

Electronics Questions – NAT 5

1) A radio and a computer mouse are examples of electronic systems.

a) An electronic system can be represented by a block diagram as shown.

Complete the block diagram by filling in the missing labels.



b) Output signals from an electronic system can either be analogue or digital.

i) The output signal from a radio is analogue.



Draw an analogue signal.

ii) The output from a computer mouse is digital.



Draw a digital signal.

2) A radio controlled model fire engine receives signals from a control unit.

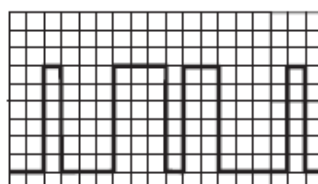
One of the control functions operates a siren on the fire engine.



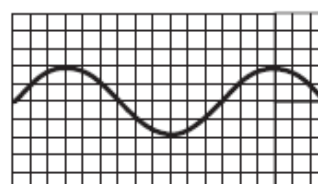
a) State a **suitable output device** for the fire engine.

b) The fire engine contains an electronic system to control the siren.

The signal at various parts of the system are displayed on the oscilloscope screens.



screen 1



screen 2

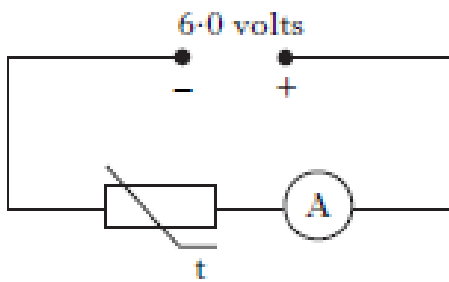
i) Which screen shows a digital system?

ii) The signal on screen 2 is now amplified.

The oscilloscope settings are unchanged.

Draw the amplified signal in the box below.

- 3) a) A thermistor is connected to a 6.0V supply in **circuit 1**. The table gives some information about the thermistor.

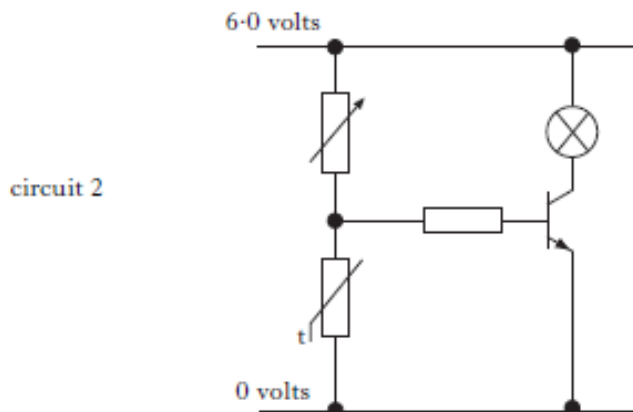


circuit 1

<i>temperature</i> (degrees Celsius)	<i>resistance</i> (ohms)
20	1000
30	600
40	400

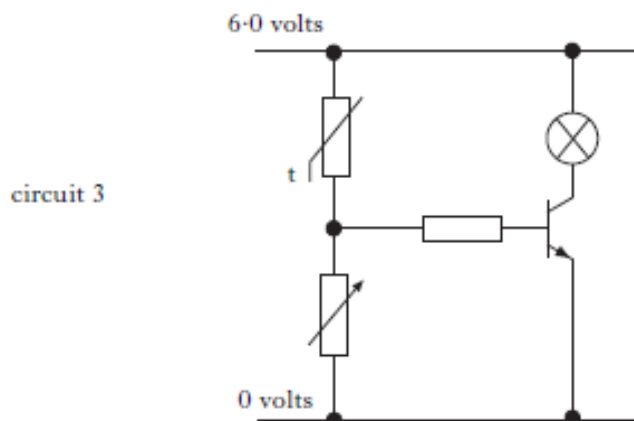
Calculate the **reading on the ammeter** when the thermistor is placed in a beaker of water at 40°C.

