# **Pearson BTEC Level 3 Nationals Extended Diploma**

**Set Task Release Date: Monday 7 December 2020** 

Paper Reference 31708H

# **Engineering**

Unit 3: Engineering Product Design and Manufacture
Part A

You do not need any other materials.

#### **Instructions**

- Part A contains material for the completion of the preparatory work for the set task.
- Part A should be undertaken over no more than three hours in a period of one week as timetabled by Pearson.
- Part A is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- Part B materials must be issued to learners during the period specified by Pearson.
- This **Part A** task booklet must not be returned to Pearson.

#### Information

• In **Part B**, the task should be undertaken in eight hours under supervision over no more than five consecutive working days. The supervised sessions take place in the two-week period timetabled by Pearson.

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#### Instructions to teachers

This task must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals *Instructions for Conducting External Assessments* (*ICEA*) document. For further details please see the Pearson website.

**Part A** should be issued to learners one week prior to undertaking **Part B** of the assessment.

Learners will be expected to conduct research.

Research is expected to be carried out over three hours. Centres must advise learners of the timetabled sessions during which they can carry out the research. It is expected that scheduled lessons or other timetable slots will be used for some or all of this work.

Learners can produce individually prepared research notes (maximum of two sides of A4) to take into the **Part B** supervised assessment.

Teachers cannot give any support to the production of the notes and the work must be completed independently by the learner.

For **Part B**, centres are free to arrange the supervised assessment period how they wish provided the eight hours for producing final outcomes are completed over no more than five consecutive working days, are under the level of supervision specified and in accordance with the conduct procedures.

Refer carefully to the instructions in this task booklet and the BTEC National *Instructions* for Conducting External Assessments (ICEA) document to ensure that the preparatory period is

conducted correctly and that learners have the opportunity to carry out the required activities independently.

Learner research notes will be retained securely by the centre after **Part B** and may be requested by Pearson if there is suspected malpractice.

#### **Instructions for Learners**

Read the set task information carefully.

This contains **Part A**, which is the information you need to prepare for the set task.

You will need to carry out your own research over the next week and you can take up to two sides of A4 of individually prepared research notes into **Part B** of the set task.

You will then be given the set task to complete under supervised conditions.

For Part A, you must work independently and must not share your work with other learners.

Your teacher will give guidance on when the preparation should be completed.

Your teacher cannot give you feedback during the preparation period.

#### **Set Task Brief**

You are advised to spend a maximum of three hours doing your research.

A client has asked you, as a junior product designer, to optimise the design of an aluminium foil tape dispenser, as it is not working effectively. The aluminium foil tape is self-adhesive and is used to seal a variety of joints.

The dispenser is manufactured in batches of 100.

You will research the design and manufacturing requirements that are relevant to the tape dispenser and its use. Your research should consider:

- existing designs for tape dispensers
- the manufacturing processes and technologies that are being used and possible alternatives
- material requirements and suitable material properties
- the health and safety requirements for the product, user and manufacturing processes
- environmental considerations including sustainability
- any other relevant factors, such as types of tape movement, ease of use and designing out risk.

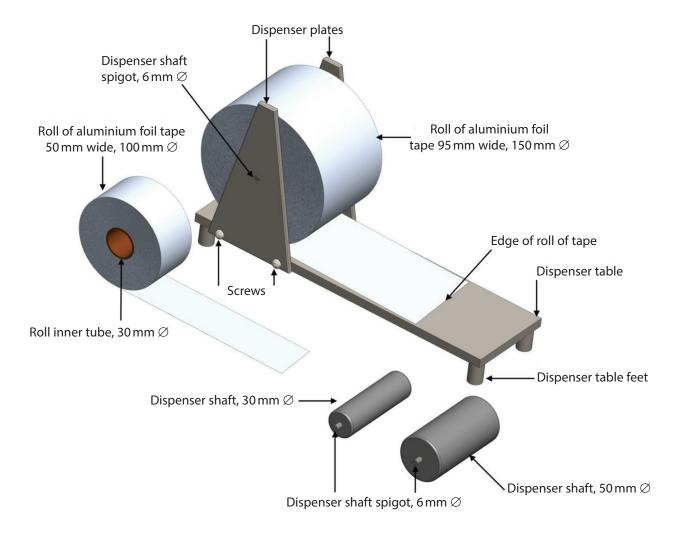
In **Part B**, you will be given further information on the specific issues with the existing tape dispenser that will allow you to redesign the tape dispenser and evaluate it against the issues. Therefore, you are advised not to undertake any design work during **Part A** (the research stage).

