



Physics
Standard Grade

Unit 4
Electronics
General & Credit Past Paper
Questions

Record Sheet

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5. Analogue Processes	21				
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RED - I don't understand the question

I NEED HELP!

AMBER - I understand most of the question

I NEED TO REVISE A LITTLE MORE!

GREEN - I got the correct answer first time!!

I UNDERSTAND THIS TOPIC

General Level

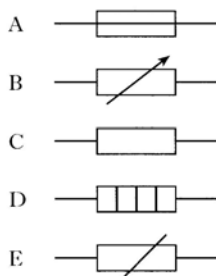
Answer questions in your Homework Jotter.

Show working for each question.

KU	PS
1	1
1	1
1	1
1	1
1	1
1	1
1	1
1	1

1.

Which of the following is the circuit symbol for a fuse?



2.

A baby alarm needs an output device that transforms electrical energy into sound energy.

Which of the following is suitable?

- A Electric motor
- B LED
- C Loudspeaker
- D Relay
- E Solenoid

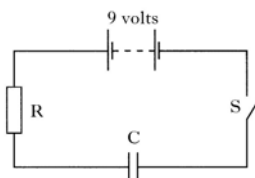
3.

What is the main energy transformation that takes place in a thermocouple?

- A Heat to light
- B Electrical to heat
- C Heat to electrical
- D Light to heat
- E Heat to chemical

4.

An uncharged capacitor C is connected to a resistor R, a 9 volt battery and a switch S as shown.



When switch S is closed the voltage across the capacitor

- A remains at 0 volt
- B gradually rises from 0 volt to 9 volts
- C immediately drops from 9 volts to 0 volt
- D gradually drops from 9 volts to 0 volt
- E remains at 9 volts.

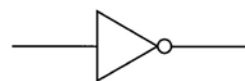
5.

Which of the following electronic devices contains a counter circuit?

- A Amplifier
- B Intercom
- C Burglar alarm
- D Computer
- E Radio receiver

6.

Identify the circuit symbol shown.



- A AND gate
- B OR gate
- C NOT gate
- D diode
- E LED

7.

Which of the following electronic devices contains a counter circuit?

- A Automatic parking light
- B Digital stopwatch
- C Electronic thermometer
- D Intercom
- E Radio receiver

8.

The purpose of the amplifier in a personal stereo is to

- A convert an analogue signal to a digital signal
- B transform an electrical signal to a sound signal
- C transform a sound signal to an electrical signal
- D increase the frequency of an electrical signal
- E increase the amplitude of an electrical signal.

General Level

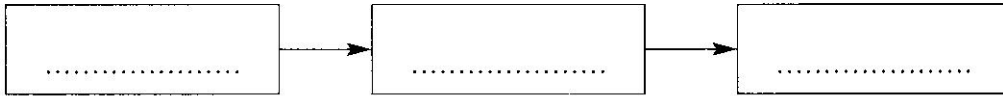
Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
3	
	1
	1
1	

9.

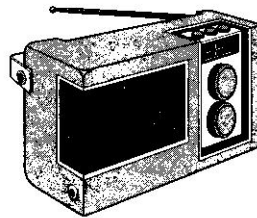
A radio and a computer mouse are examples of electronic systems.

- (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 be either analogue or digital.

- (i) The output signal from a radio is analogue.



Draw an analogue signal.

- (ii) The output signal from a computer mouse is digital.



Draw a digital signal.

10.

Draw the circuit symbol for a light emitting diode (LED)

General Level

Answer questions in your Homework Jotter.

Show working for each question.

KU	PS
1	
1	
1	
	2
	2
2	
1	
	1

11. The list below contains input and output devices.

capacitor	LDR (light dependent resistor)	switch
lamp	LED (light emitting diode)	loudspeaker
microphone	7 segment display	relay
solenoid	electric motor	thermistor

- (a) **From the list**, select an input device for **each** of the applications below.

(i) A camera light level indicator.

(ii) An ice sensor for a car.

(iii) A public announcement system at a railway station.

- (b) (i) Select **two** output devices from the list that transform electrical energy to light.

Device 1

Device 2

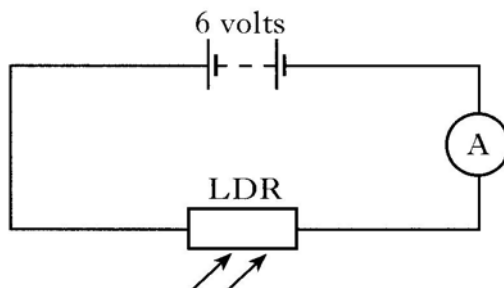
(ii) When a current passes through a conductor, there is a magnetic field created round the conductor.

Select **two** output devices from the list that make use of this effect.

Device 1

Device 2

12. A company makes sunglasses. The company uses a light meter to measure how much light passes through different types of glass. The light meter contains an ammeter, an LDR and a 6 volt battery as shown.



- (a) For one type of glass, the current in the circuit is 0.005 ampere.

(i) Calculate the resistance of the LDR.

(ii) The intensity of the light shining on the LDR is increased.

(A) State what happens to the resistance of the LDR.

(B) State what happens to the current in the circuit.

General Level

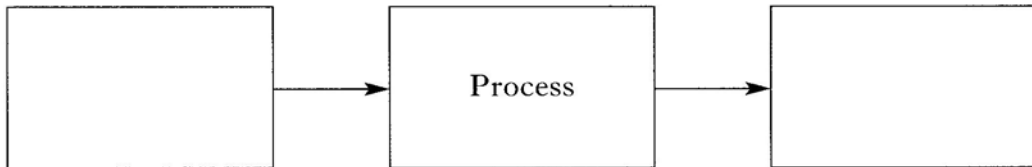
Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
1	
	1
	1
1	
	3

13. A student designs an electronic system that produces a sound when the temperature in a fish tank falls below a certain value.

(a) A block diagram of the system is shown.

Complete the block diagram by filling in the two missing labels.



(b) The following components are available to the student.

- | | | |
|--------------------|-------------------|-----------------------|
| loudspeaker | solenoid | microphone |
| thermistor | solar cell | electric motor |

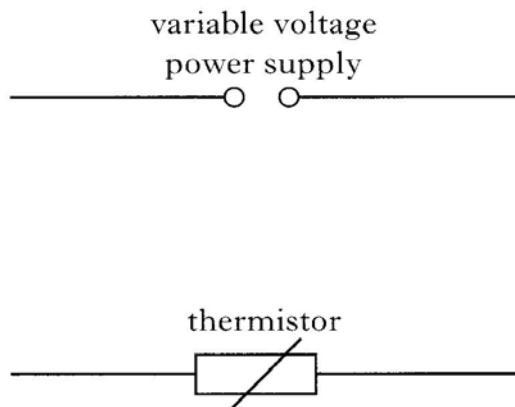
- (i) Which device **from the list** is suitable for sensing a change in temperature?
- (ii) Which device **from the list** is suitable for producing a sound?

(c) The student uses a transistor as the process device.

In the space below, draw the circuit symbol for a transistor.

14. A variable power supply, an ammeter and a voltmeter are used to investigate how the current in a thermistor changes as the voltage across the thermistor changes.

(a) Complete the circuit diagram, including the ammeter and voltmeter, to show how the current and voltage measurements are obtained.



