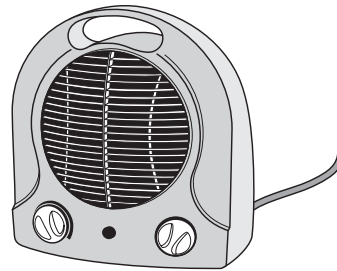


ANALOGUE ELECTRONICS QUESTIONS

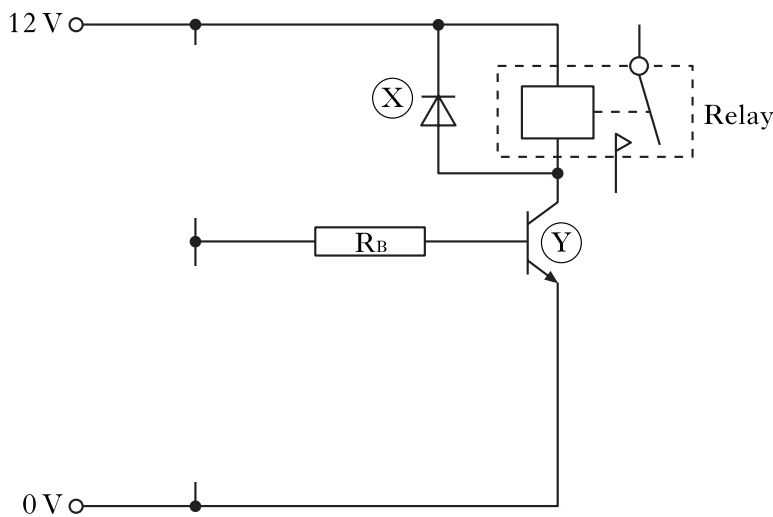
Question 1

2007 General Paper

A heater has variable temperature control.



An incomplete electronic circuit for the heater control is shown.

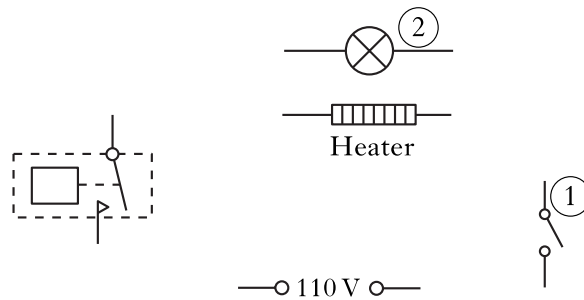


- (a) (i) Complete the circuit above by inserting the symbol for a variable resistor and a thermistor to form a **cold sensor**.
 - (ii) State the name of the components (X) and (Y).
- Component (X) _____
- Component (Y) _____
- (b) Determine, with reference to the Data Booklet, the resistance of the thermistor type 3 at 0°C.

Question 1 continued

(c) The relay is part of a 110 V electrical circuit which is made up of component (1) and the heater connected in series. Component (2) is connected in parallel with the heater.

(i) Complete the wiring of this electrical circuit.



(ii) State the name of components (1) and (2).

Component (1) _____

Component (2) _____

(iii) State why a relay is required to switch on the heater circuit.

(d) The heater is rated at 3.3 kW operating at 110 V. Calculate:

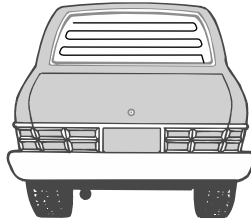
(i) the heater current;

(ii) the resistance of the heater.

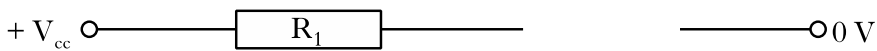
Question 2

2008 General Paper

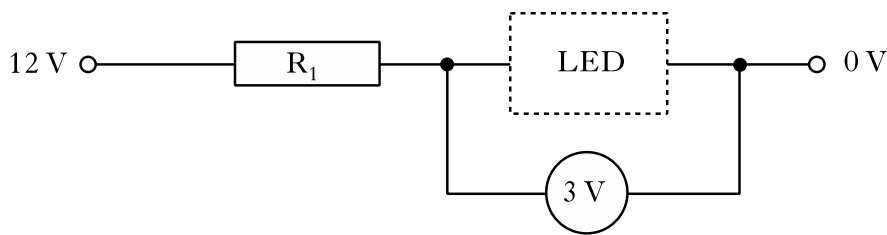
A Light Emitting Diode (LED) is used to indicate when the heated rear windscreen of a car is switched on.



