



ADVANCED
General Certificate of Education

Technology and Design
Assessment Unit A2 1
assessing

Systems and Control or Product Design
[ATE11]

Assessment

MARK
SCHEME

General Marking Instructions

Introduction

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides teachers with an indication of the nature and range of candidates' responses likely to be worthy of credit. It also sets out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for GCE Technology and Design.

Candidates should be able to:

- AO1** Demonstrate specific knowledge and understanding, be able to apply that knowledge and understanding in combination with appropriate skills in their designing, communicate ideas and outcomes, and demonstrate strategies for evaluation.
- AO2** Apply skills, knowledge and understanding of relevant materials to produce suitable and appropriate outcomes; communicate ideas and outcomes, and demonstrate strategies for evaluation.

Quality of candidates' responses

In marking the examination papers, teachers should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17- or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

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 unanticipated answers, teachers are expected to use their professional judgement to assess the validity of answers. You must not draw inferences or interpret what you think the candidate has meant. Teachers should carefully read and consider every response.

Positive marking

Teachers 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. Teachers 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 17- or 18-year-old GCE 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.

Marking Calculations

In marking answers involving calculations, teachers should apply the 'error carried forward rule' so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations. Award full marks if a candidate gives the correct answer but does not show the working out.

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.

Bands of response

In deciding which band of response to award, teachers 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 band to award to any response, teachers are expected to use their professional judgement.

The following guidance is provided to assist teachers.

- **Level 1:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Level 2:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **Level 3:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

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 band of response. The description for each band of response includes reference to the quality of written communication.

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

Band 1: Quality of written communication is basic.

Band 2: Quality of written communication is good.

Band 3: Quality of written communication is excellent.

In interpreting these level descriptions, teachers should refer to the more detailed guidance provided for questions **1(c)**, **3(a)(iii)** and **5(g)**.

Section A

AVAILABLE MARKS

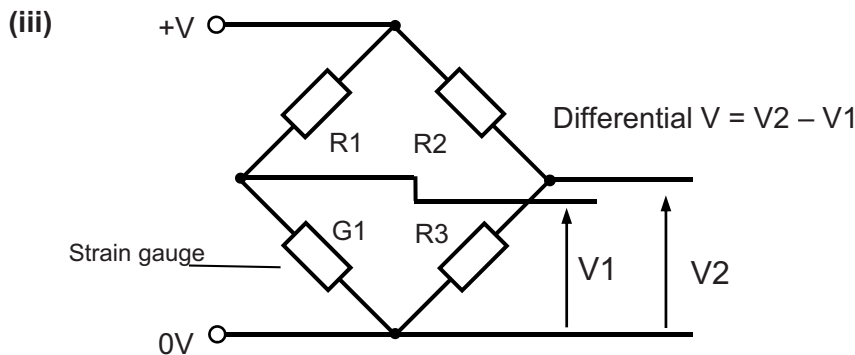
Electronic and Microelectronic Control Systems

1 (a) (i) As the strain gauge is deformed its resistance changes. [1]

Correct alternative responses should be given full credit.

(ii) When the strain gauge is deformed [1] there is little or no change to its resistance along the passive axis [1] however the resistance will change along the active axis. [1]
(2 × [1]) [2]

Correct alternative responses should be given full credit.



Bridge arrangement [1] with gauge [1] differential voltage labelled [1]
(3 × [1]) [3]

Correct alternative responses should be given full credit.

(iv) Gain = V_o/V_{in}
= $5/0.025$ [1]
= 200 [1]
(2 × [1]) [2]

Award full marks if a candidate gives the correct answer but does not show the working out.

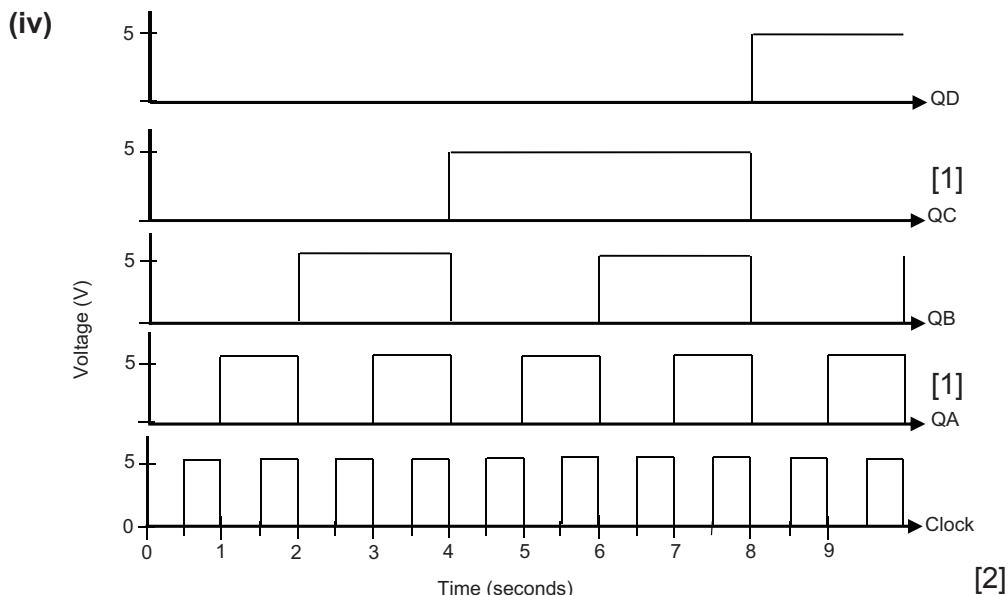
Correct alternative responses should be given full credit.

(b) (i) Decimal equivalent = 5 [1]

(ii) For a binary counter, the frequency of the LSB will be half of the clock frequency (or divide by 2) [1] and each subsequent output will be divided by 2 [1].
(2 × [1]) [2]

Correct alternative responses should be given full credit.

(iii) Clock frequency = 1 Hertz [1]



(c) Bands of response

In deciding which band of response to award, teachers 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 band to award to any response, teachers are expected to use their professional judgement.

The following guidance is provided to assist teachers.

- Level 1:** Response which just merits inclusion in the band and should be awarded a mark at or near the bottom of the range.
- Level 2:** Response which clearly merits inclusion in the band and should be awarded a mark at or near the middle of the range.
- Level 3:** Response which fully satisfies the band description and should be awarded a mark at or near the top of the range.

Indicative content:

Digital signals have only two states, either on/off or logic high/low. For a 5 volt signal this means that the output will either be 5 volts or zero volts. Analogue signals can have varying amplitudes that range from zero up to 5 volts. Analogue signals can be considered as ‘continuous’.

An ADC with 4 output bits will have 16 possible output bit patterns whereas an ADC with 8 output bits will have 256 possible output bit patterns. This means that the 8 bit ADC has a greater resolution or accuracy. Greater accuracy can mean improved sensitivity when ‘reading’ an analogue input. A practical example of an ADC is in temperature measurement and display. An ADC is required to convert the analogue output voltage from a voltage divider circuit that incorporates a thermistor. The analogue voltage from the voltage divider can be converted into a digital value binary number by the ADC that represents the temperature. This number can in turn be decoded to decimal and displayed as a numeral that can easily be read.

Response band	Description	Mark band
1	<p>The candidate provides:</p> <ul style="list-style-type: none"> - a basic description including few aspects of the difference between analogue and digital signals. - a basic explanation of the advantages of using an 8-bit ADC which includes a few of its features. - a basic outline of an appropriate application of an ADC which includes few of the details. <p>The written presentation is basic and demonstrates a basic knowledge of the subject.</p> <p>Little use is made of specialist terms and technological vocabulary are used. The candidate uses basic spelling, punctuation and grammar, and the form and style are of a basic standard.</p>	[1]–[3]
2	<p>The candidate provides:</p> <ul style="list-style-type: none"> - a good description including some aspects of the difference between analogue and digital signals. - a good explanation of the advantages of using an 8-bit ADC which includes some of its features. - a good outline of an appropriate application of an ADC which includes some of the details. <p>The written presentation is clear and demonstrates good knowledge of the subject.</p> <p>Some specialist terms and technological vocabulary are used throughout. The candidate uses good spelling, punctuation and grammar, and the form and style are of a good standard.</p>	[4]–[6]
3	<p>The candidate provides:</p> <ul style="list-style-type: none"> - an excellent detailed description including most aspects of the difference between analogue and digital signals. - an excellent explanation of the advantages of using an 8-bit ADC which includes most of its features. - an excellent outline of an appropriate application of an ADC which includes most of the details. <p>The written presentation is clear and precise and demonstrates excellent knowledge of the subject.</p> <p>Appropriate specialist terms and technological vocabulary are used throughout. The candidate uses excellent spelling, punctuation and grammar, and the form and style are of a high standard.</p>	[7]–[9]

