

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Learner Registration Number

Pearson BTEC Level
Level 3 Nationals
Extended Certificate

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Window for Supervised Period:
09/01/2019 to 23/01/2019

Controlled hours: 8 hours

Paper Reference **31708H**

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.

Total Marks

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 two A4 sides).
- **Part B** should be undertaken in 8 hours under supervision over no more than 5 consecutive working days. The supervised sessions take place in the 2-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 8-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 paper 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.

Turn over ►

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Pearson

Instructions to Teachers and/or Invigilators

This paper 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 *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 tasks:

- the project planning and product design changes made during the development process
- an 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.



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 must 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:

- 1) an orthographic drawing of the key blade and fob; and
- 2) an isometric view of the key blade and fob.

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
- an 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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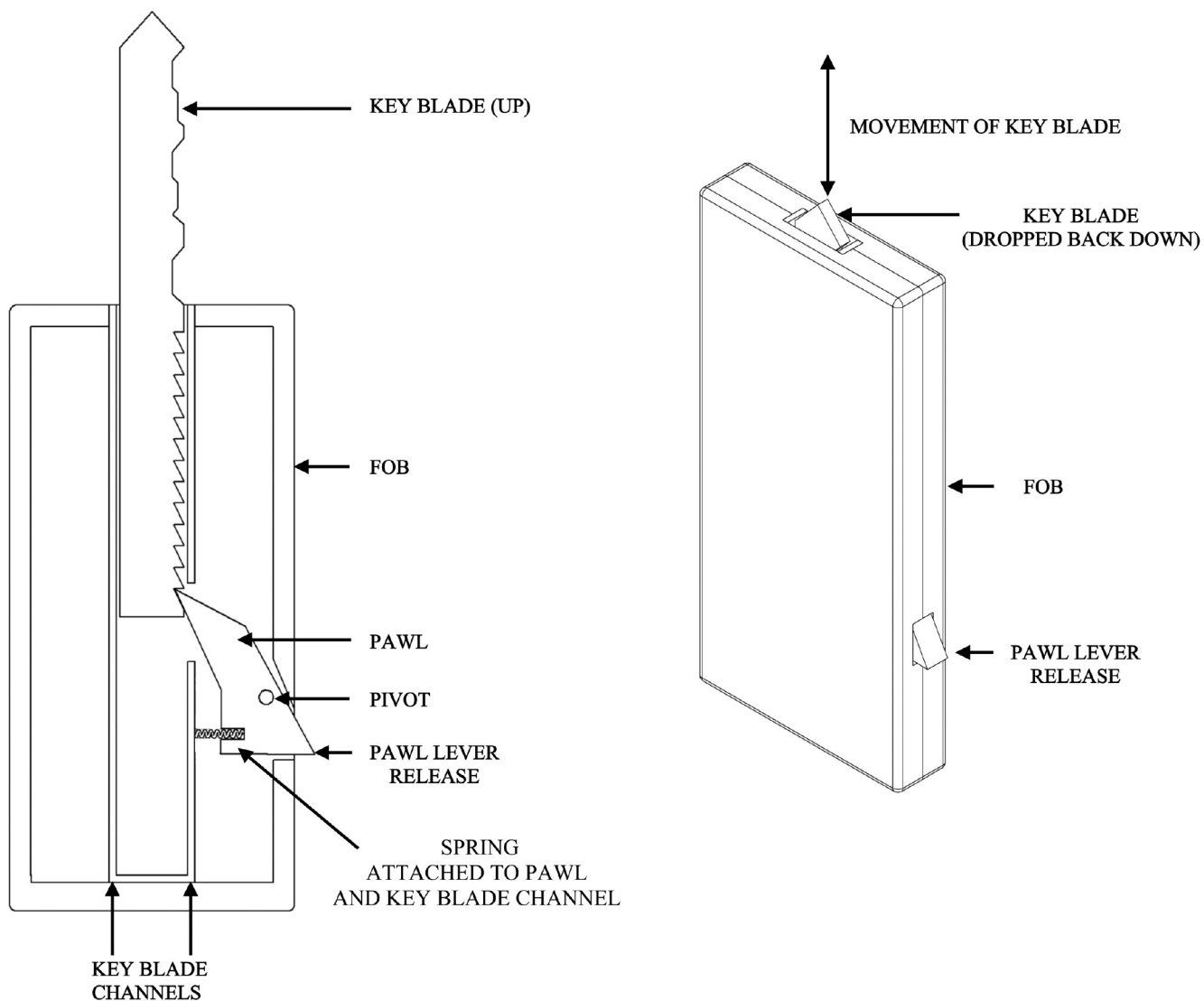
Part A Set Task Brief

