



**ADVANCED**  
**General Certificate of Education**  
**2018**

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**Technology and Design**  
**Assessment Unit A2 1**  
*assessing*

Systems and Control  
and  
Product Design

**[AV211]**

**FRIDAY 8 JUNE, MORNING**

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**MARK**  
**SCHEME**

## General Marking Instructions

### **Introduction**

Mark schemes are intended to ensure that the GCE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses. The mark schemes should be read in conjunction with these general marking instructions.

### **Assessment objectives**

Below are the assessment objectives for GCE Technology and Design.

Students must:

- recall select and communicate their knowledge and understanding of technology and design in a range of contexts (AO1);
- apply skills, knowledge and understanding, in a variety of contexts and in designing and making products (AO2); and
- analyse and evaluate products, including their design and production (AO3).

### **Flexibility in marking**

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of an unanticipated answer, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

### **Positive Marking**

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

### **Awarding zero marks**

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

### **Types of mark schemes**

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

**Levels of response**

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the “best-fit” bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Intermediate Performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **High Performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

**Marking calculations**

In marking answers involving calculations, examiners should apply the “own figure rule” so that candidates are not penalised more than once for a computational error.

**Quality of written communication**

Quality of written communication is taken into account in assessing candidates’ responses to all tasks and questions that require them to respond in written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is limited.

Level 2: Quality of written communication is satisfactory.

Level 3: Quality of written communication is very good.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

**Level 1 (Limited):** The level of accuracy of presentation, spelling, punctuation and grammar is limited. The candidate makes a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary.

**Level 2 (Satisfactory):** The level of accuracy of presentation, spelling, punctuation and grammar is satisfactory. The candidate makes a satisfactory selection and use of an appropriate form and style of writing supported with appropriate use of diagrams as required. Relevant material is organised with some clarity and coherence. There is some use of specialist vocabulary.

**Level 3 (Very Good):** The level of accuracy of presentation, spelling, punctuation and grammar is very good. The candidate successfully selects and uses the most appropriate form and style of writing, supported with precise and accurate use of diagrams where appropriate. Organisation of relevant material is very good. There is very good use of appropriate specialist vocabulary.

In all cases, correct alternative responses will be given full credit.

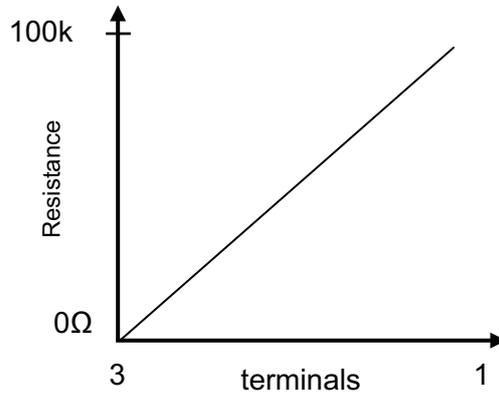
AVAILABLE MARKS

Section A

- 1 (a) Continuous system [1] as the input to the system (depth sensor) will be required to detect a range of measurements. The amplifier and bar array driver have analogue inputs and also operate over a voltage range. [2] [3]

[2] for a full justification [1] for a limited justification.

- (b) (i)



Axes [2] graph [1]

[3]

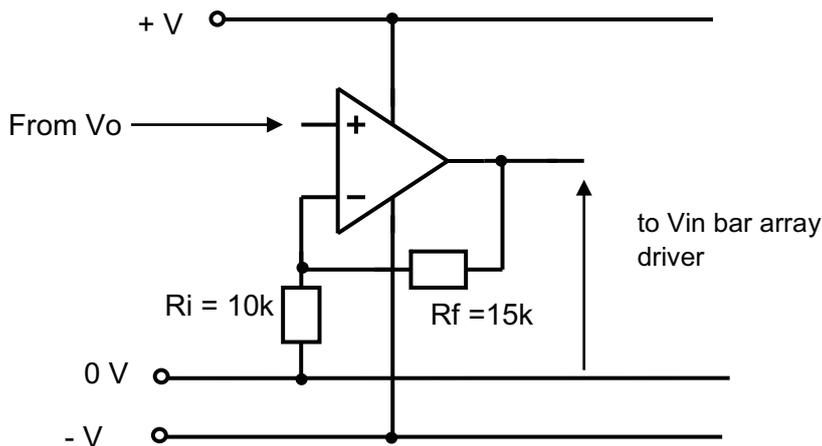
- (ii)  $V_o = (20 - 6)/20 \times 5$  [1]  
 $= 3.5$  volts [1]

[2]

- (c) (i) Gain = max required voltage/max variable resistor voltage  
 $= 5/2$  [1]  
 $= 2.5$  [1]

[2]

- (ii)



Drawing non inverting amplifier [2] Suitable values for Rf and Ri [1] in KΩ range [1]

[4]

(d) (i)

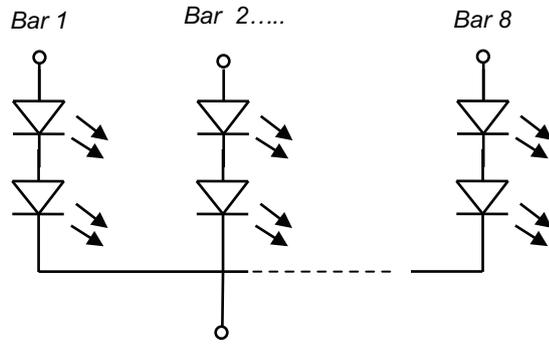


diagram indicates 8 bars [1] all cathodes joined to common negative [1]

[2]

(ii)

driver o/p = 5V  
 LED voltage drop =  $(2 \times 2V) = 4V$   
 Therefore protective resistor required [2]

Resistor value =  $5V - 4V / 10mA = 100 \Omega$  [1]

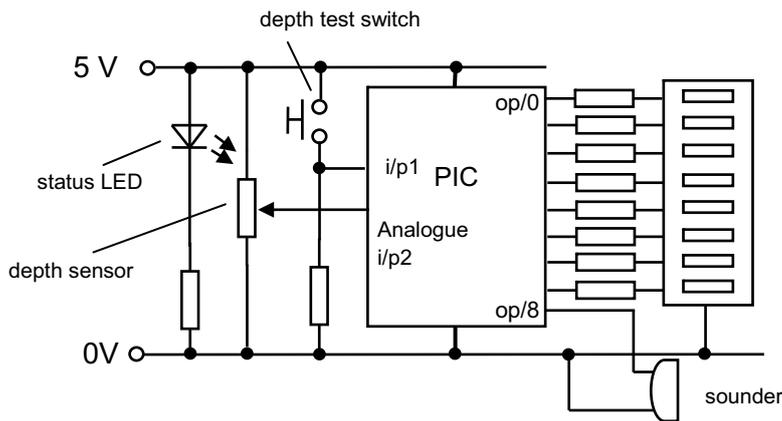
[3]

(iii)

