8 An alarm clock is controlled by a microprocessor. It uses the 24 hour clock. The hou
by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit re

(a) Identify what time is represented by the following two 8-bit registers.

A

128	64	32	16	8	4	2	1
0	0	0	1	0	0	1	0

:

B

128	64	32	16	8	4	2	1
0	0	1	1	0	1	0	1

Hours ..... Minutes .....

[2]

(b) An alarm has been set for 07:30. Two 8-bit registers, **C** and **D**, are used to represent the hours and minutes of the alarm time.

Show how 07:30 would be represented by these two registers:

C

Hours

:

D

Minutes

[2]

(c) Describe how the microprocessor can determine when to sound the clock alarm.

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.....[3]

(d) The LCD (liquid crystal display) on the clock face is back-lit using blue LE
diodes). The brightness of the clock face is determined by the level of light in
amount of light given out by the LEDs is controlled by a control circuit.

Describe how the sensor, microprocessor and LEDs are used to maintain the c
brightness of the clock face.

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.....[3]

(e) Modern LCD monitors and televisions use LED back-lit technology.

Give **two** advantages of using this new technology compared to the older cold cathode fluorescent lamp (CCFL) method.

1 .....

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2 .....

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[2]

QUESTION 2.

7 **(a)** Street lighting is controlled automatically. A light sensor and a microproces
decide when to switch each street light on or off.

Describe how the sensor, microprocessor and light interact to switch the street light c

Include in your answer how the microprocessor stops the street lights being freque
switched on and off due to brief changes in the light intensity.

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.....[5]

(b) Name **three** different sensors (other than light and pH) and describe an application for each of these sensors.

A different application is needed for each sensor.

Sensor 1 .....

Application .....

.....

Sensor 2 .....

Application .....

.....

Sensor 3 .....

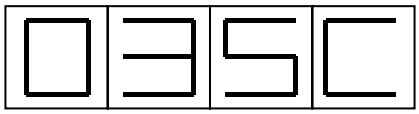
Application .....

.....

[6]

QUESTION 3.

7 Each seat on a flight is uniquely identified on an LCD above the seat. For exam
shown as:



The first three characters are digits that represent the row.
The fourth character is the seat position in that row. This is a single letter, A to F, that is stored as a hexadecimal value.

Each of the four display characters can be stored in a 4-bit register. For example, 0 and C would be represented as:

	8	4	2	1
0:	**0**	**0**	**0**	**0**
C:	**1**	**1**	**0**	**0**

(a) Show how the 4-bit registers would store the remaining two characters, 3 and 5.

3				
5				

[2]

(b) Identify which seat is stored in the following 4-bit registers.

0	**0**	**0**	**1**	→ .....
1	**0**	**0**	**1**	→ .....
0	**1**	**0**	**0**	→ .....
1	**1**	**1**	**0**	→ .....

[2]

QUESTION 4.

5

5 **Six** descriptions and **six** devices are shown below.

Draw a line to link each description to the correct device.

Description	Device
Allows a user to write on a surface using a pen; text and drawings are then captured electronically and stored for later use.	Digital Light Projector
Converts sound into an electrical signal/voltage.	Inkjet printer
Uses thermal bubble and piezoelectric technology to produce a hard copy.	Interactive whiteboard
Uses a bright white light source and micro mirrors (on a chip) to produce an image to be shone onto a wall or screen.	Laser printer
Converts a hard copy document into an electronic form to be stored as a file on a computer.	Microphone
Uses negatively charged images on a rotating drum and positively charged toner to output a hard copy.	Scanner (2D)

[5]

QUESTION 5.

9 A cold store is kept at a constant low temperature using a sensor, a microprocess
unit.

Explain how the sensor and microprocessor will maintain a constant low temperature.

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.....[6]

QUESTION 6.

6 **Six** statements are given about touch screen technology.

Tick (✓) to show if the statement applies to **Capacitive** or **Resistive** touch screen tech

Statement	Capacitive (✓)	Resis (✓)
Needs pressure to be applied to create a circuit		
May not register a touch if the user is wearing gloves		
More commonly used in smartphones		
More responsive to a touch		
Needs an electrical field to be changed to register a touch		
Cheaper to manufacture		

[6]

QUESTION 7.

