



*Rewarding Learning*

**ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2025**

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## **Technology and Design**

**Assessment Unit AS 1**

*assessing*

**Systems and Control or Product Design**

**[STE12]**

**MONDAY 12 MAY, AFTERNOON**

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**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 examiners 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, examiners 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, 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 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, examiners should apply the 'own figure 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.

### ***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***

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.

Section A

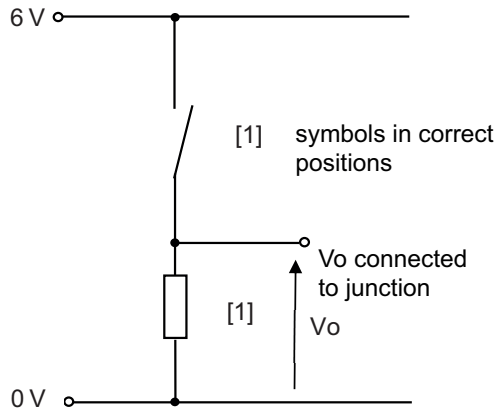
AVAILABLE MARKS

Electronic and Microelectronic Control Systems

- 1 (a) (i) Sample answer  
 A micro switch will detect very small movements [1] making it sensitive to small momentary vibrations caused by the ball hitting the target. [1][2]

All relevant, valid responses will be given credit.

- (ii) Sample answer

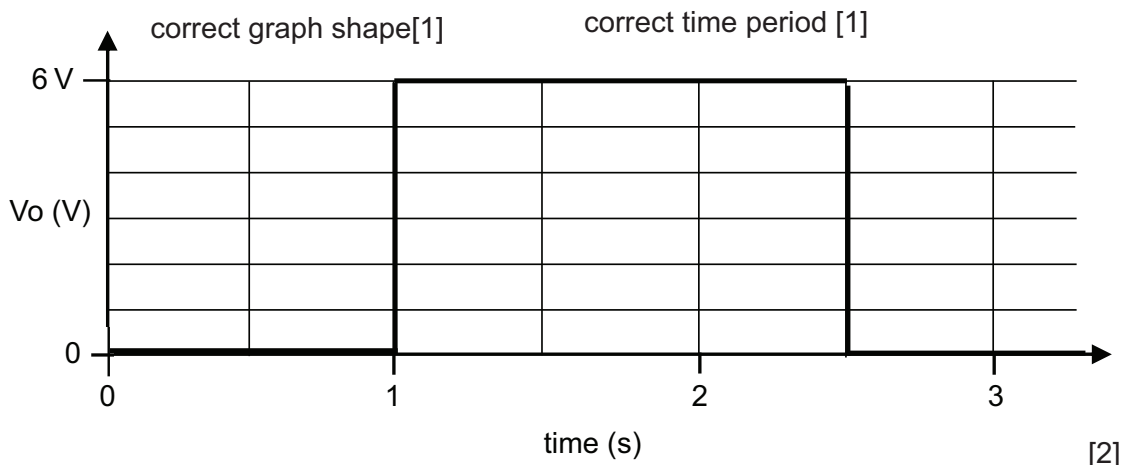


[2]

- (b) (i) Sample answer  
 Open loop systems are less efficient because they have no feedback [1] to automatically adapt the output. [1] [2]

All relevant, valid responses will be given credit.