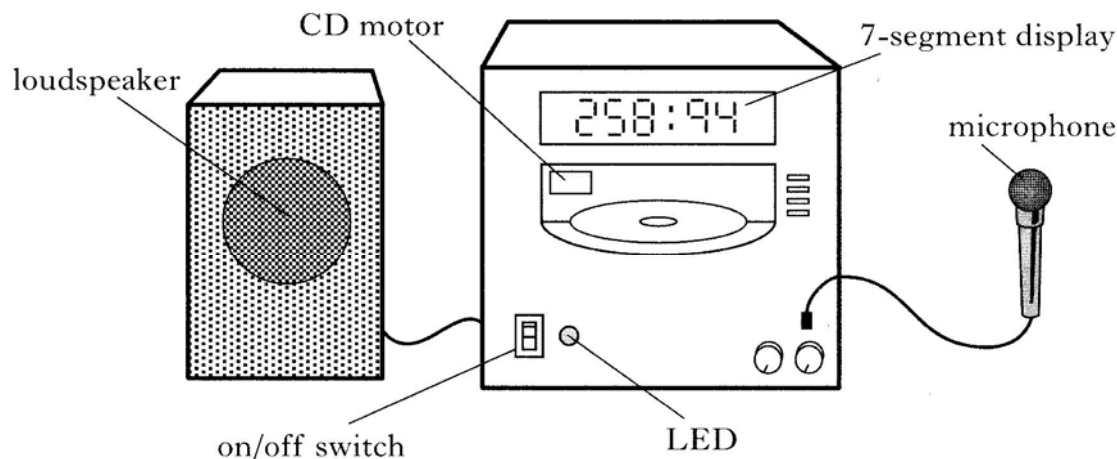
General Level

Answer questions in your Homework Jotter.

Show working for each question.

15.

A karaoke machine contains various input and output devices.



(a) State **two** output devices labelled on the diagram.

- Device 1
- Device 2

(b) State **two** input devices labelled on the diagram.

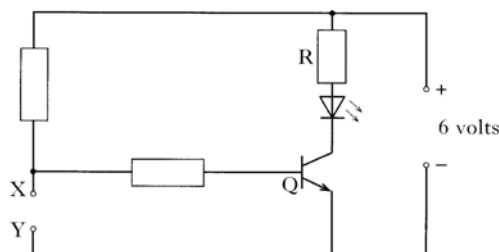
- Device 1
- Device 2

(c) The karaoke machine has an LED.

- (i) State the useful energy transfer that takes place in the LED.
- (ii) In the space below draw the symbol for an LED.

16.

The circuit shown can be used to build models of different electronic devices. This is done by inserting a different component between X and Y for each model.



(a) Three models of electronic devices are built using this circuit. In each model **one** component from the list below is placed between X and Y.

buzzer capacitor lamp LDR LED thermistor

Complete the table to show which component is used for each device.

KU	PS
	2
	2
	1
	1
	3

General Level

Answer questions in your Homework Jotter.

Show working for each question.

17. (B) continued

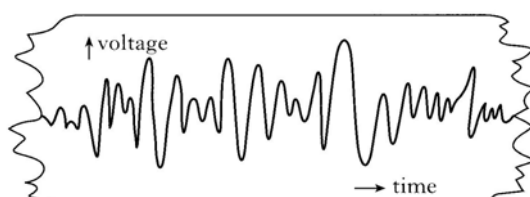
- (B) Complete the truth table for the logic gate that you have named in (b)(i)(A).

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

- (ii) What type of logic gate is X?

18.

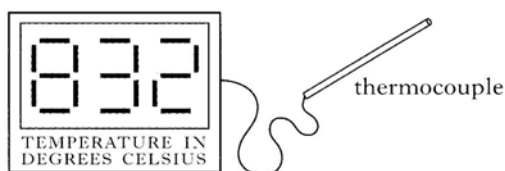
A thermocouple is used as a temperature sensor in a furnace. The thermocouple is attached to a chart recorder that records the voltage generated by the thermocouple over a period of time.



- (a) State the energy transfer that takes place in the thermocouple.
 (b) Circle the correct word in the sentence below.

The output of the chart recorder is $\left. \begin{array}{l} \text{analogue} \\ \text{binary} \\ \text{digital} \end{array} \right\}$.

- (c) The thermocouple is now connected to a circuit that has a digital display.



- (i) The resistance of the circuit is 500 ohms. At a particular temperature, the thermocouple generates a voltage of 0.8 volt.
 Calculate the current in the thermocouple circuit.
 (ii) Name a suitable output device that could be used for the digital display.

KU	PS
2	1
1	1
2	1

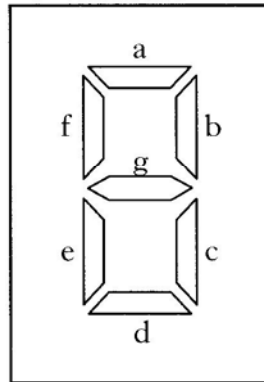
General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
	1
	1
	1

19.

A seven-segment display contains seven light emitting diodes (LEDs) arranged as shown in the diagram. Numbers are displayed by switching segments on or off.



Seven-segment display

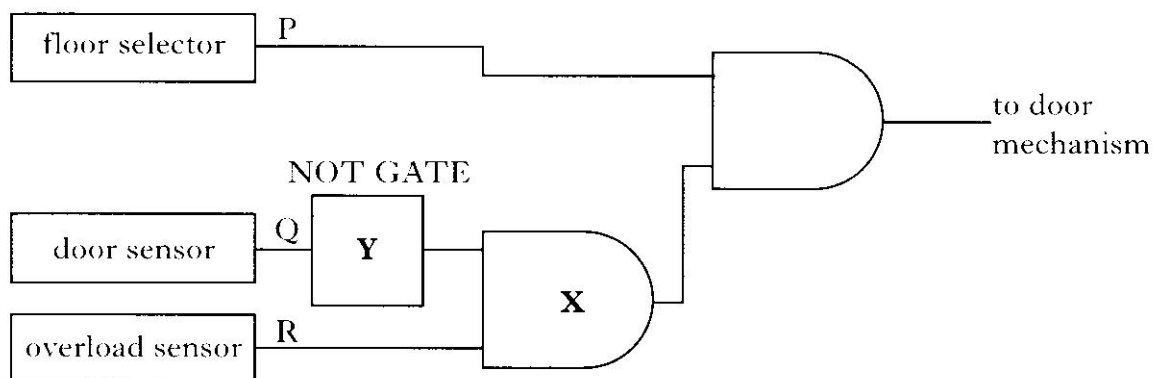
- (a) What number is shown on the seven-segment display when only segments a, c, d, f and g are switched on?
- (b) Draw the circuit symbol for an LED.
- (c) In use, each LED is connected in series with a resistor. State the function of this resistor.

20.

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.



General Level

Answer questions in your Homework Jotter.
Show working for each question.

	KU	PS
	1	
	1	
	1	
		3
		1

20. continued

The logic states are as 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.

