

Topic 100 Core Concepts Question Pack

for

Eduqas GCE A-Level Electronics



Student Name:

Class / Group:



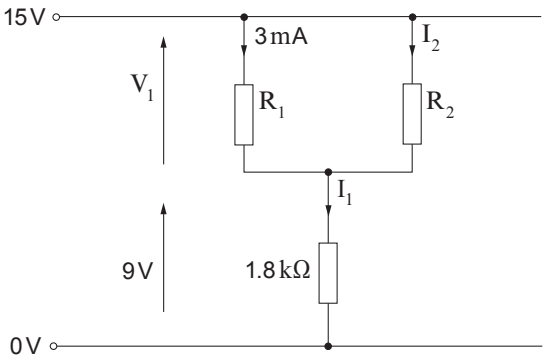
Question 1

3

Answer all questions.

Examiner only

1. Use the information given in the circuit diagram to determine the values of the quantities listed below.



Determine the value of: [7]

- (a) V_1
- (b) R_1
- (c) I_1
- (d) I_2
- (e) R_2
- (f) What is the combined resistance of the parallel combination R_1 and R_2 ?
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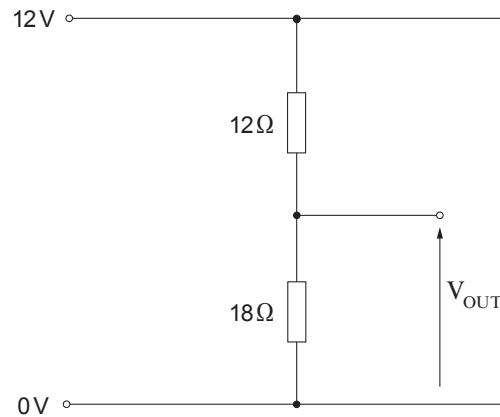


Question 2

4

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2. The following circuit is used as a voltage source.



- (a) Thevenin's theorem is used to produce an equivalent circuit for the voltage source.

- (i) Calculate the open circuit voltage V_{OC} . [1]

.....

.....

- (ii) Calculate the short circuit current I_{SC} . [1]

.....

.....

- (iii) Calculate the equivalent resistance R_O . [1]

.....

.....

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- (b) (i) Draw the equivalent circuit with a load resistor connected across the output terminals. [1]

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- (ii) Use the equivalent circuit to calculate the maximum permissible load current to ensure the output voltage V_{OUT} does not fall below 6.3 V. [2]

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Question 3

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3. (a) A Schmitt inverter can be used to condition the signal produced by an analogue sensor. Here is part of the data sheet for a Schmitt Inverter.

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When connected to a 10 V supply:

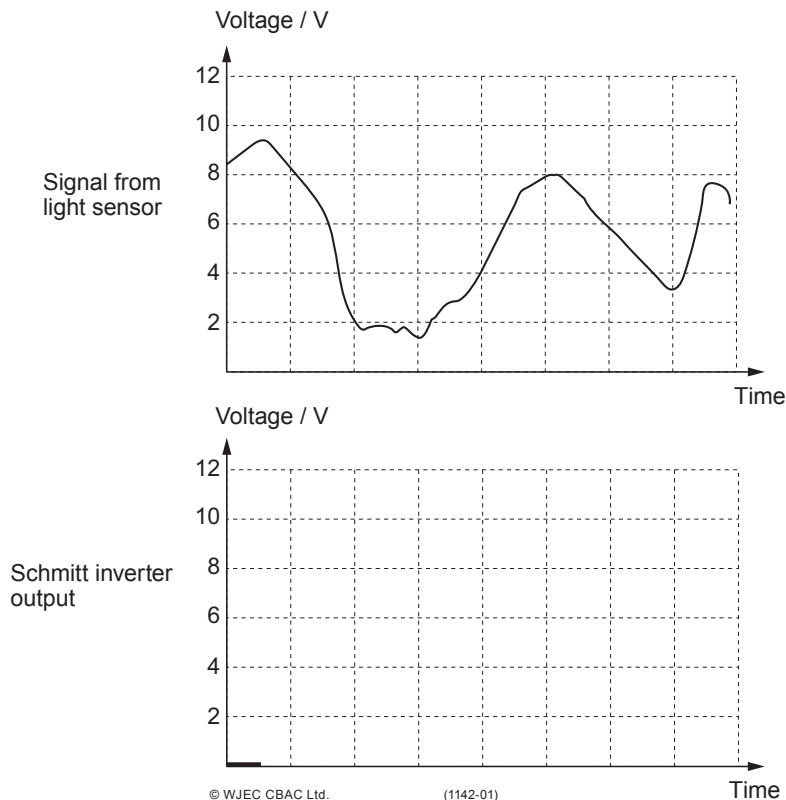
- Logic 0 = 0 V
- Logic 1 = 10 V
- The output changes from logic 1 to logic 0 when a **rising** input voltage reaches 4 V
- The output changes from logic 0 to logic 1 when a **falling** input voltage reaches 2 V

The Schmitt inverter is connected as follows in an electronic system.