- (b) (ii) Sample answer

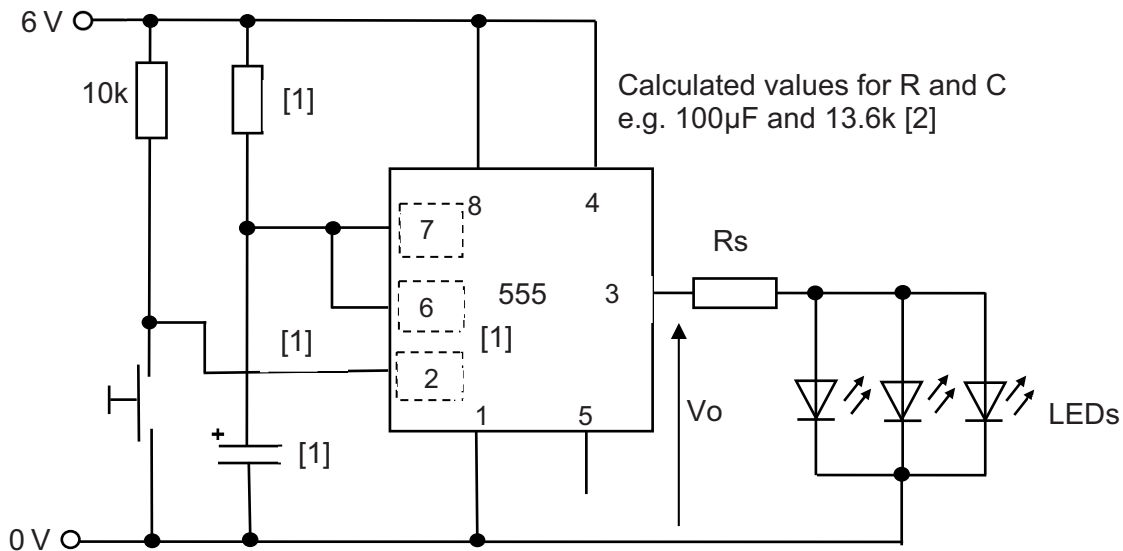


[2]

All relevant, valid responses will be given credit.

(c) (i) Sample answer

AVAILABLE MARKS



[6]

All relevant, valid responses will be given credit.

(ii)  $R_s = (6 - 1.6) / (0.015 \times 3)$  [1]  
 $= 98 \text{ ohms}$  [1]

[2]

(iii)  $P = 4.4 \times 0.045$  [1]  
 $= 0.198 \text{ watts}$  [1]

[2]

Chosen power rating = 0.25W

[1]

(iv) selected E12 value = 100 ohms

[1]

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2 (a) (i) NOT gate.

[1]

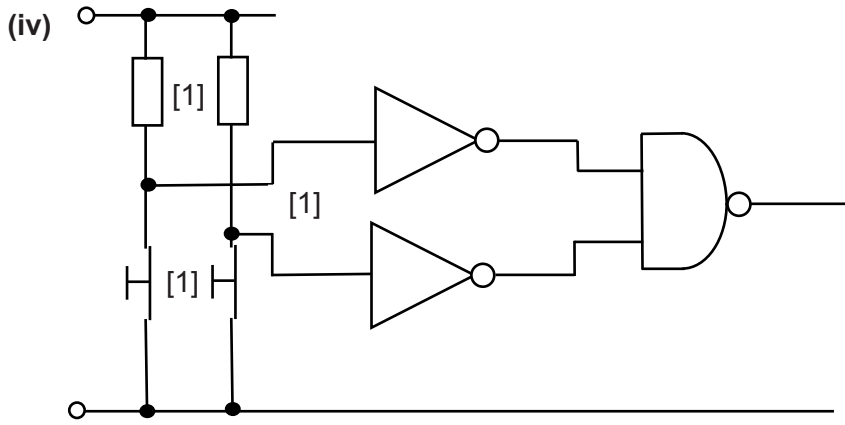
(ii)

A	B	Q
0	0	0
1	0	1
0	1	1
1	1	1

[3]

(iii) OR gate

[1]



[3]

All relevant, valid responses will be given credit.

- (b) (i) Sample answer  
 Current flows through an electromagnetic coil. [1] The resulting magnetic field pulls or pushes a mechanical valve. [1]

[2]

All relevant, valid responses will be given credit.