AVAILABLE MARKS

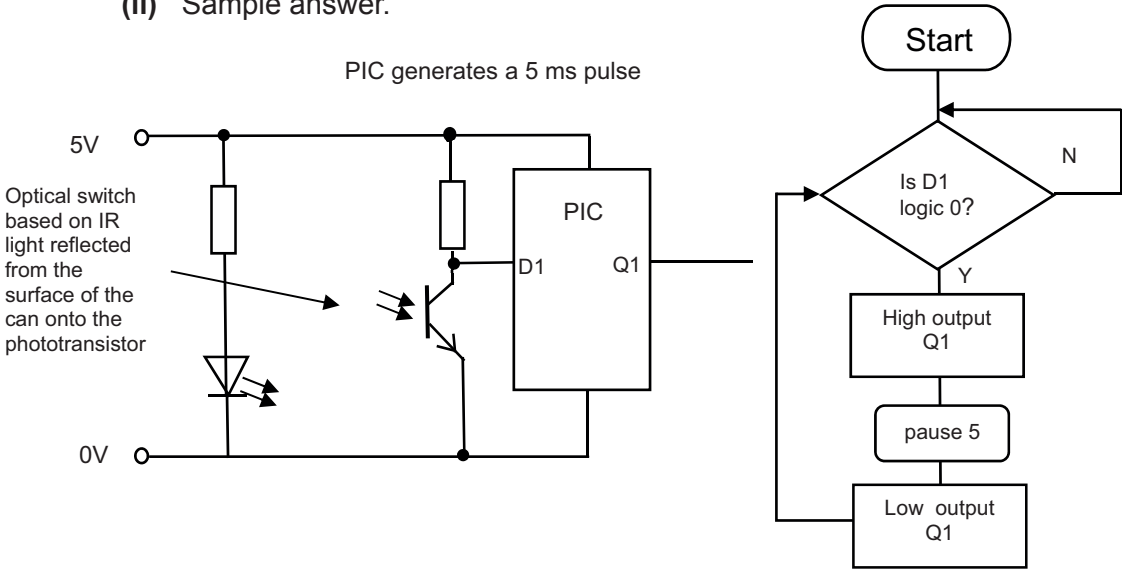
Correct alternative responses should be given full credit.

[9]

(d) (i) Conveyors usually only need to move in one direction at a fixed speed [1] and DC motors produce their maximum torque when running at a fixed RPM [1].
 (2 × [1]) [2]

Correct alternative responses should be given full credit.

(ii) Sample answer.



PIC circuit

Where a PIC based circuit is shown award [3] for circuit:

- emitter [1]
- detector [1]
- PIC [1]

[2] for the associated program:

decision [1]
 the pulse [1]

or

Hard wired circuit

Where a hard wired circuit such as a 555 monostable is used award [3] for the circuit and [2] for reference to R and C values that determine the pulse time period.
 (5 × [1]) [5]

Correct alternative responses should be given full credit.

(iii) Sample answer.

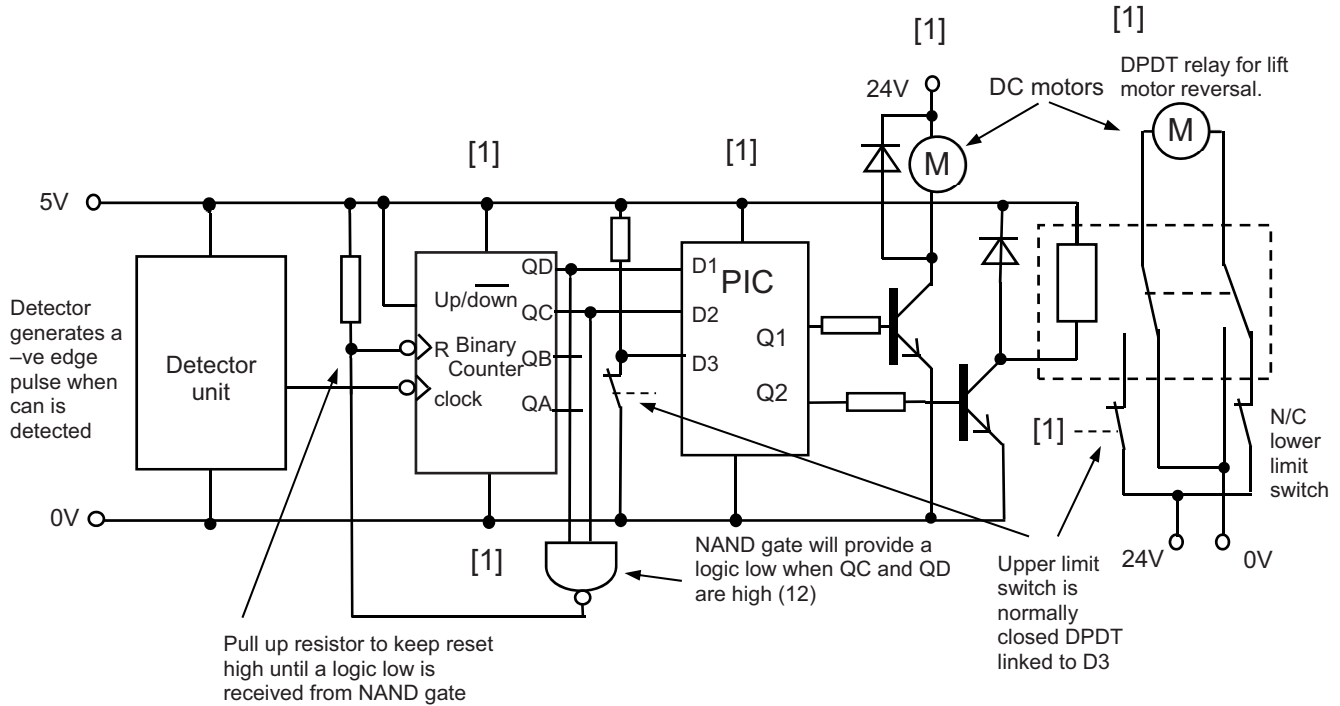
AVAILABLE MARKS

Award up to six marks for circuit as follows:

- Counter connected [1]
- PIC connected [1]
- Conveyor motor connected [1]
- Lift motor connected [1]
- Circuit connections to achieve a count of 12 [1]
- Circuit connections and/or switches to limit lift motor movement [1]

(6 × [1])

[6]



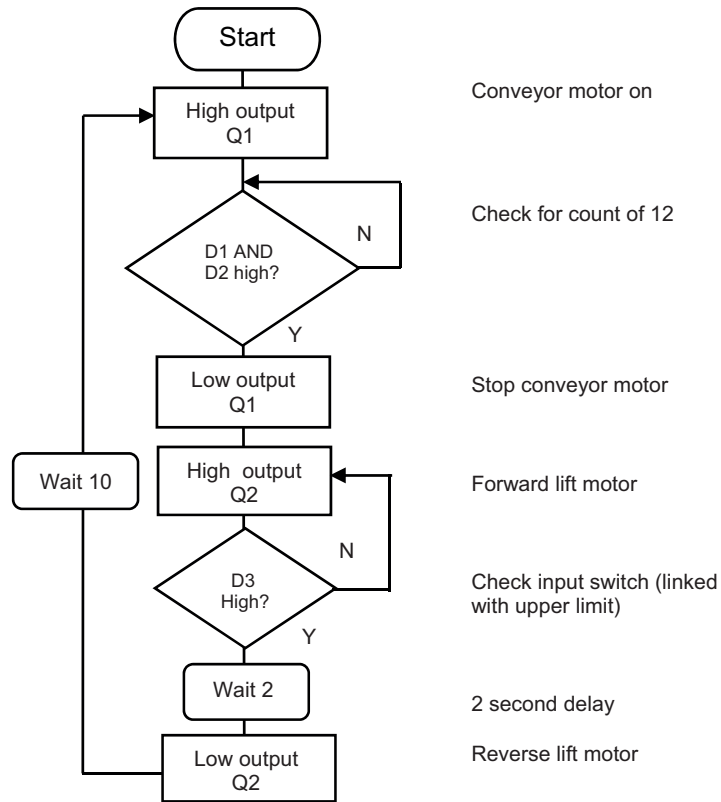
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Award up to four marks for flowchart as follows:

- Correct go and stop control of the conveyor motor [1]
- Correct forward and reverse control of lift motor [1]
- Correct time delays to allow flowchart to function [1]
- Correct checks (decisions) required for flowchart function [1]

(4 × [1])

[4]

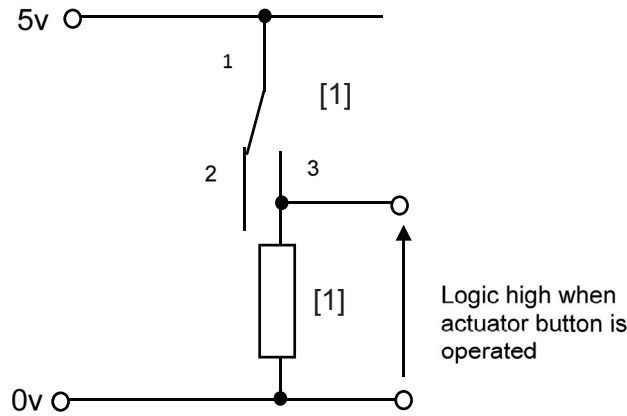


Correct alternative responses should be given full credit.

