

Surname	Centre Number	Candidate Number
First name(s)		2



GCE AS/A LEVEL

2601U10-1



MONDAY, 13 MAY 2024 – AFTERNOON

DESIGN AND TECHNOLOGY – AS unit 1
Engineering Design

2 hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	8	
2.	8	
3.	8	
4.	8	
5.	8	
6.	40	
Total	80	

ADDITIONAL MATERIALS

A calculator, ruler, pencils and coloured pencils.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question. You are advised to divide your time accordingly.

The total number of marks available is 80.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 4.



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1. The wing of the Airbus A350 airliner shown below is one of the largest single part products to have been made entirely from Carbon Fibre Reinforced Polymer (CFRP).



- (a) Give **three** reasons why CFRP has been used to make this product. 3 × [2]

(i)

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(ii)

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(iii)

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- (b) Name **two** other products that have been improved by using CFRP in their design and manufacture. 2 × [1]

(i)

(ii)

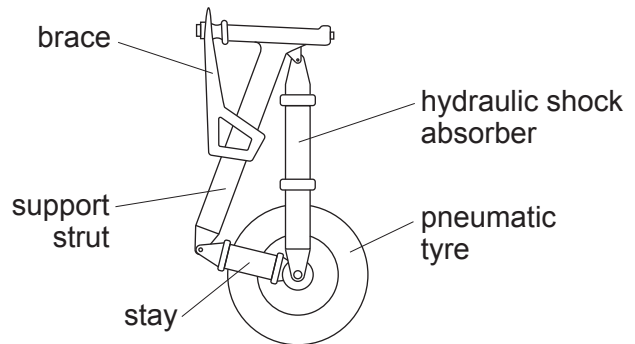


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2. Two examples of the landing gear used on modern airliners are shown below.



- (a) Evaluate the forces that are likely to be present in the landing gear when the aircraft touches down. [4]

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- (b) Suggest **two** ways in which the impact of these forces can be absorbed by the landing gear. [2]

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(c) Explain why the landing gear that is used in most commercial aircraft is retractable. [2]

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3. Additive manufacturing is a process where computer-controlled machines manufacture products by adding material. This process is often referred to as 3D printing. More traditional manufacturing methods often involve creating products by reducing the amount of material (wasting).

- (a) Describe **two** reasons why additive manufacturing is more sustainable than traditional production methods. 2 × [2]

Reason 1:

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Reason 2:

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Prior to production, designers at Dyson UK use 3D printing to manufacture prototypes that show iterative progression. This is often referred to as rapid prototyping and has been used to develop many of the parts for the product shown below.



- (b) Explain the ways in which prototypes made using this method can reduce the lead time during product development. [4]

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4. The wireless headphones shown below have been designed to interact with the user.

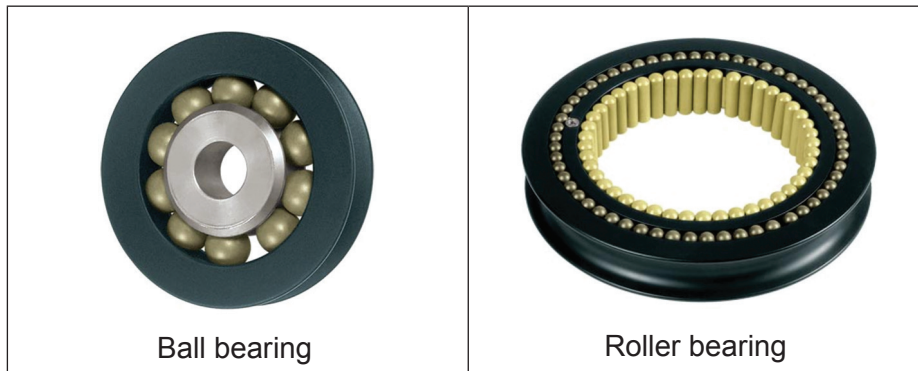


Analyse the ergonomic factors that have been taken into consideration by the design engineer as the product has been developed. [8]

Marks will be awarded for the content of the answer and the quality of written communication.



5. Design engineers use both ball and roller bearings when developing mechanical products which are subject to rotational forces.



- (a) (i) Name a specific product that uses a ball bearing. [1]

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- (ii) Justify the selection of a ball bearing for use in this product. [2]

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- (iii) Name a different specific product that uses a roller bearing. [1]

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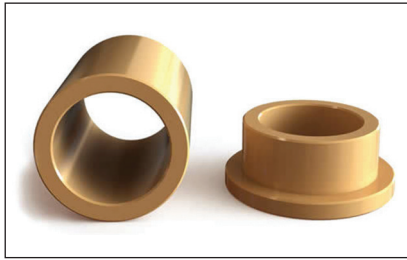
- (iv) Justify the selection of a roller bearing for use in this product. [2]

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Plain bearings, like the ones shown below, are often used for many applications as they are cheaper and require fewer moving parts.



