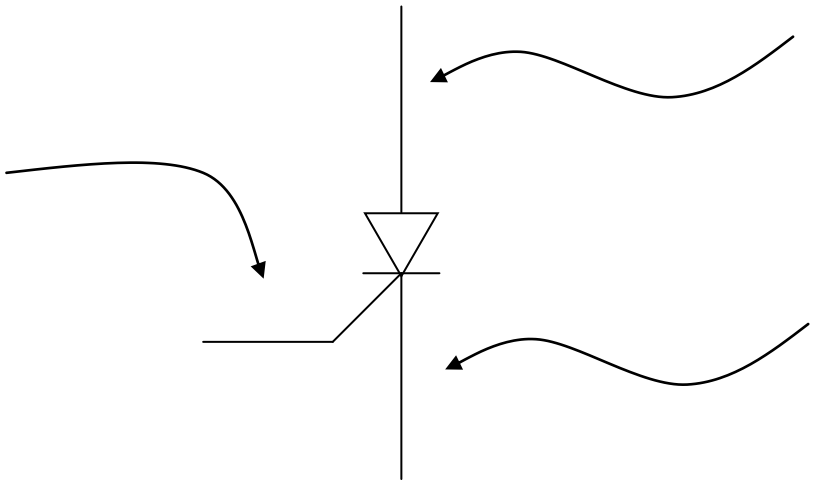


Question 4: Name each of the components in the circuit shown below.

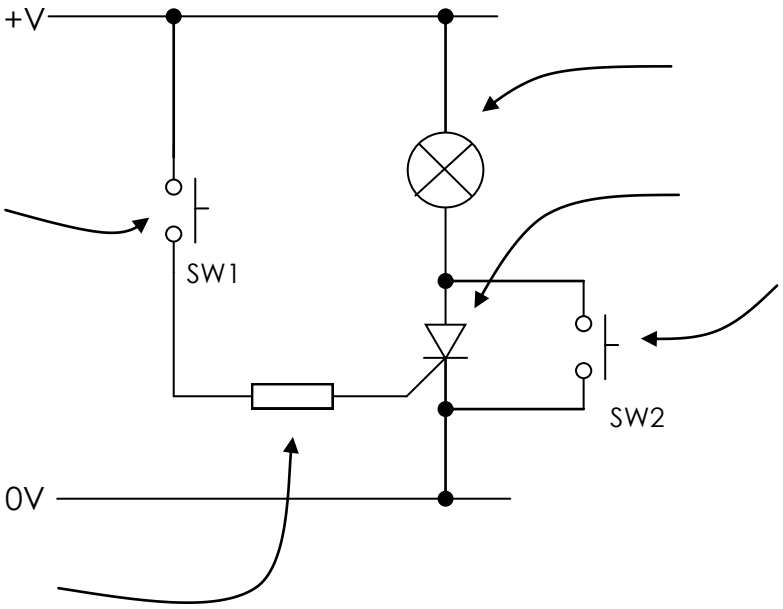


Question 5: Explain why we have to use the diode in this circuit.

Question 1: Label the leads of the thyristor



Question 2: Label this circuit using the given component list.



Component list:

- Set switch
- Reset switch
- Resistor
- Thyristor
- Lamp

Question 3: Describe how the circuit works by completing these sentences.

When the circuit is first connected up to the battery the lamp will be switched ***on / off.***

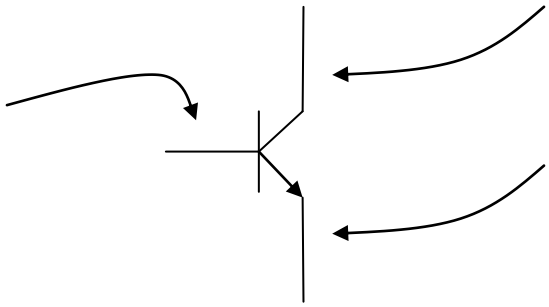
When SW1 is pressed current flows through the resistor into the ***gate / anode / cathode*** of the thyristor. The lamp will now light up.

When SW1 is released the lamp will ***stay lit / go out***, the thyristor is said to be _____.