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AVAILABLE MARKS

2 (a) (i) Sample answer.

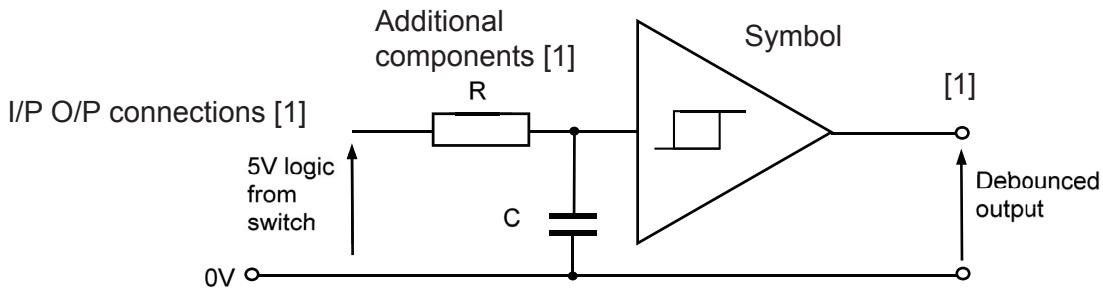


(2 × [1])

[2]

(ii) Sample answer – Schmitt trigger solution

When the microswitch is closed the capacitor will charge through the resistor presenting 5 volts at the input of the trigger [1] the output of the trigger will be high. When the microswitch opens the capacitor discharges through the resistor and the output of the trigger will switch low. With the hysteresis, the time delay is sufficient to prevent a contact bounce changing the output state [1].



(5 × [1])

[5]

Correct alternative responses should be given full credit.

(b) (i)

Sw3	Sw2	Sw1	red	amber	green
0	0	0	1	0	0
0	0	1	0	0	1
0	1	0	0	1	0
0	1	1	0	1	0
1	0	0	1	0	0
1	0	1	0	0	0
1	1	0	1	0	0
1	1	1	0	0	0

Award [1] for each correct column

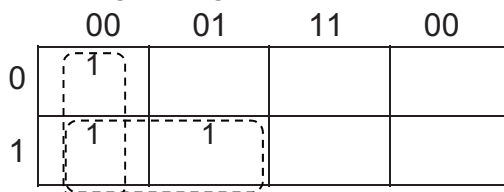
[1] [1] [1]

(3 × [1])

[3]

(ii)

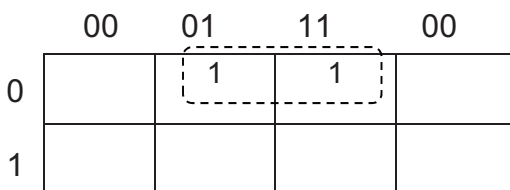
Correct grouping [1]



Correct expression [1]

$$\text{Minimised expression red} = \overline{\text{Sw1}}.\overline{\text{Sw2}} + \overline{\text{Sw1}}.\text{Sw3}$$

Correct grouping [1]



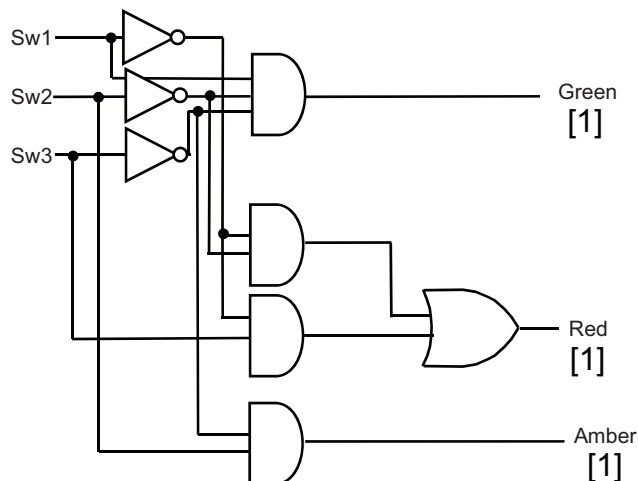
Correct expression [1]

$$\text{Minimised expression amber} = \text{Sw2}.\overline{\text{Sw3}}$$

(4 × [1])

[4]

(iii) Sample logic circuit.



(3 × [1])

[3]

Correct alternative responses should be given full credit.

(iv) Sample answer.

Safety hazards

1. Overheating driver components leading to fire hazard. [1]

2. Burn hazard from heat dissipation from components. [1]

(2 × [1])

[2]

Correct alternative responses should be given full credit.

Safety procedure

Ensure any driving components such as transistors or relays are specified to cope with voltage [1] and current ratings of lamp. [1]

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(c) (i) Sample answer.

Although there are 12 LEDs the total voltage drop will only be applied across six LEDs or $6 \times 2V = 12$ [1] volts therefore no resistor required [1].

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(ii) $P = I \times V$

$$= (20 \text{ mA} \times 2) \times 12 \text{ [1]}$$

$$= 0.48 \text{ W}$$

10 W – 0.48 [1]

Difference in power dissipated 9.52 W

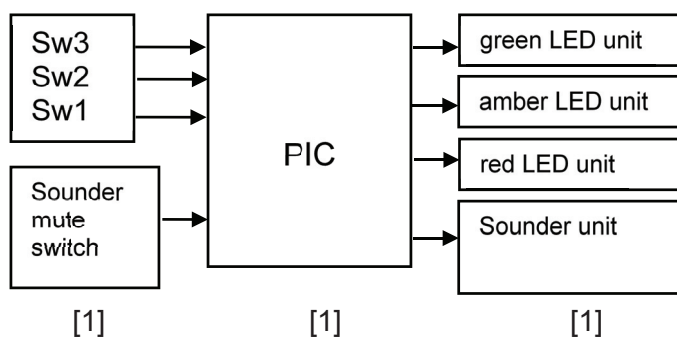
Award full marks if a candidate gives the correct answer but does not show the working out.

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(d) (i) Sample answer.



Award 1 mark for correct process, inputs and outputs

(3 × [1])

[3]

Correct alternative responses should be given full credit.

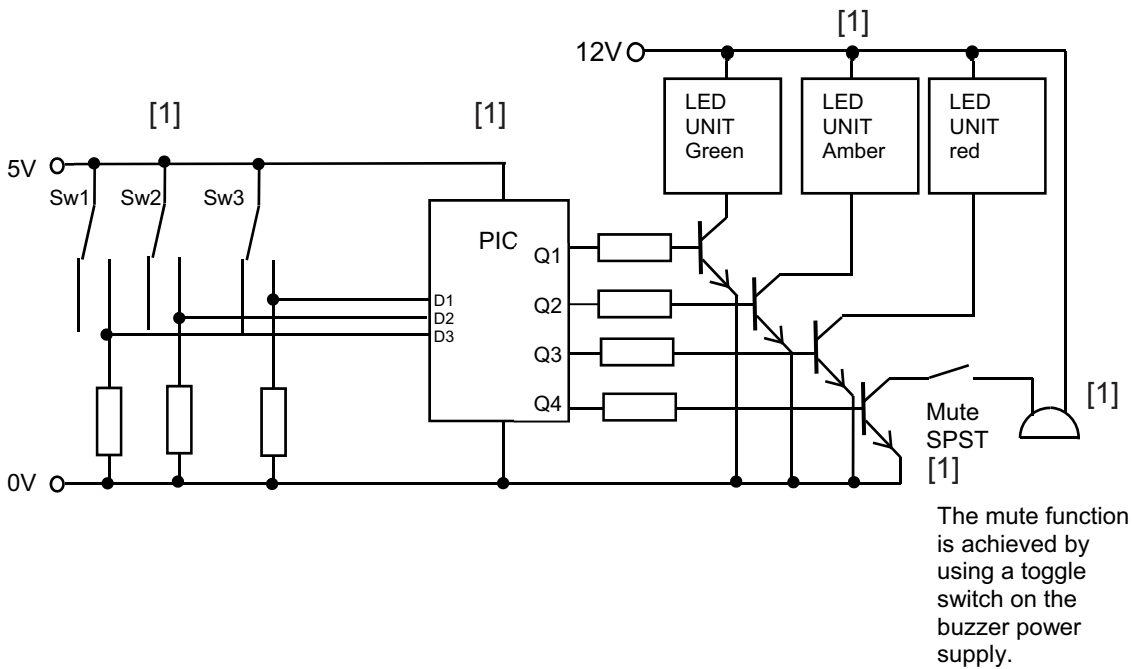
- (ii) The main advantage of an interrupt command is that it is given priority [1] in any program sequence. Therefore there will be no delay in executing the command as the main program will stop what it is doing. [1] [2]

Correct alternative responses should be given full credit.