2 **(a)** **Six** hardware devices are shown.

Tick (✓) to show if each hardware device is an **Input**, **Output** or **Storage** device.

Hardware device	**Input (✓)**	**Output (✓)**	**Storage (✓)**
Solid state drive (SSD)			
Sensor			
Headphones			
Microphone			
USB flash drive			
Actuator			

[6]

(b) Genevieve writes a paragraph about a barcode reader.

Using the list given, complete the paragraph. Not all terms in the list need to be used.

- actuators
- binary
- black
- input
- microprocessors
- output
- sensors
- storage
- white

A barcode reader is an ..... device. It shines a light at the barcode and the light is reflected back. The ..... bars in the barcode reflect less light than the ..... bars.

..... are used to capture the amount of reflected light and the different reflections are converted to ..... values.

[5]

QUESTION 8.

10 Characters can be represented in a computer by a numerical code.

The following list shows 16 characters with their numerical codes in denary:

a = 97	e = 101	k = 107	t = 116
b = 98	g = 103	m = 109	u = 117
c = 99	h = 104	o = 111	w = 119
d = 100	i = 105	r = 114	

. = 46 (code for the full stop)

Web addresses can be written using hexadecimal rather than denary. Hexadecimal codes are preceded by a % sign. For example, the word "**c a g e**" is written as:

either	99	97	103	101	(in denary)
or	%63	%61	%67	%65	(in hexadecimal)

(a) Complete the conversion of the following web address into hexadecimal:

w	w	w	.	c	i	e	.	o	r	g	.	u	k
%77	%77	%77											

[3]

(b) Complete the web address from the given hexadecimal codes:

%77	%77	%77	%2E	%72	%6F	%63	%6B	%69	%63	%74	%2E	%63	%6F	%6D
W	W	W												

[3]

11 A passenger logs onto an airline website and types in the reference number for their flight. Once the passenger accesses their account they can choose their seat and also print out a boarding pass which contains a unique barcode. This barcode is scanned at the airport check-in desk.

Name **one** input and **one** output device found at the check-in desk and give a reason for your choice.

Input device .....

Reason .....

.....

Output device .....

Reason .....

.....

[4]

QUESTION 9.

8 Four input devices are shown in the table below.

Give an application which makes use of each device and state a reason why the
appropriate for that application.

Your application must be different in each case.

Input device	Application and reason
Light sensor	Application ..... Reason ....
Keyboard	Application ..... Reason ....
Barcode reader	Application ..... Reason ....
Touch screen	Application ..... Reason ....

[8]

QUESTION 10.

10 **(a)** A manufacturer of aeroplane engines assigns a denary identification num
engine.

One engine has the ID: 0431

(i) Convert this denary number to a 12-bit binary format.

[2]

(ii) Show how this number would be represented in hexadecimal.

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.....

[3]

(b) The current status of the engine is sent to a computer in the aeroplane.

Each piece of data collected is 8 bytes in size. Data collection occurs every 30 seconds.

Calculate the number of kilobytes that would be needed to store the data collected during a 10-hour flight. Show your working.

.....

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.....

.....

..... kilobytes

[3]

(c) At the end of the flight, all of the data are sent to the aeroplane engine manuf
Internet.

The computer in the aeroplane has a MAC address and an IP address.

State what is meant by these two terms.

MAC address .....

.....

.....

IP address .....

.....

.....

[2]

(d) When sending this data, security is very important. Data are sent over the Internet using Transport Layer Security (TLS) protocol.

Name the **two** layers that make up TLS.

1 .....

2 .....

[2]

QUESTION 11.

9 A sports stadium uses a pressure sensor and a microprocessor to monitor the n
entering the sports stadium. For the counter to increment the weight on the pressur
exceed 5 kg.

Explain how the system uses the pressure sensor and the microprocessor to monitor the nu
of people entering.

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..... [5]

10 Personal computers (PCs) use an operating system.

Explain why this type of computer needs an operating system.

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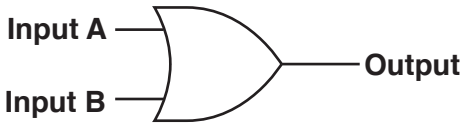
..... [4]

7 A factory manufactures plastic pipes. It uses logic circuits to control the manufact

(a) Consider the logic gate:



Complete the truth table for this logic gate.