(a) Complete the circuit below by inserting correctly the symbol for an LED.



With a supply voltage of 12 V the circuit has a current of 5 mA. The voltage across the LED is 3 V.



(b) Determine the voltage drop across the resistor R_1 .

(c) Calculate the value of resistor R_1 .

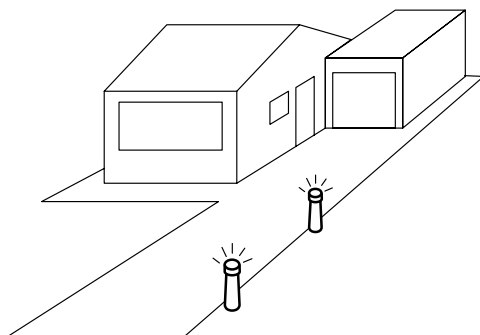
(d) State, with reference to the Data Booklet, the colour code for a 6k7 resistor.

1st Colour	2nd Colour	3rd Colour

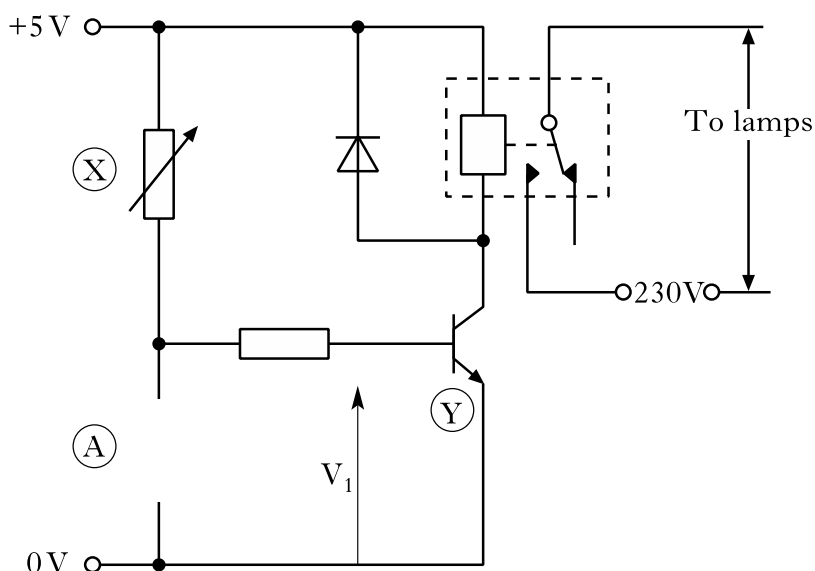
Question 3

2008 General Paper

A house owner decides to install two lamps on her driveway.



The lamps are connected to a control circuit shown below.



- (a) (i) Complete the circuit above by drawing the symbol for a Light Dependent Resistor (LDR) at position (A).
- (ii) State the name of components (X) and (Y).
- (X) _____ (Y) _____
- (iii) Determine, with reference to the Data Booklet, the light level of the LDR when the resistance is $10\text{ k}\Omega$.
- _____

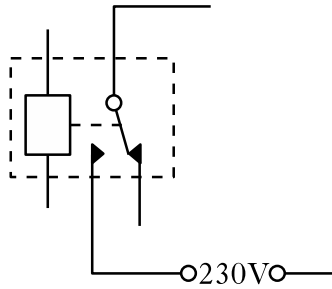
Component (Y) is fully switched when $V_1 = 0.7\text{ V}$.

- (b) State the name of this condition.
- _____

Question 3 continued

2008 General Paper

- (c) Using the symbol \otimes to represent a lamp, complete the diagram below to show the two lamps connected in **parallel** to the relay.



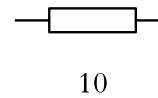
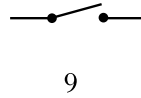
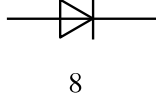
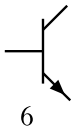
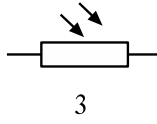
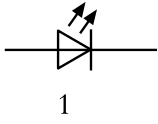
Each lamp has a rating of 230 V, 200 W.

- (d) Calculate the current used by each lamp.

Question 4

2009 General Paper

(a) The following electronic symbols have been numbered 1 to 10.



Complete the table below by inserting the symbol number for each item.