- (iii) Sample answer.

Award up to five marks for circuit as follows:

- Correct connection of all 3 inputs [1]
- Correct connection of PIC [1]
- Correct connection of all 3 outputs [1]
- Correct connection of buzzer [1]
- Correct mute hardware or software [1]
- (5 × [1]) [5]



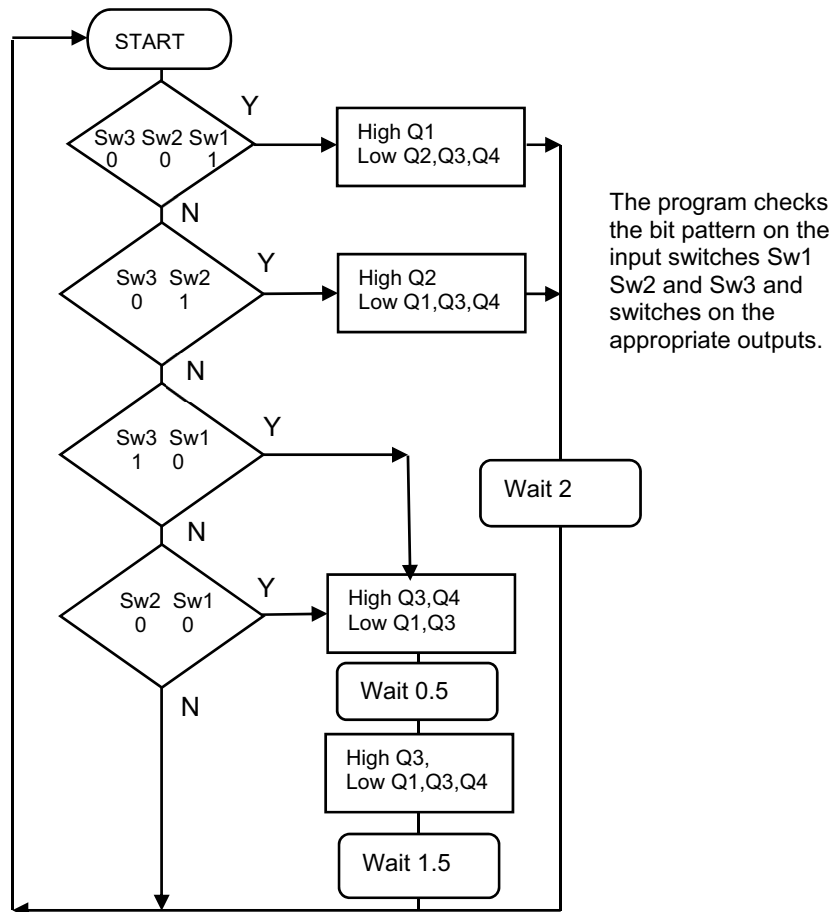
Award up to five marks for flow chart program as follows:

- Correct bit patterns [1]
- Correct checks with Yes/No [1]
- Correct time delays to allow flowchart to function [1]
- Correct information in output cells [1]
- Continuous loop [1]

(5 × [1])

[5]

Correct alternative responses should be given full credit.



AVAILABLE MARKS

40

Section A

80

Section B

**AVAILABLE
MARKS**

Mechanical and Pneumatic Control Systems

- 3 (a) (i) Any **two** possible procedures for example:
- Ensure all cuts are covered so that no compressed air can enter [1]
 - Display safety signs [1]
 - Ensure safety rules are fully explained [1]
- (2 × [1]) [2]

Correct alternative responses should be given full credit.

(ii)

Excellent sketch of the key features of the thrust bearing with excellent annotation. To include rings, ball bearing and housing.	[3]
Good sketch of the features of the thrust bearing with good annotation. To include some rings, ball bearing and housing.	[2]
Limited sketch of the thrust bearing with limited annotation.	[1]
For a response not worthy of credit	[0]

(3 × [1]) [3]

Explanation:

A thrust bearing would be used as it contains a range of ball bearings which would support the crankshaft and allow suitable movement. [1]

The bearing could also withstand the robust conditions in the engine environment better. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(iii) Bands of response

In deciding which band of response to award, teachers 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 band to award to any response, teachers are expected to use their professional judgement.

The following guidance is provided to assist teachers.

Level 1: Response which just merits inclusion in the band and should be awarded a mark at or near the bottom of the range.

Level 2: Response which clearly merits inclusion in the band and should be awarded a mark at or near the middle of the range.

Level 3: Response which fully satisfies the band description and should be awarded a mark at or near the top of the range. Indicative content:

Disc Brakes (any **three** characteristics):

- Offer great stopping power.
- Offer precise braking.
- Can operate more effectively in wet/damp conditions
- Have vents to keep them cool and dissipate heat generated during braking.
- Are self-adjusting
- Can use a hydraulic system to activate.

Cantilever Brakes (any **three** characteristics):

- More aerodynamic in shape to reduce drag.
- Are lightweight.
- Are easy to repair as they use simple rubber pads.
- Are very cheap.
- Uses a cable system to activate.

Justified Selection:

Due to the conditions on a mountain which can often be wet/damp and the need to be able to brake precisely disc brakes are used on mountain bikes. The cantilever brake is more appropriate to the road bike as it is more aerodynamic and lightweight. The forces do not have to be as reactive for the braking system as they are used on roads.

Response band	Description	Mark band
1	<p>The candidate discusses in limited detail one characteristic of:</p> <ul style="list-style-type: none"> - disc; and - cantilever brakes. <p>Limited reference is given to justification of brake selection.</p> <p>The written presentation is basic and demonstrates a basic knowledge of the subject.</p> <p>Little use is made of specialist terms and technological vocabulary are used. The candidate uses basic spelling, punctuation and grammar, and the form and style are of a basic standard.</p>	[1]–[3]
2	<p>The candidate discusses two characteristics of:</p> <ul style="list-style-type: none"> - disc; and - cantilever brakes. <p>Good reference is given to justification of brake selection.</p> <p>The written presentation is clear and demonstrates good knowledge of the subject.</p> <p>Some specialist terms and technological vocabulary are used throughout. The candidate uses good spelling, punctuation and grammar, and the form and style are of a good standard.</p>	[4]–[6]
3	<p>The candidate discusses in detail three characteristics of:</p> <ul style="list-style-type: none"> - disc; and - cantilever brakes. <p>Excellent reference is given to justification of brake selection.</p> <p>The written presentation is clear and precise and demonstrates excellent knowledge of the subject.</p> <p>Appropriate specialist terms and technological vocabulary are used throughout. The candidate uses excellent spelling, punctuation and grammar, and the form and style are of a high standard.</p>	[0]

Correct alternative responses should be given full credit. [9]

- (iv) Velocity = $0.06 \times 1200/60 = 1.2 \text{ m/s}$ [1]
 Kinetic energy = $\frac{1}{2} \times \text{mass} \times v^2$
 Kinetic energy = $0.5 \times 4.2 \times 1.2^2$ [1]
 Kinetic energy = 3.024J [1]
 Award full marks if a candidate gives the correct answer but does not show the working out.
 (3 × [1]) [3]

- (v) $P = T\omega$
 $P = 13188 = T \times (2\pi/60 \times 900 \text{ rpm})$ [1]
 $T = 140 \text{ Nm}$ [1]
 Award full marks if a candidate gives the correct answer but does not show the working out.
 (2 × [1]) [2]

- (vi) Any **two** possible advantages for example:
- Chain drives are extremely strong while pulleys are weaker due to the use of a rubber belt. [1] This enables the chain drive to rotate the wheels in a more effective manner. [1]
 - Chain drives can operate to an extremely accurate level. [1] This allows them to be used on bicycles to ensure the wheels go to a particular place. [1]
 - Chain drives do not stretch as easily as pulley drives [1] and given that the chain is more robust than a belt it would be the only option. [1]
- (2 × [2]) [4]

Correct alternative responses should be given full credit.

