

# Project Instructions<sup>1</sup>

Materials Science A214  
2025

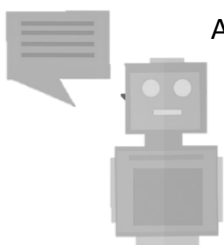
## Project Content

Four projects have been designed for students to complete over the course of the semester. These projects require students to explore the characteristics, applications and properties of the four major classes of engineering materials: ceramics, polymers, composites and metals. The relevant **self-study** chapters in Callister's 9<sup>th</sup> and 10<sup>th</sup> editions for each project are presented in the table below:

Material Class	9 <sup>th</sup> Edition Chapters	10 <sup>th</sup> Edition Chapters
<b>Ceramics (Project 1)</b>	Ch 14	Ch 12.1, 12.7 – 12.11, Ch 13.1 – 13.7, 13.9 – 13.10
<b>Polymers (Project 2)</b>	Ch 15	Ch 15.1 – 15.20
<b>Composites (Project 3)</b>	Ch 16	Ch 16
<b>Metals (Project 4)</b>	Ch 13	Ch 11.1 – 11.3

The projects will expose you to a range of materials and build your intuition of what materials are applicable in specific situations. This enables students to think critically about materials in the engineering context. Your task for each project is to create an assessment-level question and use an artificial intelligence (AI) chatbot to further develop and evaluate the question. Additionally, using your own experience of the project task, you are required to peer assess other students' work. This allows you to develop a deep understanding of the topic of each project.

## Project Task: Critiquing N(AI)ve Chatbots



Artificial intelligence (AI) chatbots (such as ChatGPT) have gained great popularity (and in some cases, notoriety) amongst universities due to their ability to assist with assignments. A user provides the AI chatbot with a prompt and within seconds an answer is generated. However, these chatbots do not always get it right and can sometimes be naive: they lack innovative thought that comes naturally from human writing, they can provide biased or incorrect information, or sometimes they even “hallucinate” by making up information. As materials engineers, we cannot rely on half-truths, especially when we are dealing with aspects that impact human safety. We consequently must develop our ability to

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<sup>1</sup> None of this document was constructed using a generative AI chatbot except where cited otherwise.

evaluate the AI responses and add our own amount of innovative, creative and critical input in order to reliably leverage the power of these AI chatbots in our professional environments.

## Instructions

This assignment is based on critiquing artificial intelligence (AI)-posed answers to student-posed questions. Students may use any free AI chatbot of their choice (such as [ChatGPT](#), [Google Gemini](#), [Microsoft Copilot](#), etc.) during the task. The procedure for completing this assignment is explained below, followed by the roles that AI and you as the student need to assume.

### Procedure:

1. Set up a unique and quality 20-mark<sup>2</sup> question, based **on the project reading** indicated both above as well as in the Module Framework under “Module Content and Schedule”. Refer to the “Question Quality” section and rubric at the end of this document for what is meant by *quality questions*. By *unique* we mean a question that you have created yourself and not one that you copied from the textbook, another resource or asked an AI-chatbot to create.
2. Pose question(s) to an AI chatbot of your choice.
3. Based on the response from the AI chatbot, refine your question(s) by adjusting it using appropriate **prompts** (instructions written to the AI chatbot). The **more effective your prompting**, the more likely the AI chatbot will be able to generate quality solution(s) to match the quality question(s). There are many **online resources on effective prompting** – a few are provided at the end of this document under “Further Reading”.
4. Once you are satisfied that the question has been refined by the prompts that you have presented to the AI chatbot, copy and paste the final prompt and response into a document so that you can add your critique of the AI-generated solutions.
5. **Critique** the AI chatbot response(s) by fact-checking the generated information and highlighting aspects that **correlate with, conflict with or are beyond the explanations** offered by the **textbook**. This is done by providing detailed references to the textbook (such as sections, figures and page numbers). Additional support from other resources (other textbooks, websites, journal articles, etc.) are also welcome.
6. Indicate the **marks distribution for the solution** as would typically be assigned in an invigilated formal assessment (ie. A1, A2, A3).
7. Upload the critique, the refined question(s) and memo(s) in **one PDF** file to SUNLearn for peer assessment. Note the following:




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<sup>2</sup> The reason for the 20-mark specification is to limit the completion time of the question. In other words, if we go on the mark-a-minute rule-of-thumb, it should take a student roughly 20 minutes to complete your question.

- This PDF must have selectable text which means that it should be typed in MS Word (or other word processor) and converted to a PDF.
- **No written submissions will be accepted.**
- You are highly encouraged to include **relevant figures and facts** to bolster your argument and cross-reference the AI-generated answers, but you must cite the original source (whether this is the textbook, a journal article, a website, etc.). Refer to our [library page](#) for tips on how to provide a citation/reference using the Harvard<sup>3</sup> referencing format. Also clearly highlight which content was AI-generated.
- A suggested submission layout is provided under “Project Format: An Example”. You are free to **use any layout as long as the instructions above are followed.**

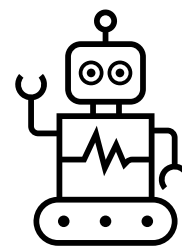
8. Subsequently, **peer review** other assigned submissions.