Input	Output
0	
1	

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

Logic level at P

Logic level at Q

Logic level at R

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

General Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
	1
1	
1	
2	
1	
	1
2	

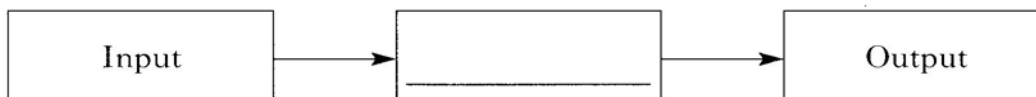
21. A public address system is used in a supermarket to make announcements. These announcements are made using a microphone, and the sound from loudspeakers is heard by customers. A block diagram for this system is shown below.



- (a) Name the input device.
- (b) The voltage gain of the amplifier is 2000. What is meant by voltage gain?
- (c) An input signal applied to the amplifier has a frequency of 5000 hertz. What is the frequency of the output signal?
- (d) The power output of the amplifier is 150 watts. Calculate how many joules of energy are supplied by this amplifier in one minute.

22. A hearing aid is an electronic system.

- (a) An electronic system can be represented by a block diagram as shown. Complete the block diagram by filling in the missing label.



- (b) The hearing aid contains an input device, an amplifier and an output device.
- (i) Select a suitable device **from the list below** to be used as the input.
- | | | |
|---------------------------------|-------------------|-------------------|
| light dependent resistor | switch | microphone |
| thermocouple | solar cell | thermistor |
- (ii) The output device transforms electrical energy into sound energy. State a suitable device to be used as the output.
- (c) During a test of the hearing aid, the voltage generated by the input device is 0.15 volt. The voltage across the output device is 0.45 volt. Calculate the voltage gain of the amplifier.

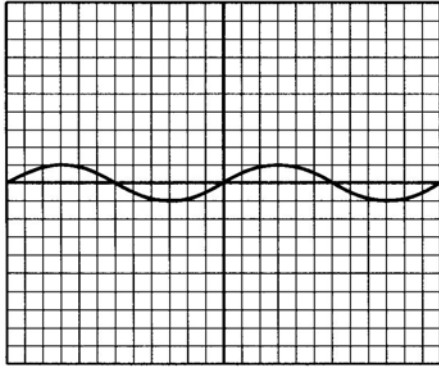
General Level

Answer questions in your Homework Jotter.
Show working for each question.

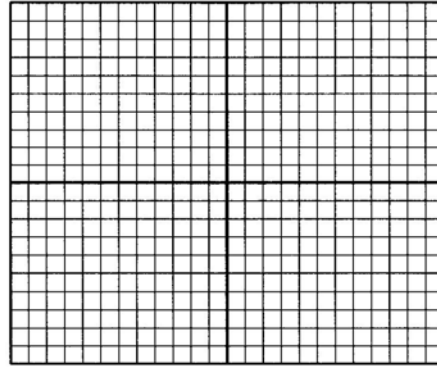
22. continued

- (d) The voltage gain of the amplifier is now set at 5. The input signal to the amplifier is shown below.

Draw the output signal from the amplifier using the same scales.



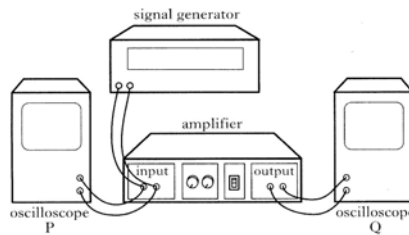
Input signal to amplifier



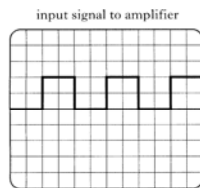
Output signal from amplifier

1

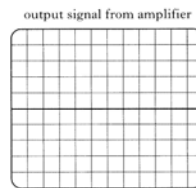
23. A technician uses a signal generator and two oscilloscopes as shown to test an amplifier.



- (a) The screens of both oscilloscopes are shown below.



oscilloscope P



oscilloscope Q

The settings on both oscilloscopes are identical.

- (i) Complete the diagram to show the amplified output signal seen on oscilloscope Q.
(ii) Circle the correct answer in the statement below.

The signal shown on oscilloscope P is $\left\{ \begin{array}{l} \text{analogue} \\ \text{decimal} \\ \text{digital} \end{array} \right\}$.

2

1

- (b) Which of the following devices contains an amplifier?

lamp radio relay transformer

1

Credit Level

Answer questions in your Homework Jotter.

Show working for each question.

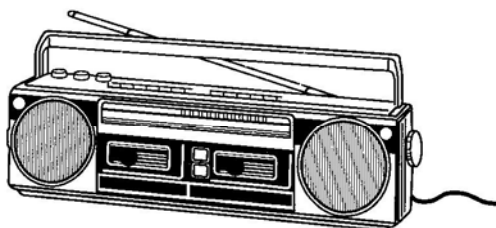
24.

A radio has three types of output device.

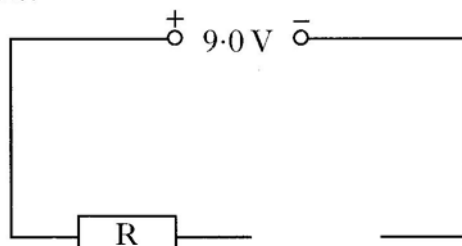
filament lamp

LED

loudspeaker



- (a) Which of these output devices transforms electrical energy into sound energy?
- (b) Which of these output devices is most suitable for illuminating the front panel of the radio?
Explain your choice.
- (c) The LED is connected in series with resistor, R, to the 9.0 V power supply of the radio.



- (i) In the space in the circuit above draw the LED connected correctly.
- (ii) When lit, the voltage across the LED is 2.4 V and the current in the LED is 20 mA.
Calculate the resistance of R.

KU	PS
	1
	2
	2
	3

Credit Level

Answer questions in your Homework Jotter.

Show working for each question.

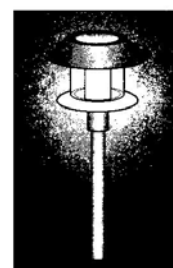
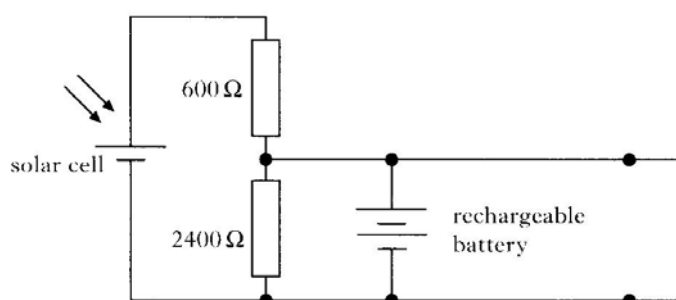
KU	PS
1	2
1	

25.

A high intensity LED is used as a garden light. The light turns on automatically when it becomes dark.

The light also contains a solar cell which charges a rechargeable battery during daylight hours.

