

Candidate Name	Centre Number	Candidate Number
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GCSE

4161/01

ELECTRONICS

UNIT E1

(Paper version of on-screen assessment)

A.M. WEDNESDAY, 8 June 2011

1 hour

For Examiner's use only

Total Mark	
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4161
01/0001

ADDITIONAL MATERIALS

Information sheet.

In addition to this examination paper you may need a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

INFORMATION SHEET FOR UNIT E1

This information may be of use in answering the questions.

1. Resistor Colour Codes

BLACK	0	GREEN	5
BROWN	1	BLUE	6
RED	2	VIOLET	7
ORANGE	3	GREY	8
YELLOW	4	WHITE	9

The fourth band colour gives the tolerance as follows:

GOLD $\pm 5\%$

SILVER $\pm 10\%$

2. Preferred Values for Resistors – E24 series

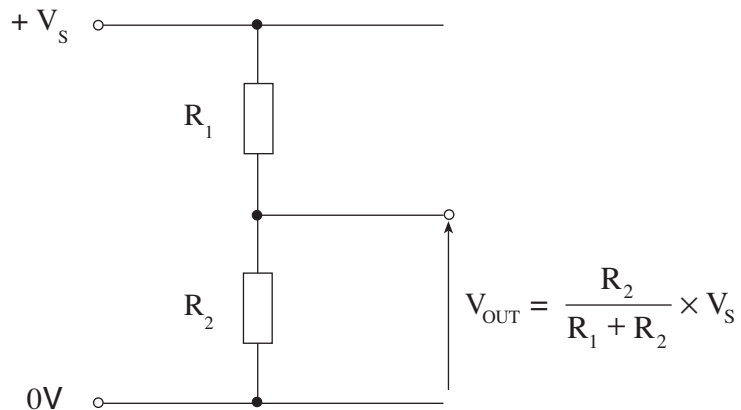
10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91.

3. **Resistance** = $\frac{\text{voltage}}{\text{current}}$; $R = \frac{V}{I}$.

4. **Effective resistance**, R , of two resistors R_1 and R_2 in series is given by $R = R_1 + R_2$.

5. **Effective resistance**, R , of two resistors R_1 and R_2 in parallel is given by $R = \frac{R_1 R_2}{R_1 + R_2}$.

6. Voltage Divider



7. **Power** = voltage \times current; $P = VI = I^2R = \frac{V^2}{R}$.

8. **LED** The forward voltage drop across an LED is 2V.

9. **NPN Transistors** (i) Current gain = $\frac{\text{Collector current}}{\text{Base current}}$; $h_{FE} = \frac{I_C}{I_B}$.

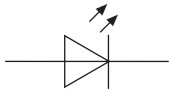
(ii) The forward voltage drop across the base emitter junction is 0.7V.

Answer **all** questions.

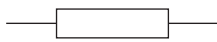
1. Here is a list of electronic components.

thyristor *LED* *resistor* *LDR*

Give the correct name for each component below.



.....



.....



.....

[3]

2. The following electronic sub-systems can be used to build larger systems.

Buzzer *Latch unit* *Delay unit* *Light sensing unit*

Give the names of the sub-systems that answer the questions below.

(a) Which of these sub-systems is an input sub-system?

(b) Which of these sub-systems can keep an output on for a short amount of time and reset automatically?

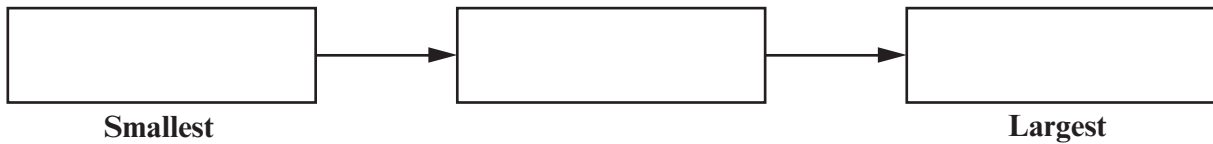
(c) Which of these sub systems is an output sub-system?