- b) The thermistor is now connected as shown in **circuit 2** and placed in a tropical fish tank. The circuit provides a warning when the temperature of the water in the tank becomes too low.



circuit 2

- i) What is the purpose of the transistor in **circuit 2**?
- ii) The same components are used to construct **circuit 3**.

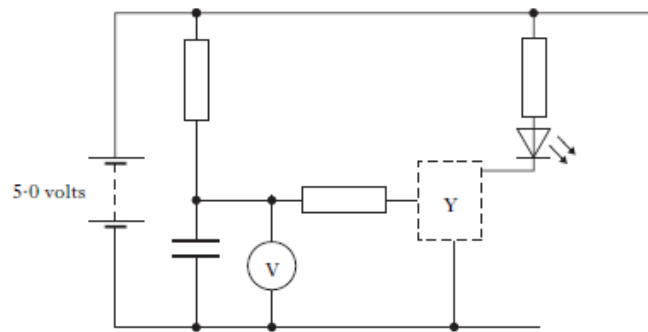


circuit 3

State how the operation of **circuit 3** differs from the operation of **circuit 2**.

4) a) The circuit below can be used to light an LED after a short time delay.

The capacitor is charged using the 5.0V supply.



i) State what happens to the voltage across the capacitor when it charges.

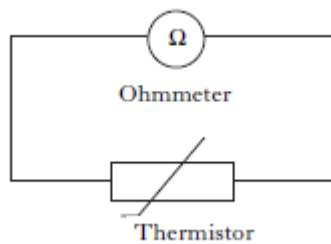
ii) Component Y is a transistor.

Draw the symbol for a transistor.

iii) State the function of a transistor in this circuit.

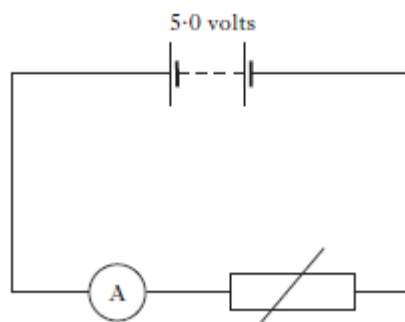
b) The circuit below is used to monitor temperature changes in a liquid.

The thermistor is immersed in the liquid.



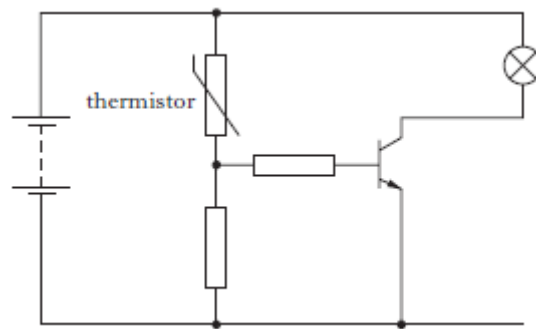
i) State what happens to the reading on the ohmmeter when the liquid cools.

ii) The thermistor is now connected to a battery and an ammeter as shown.



Calculate the current in the circuit when the resistance of the thermistor is 1000Ω .

5) An electronic circuit, used to give a warning, is shown below.



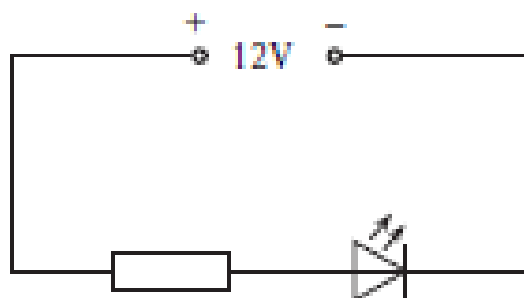
- a) i) What causes the resistance of the thermistor to change?
- ii) State the function of the transistor in the circuit.
- iii) How does the circuit indicate this warning?
- iv) Suggest where this circuit could be used to give a warning?

b) Some electronic devices are listed below.