9. Assign a mark to your assigned fellow students using the **rubric** which can be found at the end of this document. Be fair in your assessment of your peers – **read the rubric descriptions carefully and describe briefly in the feedback section how they could improve for their next submission.**

In **summary**, the roles of the different parties (AI chatbot vs student) in this assignment are as follows:

AI chatbot’s role:

- ❖ generate solution(s) to a unique and quality 20-mark question(s) posed by a student.



Student’s role:

- ❖ pose a unique and quality 20-mark question(s) to the AI chatbot
- ❖ use appropriate prompts (instructions written to the AI chatbot) to refine the question and solutions that is posed to the AI chatbot
- ❖ critique the AI chatbot response(s)
- ❖ assign marks to appropriate parts of the AI chatbot solution(s)
- ❖ submit the critique, refined question(s) and AI chatbot memo(s) to SUNLearn for peer assessment
- ❖ complete the peer assessment of other peers’ submissions and assign marks and feedback using the rubric
- ❖ learn from your own peer feedback for subsequent assignments

This process will be internally moderated. **Dates and time of when submissions and peer assessments are opened and closed on the Project workshop tool can be found in the Module Framework under “Module Content and Schedule” for each project.**

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<sup>3</sup> The Harvard referencing method is one of the referencing formats that you will encounter in your final year projects and/or postgraduate thesis/dissertation write up when you must cite the work of others.

## Motivation:

### *What is the motivation behind this assignment?*

The projects involve using a generative artificial intelligence (AI) chatbot (such as ChatGPT) of your choice to provide solutions to student-posed examination-like questions which you will subsequently critique. The **learning goal** of the projects is two-fold:

- ❖ To foster the development of the students' integrative learning abilities<sup>4</sup>, simultaneously supporting the development of their critical and creative thinking and evaluative judgement skills necessary as preparation for NQF level 7 and higher levels (third year and up)
- ❖ To help students build an understanding of the powerful opportunities for incorporating AI into their professional work, while simultaneously developing the ability to use the tool responsibly and strategically.



So, why are students required to use AI chatbots to generate answers to their questions and subsequently question (or critique) the AI output? We have Socrates to thank for that. According to his student, Plato, the Greek philosopher, Socrates, believed that to be able to critically understand anything, one should question it.

This is why teachers and professors love to pose questions in their classes or lectures. It is less common, however, for students to pose their own questions to themselves, to a generative AI chatbot or even to other students. Student/AI-posed questioning and review has the following advantages:

- ❖ It encourages self-regulation of your learning through metacognitive strategy (awareness of your own learning and ability to apply knowledge to a task).
- ❖ Critically evaluating AI responses helps to stimulate critical thinking about the course material which is vital in a theory-rich course where pure memorisation (rote learning) of ALL content is challenging and not expected.
- ❖ It requires you to revise prior knowledge and connect with other concepts in an integrative manner.
- ❖ Posing questions and assessing others' questions and answers develops critical thinking skills that are required in the engineering workplace. For instance, asking questions about another engineer's proposed design or questioning the weak points of a safety protocol or quality control system. Following the proliferation of AI in professional working environments, it will also become a requirement to be able to critically assess AI outputs




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<sup>4</sup> Integrative learning ability: the ability to make connections between different concepts in different knowledge areas in order to apply knowledge appropriately and critically in different contexts, to be able to compare and contrast these different scenarios, and to extend the applications beyond what has already been learned.

whilst still leveraging this technology to assist in a productive yet reliable and ethical manner.

## Peer Assessment:

### *Learning is a collaborative process with your peers*



The *peer assessment* section of the project is just as important as the question and memo generation itself and will make use of a rubric (at the end of this document in Table 3) that will guide you through the process of evaluating the work of your peers, a very common and necessary practice in our field. Engineers almost always work in teams, with one member checking the work of another. This mechanism helps us to prevent big design mistakes from going into production. In this process, it is important to be both honest and critical in your evaluation without judgement or prejudice. **Constructive criticism and sufficient feedback**<sup>5</sup> are valuable in moving towards a more robust and effective final design. Being able to deliver and receive quality feedback from your peers is critical to your success as an engineer.

The **assignment mark for the projects is split 80 : 20** for the **submission : assessment** sections.

- **Submission marks** are averaged from your peers' marks assigned to you.
- **Assessment marks** are meant to estimate the quality of assessments that the participants gave to their peers and are calculated automatically from a SUNLearn algorithm designed to observe your: consistency in reviewing other peers' work; tendency to consistently over-rate or under-rate your peers' work (agreement with other peers' assessments); and effort into providing feedback amongst other factors. In order to score well for the assessment mark, you must *conscientiously* assess your peer using the rubric, i.e. read the rubric carefully and spend time on assessing your peers' work.

## Question Quality

### *There are no stupid questions, only less explorative ones!*

Not every type of question is effective in achieving critical thinking which is vital to a student's success in a theory-intensive course such as Materials Science. *Quality questions* are required to be thoughtful, divergent, open-ended, explorative, connects dots with other content; and the answers usually require higher-order thinking skills. On the opposite end are *content questions* which have specific, usually one-worded answers; discovery of the answer only requires simple recollection; and no connections to other topics are usually made.



