Higher
Coursework
Assessment Task

Higher Engineering Science

Assignment

Assessment task: manufacturing factory

This document provides information for teachers and lecturers about the coursework component of this course in terms of the skills, knowledge and understanding that are assessed. It **must** be read in conjunction with the course specification.

Specimen — valid from session 2018-19 and until further notice.

This edition: August 2018 (version 1.0)

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Introduction

This document contains instructions for teachers and lecturers, instructions for candidates and marking instructions for the Higher Engineering Science assignment. You must read it in conjunction with the course specification.

This assignment is worth 50 marks. This is 31% of the overall marks for the course assessment.

This is one of two course assessment components. The other component is a question paper.

Instructions for teachers and lecturers

This is a specimen assessment task.

SQA publishes a new assessment task on the secure website each academic year. The task is valid for that year only. Once complete, you must send the assignment responses to SQA to be marked.

You must conduct the assignment under a high degree of supervision and control. This means:

- candidates must be within your direct sight
- candidates must not interact with each other
- candidates must not have access to e-mail, the internet and mobile phones
- candidates must complete their work independently — no group work is permitted
- classroom display materials that might provide assistance must be removed or covered
- with no interruption for learning and teaching
- in a classroom environment

Time

Candidates have 8 hours to complete the assignment, starting at an appropriate point in the course after all content has been delivered. Once candidates begin, they must continue in each subsequent class period until the permitted time allocation has been used up.

You have a responsibility to manage candidates' work, distributing it at the beginning and collecting it at the end of each session, and storing it securely in between. This activity does not count towards the total time permitted for candidates to complete the assignment.

Resources

This is a closed-book assessment. Candidates must not have access to learning and teaching materials, the internet, notes, exemplar materials, resources on classroom walls or anything similar.

A data booklet containing relevant data and formulae is available on the Higher Engineering Science subject page on SQA's website. This can be used for the assignment.

There may be instances where restriction of internet/network use is not practical/feasible (for example, if you have a local authority-managed network with specific limitations, software that is web-based, or something similar). However, it remains your professional responsibility to make every effort to meet the assessment conditions.

Each assessment task includes instructions and details of any equipment or materials required. Candidates can also use normal classroom equipment, software and

hardware (such as drawing instruments, pneumatics, mechanisms and electronics kit, simulation software, and PCs to run the software) to complete the tasks.

Reasonable assistance

Candidates must progress through each stage of the assignment without your intervention or guidance, having acquired the skills earlier in the course.

Once candidates complete the assignment, you must not return it to them for further work. You must not provide feedback to candidates or offer your opinion on the perceived quality or completeness of the assignment response, at any stage.

You can provide reasonable assistance to support candidates with the following aspects of their assignment:

- printing, collating and labelling their evidence to ensure it is in the format specified by SQA
- ensuring candidates have all the materials and equipment required to complete the assignment
- understanding the information outlined in these instructions

Evidence

All candidate evidence (whether created manually or electronically) must be submitted to SQA in paper-based format.

Each task details what evidence is required and how many pages are expected. This is a guide to ensure that candidates do not produce too much work or spend too long on a single task.

Candidates must submit single-sided A4 pages. The pages must not have anything fixed to them. Any screenshots, simulation printouts and/or images must be clear and easy to read.

Alteration or adaptation

You must not alter, adapt or modify the assignment in any way. This includes moving the content of the assignment into a different format or workbook. All candidates must undertake the assignment exactly as it is provided by SQA.

Submission

Each piece of work must be labelled with the task number, for example task 2a, and the back of each page must be clearly labelled with the candidate's details.

Photographs must show the candidate's name next to the piece of work.

Volume

There is no word or page count.

Specific instructions for teachers and lecturers: specimen assignment

You must follow these specific instructions. You must ensure that candidates are aware of the assessment conditions and know what they should do for each task.

This assignment has three mandatory tasks. Candidates can complete the tasks in the order presented or in an order that helps manage classroom equipment.

Each task has a notional time allocated to it — this provides an indication of how long candidates should spend on the task.

All tasks must be completed on A4 single-sided paper or the worksheets provided, with the task number clearly labelled.

Any evidence printed (screenshots or images) **must be clear and easy to read**.

Task 1 (18 marks)
Notional time: 3 hours

- task 1: completed on up to five single-sided A4 pages
- task 1c: a worksheet is provided for this task

Task 2 (24 marks)
Notional time: 3 hours 45 minutes

- task 2: completed on up to six A4 single-sided pages
- task 2d: a worksheet is provided for this task

Task 3 (8 marks)
Notional time: 1 hour 15 minutes

- task 3: completed on up to four A4 single-sided pages
- task 3a: candidates **must not** use simulation software for this task
- task 3c: a worksheet is provided for this task

Note: electronically-generated evidence (for example simulations and coding) is included in the expected number of pages for each task. This must be printed off and compiled for uplift by SQA.

Instructions for candidates

This assessment applies to the assignment for Higher Engineering Science.

This assignment is worth 50 marks. This is 31% of the overall marks for the course assessment.

It assesses the following skills, knowledge and understanding:

- demonstrating engineering science skills and creativity
- analysing engineering problems
- designing and building/simulating solutions to engineering problems
- testing and evaluating solutions to engineering problems

This is a closed-book assessment. Your teacher or lecturer will let you know if there are any specific conditions for doing this assessment.

In this assessment, you have to:

- analyse a problem
- design a solution to the problem
- build (simulate or construct) your solution
- test your solution
- evaluate your work

You have 8 hours to complete the assignment. The time to set up and clear away any equipment you need, and for any printing that is necessary, does not count towards the 8 hours.

You should complete all of the tasks in the order presented, unless otherwise instructed.

The assignment has three tasks, with marks allocated as follows:

Task 1 — 18 marks: analysing, building, designing, testing and evaluating a solution (electronics) for the control of a heating system
(analysing = 6 marks, building = 4 marks, testing = 4 marks, evaluating = 4 marks)

Task 2 — 24 marks: building, designing, testing and evaluating solutions (pneumatics, structures and mechanisms) for the assembly line
(building = 6 marks, designing = 8 marks, testing = 5 marks, evaluating = 5 marks)

Task 3 — 8 marks: designing, building, testing and evaluating a solution (electronics) for the security system
(designing = 3 marks, building = 2 marks, testing = 1 mark, evaluating = 2 marks)

For each task, you are provided with an engineering science problem or situation.

Submitting your work

Your teacher or lecturer will let you know the approximate amount of time to spend on each task, along with an indication of the number of single-sided A4 pages of evidence that you should produce.