(b) (i)	Excellent diagram of the 5/3 showing all connections and correct piping.	[3]
	Good diagram of the 5/3 showing most of the connections and piping.	[2]
	Limited diagram of the 5/3 valve with limited connections and piping.	[1]
	For a response not worthy of credit.	[0]

(3 × [1]) [3]

- (ii) Ans = $W = F \times L$
 $820 \times 0.20 = 164 \text{ J}$ [1]
 $- (20\%) = 164 - 32.8 = 131.2 \text{ J}$ [1]
 Award full marks if a candidate gives the correct answer but does not show the working out.
 (2 × [1]) [2]

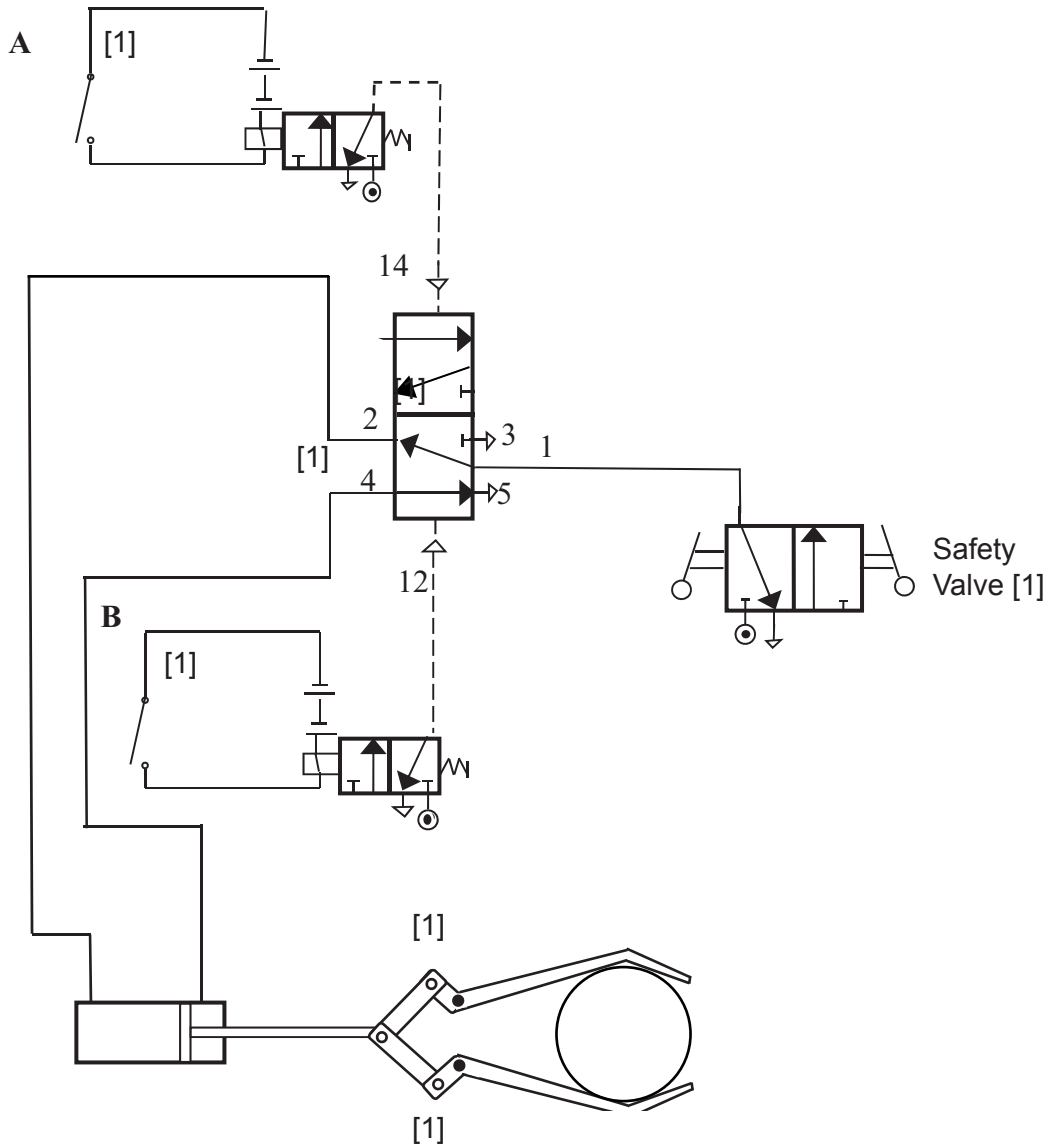
(c) (i)	Excellent sketch of the key features of a ratchet and pawl.	[4]
	Good sketch of the key features of a ratchet and pawl.	[3]
	Satisfactory sketch of the features of a ratchet and pawl.	[2]
	Limited sketch of of a ratchet or pawl.	[1]
	For a response not worthy of credit	[0]

(4 × [1])

[4]

Correct alternative responses should be given full credit.

(ii)



Safety valve [1]
 Solenoids [2]
 Piping [1]
 Mechanism [2]
 (6 × [1])

[6]

Correct alternative responses should be given full credit.

AVAILABLE
MARKS

40

4 (a) (i) PITCH CIRCLE DIAMETER

Drawing [1]

PITCH POINT

Drawing [1]

(2 × [1])

[2]

(ii) Explanation:

The pitch circle diameter of a gear can be determined by measuring from the top of one gear tooth to the bottom of the opposite gear tooth, [1] whereas the pitch point is the point where two gears are in contact. [1]

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(b) (i)

Gain in PE = mgh

Gain in PE = 20000 × 9.82 × 20 [1]

Gain in PE = 3928000 J [1]

Award full marks if a candidate gives the correct answer but does not show the working out.

(2 × [1])

[2]

(ii) P = work/time

= 1000 × 9/time

Time = Work/Power

Time = $\frac{1000 \times 9}{600}$ [1]

Time = 15 sec [1]

Award full marks if a candidate gives the correct answer but does not show the working out.

(2 × [1])

[2]

(iii) Torque = Force × Distance from Turning Point

Distance from Turning Point = $\frac{\text{Torque}}{\text{Force}}$

= $\frac{100}{300}$ [1]

= 0.33 m [1]

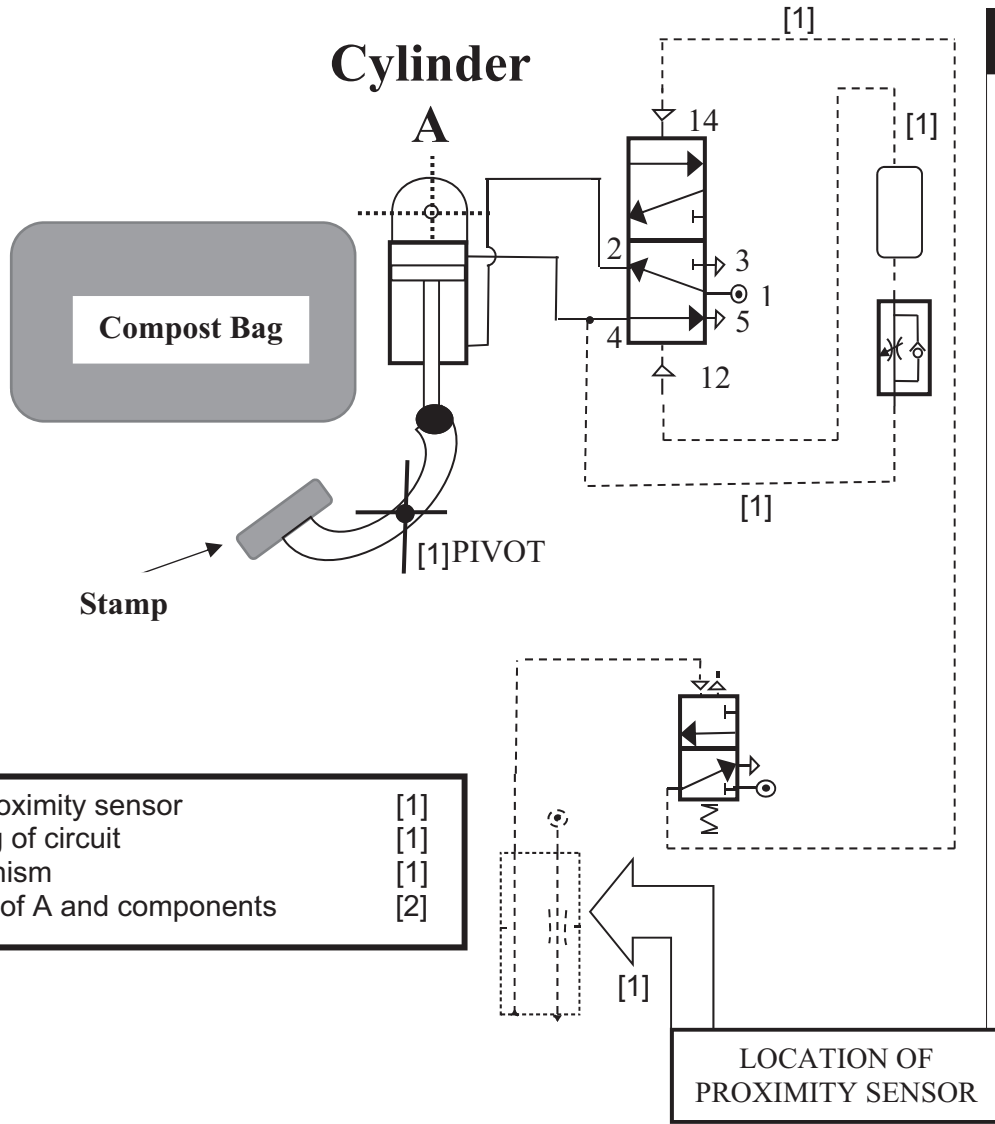
Award full marks if a candidate gives the correct answer but does not show the working out.