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

[1]

(b) Consider the truth table:

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

State the **single** logic gate that produces the given output.

..... [1]

(c) Plastic pipes of various sizes are manufactured by heating the plastic and us

The manufacturing system uses sensors to measure the pressure (P), temperat
speed (S) of production.

The inputs to the manufacturing system are:

Input	Binary value	Condition
P	1	pressure is > 5 bar
	0	pressure is <= 5 bar
T	1	temperature is > 200 degrees Celsius
	0	temperature is <= 200 degrees Celsius
S	1	speed is > 1 metre per second
	0	speed is <= 1 metre per second

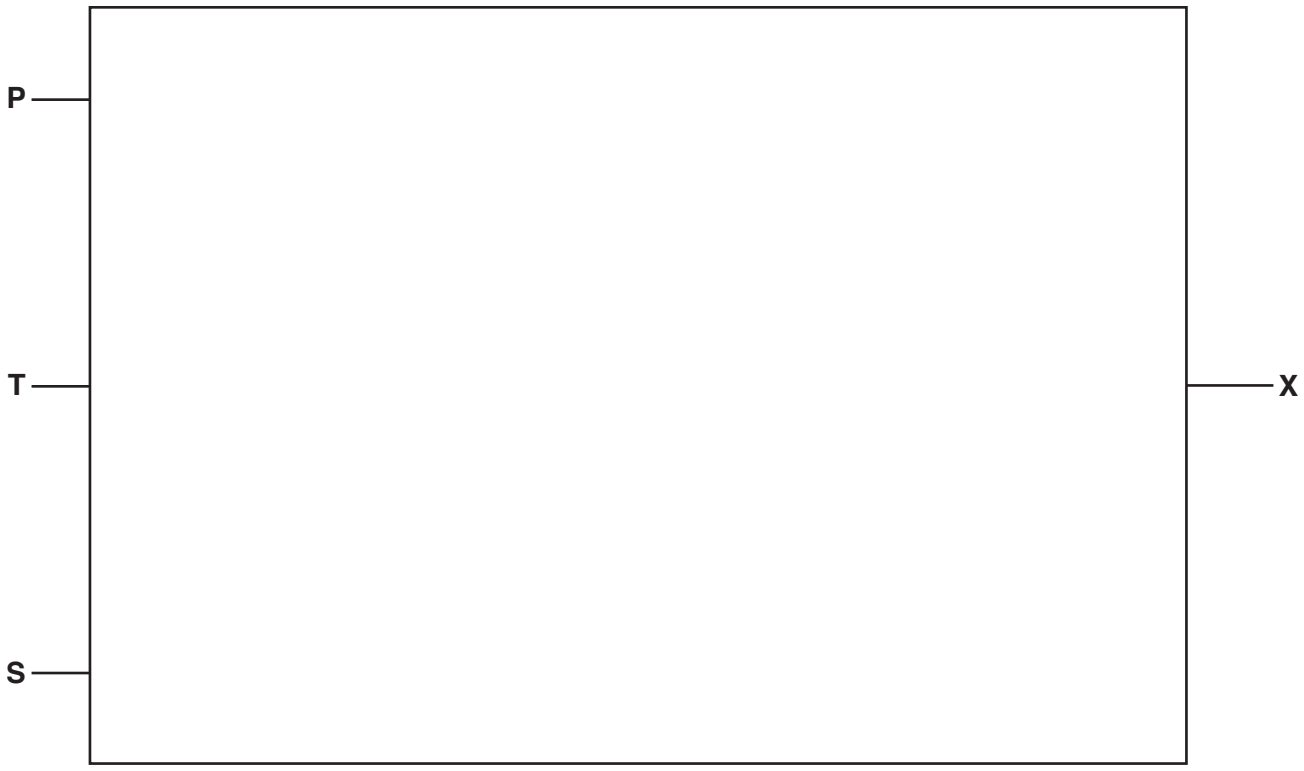
The system will sound an alarm (**X**) when certain conditions are detected.