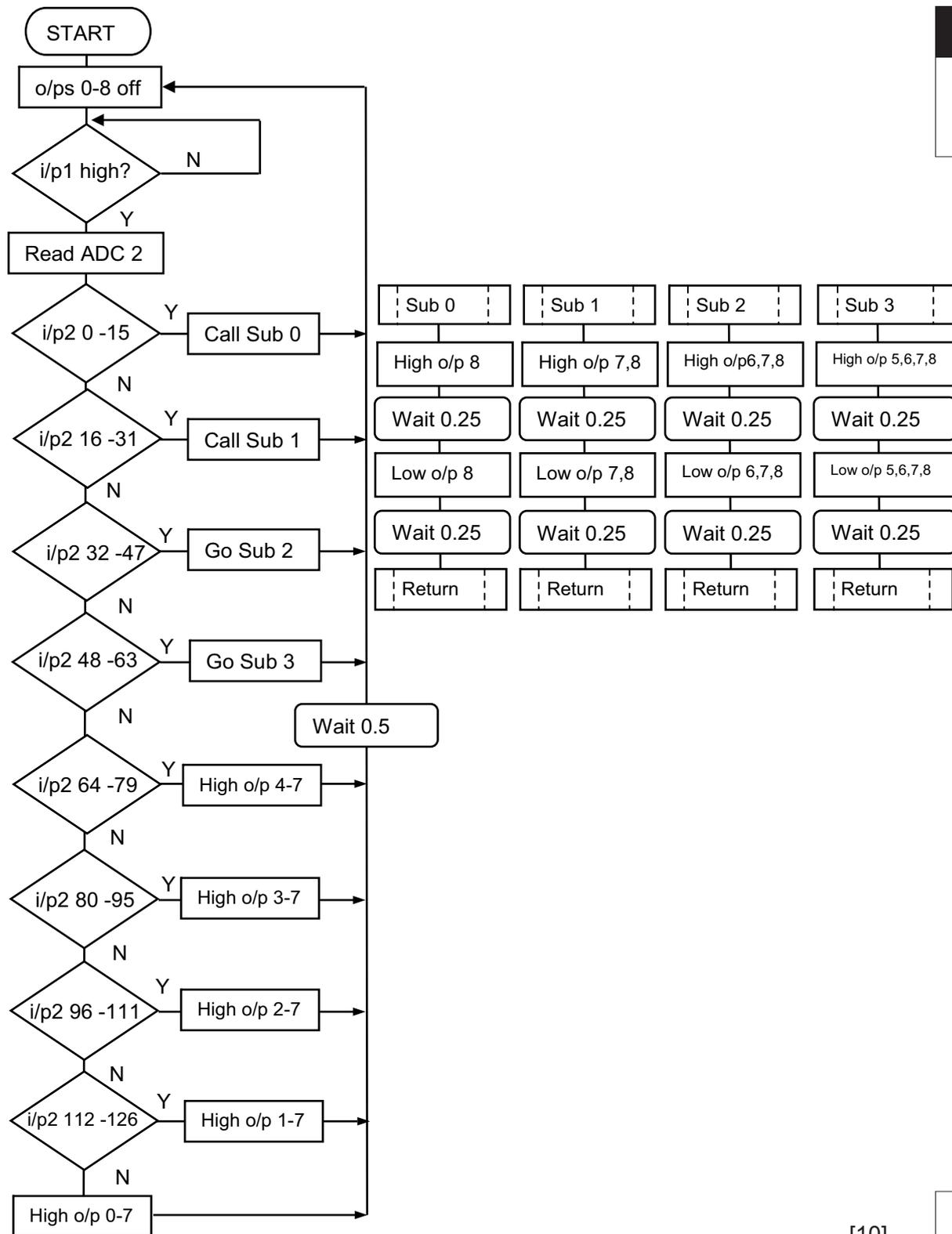
power dissipated by 1 bar =  $4V \times 10mA = 40mW$  [1]  
 Power dissipated by 8 bars = 320mW [1]

[2]

(e) Sample Answer:



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[10]

- (f) Answers likely to refer to the following main safety issues:
- Components can overheat leading to burn hazards. This can be due to using components with incorrect power ratings that are unable to dissipate the generated heat.
  - Short circuits can cause components to fail due to the high currents that consequently pass through them. Short circuits can be caused by lack of insulation or incorrect connections which can be a fire hazard as components may get hot enough to ignite.
  - Although students are working with low voltage circuits a low level shock risk exists where components have exposed contacts or defective/missing insulation.

Safety measures may include:

Extensive virtual testing to ensure that components have the appropriate ratings or using appropriate calculations to check ratings. Visual checks that components have been connected with correct polarity and have sufficient insulation where conducting elements of components and wiring are likely to touch. Utilising current limited power supplies to prevent short circuit component failures. Insertion of fuses in circuits to protect from excessive currents. Provision of appropriate fire extinguishers and first aid kits to deal with potential fires and burns. [5]

Quality of Written Communication

For a response not worthy of credit	<b>0</b>
Poor selection and use of a writing form and style appropriate to the content. The content is poorly organised and little use is made of appropriate technological vocabulary. The writing is barely legible and spelling, grammar and punctuation are inaccurate.	<b>[1]–[2]</b>
Good selection and use of a writing form and style appropriate to the content. The content is organised and use is made of appropriate technological vocabulary. The writing is legible and spelling, grammar and punctuation are accurate.	<b>[3]</b>
Very good selection and use of a writing form and style appropriate to the content. The content is well organised and good use is made of appropriate technological vocabulary. The writing is clearly legible and spelling, grammar and punctuation are very accurate.	<b>[4]</b>

[4]

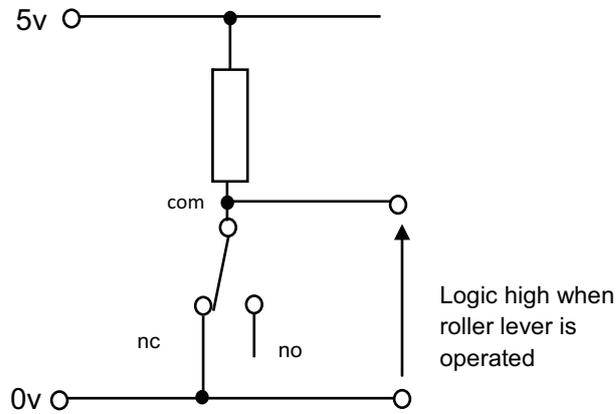
AVAILABLE  
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2 (a) (i) Microswitch contacts are typically maintained by means of a spring or spring mechanism. [1]