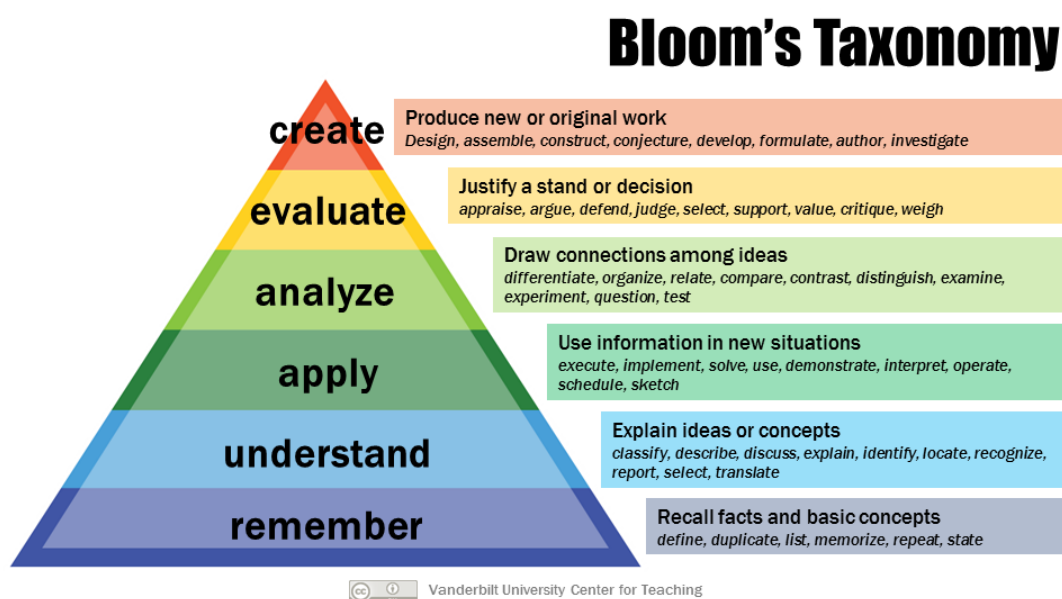
There is a time and place for both kinds of questions, but your engineering studies inside of Materials Science and in other courses will really benefit from posing, answering and

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<sup>5</sup> Additional hints and considerations concerning peer assessment are provided at the end of this document.

reviewing *quality questions*. It is therefore vital that your prompting of the AI chatbot takes this concept of a quality question into account.

One well-known method of categorising questions is **Bloom's taxonomy** shown in Figure 1. The pyramid consists of progressive levels in which students can interact with knowledge ranging from simple (*remembering* simple facts) to more complex tasks (*evaluation* of an idea or creation of an original piece of work). Quality questions are those that are embodied by the actions of the "*understanding*" and *higher levels* in the pyramid of Bloom's taxonomy. That is, quality questions require students to at least "explain ideas or concepts" through using actionable verbs such as classify, describe, discuss, explain etc (see Figure 1 Level: Understand) and do not require students to only "recall/repeat facts or basic concepts" as appropriate at the foundational "*remember*" level.



**Figure 1:** Bloom's Taxonomy (Armstrong, P. (2010). Bloom's Taxonomy. Vanderbilt University Center for Teaching. Retrieved [2021/08/04] from <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>.)

**A word of caution:** just because your question/prompt uses the actionable verbs in Figure 1 at higher levels does not mean that they are automatically focused at that level. For example, "Compare and contrast the properties of carbon fiber and aluminum." This question, although prompting some "*analyze*" level thinking, is superficial. Fundamentally, there are many similarities and differences between these materials but so what? This question does not require students to delve deeply into, say, different contexts (such as aircraft construction). It is therefore more correctly classified at lower levels of "*understand*" or "*remember*". By contrast, consider this question: "Analyze the trade-offs between using carbon fiber and aluminum alloys in the construction of airplane wings. Distinguish between the roles of strength, weight and fatigue resistance in wing design. Relate these material properties to the specific demands placed on airplane wings during flight." This question requires students to distinguish between different aspects and relate them to a specific context ("*analyze*" level).

**Partial examples of quality versus content questions are provided in Table 1.** Note you should be able to allocate 20 marks to the solutions of the questions.