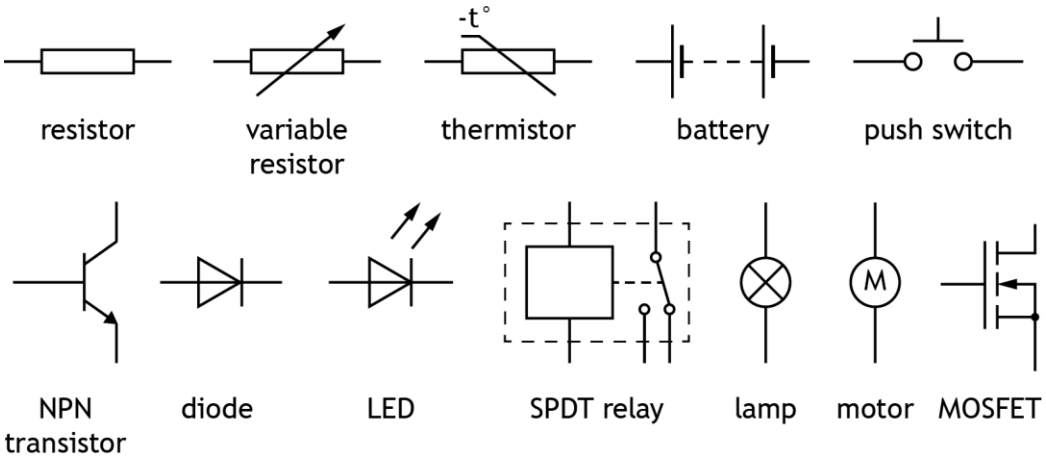
You must label each piece of evidence with the task number (for example task 2a), and on the back of each page include your:

- name
- date of birth
- Scottish Candidate Number (SCN)
- centre name
- centre number

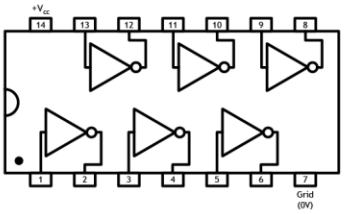
Candidate data sheets — manufacturing factory

You can use these data sheets and SQA's Higher Data Booklet when completing this assignment. **No other resource material is permitted.**

Electronic components



IC pinout diagrams



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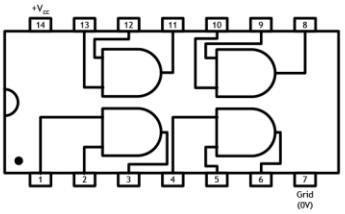

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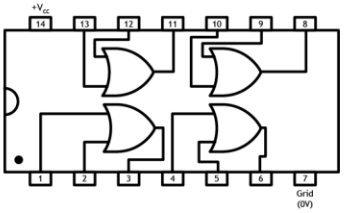

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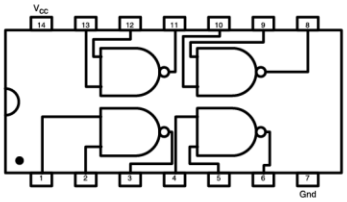

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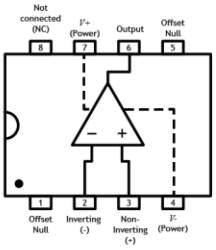
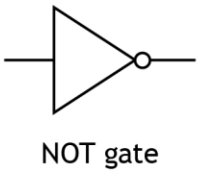