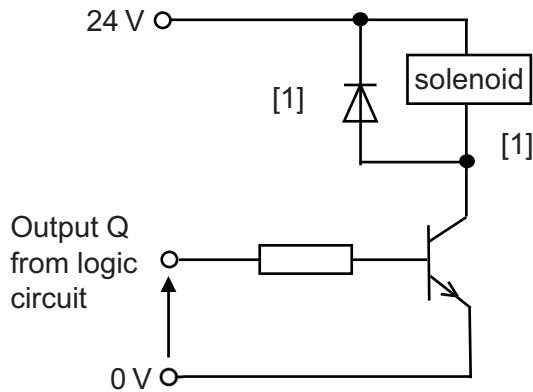
(ii)  $I_c = 24 \div 150 = 0.16 \text{ A}$  [1]

If gain = 60 then  $I_b = 2.67 \text{ mA}$  [1]

$R_b = (5\text{V} - 0.6\text{V}) \div 2.67 \text{ mA} = 1650 \text{ ohms}$  [1]

[4]

- (iii) Sample answer



[2]

All relevant, valid responses will be given credit.

(iv) Sample answer

Main advantage – smaller circuit size as an 8 pin PIC could be used [1]  
whereas a 14 pin logic gate chip would be the minimum requirement for  
the logic circuit [1] [2]

**All relevant, valid responses will be given credit.**

Main disadvantage – programmable systems generally run slower [1]  
than hard wired systems due to the required execution time for the  
program. [1] [2]

**All relevant, valid responses will be given credit.**

**Section A**

**AVAILABLE  
MARKS**

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Section B

AVAILABLE  
MARKS

Mechanical and Pneumatic Control Systems

3 (a) Jockey wheel/Jockey pulley. [1]

By operating the foot pedal the jockey wheel allows the user to engage and disengage the drive. [1] When the foot pedal is released, the belt becomes slack and there is no friction between the belt and the jockey wheel. [1] When the pedal is pressed the jockey wheel takes up the slack in the belt and allows the motor drive to be transmitted through the drive train. [1] [4]

All relevant, valid responses will be given credit.

(b) (i) Component B – Roller follower  
Component C – Snail cam  
Change in motion – converts rotation into reciprocating motion.  
(3 × [1]) [3]

(ii) Any **one** advantage for example:

- Belt drives provide quiet operation [1]
- Operate over long distance [1]
- No lubrication required [1]
- Belt drives require little maintenance. [1]

Any **one** disadvantage for example:

- Belt and pulley systems can take up a significant amount of space [1]
  - Belts can slip under heavy loads. [1]
- (2 × [1]) [2]

All relevant, valid responses will be given credit.

(c) (i)

	B		D		F		H		VR
Driven	400	×	140	×	175	×	120	=	30.0
Driver	<u>196</u>		<u>40</u>		<u>50</u>		<u>100</u>		
	A		C		E		G		
	2.041	×	3.5	×	3.5	×	1.2	=	30
	[1]		[1]		[1]		[1]		[1]