7 segment display	LED	Relay	Switch
Motor	Solar Cell	LDR	Solenoid

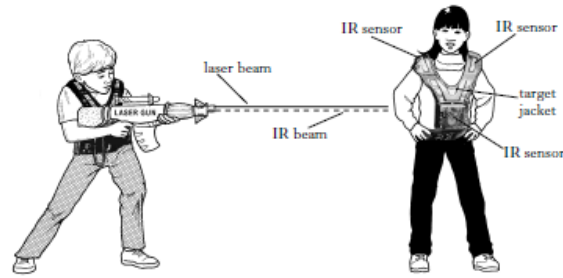
From the list, state **two** digital output devices.

6) An LED circuit is shown below.



- a) A resistor is placed in series with the LED.
State the purpose of the resistor.
- b) When lit, the LED has a voltage of 3.5V across it and a current of 200mA passing through it.
Calculate the resistance of the resistor.

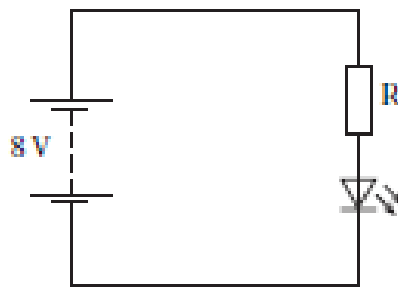
7)



- a) A laser gun operates from a 7.2V rechargeable battery. The battery is charged from the mains and takes 2 hours to fully recharge. A current of 3A is used in the charging circuit.

Calculate how much charge the battery stores when fully charged.

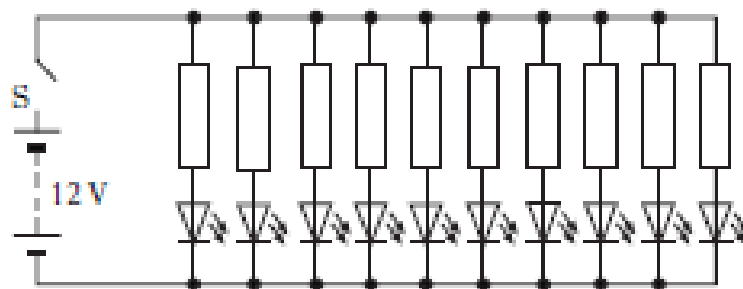
- b) When the IR beam hits a sensor on the target jacket, the following circuit is completed and the LED lights. The LED has an operating voltage of 2V and an operating current of 15mA. The circuit has an 8V supply.



Calculate the **resistance R** in the circuit.

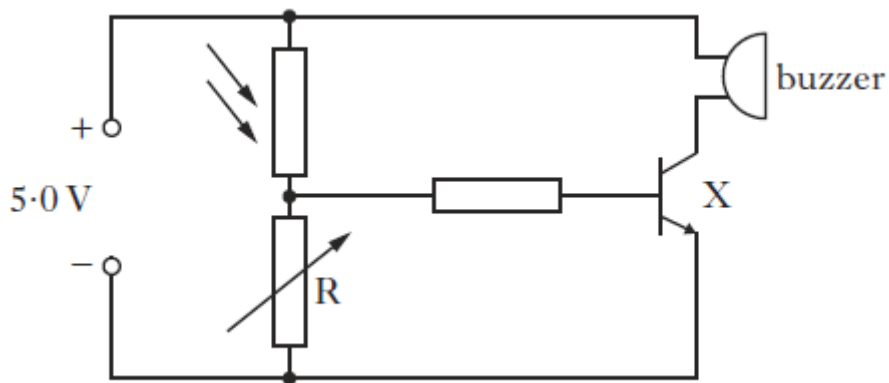
- 8) The rear light of a car is made up of a row of 10 identical red LED's.

Each LED requires 2V and 20mA to operate correctly.