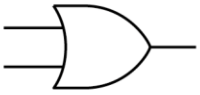
741

Logic gates



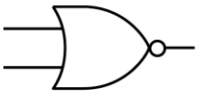
NOT gate

AND gate

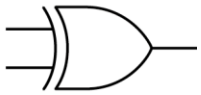


OR gate

NAND gate

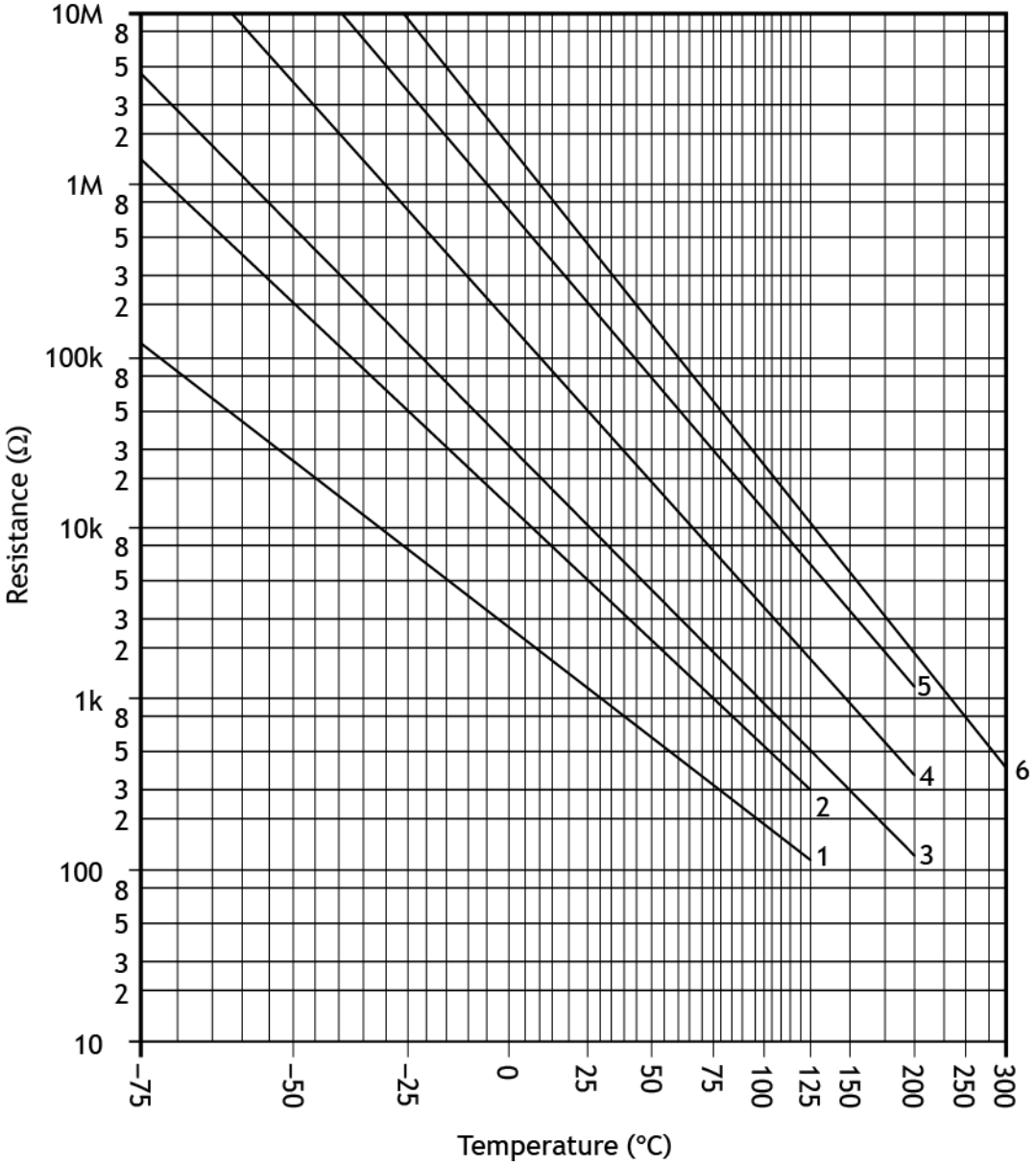


NOR gate

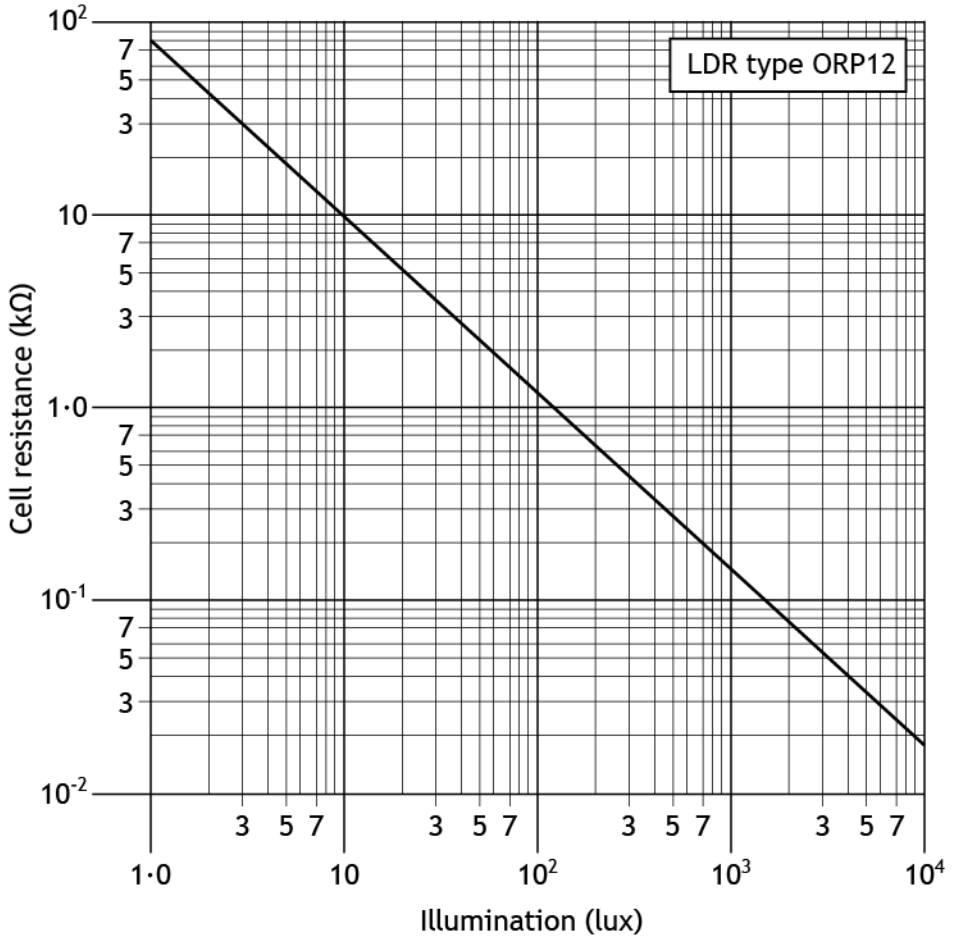


XOR gate

Thermistor graph



Light Dependent Resistor (LDR) graph for an ORP12 LDR



Pneumatic components

Actuators

solenoid

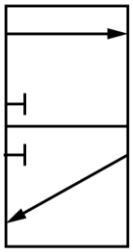
plunger

diaphragm

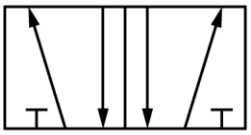
spring return

pilot air

Valves



3/2 valve

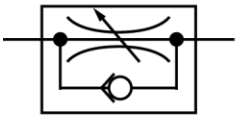


5/2 valve

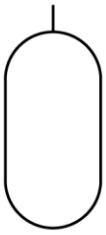
main air

exhaust

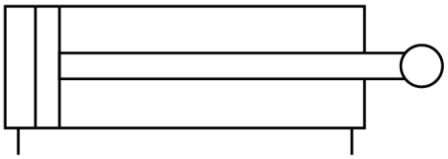
Components and cylinders



unidirectional restrictor



reservoir



double acting cylinder

Manufacturing factory

A team of engineers is involved in several tasks during the planning of a new factory.

The tasks include developing proposals for the following:

- heating system
- package distribution system
- security system

Task 1 — heating system

The proposed factory heating system is a pumped hot-water and radiator system.

An electronic control system is required to control the heating system within the factory. The system should meet the following specification:

i A user sets the desired temperature within the factory.

ii Whenever the actual temperature of the factory drops below the desired temperature, a motorised pump switches on.

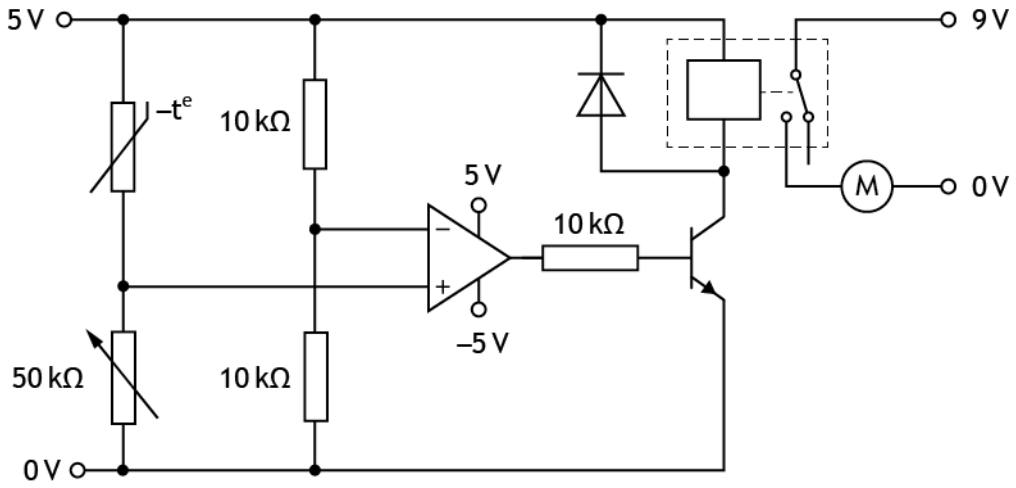
iii Whenever the actual temperature of the factory rises above the desired temperature, the motorised pump switches off.

1a Analyse the above specification by designing a control diagram for the electronic control and pump motor.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(6 marks)

The circuit diagram below shows a proposal for the electronic control system of the heating system.



1b Simulate or construct this circuit.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read.**

(3 marks)

1c Complete the testing table in **worksheet 1c** by carrying out the planned tests given in the table. You should make amendments, as necessary, **before** moving on to the next test.

You must write descriptions of the actual results you observed during testing and any appropriate amendments you made to enable the system to satisfy the specification.

You must present completed **worksheet 1c** on an A4 single-sided page, with the task number clearly labelled.

(4 marks)

1d Using your results from **task 1c**, simulate or construct your amended circuit.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read.**

(1 mark)

1e Evaluate the performance of your amended circuit from **task 1d** against the system specification, by:

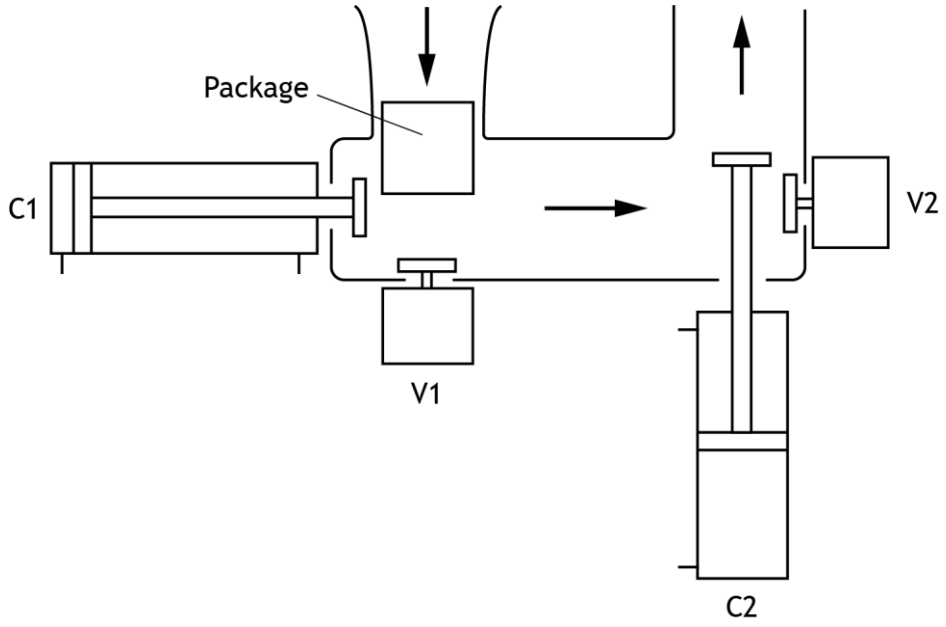
- describing how your amended solution meets specification points ii and iii — you should do this by referring to testing and any amendments you may have made
- describing the overall effectiveness of your amended solution in controlling the heating system
- suggesting an improvement to the system

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(4 marks)

Task 2 — package distribution system

A plan view of part of the factory's pneumatically operated package distribution system is shown below.