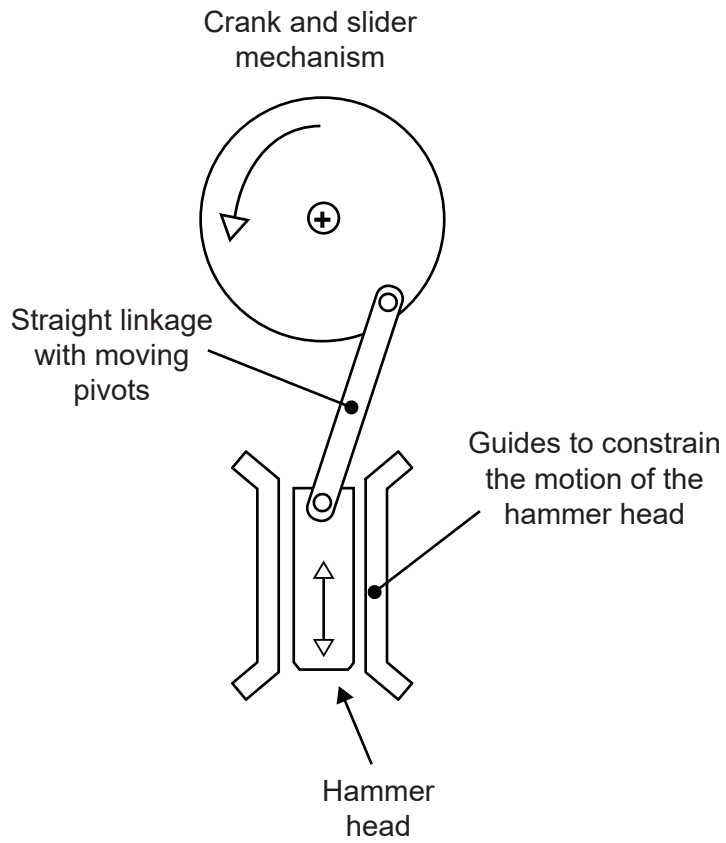
[5]

(ii) VR = 45

Output  $60/2 = 30$  [1]

input = VR × output =  $45 \times 30 = 1350$  rev/min [1] [2]

(d)



Sketch of linkage between input and steel hammer. [1]  
Sketch of constraints at each side of the steel hammer. [1]  
Crank and slider mechanism label. [1]  
Helpful annotation. [1]  
(4 × [1])

[4]

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**All relevant, valid responses will be given credit.**

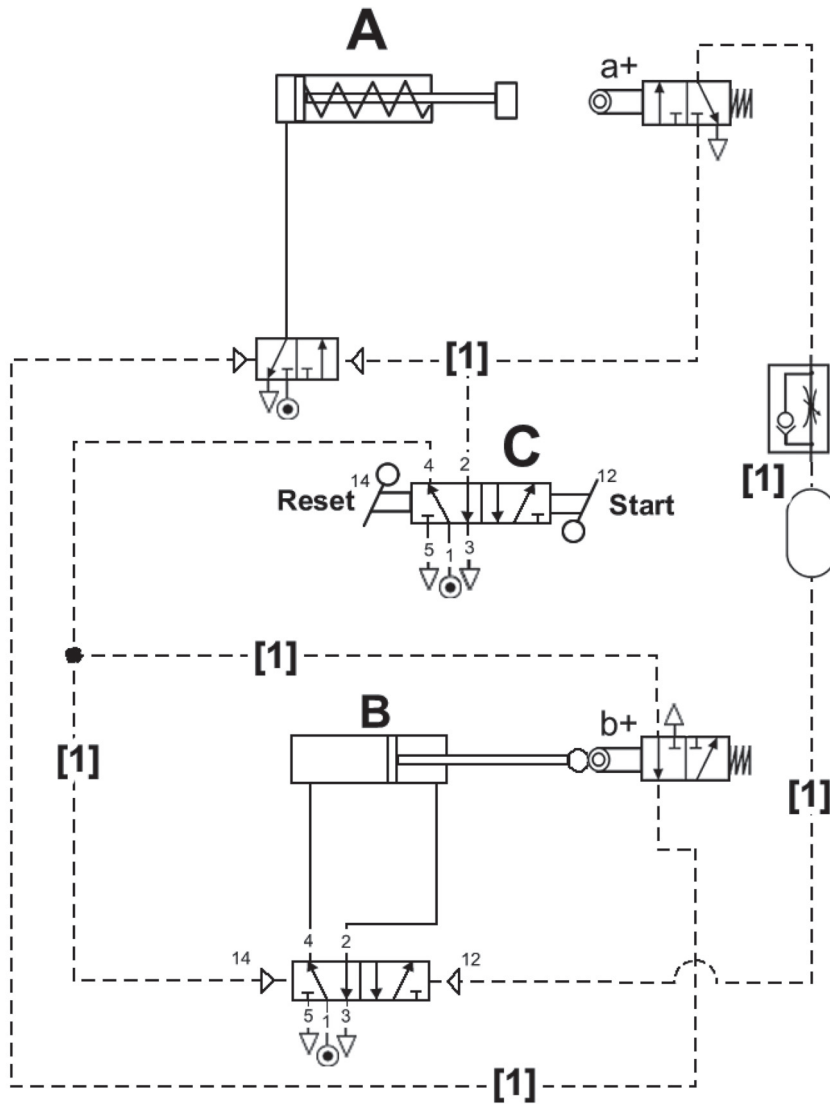
4 (a) (i) Area =  $(25 \times 25) 3.14 = 1962.5 \text{ mm}^2$  [1]  
 Force =  $1962.5 \times 0.25 = 490.625 \text{ N}$  [1]  
 Efficiency =  $319/490 = 0.65$  [1]  
 Efficiency = 65% [1] [4]