- a) Why does each LED need a resistor in series?
- b) The voltage of the car battery is 12V.
Calculate the resistance of each resistor.
- c) Calculate the total current in amperes, from the battery when the rear light is operating correctly.

- 9) A photographic darkroom has a buzzer that sounds when the light level in the room is too high. The circuit diagram for the buzzer system is shown below.



- a) i) Name component **X**.
 ii) What is the purpose of component X in the circuit?

- b) The darkroom is opened and the light level increases.
 Explain how the circuit operates to sound the buzzer.

- c) The table shows how the resistance of the LDR varies with light level.

<i>Light level (units)</i>	<i>LDR Resistance (Ω)</i>
20	4500
50	3500
80	2500

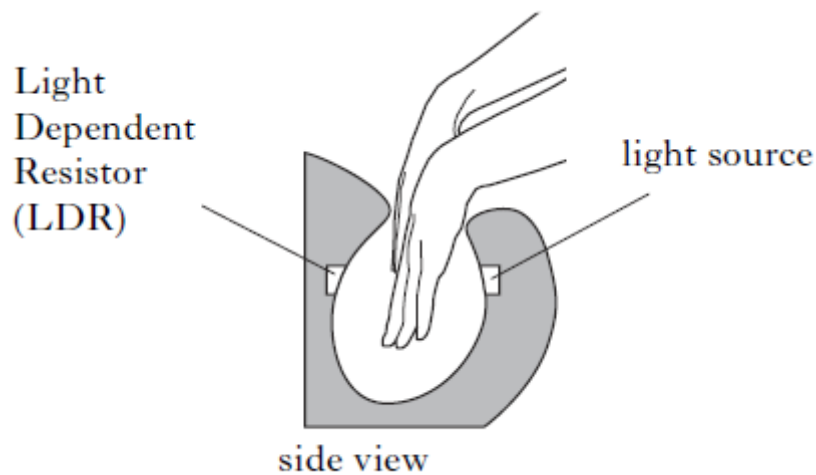
The variable resistor has a resistance of 570Ω .

The light level increases to 80 units.

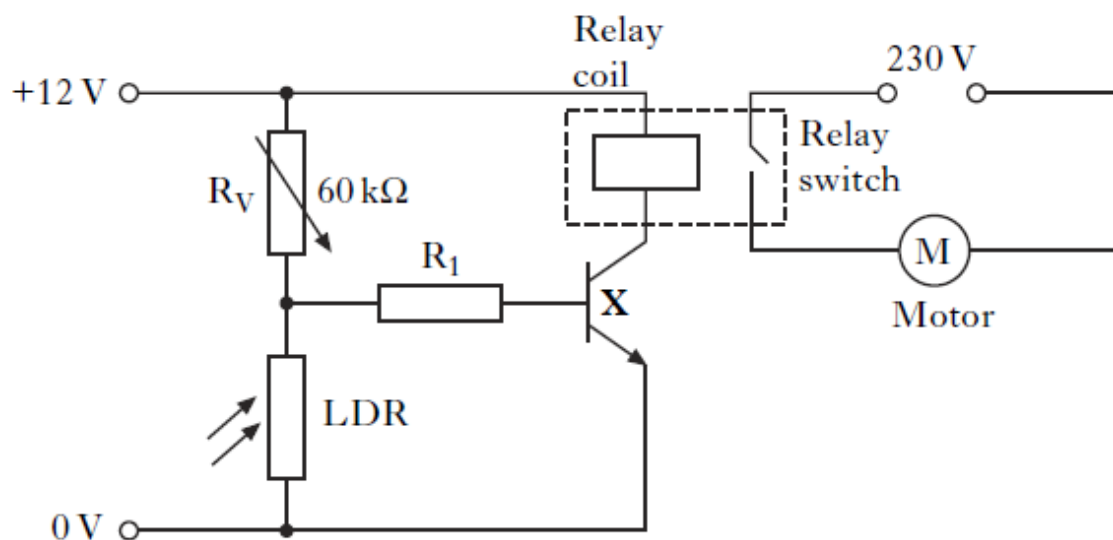
Calculate the current in the LDR.