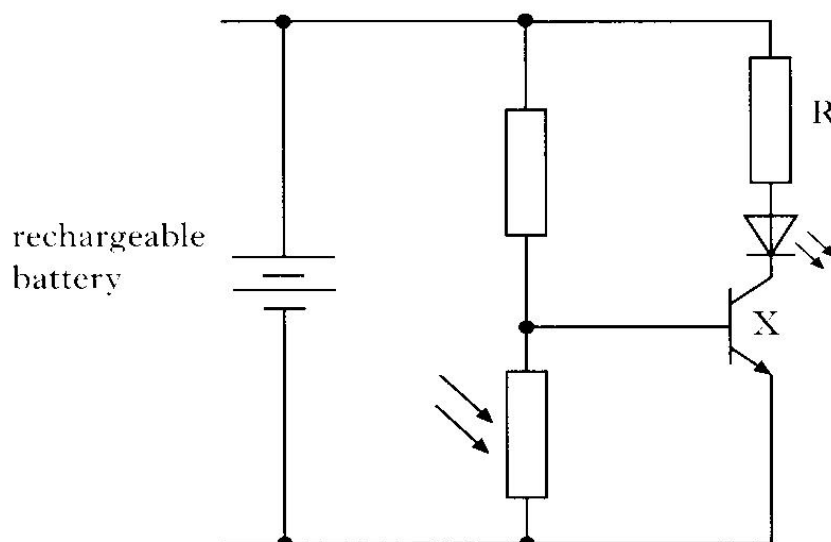
(a) Part of the circuit is shown below.



- (i) State the energy transformation in a solar cell.
- (ii) At a particular light level, the voltage generated by the solar cell is 1.5 V.

Calculate the voltage across the rechargeable battery at this light level.

(b) The LED is switched on using the following circuit.



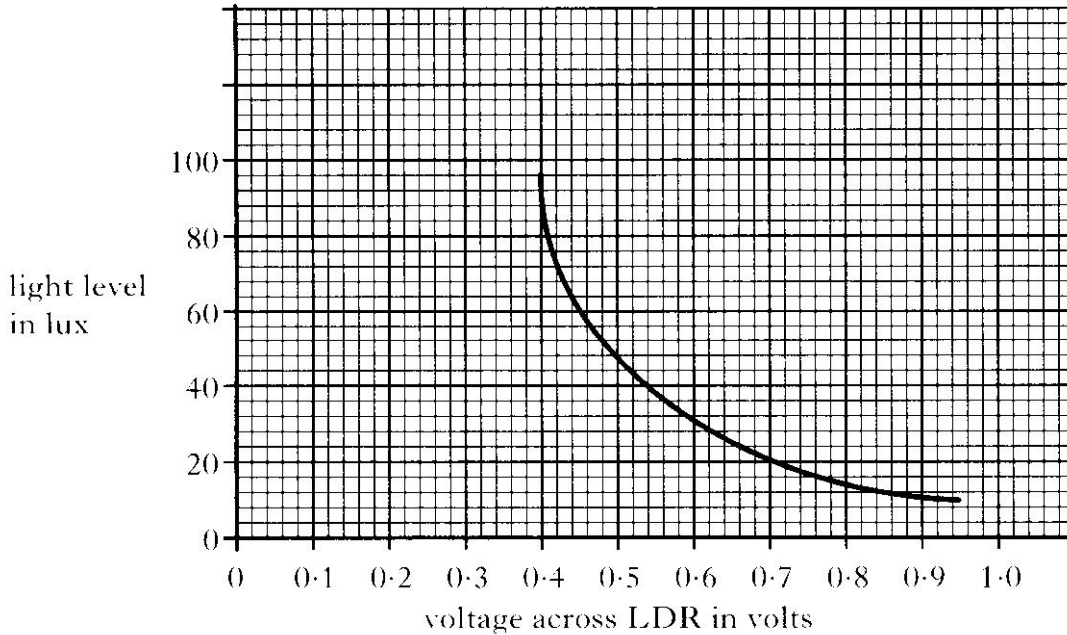
- (i) Name component X.

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

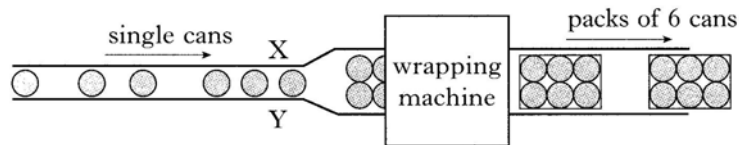
KU	PS
1	1

25. The graph below shows the voltage across the LDR in this circuit for different light levels.
Light level is measured in lux.

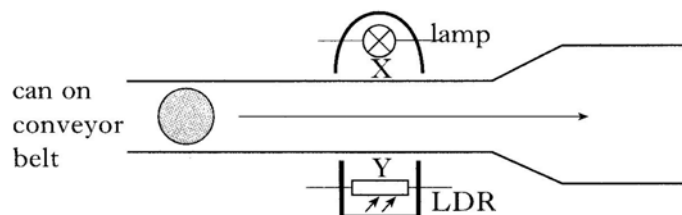


- (ii) For the LED to be lit, the voltage across the LDR must be at least 0.7 V.
What is the maximum light level for the LED to be lit?
- (iii) Explain the purpose of resistor R.

26. A factory wraps cans in packs of six. The cans travel in a single line along a conveyor belt to a wrapping machine which seals them in plastic.



A light beam is set up across X–Y to send a signal to a counter. This signal operates the wrapping machine after six cans are detected.



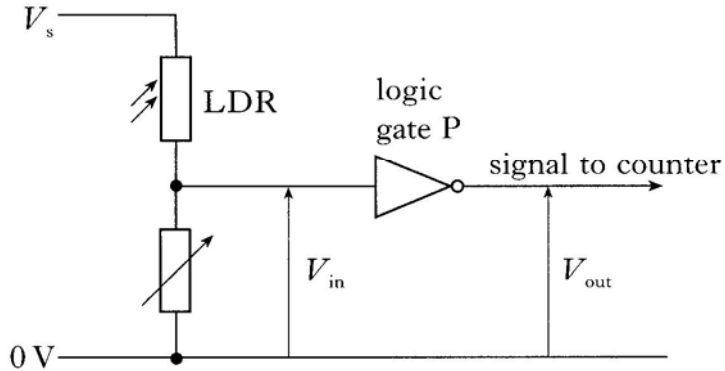
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
1	4

26. continued

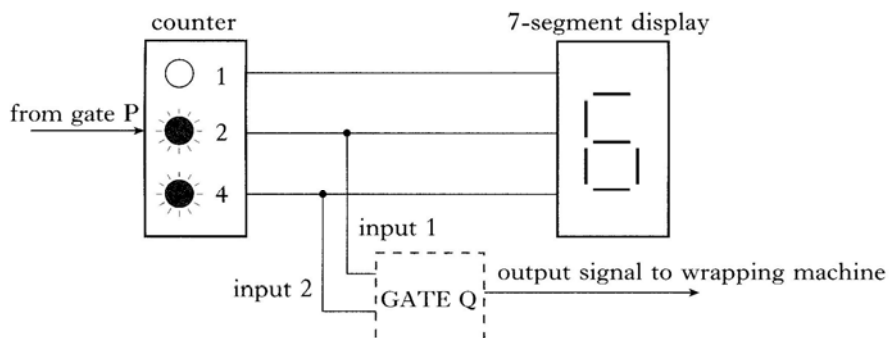
(a) The circuit shown produces the input signal for the counter.



- (i) What type of logic gate is P?
- (ii) Complete the following table, writing either **high** or **low** for each entry, to show what happens as cans pass through the light beam.