A client has asked you, as a technician engineer, to optimise the design of a retractable key.

Part A Set Task Brief Information

The product is a retractable key that is used to open a lock. The key blade is designed to be pulled up by the user when needed and a ratchet mechanism holds it in place. The user can press the pawl lever release so the key blade drops back down into the fob after use. The retractable key is manufactured in batches of 10,000.

The key blade and pawl are made from high carbon steel.



Fob dimensions: Depth = 10 mm, Width = 40 mm, Height = 85 mm



Part B Set Task Information

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

In the information booklet you will be provided with:

1. an orthographic drawing of the key blade and fob; and
2. an isometric view of the key blade and fob.

Client brief

The retractable key is typically used to open and start motor cars and other vehicles.

The client is aware that the current design for the retractable key has a number of issues, but the redesign has been triggered by complaints from customers about:

1. how difficult it is to use; and
2. the top section of the key blade bending and snapping away from the lower section.

Customers have also provided feedback that the retractable key is not effective for a number of other reasons.

The client believes that the sources of the issues are:

1. problems with the length of the key blade;
2. difficulties with gripping the key blade to pull it up;
3. the position of the pawl lever release; and
4. the initial spring stiffness being too great, making it difficult to retract the blade.

The client wants the width and thickness of the fob to remain the same and the top section of the key blade cannot be changed.

Based on tests, the client has provided the following information in Table 1, which can be used to perform a statistical analysis of the in-service use of the retractable key. The client had intended the life cycle of the retractable key to be 12 years.

The client has asked you to design a new and improved retractable key and you must consider the movement of the key blade. As part of your redesign you should also consider the interfaces between the key blade, mechanism and fob.

Your solution must take into account the most efficient use of materials and manufacturing processes.

The retractable key **must**:

- allow the top section of the existing key blade to be inserted into and open a lock
- include an effective method of safely storing the top section of the key blade when not in use
- have a polypropylene fob that has a width of 40 mm and a thickness of 10 mm
- be robust enough to last for the expected life cycle
- be capable of being manufactured in batches of 10,000.

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Table 1 – Outcomes of tests on the retractable key

Retractable key	Key blade material	Thickness of key blade channels (mm)	Initial spring stiffness (N/m)	Life cycle to failure of product (in years)							
				Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
A	Tungsten	1	85	1	2	2	4	3	1	3	4
B	High carbon steel	1	62	3	3	2	3	2	4	3	4
C	Nickel silver	1	62	4	4	4	3	3	2	3	4
D	High carbon steel	1.5	85	4	4	4	3	4	2	4	4
E	Nickel silver	1.5	85	5	6	5	8	5	7	5	4
F	Tungsten	1.5	62	5	6	5	4	5	3	5	4
G	Nickel silver	2	62	8	8	7	8	6	7	5	8
H	High carbon steel	2	62	6	6	6	8	5	8	6	5
I	Tungsten	2	85	6	6	5	7	6	4	6	6



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Redesign of the product

Activity 1

At the start of the task create a short outline project time plan in your task book.

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

- 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 with 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 book entry **must** evaluate:

- 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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(Total for Activity 1 = 6 marks)



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(Total for Activity 2 = 6 marks)



Activity 3

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

- sketches
- annotations.

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(Total for Activity 3 = 9 marks)



Activity 4

Develop a modified product proposal with relevant design documentation.