[3]

3. The following are three units of resistance.

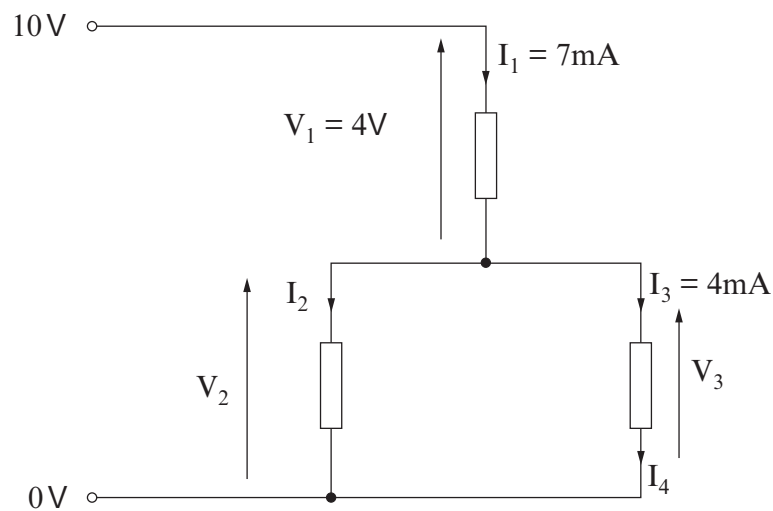
kilohm ($k\Omega$) megohm ($M\Omega$) ohm (Ω)

Write the name of each unit in the boxes below so that they are in order of **increasing** size.



[1]

4. Study the following circuit containing three resistors.



Circle the correct answer from the choices given.

- (a) What is the value of I_2 ?

0 mA 1 mA 2 mA 3 mA 4 mA 5 mA 6 mA 7 mA 8 mA 9 mA

[1]

- (b) What is the value of I_4 ?

0 mA 1 mA 2 mA 3 mA 4 mA 5 mA 6 mA 7 mA 8 mA 9 mA

[1]

- (c) What is the value of V_2 ?

0 V 1 V 2 V 3 V 4 V 5 V 6 V 7 V 8 V 9 V

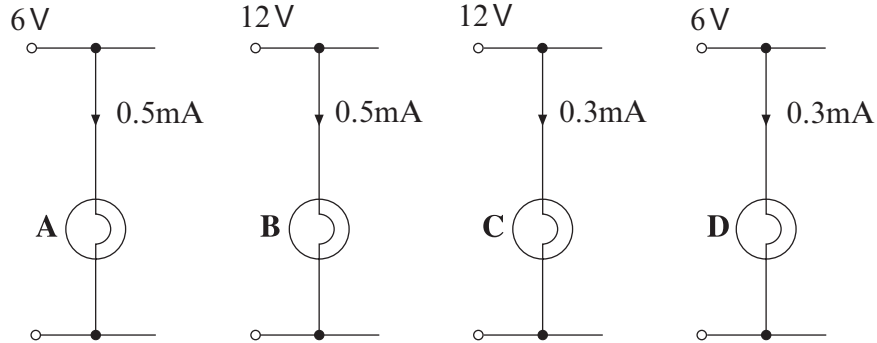
[1]

- (d) What is the value of V_3 ?

0 V equal to V_1 equal to V_2 10V

[1]

5. Here are 4 lamps.



(a) Which lamp is using the least power?

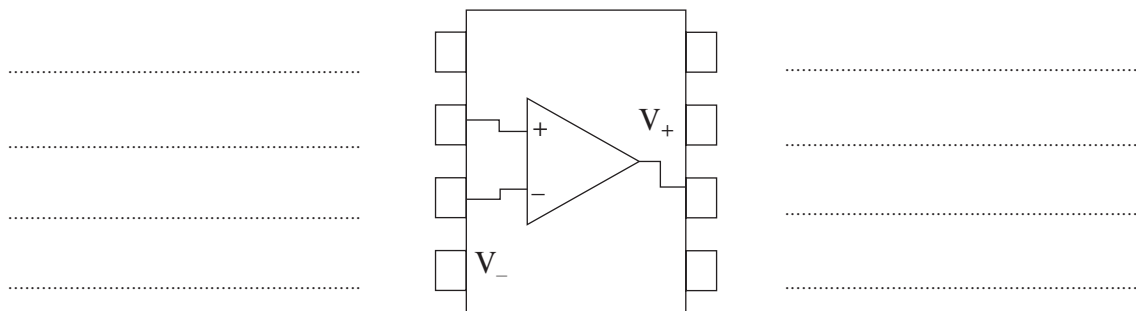
[1]

(b) Calculate the power in mW for lamp B.