You will be able to take up to two sides of individually prepared A4 research notes from **Part A** into **Part B** of the set task.

#### **Part A Set Task Information**

The product is an aluminium foil tape dispenser. The dispenser consists of a table with four feet, two plates, a shaft and screws. There are two different diameters of dispenser shaft that are interchangeable. The inner tube of the aluminium foil tape roll is pushed onto a shaft and then assembled using the plates and screws. The user finds the edge of the roll of tape, pulls a length of tape from the roll and then cuts the tape. The dispenser is manufactured in batches of 100.

The table and plates are made from low carbon steel and the dispenser shafts, including the spigots, are made from ABS (Acrylonitrile Butadiene Styrene).



Tape dispenser dimensions: L=350 mm, W=112 mm, H=200 mm

# **Pearson BTEC Level 3 Nationals Extended Diploma**

Window for Supervised Period:
Wednesday 6 January 2021 – Wednesday 20 January 2021

Controlled hours: 8 hours

Paper Reference 31708H

# **Engineering**

Unit 3: Engineering Product Design and Manufacture
Part B

## **Information Booklet**

Do not return this Information Booklet with the Task Booklet.

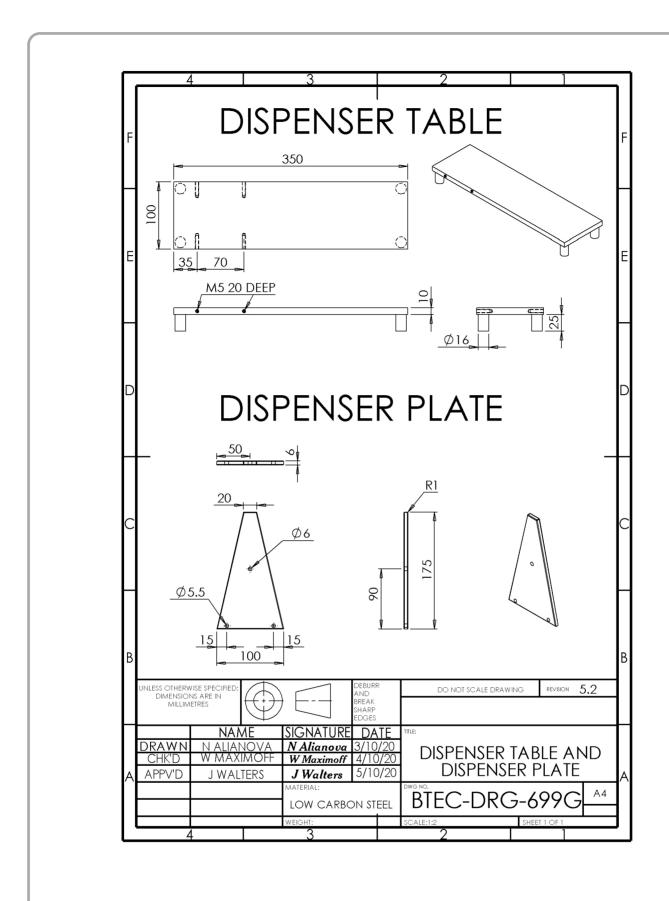
## **Instructions**

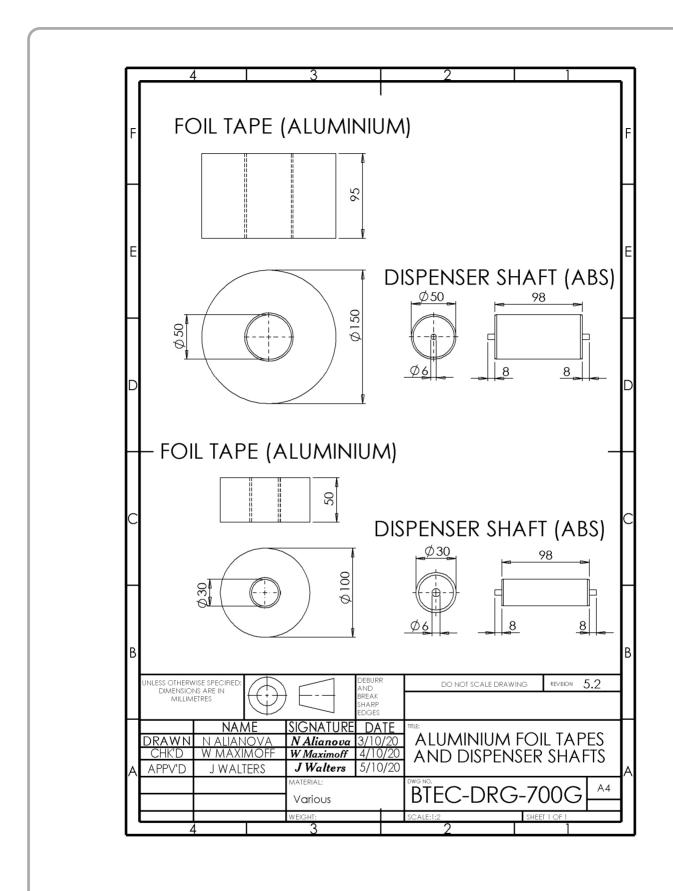
- You will need the information in this booklet to complete the task.
- Read the information carefully.
- You must **not** write your answers in this booklet.
- Only your answers given in the task booklet in **Part B** will be marked.

Turn over ▶









Please check the examination details below before entering your candidate information						
Candidate surname	Other names					
Pearson BTEC Level 3 Nationals Extended Diploma  Centre Number	Learner Registration Number					
Window for Supervised Period: Wednesday 6 January 2021 – W	ednesday 20 January 2021					