The system must meet the following specification:

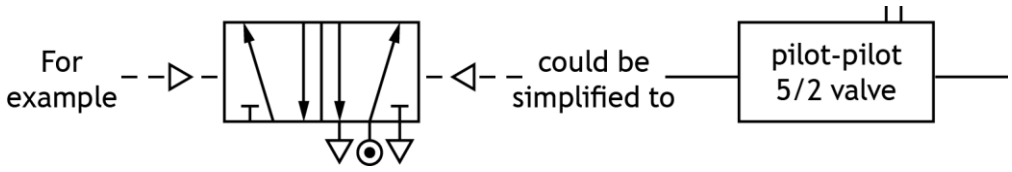
i A package is loaded manually and pushed into position to activate valve V1.

ii Cylinder C2 instrokes and, after an adjustable delay, cylinder C1 outstrokes.

iii The package then slides down a slope and actuates valve V2. This causes cylinder C1 to instroke and, at the same time, causes cylinder C2 to outstroke.

Description of part	Number supplied
5/2 Pilot-pilot valve	2
3/2 Plunger, spring return valve	2
Unidirectional flow restrictor	1
Reservoir	1
Double acting cylinder	2

2a Design a pneumatic circuit to meet the specification, using the correct symbols for the components or block diagrams.



You must label V1, V2, C1 and C2, and the direction of the piston outstroke on cylinders C1 and C2. Show all required pipe connections between the components.

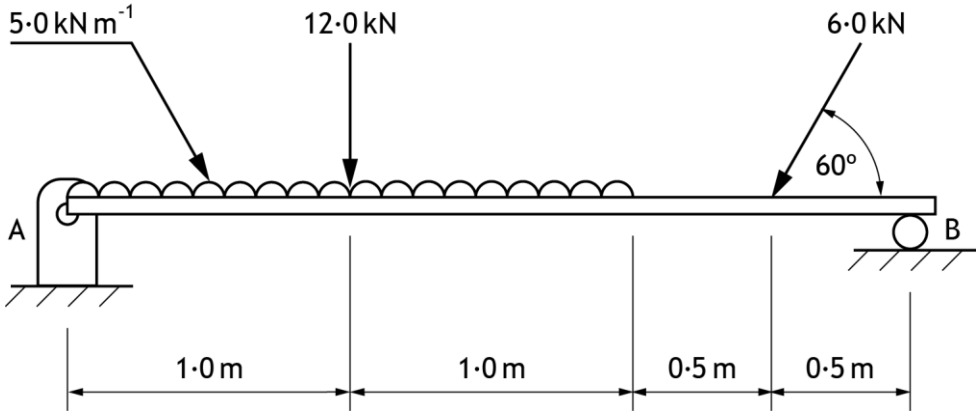
If using block diagrams, label all pneumatic components.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(6 marks)

The package distribution system for the factory needs load-bearing supports.

A diagram of a support is shown below.



2b Simulate this structure to determine the horizontal and vertical reactions at A and at B.

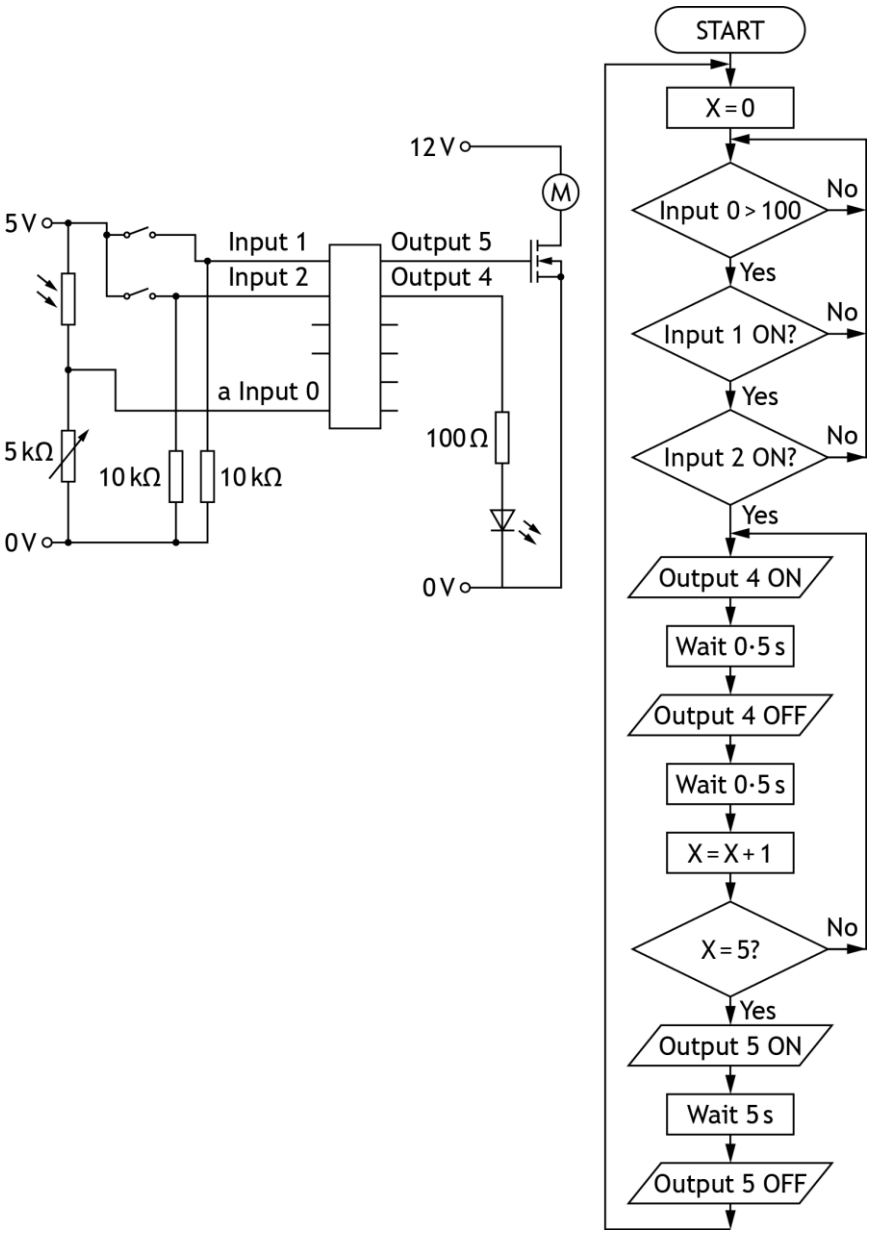
You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(2 marks)

A section of the package distribution system will use a microcontroller to operate a motorised packaging machine and warning system.

As a possible solution, an electronic engineer has designed the flowchart and circuit shown below.

Note: the voltage divider is connected to an analogue input.



2c Simulate or construct the flowchart and electronic circuit **integrated together** as shown above.