.....

[1]

6. The following diagram shows the pinout of a comparator IC.



Write the following labels next to the correct pins on the comparator IC.

Negative Supply Pin

Non-inverting Input Pin

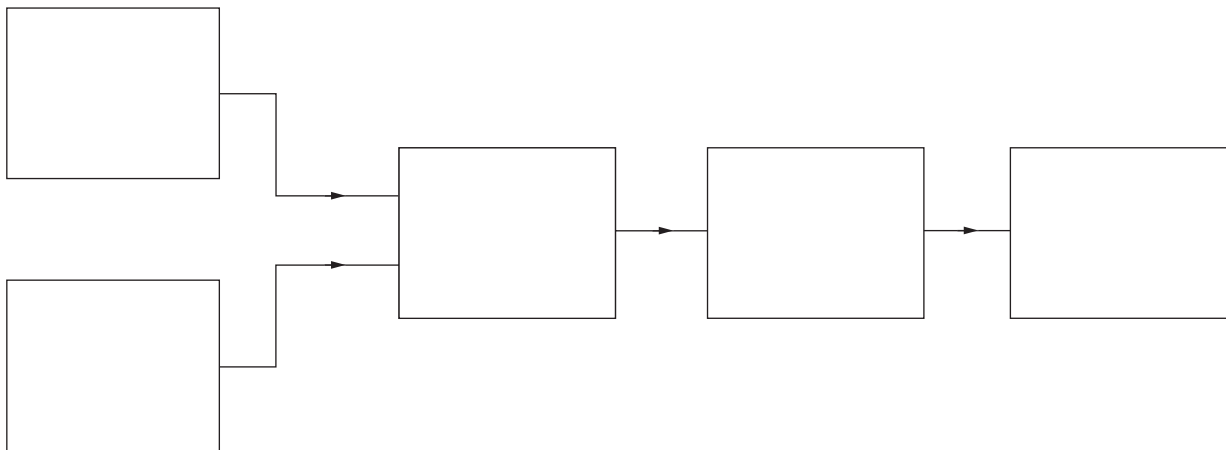
Output Pin

[3]

7. A hazard beacon warns drivers about a skip at the side of the road. It flashes on and off continuously when it gets dark, and switches off in daylight. The following sub-systems are available.

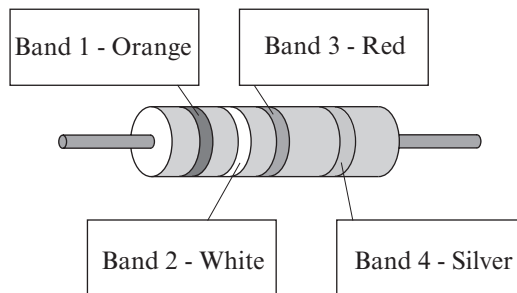
- Thyristor OR gate Pulse Generator Temperature Sensing Unit Buzzer unit*
Time Delay Lamp Unit Light Sensing Unit AND gate Transistor Switch

Select the correct sub-systems to complete the block diagram.



