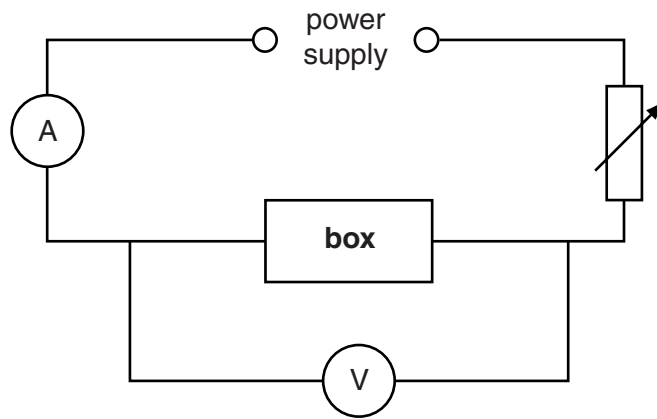


1 (a) Vic has a sealed box containing an electronic component.

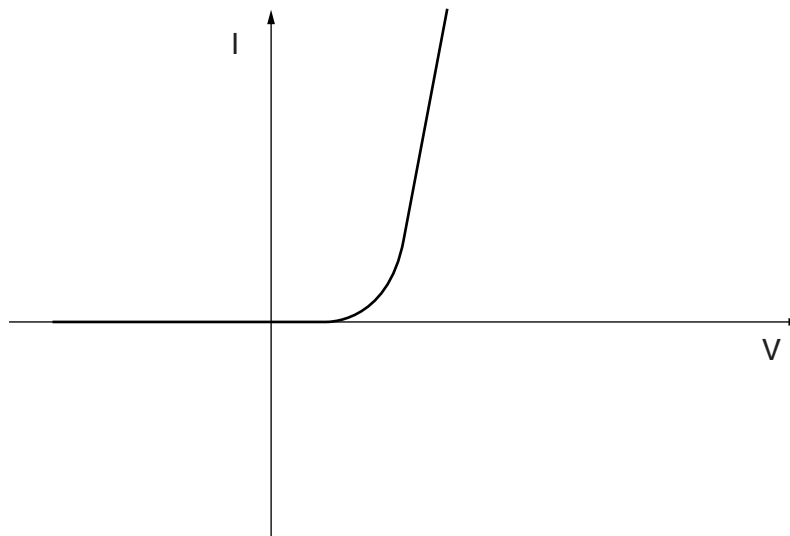
The box has lost its label.

He connects a circuit containing the component in the box.



He changes the voltage across the box and measures the current.

Look at the graph of his measurements.



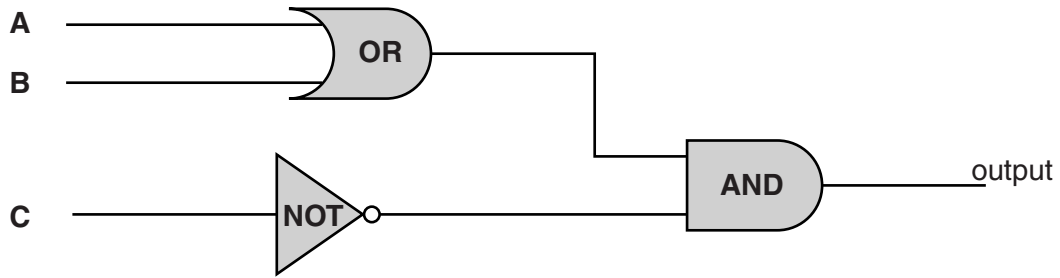
Write down the name of the component in the box.

.....

Explain your answer, using ideas about resistance.

.....
.....

(b) Look at the logic circuit.



(i) Complete the truth table for the logic circuit.

A	B	C	Output
0	0	0	0
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	
1	0	1	
0	1	1	
1	1	1	

[1]

(ii) The circuit is used by a gardener in his greenhouse to control a fan.

A is a temperature sensor hot = 1

B is a moisture sensor wet = 1

C is a light sensor light = 1

What conditions are necessary for the fan to operate?

.....

.....

.....

..... [2]

(iii) The fan operates from the mains.