You must present your evidence on A4 single-sided pages with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(4 marks)

The packaging distribution system is operated by a microcontroller, using the following specification:

i When the light level drops below a set level (100), the system must be ready to activate the motor and LED.

ii If either switch is pressed when the light level is below the set level then the LED will flash.

iii The LED must flash five times before the motor is activated.

Errors were found with the flowchart during testing.

2d Complete the testing table in **worksheet 2d** by carrying out the planned tests given. You should make amendments, as necessary, **before** moving on to the next test.

You must write descriptions of the actual results you observed during testing and any appropriate amendments you made to enable the system to satisfy the specification.

You must present completed **worksheet 2d** on an A4 single-sided page, with the task number clearly labelled.

(5 marks)

2e Draw or simulate your **amended flowchart** from task 2d.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(2 marks)

2f Evaluate the performance of your circuit and amended flowchart from **task 2e** against the system specification by describing:

- how your amended flowchart meets each of the specification points
- two observations on its overall suitability as a packaging distribution system

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(5 marks)

Task 3 — security system

A combinational logic circuit is required to control part of the factory's security system.

An electronic engineer has developed the following Boolean equation:

$$Z = (\overline{A \cdot B}) + (C \cdot D)$$

3a Draw a circuit diagram to perform this function**.** You **must not** use simulation software to complete this task.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(3 marks)

3b Simulate or construct your logic circuit from **task 3a**.

You must present your evidence on A4 single-sided pages, with the task number clearly labelled. Screenshots or images **must be clear and easy to read**.

(2 marks)

3c Test your logic circuit and complete the truth table on **worksheet 3c** showing the actual results.

You must present completed **worksheet 3c** on an A4 single-sided page, with the task number clearly labelled.

(1 mark)

3d Evaluate the performance of your logic circuit against the expected results in **worksheet 3c**.

(1 mark)

The electronic engineer considered using a NAND equivalent circuit as an alternative to a circuit made up of different logic gates.

3e Describe the impact this would have on the circuit.

You must present your evidence for **tasks 3d and 3e** on A4 single-sided pages, with the task number clearly labelled.

(1 mark)

Worksheet 1c

Planned test	Expected result	Actual result	Amendments made
Starting with the lowest temperature setting, increase the temperature to the thermistor to its highest setting	Motor will switch off		
Lower the temperature to the thermistor to its lowest setting	Motor will switch on		
Adjust the variable resistor, and then raise and lower the temperature	Motor will switch off or on at different temperatures		

(4 marks)

Worksheet 2d

Planned test	Expected result	Actual result	Amendments made
Adjust the LDR to drop the light level below 100	System is ready for switches to be activated — flow chart progresses to the next decision box		
Press the switch connected to input one, when light level is below 100	LED starts to flash		
Press either switch, when light level is below 100	LED flashes five times, then the motor spins		

(5 marks)

Worksheet 3c

A	B	C	D	Expected result	Actual result
0	0	0	0	1	
0	0	0	1	1	
0	0	1	0	1	
0	0	1	1	1	
0	1	0	0	0	
0	1	0	1	0	
0	1	1	0	0	
0	1	1	1	1	
1	0	0	0	0	
1	0	0	1	0	
1	0	1	0	0	
1	0	1	1	1	
1	1	0	0	0	
1	1	0	1	0	
1	1	1	0	0	
1	1	1	1	1	

(1 mark)

Marking instructions

The following marking instructions are for the Higher Engineering Science specimen assignment. In line with SQA's normal practice, they are addressed to the marker. They will also be helpful if you are preparing candidates for course assessment.

Marking instructions are not provided for annual assessment tasks. Candidates' evidence is submitted to SQA for external marking.

General marking principles

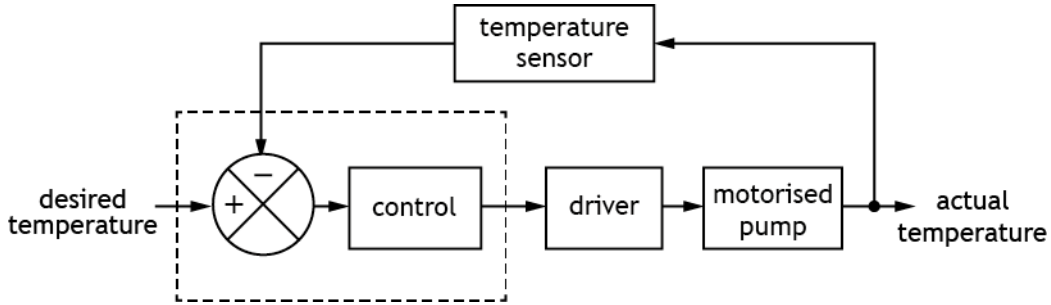
Always apply these general principles. Use them in conjunction with the specific marking instructions, which identify the key features required in candidates' responses.

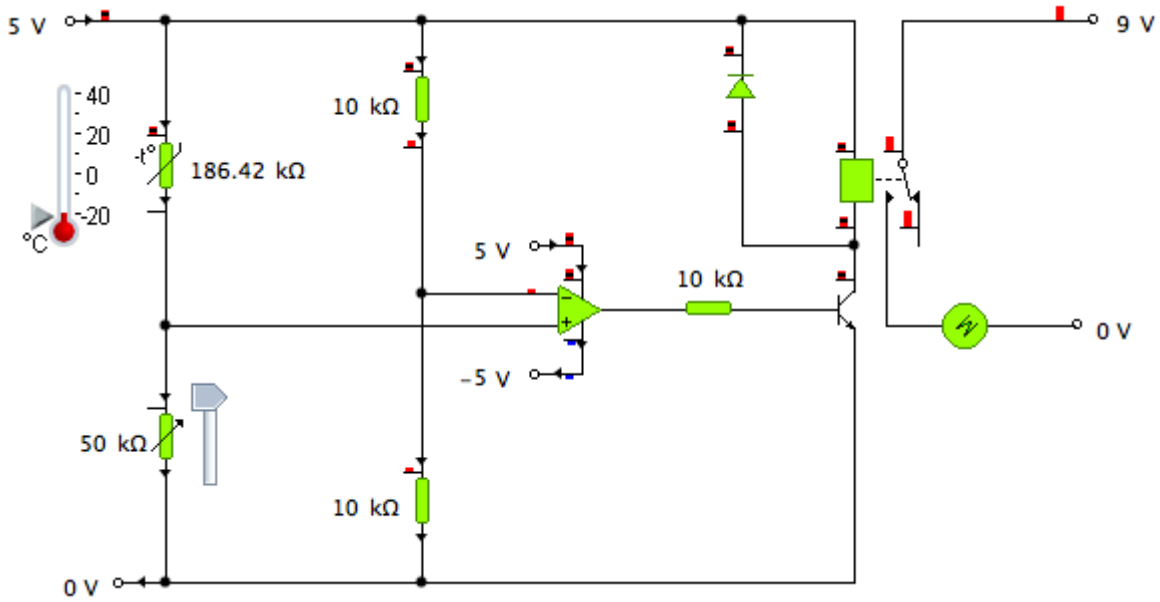
a Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

b If a candidate response does not seem to be covered by either the principles or specific marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

Specific marking instructions

Task 1 — heating system

Task		Expected response	Max mark	Additional guidance
1	a		6	Control diagram: ♦ error detector **(1 mark)** ♦ control box, correct order **(1 mark)** ♦ driver box, correct order **(1 mark)** ♦ motor box, correct order **(1 mark)** ♦ temperature sensor, feedback loop, from correct place and direction **(1 mark)** ♦ both input and output **(1 mark)**

Task		Expected response	Max mark	Additional guidance
1	b		3	Input – voltage dividers **(1 mark)** Process – op-amp and transistor **(1 mark)** Output – relay, motor, power supply, diode and orientation **(1 mark)**