[5]

8. The diagram shows a resistor.

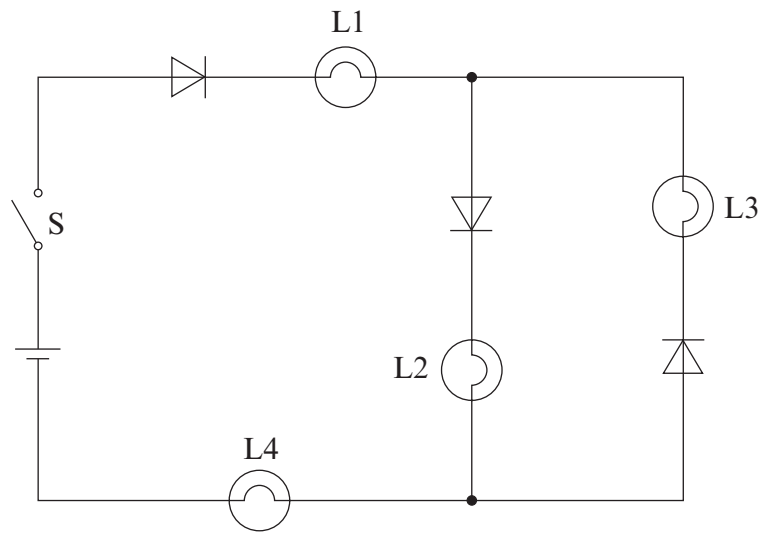


(a) Write down the value of this resistor in ohms. [3]

(b) What is the tolerance of this resistor? **Circle** the correct answer.

- $\pm 1\%$ $\pm 2\%$ $\pm 5\%$ $\pm 10\%$ $\pm 20\%$ [1]

9. The circuit shows some diodes and lamps connected to a battery.

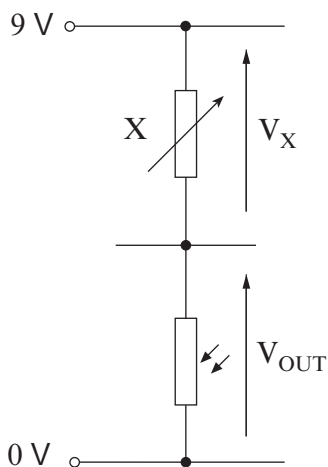


The Switch S is now closed. Which lamp, L1, L2, L3 or L4, will **NOT** light up?

.....

[1]

10. Here is the circuit diagram for a light sensing unit containing an LDR.



(a) **Circle** the name of the component labelled X.

- Resistor Variable Resistor LED Thermistor

[1]

(b) $V_{OUT} = 2V$. **Circle** the correct voltage across the component X.

- 0 V 1 V 2 V 3 V 4 V 5 V 6 V 7 V 8 V 9 V

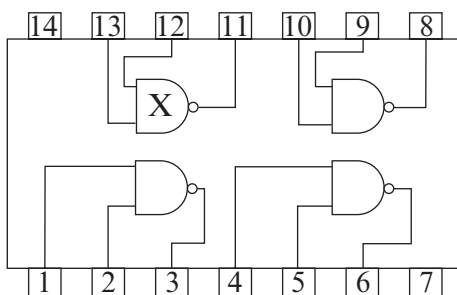
[1]

(c) What happens to the resistance of the LDR when the light level increases? Tick (✓) the correct answer.

- It increases
- It stays the same
- It decreases
- It depends on how good the battery is

[1]

11. Here is the pinout for a logic gate IC.



(a) How many logic gates are there on the IC?

[1]

(b) What is the pin number of the output of logic gate X?

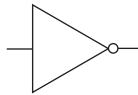
[1]

12. The following list gives the names of some logic gates.

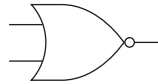
AND gate NAND gate NOR gate NOT gate OR gate

Use the correct logic gate name for the symbols below.

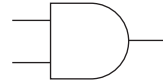
(a)



(b)



(c)



.....

.....

.....

[3]

13. (a) **Circle** the name of the logic gate that has the following truth table.