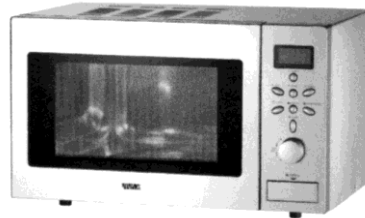
The first one has been completed for you.

Item	Symbol Number
Resistor	10
Lamp	
LED	
Motor	
Transistor	
Switch	
LDR	

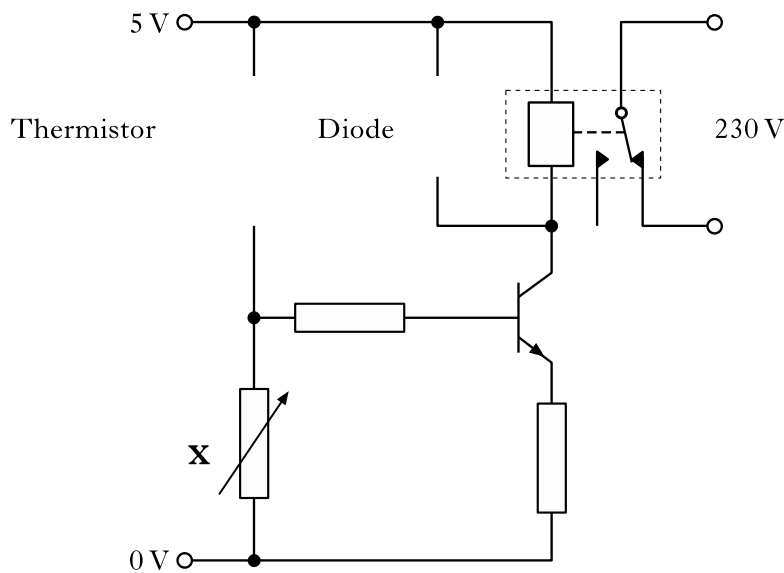
Question 5

2009 General Paper

A microwave oven is fitted with a safety circuit that will automatically switch off if the outside surface gets too warm.



The incomplete safety circuit is shown below.



- (a) Draw the symbols for the two components named above to complete the safety circuit.
- (b) State the name of component **X**.

- (c) Determine, with reference to the Data Booklet, the temperature **range** of a **type 1** thermistor.
_____ °C to _____ °C.
- (d) State the saturation voltage of a transistor.

V_{bc} _____

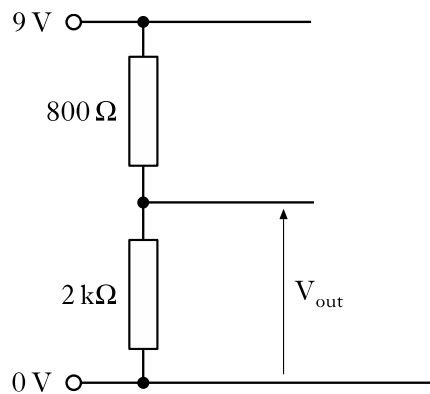
Question 5 continued

2009 General Paper

- (e) (i) Calculate the current flowing through the relay if the coil has a resistance of $400\ \Omega$ and a voltage drop of $4\ \text{V}$.
- (ii) Calculate the power used by the relay coil.

Resistors are used in many electronic circuits.

- (f) (i) Calculate the voltage V_{out} in the circuit shown below.



- (ii) State the name of the series resistor arrangement shown above.
-

Question 6

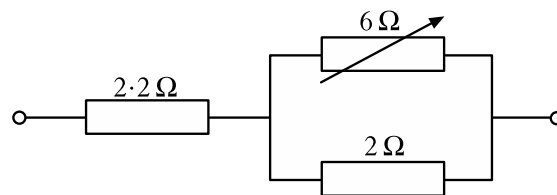
2010 General Paper

A hire shop in a popular Spanish resort rents out electric scooters.



The scooters use rechargeable batteries.

(a) Part of a resistor arrangement for the battery charger is shown.

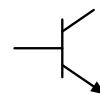
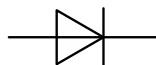
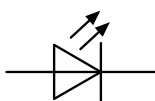


(i) Calculate the resistance of the **parallel** branch shown above.

(ii) Calculate the **total** circuit resistance for the arrangement shown above.

Other electronic components are used in the battery charger.

(b) State the name of the electronic components shown below.