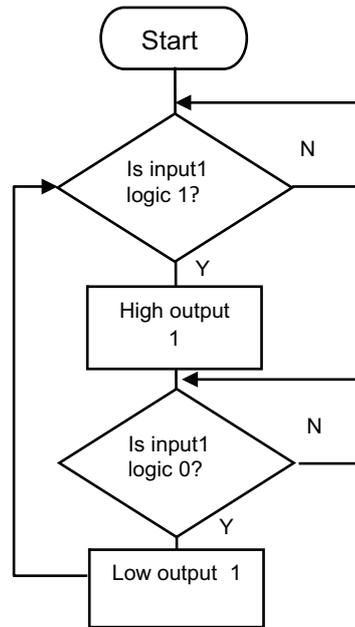
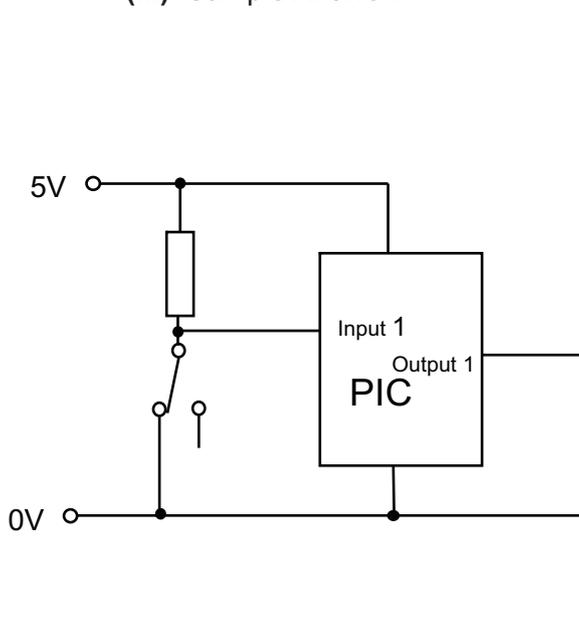
AVAILABLE MARKS

(ii) Sample Answer:



[3]

(iii) Sample Answer:

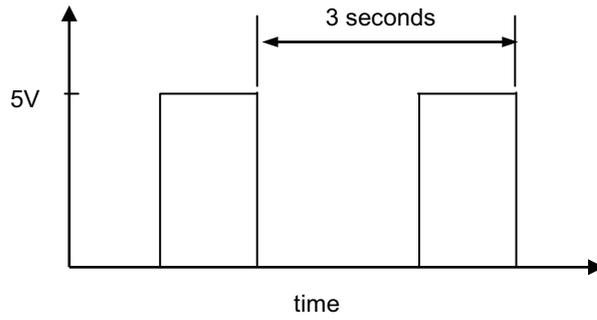


The PIC has been programmed to read when the microswitch contacts touch and then when they are released. Any consequent touching of contacts will not be registered.

[5]

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(b) (i) Sample Answer:



[3]

(ii) truth table

Q2	Q1	Q0	A	B	C
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	0	0	1
1	0	0	0	1	0
1	0	1	0	0	1
1	1	0	0	1	0
1	1	1	1	0	0

Q0.Q1.Q2 [1] A, B, C [3]

[4]

(iii)  $A = Q_0.Q_1.Q_2$  [1]

$$B = \bar{Q}_0.Q_1 + \bar{Q}_0.Q_2 + Q_0.\bar{Q}_1.\bar{Q}_2$$
 [1]

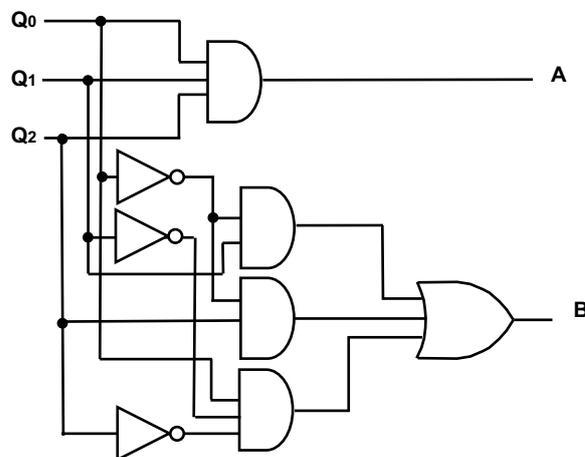
$$C = \bar{Q}_0.\bar{Q}_1.\bar{Q}_2 + Q_0.Q_1.\bar{Q}_2 + Q_0.\bar{Q}_1.Q_2$$
 [1]

Q0 Q1	00	01	11	10
Q2 0	0	1	0	1
Q2 1	1	1	0	0

Q0 Q1	00	01	11	10
Q2 0	1	0	1	0
Q2 1	0	0	0	1

[5]

(iv) Sample logic circuit:



A one stage [1]

B two stages [2]

[3]

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(c) (i) LED displays are generally less energy efficient than LCD displays [1]

(ii) The most significant bit is the bit in a binary number with the greatest value. For example, in the binary number 1000, the MSB is 1 with a decimal equivalent of  $2^3$  or 8. [2]

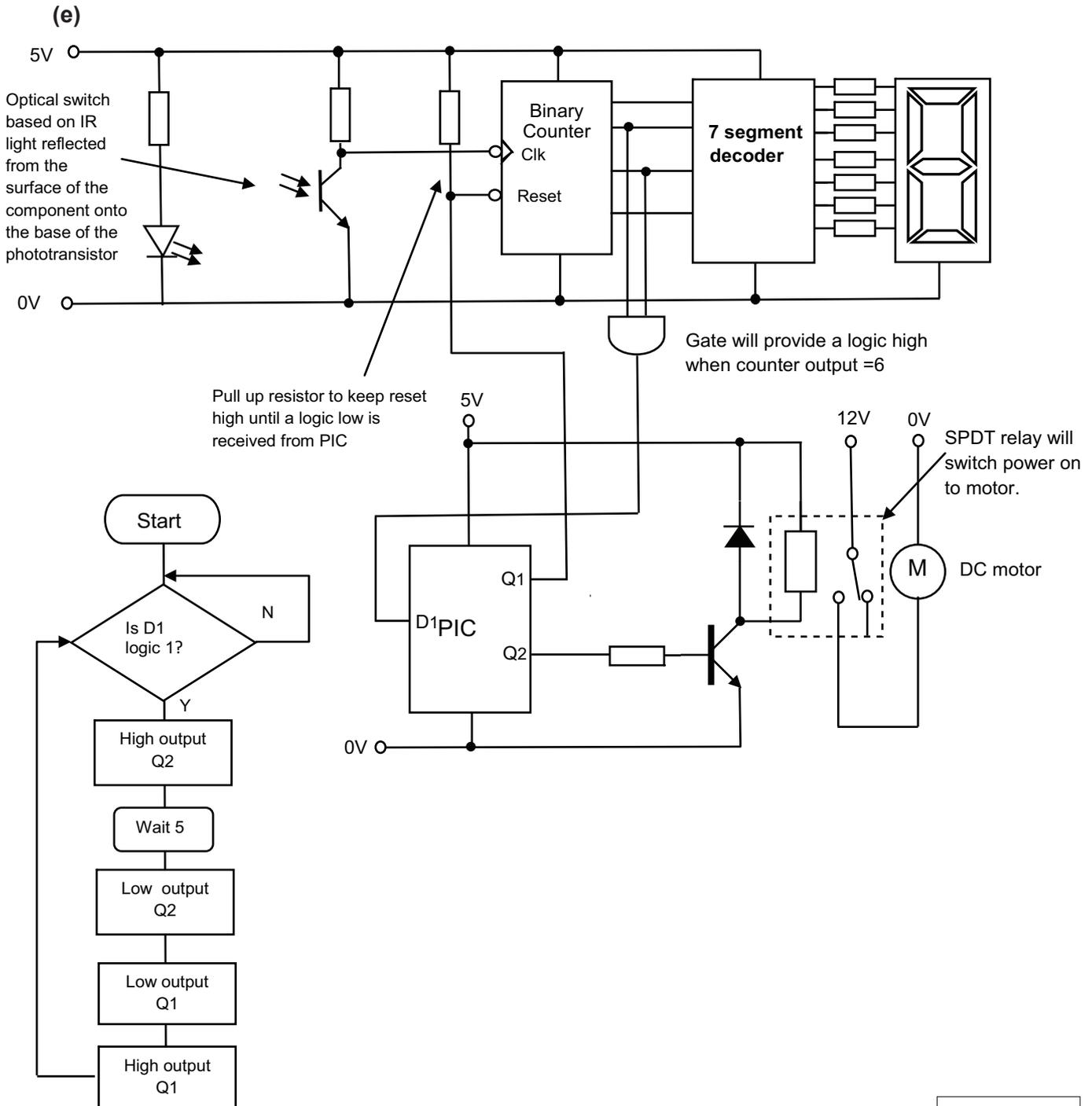
(iii) 15 [1]

