

Student Feedback & Marking Report

Student: Grant Brooks (2514976)

Module: ACMA4000 – Materials and Introduction to Processing

Assessment: Manufacturing Processes and Defects (Report 40% + Video 10%)

REPORT MARKING (40%)

1. Engagement with Literature Skills

Mark Awarded: 17 / 20

The report demonstrates strong engagement with appropriate academic and technical literature, including authoritative textbooks (Callister & Rethwisch, 2020; Kalpakjian et al., 2014; Groover, 2021), materials handbooks (ASM), and peer-reviewed journal articles (Jiang et al., 2022; Hopewell et al., 2009). The sources are applied directly to justify material choice and manufacturing routes, for example when high-carbon steel is linked to hardness and toughness for forged hammers, silicone elastomers are justified for impact absorption in phone cases using rubber science literature, and aluminium alloys are selected for engine blocks based on thermal conductivity and strength-to-weight ratio supported by Polmear (2005). The lifespan and sustainability discussion is also supported by credible references to recycling efficiency of aluminium and limitations of polymer recycling. This represents consistent alignment with the coursework requirement to evidence claims across Tasks 1–5.

A minor limitation is that some market figures and production volumes are drawn from industry estimates without critical discussion of uncertainty or source reliability. In addition, while sources are appropriate, the literature is often used to support individual claims rather than being synthesised into comparative arguments, particularly in the environmental and lifecycle discussion.

To strengthen this criterion further, the student could synthesise findings across two or more independent sources into a comparative lifecycle assessment paragraph and present a small table comparing indicative CO₂ emissions per functional lifetime of the three products. Nevertheless, the breadth and relevance of literature justify a high mark.

2. Knowledge and Understanding Skills

Mark Awarded: 20 / 25

The submission demonstrates strong technical understanding of materials and manufacturing processes. The description of hot forging for the ball-peen hammer correctly links grain flow alignment to improved toughness and fatigue resistance, and the explanation of heat treatment (quenching and tempering) shows understanding of how processing modifies steel microstructure and properties. The polymer section correctly describes silicone elastomers in terms of crosslinked structure, elasticity and tear resistance, and links compression moulding to low waste and high productivity. The aluminium engine block section accurately explains sand casting, including mould preparation, shrinkage allowances and the need for post-casting machining, and correctly links aluminium's thermal conductivity to heat dissipation in engines. The mechanical and thermal property comparison

table supports the narrative and demonstrates appropriate understanding of how properties influence performance.

Some areas would benefit from deeper structure–property linkage. For instance, while forging is described in terms of grain alignment, the report could further explain how this microstructural refinement influences crack propagation under repeated impact. Similarly, the polymer section could more explicitly link crosslink density in silicone to its energy absorption behaviour. The aluminium section could benefit from clearer discussion of how alloying elements and casting microstructure influence fatigue and thermal fatigue resistance in engine blocks.

To enhance this criterion, brief microstructural schematics or a short paragraph explicitly linking processing to microstructure and microstructure to performance for each product would raise the work into the highest band. Nonetheless, the technical understanding demonstrated is strong.

3. Cognitive and Intellectual Skills

Mark Awarded: 15 / 20

The report demonstrates evaluative reasoning through comparison of original and alternative materials. The student justifies forged high-carbon steel over copper or polymer composites for hammers by weighing impact resistance and wear against softness and deformation of alternatives. The comparison between silicone and TPU for phone cases identifies trade-offs between thermal stability, ageing resistance and stiffness. The discussion of aluminium engine blocks versus compacted graphite iron and magnesium alloys demonstrates appropriate consideration of trade-offs between weight, strength, corrosion resistance and cost. These sections show sound engineering judgement supported by literature.

However, the analysis remains largely qualitative. Trade-offs are clearly identified but not structured within a formal decision-making framework. The environmental and sustainability trade-offs, while mentioned, are not compared using consistent metrics, and the relative importance of criteria (e.g. weight versus cost versus recyclability) is not explicitly prioritised.

To strengthen this criterion, the student could introduce a simple weighted decision matrix for each product, ranking candidate materials against criteria such as performance, manufacturability, cost and sustainability. This would demonstrate more advanced cognitive skills and more explicit justification of engineering decisions.

4. Practical Application Skills

Mark Awarded: 20 / 25

The selected products are appropriate everyday items that allow clear application of materials and manufacturing theory to real-world contexts. The report consistently links properties to service requirements, for example impact resistance and durability for hammers, shock absorption and environmental resistance for phone cases, and thermal conductivity and fatigue resistance for engine blocks. Manufacturing processes are described in realistic industrial terms, including production rate, energy consumption and cost implications for forging, compression moulding and sand casting. The

lifespan discussion demonstrates understanding of degradation mechanisms such as corrosion in steel, UV and mechanical degradation in silicone, and thermal fatigue in aluminium engine blocks.

A notable strength is the effective use of figures, process diagrams and comparative tables, which enhance clarity and demonstrate practical understanding of manufacturing routes. In line with the marking approach, the presence of multiple labelled figures and tables supports a generous mark in this criterion.

The practical application could be strengthened further by more explicit visualisation of lifecycle and end-of-life pathways. While recycling of aluminium is discussed, a lifecycle flow diagram illustrating raw material extraction, manufacturing, use and end-of-life for each product would deepen the application of lifecycle thinking.

To enhance this criterion further, the student could add a simple lifecycle flowchart for each product and one illustrative figure showing typical defects or degradation mechanisms (e.g. forging laps, moulding flash, casting porosity). This would strengthen real-world contextualisation.

5. Transferable Skills for Life and Professional Practice

Mark Awarded: 8 / 10

The report is professionally structured, with a clear abstract, contents, lists of figures and tables, logically organised sections aligned with the coursework tasks, and a comprehensive reference list. Figures and tables are clearly labelled and integrated into the report, aiding clarity and professional presentation. The writing is coherent, technically appropriate and generally well-formatted, with consistent academic tone and referencing.

Minor improvements could be made in tightening phrasing in some sections and ensuring complete consistency in formatting (e.g. spacing and heading styles). However, overall presentation quality is high and meets professional expectations for Level 4 work.

VIDEO PRESENTATION MARKING (10%)

Video file reviewed: Yes (MP4 submitted)

Video Technical Content and Communication

Mark Awarded: 7 / 10

The video clearly introduces the three products and accurately explains their materials, manufacturing processes and key mechanical and thermal differences. The presentation demonstrates good understanding of why each material–process combination is used and communicates trade-offs between performance, cost and durability. The structure is logical and aligned with the report, and the delivery is clear and professional.

The video would benefit from stronger visual reinforcement. While objects and processes are discussed verbally, the inclusion of simple on-screen process flow diagrams or a condensed comparison table of properties would improve clarity and technical communication. The discussion

of sustainability and alternatives could also be more explicitly framed as engineering trade-offs to strengthen evaluative content.

To reach the highest band, the student should incorporate one or two concise visual aids (e.g. forging flowchart, sand casting schematic) and explicitly summarise trade-offs in the concluding section.

Overall Summary

Report marks:

Engagement with Literature: **17/20**

Knowledge and Understanding: **20/25**

Cognitive and Intellectual Skills: **15/20**

Practical Application: **20/25**

Transferable Skills: **8/10**

Video mark: 7/10