1 _____ 2 _____ 3 _____

Question 6 continued

2010 General Paper

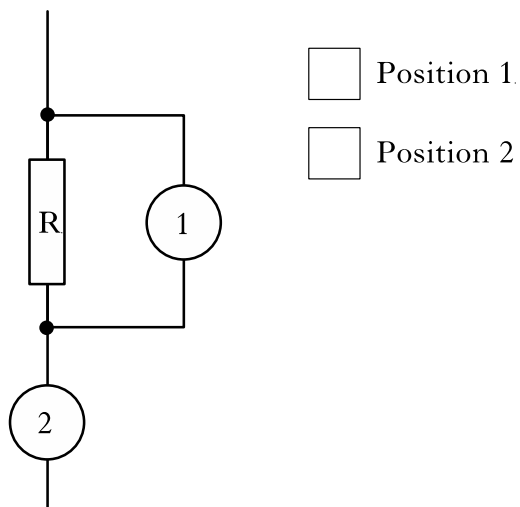
The current flowing through the $2.2\ \Omega$ resistor is 0.6 amps.

(c) (i) Calculate the voltage across the $2.2\ \Omega$ resistor.

(ii) Calculate the power used by the $2.2\ \Omega$ resistor.

(iii) Draw the symbol for an ammeter.

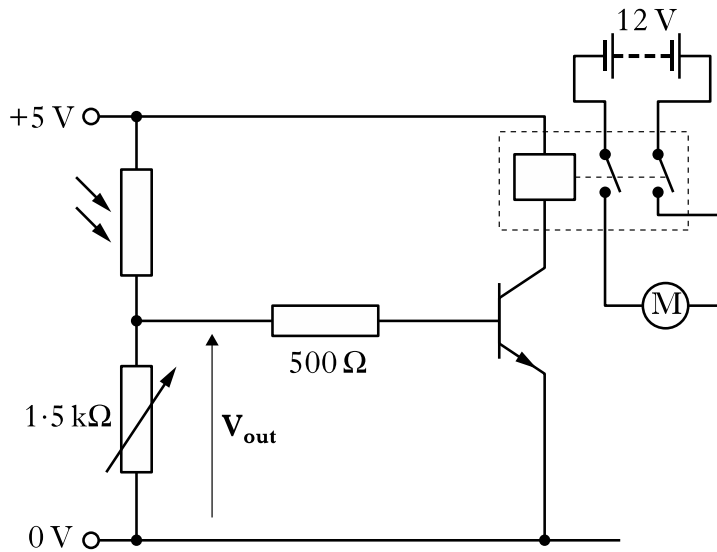
(d) (i) Select (✓) the correct position of a voltmeter to measure the voltage across the resistor R.



(ii) Draw the symbol for a voltmeter.

Question 7

A prototype electronic circuit is shown below.



(a) State the full name of an LDR.

The variable resistor and the LDR form a voltage divider sub-system.

(b) Describe the operation of the **voltage divider sub-system**.

(c) (i) Determine, with reference to the Data Booklet, the resistance of the LDR at 300 lux.

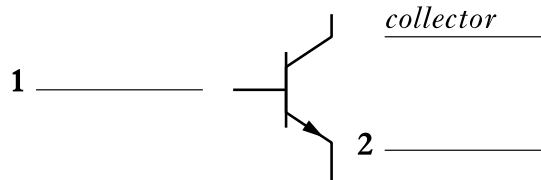
(ii) Calculate V_{out} from the voltage divider sub-system at 300 lux.

Question 7 continued

2011 General Paper

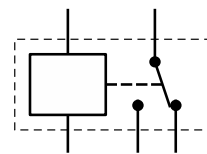
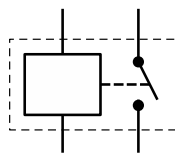
- (d) Complete the circuit diagram to show how a diode could be used to protect the transistor from back-voltage (e.m.f.).
- (e) The transistor is fully switched on when V_{BE} is 0.7 V.
- (i) State the name given to this condition.

- (ii) The symbol for a transistor is shown below. Label the connections 1 and 2.



- (f) (i) Explain why a relay is often used with electronic circuits.

- (ii) A DPST (double pole single throw) relay is used in the circuit. State the names of the types of relays shown below.