(2 × [1])

[2]

AVAILABLE
MARKS

(c) (i)



Drawing of proximity sensor	[1]
Correct piping of circuit	[1]
Lever Mechanism	[1]
Auto instroke of A and components	[2]

(5 × [1])

[5]

(ii) $F = P \times A$

Taking Min Force by selecting (d) 16 mm (D) 40 mm at 3 bar

$$\begin{aligned} \text{Min force for cylinder} &= ((3.14 \times 20^2) - (3.14 \times 8^2)) \times 0.3 \\ &= ((1256) - (200.96)) \times 0.3 \quad [1] \\ &= 316.512 \text{ N} \quad [1] \end{aligned}$$

Taking Max Force by selecting (d) 8 mm (D) 64 mm at 9 bar

$$\begin{aligned} \text{Max force for cylinder} &= ((3.14 \times 32^2) - (3.14 \times 4^2)) \times 0.9 \\ &= ((3215.36) - (50.24)) \times 0.9 \quad [1] \\ &= 2848.60 \text{ N} \quad [1] \end{aligned}$$

$$\begin{aligned} \text{Max force for cylinder} - \text{Min force for cylinder} \\ 2848.60 - 316.512 \\ = 2532.08 \quad [1] \end{aligned}$$

Award full marks if a candidate gives the correct answer but does not show the working out.

(5 × [1])

[5]

(d) See A3 mark scheme

[10]

(e) See A3 mark scheme

[10]

40

Section B

80

AVAILABLE MARKS

Section C

AVAILABLE
MARKS

Product Design

- 5 (a) Incremental developments refer to stepped changes or improvements or additional features in products [1] whereas radical developments refer to a significant leap forward in the use of materials or processes or systems within a product. [1]
(2 × [1]) [2]

Correct alternative responses should be given full credit.

- (b) (i) Any **two** main factors associated with technology push for example:
- With the introduction of new technologies products that were previously thought to be impossible to create are now possible. [1]
 - New technologies are sometimes driven by environmental pressures or consumer trends. [1]
 - New technologies are used as a way of achieving an advantage in the market as they may be perceived as hi-tech and attractive to the consumer. [1]
- (2 × [1]) [2]

Correct alternative responses should be given full credit.

- (ii) Any **two** main reasons why it is so important to have innovation in the market for example:
- It creates new and exciting products for the consumer. [1]
 - It develops competition between different companies. [1]
 - It helps to drive sales figures. [1]
- (2 × [1]) [2]

Correct alternative responses should be given full credit.

- (c) Any **two** different ways in which market research could be carried out to assist in the development of new or existing hand tools for example:
- Personal interviews [1] with structured and unstructured open ended questions on a range of hand tools.
 - Observe customers [1] using new hand tools and record any issues together with consumer feedback on their individual experience. [1]
 - A facilitator would use focus groups [1] to discuss or debate the key features of a new or existing hand tool. [1]
- (2 × [2]) [4]

Correct alternative responses should be given full credit.

- (d) Explanation of any **two** main differences between the main characteristics of growth and the main characteristics of decline for example:
- Marketing costs will have reduced slightly in the growth stage [1] but will not exist in the decline stage as there will be no marketing activity. [1]
 - Product sales increase significantly during the growth stage whereas in decline stage the sales start to decrease. [1]
 - Product begins to make a profit during the growth stage [1] whereas profit margin starts to diminish during the decline stage. [1]
- (2 × [2]) [4]

Correct alternative responses should be given full credit.

(e) Any **three** main issues regarding sustainability in the manufacture and disposal of plastics for example:

- In the manufacture of plastic non-renewable sources are used.
- High greenhouse gas emissions associated with the use of energy for manufacture of resins for plastics and the actual processing of plastics.
- In the disposal of plastics, many products end up in landfill sites which can be harmful to the environment.
- In the disposal of plastics recycling can be expensive and time consuming.

(3 × [1]) [3]

Correct alternative responses should be given full credit.

(f) (i) It is so important for manufacturers to consider the concept of refuse in terms of the 6R's as consumers of products may exercise their environmental concerns by refusing to purchase a particular product [1] based on its environmental credentials which could affect sales and profits. [1] [2]

Correct alternative responses should be given full credit.

(ii) A photodegradable plastic is one which breaks down [1] when exposed to light. [1]
Award [2] for a full explanation and [1] for a limited explanation. [2]

Correct alternative responses should be given full credit.

(g) **Bands of response**

In deciding which band of response to award, teachers 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 band to award to any response, teachers are expected to use their professional judgement.

The following guidance is provided to assist teachers.

Level 1: Response which just merits inclusion in the band and should be awarded a mark at or near the bottom of the range.

Level 2: Response which clearly merits inclusion in the band and should be awarded a mark at or near the middle of the range.

Level 3: Response which fully satisfies the band description and should be awarded a mark at or near the top of the range.

For each of the following explain three specific features that a company would need to have knowledge and understanding of in order to guide their business.

- Price to include methods and strategies.
- Place to include geographical and physical placing.
- Promotional methods and strategies.

Indicative content:

Any **three** specific features with regards to pricing methods and strategies for example:

- To understand the basis of cost-plus, contribution pricing or perceived value and select the most appropriate for their business.
- To appreciate that with cost-plus pricing the company has no way of knowing if the potential customers will pay the calculated price.
- To appreciate that contribution pricing would only be used for products that have a long product life cycle.
- To appreciate that perceived value pricing can be used during all of the stages of a product's life cycle and normally operates in competitive environments.

Any **three** specific features with regards to place to include geographical and physical placing for example :

- To appreciate the international and regional differences that exist with regards to their product and how this might impinge on trading.
- To appreciate the accessibility of regional markets compared to international markets.
- To appreciate that international trade is more expensive than regional trade due to border delays and expenses.
- To appreciate the importance of physical placing to ensure that getting the product to the right place at the right time is essential.

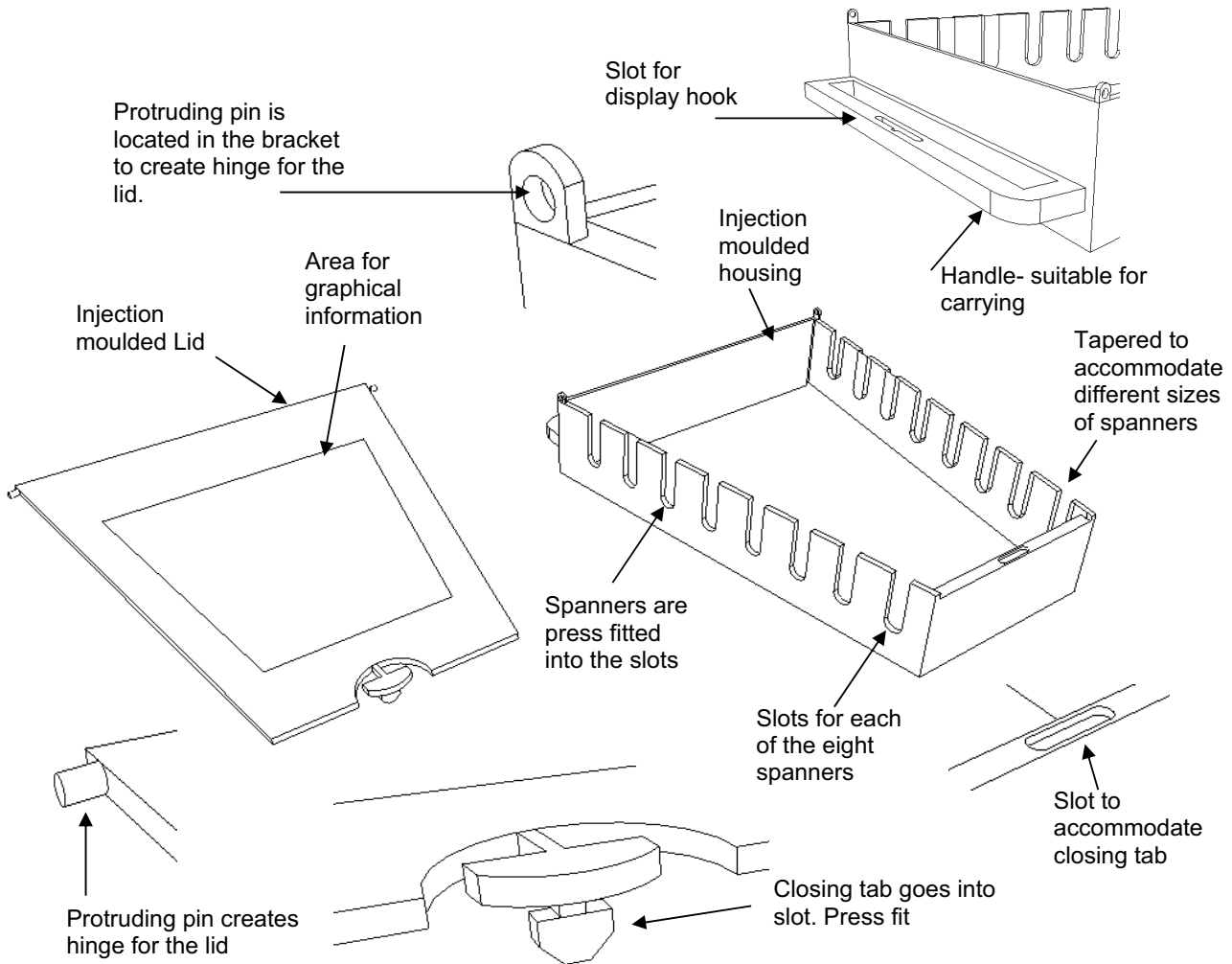
Any **three** specific features with regards to promotion to include promotional methods and strategies for example :

- To understand that promotion raises the consumer's awareness of the product's price and quality.
- To understand that promotion is important at all stages of a product's life cycle because the target market needs to be reminded about its existence.
- To understand the benefits of personal selling, sales promotions, advertising, trade fairs and exhibitions and select the most appropriate method for their target audience.
- To appreciate that strategies such as modifying the product, altering the packaging, reducing the price and exporting the product to new markets can prolong the life cycle of a product.