<table>
<tr><th colspan="2">Task</th><th colspan="4">Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td rowspan="4">1</td><td rowspan="4">c</td><td>Planned test</td><td>Expected result</td><td>Actual result</td><td>Amendment made</td><td rowspan="4">4</td><td rowspan="4">Actual result:
motor remains on
(1 mark)

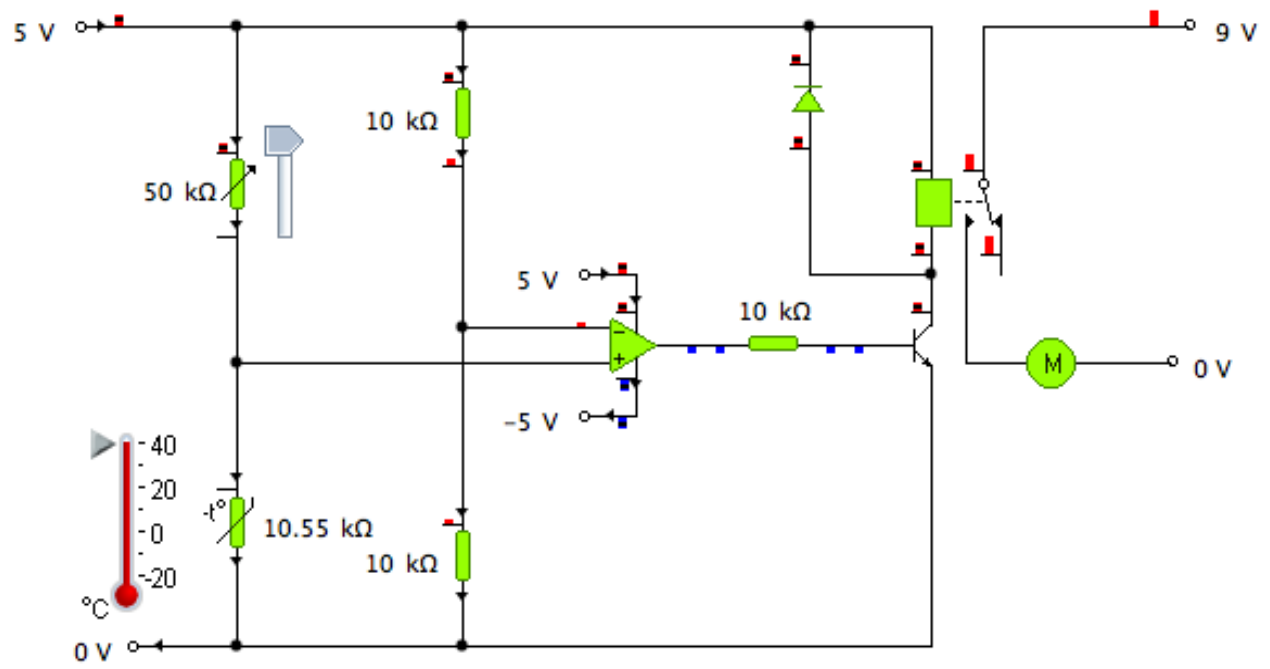
Amendment made:
rewire the relay or flip voltage divider or flip op-amp
(1 mark)

Actual result:
motor will switch on
(1 mark)

Amendment made:
none required

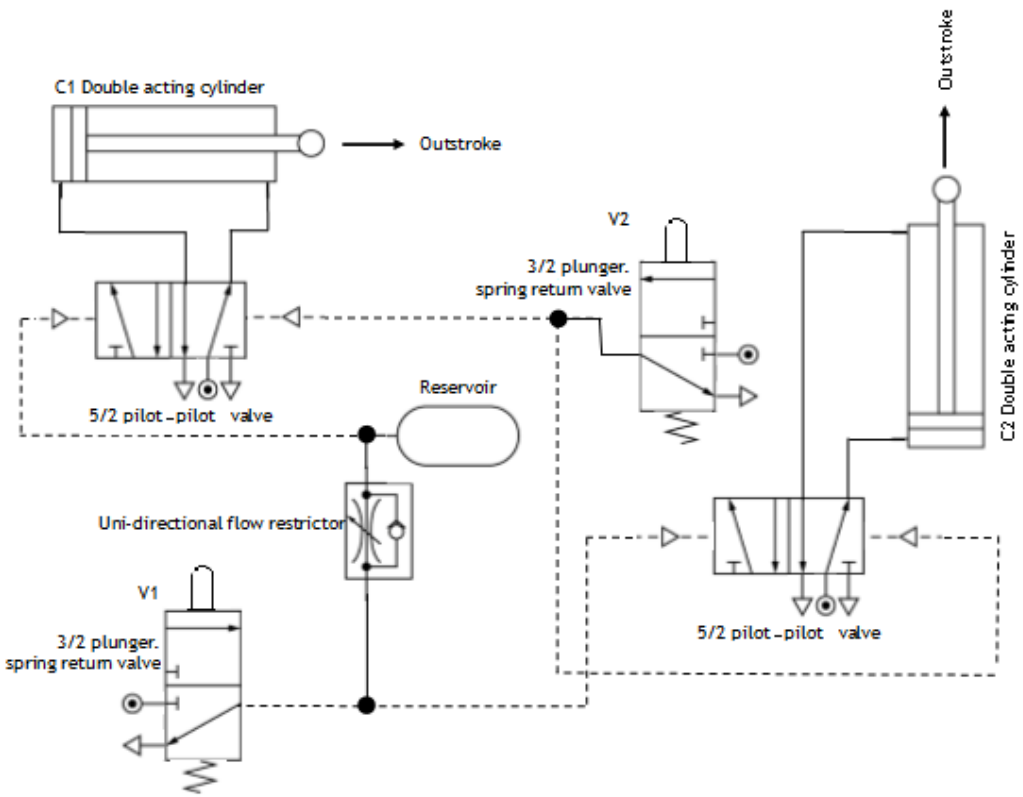
Actual result:
motor will switch off or on at different temperatures
(1 mark)

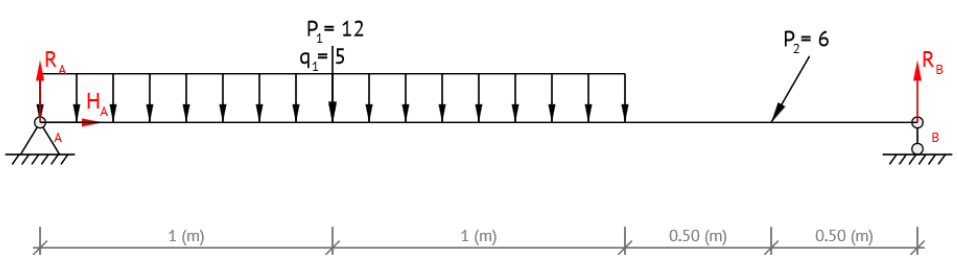
Amendment made:
none required</td></tr>
<tr><td>Starting with the lowest temperature setting, increase the temperature to the thermistor to its highest setting</td><td>Motor will switch off</td><td>Motor switches on</td><td>Rewire the relay or flip voltage divider or flip op-amp</td></tr>
<tr><td>Lower the temperature to the thermistor to its lowest setting</td><td>Motor will switch on</td><td>Motor does switch on</td><td>None required</td></tr>
<tr><td>Adjust the variable resistor, and then raise and lower the temperature</td><td>Motor will switch off or on at different temperatures</td><td>Motor does switch off or on at different temperatures</td><td>None required</td></tr>
</table>