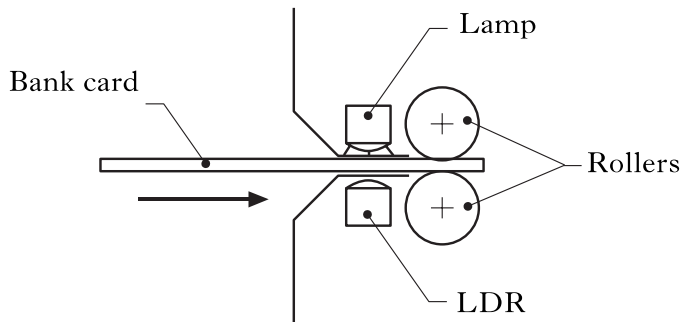


- (iii) State the name of the relay type which would allow forward **and** backward control of a motor.

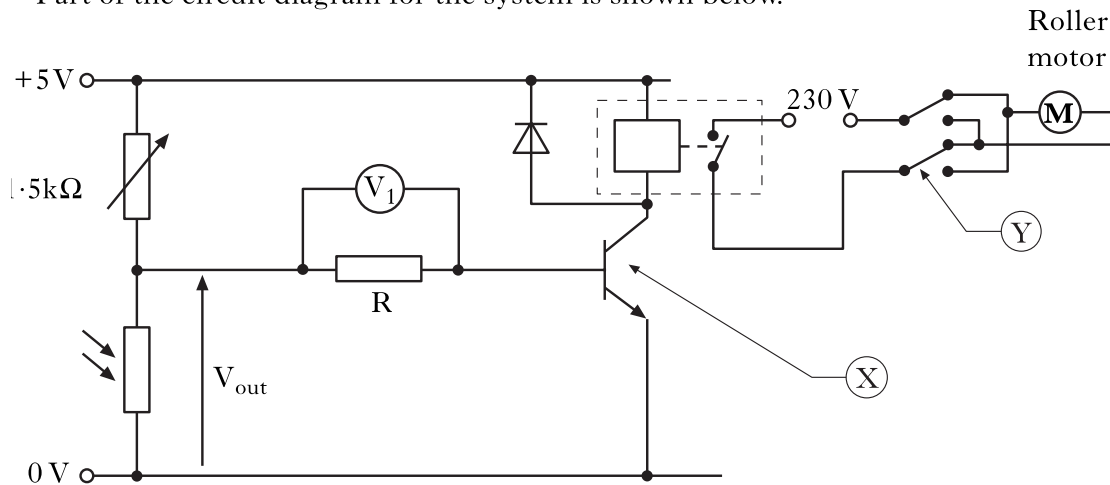
Question 8

2007 Credit Paper

An ATM cashpoint detects a bank card using a darkness sensor. Rubber rollers then grip the card and feed it into the machine for reading.



Part of the circuit diagram for the system is shown below.



- (a) State the purpose of the variable resistor in the voltage divider sub-system.

- (b) State the **full** name of Component (Y).

- (c) With reference to the circuit diagram, state the **function** of the following components.
 - (i) Component (X) function

 - (ii) Component (Y) function

Question 8 continued

The variable resistor is set to $1.5 \text{ k}\Omega$ and the light level is at 200 lux.

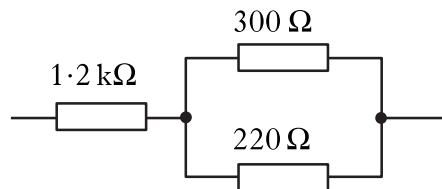
- (d) (i) Determine, with reference to the Data Booklet, the resistance of the LDR.

-
- (ii) Calculate the output of the voltage divider sub-system, V_{out} .

- (iii) Determine the voltage V_1 when component \textcircled{X} is saturated.

- (iv) State the purpose of resistor R in the circuit.
-

Another part of the circuit uses the resistor network shown.