	<i>No can in light beam</i>	<i>Can in light beam</i>
Light level at LDR		
Resistance of LDR		
V_{in}		
V_{out}		

(b) The output of gate P goes to the counter. A 7-segment display shows the number of cans at the wrapping machine. Part of this circuit is shown below.



Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
2	1
2	1

26. continued

- (i) Complete each sentence below by choosing a word from the following list.

analogue binary decimal

The output of the counter circuit is

The output of the 7-segment display is

- (ii) Gate Q sends a signal to the wrapping machine when six cans have been detected.

(A) What type of logic gate is Q?

(B) Complete the truth table for gate Q.

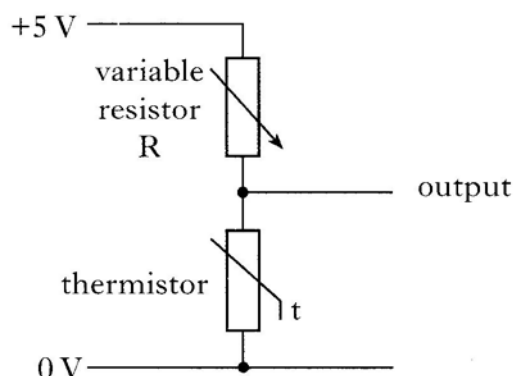
Input 1	Input 2	Output
0	0	
0	1	
1	0	
1	1	

- (iii) There is a short delay to allow six cans to enter the wrapping machine before they are wrapped.

Name a suitable input device that could provide this delay.

27.

A thermistor is used as a temperature sensor in the voltage divider circuit shown below. The circuit is used to sense the temperature of water in a tank. When the temperature of the water in the tank falls below a certain value, the output of the voltage divider causes a switching circuit to operate a heater.



Credit Level

Answer questions in your Homework Jotter.

Show working for each question.

KU	PS
	2
	1
	2

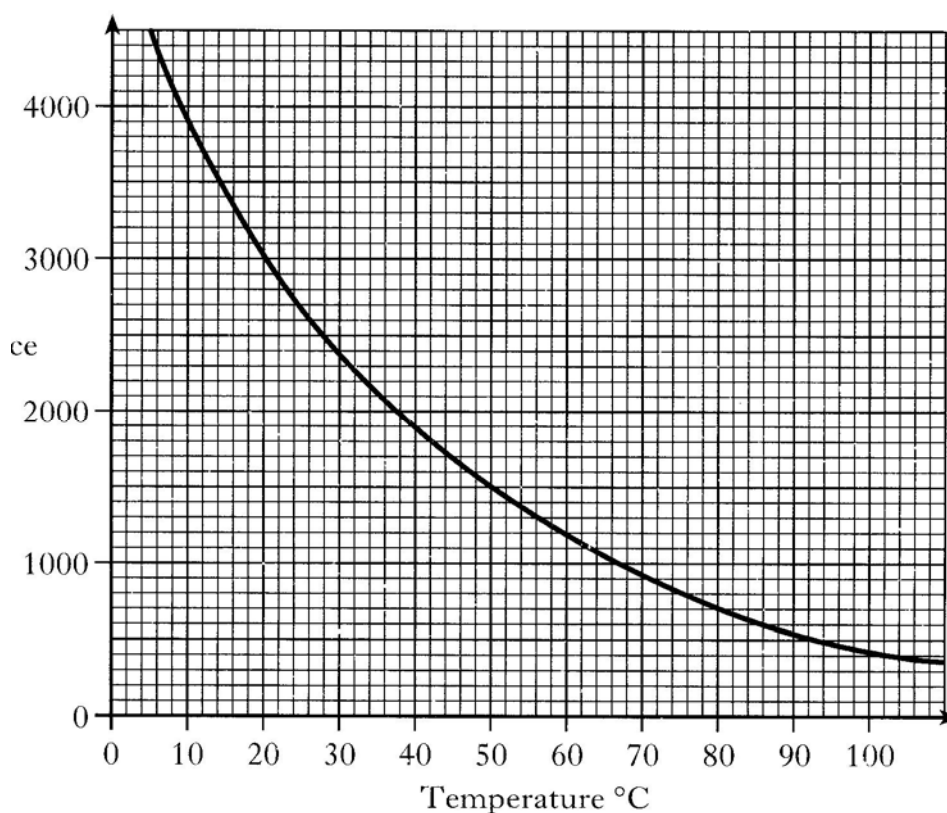
27. continued.

(a) When the voltage across the thermistor reaches 0.7 V, the circuit causes the heater to be switched on.

(i) The variable resistor R is set to a resistance of 4300 Ω .

Calculate the resistance of the thermistor when the voltage across the thermistor is 0.7 V.

(ii) The graph shows how the resistance of the thermistor changes with temperature.



(A) Use the graph to decide the temperature at which the heater is switched on.

(B) The resistance of the variable resistor R is increased to a value **greater than** 4300 Ω .

What effect does this have on the temperature at which the heater is switched on?

Explain your answer.

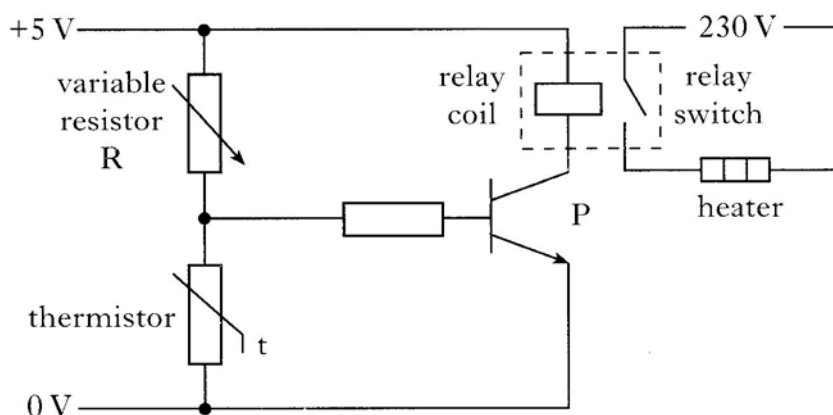
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
1	3

27. continued.

- (b) The voltage divider circuit is connected to the switching circuit, as shown, to operate the heater. When there is a current in the relay coil, the relay switch closes.



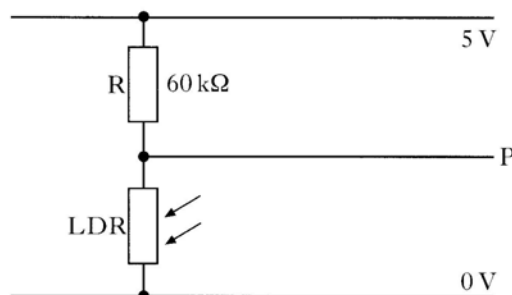
- (i) Name component P.
- (ii) Explain why the heater switches on as the temperature falls below a selected value.

28.

The exit of an underground car park has an automatic barrier. The barrier rises when a car interrupts a light beam across the exit and money has been put into the pay machine. The barrier can also be operated by using a manual switch.



The light beam is directed at an LDR that is connected as shown in the circuit below.