- d) What is the purpose of the variable resistor R in the circuit?

10) An automatic hand dryer used in a washroom is shown in the diagram below.



Inserting hands into the hand dryer breaks a light beam, this is detected using an LDR. The LDR is part of the switching circuit which activates the hand dryer when hands are inserted. Part of the circuit for the hand dryer is shown below.



a) The variable resistor R_v is set to a resistance of 60k Ω .

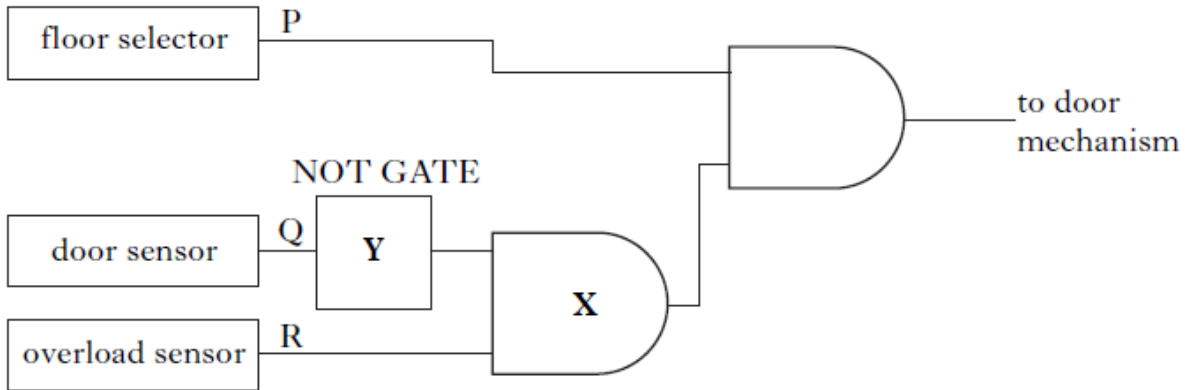
Calculate the voltage across the LDR when its resistance is 4k Ω .

b) Name component **X** in the circuit.

c) Explain how the circuit operates to activate the motor in the dryer when the light level falls below a certain value.

11) An electronic system is used to control a lift. When a floor has been selected, two checks are made:
 there are no obstructions to the doors;
 the lift is not overloaded.

Part of the circuit is shown below.



The logic states are shown for the floor selector, the sensors and the door mechanism.

		logic level
floor selector	not pressed	0
	pressed	1
door sensor	no obstruction	0
	obstruction	1
overload sensor	overloaded	0
	not overloaded	1
door mechanism	doors open	0
	doors closed	1

a) Name logic gate X.

b) i) Gate Y is a NOT gate.

Draw the symbol for a NOT gate.

ii) Complete the truth table for a NOT gate.

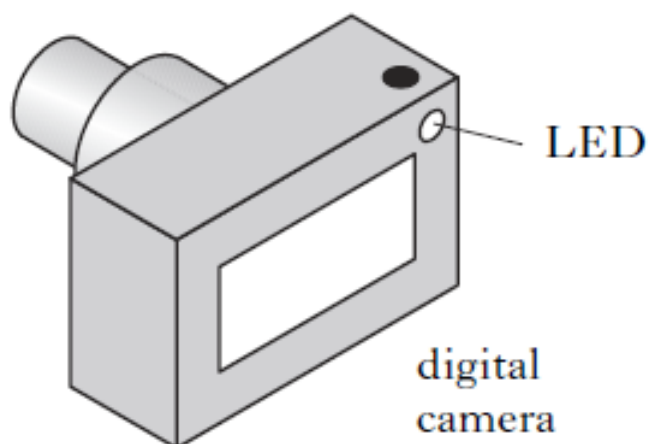
<i>Input</i>	<i>Output</i>
0	
1	

c) i) State the logic levels needed at P, Q and R to close the lift doors.