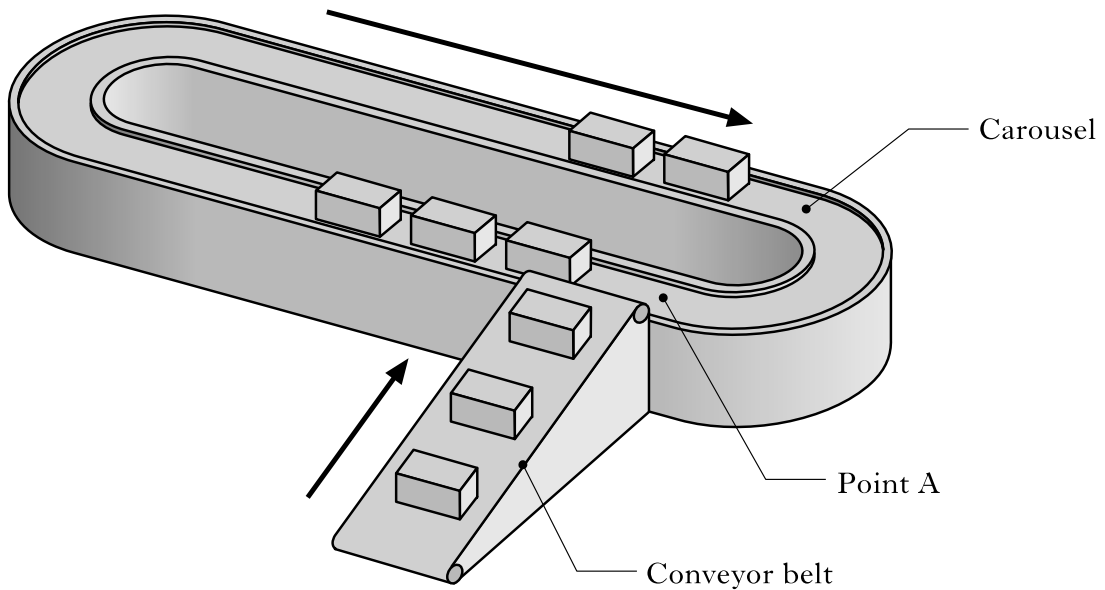


- (e) Calculate the total resistance of this network.

Question 9

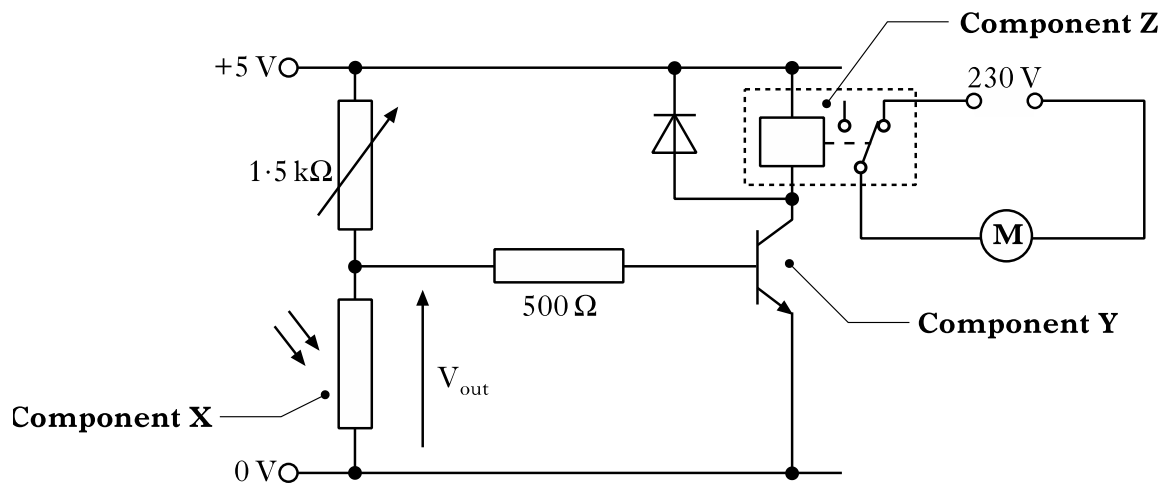
2008 Credit Paper

Detail of a luggage delivery system used in an airport is shown below.



Bags are added to the carousel by a conveyor belt. If bags are detected at point A, the conveyor belt will automatically halt until there is space on the carousel for more bags.

The control circuit is shown below.



(a) State the purpose of the variable resistor in the circuit.

(b) State the **full name** of component X.

Question 9 continued

- (c) Determine, with reference to the Data Booklet, the resistance of component X, when the light level is at 50 lux.

- (d) Describe the operation of this voltage divider sub-system.

- (e) Calculate the value V_{out} from the voltage divider sub-system at 50 lux.

- (f) State the name of component Y.

- (g) State the voltage at which component Y saturates.

- (h) Calculate the current through the $500\ \Omega$ resistor, when component Y is saturated.