The upper graph shows the light sensor output.

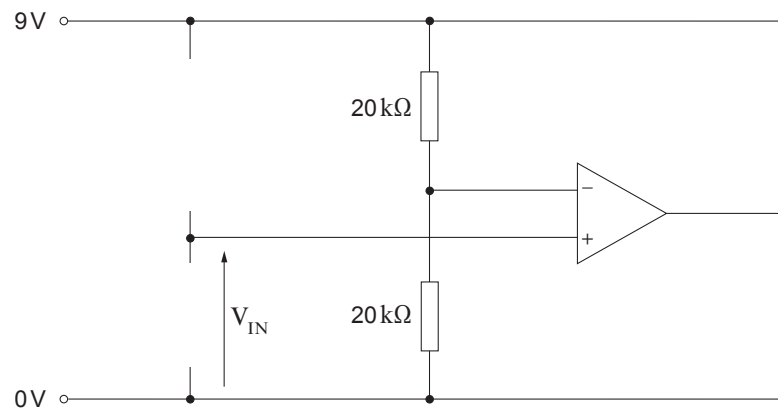
Complete the lower graph to show the signal obtained at the output of the Schmitt Inverter. [3]



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- (b) The diagram below shows an incomplete circuit diagram for a different system that gives a warning when the light level in a photography dark room is too high.



- (i) Complete the design by adding: [4]
- a LED and protective resistor;
 - a LDR;
 - a component that will allow the light level that activates the LED to be adjustable.
- (ii) What is the smallest value of V_{IN} that turns on the LED? [1]

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Question 4

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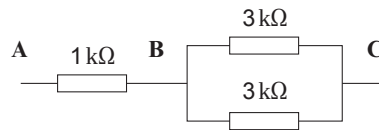
*Answer all questions.*Examiner
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1. (a) For the resistor network below calculate the combined resistance between:

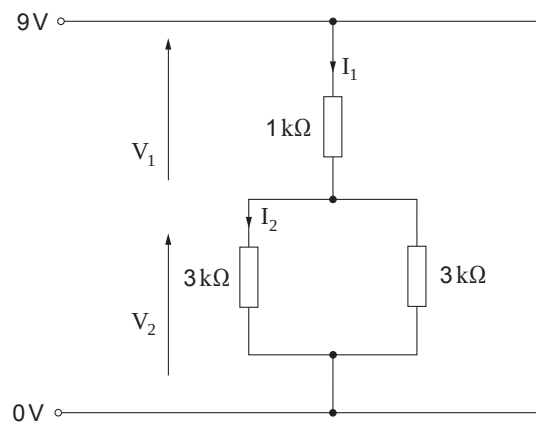
Points **B** and **C**

Points **A** and **C**

[2]



- (b) The resistor network is used in the following circuit

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Determine the value of:

I_1 [1]

I_2 [1]

V_1 [1]

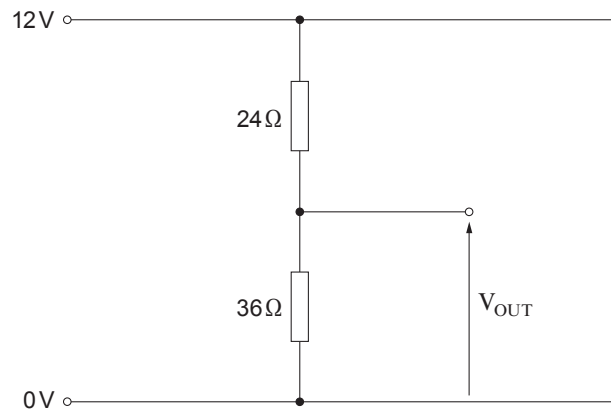
V_2 [1]

Question 5

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2. The following circuit is used as a voltage source.



- (a) Thevenin's theorem is used to produce an equivalent circuit for the voltage source.

- (i) Calculate the open circuit voltage V_{OC} .

[1]

.....