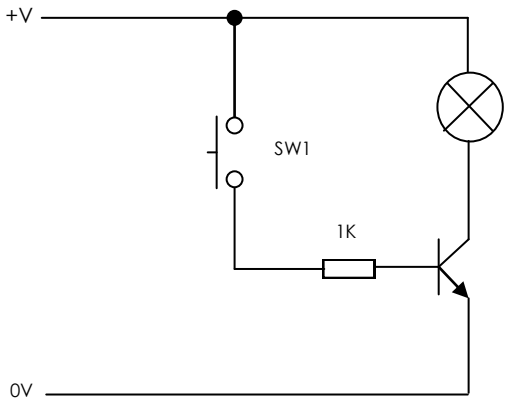
When SW2 is pressed and then released the current between the anode and cathode of the thyristor is interrupted. The thyristor will switch ***on/off*** and therefore the lamp will be switched ***on / off.***

A thyristor is a type of electronic ***latch / amplifier / resistor.***

Question 1: Label the leads of the transistor



Question 2: Describe how the circuit works by completing these sentences.



Normally the lamp will be ***on / off***.

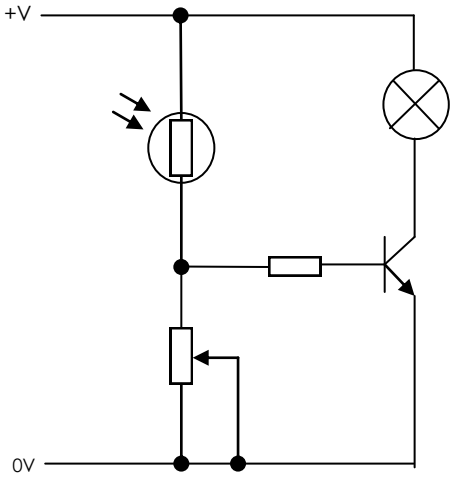
When SW1 is pressed a ***small / large*** current flows through the _____ and into the ***base / collector / emitter*** of the transistor.

This makes a ***small / large*** current flow between the collector and the ***base / emitter*** connections of the transistor.

The transistor is now switched on and the lamp will light up.

A transistor can be used as an electronic _____. It allows a tiny current flowing into the base to switch on a much larger current.

Question 2: Describe how the circuit works by completing these sentences.



When it is dark the resistance of the LDR is ***high / low*** and so very little current flows into the base. The transistor will be switched ***on / off*** and so the lamp be switched ***on / off***.

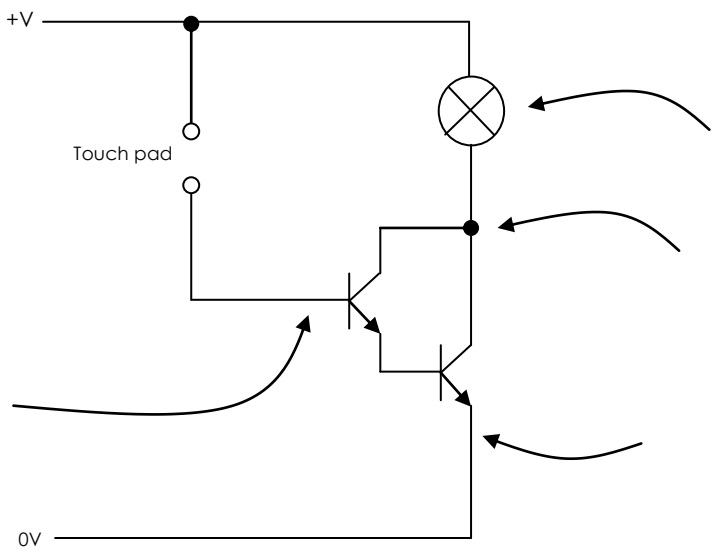
When it is light the resistance of the LDR is ***high / low***. The amount of current flowing into the base of the transistor will be ***higher / lower***.