(ii) Difference in force applied =  $294.4 - 247.3 = 47.1 \text{ N}$  [1]  
 Area of piston rod  $\text{mm}^2 = 47.1 / 0.15 = 314 \text{ mm}^2$  [1]  
 Radius of piston rod =  $\text{SQRT}(314/3.14) = 10 \text{ mm}$  [1]  
 Diameter of Piston rod = 20 mm [1] [4]

(b) Symbol C – Bidirectional flow restrictor [1]  
 Symbol D – Shuttle valve [1]  
 Explanation of Component C – adjusts the speed [1] of cylinder actuation in both directions. [1] [4]

All relevant, valid responses will be given credit.

(c)



[6]

- (d) Any **two** safety procedures which should be employed for example:
- Check connections are tight. [1]
  - Check that the circuit is configured correctly before supplying pressurised air. [1]
  - Always turn the air off before altering or adjusting connections in the circuit. [1]

[2]

**All relevant, valid responses will be given credit.**

**Section B**

AVAILABLE MARKS
20
<b>40</b>

Section C

AVAILABLE  
MARKS

Product Design

- 5 (a) (i) Primary sources of research involves collecting information yourself, from various sources. [1] Primary sources are original contributions such as questionnaires. [1] [2]

**All relevant, valid responses will be given credit.**

- (ii) Secondary sources of research for example the internet, are easier to obtain [1] and involve a designer using other information (other people's primary sources) as a basis for their own research [1] [2]

**All relevant, valid responses will be given credit.**

- (b) **Two** main characteristics of thought showers, for example:
- No criticism of any idea is allowed – judgement is withheld until later.
  - All ideas are welcomed and encouraged, no matter how bizarre they may appear.
  - The emphasis is to produce a large number of ideas. (2 × [1]) [2]

**All relevant, valid responses will be given credit.**

- (c) Production of parts through laser cutting. **Two** advantages and **one** disadvantage.

Any **two** advantages of laser cutting, for example:

- Some materials or features are very difficult or impossible to cut by more traditional means.
- Lack of physical contact with the material produces a clean edge.
- Accuracy as it is computer controlled and has limited human interaction. (2 × [1]) [2]

Any **one** disadvantage, for example:

- Very expensive machinery.
- A high energy consumption required to power the laser. [1]

**All relevant, valid responses will be given credit.**

- (d) Any **two** main characteristics associated with mass production, for example:
- Involves the manufacture of 1000's of products.
  - Only limited variation to meet client requirements can be achieved.
  - Cheaper unit cost compared to one-off and batch production. (2 × [1]) [2]

**All relevant, valid responses will be given credit.**

- (e) (i) Any **two** main characteristics, for example:
- It is designed to protect employees in the workplace.
  - The regulations inform the employers how these chemicals and materials should be handled and stored safely.
  - Protective clothing / safety signs are the most common methods employers use to meet the COSHH requirements.
- (2 × [1]) [2]