Controlled hours: 8 hours	Paper Reference <b>31708H</b>					
Engineering Unit 3: Engineering Product Design and Manufacture Part B						
You must have: Information Booklet containing engineering drawings (enclosed), HB or B pencil, ruler, eraser, drawing instruments and calculator.						

## **Instructions**

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- You will need your research notes from **Part A** (maximum of two sides of A4).
- Part B should be undertaken in eight hours under supervision over no more than five consecutive working days. The supervised sessions take place in the two-week period timetabled by Pearson.
- Part B contains material for the completion of the set task under supervised conditions.
- Part B is specific to each series and this material must only be issued to learners who have been entered to undertake the task in the relevant series.
- Part B should be kept securely until the start of the eight-hour supervised assessment period.
- You must not submit your research notes to Pearson.
- Answer all activities.
- Answer the activities in the spaces provided
  - there may be more space than you need.

#### **Information**

- The total mark for this task is 60.
- The marks for **each** activity are shown in brackets
  - use this as a guide as to how much time to spend on each activity.

## **Advice**

- Read each activity carefully before you start to answer it.
- Try to answer every activity.
- Check your answers if you have time at the end.

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## **Instructions to Teachers and/or Invigilators**

This task must be read in conjunction with information on conduct for the task in the unit specification and the BTEC Nationals Instructions for Conducting External Assessments (ICEA) document. For further details please see the Pearson website.