Response band	Description	Mark band
1	<p>The candidate provides a basic discussion on one feature associated with:</p> <ul style="list-style-type: none"> - Price; - Place; and - Promotion. <p>The written presentation is basic and demonstrates a basic knowledge of the subject.</p> <p>Little use is made of specialist terms and technological vocabulary are used. The candidate uses basic spelling, punctuation and grammar, and the form and style are of a basic standard.</p>	[1]–[3]
2	<p>The candidate provides a good discussion on two specific relevant features associated with:</p> <ul style="list-style-type: none"> - Price; - Place; and - Promotion. <p>The written presentation is clear and demonstrates good knowledge of the subject.</p> <p>Some specialist terms and technological vocabulary are used throughout. The candidate uses good spelling, punctuation and grammar, and the form and style are of a good standard.</p>	[4]–[6]
3	<p>The candidate provides an excellent discussion on three specific relevant features associated with</p> <ul style="list-style-type: none"> - Price; - Place; and - Promotion. <p>Excellent reference is given to justification of brake selection.</p> <p>The written presentation is clear and precise and demonstrates excellent knowledge of the subject.</p> <p>Appropriate specialist terms and technological vocabulary are used throughout. The candidate uses excellent spelling, punctuation and grammar, and the form and style are of a high standard.</p>	[7]–[9]

AVAILABLE MARKS

[9]



Design requirements:

- Low-cost compact storage unit.
- Secure housing for the 8 spanners.
- Accommodate easy removal and replacement of the spanners.
- Suitability for display.
- Easily carried.

Marks should not be awarded for repetitive sketches which do not show any further design thinking.

AVAILABLE MARKS

Response band	Description	Mark band
When a response is not worthy of credit, a [0] mark should be awarded.		
1	Basic sketch conveying little detail.	1
2	Both the sketch and annotation of the design are basic. The design considers one of the design requirements outlined above.	2
3	Both the sketch(es) and annotation of the design are limited. The design considers two of the design requirements outlined above.	3
4	Both the sketch(es) and annotation of the design are satisfactory. The design considers three of the design requirements outlined above.	4
5	Both the sketch(es) and annotation of the design are satisfactory. The design incorporates three of the design requirements outlined above.	5
6	Both the sketch(es) and annotation of the design are good. The design incorporates three of the design requirements outlined above.	6
7	Very good, annotated sketch(es) of a design which incorporates four of the design requirements outlined above.	7
8	Very good, annotated sketch(es) of an appropriate design which incorporates four of the design requirements outlined above.	8
9	Excellent annotated sketch(es) of an appropriate design which incorporates five design requirements outlined above.	9
10	Excellent detailed annotated sketch(es) of an appropriate design which fully incorporates five design requirements outlined above.	10

AVAILABLE MARKS

Correct alternative responses should be given full credit.

[10]

40

- 6 (a) The concept of elasticity of demand is the measurement of change in demand for a product [1] in response to changes in its price. If the elasticity of demand is more than 1 it is sensitive to change and if it is less than 1 it is less sensitive to change. [1]
(2 × [1]) [2]

Correct alternative responses should be given full credit.

- (b) (i) Any **two** main characteristics associated with the masses for example:
- The masses adopt the product after seeing it used successfully by the early opinion leaders. [1]
 - The masses are the first sizable segment of the population which adopt the product. [1]
 - Masses tend to adopt the product over a longer period of time compared to the other consumer segments. [1]
- (2 × [1]) [2]

Correct alternative responses should be given full credit.

- (ii) Any **two** main characteristics associated with late adopters for example:
- The late adopters are described as being cautious before adopting. [1]
 - The late adopters adopt when the product's popularity fades. [1]
 - The late adopters often adopt when the product is marked for sale/clearance. [1]
- (2 × [1]) [2]

Correct alternative responses should be given full credit.

- (c) Washing machine
Extraction of materials needed for the product – Plastics and steel are the two main materials used. Although the recycling rate is high for steels the extraction still has a large impact on the environment. [1] Many of the plastic internal components are now designed to use recycled materials. [1]

The use of the product – In the use phase a typical washing machine uses 87% of the energy required over its life cycle. [1] Advances in technology and better consumer wash selection will continue to offer further resource efficiency opportunities. [1]

End of life considerations – There are opportunities at end of life for refurbishment and reuse of machines as new technologies come on board. [1] In addition there is a growing interest in finding new uses for washing machine components at the end of their initial use phase. [1]
(3 × [2]) [6]

Correct alternative responses should be given full credit.

- (d) (i) Embodied energy when considering sustainability is the measure of the energy used throughout the entire production chain [1] from resource acquisition to final packaging and distribution. [1]
(2 × [1]) [2]

Correct alternative responses should be given full credit.

(ii) Any **one** main reason for adopting the Kanban system for example:

- Less space used for storage as components are delivered when they are needed [1] in the quantity that is needed for that day or week. [1]
- Good supply and demand flexibility as a Kanban system can self-regulate by pulling lower level builds when demand dictates [1] and conversely speeds up when demand increases. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(e) (i) Jigs – Example kitchen doors

When holes have to be drilled in the same position repeatedly for hinges and fittings a jig is often used. [1] The jig is a fixed frame which allows the operator to quickly place the door in position for drilling to ensure speed of operation, accuracy and repeatability thus assisting quality control. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(ii) An Example. Electric guitar – a very accurate profile of the guitar is generated in the form of templates [1]. These templates are then placed on the selected wood, drawn around and cut out using table saws and routers. These templates aid accuracy and ensure consistency during manufacture thus assisting quality control. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(f) Example 1.

Eco-Labeling – The EU developed a labelling system which rated the energy efficiency of domestic products such as fridges, washing machines and tumble dryers, [1] etc. This label indicated to customers the level of efficiency of the product. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

Example 2.

The EU air quality directive has set maximum permissible levels for atmospheric concentrations of pollutants. [1] Emissions of these air quality pollutants from road vehicles are being reduced by improving the quality of fuels and better engine design. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(g) (i) How the design or manufacture of a product has been influenced by ethnic factors for example.

In Japan, traditionally it is not uncommon for people to sit on the floor to eat the family meal. [1] The design of dining furniture for Japan is very different to that designed for the European market. [1]

(2 × [1]) [2]

Correct alternative responses should be given full credit.

(ii) A product that incorporates environmental factors for example.

The smart car. The smart car is 95% recyclable and has been designed to consume less fuel and use more sustainable fuels. [1] The manufacturing processes have been developed to minimise the car's impact on the environment. [1]

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(h) Any **two** main characteristics which describe the influence of Trevor Baylis in terms of product design for example:

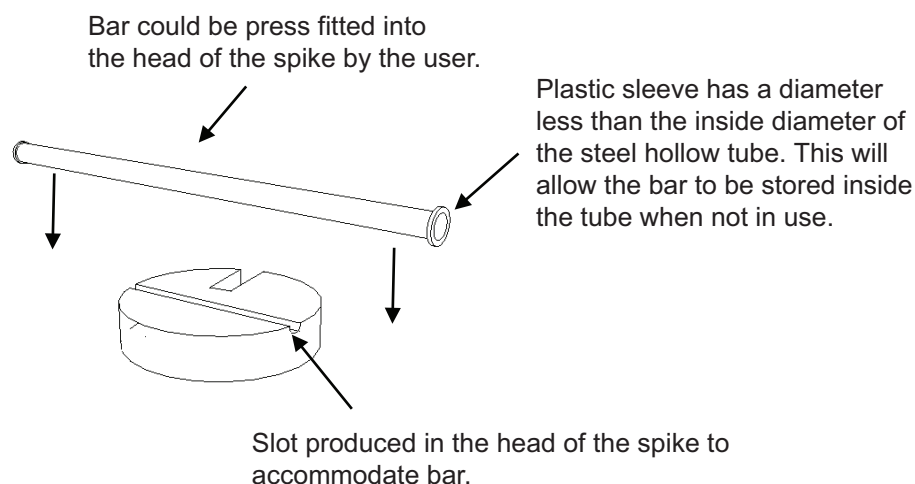
- Baylis with his design of the wind-up radio forced many companies to take sustainability seriously and as a result a number of products developed from the use of his technology. [1]
- He founded the Trevor Baylis Brands which was set up to help inventors connect with patent lawyers so that they could ensure that their designs were protected. [1]
- He promoted the activity of invention by encouraging and supporting inventors and engineers through the Trevor Baylis Foundation. [1]

(2 × [1])

[2]

Correct alternative responses should be given full credit.