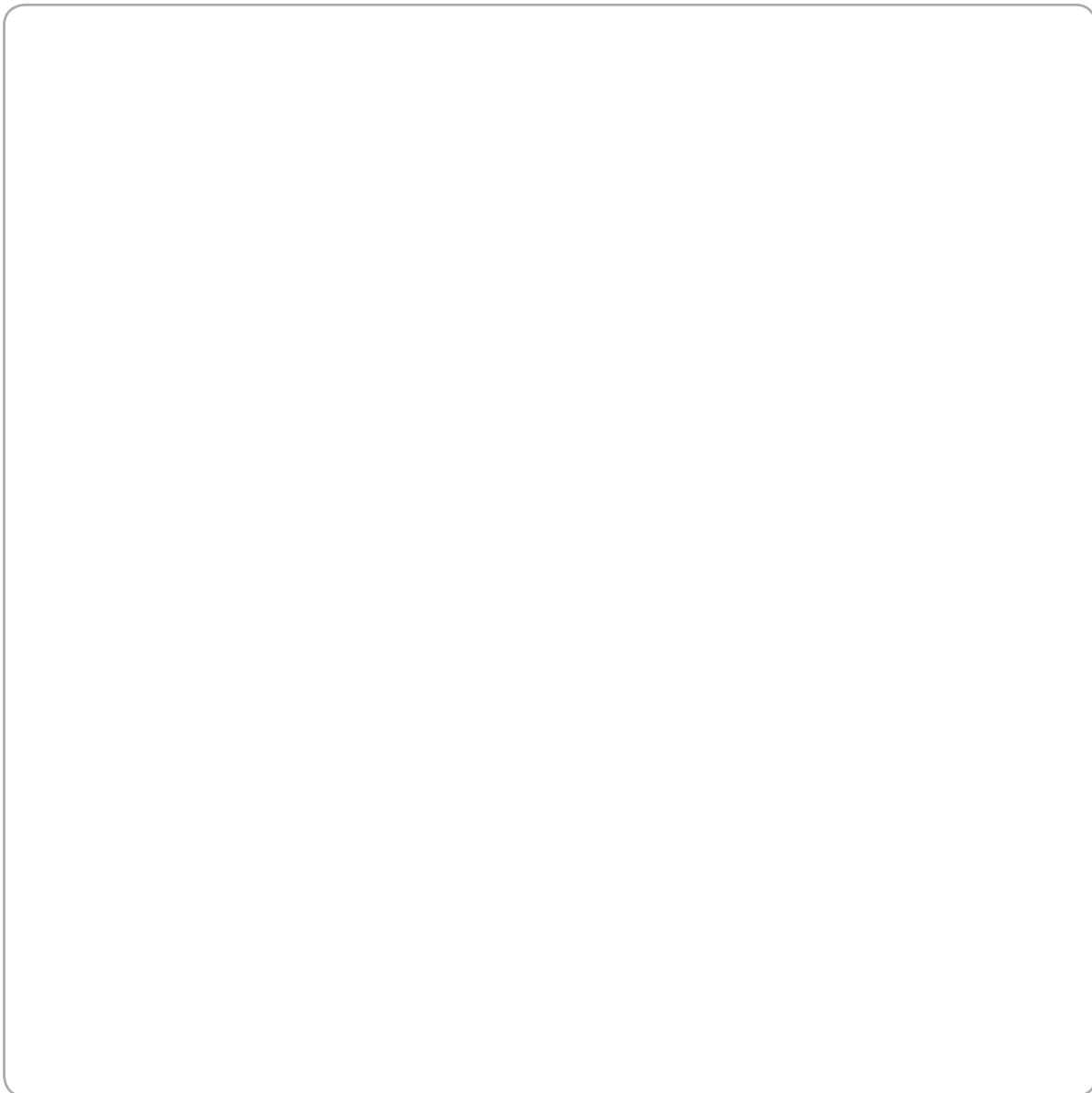
The proposal **must** include:

- a solution with a final drawing.

The proposal **must** consider:

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

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(Total for Activity 4 = 30 marks)



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(Total for Activity 5 = 9 marks)

(TOTAL FOR TASK = 60 MARKS)





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