The set task should be carried out under supervised conditions.

Work should be completed in this task booklet, using additional sheets if required.

Learners can use individually prepared research notes (maximum two sides of A4) to support the supervised assessment (Part B). These research notes must be kept secure once the supervised assessment has begun.

All learner work must be completed independently and authenticated before being submitted to Pearson by the teacher and/or invigilator.

Centres are free to arrange the supervised assessment period how they wish, provided the eight hours for producing final outcomes are under the level of supervision specified, and in accordance with the conduct procedures. The assessment must take place in a two-week period set by Pearson, once the learner has started **Part B** the assessment must be completed in five consecutive working days.

Refer carefully to the instructions in this task booklet and the BTEC Nationals *Instructions* for Conducting External Assessments (ICEA) document to ensure that the assessment is supervised correctly. An authentication statement will be required confirming that learner work has been completed as directed.

Learners must not bring anything into the supervised environment or take anything out without your knowledge and approval.

Centres are responsible for putting in place appropriate checks to ensure that only permitted material is introduced into the supervised environment.

## **Maintaining security**

- For **Part B**, learners **must not** have access to computers or the internet.
- Learners can only access their work under supervision.
- Any work learners produce under supervision must be kept secure.
- Any materials being used by learners must be collected in at the end of each session, stored securely and handed back at the beginning of the next session.



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#### **Outcomes for submission**

One task booklet will need to be submitted by each learner, which includes the following activities:

- the project planning and product design changes made during the development process
- interpretation of the brief into operational requirements
- a range of (three or four) initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal.

A fully completed authentication sheet must be completed by each learner.

Learner research notes will be retained securely by the centre after **Part B** and may be requested by Pearson if there is suspected malpractice.

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#### **Instructions for Learners**

Read the set task information carefully.

You must plan your time accordingly and be prepared to submit all the required evidence by the date specified.

You may use your preparatory work from **Part A** to complete the set task in **Part B**.

Your preparatory notes from Part A will not be submitted with the task booklet from Part B. Only your task booklet from Part B will be submitted to Pearson for marking.

You will complete this set task under supervision and your work will be kept securely during any breaks taken.

For **Part B**, you **must not** use computers or the internet.

You must work independently throughout the supervised assessment period and must not share your work with other learners.

In the Information Booklet you will be provided with drawings of the dispenser table, dispenser plate, dispenser shafts and aluminium foil tapes.

#### **Outcomes for submission**

You will need to submit one task booklet on completion of the supervised assessment period, which includes the following activities:

- a record of the project planning and product design changes made during the development process
- interpretation of the brief into operational requirements
- a range of (three or four) initial design ideas based on the client brief
- a modified product proposal with relevant design documentation
- an evaluation of the design proposal.

You must also submit a fully completed authentication sheet; any prepared research notes must not be submitted with the final outcomes to Pearson.



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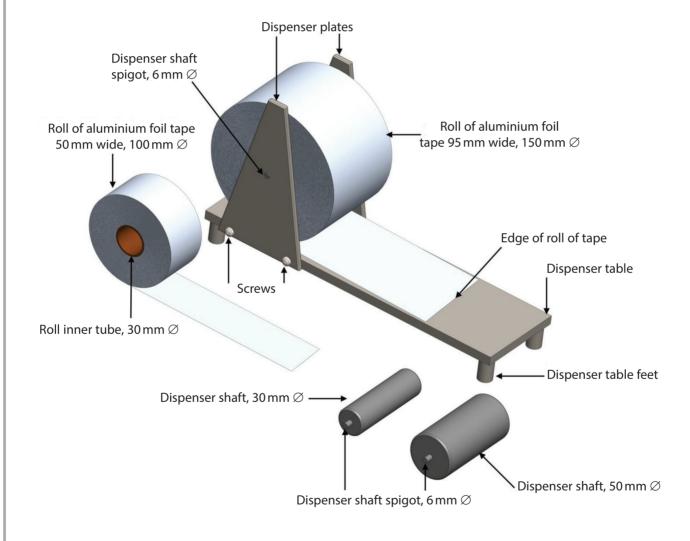
#### Part A Set Task Brief

A client has asked you, as a junior product designer, to optimise the design of an aluminium foil tape dispenser, as it is not working effectively. The aluminium foil tape is self-adhesive and is used to seal a variety of joints.