[1]

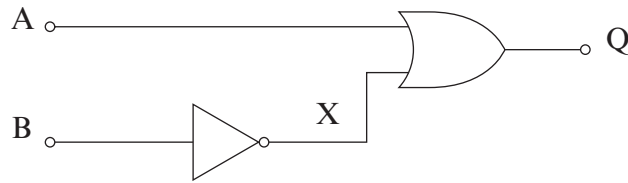
Inputs		Output
A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

AND gate NAND gate NOR gate NOT gate OR gate

(b) **Circle** the name of the logic gate that outputs a logic 0 signal only when both inputs are at logic 1. [1]

AND gate NAND gate NOR gate NOT gate OR gate

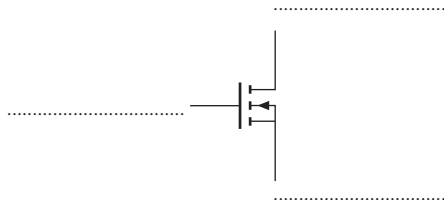
14. Complete the truth table for the following logic system.



A	B	X	Q
0	0		
0	1		
1	0		
1	1		

[2]

15. (a) Here is a diagram for a MOSFET.



Select from the list of terminal names below, to label the diagram.

- Base Collector Drain Source Emitter Gate

[3]

(b) Why is a MOSFET often used instead of a transistor to interface a logic system to a motor?

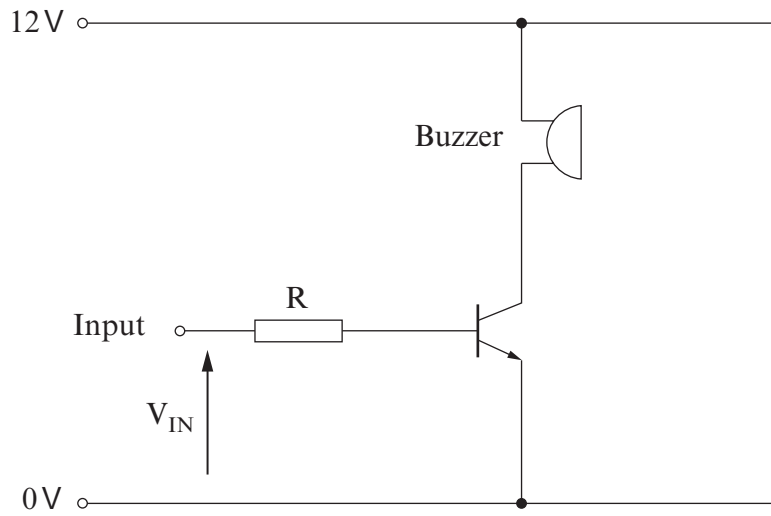
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[1]

16. The circuit diagram shows part of a system used to switch on an alarm.

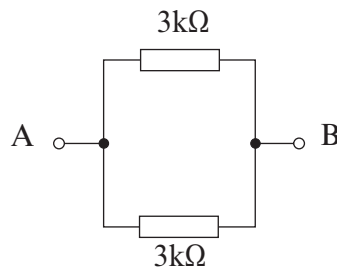


Write either the word 'ON' or 'OFF' to show what happens to the buzzer for each value of V_{IN} .

V_{IN}	Buzzer On / Off?
0.4 V	
2.2 V	

[1]

17. The diagram below shows two resistors connected in parallel.



What is the resistance between A and B?
Circle the correct answer.

- 1 kΩ 1.5 kΩ 2 kΩ 2.5 kΩ 3 kΩ 3.5 kΩ 4 kΩ 4.5 kΩ 5 kΩ 5.5 kΩ 6 kΩ

[1]

18. Here are two truth tables.

For each of the following, tick (✓) the correct Boolean equation that represents the function described by the truth table.

(a)

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

Answer:

$Q = A \cdot B$

$Q = A + B$

$Q = \bar{A} \cdot B$

$Q = \overline{A + B}$

[1]

(b)

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

Answer:

$Q = A \cdot B$

$Q = A + B$

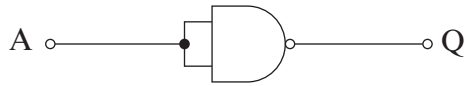
$Q = \bar{A} \cdot B$

$Q = \overline{A + B}$

[1]

19. The following diagrams show some arrangements of NAND gates. For each arrangement tick (✓) the equivalent 'standard' gate.