The alarm will sound when:

Temperature is > 200 degrees Celsius and the pressure is <= 5 bar
or
Speed is > 1 metre per second and Temperature is <= 200 degrees Celsius

Draw a logic circuit to represent the above alarm system.

Logic gates used must have a maximum of **two** inputs.



[5]

(d) Give **two** benefits of using sensors to monitor the manufacture of plastic pip

1 .....

.....

2 .....

4 A factory that manufactures cleaning products has a system that monitors cond... the manufacturing process.

The inputs to the system are:

Input	Binary value	Condition
A	1	pH > 7
	0	pH < = 7
T	1	Temperature < 35 °C
	0	Temperature > = 35 °C
P	1	Pressure > = 80 %
	0	Pressure < 80 %

(a) The system will sound an alarm (**X**) when certain conditions are detected.

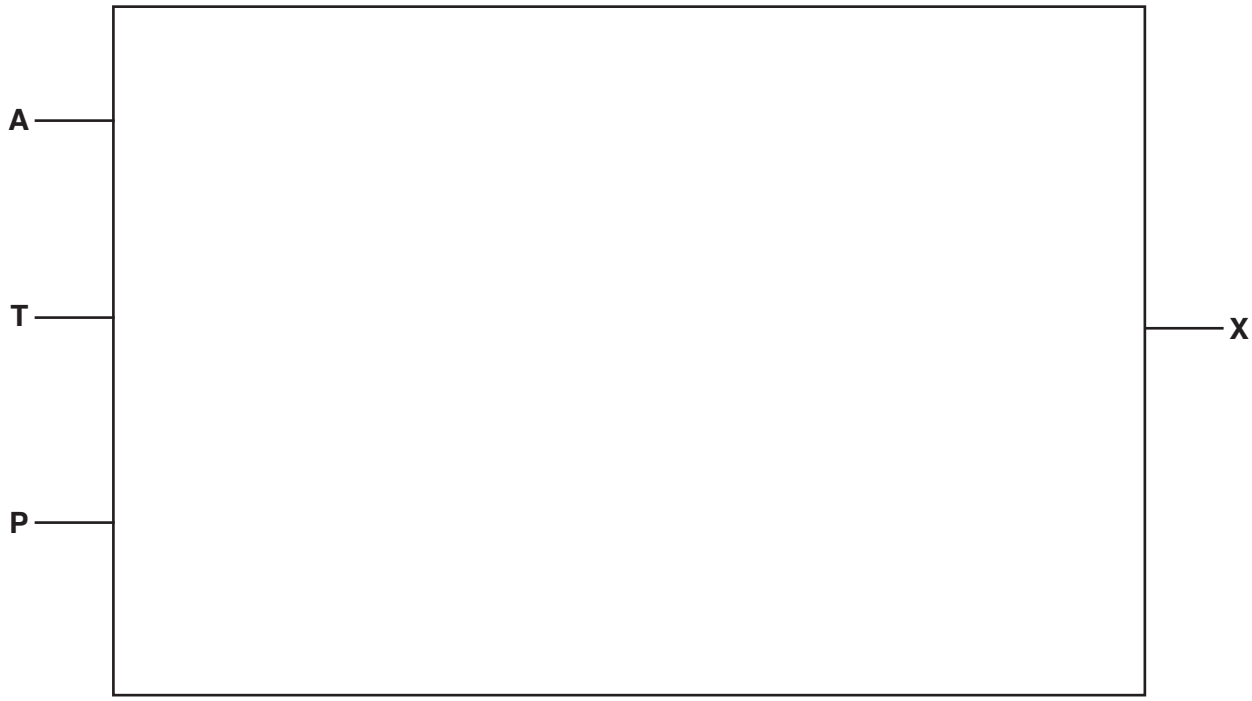
The alarm will sound when:

- The pressure > = 80 % and the temperature > = 35 °C

or

- The temperature < 35 °C and the pH > 7

Draw a logic circuit to represent the alarm system in the factory. Each logic gate must have a maximum of two inputs.



[4]

(b) Complete the truth table for the given logic problem.

A	T	P	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) A sensor and a microprocessor are used to monitor the pH of the cleaning products. The system records each reading that is taken. If the reading is greater than 7 a warning message is displayed on a monitor.

Explain how the sensor and microprocessor are used in the system.

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..... [6]