.....

- (ii) Calculate the short circuit current I_{SC} .

[1]

.....

.....

- (iii) Calculate the equivalent resistance R_O .

[1]

.....

.....

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- (b) (i) Draw the equivalent circuit with a load resistance connected across the output terminals. [1]

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- (ii) Use the equivalent circuit to calculate the voltage across the output terminals when the load current is 100mA. [2]

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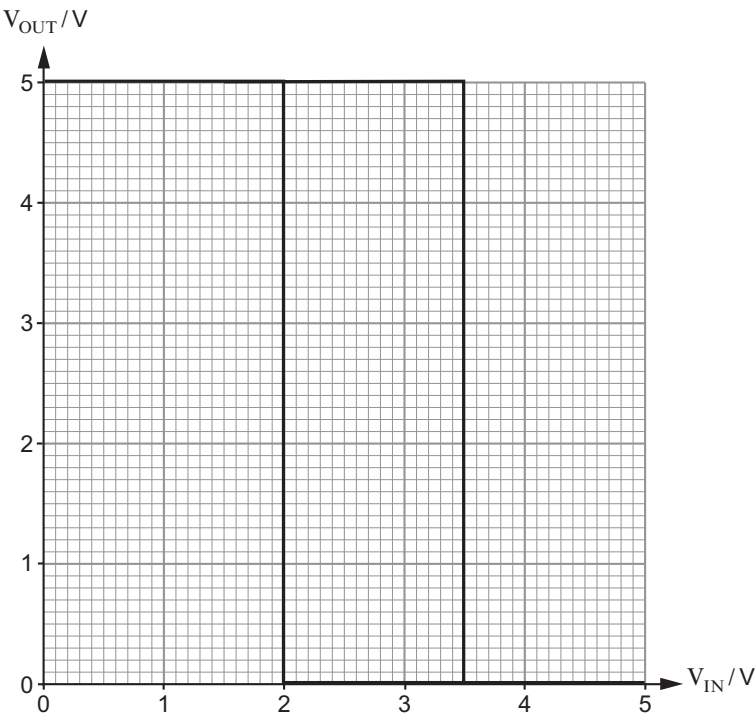
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Question 6

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3. A Schmitt inverter has the following characteristics.



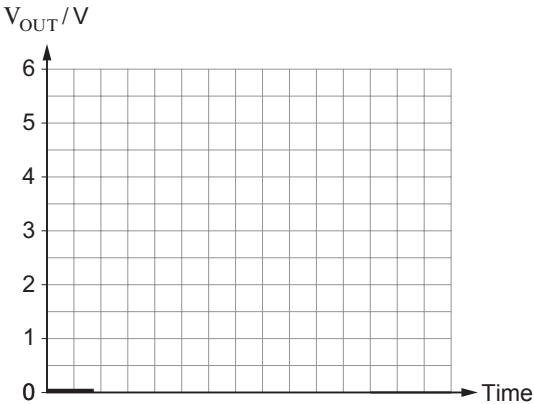
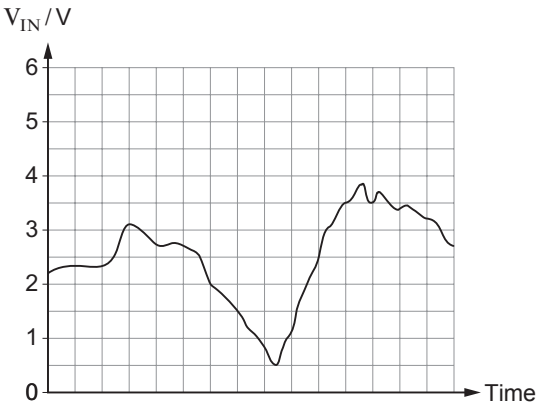
The Schmitt inverter is used to condition the signal produced by a sensing unit.

- (a) Determine the input switching threshold for:
- (i) an increasing input voltage [1]
 - (ii) a decreasing input voltage [1]



- (b) The signal V_{IN} produced by a sensing unit changes over a period of time. Complete the graph to show the signal V_{OUT} obtained at the output of the Schmitt inverter. [3]

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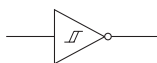
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(c) Another Schmitt inverter is used as part of an astable circuit.

(i) Complete the circuit diagram for the astable circuit.

[2]

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0V ○ _____

(ii) Calculate the values of all components required to produce a frequency of 500 Hz.