(d)

number	A	B	C	D	a	b	c	d	e	f	g
1	1	0	0	0	0	1	1	0	0	0	0
3	1	1	0	0	1	1	1	1	0	0	1

[2]

AVAILABLE MARKS



[10]

Section A

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## Section B

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## Mechanical and Pneumatic control systems

- 3 (a) (i) Any **two** of the following:
- Use appropriate guards on the machine
  - Display safety signs
  - Complete proper maintenance of machines
- (2 × [1]) [2]
- (ii) Any **two** from the following:
- A gasket is a mechanical seal which fills the space between two or more mating surfaces.
  - They prevent leakage from or into the joined objects while under compression.
  - Often the two mating surfaces are not completely matched, requiring the need for a gasket to seal the different levels at the join.
  - Gaskets save money by allowing “*less-than-perfect*” mating surfaces on machine parts which can use a gasket to fill irregularities.
  - They allow for assembly and disassembly of components or parts for maintenance. [2]
- (iii) Answer: Garter Seal or other appropriate seal [1]
- Annotated Sketch [2]  
Justification [1]
- (iv) Answers likely to refer to the following factors when selecting lubricant:
- **Requirements** [1]  
Oils have to operate under different working conditions of load, speed, and force, and therefore require different properties. It is necessary to select the correct type of oil for specific jobs.
  - **Environment** [1]  
Oil is affected by temperature – the hotter an oil gets, the lower the viscosity. Therefore it is essential to select the correct oil for the temperature it is being exposed to.
  - **Viscosity** [1]  
Thin oils have a low viscosity and flow easily through small holes and clearances. Thick oils have a high viscosity and offer more resistance to flow.
- Justification:  
An SAE 30 oil would be suitable as it is a general purpose oil recommended for use in engines. The viscosity of the oil and the range of its working temperatures make it particularly suitable for the gearbox. [2]

## Quality of Written Communication

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For a response not worthy of credit	<b>0</b>
Poor selection and use of a writing form and style appropriate to the content. The content is poorly organised and little use is made of appropriate technological vocabulary. The writing is barely legible and spelling, grammar and punctuation are inaccurate.	<b>[1]–[2]</b>
Good selection and use of a writing form and style appropriate to the content. The content is organised and use is made of appropriate technological vocabulary. The writing is legible and spelling, grammar and punctuation are accurate.	<b>[3]</b>
Very good selection and use of a writing form and style appropriate to the content. The content is well organised and good use is made of appropriate technological vocabulary. The writing is clearly legible and spelling, grammar and punctuation are very accurate.	<b>[4]</b>

[4]

- (b) Drawing of bearing – outer race/inner race roller and cage [1]  
 Housing – design for holding bearing [1]  
 Secure the bearing – grub screw and flat [1]  
 Provision for lubrication – drilled hole with dust cap [1]

(c) (i)  $VR = \frac{\text{Driven}}{\text{Driver}}$   
 $= \frac{8}{32} \times \frac{36}{18} \times \frac{40}{36}$   
 $= 0.25 \times 2 \times 1.111$  [1]  
 $= 0.55$  [1]

(ii) Output torque = input torque  $\times \frac{\text{Product of driven teeth}}{\text{Product of driver teeth}}$   
 Output torque =  $300 \times (8 \times 36 \times 40 / 32 \times 18 \times 36)$   
 Output torque =  $300 \times 11520 / 20736$   
 Output torque = 166.66 Nm [2]

(iii) Chain and Sprocket:

Any **one** advantage from the following:

- No slippage
- Very strong
- Can transfer a rotary motion over a large distance [1]

Any **one** disadvantage from the following:

- Chain can stretch
- Tension must be constant
- Expensive to manufacture [1]

- (d) Sketch of main feature of three pulleys, correct rope and hook position [3]

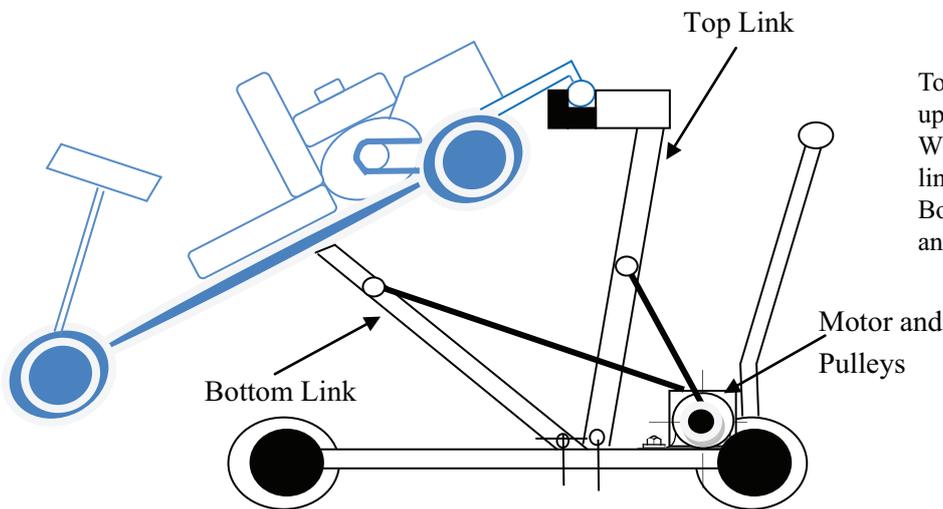
- (e) (i) Sample Answer: Handle will engage pinion which will enable seat to move on the rack (attached to the rail). Handle will disengage from rack to enable position to be locked in place.

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For a response not worthy of credit with content poorly organised.	<b>0</b>
Poor selection of mechanism choice and drawing/annotation. Content is fairly well organised. No evidence of a suitable locking mechanism.	<b>[1]–[2]</b>
Good selection of mechanism choices and use of drawing/annotation. Content well organised. Some evidence of a suitable locking mechanism.	<b>[3]</b>
Very good selection of mechanism and use of a drawing/annotation. Content very well organised. Evidence of a suitable locking mechanism.	<b>[4]</b>

[4]

- (ii) Sample Answer: Linkage connected by a motorised pulley



Top link hooks onto bar and is pulled up by motor and pulley. When up a suitable distance second link goes underneath go-kart. Both links are powered by the motor and pulleys.