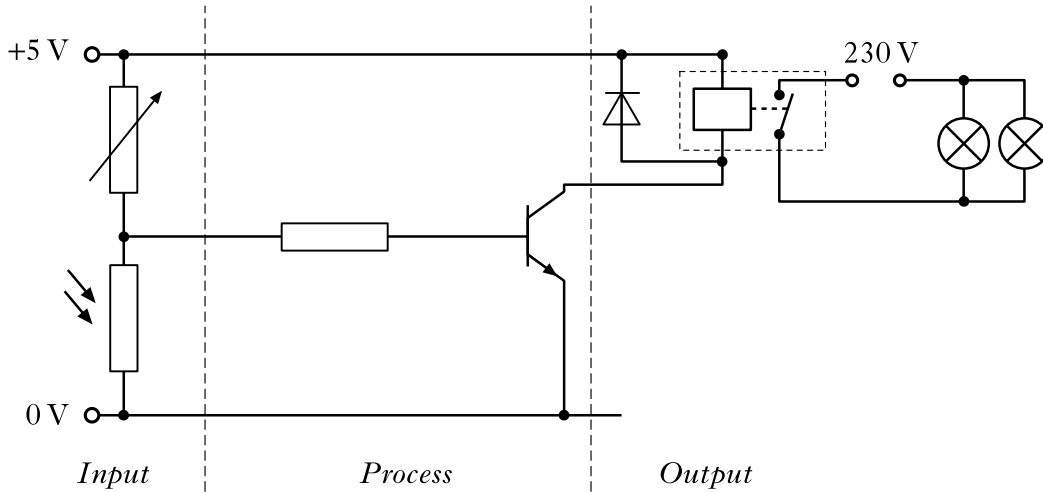
- (i) State the purpose of the diode in the control circuit.

- (j) State the name of component Z.

Question 10

2009 Credit Paper

An automatic lighting system has been developed so that it only switches on when someone is sensed in the room. The circuit diagram is shown below.



(a) Describe, using appropriate terminology, the operation of the:

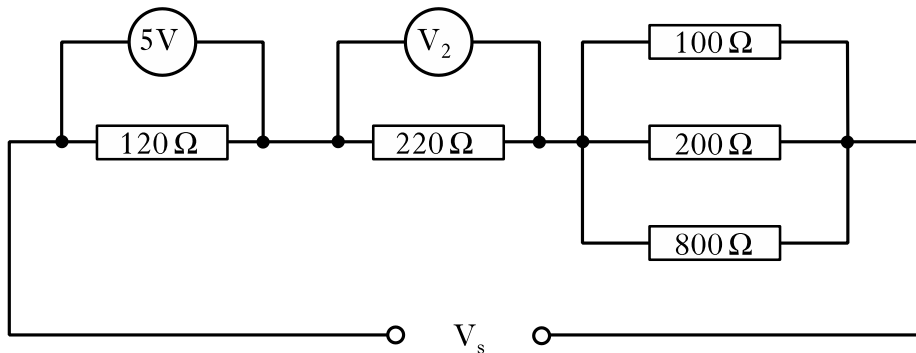
(i) Input sub-system _____

(ii) Process sub-system _____

(iii) Output sub-system _____

Question 10 continued

Another part of the lighting system uses the following circuit.



(b) Calculate:

(i) the current through the 120 Ω resistor;

(ii) the voltage V₂;

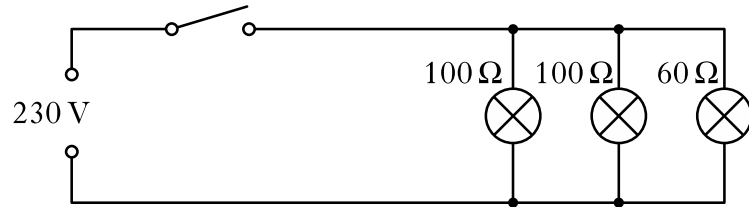
(iii) the total resistance of the three parallel resistors;

(iv) the supply voltage V_s.

Question 11

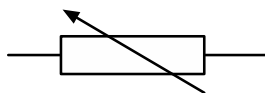
2010 Credit Paper

An interior designer wants three lamps to come on when a switch is activated. The lighting circuit is shown below.



- (a) State two reasons why it is good practice to have the lamps wired in **parallel** rather than in series.
- (i) _____
- (ii) _____
- (b) Calculate, showing all working and units, the total resistance of the lighting circuit shown above.

The designer wants the brightness of the lights to be altered using the following component.