**Table 1:** Examples of simple (partial) examples of content vs quality questions

	Question	Answer
<b>Content</b>	<p>Q1. Ferrous alloys contain iron as their primary element.</p> <p>(a) What is the carbon composition of low-carbon steels? [1]</p> <p>(b) Give one use of high-carbon steels. [1]</p> <p>(c) List two advantages of stainless steels. [2]</p>	<p>Q1 Memo</p> <p>(a) &lt; 0.25 wt% C ✓</p> <p>(b) Hacksaw blades ✓</p> <p>(c) - Corrosion resistant ✓ - Can be used at high temperatures ✓✓</p>
<b>Quality</b>	<p>Q1. Ferrous alloys contain iron as their primary element.</p> <p>(a) Why do you think some buildings employ large quantities of steel? [4]</p> <p>(b) Would you fabricate casting moulds from steels? Why and/or why not? [5]</p> <p>(c) Is "cast irons" an appropriate descriptor? [2]</p>	<p>Q1 Memo</p> <p>(a) - Steels contain mostly iron, carbon and small amounts of other alloying elements. This makes it economical to use in large-scale projects requiring significant amounts of bulk material as iron is relatively cheap. ✓ - Steels are amenable to fabrication through extrusion and rolling which is commonly employed for obtaining constant cross sections of I-beams for instance. ✓ - A wide range of properties is possible through control of relative alloy amounts and appropriate heat treatments. ✓ - Steels can be used to reinforce concrete blocks for improved strength because they have similar expansion properties to concrete. ✓</p> <p>(b) -No. ✓ -Casting involves pouring molten metal into moulds which requires them to have structural and chemical stability at temperatures in excess of the melting temperature of some metals. ✓ -Although some steels can reasonably hold metals with low melting temperatures and some cast irons (due to the lower melting temperatures of cast irons), steels are not chemically stable at higher temperatures which might make them susceptible to corrosion and possibly reactive with the cast metal. ✓ -The heating of the mould could also austenitize the steel and cause martensite formation (which is brittle) and cracking upon mould cooling. ✓ -The cost savings from using steel as opposed to more appropriate yet costly refractory metals, for instance, would be offset by the limited use of the steel moulds, their short lifespan and need for mould replacement. Quality assurance (no corrosive/reactivity products) on final cast product would also incur a further cost. ✓</p> <p>(c) Yes and no. Yes: "Cast" in cast irons refers to the ability of cast irons to be easily moulded on account of their lower melting temperatures (see iron-carbon diagrams where the liquidus line drops with increasing carbon content). ✓ No: "irons" in cast irons implies that they contain only iron when in fact they contain more carbon (&gt; 3 wt%) than steels (along with other alloying elements). ✓</p>

## Project Format: An Example

In this section, an example layout of a potential submission is given. It is in no way meant to be prescriptive: it is merely an example of how to format the submission and has been shortened for simplicity and brevity. It is not a perfect example. Feel free to be creative in your submission (provided you follow instructions given above)!

The first time you do this task, it will be a big learning curve, but you will eventually get accustomed to the process. Marks for originality and integration of other activities/chapters are also included as shown in the rubric in Table 3 at the end of this document.

A few tips:

- ❖ It might take you a few tries using prompts to get a workable answer. Each time you might have to adjust your prompt slightly to get a better output. That is ok! The example below took many tries (see part of one of my ChatGPT conversations [here](#)). Only include your final prompt that produced the answer that you then critiqued.
- ❖ Try finding a core topic in the relevant chapter. For instance, if the project is on metals, you can focus on ferrous alloys for instance and their mechanical properties. You can then further provide a very specific context or case study: for example, you wish to build a submarine from cast iron, and you want to know if it is feasible from a processing, corrosion, etc. point of view and why/why not.
- ❖ The more creative you are, the harder it will be for the AI chatbot to give you a technically correct answer<sup>6</sup>. Try to think of questions that have not been asked before in the textbook or elsewhere. There are a variety of ways in which you can use AI chatbots to answer a question, including co-opting the use of a diagram, supplying it with a known case study, a design problem, etc. The idea is to “shake the AI’s snow globe” so that the critical evaluation of its response (whether right or wrong) is potentially more engaging, uncovers new insights for learning and is more interesting.
- ❖ You are welcome to include topics from other chapters of the textbook or from other sources on the internet provided they, at their core, test the content in the self-study chapters mentioned at the start of this document. Use the infographic for guidance on which other chapters may be relevant to each of the project topics. Integration (of other chapters/content) and relevance (to the self-study chapter) are both rewarded in the rubric. Word of caution: AVOID generating questions that require specialist knowledge. Any question must be able to be answered by referring back to the textbook; i.e. you should be able to answer the question in an assessment. For example, “List the challenges of osseointegration of implants made from titanium alloys.” would require advanced biomedical engineering concepts not covered in this course.

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<sup>6</sup> As generative AI models become more advanced and learn from a growing corpus of information and user interaction, their responses will become more and more reliable. However, it is still vital for engineers to be critical of any tool that they use. For example, calculators are well-established mathematical aids but sometimes you still need to verify if the angle that results from the calculator’s arcsine of a positive value is meant to be acute or obtuse. This is because most calculators will only give the acute angle even if the obtuse angle is the one under consideration.



- ❖ Since late 2024, some free AI chatbots can read and interpret figures (although this is not always done perfectly). See a simple example of a chat using a figure [here](#). Feel free to use figures (where applicable) in your questions as well. If properly used, figures can also help to elevate the question quality (for example, use the figure to predict x, how would the figure differ under situation x rather than y, etc.).
- ❖ A **good prompt** has the **characteristics** listed in Table 2 (adapted from [source](#)).