A relay must be connected between the output of the logic gate and the fan circuit.

Explain why.

.....

.....

.....

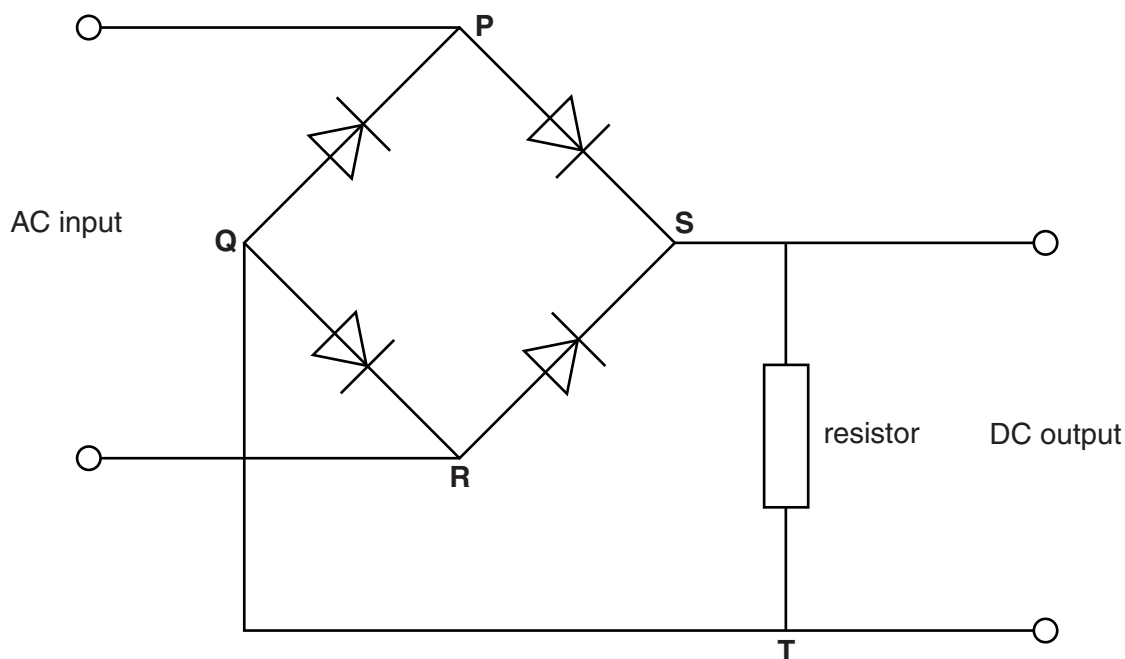
..... [2]

[Total: 7]

2 Computers will only work with a DC supply.

A bridge rectifier changes AC to DC.

Look at the diagram.



(a) Complete the following sentences to explain how this circuit changes AC to DC.

When the AC input makes **P** positive and **R** negative, the current

.....
.....

When the AC input makes **P** negative and **R** positive, the current

.....
.....

[2]

(b) A large capacitor is connected in parallel with the resistor.

Describe what effect this has on the DC output.

You may draw a diagram if you wish.

.....

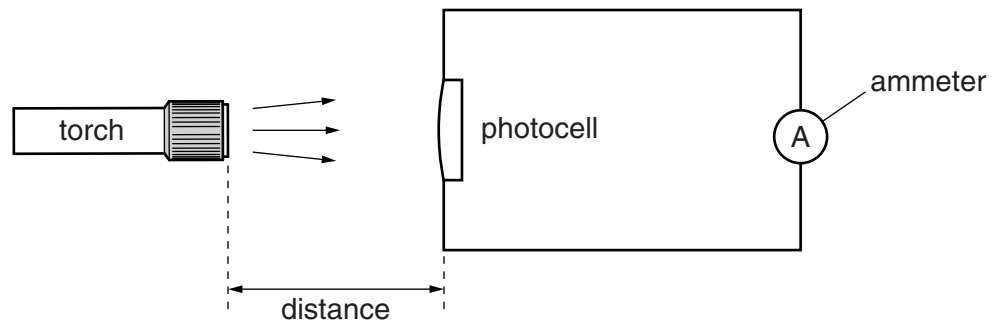
.....