The transistor will switch ***on / off*** and the lamp will be ***on / off.***

To make the lamp turn on when it is dark instead we would have to_____

Question 1:

Add the labels



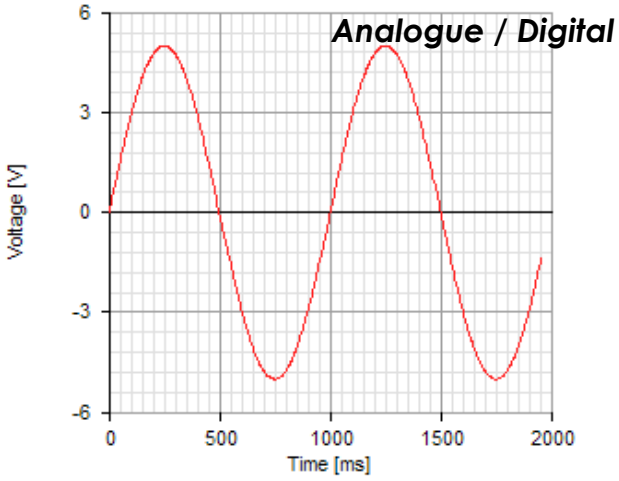
Question 2: Describe how the circuit works by completing these sentences.

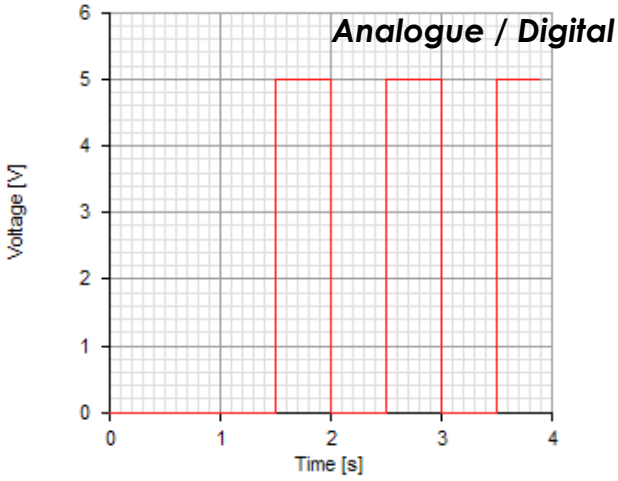
When the touch pad is not touched its resistance is very ***high / low***. This means that no current flows into the base and the transistor will be switched ***on / off*** so the lamp will be switched ***on /off***.

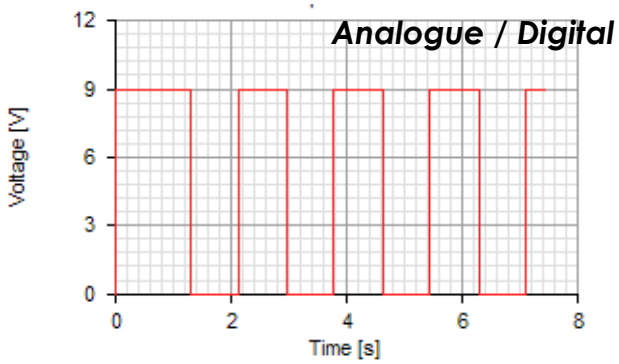
When the touch pad terminals are touched a tiny amount of current will through your finger. This tiny current flows into the ***base / collector / emitter*** of the transistor. The transistor will therefore switch ***on /off***.

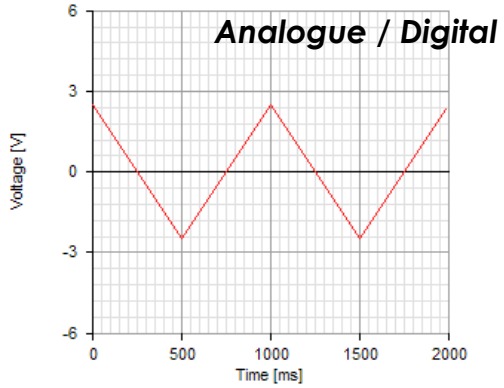
A Darlington transistor is a very sensitive type of electronic switch and can amplify very tiny currents.

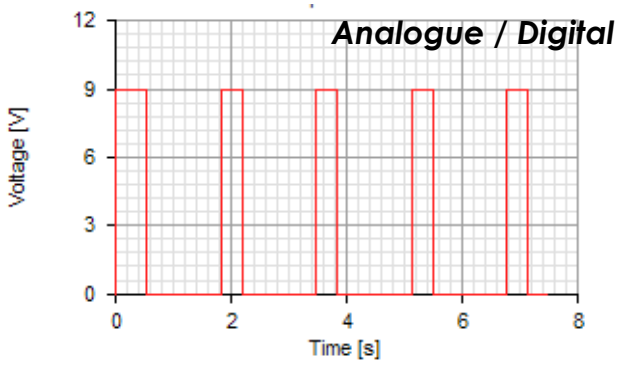
Question 1:
Are these signals analogue or digital?