- (b) Name a suitable specific material that could be used to manufacture a plain bearing bush and provide **one** reason for your selection. [2]

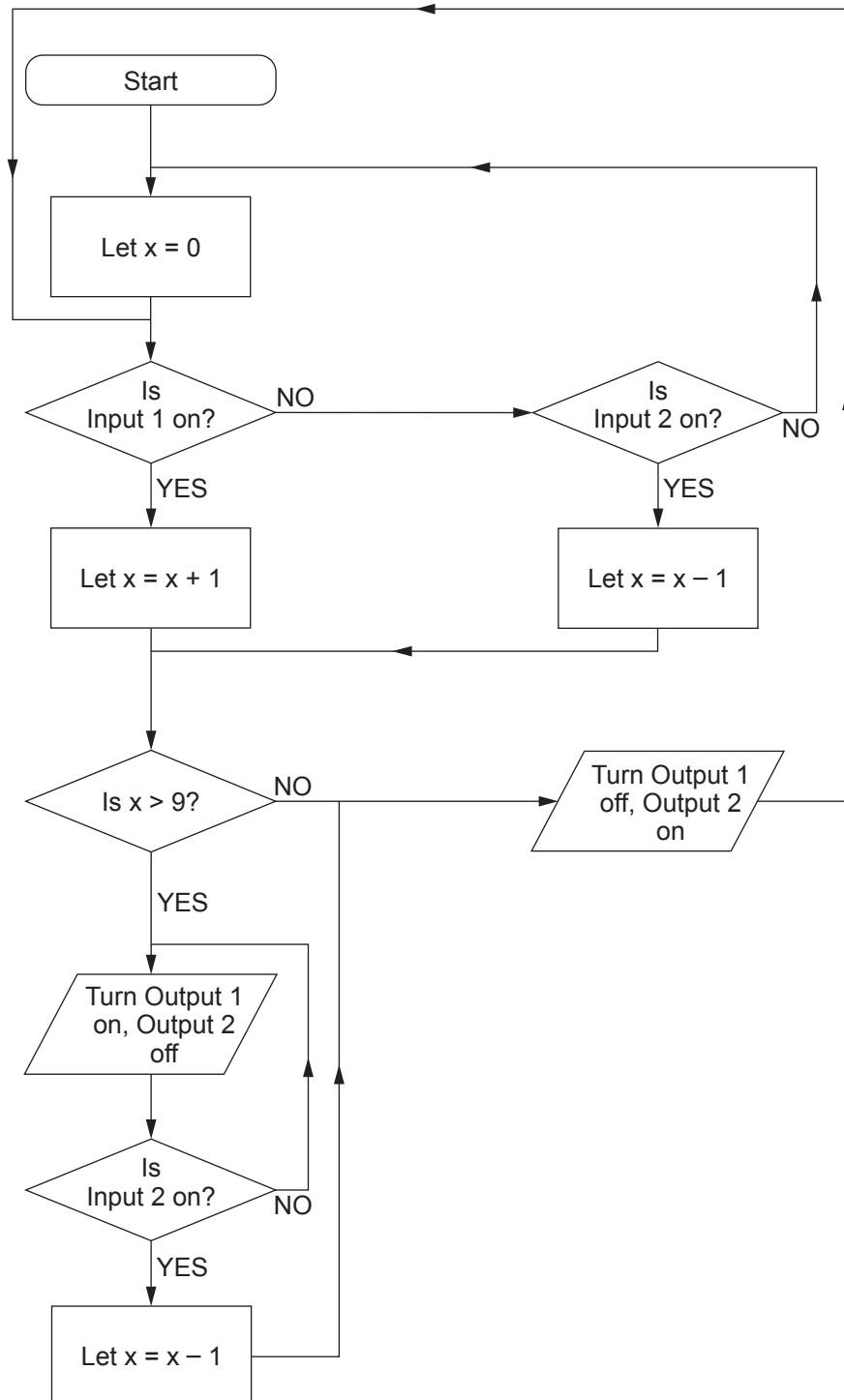
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6. To improve health, safety and security the manager of a retail outlet requires a system that will restrict the number of people entering the shop.



The flow chart shown is used to control the entry and exit system, ensuring that a maximum of ten customers are in the shop at any one time. A green light shows when the number of people in the shop is nine or less and a red light turns on when the number exceeds nine.