..... [1]

[Total: 3]

3 John investigates the current produced by a photocell.

Look at the circuit he uses.



John moves the torch away from the photocell.

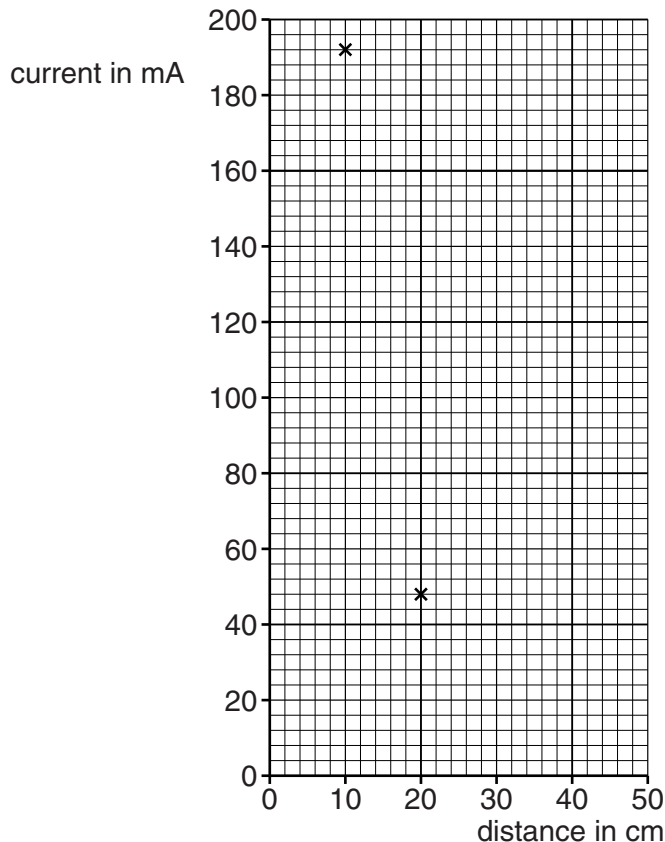
This changes the current through the ammeter.

Look at his results.

Distance between torch and photocell in cm	10	20	30	40	50
Current in mA	192	48		12	8

(a) (i) Use the graph to help predict the current in mA for a distance of 30 cm.

The first two results in the table have been plotted for you.



Current for a distance of 30 cm = mA [2]

(ii) Write a detailed conclusion about the relationship between the current and the distance between the torch and the photocell.

.....
.....
.....
..... [2]

(iii) Explain why this trend happens.

.....
..... [1]

(b) Light is absorbed by photocells and electricity is produced.

Explain how a photocell produces electricity.

.....

.....

..... [2]

[Total: 7]

4 This question is about photocells.

(a) Describe how **light** produces an **electrical current** in a photocell.

.....

.....

.....

.....

..... [3]

5 This question is about paying for electricity.


- (a) Alice checks the information on her electricity bill. She also looks at information about some of her appliances.

Appliance	Average power in kW	Time used per week in hours
cooker	2.0	6
immersion heater	3.0	12
central heating	6.0	18

Habib also looks at the information.


He sees from the bill that the price of a unit of electricity is 20p.

Using the immersion heater will cost twice as much a week as using the cooker.



Alice

Using the immersion heater will cost nearly £5 more a week than using the cooker.



Habib

Complete calculations to show who is correct.

.....

.....

.....

.....

Who is correct? [3]

(b) The electricity that Alice and Habib use comes from the National Grid.

The National Grid has many power lines at high voltage.

The National Grid uses two high voltages.

- $4.00 \times 10^5 \text{V}$
- $2.75 \times 10^5 \text{V}$

Both voltages are used to transfer $2.0 \times 10^9 \text{W}$ of electrical power.

Calculate the current in the power lines at each voltage and explain why the higher voltage is better for power transmission through the National Grid.

At a voltage of $4.00 \times 10^5 \text{V}$

.....

.....

.....

answer A

At a voltage of $2.75 \times 10^5 \text{V}$

.....

.....

.....

answer A

Explanation

.....

.....

.....

..... [3]