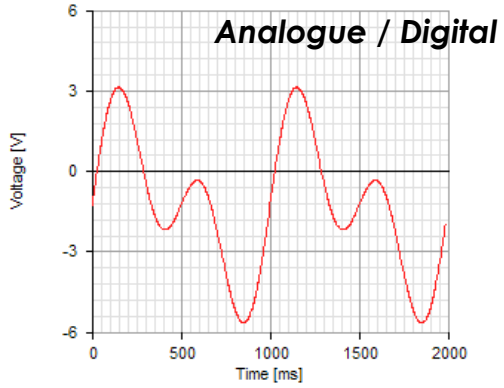


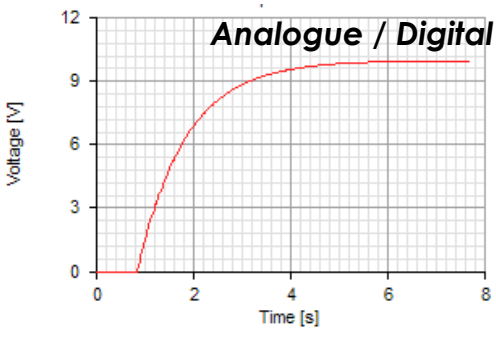






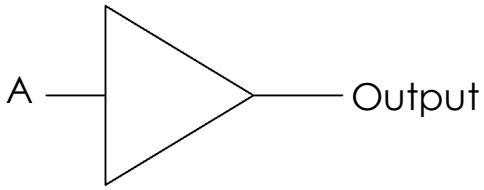


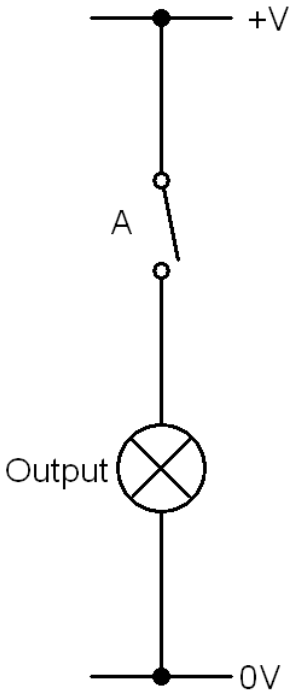




Complete the truth tables for the logic gates:

BUFFER

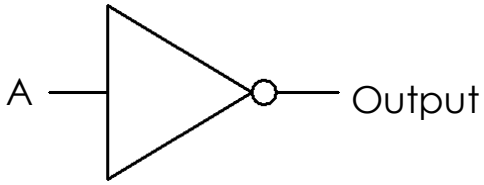


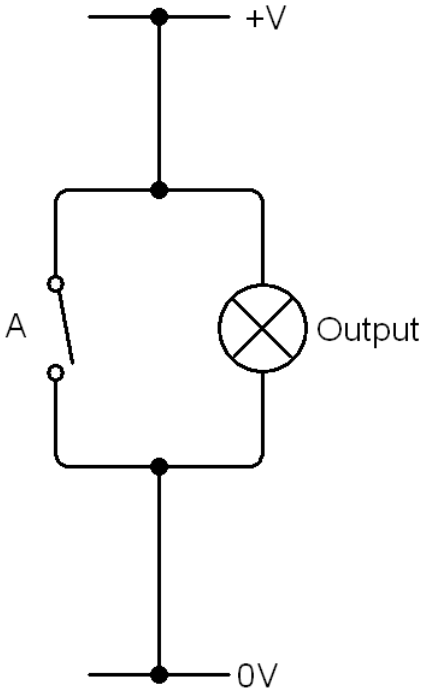


Buffer Truth-Table

Input A	Output
0	
1	
0	
1	

NOT



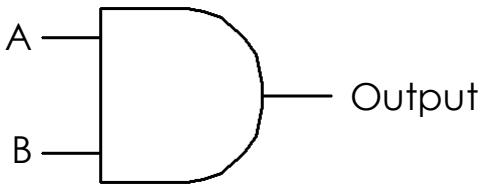


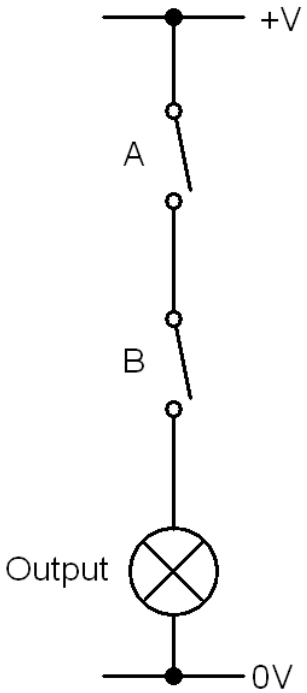
NOT Truth-Table

Input A	Output
0	
1	
0	
1	

Complete the truth tables for the logic gates:

AND

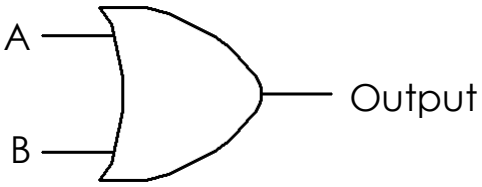


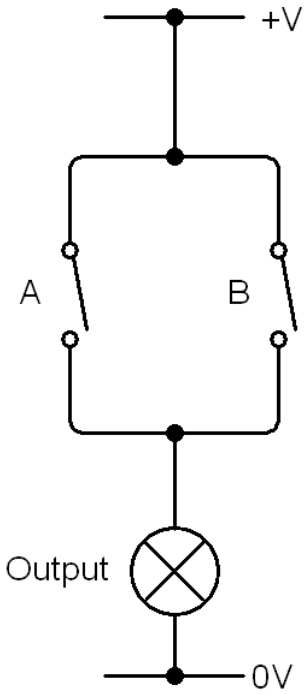


AND Truth-Table

Input B	Input A	Output
0	0	
0	1	
1	0	
1	1	

OR



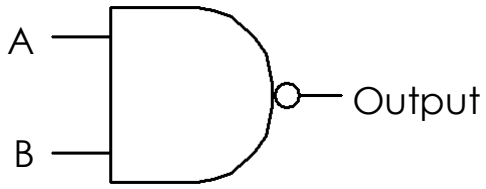


OR Truth-Table

Input B	Input A	Output
0	0	
0	1	
1	0	
1	1	

Complete the truth tables for the logic gates:

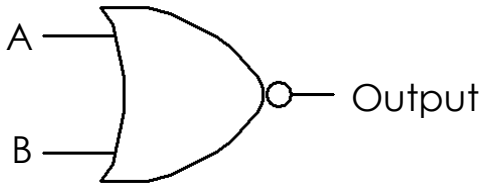
NAND



NAND Truth-Table

Input B	Input A	Output
0	0	
0	1	
1	0	
1	1	

NOR

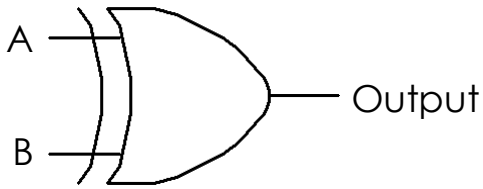


NOR Truth-Table

Input B	Input A	Output
0	0	
0	1	
1	0	
1	1	

Question 1: Complete the truth tables for the logic gates:

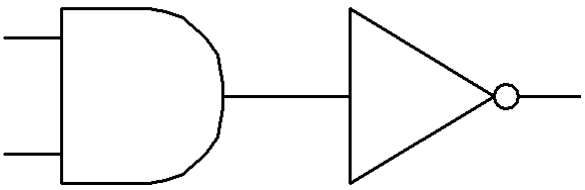
XOR



NAND Truth-Table

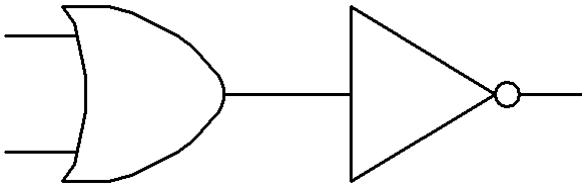
Input B	Input A	Output
0	0	
0	1	
1	0	
1	1	

Question 2: Logic gates can be combined to form new circuits. Complete the sentences:



This circuit will work in the same as a single logic gate. This gate is a:

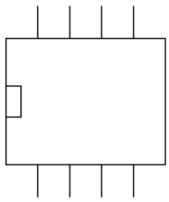
AND / OR / NAND / NOR / NOT



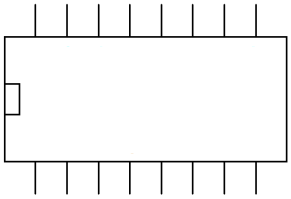
This circuit will work in the same as a single logic gate. This gate is a:

AND / OR / NAND / NOR / NOT

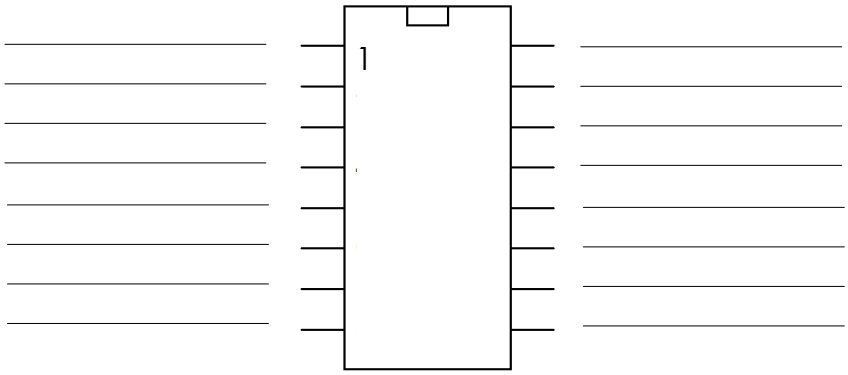
Question 1a: This is the symbol of an 8-pin IC. Number each pin.



Question 1b: This is the symbol of a 16-pin IC. Number each pin.

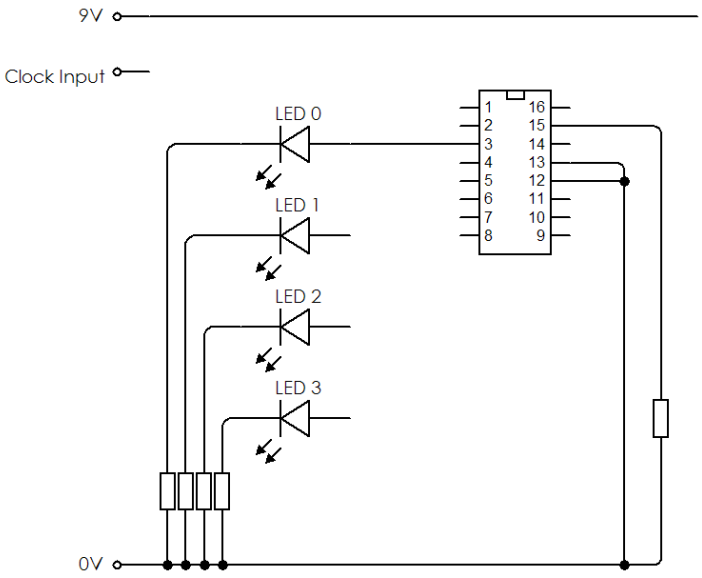


Question 2: Label each pin using the table shown:



4017 Decade counter pin layout

Pin 1	*Output 5*	Pin 9	*Output 8*
Pin 2	*Output 1*	Pin 10	*Output 4*
Pin 3	*Output 0*	Pin 11	*Output 9*
Pin 4	*Output 2*	Pin 12	*÷ by 10 output*
Pin 5	*Output 6*	Pin 13	*Clock enable*
Pin 6	*Output 7*	Pin 14	*Clock input*
Pin 7	*Output 3*	Pin 15	*Reset*
Pin 8	*0V*	Pin 16	*Power (9V)*



Question 3: Add the wires to this diagram to make this decade counter circuit. Use the information from the questions above:

a. Connect the 4017 to the power supply.

b. Connect the Clock signal to the Clock input.

c. Connect the LEDs so they will come on in sequence.

d. Add a wire that will make the counter reset when it counts up to five.

e. Connect any unused inputs to 0V and any unused outputs through a resistor to 0V

Question 4: Why do we need to connect a resistor to each LED?

Question 5: What is the purpose of the resistor that is connected to the RESET input?