**All relevant, valid responses will be given credit.**

- (ii) The Trade Descriptions Act protects consumers from shops or traders selling goods which were falsely described. [1]

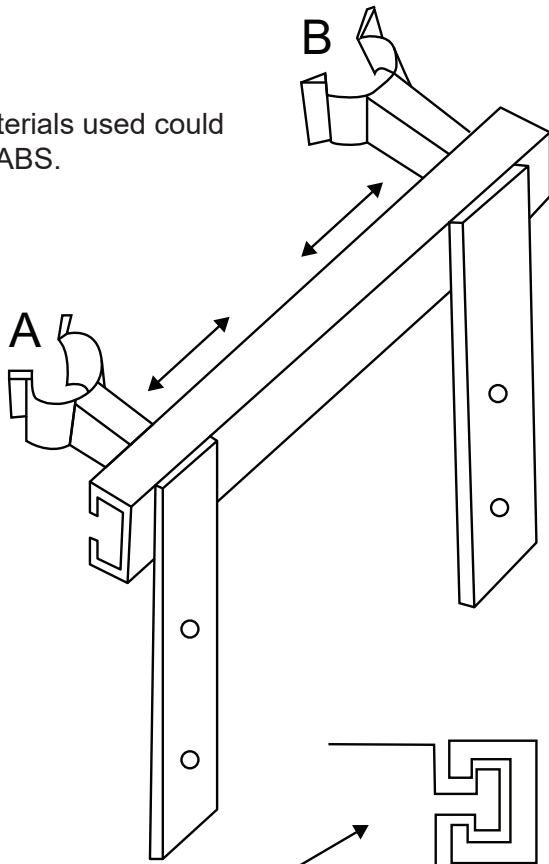
**All relevant, valid responses will be given credit.**

AVAILABLE  
MARKS

(f) Sample answer

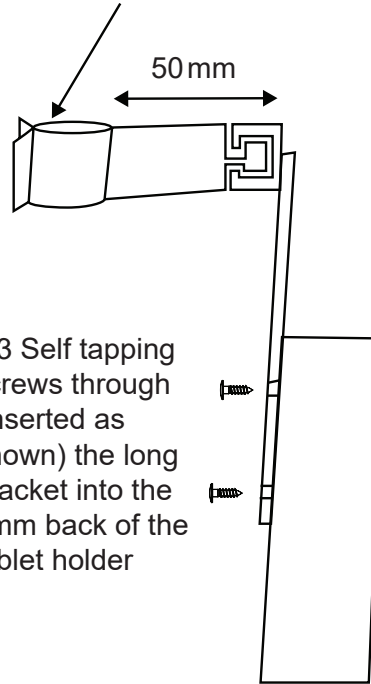
AVAILABLE MARKS

Materials used could be ABS.



This form of attachment and channel will allow the clips to slide easily up and down the channel.

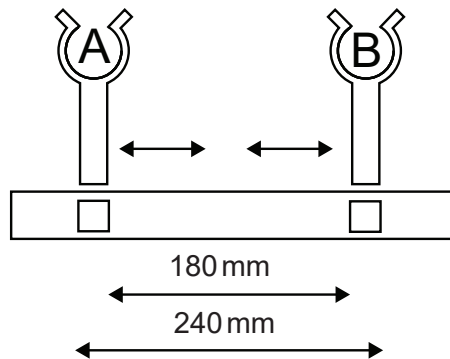
50 mm from the clip to the tablet holder to let it sit over the back of the seat.



M3 Self tapping screws through (inserted as shown) the long bracket into the 6mm back of the tablet holder

Rigid ABS clips that can go around the head rest bars and be removed easily

They can slide up and down the hollow channel to accommodate bars which can range from 180 mm–240 mm apart.



Empty vertical box for available marks.