#### **Part A Set Task Brief Information**

The product is an aluminium foil tape dispenser. The dispenser consists of a table with four feet, two plates, a shaft and screws. There are two different diameters of dispenser shaft that are interchangeable. The inner tube of the aluminium foil tape roll is pushed onto a shaft and then assembled using the plates and screws. The user finds the edge of the roll of tape, pulls a length of tape from the roll and then cuts the tape. The dispenser is manufactured in batches of 100.

The table and plates are made from low carbon steel and the dispenser shafts, including the spigots, are made from ABS (Acrylonitrile Butadiene Styrene).



Tape dispenser dimensions: L=350 mm, W=112 mm, H=200 mm



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#### **Part B Set Task Information**

For **Part B**, you are allowed to use your individually prepared research notes from **Part A** to support you during the supervised assessment period.

In the Information Booklet you will be provided with drawings of the dispenser table, dispenser plate, dispenser shafts and aluminium foil tapes.

#### **Client brief**

The client manufactures ducting and the self-adhesive aluminium foil tape is used to seal a variety of joints. There are two different widths of aluminium foil tape and the operatives change between them when sealing different types of joint. The tape dispenser is fixed to a bench using the table feet to locate it securely.

The client is aware that the current design for the tape dispenser has a number of issues, but the redesign has been triggered by feedback from manufacturing operatives (the users) about the dispenser shaft bending or breaking so it does not work as intended. The operatives' feedback is that the dispenser is not effective for several reasons.

The client believes that the source of the issues is that the current tape dispenser:

- is difficult to disassemble and assemble when a different roll of tape is required
- isn't robust enough for constant use
- frustrates operatives as finding the edge of the roll of tape is difficult and time consuming
- lacks a method for measuring a length of tape before it is cut from the roll
- doesn't include a means of cutting a length of tape from the roll.

The issues also result in a lot of aluminium foil tape being wasted. The aluminium foil tape is bought-in, and the sizes cannot be changed. In addition, redesign of the dispenser table is not possible, so the client needs a solution that can be retrofitted onto it.

Based on tests, the client has provided the information in Figures 1 and 2, which can be used to perform a statistical analysis of the in-service use of the tape dispenser. The client had intended the life cycle of the tape dispenser to be eight years.



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The client has asked you, as a junior product designer, to design an alternative solution for the tape dispenser that will also take into account the most efficient use of materials and manufacturing processes. You should optimise the design in terms of safety, form, usability, sustainability and other factors. You also have an opportunity to reduce the issues with the existing design of the tape dispenser by considering equipment interfaces and retrofitting extra, low-cost components.

# The tape dispenser **must**:

- use the existing dispenser table
- allow the roll of aluminium foil tape to be changed efficiently
- allow the aluminium foil tape to be dispensed effectively, e.g. safely, accurately and quickly
- be robust enough to last for the intended life cycle
- be capable of being manufactured in batches of 100.

