Paper & cardboard
Exam expectations

Knowledge about materials is always tested in the written paper. You are expected to know about paper/card and at least one other material area.
Know about paper/card

- Where it comes from
- How it is made
- How products are cut from paper/card
Materials and components

• In what stock sizes and forms is paper/board supplied?
• Is it a renewable/non-renewable material?
• How are papers and cardboards classified (grouped)?
• What properties do different papers/boards have?
• What are components and why are they used?
• What are combined materials?
Standard stock forms

Most materials are supplied in standard stock forms. When specifying paper and cardboard you would choose the size (A1, A2, A3, A4 etc.) then you would choose the weight (grams per square metre). It is usually best to use standard stock forms:

- The printing industry need consistent sizes and qualities
- Makes it cheaper to buy in this form
- Non-standard can greatly increase the costs
Paper

- Paper is a web-like material made from very fine vegetable fibres.
- These fibres usually come from wood pulp although sometimes plants such as flax and hemp are used.
- The fibres are made of cellulose and they stick to each other to form a strong web.
- Recycled fibres are often mixed with new or “virgin” materials.
Making Paper

Papermaking has been around for 2,000 years although it is now highly automated.

1. Trees cut & shredded
2. Water added
3. Boiled up to make wood pulp
4. Chemicals and dyes added
5. Pulp poured over fine mesh and squeezed between rollers
Fibres

• When plants are used to make paper, it is usually necessary to use a special chemical process to break down the lignin found inside the cell walls of the plant.

• Generally, this is done with the Kraft process. If the fibers used to make the paper are recycled, it is not necessary to undergo this process because the lignin has already been removed.

• If the lignin is not removed from the pulp, the resulting paper will turn yellow when it is exposed to light and air.
There are two ways to break down the pulp used to make paper: mechanically and chemically.

When it is broken down mechanically, the resulting pulp is known as "ground wood pulp".

This process does not require chemicals, but the lignin is not removed.

This results in a relatively high yield of pulp, but the paper does turn yellow as it ages.

This type of paper is generally used for newspapers and other non-permanent types of paper.
Chemical pulp

• Chemically broken down pulp is called "chemical pulp."
• The primary reason to break the pulp down in this manner is to remove the lignin by breaking it down and making it soluble.
• Removing the lignin also helps break down the wood chips to prepare them for the next step in the paper making process.
• It is not necessary to pulp recycled fibers in either of these two ways because they have already been treated before. Therefore, a gentler process is utilised.
Additives

• Wood pulp tends to produce a pale grey material
• After the extraction of the fibers, they are dyed or bleached if necessary and any additional ingredients are added to change the appearance of the paper.
• Products such as Kaolin, for example, are sometimes added to make the paper look glossy for use in items such as magazines.
Sheet formation

• The next step is sheet formation.
• At this stage in the process, the pulp mixture is diluted some more with water.
• This is then strained through a moving screen made of fine mesh in order to create a fibrous web.
• At this time, a watermark may be impressed into the paper if desired.
• Then, the moving web of pulp is pressed and allowed to dry.
• Pressure may be applied to help squeeze out the water.
Sheet formation

• The resulting paper sheet can be removed from the mesh screen mould while it is still wet or it may be removed after it is completely dry in order to undergo additional processing.
• With most paper, it undergoes the Fourdrinier process in order to form a web of fibers or a reel in a thin sheet.
• Once try, the sheet can be cut to size.
The final stage of the paper making process is drying, which is accomplished with time and pressing of the paper. The exact method for drying depends on the overall process used to make the paper.

When pressing is used, the excess water is removed by force. Once forced out, an absorbent material is used to collect the water. Felt, which is not the same as the typical felt used in crafts and other projects, is usually used on paper machines to accomplish this task.

When paper is made by hand, a blotter sheet is used to absorb excess water.
Drying

- Air and heat are also used to remove the water.
- In the early years, this was accomplished by hanging the paper sheets out like laundry.
- Today, heated drying mechanisms are usually used, with the most common being the steam-heated can dryer.
- These dryers are capable of reaching over 200 degree Fahrenheit and can dry paper to less than 6% moisture.
Board

- Described in weight \((\text{gm}^2)\) and often in thickness (microns)
- Over 200\(\text{gm}^2\) is called board
- A sizes (A0, A1 etc.) are still most common although larger sizes are regularly used
- Heavier boards are laminated from layers
- Often made into a combined material using other materials such as aluminium foil
Paper & cardboard

Common paper/board materials:

• Layout & tracing
• Cartridge
• Cardboard
• Solid white board
• Duplex board
• Foil lined board
• Corrugated board
Cutting card nets

I Cut – Die Cut

Die-cutting

(creasing done with rounded blade)
Die cutting

• In the packaging industry these are called cutting formes
• Usually, the blade is fitted into a flat plywood sheet
• For very large scale production these blades can be made to fit a roller
CNC Cutting & creasing

- Used for sampling and very small batches
- Around 2,000 packages could be made
- Slow but saves making cutting forme and setting up automated folding and gluing