Description	Marks awarded
<p>Excellent detailed annotated sketches of an appropriate design for a rigid bracket attached at one end to the back of the tablet holder, whilst at the other end allowing the user to quickly attach or remove it from the headrest bars A and B. The design will accommodate bars which can span between 180 mm–240 mm apart to suit different vehicles.</p>	[4]–[5]
<p>Good annotated sketches of a design. It may be limited in terms of its appropriateness as a rigid bracket attached at one end to the back of the tablet holder, whilst at the other end allowing the user to quickly attach or remove it from the headrest bars A and B. The design may have limitations in determining if it will accommodate bars which can span between 180 mm–240 mm apart to suit different vehicles.</p>	[2]–[3]
<p>Basic sketches, and some annotation. Difficulties in determining if the rigid bracket is appropriately attached at one end to the back of the tablet holder, whilst at the other end allowing the user to quickly attach or remove it from the headrest bars A and B. It may also be difficult to determine if the design will accommodate bars which can span between 180 mm–240 mm apart to suit different vehicles.</p>	[1]
<p>Level of response not worthy of credit</p>	[0]

for an appropriate material. [1]

[6]

20

AVAILABLE MARKS
20

6 (a) SCAMPER

C: Combine [1] – think about combining two or more parts of your problem to create a different product. [1] [2]

E: Eliminate [1] – Simplify, reduce or eliminate components in order to create new ideas. [1] [2]

**All relevant, valid responses will be given credit.**

(b) Outline **two** advantages of Glass-reinforced plastic (GRP), for example:

- A lightweight, but strong material.
- Stiffness can be achieved with multiple layers.
- Can be produced in a range of colours.

(2 × [1]) [2]

**All relevant, valid responses will be given credit.**

(c) Application of SMAs could be artificial robotic limbs. [1]

Any **one** characteristic, for example:

- They are made with an original form, created through heat treatment that is remembered, and can be returned to repeatedly through the application of heat. [1]
- When an electrical current is passed through the material its temperature is raised, which results in a rapid change of shape. [1]

[2]

**All relevant, valid responses will be given credit.**

(d) Cell production involves the workflow of a company to be split up into teams or cells. [1] Each cell has a specific task and within each task there is a range of different jobs. [1] [2]

**All relevant, valid responses will be given credit.**

(e) Any scientific advancements and how they have improved the design of products, for example:

- Advanced battery technology including Lithium-Ion rechargeable batteries [1], providing a lightweight means of storing a lot of energy resulting in smaller and thinner fuel cells. [1]
- Advanced liquid crystal displays (LCDs) [1] enabling colour screens that are brighter and require much smaller current, meaning greater energy efficiency and slimmer housings. [1]

[2]

**All relevant, valid responses will be given credit.**

(f) (i) Any **two** reasons for a product review, for example:

- This will give feedback to improve the product.
- Helps with options for future developments.
- Product review can indirectly influence the marketing of the product.