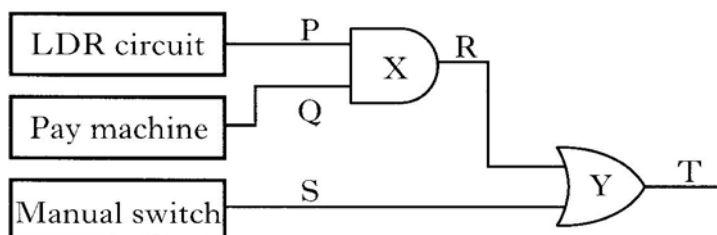
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
2	
1	
1	
4	
	1

28. continued.

- (a) Calculate the voltage across the LDR when its resistance is 15 kΩ.
- (b) Part of the control circuit for the automatic barrier is shown below.



When a car interrupts the light beam, the logic level at P changes from logic 0 to logic 1.

When money is put into the pay machine, the logic level at Q changes from logic 0 to logic 1.

When the manual switch is operated, the logic level at S changes from logic 0 to logic 1.

- (i) Name logic gate X.
- (ii) Name logic gate Y.
- (iii) Complete the truth table below for the control circuit shown, by filling in the values of the logic levels at R and T.

P	Q	R	S	T
0	0		0	
0	1		0	
1	0		0	
1	1		0	
0	0		1	
0	1		1	
1	0		1	
1	1		1	

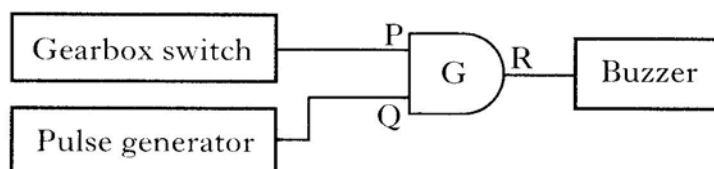
- (iv) Describe a situation where it would be necessary to operate the barrier by using the manual switch.

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

29.

A bus is fitted with a buzzer that sounds only when the bus is reversing. Part of the circuit that operates the buzzer is shown.



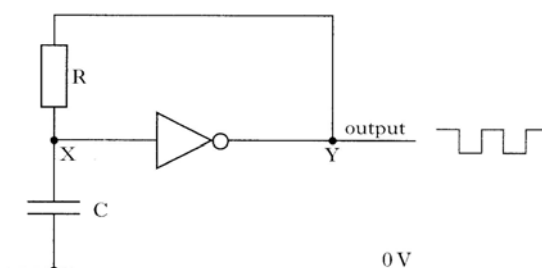
The output from the gearbox switch is high (logic 1) when the bus is reversing.

- (a) Name logic gate G.
- (b) The table shows the different possible combinations of logic levels (0 or 1) for input P and input Q to gate G.

Complete the last column of the table by **drawing** the output R from gate G for each combination of inputs.

Input P	Input Q	Output R
1	1	1
0	0	0
1	1	1
0	0	0
1	1	1
0	0	0
1	1	1
0	0	0

- (c) The pulse generator part of the circuit is shown below.
The power supply to the NOT gate has been omitted for clarity.



- (i) Capacitor C is initially discharged.

Explain the operation of the pulse generator circuit, by referring to points X and Y in the circuit.

- (ii) The pulse generator produces an output with a high frequency.

State **one** change that could be made to the circuit to give an output of lower frequency.

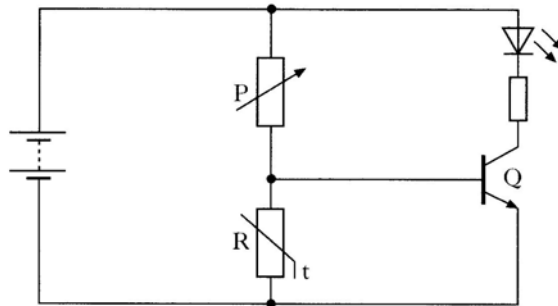
KU	PS
1	
	2
	2
	1

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

30.

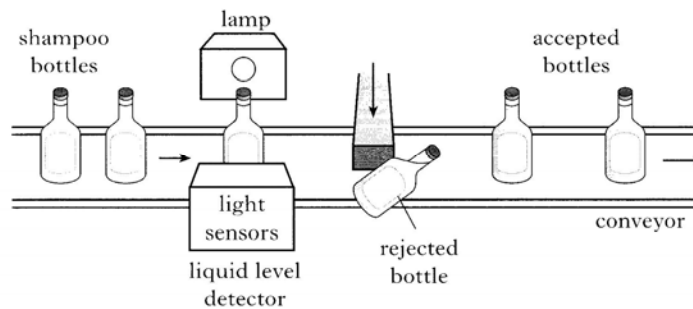
An electronic circuit is shown below. Component R is a thermistor.



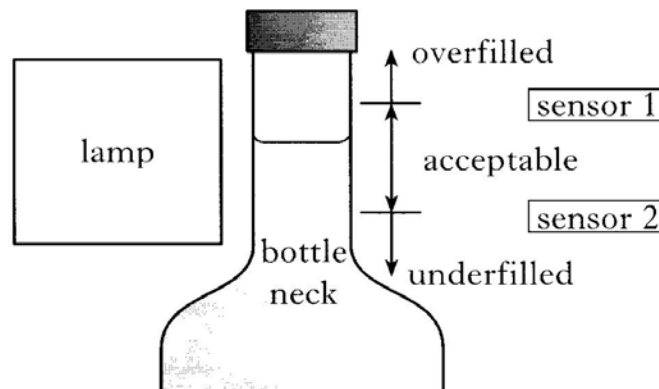
- (a) Name component P.
- (b) (i) Name component Q.
- (c) Explain how the circuit operates.

31.

At a bottling plant, shampoo bottles on a conveyor pass a liquid level detector. Bottles filled to an acceptable level continue along the conveyor for packing. Bottles that are overfilled or underfilled are rejected.



The liquid level detector consists of a lamp and two identical light sensors. The sensors are placed as shown in the diagram below. Light from the lamp can reach a sensor only when there is no shampoo between the lamp and the sensor.



KU	PS
1	
1	
	2

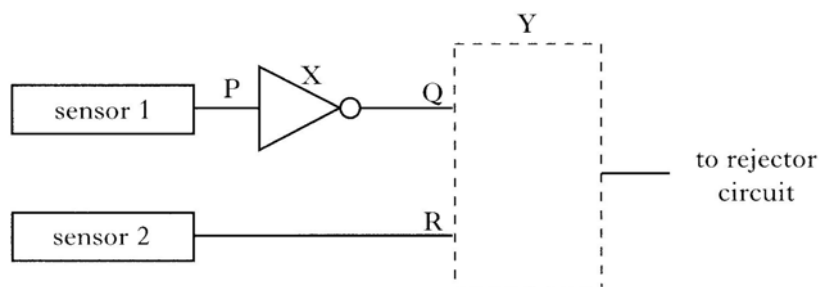
Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
	1
	3
	1

31. continued.

Part of the logic circuit of the liquid level detector is shown below.



The logic level outputs of a light sensor are as shown.

<i>Light level at sensor</i>	<i>Logic level output</i>
dark	0
light	1

- (a) Name gate X.
- (b) Complete the table to show the logic levels at P, Q and R when bottles filled to different levels are at the detector.