**Table 2:** Key characteristics of a good prompt for a generative AI chatbot (such as ChatGPT)

A Good Prompt:	Examples of Prompts
Is <i>clear</i> , concise and specific	"Explain the concept of dislocation strengthening in simple terms."
Provides <i>context</i>	"What kind of fabrication techniques would you recommend to someone wishing to make a composite bicycle frame?"
Asks <i>follow-up</i> questions	"Explain more about how these fabrication techniques would change if it was a titanium alloy bicycle frame?"
Specifies the <i>language</i> output	"Respond with UK English spelling."
Specifies the <i>length</i> / <i>mark</i> allocation of the response	"I would like a brief/detailed/300 words response. The answer should count out of 10 marks."
Specifies the response format using an <i>example</i>	"Present the response in bullet points/table/numbered paragraphs."
Specifies the knowledge <i>level</i> of output	"Respond in a manner suitable for a second-year engineering university student taking materials science for the first time." "Respond in a manner suitable to a Masters/PhD/researcher target audience."
Specifies the <i>tone/style</i> of the output	"Write the response in a style suitable for technical reporting produced by a materials failure engineer."

Start of Partial Example

**Prompt:** You are a materials failure analyst with second year engineering materials science and engineering knowledge. You are hired to investigate the cause of failure of a batch of electrical insulators [(shown in Figure 2) - not included in ChatGPT prompt but included for clarity for my peers] in a nearby town. Looking at the material and processing records of the batch, you realise that this batch of insulators consisted mostly of porcelain made by a local manufacturer who had experienced load shedding and loss of power to their electric kilns during the manufacturing dates tied to the batch numbers. Answer the questions that follow in a similarly numbered format. [Total marks: 10]

(a) Explain in five or less bulleted paragraphs why you think the insulators failed with special reference to the effects of the interrupted processing on the ceramic's microstructure and properties. [Marks: 5]

(b) The insurance company requires proof of the cause of the failure before the insulators can be replaced and power supply can be restored to the town. In five or less bulleted paragraphs, what kind of testing can you employ to confirm your conclusion above? [Marks: 5]



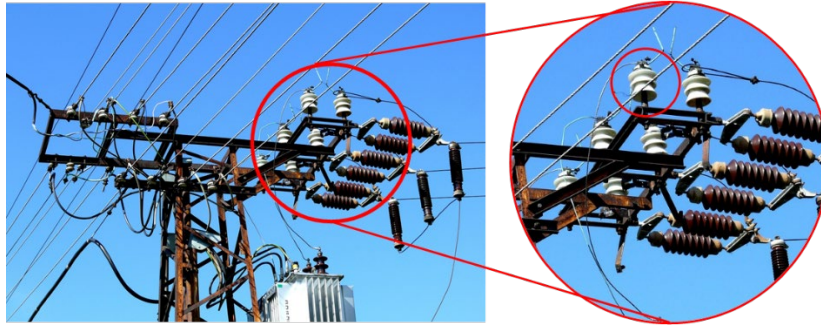


Figure 2: Photograph of porcelain electrical insulators used in this case study (Source: Pixabay.com)

**AI Response and Critique** (truncated for simplicity and brevity wherever [continue] is written):

- Wording in *italics*: response written by ChatGPT (OpenAI, 2023)
- Wording in blue: student critical evaluation of AI response

All section and/or page number references below are from the 10<sup>th</sup> edition of the textbook by Callister & Rethwisch (2020) unless otherwise specified.

*(a) Explanation for the insulator failure due to the lack of firing process:*

*Insufficient firing time due to the power loss could result in incomplete vitrification of the porcelain. Incomplete vitrification means that the material does not fully transform into a glassy state, leaving behind higher levels of porosity. These pores act as stress concentrators, weakening the material and making it more susceptible to mechanical failure.*

Correlates with Section 13.12 (Fabrication and Processing of Clay Products, page), page 503: “The degree of vitrification controls the room-temperature properties of ceramicware; strength, durability, and density are all enhanced as it increases”. However, the response “incomplete vitrification means that the material does not fully transform into a glassy state” does not completely agree with the definition of “vitrification” which is the process wherein a liquid phase of glass forms and flows to fill pores between unreacted quartz particles (page 502). In other words, vitrification of the porcelain does not necessarily involve a complete transformation to just a glassy state because some unreacted quartz and mullite (Figure 13.21) remains...[continue]

The statement “pores act as stress concentrators” agrees with Section 8.5 (Principles of Fracture Mechanics), page 234 as microscopic flaws (such as pores) amplify applied stress. However, the response is vague in stating that this makes the material “susceptible to mechanical failure” and the response does not directly tie the effect to specific properties, apart from strength. For instance, porosity effects fracture toughness (Section 8.5, page 237) of the material which is already low for ceramics (Figure 1.7, page 9 + Section 12.8 (Brittle Fracture of Ceramics), page 459).