(a)

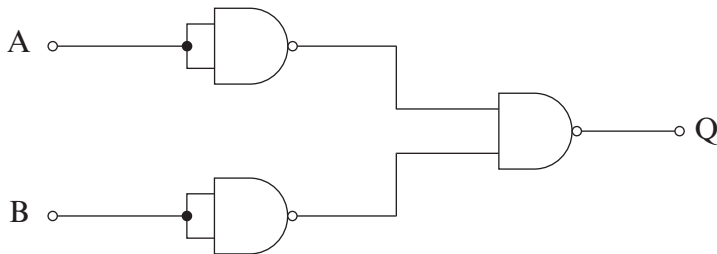


Answer:

- NOT Gate
- AND Gate
- OR Gate
- NOR Gate

[1]

(b)

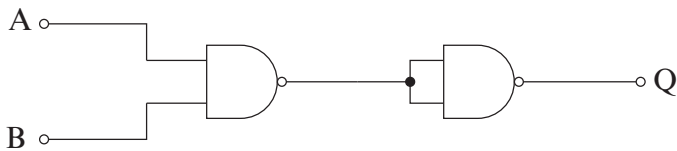


Answer:

- NOT Gate
- AND Gate
- OR Gate
- NOR Gate

[1]

(c)



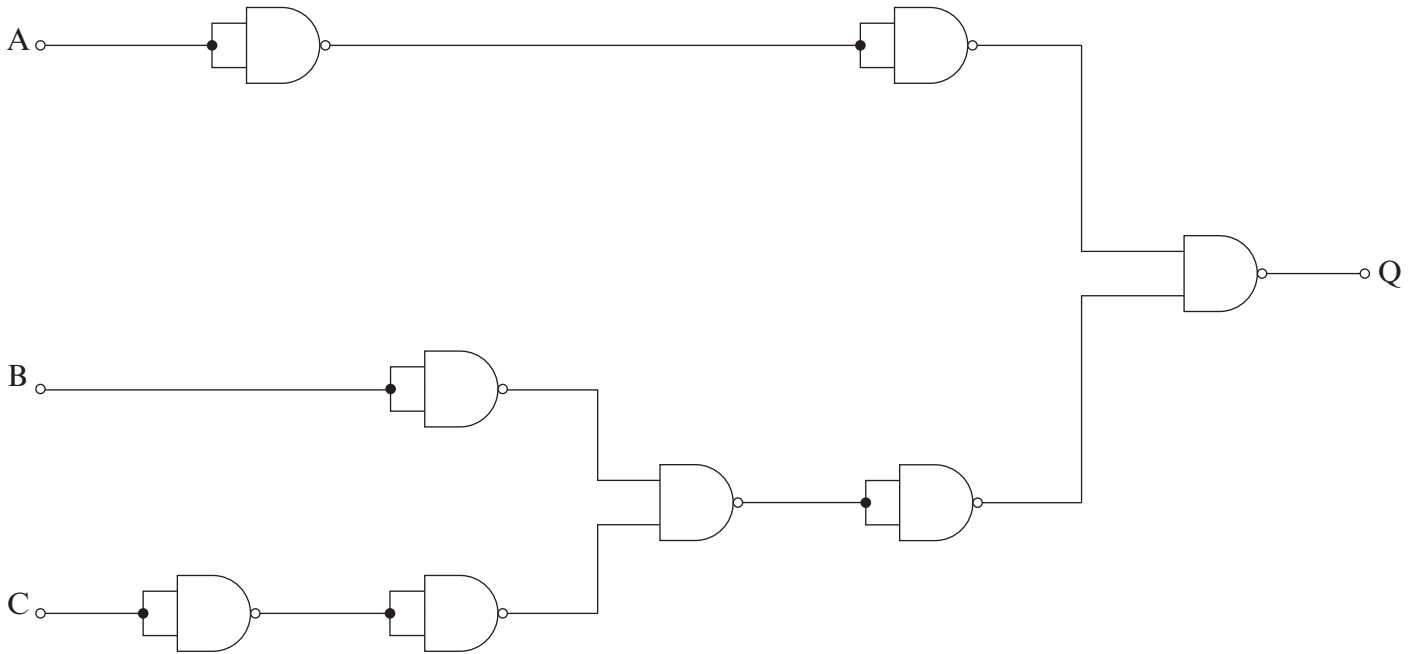
Answer:

- NOT Gate
- AND Gate
- OR Gate
- NOR Gate

[1]

20. Some of the NAND gates in the logic circuit below are redundant.

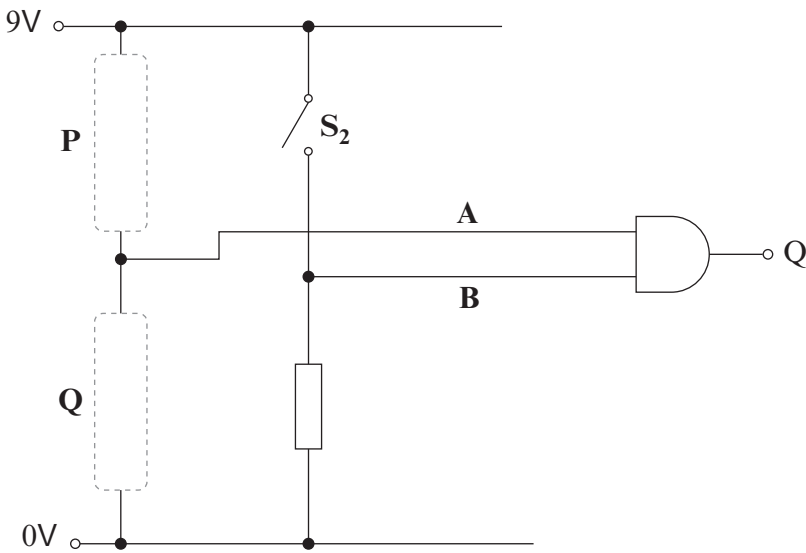
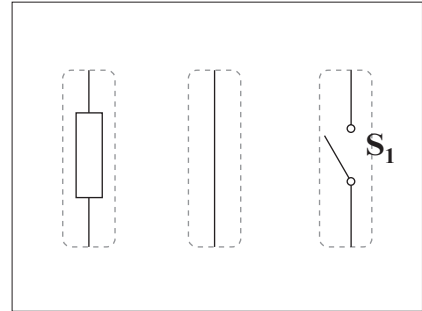
Cross out all of the redundant NAND gates.



[2]

21. Here is part of an alarm circuit.

- (a) Draw the two components required in boxes P and Q so that Input A receives a logic 0 input to the logic system when a switch S₁ is pressed.



[1]

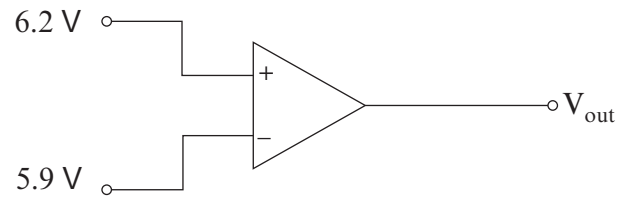
- (b) What combination of switch settings will cause the output of the AND gate to be high?

S₁ Off & S₂ Off, S₁ On & S₂ Off, S₁ Off & S₂ On, S₁ On & S₂ On

Circle the correct answer.

[1]