<i>Liquid level</i>	P	Q	R
Overfilled			
Acceptable			
Underfilled			

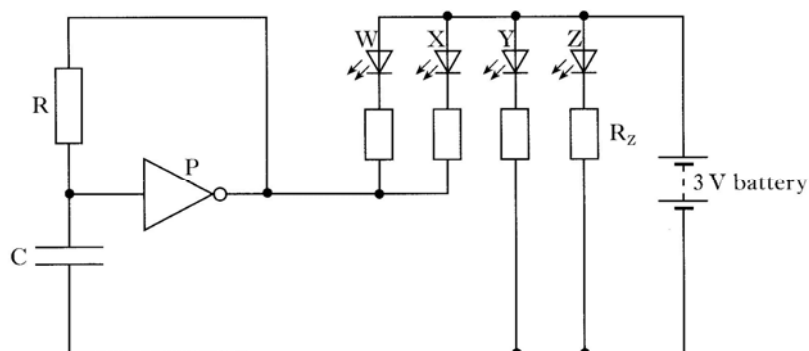
- (c) The rejector circuit requires a logic level 1 to operate.
What type of gate at Y gives a logic 1 output only when a bottle is not filled to an acceptable level?

Credit Level

Answer questions in your Homework Jotter.

Show working for each question.

32. A bicycle lamp contains four LEDs W, X, Y and Z and a 3 V battery. The lamp uses a pulse generator to make two of the LEDs flash. A simplified circuit diagram of the bicycle lamp is shown.



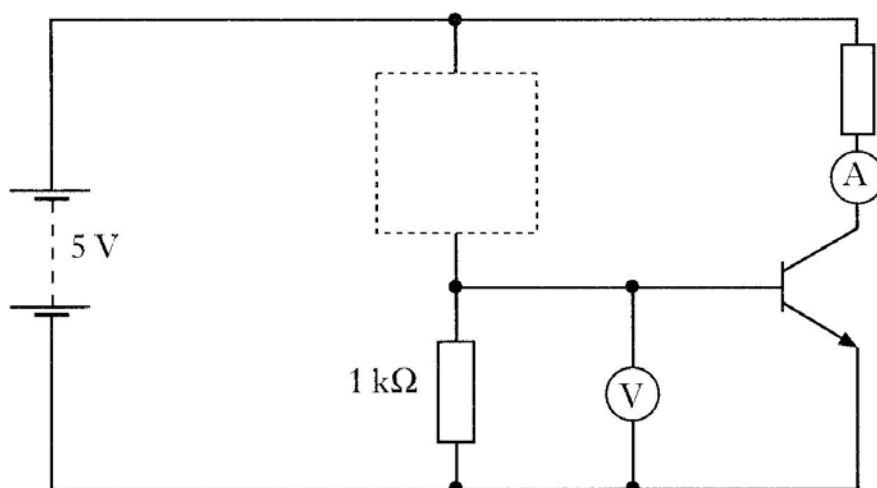
- (a) (i) Which LEDs flash when the lamp is operating?
 (ii) State two changes that could be made to the circuit to increase the frequency at which the LEDs flash.
- (b) When LED Z is lit, the current in it is 15 mA and the voltage across it is 1.8 V.
 Calculate the resistance of R_Z .

1

2

3

33. The circuit shown is used to investigate the switching action of a transistor.



- (a) Draw the symbol for a variable resistor in the dotted box in the above diagram.

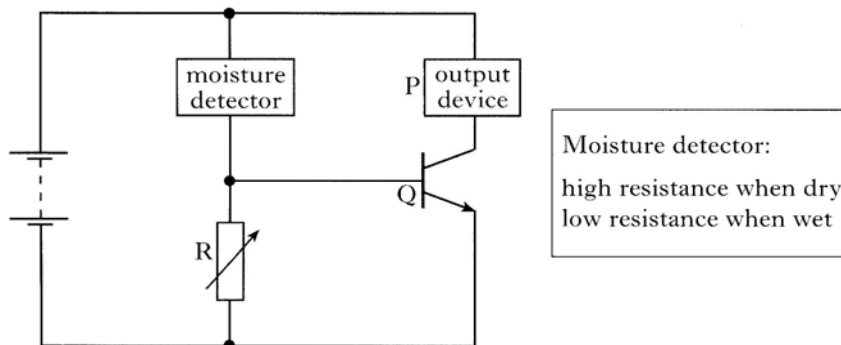
1

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

35.

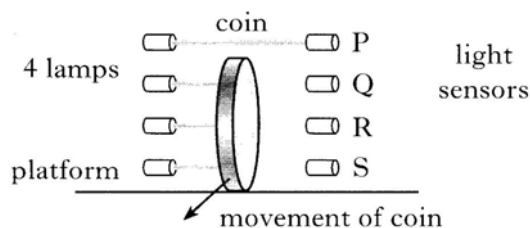
A student designs a lie detector using the following circuit.



- (a) Name component Q.
- (b) Suggest a suitable output device that could be used at P to produce an audible output.
- (c) This lie detector is based on the fact that when a person tells a lie, the moisture on their skin increases. Initially, the person holds the moisture detector in dry hands and component R is adjusted until the output device is silent.
 - (i) What happens to the resistance of the moisture detector when the person holding it tells a lie?
 - (ii) Explain how the circuit operates as a lie detector.

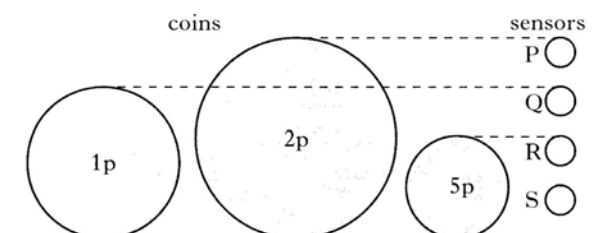
36.

An automatic vending machine accepts 1p, 2p and 5p coins. Four light sensors P, Q, R and S are arranged as shown in the coin slot.



When a coin passes between a lamp and its sensor, the light is blocked. Coins of different diameters block the light from different lamps.

The position of the sensors in relation to the diameters of coins is shown below.



KU	PS
1	
	1
	1
	2

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

36. continued.

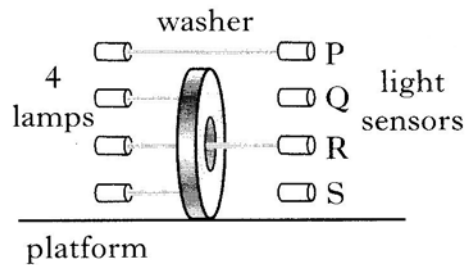
The logic output of the sensors is as follows:

- light blocked – logic output 1
- light not blocked – logic output 0

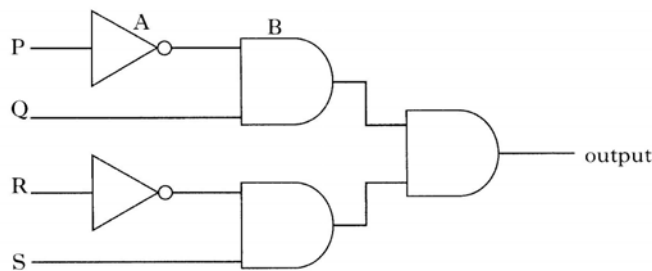
- (a) (i) Name a suitable input device to be used as a sensor.
 (ii) Complete the truth table for the outputs of the sensors when each of the coins passes between the lamps and the sensors.