(i) (i) Sample Answer.

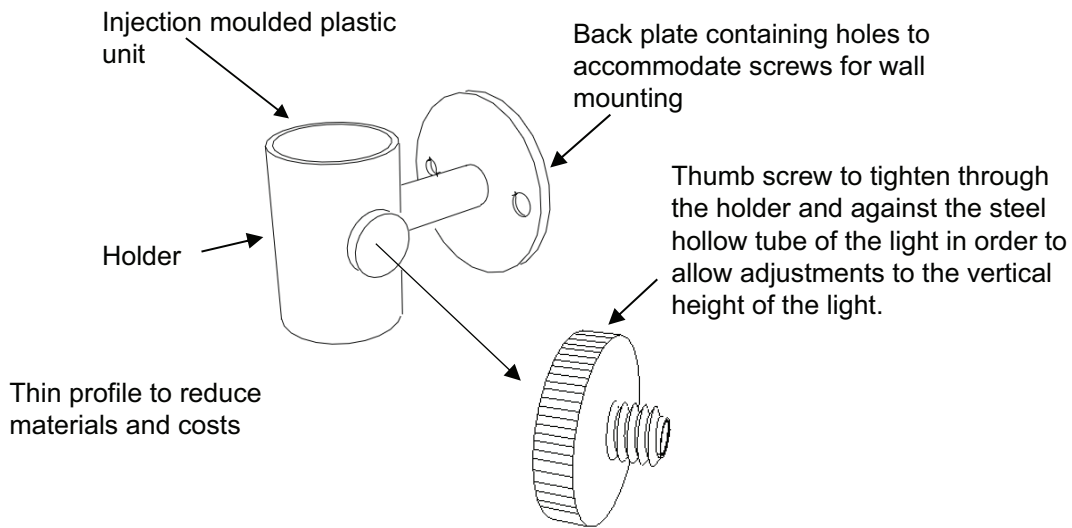


Response band	Description	Mark band
When a response is not worthy of credit, a [0] mark should be awarded.		
1	Basic sketch lacking detail.	1
2	<p>Sketch(es) and annotation are satisfactory.</p> <p>The design lacks detail of how the user can force the design into the ground:</p> <ul style="list-style-type: none"> - to the required depth; and/or - without the use of hand tools. <p>The attachment of the design to prevent loss is reasonable.</p>	2
3	<p>Sketch(es) and annotation are good.</p> <p>The design shows how the user can force the design into the ground:</p> <ul style="list-style-type: none"> - to the required depth; and - without the use of hand tools. <p>The attachment of the design to prevent loss is good showing some detail.</p>	3
4	<p>Sketches and annotation are excellent.</p> <p>The design shows in detail how the user can force the design into the ground:</p> <ul style="list-style-type: none"> - to the required depth; and - without the use of hand tools. <p>The attachment concept is excellent and clearly demonstrate all aspects of the design.</p>	4

[4]

AVAILABLE MARKS

(iii) Sample answer



Response band	Description	Mark band
When a response is not worthy of credit, a [0] mark should be awarded.		
1	Basic sketch lacking detail.	1
2	Sketch(es) and the annotation are limited. The design lacks detail showing: - the low-cost nature of the bracket; and/or - how the light can be secured to a wall; and/or - the height adjustment feature.	2
3	Sketch(es) and the annotation are satisfactory. The design satisfactorily shows: - the low-cost nature of the bracket; and/or - how the light can be secured to a wall; and/or - the height adjustment feature.	3
4	Sketch(es) and annotation are good. The design demonstrates: - the low-cost nature of the bracket; and - how the light can be secured to a wall; and - the height adjustment feature.	4
5	Sketch(es) and annotation are very good. The design clearly demonstrates: - the low-cost nature of the bracket; and - how the light can be secured to a wall; and - the height adjustment feature.	5
6	Sketches and annotation are excellent. The design clearly demonstrates in detail: - the low-cost nature of the bracket; and - how the light can be secured to a wall; and - the height adjustment feature.	6

[6]

Section C

Total

AVAILABLE MARKS

40

80

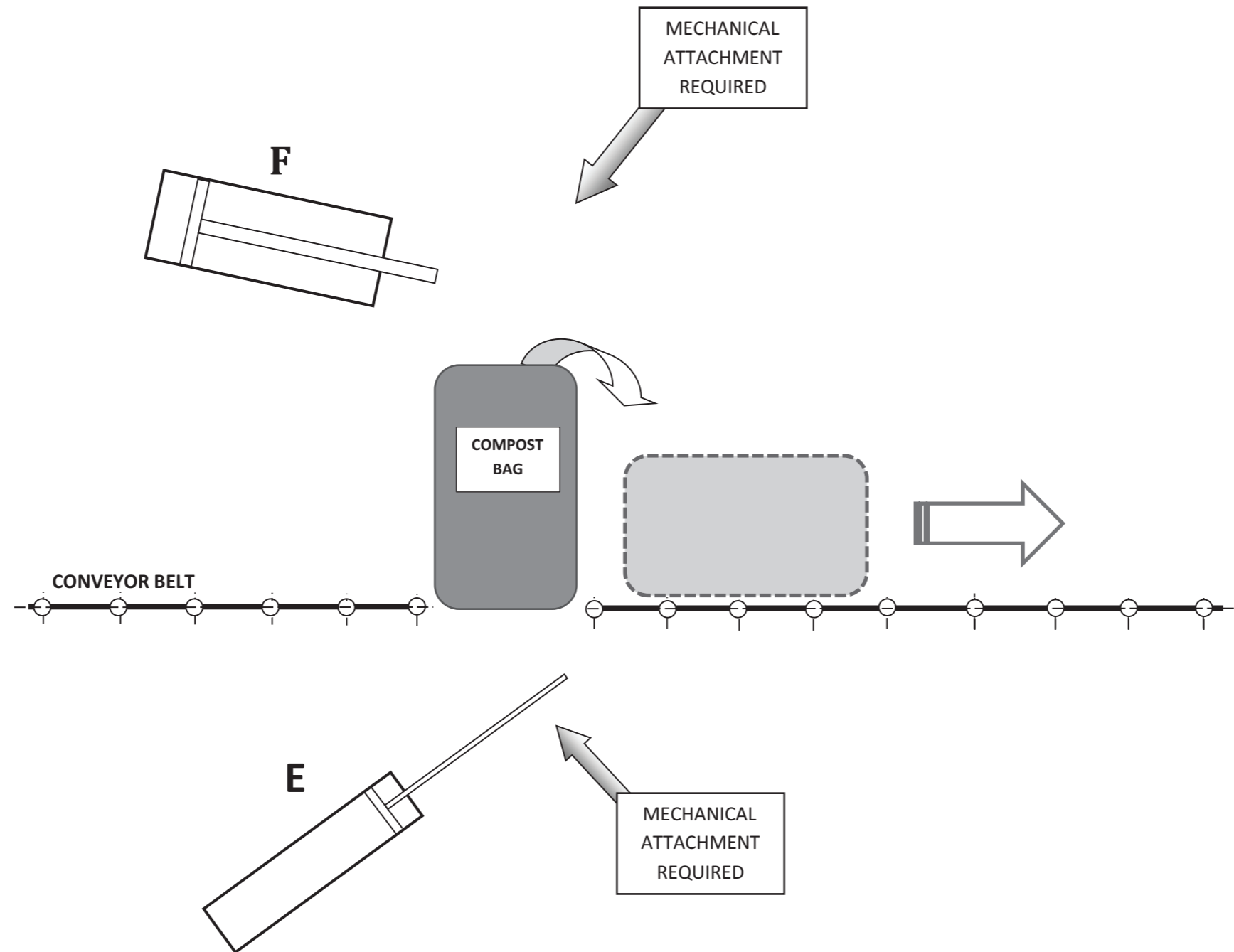
80

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Pro forma answer page
(answer number 4(e))

Question No. 5(h)

**Advanced (A2) Technology and Design
Assessment Unit A2 1**

Centre Number

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Candidate Number

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**Pro forma answer page
(answer number 5(h))**

Question No. 6(i)(i) and (ii)

**Advanced (A2) Technology and Design
Assessment Unit A2 1**

Centre Number

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**Pro forma answer page
(answer number 6(i)(i) and (ii))**