[2]

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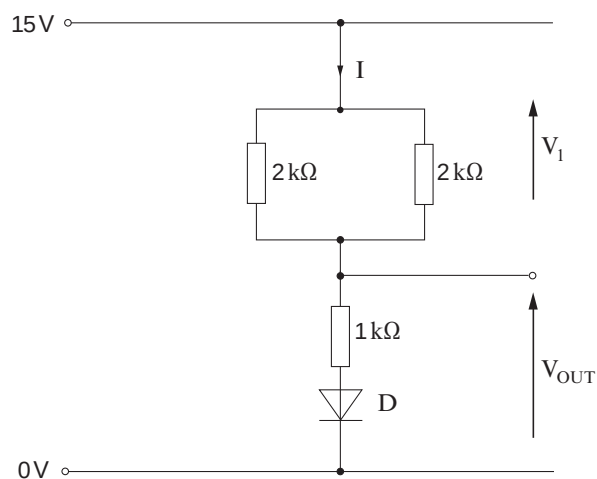
Question 7

3

Answer all questions.

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1. In the following circuit, D is a silicon diode.



Determine the values of the quantities listed below.

- (a) The combined resistance of the two $2\text{ k}\Omega$ resistors. [1]

.....

- (b) The combined resistance of all three resistors. [1]

.....

- (c) I [2]

.....

- (d) V_1 [1]

.....

- (e) V_{OUT} [1]

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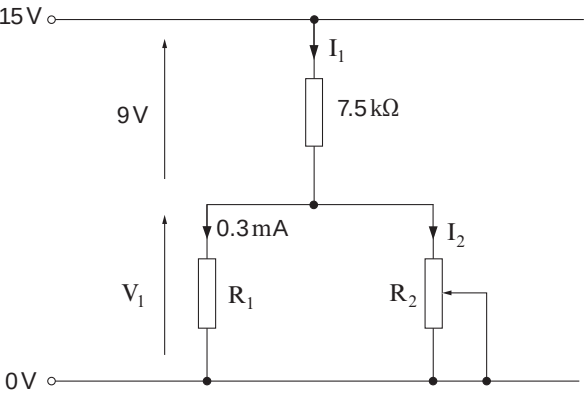
Question 8

3

Answer all questions.

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1. Use the information given in the circuit diagram to determine the values of the quantities listed below. [6]



- (a) I_1
-
- (b) V_1
-
- (c) R_1
-
- (d) I_2
-
- (e) The resistance of variable resistor R_2 .
-
-

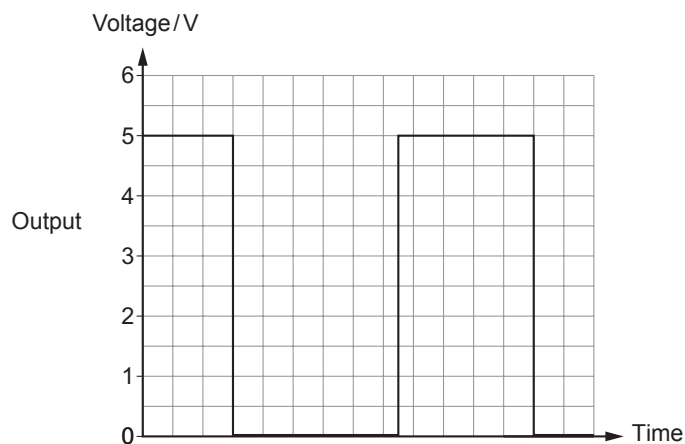
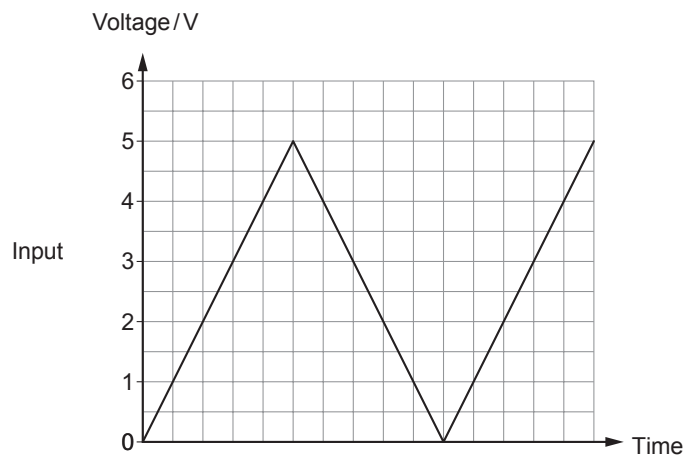
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Question 9

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2. The performance of a Schmitt inverter is checked by applying a triangular waveform to the input. The graphs of the input and output signals are shown below.