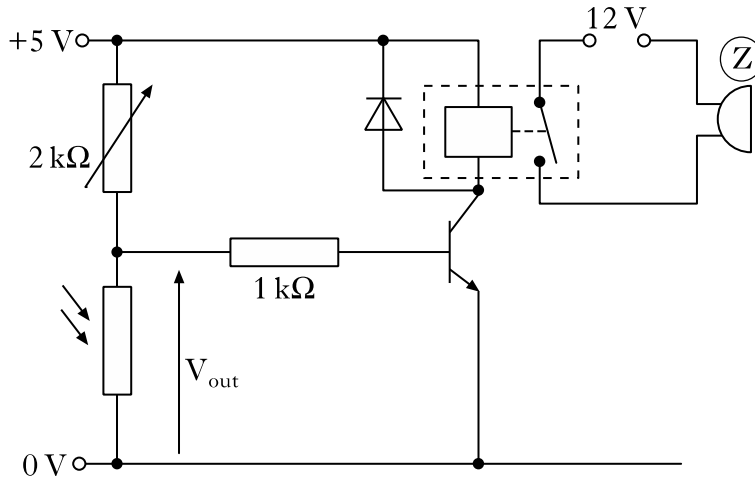


- (c) State the name of the component shown above.
- _____
- (d) State the name of the device that is used to measure current in a circuit.
- _____

Question 12

2010 Credit Paper

A prototype circuit for a parking sensor in a car is shown below.



(a) (i) State the name of component (Z) shown in the circuit above.

(ii) State the type of relay shown in the circuit above.

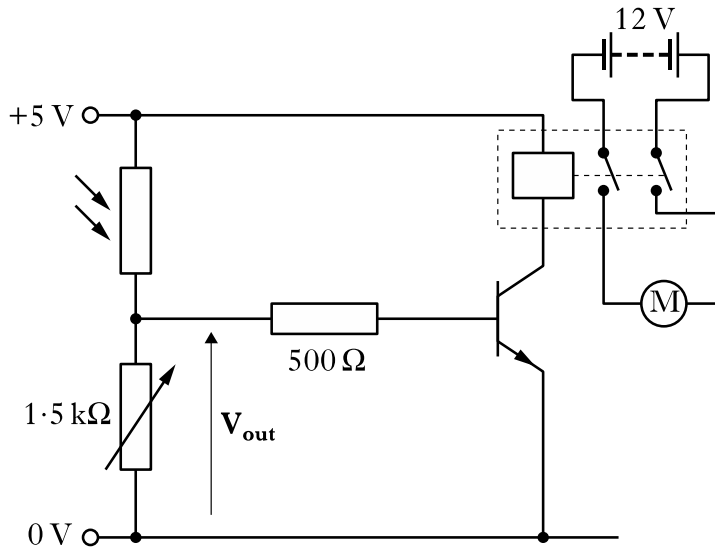
(b) Describe the operation of the circuit.

As light level drops

(c) Calculate, with reference to the Data Booklet, the value of V_{out} when the light level on the LDR is 9 lux.

Question 13

A prototype electronic circuit is shown below.



- (a) State the full name of an LDR.

The variable resistor and the LDR form a voltage divider sub-system.

- (b) Describe the operation of the **voltage divider sub-system**.

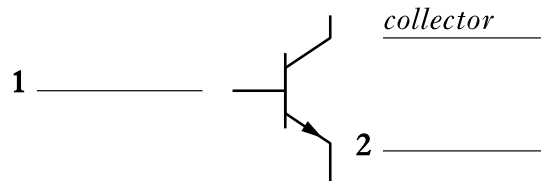
- (c) (i) Determine, with reference to the Data Booklet, the resistance of the LDR at 300 lux.

- (ii) Calculate V_{out} from the voltage divider sub-system at 300 lux.

Question 13 continued

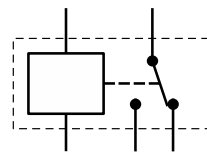
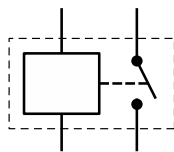
- (d) Complete the circuit diagram to show how a diode could be used to protect the transistor from back-voltage (e.m.f.).
- (e) The transistor is fully switched on when V_{BE} is 0.7 V.
- (i) State the name given to this condition.

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- (f) (i) Explain why a relay is often used with electronic circuits.

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- (iii) State the name of the relay type which would allow forward **and** backward control of a motor.