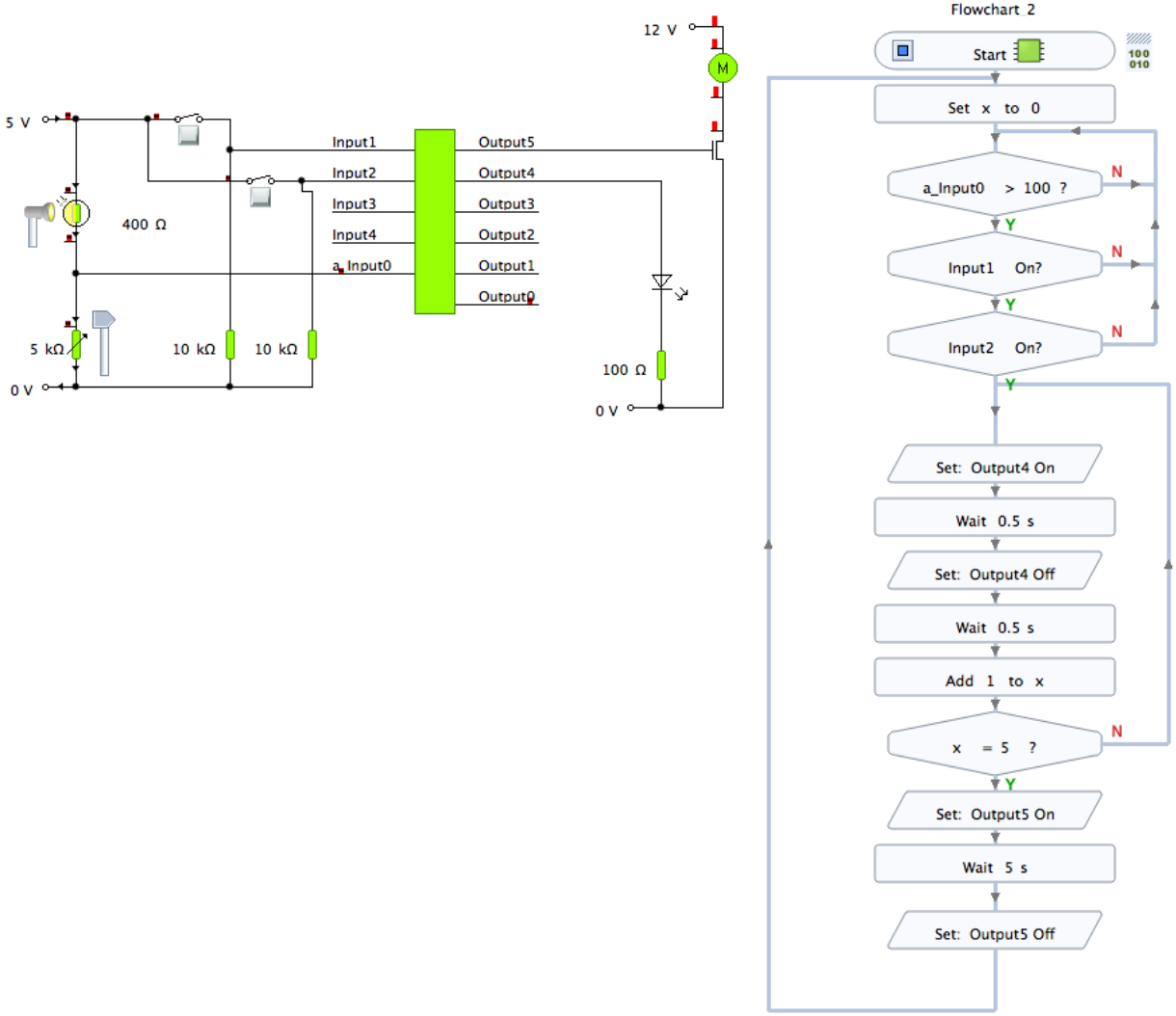
Task		Expected response	Max mark	Additional guidance
1	d		1	Correct positive amendment made to the circuit shown on simulation **(1 mark)** Allow follow-through error based on candidate's response in testing table 1c

Task		Expected response	Max mark	Additional guidance
1	e	Specification point ii met – when I lower the input temperature, the motor switches on. Specification point iii met – when I raise the input temperature, the motor switches off. After switching off, the motor took a considerable time to slow down and stop. This may cause some issues, as heat would still be supplied during this phase, raising the temperature even further. The sensitivity of the temperature sensor was successfully altered using the variable resistor, so the user could set the system to trigger at different levels. The solution performs as expected, however, it would only provide very basic control for what is a quite complex environment. Introducing independent controls for different areas would be a much better option.	4	Evaluative comment about each specification point, maximum 2 marks **(1 mark each point)** Evaluative comment about the overall system **(1 mark)** Improvement comment about system **(1 mark)** Evaluative comments should be descriptive and detail how well the specification points were met, and the changes that were made You can award the mark for the evaluative comment about the overall system for possible improvements Allow follow-through error based on candidate's response in testing table 1c

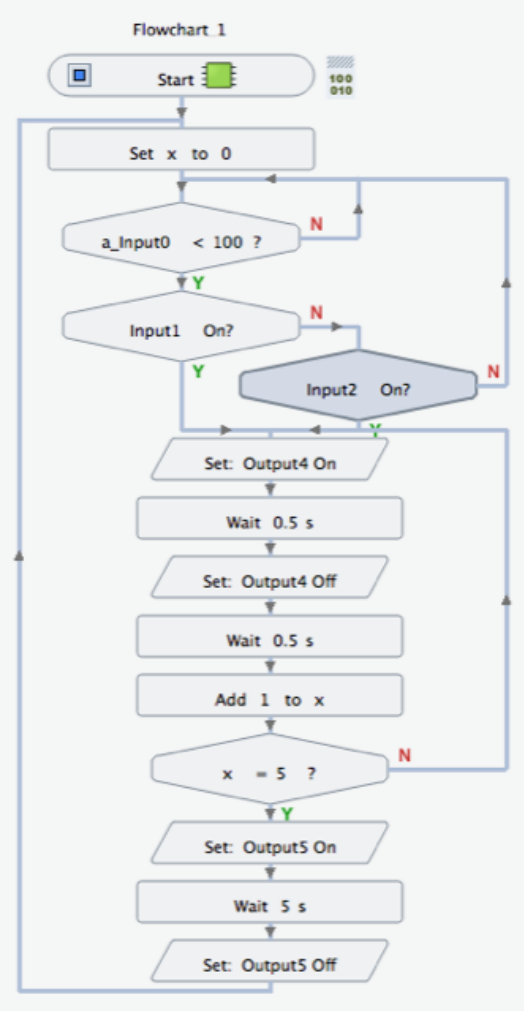
Task 2 — package distribution system

Task		Expected response	Max mark	Additional guidance
2	a		**6**	Both 5/2 valves connected to each cylinder **(1 mark)** V1 3/2 valve connected to 5/2 to produce C2- (**1 mark**) V1 3/2 valve connected to 5/2 to produce C1+ (**1 mark**) V2 connected to produce C1- and C2+ (**1 mark**) V2 connected to produce C2+ (**1 mark**) UDR and reservoir positioned to form delay (**1 mark**)