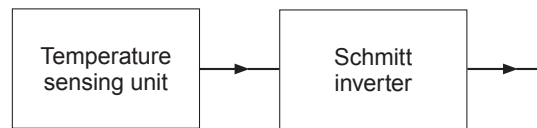


- (a) Determine the input switching threshold for:

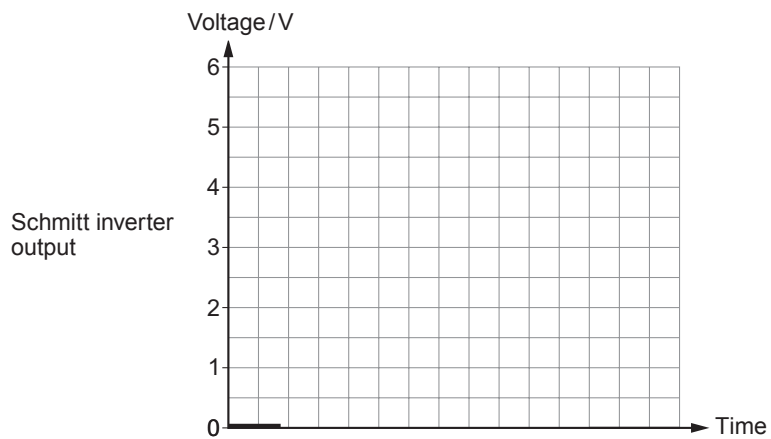
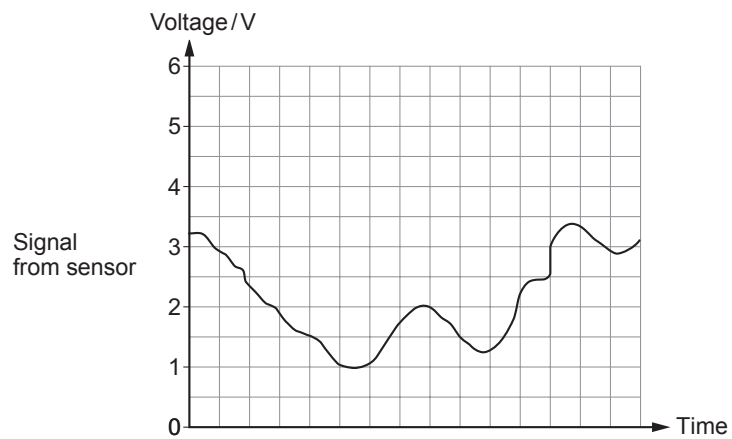
[2]

- (i) an increasing input voltage;
- (ii) a decreasing input voltage.

- (b) The Schmitt inverter is used to condition the signal produced by a temperature sensing unit.



Complete the graph to show the signal obtained at the output of the Schmitt inverter. [3]

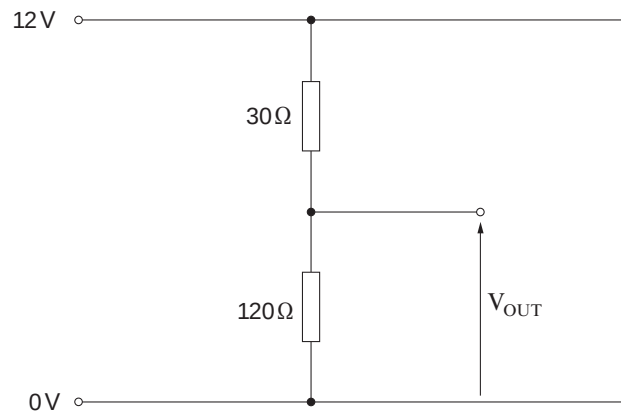
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Question 10

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5. The following circuit is used as a voltage source.



- (a) Thevenin's theorem is used to produce an equivalent circuit.

- (i) Calculate the open circuit voltage V_{OC} .

[1]

.....

.....

- (ii) Calculate the short circuit current I_{SC} .

[1]

.....

.....

- (iii) Calculate the equivalent resistance R_O .

[1]

.....

.....

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(b) This voltage source is used to drive two output devices each having a resistance of $72\ \Omega$.

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- (i) Draw the equivalent circuit with the two $72\ \Omega$ output devices connected ***in parallel*** across the output. [1]

- (ii) Use the equivalent circuit to calculate the power dissipated in **one** of the output devices. [3]

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