According to Section 12.11 (Miscellaneous Mechanical Considerations), we can see that porosity does tend to lower the stiffness (or Young’s modulus) according to Equation 12.9 which is demonstrated in Figure 12.33 (page 467) albeit for a different material (aluminium oxide) and process (sintered powder). Therefore, the stiffness is less for unfired clay ceramics than fired ceramics due to densification that occurs during vitrification. A similar argument is present for flexural strength in Equation 12.10 (page 467). For porcelain, this assumption is confirmed by the works of Martin-Marquez (2010). [continue]

- Mark allocation:
  - 1 mark for mentioning vitrification and 1 mark for giving definition
  - 1 mark for relating increased porosity to lack of firing

- 1 mark for relating increased porosity to lower stiffness
- 1 mark for relating increased porosity to lower flexural strength

**(b) Testing to confirm the conclusion:**

*Microstructural analysis using scanning electron microscopy (SEM) can be employed to examine the cross-section of the failed insulators. This analysis can reveal any signs of incomplete vitrification, non-uniform grain growth, and the presence of porosity, which are indicative of improper firing.*

Correlates with example electron micrograph in Figure 13.21 (page 502) in the textbook (reproduced in Figure 3 below) where SEM was used to observe porosity in a fired porcelain. Correlates with Section 4.10 (Microscopic Techniques), Figure 4.16 (page 119): SEM was needed because the scale bar (10  $\mu\text{m}$ ) on Figure 3 indicates that the pores are  $\sim 5 \mu\text{m}$  in diameter.

Additional details could be provided on specimen preparation given that ceramics are very brittle and hard (page 467), making the grinding and polishing stage quite challenging (page 116). ChatGPT could be more specific though to say SEM can be used to look at small pores whereas cheaper optical microscopy (OM) can be used more conveniently to look for larger cracks given OM's lower resolution. [continue]

- Mark allocation:
  - 1 mark for identifying SEM use for pore observation
  - 1 mark for identifying OM for crack observation

*Mechanical testing, such as hardness testing and flexural strength testing, can be performed to evaluate the mechanical properties of the insulators. The mechanical test results can then be compared with those of properly fired insulators to identify any discrepancies.*

The recommendation of hardness or flexural strength testing correlates with Section 12.9 (Stress-strain behaviour, page 463) because tensile tests are not usually easy to do with brittle ceramics because "First, it is difficult to prepare and test specimens having the required geometry. Second, it is difficult to grip brittle materials without fracturing them. Third, ceramics fail after only about 0.1% strain, which necessitates that tensile specimens be perfectly aligned to avoid the presence of bending stresses, which are not easily calculated." However, ChatGPT does not indicate a specific trend to look out for, ie. strength, stiffness, hardness, flexural strength is lowered with an increase in porosity due to improper firing and densification. ChatGPT should also specify what type of hardness tests as using pyramidal shapes (page 467) such as the Knoop or Vickers indenters in Table 6.5 are recommended for brittle ceramics (page 179)...[continue]

- Mark allocation:
  - 1 mark for mention tensile tests are difficult to do
  - 1 mark for mentioning three-point bending tests to measure flexural strength
  - 1 mark for mentioning hardness tests using pyramidal shapes (0.5 marks if only hardness test was mentioned)

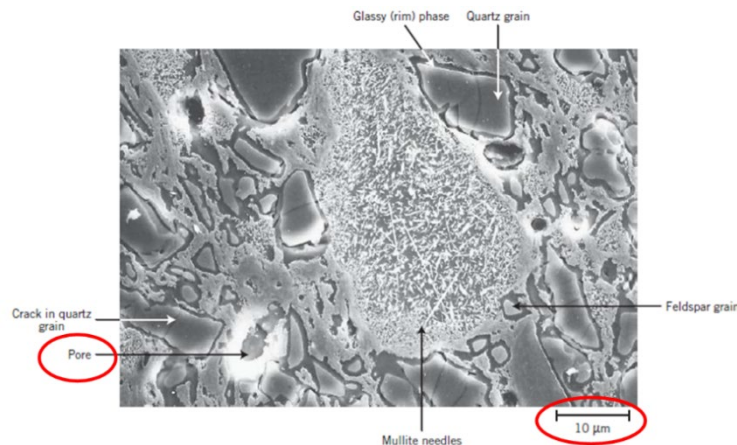
*X-ray diffraction (XRD): XRD analysis can be employed to determine the crystalline phases present in the clay material. The absence of characteristic ceramic phases in the XRD pattern would support the conclusion that the firing process was not performed.*

Correlates with Section 3.16 (X-Ray Diffraction, page 83) but XRD is not covered directly in the course. However, it is interesting to note that you could use XRD to observe change in phases that occur during the firing process (for instance, conversion of kaolinite clay crystals (Figure 12.14) into mullite crystals (shown in Figure 13.21).

- Mark allocation:

- No mark allocation: not covered directly in course but can award bonus mark if able to indicate that some phase changes do occur and can be picked up after firing compared to “green” part.