22. The following diagram shows a comparator. The comparator saturates at +1.5V and +8.5V.



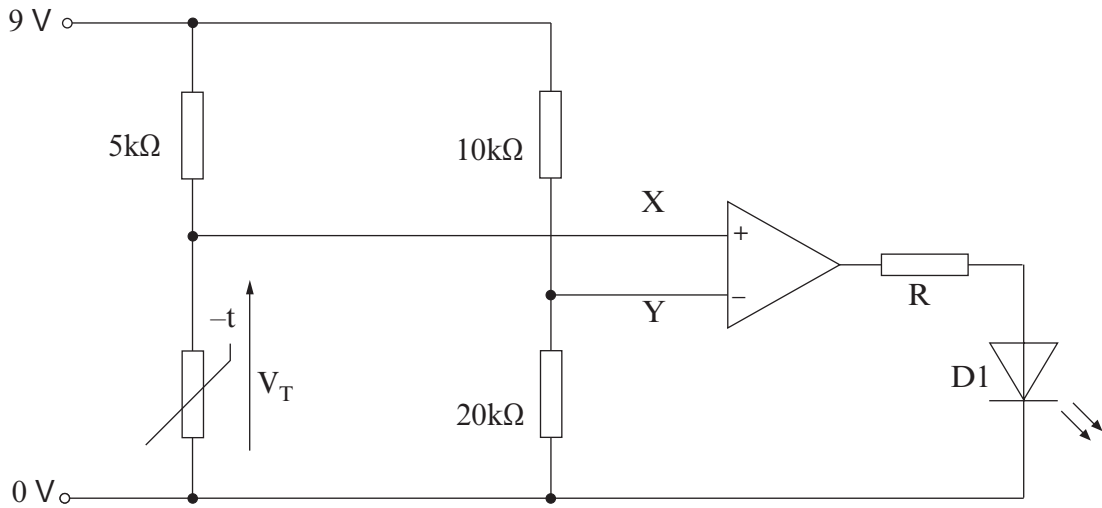
The output of the comparator is:

- 0.3V
- 1.5V
- 5.9V
- 6.2V
- 8.5V
- 12.1V

Tick (✓) the correct answer.

[1]

23. The following circuit shows a comparator which is configured as a fire alarm.



(a) When the temperature rises, the resistance of the thermistor:

- increases
- stays the same
- decreases
- doubles

Tick (✓) the correct answer. [1]

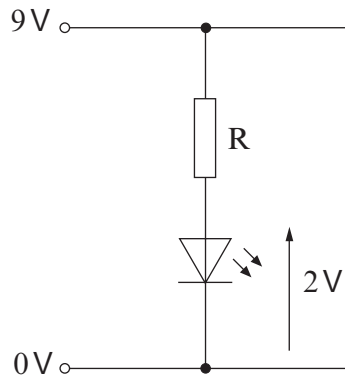
(b) Calculate the voltage at the inverting input 'Y'.

.....

.....

[1]

24. An LED is to be used as a power-on indicator as shown below. The LED passes a current of 10mA .



- (a) What is the current through resistor R? mA [1]
- (b) What is the voltage drop across the resistor R? V [1]
- (c) What is the ideal resistance of resistor R? Ω [1]
- (d) Select the preferred value resistor that would ensure that the current through the LED is **no more** than 10mA. (**Circle** the correct answer)

100 Ω 220 Ω 270 Ω 330 Ω 390 Ω 470 Ω 560 Ω 820 Ω 1000 Ω

[1]



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ELECTRONICS

CANDIDATE INFORMATION SHEET FOR UNIT E1

A.M. WEDNESDAY, 8 June 2011

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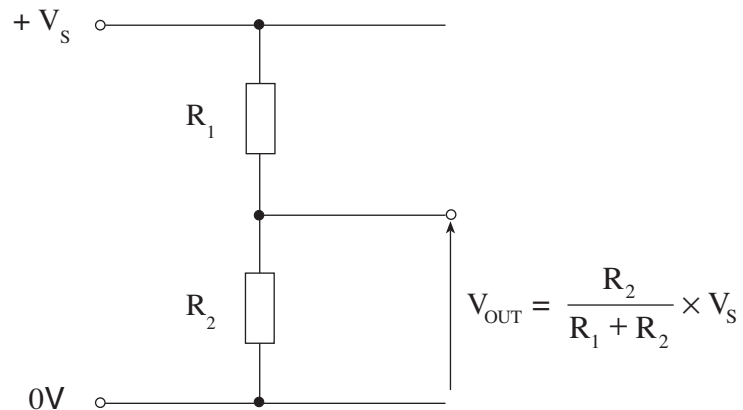
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6. Voltage Divider



7. **Power** = voltage \times current; $P = VI = I^2R = \frac{V^2}{R}$.

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