Higher National Certificate/Diploma Assessment

Qualification	Pearson BTEC Higher Nationals for England (2024)

Unit number and title	4014: Production Engineering for Manufacture
Assignment title	Product Material Types
Assessor	Engineering Team

Academic year	1	Unit Code	H/651/0729	Assignment	2 of 3
Internal Verifier	Dr. Michael Shaw	Verification Date		1st September 2025	
Issue Date	1st September 2025	Final Submission Date		No later than 31st August 2026	

Policy on the Use of Artificial Intelligence (AI)

- Students are required to acknowledge the use of AI in the preparation of any assignment.
- AI tools **may be** permissible for use as learning aids, subject to the AI Assessment Scale designation given below.
- AI cannot be used to generate the final, submitted work in its entirety.
- AI cannot be used to substitute for a student's own critical thinking, analysis, and original expression.
- Assignments must reflect the student's original thought and understanding.
- Assignments are checked automatically on submission for AI content, through Turnitin.
- Assignment grades are only confirmed following viva voce examination at the end of each unit.

Artificial Intelligence Assessment Scale (AIAS)

Full details of the Artificial Intelligence Assessment Scale (AIAS) are available at this link.

The AI Assessment Scale (AIAS)

Level	Description	Guidelines
1 NO AI	The assessment is completed entirely without AI assistance in a controlled environment, ensuring that students rely solely on their existing knowledge, understanding, and skills.	**You must not use AI at any point during the assessment. You must demonstrate your core skills and knowledge.**
2 AI PLANNING	AI may be used for pre-task activities such as brainstorming, outlining and initial research. This level focuses on the effective use of AI for planning, synthesis, and ideation, but assessments should emphasise the ability to develop and refine these ideas independently.	**You may use AI for planning, idea development, and research. Your final submission should show how you have developed and refined these ideas.**
3 AI COLLABORATION	AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding.	**You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use.**
4 FULL AI	AI may be used to complete any elements of the task, with students directing AI to achieve the assessment goals. Assessments at this level may also require engagement with AI to achieve goals and solve problems.	**You may use AI extensively throughout your work either as you wish, or as specifically directed in your assessment. Focus on directing AI to achieve your goals while demonstrating your critical thinking.**
5 AI EXPLORATION	AI is used creatively to enhance problem-solving, generate novel insights, or develop innovative solutions to solve problems. Students and educators co-design assessments to explore unique AI applications within the field of study.	**You should use AI creatively to solve the task, potentially co-designing new approaches with your instructor.**

This assignment is based on the AIAS level indicated by the colour above.
Follow the instructions for that level.

If the submitted work falls outside the scope of the AIAS designation above, the assignment will be failed.

References

- Prepare your references and correctly cite them within the body of your assignment using zbib.org.
- Use the Harvard referencing standard of any of the listed UK universities.
- In zbib.org, create a 'Link to this Version' and copy it into your References section.
- **Assignments will be rejected if this process is not followed correctly.**

Submission Format

All text elements of your submission should be word processed, mathematical solutions can be handwritten (neatly) and scanned into your document.

Word Limit

- The recommended word limit for the information pack is 3,000 words. Exceeding this limit will not result in penalties; however, concise and focused writing is encouraged.

Assignment Format

- **Organisation**: Use clear headings, paragraphs, and sub-sections, to ensure clarity and ease of reading. Refer to Task numbers or sections to make it clear which question you are answering. *Assignment Structure*

Your assignment **MUST** include the following sections:

- **Cover Page**: Your Course, Name, Unit Name and Assignment number/name
- **Contents Page**: List tasks or questions with page numbers.
- **References**: Correctly cite and list all sources used, but do not use Wikipedia. Please see the detailed advice on page 1.

Submission Requirements

By submitting your assignment, you confirm the following:

- **Originality**: The work is your own, with all sources properly cited.
- **Plagiarism**: You acknowledge that plagiarism and collusion are forms of academic misconduct and are strictly prohibited.
- **Plagiarism Detection**: Your assignment will be submitted to TurnItIn, a plagiarism detection service, that compares your work against databases, online sources, and other students' work.
- **False Declaration**: Making a false declaration is academic misconduct.