In summary, I feel ChatGPT did provide some good answers although it can be very vague at times with precise definitions (e.g. vitrification) and struggles with providing more contextual examples (e.g. actual types of properties affected by lack of firing process)...[continue]



**Figure 3:** A SEM electron micrograph of a typical porcelain specimen that has undergone a firing process and vitrification (Source: Callister & Rethwisch, 2020: 502)

#### Reference list:

- Callister, William D. Jr, & Rethwisch, David G. 2020. *Materials Science and Engineering - An Introduction - SI Version*. 10th Edition, John Wiley & Sons, New York.
- Martín-Márquez, J., Rincón, J.M., & Romero, M. 2010. *Journal of the European Ceramic Society*, 30(15), 3063-3069.
- Open AI. 2023. *ChatGPT* (July 20 Version) [Large language model]. <https://chat.openai.com/>

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Example End

## Further Reading

1. [What is ChatGPT? Everything You Need to Know](#)
2. [ChatGPT Guide: Use these prompt strategies to maximize your results](#)
3. [Introducing: ChatGPT Edu-Mega-Prompts](#)
4. [Your Guide to Communicating with Artificial Intelligence](#)
5. [Guide for ChatGPT usage in teaching and learning](#)
6. Feel free to share on the forums any other resources you find helpful.

## Privacy Concerns

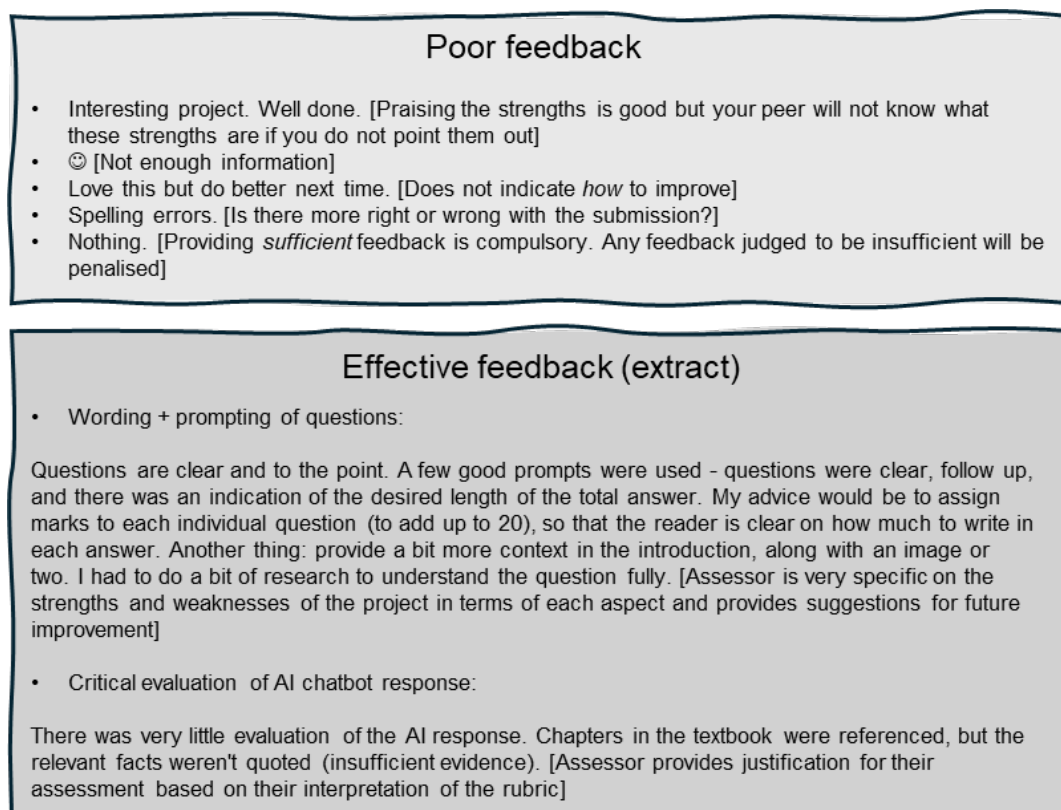
As a measure to comply with data privacy laws, **avoid supplying ChatGPT with your or anyone else's personal or confidential data**. The large language model can train on these inputs (even if it includes private information) and adds it to the public domain of data.

## Peer Assessment Considerations



Here are some considerations when performing the peer assessment tasks of each of the projects.

- ❖ First read through the entire rubric in Table 3 on the next page to get an idea of what to look out for in your peer's project. Then read through your peer's entire project while making notes of the strengths and weaknesses of their project across the various criteria indicated in Table 3.
- ❖ Use your judgement to assess which level is most appropriate for their project. Note: **Descriptors for each of the criteria provide guidance to the assessor. Not all aspects of the descriptors need to be relevant to award the level. In cases where descriptors are relevant across levels, select the most appropriate grade/level.**
- ❖ It is vital that you are fair and consistent in your assessment and that you provide reasons in the feedback for your assessment. The notes that you made above will aid in providing this feedback to your peer to help them improve on their future submissions.
- ❖ **Examples of extracts of poor and effective feedback are provided in Figure 4 below.** These are not meant to be prescriptive, but they convey the overall spirit that should be aimed for in providing feedback to your peers.



**Figure 4:** Extracts of poor and effective feedback from previous submissions. Some guiding principles are provided in the [square brackets].