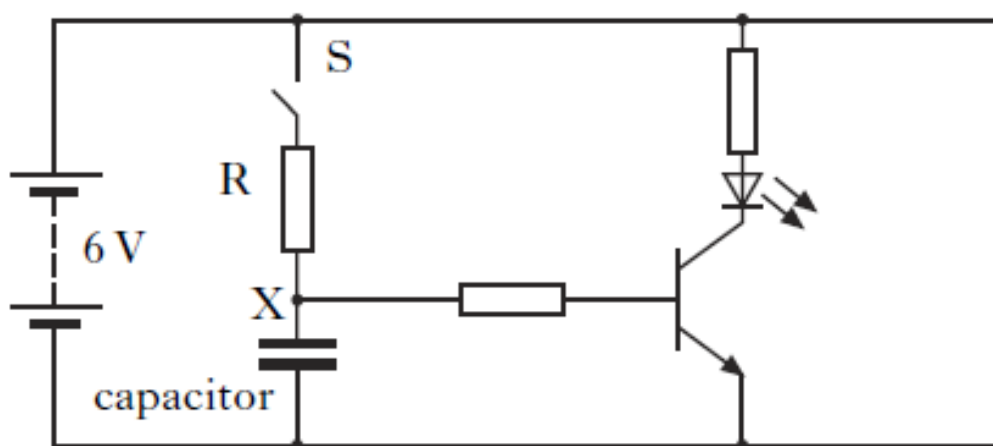
ii) What output device could be used for the door opening and closing mechanism?

12) A digital camera is used to take pictures. When switched on, the flash on a digital camera requires some time before it is ready to operate.

When ready, a green light LED is illuminated.



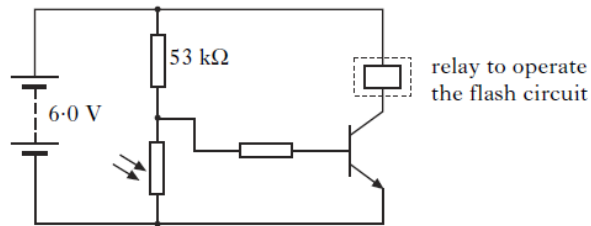
The part of the circuit used to control the LED is shown below. The voltage at point X is initially 0V.



- a) Describe what happens to the voltage at point X when the switch S is closed.
- b) The camera manufacturer wants to change the time taken for the flash to be ready to operate.
- State **two** changes which could be made to the above circuit so that the time for the green LED to come on is reduced.

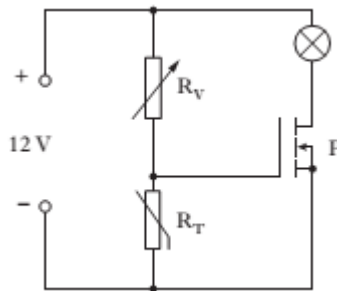
c) The camera flash is designed to operate under dim lighting conditions.

Another part of the circuit for the camera flash is shown below. The flash only operates when a minimum voltage of 0.7V occurs across the LDR.



- i) Calculate the voltage across the $53\text{k}\Omega$ resistor when the voltage across the LDR is 0.7V.
- ii) Calculate the **minimum** resistance of the LDR that allows the flash to operate in dim conditions.

13) The circuit shown below switches a warning lamp on or off depending on the temperature. R_V is set at 5600Ω .



- (a) Name **component P**.
- (b) As the temperature increases the resistance of thermistor R_T decreases.
What happens to the voltage across R_T as the temperature increases?
- (c) When the voltage applied to component P is equal to or greater than 2.4V, component P switches on and the warning lamp lights.
At this point **calculate**:
 - i) The voltage across R_V .
 - ii) The resistance of R_T .
- (d) The temperature of R_T now decreases.
Will the lamp stay **on or off**?