Vocational Scenario or Context	You are a newly appointed Production Engineer in a Vehicle Engineering Manufacturing Plant. Part of your role is you support your line manager with the process of selecting the most appropriate production processes and related facilities available within the plan. Your manager has therefore tasked you with writing a report to determine your level of knowledge, and your understanding of different production methods and materials

Task 1	a) Critically review the key features of using sintering, hot pressing, chemical vapour deposition and reaction bonding processes, applied within a car manufacturing plant or one of its specialist parts suppliers. For each of the above processes, outline the advantages and disadvantages.
	
	b) Provide an example of a ceramic product created using each one of the above processes, and state where each product may be applied making reference to its material properties.
	
	c) Composite manufacturing techniques can include manual and automated layup, filament winding, pultrusion and resin transfer moulding processes. Describe, with examples, how each of these techniques are performed. What are their advantages and disadvantages?
	
	d) From the list below, research and discuss the key elements of TWO different polymer manufacturing processes. Using an example <u>product</u> from each, outline any advantages <u>relating to both the quality of the parts created through these processes, and any benefits to the manufacturing processes</u>.
	
	    ▪ Injection moulding
	    ▪ Injection blow moulding
	    ▪ Vacuum forming
	    ▪ Compression/Transfer moulding
	    ▪ Rotational moulding
	    ▪ Extrusion moulding
	    ▪ Foam moulding
	    ▪ 3D Printing of polymers
	
	Your line manager has requested your input on the assembly process of a newly launched automobile:
	e) For each of the following, provide an example of the materials and components where these bonding and joining techniques may be applied. Justify your answer by discussing the strengths and weaknesses of EACH method used when applied within a car manufacturing plant:
	
	    ▪ Welding
	    ▪ Adhesives
	    ▪ Snap-Fits
	    ▪ Interference-Fits
	    ▪ Mechanical Assemblies
	
	Select, and justify, which of the above methods you think is most suited to the assembly of a vehicle dashboard?

Sources of information to support you with this Assignment	• Baudin M. and Netland T. (2023) *Introduction to Manufacturing: An Industrial Engineering and Management Perspective*. 1st Ed. Routledge. • Burduk A., Batako A.D.L., Machado J., Wyczolkowski R., Dostatni E. and Rojek I. (Editors (2023) *Intelligent Systems in Production Engineering and Maintenance III – Lecture Notes in Mechanical Engineering* (Paperback). Springer. • Davim J.P. (Editor) (2016) *Design of Experiments in Production Engineering*. Springer International Publishing Switzerland. • Durakbasa N.M. and Gencyilmaz M.G. (Editors) (2021) *Digitizing Production Systems: Selected Papers from ISPR2021 – Lecture Notes in Mechanical Engineering* (Paperback). Springer. • Grote K.H. and Hefazi H. (Editors) (2021) *Springer Handbook of Mechanical Engineering*. Springer Nature. • Groover M.P. (2020) *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems*. John Wiley & Sons. • Machado C. and Davim J.P. (Editors) (2022) *Green Production Engineering and Management*. 1st Ed. Woodhead Publishing. • Mair G. (2019) *Essential Manufacturing*. Wiley. Phanden R.K., Kumar R., Pandey P.M., and Chakraborty A. (Editors) (2023) *Advances in Industrial and Production Engineering: Select Proceedings of FLAME 2022 – Lecture Notes in Mechanical Engineering*

Relevant Learning Outcomes and Assessment Criteria

	Pass		Merit		Distinction
LO2	*Describe the most appropriate production processes and associated facility arrangements for manufacturing products of different material types*				
P3	Examine the properties and applications of ceramic products manufactured using the sintering, hot pressing, chemical vapour deposition (CVD) and reaction bonding processes.				Evaluate how the choice of bonding and jointing processes influence both the product design and the selection of the most effective production process.
			M2	Discuss the benefits associated with polymer manufacturing processes.	**D1**
P4	Describe the properties and applications of composite products manufactured using manual and automated layup, filament winding, pultrusion and resin transfer moulding processes.				