For a response not worthy of credit with content poorly organised.	<b>0</b>
Poor selection of mechanism choice and drawing/annotation. Content is fairly well organised. Little evidence of motor integrated with mechanism.	<b>[1]–[2]</b>
Good selection of mechanism choices and use of drawing/annotation. Content well organised. Some evidence of motor integrated with mechanism.	<b>[3]–[4]</b>
Very good selection of a suitable mechanism and use of a drawing/annotation. Content very well organised. Motor fully integrated with mechanism.	<b>[5]–[6]</b>

[6]

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- 4 (a) (i) It is the design of circuits so that each operation is dependent on the completion of the previous. [2] for a full explanation [1] for a limited explanation. [2]
- (ii) The circuit operates as follows:  
 Valve A is pressed activating the 1:4 side of the 5/2 valve. This will put Cylinder B positive and Cylinder A negative [1]. Either the plunger of Valve C will be activated or Valve D can be pressed. The selected valve activates the shuttle valve [1] and then the time delay activates Valve B [1]. Valve B operates on a pressure differential between the main air signal and the amplified exhaust air signal. Valve B eventually activates the 1:2 side of the 5PV putting the Cylinder B negative and Cylinder A positive [1].  
 The sequence can continue again when Valve A is activated. [4]
- (b) (i)  $W = F \times L = 2000 \text{ N} \times 0.6 = 1200 \text{ J}$  [2]
- (ii)  $F = P \times A$
- Taking Min force by selecting (d) 76 mm (D) 140 mm at 3 bar
- $$\begin{aligned} \text{Min force for cylinder} &= (3.14 \times 70^2) - (3.14 \times 38^2) \times 0.3 \text{ N} \\ &= (15386) - (4534.26) \times 0.3 \text{ N} \\ &= 3255.522 \text{ N} \end{aligned} \quad [2]$$
- Taking Max force by selecting (d) 44 mm (D) 180 mm at 5bar
- $$\begin{aligned} \text{Max force for cylinder} &= (3.14 \times 90^2) - (3.14 \times 22^2) \times 0.5 \text{ N} \\ &= (25434) - (1519.76) \times 0.5 \\ &= 11957.12 \text{ N} \end{aligned} \quad [2]$$
- Answer = Max force for cylinder – Min force for cylinder – 20%  
 $11957.12 \text{ N} - 3255.522 \text{ N}$   
 $8701.598 - 20\%$   
 $8701.598 - 1740.3196 = 6961.28$  [2]
- (c) See proforma answer [16]
- (d) (i) See proforma answer [4]
- (ii) See proforma answer [6]

Section B

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## Section C

## Product Design

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- 5 (a) Any **one** point outlining why market research needs to be reliable for example:
- To ensure that there is a need for the product.
  - The designer will design what the customer needs/wants. [1]
- (b) (i) Non-probability sampling is when the company selects a sample of people that they think would purchase the product, have a need for it or would use it.
- [2] for a full explanation [1] for a limited explanation. [2]
- (ii) Any **one** main reason why companies would prefer to use non-probability sampling for example:
- More accurate reflection of the user's needs.
  - May result in a higher response rate of feedback. [1]
- (iii) Any **two** main advantages associated with the use of postal questionnaires for example:
- They have the potential to cover a lot of people hence increasing the sample size.
  - They are very affordable as the only cost is that of printing and distributing.
  - The person completing the questionnaire has more time to think and would be able to give a more honest reply due to the absence of interviewer bias.
- (2 × [1]) [2]
- (iv) Any **two** main disadvantages associated with the use of postal questionnaires for example:
- The body language of the respondent cannot be observed as the respondent cannot be seen.
  - Those people who do mail back the questionnaire might not have all of the questions answered in it.
  - It can be time consuming.
- (2 × [1]) [2]
- (c) (i) Any **two** ways in which ICT is used to implement market research for example:
- Virtual reality modelling of the foot pumps to determine customer feedback.
  - Phone surveys or questionnaire on the use of foot pumps.
  - Online questionnaires regarding the various models.
- (2 × [1]) [2]
- (ii) Any **two** ways in which ICT is used to analyse the outcomes of research for example:
- For demographic analysis of potential customer bases.
  - Market share cost and profit analysis on the product range.
  - Software may be used to model decisions on the product range and provide predictions from the analysis.
- (2 × [1]) [2]

- |  |  | AVAILABLE MARKS |
|--|--|-----------------|
| <p><b>(d) (i)</b> Life-cycle assessment is an assessment of the environmental impact associated with all the stages of a product's life from-cradle-to-grave (i.e. from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).</p> <p>[2] for a full explanation [1] for a limited explanation. [2]</p> <p><b>(ii)</b> An environmental audit is a systematic, documented, periodic and objective process carried out by an independent third party to assess the current status of an organisation's compliance with local environmental laws and regulations.</p> <p>[2] for a full explanation [1] for a limited explanation.</p> <p>Any <b>one</b> main potential benefit for example:</p> <ul style="list-style-type: none"> <li>• Customers may have more confidence in the company/product and this may influence sales.</li> <li>• Self-belief and confidence within the company that they are compliant with local environmental laws and regulations. [1] [3]</li> </ul>  |  |                 |
| <p><b>(e) (i)</b> Perceived value pricing is a method based on market research. The research will establish what customers think a product is worth drawn from comparison with other products and the range of functions which it offers.</p> <p>[2] for a full explanation [1] for a limited explanation. [2]</p> <p><b>(ii)</b> Cost-plus is concerned with estimating the average cost of producing and marketing a product and adding a mark-up for profit whilst contribution pricing is more sophisticated as it takes account of the variation in costs of production at different levels.</p> <p>[2] for a full explanation [1] for a limited explanation. [2]</p>   |  |                 |
| <p><b>(f)</b> Any <b>five</b> main discussion points regarding the influence that Dyson has had on product design for example:</p> <ul style="list-style-type: none"> <li>• James Dyson is one of the most successful product designers in the UK in recent years. His high efficient cyclonic separation vacuum has changed how people vacuum their homes.</li> <li>• His philosophy is to produce elegant, easy to use products that people want to use on a daily basis and this has influenced other designers to copy this approach.</li> <li>• Dyson encourages people to make mistakes and has encouraged other designers to use failure to drive success and to think and make decisions which are not always right, hence his 5,127 prototypes.</li> <li>• Dyson has expanded his influence on many other products to include washing machines hand and hair dryers.</li> <li>• Dyson set up the Dyson foundation in 2002 to support design and engineering education. This is to inspire young people to study engineering and become engineers.</li> <li>• The Dyson award is an international award set up to celebrate, encourage and inspire the next generation of design engineers. (5 × [1]) [5]</li> </ul> <p>Quality of Written Communication [4]</p> |  |                 |

For a response not worthy of credit	<b>0</b>
Poor selection and use of a writing form and style appropriate to the content. The content is poorly organised and little use is made of appropriate technological vocabulary. The writing is barely legible and spelling, grammar and punctuation are inaccurate.	<b>[1]–[2]</b>
Good selection and use of a writing form and style appropriate to the content. The content is organised and use is made of appropriate technological vocabulary. The writing is legible and spelling, grammar and punctuation are accurate.	<b>[3]</b>
Very good selection and use of a writing form and style appropriate to the content. The content is well organised and good use is made of appropriate technological vocabulary. The writing is clearly legible and spelling, grammar and punctuation are very accurate.	<b>[4]</b>

- (g) (i)** Solution based on mild steel legs with similar profile to the current legs which could be pressed for low cost. Hollow bars (offset for each side) could be inserted between the current support legs and a telescopic design arrangement would allow for the additional support legs to move in and out of the hollow bars as required. For quick release and to ensure that the legs are secured in position a nylon knurled thumb screw which is threaded and mates with the tapped hole on the hollow bars could be used.