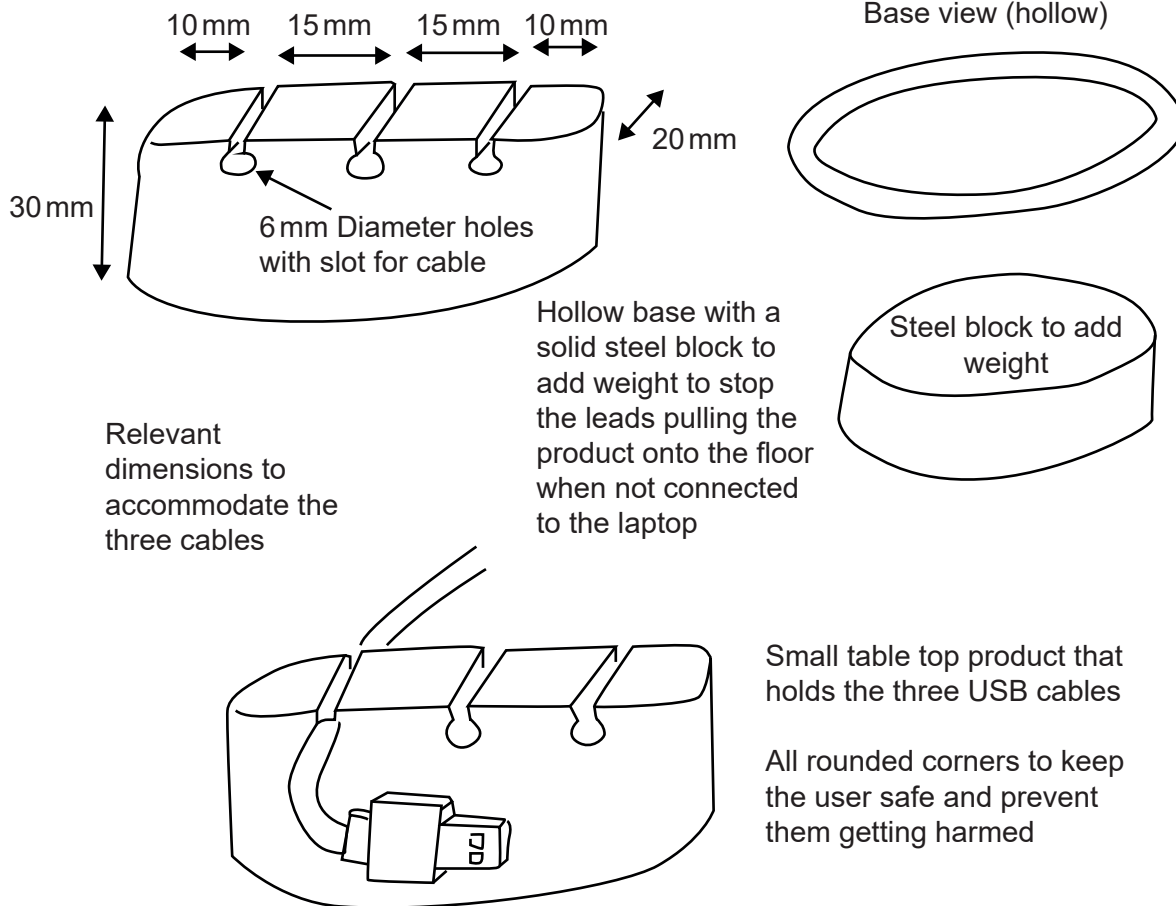
(2 × [1]) [2]

**All relevant, valid responses will be given credit.**

- (ii) e.g. A computer mouse. The mouse should be tested under realistic conditions [1] to check the product's performance and quality. [1] [2]

All relevant, valid responses will be given credit.

(g) Sample annotated sketches.



AVAILABLE MARKS

Description	Marks Awarded
<p>Excellent detailed annotated sketches of a freestanding work surface design that will securely hold up to three USB cables. These cables are easily inserted or removed and consider the safety of the user.</p> <p>The dimensions clearly show how the materials have been minimised whilst maintaining the functional requirements of the design.</p>	[4]
<p>Good annotated sketches of a design. The design represents a possible solution, but it may be limited in terms of its appropriateness to be a freestanding work surface design that will securely hold up to three USB cables. It may also be limited in its ability to be easily inserted or removed and consider the safety of the user.</p> <p>The dimensions may be limited in showing how the materials have been minimised whilst maintaining the functional requirements of the design.</p>	[2]–[3]
<p>Basic sketches, with some annotation. Difficulties in determining if the freestanding work surface design will securely hold up to three USB cable. Difficulties in determining if the cables could be easily inserted or removed and if the design considers the safety of the user.</p> <p>Difficulties in determining if the dimensions show how the use of material has been minimised whilst maintaining the functional requirement of the design.</p>	[1]
<p>The response is not worthy of any credit.</p>	[0]

[4]

**Section C**

AVAILABLE MARKS
20
40