- (a) Using the flow chart for reference, develop a five-point technical specification that would ensure that the system meets the design requirements. 4 × [2]
Point 1 has been done for you.

Point 1: The system should numerically add ONE to the count when somebody enters the shop.

Point 2:

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Point 3:

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Point 4:

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Point 5:

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- (b) In the space below, design a detailed electronic circuit diagram that can be programmed to control the system. [12]

The system must include:

- A suitable input sensor used to detect people entering the shop.
- A suitable input sensor used to detect people leaving the shop.
- Two suitable output devices correctly connected.
- Correct representation of a suitable microcontroller.
- Any interface devices that are required for programming.



- (c) To ensure that people comply with a one-way system, the shop is planning to install access barriers that allow people to enter and leave in one direction only. A possible solution is shown below.



In the space below, design a suitable mechanism that will activate the barrier.

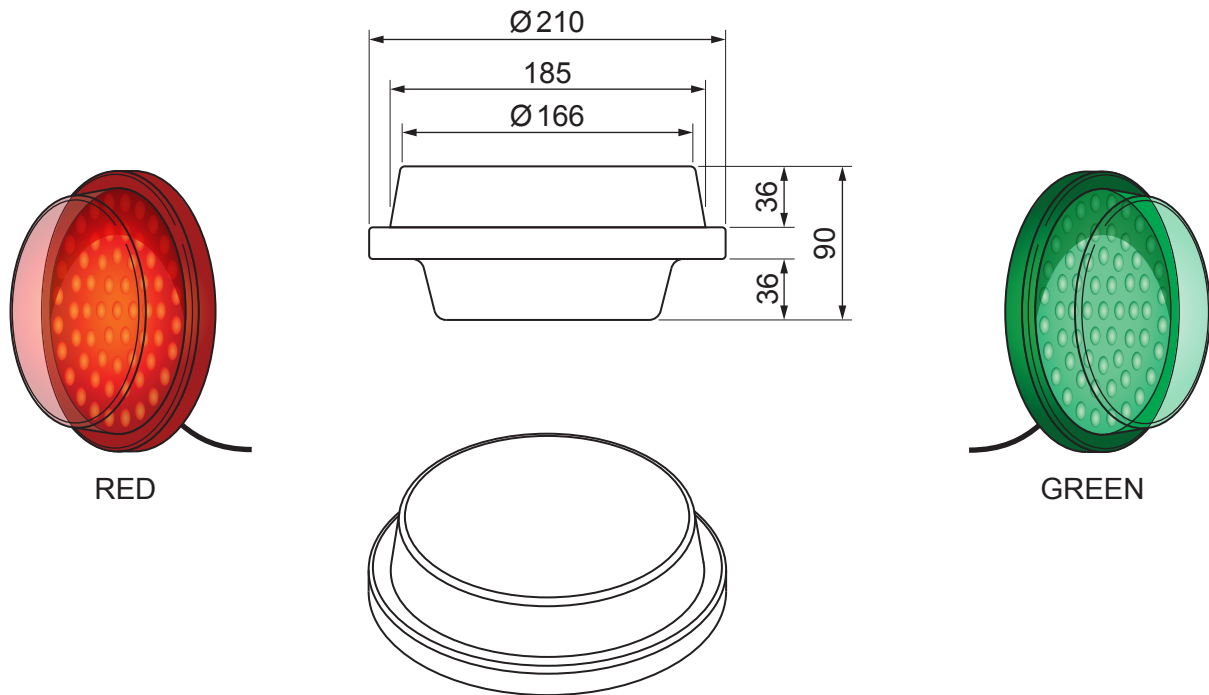
[8]

Your solution must include:

- A suitable mechanism.
- Appropriate technical annotation with all components correctly identified.
- Justified selection of appropriate materials.
- High quality graphic communication.



- (d) Details of the two 24 Volt LED lights used to inform customers when it is safe to enter the shop are shown below.



In the space provided on the next page, design a suitable housing that will hold the two 24 Volt LED lights so that they can be easily seen by the customers. [8]

Your design must include:

- A suitable housing that will hold the two 24 Volt LED lights securely.
- A suitable method that will enable the housing to be fixed to the access barrier.
- Justification for the selection of appropriate materials.
- Important dimensions.



Marks will be awarded for sketching your initial ideas, a well-developed final solution, detailed notes that explain your thinking, appropriate use of materials and important dimensions.

Initial ideas

Final solution



- (e) Evaluate the proposed entry system and suggest and justify **two** ways in which it could be improved to protect both staff and customers in the sudden event of an emergency.

[4]

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END OF PAPER



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