Level of response not worthy of credit	<b>0</b>
Poor sketches with little or no annotation. Difficulties in deciding if the design is low cost, suitable and would allow the user to extend out the legs and provide a wider base and therefore improve stability. Difficulty in deciding if the design can be quickly released, moved out and secured in position without the use of tools and if it is attached to the support legs.	<b>[1]–[2]</b>
Annotated sketches are good. The design has elements which are low cost, would allow the user to extend out the legs and provide a wider base to improve stability. Good consideration is provided as to how the design can be quickly released, moved out and secured in position without the use of tools and how it is attached to the support legs.	<b>[3]</b>
Detailed annotated sketches. The design is low cost, suitable and would allow the user to extend out the legs and provide a wider base for improved stability. An appropriate means is provided by which the design can be quickly released, moved out and secured in position without the use of tools and how it is attached to the support legs.	<b>[4]–[5]</b>

[5]

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- (ii) Solution based on a shallow injection moulded tray which is a press fit (open clip arrangement) onto the two support legs. The three parts would also be a press fit into the tray to facilitate removal and replacement and provide a degree of protection. The design may have a finger indent profile to assist removal of the part.

Level of response not worthy of credit	<b>0</b>
Poor sketches with little or no annotation. Difficulties in deciding if the design could be fitted to the support legs of the foot pump, be housed safely and be quickly removed or replaced. Difficulty in deciding if the design could be attached without the use of tools.	<b>[1]–[2]</b>
Annotated sketches are good. The design has elements which allow it to be fitted to the support legs of the foot pump, be housed safely and be quickly removed or replaced. Good consideration is provided as to how the design could be attached without the use of tools.	<b>[3]</b>
Detailed annotated sketches. The design is suitable and would allow it to be fitted to the support legs of the foot pump, be housed safely and be quickly removed or replaced. An appropriate means is provided by which the design could be attached without the use of tools.	<b>[4]–[5]</b>

[5]

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- 6 (a) Needs are concerned with products which we cannot do without (e.g. food, clothing and shelter) whilst demands are products that we would like and arise directly from our needs.
- [2] for a full explanation [1] for a limited explanation. [2]
- (b) (i) It is so important to have innovation in the market as it not only creates new and exciting products but it is the key to long term competitive success within a market.
- [2] for a full explanation [1] for a limited explanation. [2]
- (ii) Any **two** main factors associated with market pull for example:
- Responding to changing lifestyles, e.g. chill-cook meals.
  - Changing consumer attitudes change design priorities.
  - People like new products.
- (2 × [1]) [2]
- (c) (i) The type of information gained by researching government legislation (e.g. child's car seat) would be the age limit for child car seats, height limits for the seat, weight restrictions for specific seats and legislation on fitting seats in the car.
- [2] for a full explanation [1] for a limited explanation. [2]
- (ii) This might influence future decisions for the company producing children's car seats in how they design their seats for different ages, heights and weights. It may also influence the design of how their products are secured in position with the seat belt and how this interacts with the user.
- [2] for a full explanation [1] for a limited explanation. [2]
- (d) (i) Any **two** main characteristics associated with retail audits for example:
- Retail audits can be used when research is required on a competitor in relation to their marketing activities and strategies.
  - It seeks to measure if the shelf presence of one brand is better than the position of competing brands, and the impact of additional product displays, promotional materials and prices on the level of sales.
  - Retail audit provides information that can help shape decisions with a view to improving market share.
- (2 × [1]) [2]
- (ii) Any **two** main characteristics associated with omnibus surveys for example:
- Omnibus surveys can provide information on markets and opinions with a means to get quick, relatively low cost answers to a company's questions without financing and organising a full market or opinion research survey themselves.
  - The research company conducts a number of interviews with the target group on a regular basis. These interviews combine a number of standard questions with questions effectively sponsored by clients.
  - Omnibus surveys can also be used to reach more specific audiences such as men or women, certain age, education, or income groups, or even individuals who engage in a specific behaviour.
- (2 × [1]) [2]

AVAILABLE  
MARKS

- (e) (i) Fashion innovators are generally the first to adopt a new product whereas the opinion leaders copy the fashion innovators and change the product into a popular style.
- [2] for a full explanation [1] for a limited explanation. [2]
- (ii) Any **two** main characteristics associated with the masses for example:
- This group generally wait until it has been accepted by the opinion leaders before adopting the product.
  - This group generally adopt the product with an attitude that everyone else has one so why not them.
  - The masses generally wait to adopt innovative products when they are sure they get value for money from them.
- (2 × [1]) [2]
- (f) **Example 1**  
Dyson created in their new products (airblade) machines which performed better using fewer raw materials. In addition, the digital motor was reduced a third in size which helped reduce the size of the machine and ultimately the use of materials.
- [2] for a full explanation [1] for a limited explanation. [2]
- Example 2**  
Coca-Cola have created more efficient packaging for their product range. They have managed to reduce materials through design which has resulted in trimming the weight of the 20 ounce PET bottle by more than 25%. In addition, they have managed to shave 30% off the weight of the standard aluminium can and nearly 50% off the 8 ounce glass bottle.
- [2] for a full explanation [1] for a limited explanation. [2] [4]
- (g) (i) Moral factors have been incorporated into the design of software for computers. Software can restrict access to specific sites which might be considered morally unsuitable for children or other users and software (encryption) can restrict certain users (passwords) to prevent theft.
- [2] for a full explanation [1] for a limited explanation. [2]
- (ii) The way in which social factors have been incorporated into the design of, for example, the bicycle.
- Bicycles are designed to suit different lifestyles. Touring, mountain biking, racing and off-road are a few examples of how the designer has incorporated social factors in its design.
- [2] for a full explanation [1] for a limited explanation. [2]
- (h) Any **two** main specific barriers or difficulties associated with international trading for example:
- War or other unforeseeable events can have a negative impact on trading.
  - A risk of unfavourable exchange rate movement can have a negative impact.
  - Bribery or corruption could affect the company competing fairly in that country.

AVAILABLE  
MARKS

[2] for a full explanation of each specific barrier or difficulty and [1] for a limited explanation of each specific barrier or difficulty.

(2 × [2])

[4]

- (i) (i) Solution based on a small plastic circular base with a protruding plastic rod. A stepped nylon bush would be screwed onto the base of the display unit which would then allow the unit to slide onto the protruding plastic rod and rotate. Four injection moulded rollers could be positioned, equally spaced and screwed into the base of the unit to improve stability and ensure ease and freedom of rotation.