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# Outcomes of tests on the tape dispenser

# Figure 1: Roll of tape diameter = $150 \, \text{mm}$ , Width of tape = $95 \, \text{mm}$ , Dispenser shaft diameter = $50 \, \text{mm}$

					Life cycle	to failure o	f dispenser	(in years)	
Tape dispenser	Shaft material	Mean time to find the edge of the roll of tape (seconds)	Maximum pulling force used to dispense the tape (N)	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
А	ABS	25	15	0.5	1	0.5	1.5	1.5	1
В	Low carbon steel	23	13	2.5	3	3.5	2.5	1.5	3
С	ABS	15	12	1	1.5	2	2.5	1	2
D	Low carbon steel	16	16	3	2.5	2.25	2.5	3.5	3

# Figure 2: Roll of tape diameter = $100 \, mm$ , Width of tape = $50 \, mm$ , Dispenser shaft diameter = $30 \, mm$

			Life cycle to failure of dispenser (in years)						
Tape dispenser	Shaft material	Mean time to find the edge of the roll of tape (seconds)	Maximum pulling force used to dispense the tape (N)	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
E	ABS	17	10	1.5	2	1.5	1.5	1.5	2
F	Low carbon steel	19	11	3.5	4	4.5	3.5	2.5	4
G	ABS	12	6	2	2.5	3	3.5	2	3
Н	Low carbon steel	11	6	4	3.5	5	3.5	4.5	4

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## Redesign of the product

# **Activity 1**

At the start of the activity, create a short outline project time plan in your task booklet.

During the other activities (2 to 5), you should also record **in the Activity 1 section** of your task booklet:

- why specific changes were made to the design during each session
- specific action points for the next session.

(Total for Activity 1 = 6 marks)

**Suggested time 45 minutes** 

# **Activity 2**

Interpret the client brief into operational requirements, to include:

- product requirements
- opportunities and constraints
- interpretation of numerical data
- key health and safety, regulatory and sustainability factors.

(Total for Activity 2 = 6 marks)

**Suggested time 45 minutes** 

# **Activity 3**

Produce a range of (three or four) initial design ideas based on the client brief, to include:

- sketches
- annotations.

(Total for Activity 3 = 9 marks)

**Suggested time 1 hour 15 minutes** 



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# **Activity 4**

Develop a modified product proposal with relevant design documentation.

The proposal **must** include:

• a solution, including a final drawing.

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

(Total for Activity 4 = 30 marks)

**Suggested time 4 hours** 

# **Activity 5**

Your final task booklet entry **must** evaluate:

- the success and limitations of the completed solutions
- indirect benefits and opportunities
- constraints
- opportunities for technology-led modifications.

(Total for Activity 5 = 9 marks)

**Suggested time 1 hour 15 minutes** 



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Activity 1						
At the start of the activity, create a short outline project time plan in your task booklet.						
During the other activities (2 to 5), you should also record <b>in the Activity 1 section</b> of your task booklet:						
why specific changes were made to the design during each session	ı					
specific action points for the next session.	(6)					

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(Total for Activity 1	= 6 marks)



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Activity 2					
Interpret the brief into operational requirements, to include:					
•	product requirements				
•	opportunities and constraints				
•	interpretation of numerical data				
•	key health and safety, regulatory and sustainability factors.	(6)			
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(Total for Activity 2 = 6 marks)
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Activity 3				
Produce a range of (three or four) initial design ideas based on the client brief, to include:				
• sketches				
• anr	notations.	(9)		
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(Total for Activity 3 = 9 marks)



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## **Activity 4**

Develop a modified product proposal with relevant design documentation.

The proposal **must** include:

a solution, including a final drawing.

The proposal **must** consider:

- existing products
- materials
- manufacturing processes
- sustainability
- safety
- other relevant factors.

(30)

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(Total for Activity 4 = 30 marks)



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Your final task booklet entry <b>must</b> evaluate:  • the success and limitations of the completed solutions  • indirect benefits and opportunities  • constraints  • opportunities for technology-led modifications.  (9)
<ul> <li>indirect benefits and opportunities</li> <li>constraints</li> <li>opportunities for technology-led modifications.</li> </ul>
<ul> <li>constraints</li> <li>opportunities for technology-led modifications.</li> </ul>
opportunities for technology-led modifications.

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(Total for Activity 5 = 9 marks)
TOTAL FOR TASK = 60 MARKS



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