Task		Expected response	Max mark	Additional guidance
2	b	 **Calculate the reactions at the supports of a beam** 1. A beam is in equilibrium when it is stationary relative to an inertial reference frame. The following conditions are satisfied when a beam, acted upon by a system of forces and moments, is in equilibrium: **$\Sigma F_x = 0$:** $H_A - P_2*\cos(60) = 0$ **$\Sigma M_A = 0$:** The sum of the moments about a point A is zero: $- q_1*2*(2/2) - P_1*1 - P_2*\sin(60)*2.5 + R_B*3 = 0$ **$\Sigma M_B = 0$:** The sum of the moments about a point B is zero: $- R_A*3 + q_1*2*(3 - 2/2) + P_1*2 + P_2*\sin(60)*0.5 = 0$ 2. Solve this system of equations: $H_A = P_2*\cos(60) = 6*0.5000 = 3.00$ (kN) Calculate reaction of roller support about point B: $R_B = (\ q_1*2*(2/2) + P_1*1 + P_2*\sin(60)*2.5) / 3 = (\ 5*2*(2/2) + 12*1 + 6*\sin(60)*2.5) / 3 = 11.66$ (kN) Calculate reaction of pin support about point A: $R_A = (\ q_1*2*(3 - 2/2) + P_1*2 + P_2*\sin(60)*0.5) / 3 = (\ 5*2*(3 - 2/2) + 12*2 + 6*\sin(60)*0.5) / 3 = 15.53$ (kN) 3. The sum of the forces is zero: **$\Sigma F_y = 0$:** $R_A - q_1*2 - P_1 - P_2*\sin(60) + R_B = 15.53 - 5*2 - 12 - 6*\sin(60) + 11.66 = 0$ Vertical: R_A = 15·53 kN R_B = 11·66 kN Horizontal: R_A = 3 kN R_B = 0 N	2	Reaction at R_A, horizontal and vertical **(1 mark)** Reaction at R_B, horizontal and vertical **(1 mark)** Allow follow-through error for incorrect values simulated/constructed

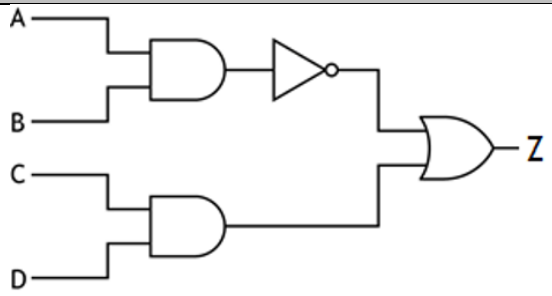
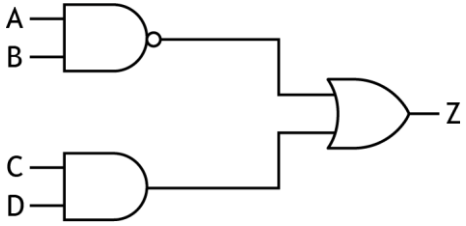
Task		Expected response	Max mark	Additional guidance
2	c		4	Digital inputs (**1 mark**) Using analogue input on microcontroller and voltage divider (**1 mark**) Outputs, including MOSFET (**1 mark**) Flow chart (**1 mark**)

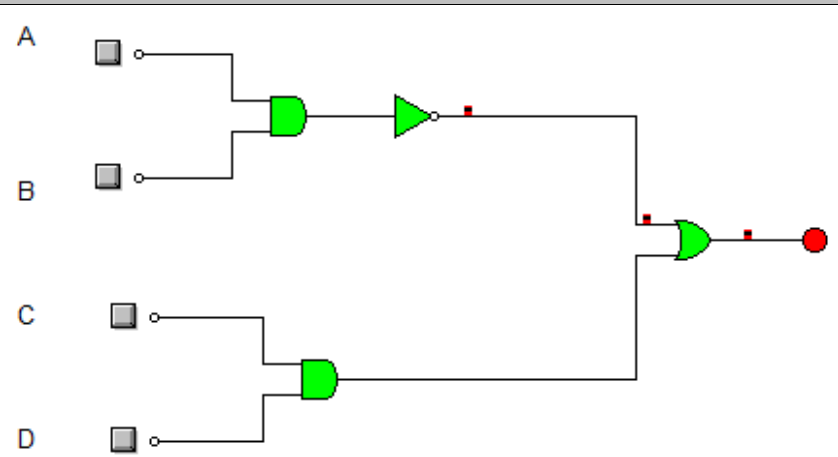
Task		Expected response		Max mark	Additional guidance
2	d	**Actual result**	**Amendments made**	5	Actual result for light sensor **(1 mark)** Actual result for AND/OR **(1 mark)** Actual result for fixed loop **(1 mark)** Amendment for light sensor **(1 mark)** Amendment for AND/OR **(1 mark)** Follow through: award marks if candidates make mistakes completing the simulation, but rectify them in the testing section
		Flow chart moved on when light level increased above 100	Change decision box so that > becomes <		
		LED started flashing only when both switches were pressed By testing that only one switch is pressed, the result is the LED does not flash	Moved decision boxes to form OR arrangement		
		LED flashed five times before the motor spun	No amendments		

Task		Expected response	Max mark	Additional guidance
2	e		2	Flowchart must cover both amendments Light level amendment **(1 mark)** OR control amendment **(1 mark)**

Task		Expected response	Max mark	Additional guidance
2	**f**	Specification point i met — the system now requires the light level to be below 100 before anything else can happen and works effectively. Specification point ii met — initially the system operated an AND function with the switches, but has now been changed to the required OR function and operates correctly. Specification point iii met — the LED successfully flashed five times before the motor began. The use of the microcontroller means that the system can easily be adapted or upgraded if additional functions are required. Using push-to-make switches would mean the system would not just keep repeating without further user input.	**5**	Award 1 mark for referencing each specification point and stating if the specification point is met (**3 marks**) Award 1 mark for each observation on broader aspects of the solution **(2 marks)** Allow follow-through error based on final flowchart/circuit

Task 3 — security system

Task		Expected response	Max mark	Additional guidance
3	a	 	3	Award 1 mark for each correct gate with connections (**3 marks**) AND and NOT in series could be replaced with NAND as shown in the second diagram

Task		Expected response	Max mark	Additional guidance
3	b		2	Correct gates, as per candidate's design, follow through **(1 mark)** Inputs/outputs **(1 mark)** AND and NOT could be replaced with NAND

Task		Expected response						Max mark	Additional guidance
3	c	A	B	C	D	Expected result	Actual result	1	Actual results in truth table **(1 mark)** Award no marks if there is no evidence of simulation in 3b Allow follow-through error, based on final flowchart/circuit
		0	0	0	0	1	**1**		
		0	0	0	1	1	**1**		
		0	0	1	0	1	**1**		
		0	0	1	1	1	**1**		
		0	1	0	0	0	**1**		
		0	1	0	1	0	**1**		
		0	1	1	0	0	**1**		
		0	1	1	1	1	**1**		
		1	0	0	0	0	**1**		
		1	0	0	1	0	**1**		
		1	0	1	0	0	**1**		
		1	0	1	1	1	**1**		
		1	1	0	0	0	**0**		
		1	1	0	1	0	**0**		
		1	1	1	0	0	**0**		
		1	1	1	1	1	**1**		
		0	0	0	0	1	**1**		

Task		Expected response	Max mark	Additional guidance
3	d	The actual results were significantly different from the expected results because the combinational logic circuit behaves exactly as the Boolean expression requires. The expected results in the table are therefore incorrect.	1	Evaluative comment based on the result **(1 mark)** Evaluative comments must be descriptive
3	e	Producing the control system with a NAND equivalent circuit would be easier to construct and cheaper, as it would use fewer chips.	1	Description of the impact of using a NAND alternative **(1 mark)** You can award the mark for describing a possible improvement to the overall system

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Administrative information

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History of changes

Version	Description of change	Date

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