## Rubric

**Table 3:** Rubric for project peer assessment indicating progressive levels of achievement. Note: if a criterion is missing/has not been addressed in the submission, a level 0 (omitted) must be awarded

Criteria	Levels				
	1 (Lacking)	2 (Developing)	3 (Average)	4 (Above average)	5 (Exceptional)
Wording + prompting of questions	Very vague, very unclear questions/prompts, very poorly worded, very poor grammar and spelling, lack of actionable verbs, have little to no characteristics of good prompts (Table 2), AI answer does not correspond accurately with prompts – is off-topic.	Somewhat vague, questions/prompts are somewhat unclear, are poorly worded, many grammar and spelling errors, have a few characteristics of good prompts (Table 2), there is weak correspondence with AI answer.	Contain some subjective/vague terms, some grammar/spelling errors, some improvement required in clarity of questions/prompts, have some characteristics of good prompts (Table 2), there is some correspondence with AI answer.	Not vague, well-posed and clearly worded, few grammar/spelling errors, have most characteristics of good prompts (Table 2), AI responses mostly align with prompted questions.	Not vague (everyone agrees on what the questions mean), well-posed and clearly worded, almost no grammar and spelling errors, have almost all characteristics of good prompts, AI response addresses every aspect in the prompts – is on-topic.
Question quality/ thinking skills required	Questions are focussed only at the “remember” Bloom’s level, no effort required in thinking about the answer, no depth to the question.	Broader range of questions that include up to Bloom’s level of “understanding”, developing towards depth and thinking level described in level 5.	Broader range of questions that include up to Bloom’s level of “apply”, developing towards depth and thinking level described in level 5.	Broader range of questions that include up to Bloom’s level of “analyse”, developing towards depth and thinking level described in level 5.	Broad range of questions that include up to Bloom’s level of “evaluate”, questions could not be answered with simple recollection of information, questions have depth that forces you to think about the answer.
Originality of student-posed question(s)	Copy and paste out of the textbook with few changes, AI can provide clear answers that are easily verifiable as it does not require individual creativity or intellectual exploration to respond.	Similar to questions from the textbook, with only some values/concepts changed, AI provides clear and easily verifiable answers to most parts of the questions.	Somewhat like textbook questions, with most concepts/values changed or unique parts/sub-questions added, AI provides a mixture of vague and easily verifiable answers as it starts to struggle to copy human independent thought.	Most of the questions are not like anything found in the book, online or in other resources, is somewhat unique, AI provides some vague answers as it struggles with the nuances of some parts of the questions.	Not similar at all to anything found in the book, online or in other resources, is unique and interesting, you found you learnt something new from it, AI provides mostly vague answers that only you as human can clarify using individual creativity and independent thought.
Relevance and integration	It is evident from the questions and critical evaluation of the memos that most prescribed readings were not done, includes few or no aspects of characteristics, properties and applications of the relevant material, no aspects included from other themes/chapters.	It is not clear from the questions and critical evaluation of the memo that all prescribed readings were completed, question combines only 1 to 2 aspects of characteristics, properties and applications of the relevant material, no aspects included from other themes/chapters.	It is clear from the questions and critical evaluation of the memo that some of the prescribed readings were completed, question combines most aspects of characteristics, properties and applications of the relevant material, questions/critique include few aspects to other themes/chapters of the book.	It is evident from the questions and critical evaluation of the memo that most prescribed readings were completed, the question combines aspects of characteristics, properties and applications of the relevant material, questions/critique include aspects from other themes/chapters of the book (such as Ch 8 Failure).	It is evident from the questions and critical evaluation of the memo that all prescribed readings were completed, the question combines aspects of characteristics, properties and applications of the relevant material, questions/critique include aspects outside of the textbook (eg. practicals, online resources, etc.).
Critical evaluation of AI chatbot response	Evaluation fails to pinpoint AI answers that are mostly wrong, few to no arguments or evidence presented, lack of references to the textbook*, no supporting figures/tables are used, marks totalling to 20 are not identified clearly/at all.	Evaluation is mostly correct with some errors, yet evidence or arguments are somewhat lacking, some references to the textbook* are given but are poorly formatted/missing, figures/tables are not completely clear or are irrelevant, marks totalling to 20 are identified but are not properly allocated (giving marks to something that is not examinable – eg. mark for defining theory of relativity in a MatSci course).	Evaluation is mostly correct with few errors, evidence or arguments not completely correct or clear, most references are from the textbook* and are given with few formatting errors, figures/tables are somewhat clear and relevant, marks totalling to 20 are clearly identified and mostly properly allocated.	Evaluation is mostly correct, arguments or evidence are mostly clear and complete, all references are given with very few formatting errors, some other references (journal articles, other books, etc.) are used in addition to the textbook*, figures/tables are clear and relevant in bolstering evaluation, marks totalling to 20 are clearly identified and properly allocated.	Evaluation is completely correct, arguments and evidence are clearly presented and easy to follow, all references and formatting is correct, a variety of reference sources are used in addition to the textbook*, a mixture of relevant and clear figures and tables are used to substantiate arguments, marks totalling to 20 are clearly identified and properly allocated.

\*Be clear on what edition of the textbook you are using in your reference list. Provide section headings to make it easier for peers to cross-reference with their own editions.