Level of response not worthy of credit	<b>0</b>
Poor sketches with little or no annotation. Difficulties in deciding if the design is a suitable low cost rotating platform to enable the user to move the unit in either a clockwise or anti-clockwise direction. Difficulty in deciding if the design minimises the use of materials.	<b>[1]–[2]</b>
Annotated sketches are good. The design has elements which are low cost and allows the user to move the unit in either a clockwise or anti-clockwise direction. Good consideration is provided as to how the design minimises the use of materials.	<b>[3]</b>
Detailed annotated sketches. The design is suitably low cost and allows the user to move the unit in either a clockwise or anti-clockwise direction. Detailed consideration is provided as to how the design minimises the use of materials.	<b>[4]–[5]</b>

[5]

- (ii) Solution based on a ball and socket type joint. The ball would be manufactured with a bracket containing three holes to allow it to be fixed to the top plate of the display unit using three 3.5 × 20 mm countersunk screws. The socket could be manufactured with a plate to allow the mirror to be attached with double sided tape.

Level of response not worthy of credit	<b>0</b>
Poor sketches with little or no annotation. Difficulties in deciding if the bracket is suitable and would allow the user to rotate the mirror through 360 degrees. Difficulty in deciding if the bracket is securely attached to the mirror and to the top plate of the display unit.	<b>[1]–[2]</b>
Annotated sketches are good. The bracket has elements which are suitable to allow the user to rotate the mirror through 360 degrees. Good consideration is provided as to how the bracket is securely attached to the mirror and to the top plate of the display unit.	<b>[3]</b>
Detailed annotated sketches. The bracket is suitable and would allow the user to rotate the mirror through 360 degrees. An appropriate means is provided as to how the bracket is attached to the mirror and to the top plate of the display unit.	<b>[4]–[5]</b>

[5]

