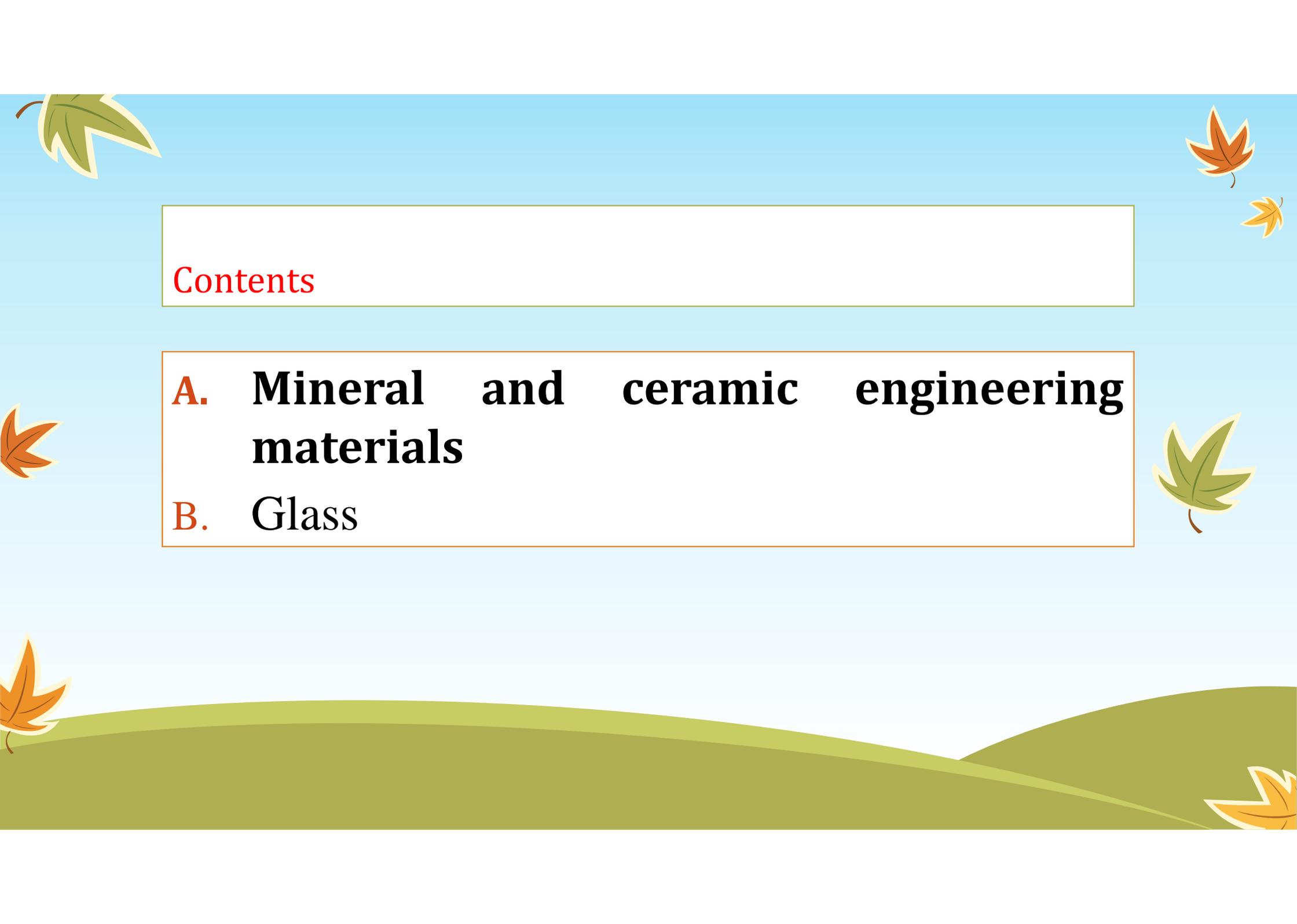




Technical English  
Unit 15  
professional English  
**Minerals and ceramics**

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المرزجة	vitrified
مصهور	molten
مزاج	tempered
مصفح	laminated
تحطم	<b>shatter</b>

## A. Mineral and ceramic engineering materials

A **mineral** is a natural, **inorganic** material (one that is not living) which is found in the ground, often within rocks. Minerals are quite pure. Rocks, on the other hand, can be mixtures of several minerals, and may also contain previously **organic** material. Examples of minerals include different types of ore- from which metal can be extracted- such as iron **ore**. Non-metallic minerals include:

- **diamond**, an extremely hard form of **carbon** (C), which is used as an **abrasive** (very hard and rough) material in cutting tools- frequently referred to as **industrial diamond** when used in engineering



Clay bricks

- **silicon** (Si), found in sand as **silica** (silicon dioxide-  $\text{SiO}_2$ ), which can be heated to high temperatures to make glass.
- Generally, inorganic, non-metallic materials that have been formed by heating are called **ceramics**. Glass is therefore a ceramic. When materials are heated to extremely high temperatures to form ceramics that are **glasslike** - that is, with a structure like that of glass - we say that they are **vitrified**.
- **Ceramic** materials are used to make construction materials such as **bricks**. These are made from **clay**, and are then **fired** in **a kiln**- that is, heated to a high temperature in an industrial oven. Clay can also be vitrified - for example, to make waterproof pipes