	1p coin	2p coin	5p coin
Sensor P			
Sensor Q			
Sensor R			
Sensor S			

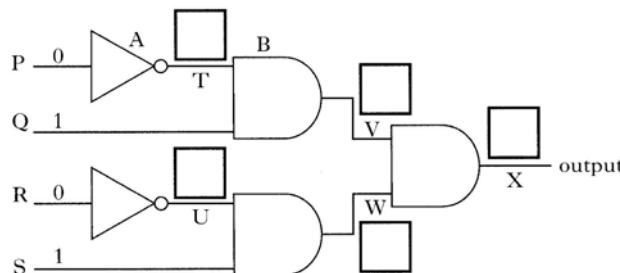
- (b) A washer is a metal disc with a hole in the middle. The machine is able to reject washers, when they are inserted instead of coins. A washer the same diameter as a 1p coin blocks the light from reaching sensors Q and S only.



Part of the circuit used is shown below.



- (i) Name gate A.
 (ii) Name gate B.
 (iii) When a washer is inserted, the logic levels at P, Q, R and S are as shown below.



KU	PS
	1
	3
	1
	1

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
	2
	1
	1
	2
	3

36. continued.

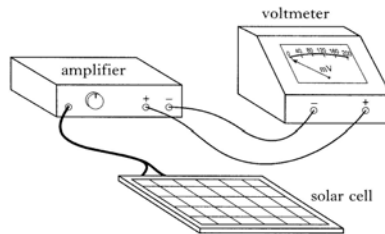
In the boxes on the diagram above, enter the logic levels at each position T, U, V, W and X.

(iv) When a washer is detected, this circuit activates an output device that pushes the washer to reject it.

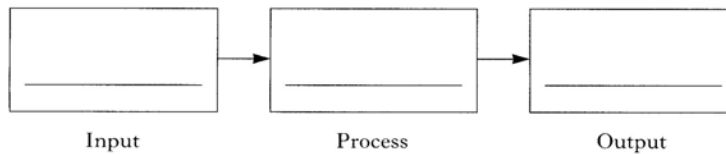
Name a suitable device to be used as the output device.

37.

The electronic system shown is used as a light meter. A voltage is generated when light falls on the solar cell. This voltage is amplified and the output voltage is displayed on the voltmeter.



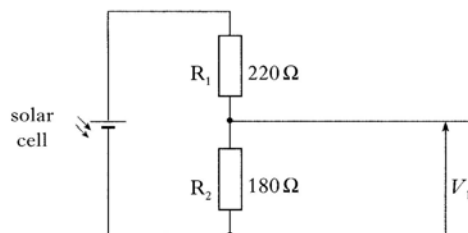
(a) Enter the names of each of the three parts of this electronic system in the block diagram below.



(b) The table shows the voltage generated by the solar cell, and the output voltage of the amplifier for various values of light level. (Light level is measured in lux.)

Light level (lux)	350	400	450	500	550
Voltage generated by solar cell (mV)	0.1	0.2	0.3	0.4	0.5
Output voltage of amplifier (mV)	40	80	120	160	200

- (i) Calculate the voltage gain of the amplifier.
(ii) The solar cell is connected to the amplifier as shown.



Calculate the voltage V_1 when the solar cell is in a light level of 500 lux.

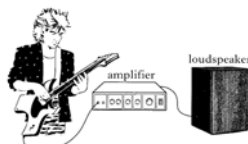
Credit Level

Answer questions in your Homework Jotter.

Show working for each question.

38.

An electric guitar is connected to an amplifier.



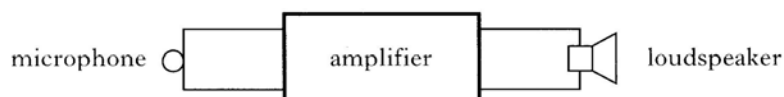
The input power to the amplifier from the guitar is 16 mW. The output of the amplifier is connected to a loudspeaker. The loudspeaker has a resistance of $9\ \Omega$.

- (a) The amplifier delivers an output power of 64 W to the loudspeaker.
 - (i) Calculate the power gain of the amplifier.
 - (ii) Calculate the voltage across the loudspeaker.
- (b) A second, identical loudspeaker is connected in parallel with the first. Calculate the combined resistance of the two loudspeakers in parallel.
- (c) The guitarist plays a note of frequency 256 Hz. What is the frequency of the output signal from the amplifier?

39.

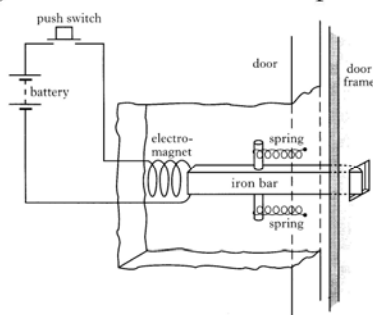
An entry system for a block of flats lets residents speak to callers before unlocking the outside door.

- (a) A microphone at the outside door is connected through an amplifier to a loudspeaker in a flat.



The input power to the amplifier from the microphone is 5 mW and the output power from the amplifier is 2 W.

- (i) Calculate the power gain of the amplifier.
 - (ii) The voltage across the loudspeaker is 4 V. Calculate the resistance (impedance) of the loudspeaker.
- (b) The entry system allows a resident to unlock the outside door from the flat. The diagram below shows this part of this system.



Explain how this part of the system operates to unlock the door.

KU	PS
2	2
2	2
1	1
2	2
2	2
2	2

Credit Level

Answer questions in your Homework Jotter.
Show working for each question.

KU	PS
2	
1	2

40.

An electronic tuner for a guitar contains a microphone and an amplifier.
The output voltage from the amplifier is 9 V.

(a) The voltage gain of the amplifier is 150.

Calculate the input voltage to the amplifier.

(b) The tuner is used to measure the frequency of six guitar strings.

The number and frequency of each string is given in the table below.

<i>Number of string</i>	<i>Frequency (Hz)</i>
1	330.0
2	247.0
3	196.0
4	147.0
5	110.0
6	82.5

The tuner has an output socket which has been connected to an oscilloscope. The trace for string 5 is shown in Figure 1.

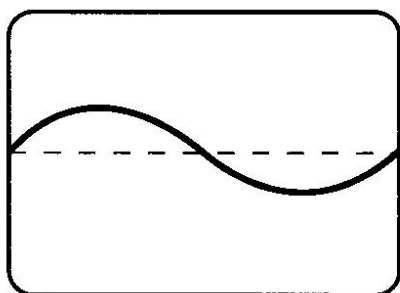


Figure 1

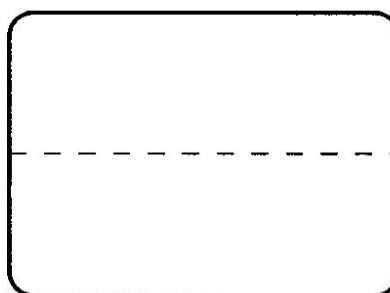


Figure 2

(i) The controls of the oscilloscope are **not** altered.

In Figure 2, draw the trace obtained if string 1 is played **louder** than string 5.

(ii) String 3 is plucked.

What is the frequency of the output signal from the amplifier?

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