**Total**

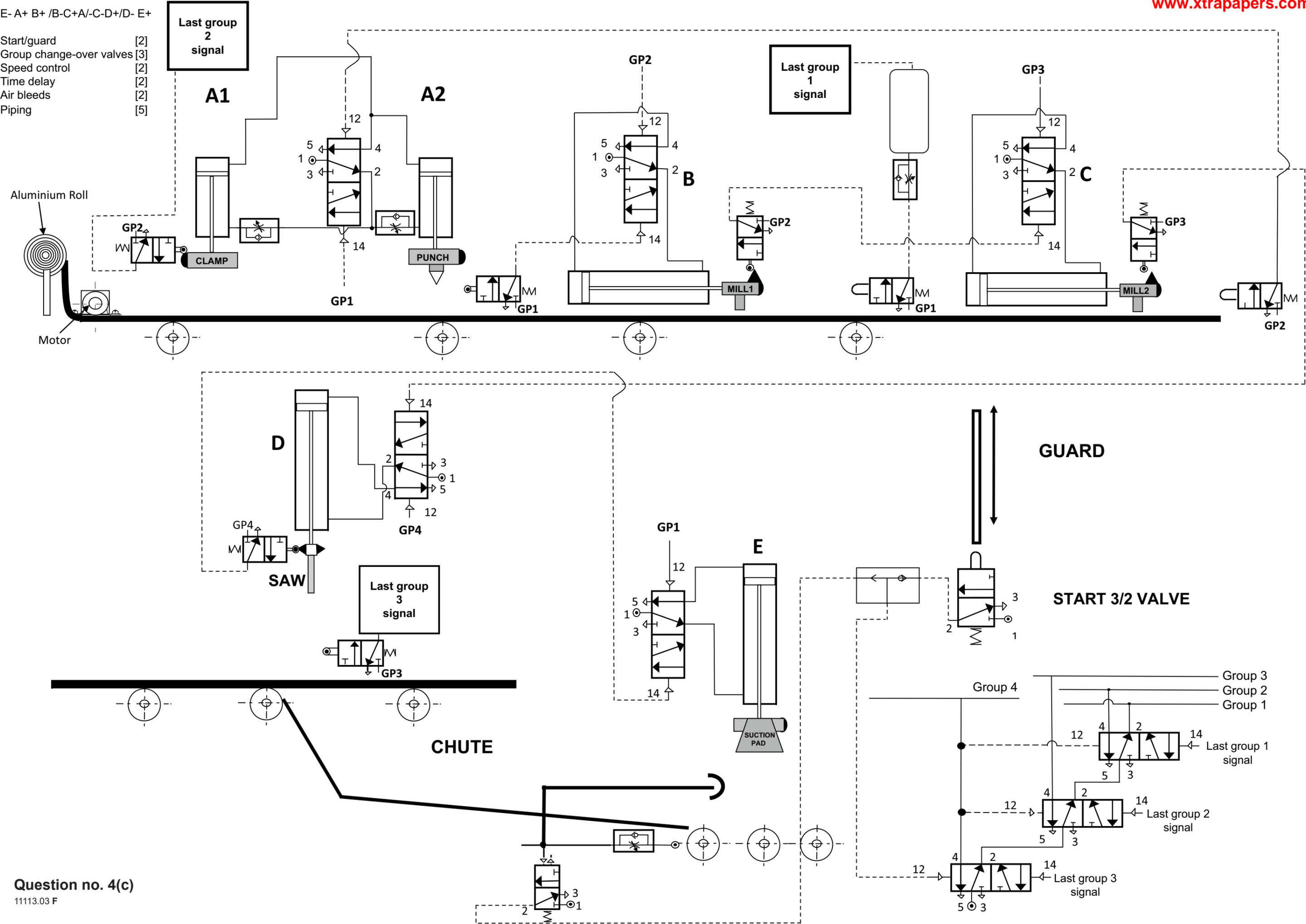
**AVAILABLE  
MARKS**

40

**80**

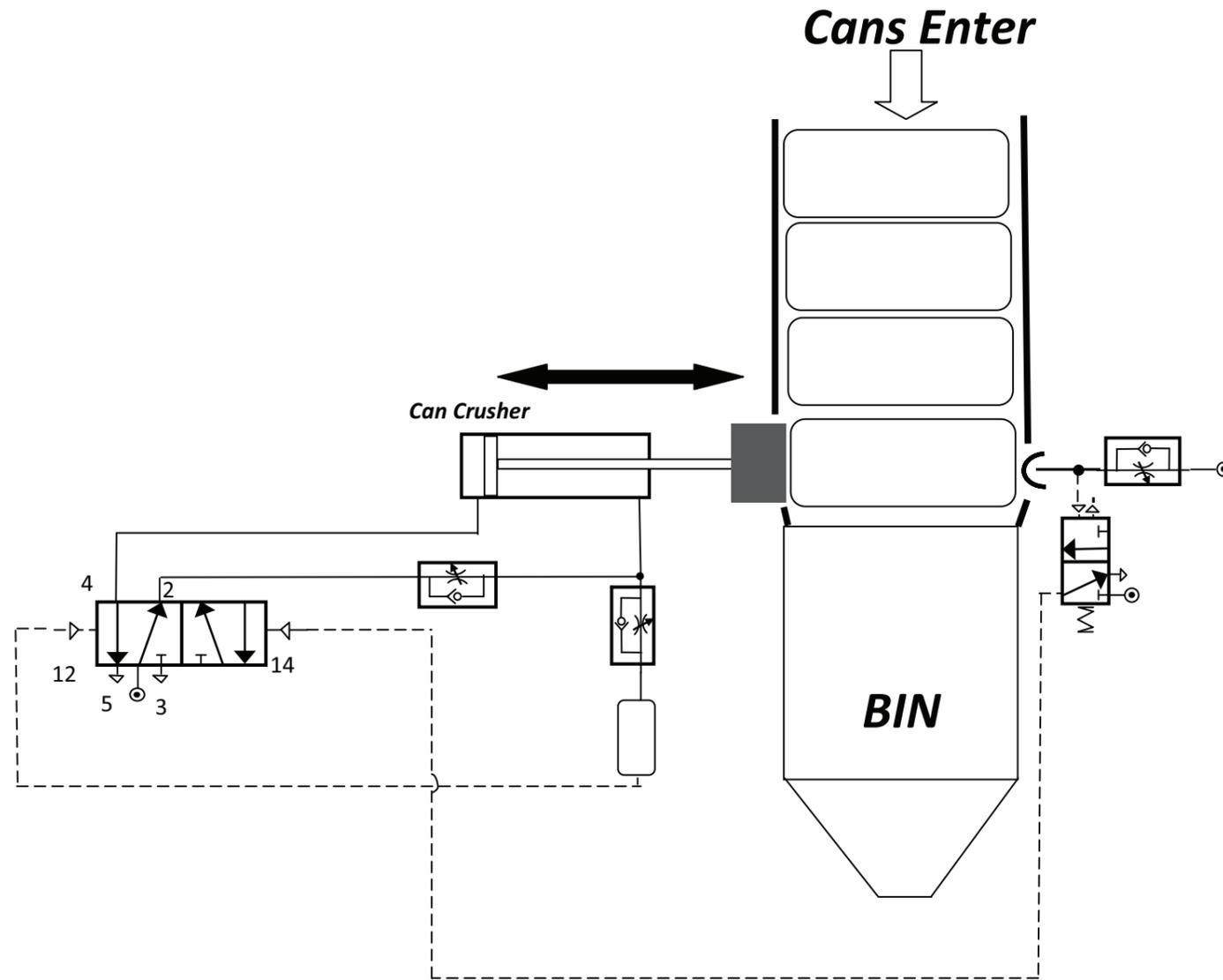
E- A+ B+ /B-C+A/-C-D+/D- E+

- Start/guard [2]
- Group change-over valves [3]
- Speed control [2]
- Time delay [2]
- Air bleeds [2]
- Piping [5]



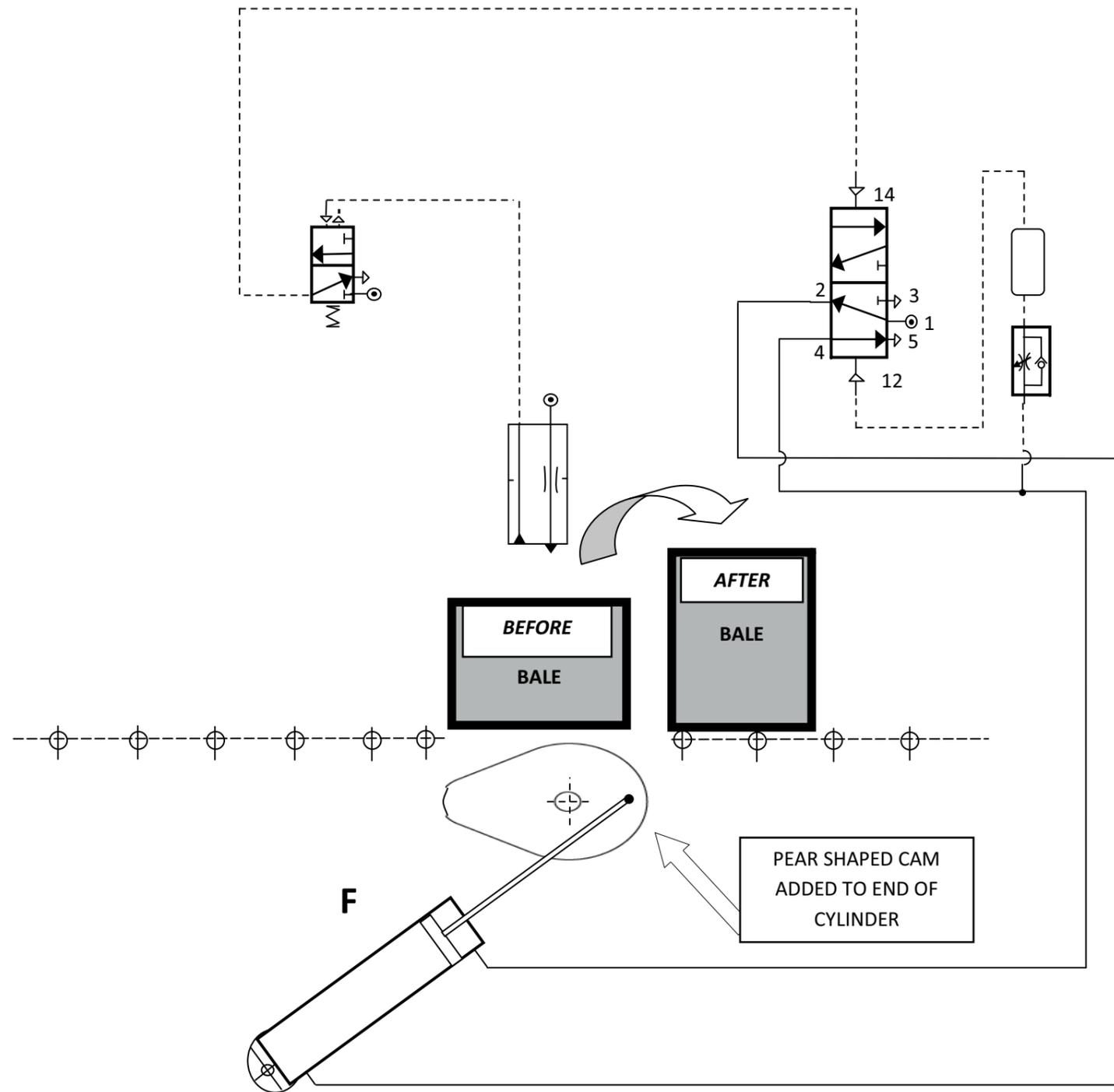
Question no. 4(c)  
11113.03 F

Question no. 4(d)(i)



Correct drawing and piping of air bleed	[1]
Correct piping 5PV	[1]
Method of return	[1]
Speed control	[1]

Question no. 4(d)(ii)



Correct piping 5PV	[1]
Method of return	[1]
Proximity sensor piping	[1]

Fully functional mechanism on cylinder	[3]
Partially functional mechanism on cylinder	[1]–[2]
Level of response not worthy of credit	[0]