## B Glass

- A technical adviser for a glass manufacturer is giving a briefing to a group of engineers at a trade fair.
- '**Sheets** of glass, which are obviously flat and thin, are called **float glass**. This refers to the manufacturing technique where molten glass is floated on molten tin, to produce flat sheets. Usually, after float glass has been formed, it's **annealed** - it's left to cool slowly. But if it's left in this state, and the glass later gets broken, it breaks into dangerous, sharp pieces. So for most engineering and architectural uses, **annealed glass** is unsuitable. We need to use what we call **safety glass**.'
- 'One type of safety glass is **toughened glass**, also called **tempered glass**. As the term suggests, the glass is tempered - it's heated and kept hot for a certain time, to change its structure.'

- Then if tempered glass is broken, it **shatters** - it breaks into tiny pieces. These are a lot safer than the long, sharp pieces produced when annealed glass breaks. The disadvantage of toughened glass is that it can't withstand impacts from small objects, such as flying stones. So, for instance, that makes it unsuitable for vehicle **windcreens**. So in cases where impacts are a problem, another type of safety glass - **laminated** glass- is generally used. This is made by **laminating** glass **with** a polymer- in other words, making a glass and polymer 'sandwich', with a sheet of polymer in the middle and sheets of glass at either side. The advantage of having a laminated material is not just that it's very strong. The **layers** of glass are **bonded** to a layer of polymer- they're stuck to the polymer- so if the glass does break, the broken pieces are held together, and don't fly.'





BrE: windscreen; AmE: windshield

**15.1** Decide whether the sentences below are true or false. Then, change one word in each of the false sentences to correct them.

1. Minerals are organic.
2. Minerals can be found in rocks.
3. Silica is a compound containing silicon.
4. Minerals can be metallic or non-metallic.
5. Industrial diamond is an abrasive, metallic mineral.
6. In order to become ceramics, materials must be heated/fired. (Only glass-like ceramics are vitrified.)
7. Clay can be fired

1 false – Minerals are inorganic.

2 true

3 true

4 true

5 false – Industrial diamond is an abrasive, non-metallic material.

6 false – In order to become ceramics, materials must be heated/fired. (Only glass-like ceramics are vitrified.)

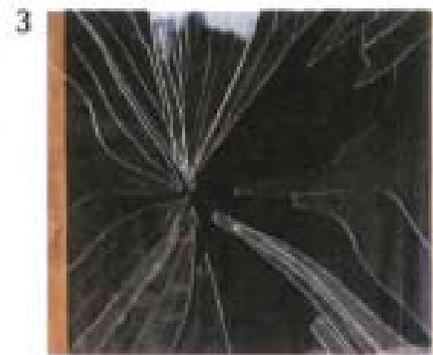
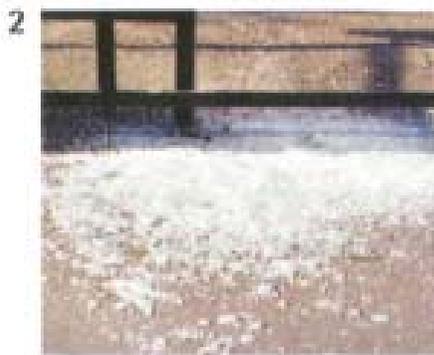
7 true

**15.2** Use the words and expressions in the box to describe each photo. You will need to use some words more than once.

annealed glass  
tempered glass

laminated glass  
toughened glass

safety glass  
windscreen



**15.2** 1 laminated glass, safety glass, windscreen  
2 safety glass, tempered glass, toughened glass  
3 annealed glass

### 15.3 Complete the article about bulletproof glass from a science and technology magazine, using words from B opposite. Sometimes, more than one word is possible.

'Bulletproof' is a loosely used word, suggesting something is totally unbreakable. But technically speaking, how accurate is the term 'bulletproof glass'? Outside of Hollywood movies, can glass really stop bullets? The answer is, not on its own. But if several (1) ..... of glass are sandwiched with a high-strength polymer to form (2) ..... glass, a bullet-resistant, if not completely bulletproof, barrier can be obtained.

The technique of sandwiching polymer and glass is nothing unusual. Car windscreens are made by (3) ..... glass to a polymer, such as polyvinyl butyral (PVB), to form a type of safety glass. Unlike the other main type of safety glass – (4) ..... glass – laminated glass remains intact on breaking. If a stone hits a windscreen, even though a small section of the glass on the outside may crack, the polymer behind it will stop the stone, and also ensure the entire piece of glass doesn't (5) ..... Bullet-resistant glass uses the same principle, but must be much tougher. A stronger polymer is therefore used – often polycarbonate – as well as a greater number of (6) ..... of glass and polymer.

15.3 1 layers/sheets  
2 laminated

3 bonding  
4 toughened/tempered

5 shatter  
6 layers/sheets



## HW 15



Think about the different ceramics and minerals used in your industry, or in an industry you're familiar with. What types of material are used, and why?