






GCSE Design & Technology: Graphic Products

The 5 Stages of the Design Process

The Design Process can be broken down into 5 simple stages. Each stage can be carried out in a number of ways, which are highlighted below.

The Design Process	
	<p><u>Investigation (Research):-</u></p> <ul style="list-style-type: none"> • Analysing and Understanding the Design Brief • Target Audience Questionnaires to identify their needs • Researching Existing Products • Researching Materials • Researching Manufacturing Methods
	<p><u>Development (Designing):-</u></p> <ul style="list-style-type: none"> • Write a Specification • Quick Sketches • Development of preferred idea • CAD – 2D & 3D • Models • Final Presentation
	<p><u>Planning:-</u></p> <ul style="list-style-type: none"> • Gantt Chart • Flow Chart • Selecting Tools and Materials • Working out Costs • Considering Quality Control and Health & Safety
	<p><u>Manufacturing (Making):-</u></p> <ul style="list-style-type: none"> • Gather and Prepare your Materials and required Tools/Equipment • Manufacture your Outcome • Check sizes, fit etc. for quality • Apply Finishes to your parts/components • Assemble using the correct techniques
	<p><u>Evaluating:-</u></p> <ul style="list-style-type: none"> • Compare your Outcome against your Specification • Detailed reasons why your outcome has/has not met the points • Seek the opinions of your Target Audience • Seek the opinions of Experts • Use the above feedback to suggest ways to improve your Final Design and/or Manufacturing

Investigation (Research)

The first stage of the Design Process is often considered to be the most important because it is where you gather the information you need in order to design and make a successful product. If you do not know who your product is aimed at and how you can compete with existing products then you are likely to fail.

This booklet focusses on the different ways in which you can carry out your Investigation and why each way is suited to different situations.

Design Brief

To the right is an example of a Design Brief which would be used in GCSE Graphic Products.


A Design Brief is a statement of what you intend to do in order to solve/overcome a problem (Situation).

Once you have read the Design Brief you must go back and underline or highlight the key words/phrases in order to fully understand the requirements. (See right).



Identifying the Target Audience

You need to ask various questions to find out who the Target Audience is for a specific product.

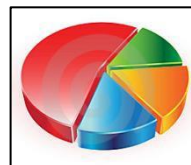
Target Audience	
	<p><u>Target Audience (Target Market):-</u></p> <ul style="list-style-type: none"> • Use Questionnaires to find out who uses a product, why, where, how often etc. • Find out if different styles are used for different Ages, Groups, Religions etc. • Record your results using Bar Charts, Tally Charts or Pie Charts • Analyse your findings to find patterns, trends, similarities, differences etc.



Bar Chart

Method of Travel	Tally	Frequency
Walk		4
Bike		3
Car		4
Bus		4
TOTAL		15

Tally Chart









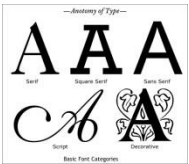
Pie Chart

Analysing Existing Products

Product Analysis is about looking at a product and thinking about the design features to see why it is suitable for the intended audience as well as looking at how it was made.

Use the tables below to help you when analysing existing packaging products and existing logos.








Product Analysis (Packaging)	
	<p><u>Function:-</u></p> <ul style="list-style-type: none"> • What does it do / What is it's job? (Promote, Protect, Preserve) • How does it do it's job? • Use Spider Diagrams or Bullet Points to help think about these things
	<p><u>Cost:-</u></p> <ul style="list-style-type: none"> • Compare prices between a number of similar products • How much per item? • How much when bought in bulk?
	<p><u>Target Audience:-</u></p> <ul style="list-style-type: none"> • Who is it aimed at? How can you tell? • What makes it suitable / appropriate? • Could it be improved?
	<p><u>Ergonomics:-</u></p> <ul style="list-style-type: none"> • Is it easy to hold or use? • Does it open and close easily? • Are parts supposed to be removed? Is this easy to do?

Logo Analysis	
	<p><u>Colours:-</u></p> <ul style="list-style-type: none"> • What colours are used? • What do they mean or represent? • How many colours are used? Does this affect the logo design?
	<p><u>Images:-</u></p> <ul style="list-style-type: none"> • Are the images related or linked to the nature of the company? • Is the image simple or detailed? • Why was this image used? (Target Audience, Message, Eye-catching)
	<p><u>Typography:-</u></p> <ul style="list-style-type: none"> • What style of font is used? Why? • Does it reflect the nature of the business or product being sold? • Is it easy to read (legible) or difficult to read (illegible)?

Materials

You will need to learn and understand a range of materials, which are very different to those covered in Key Stage 3.

Material knowledge is important when carrying out a Product Analysis as well as when designing and making your own products.

Units of Measurement	
	<p><u>Units of Measurement:-</u></p> <ul style="list-style-type: none"> • Microns – The thickness of paper/card • gsm (grammes per square metre) – The weight of paper/card • A2, A3, A4, A5 – The most commonly sold sizes of paper/card
Paper & Card	
	<p><u>Tracing Paper:-</u></p> <ul style="list-style-type: none"> • Translucent • Very lightweight • Used for tracing drawings and sketches
	<p><u>Folding Box Board:-</u></p> <ul style="list-style-type: none"> • Stiff but can be easily scored and folded • Slightly yellow in colour • Used for packaging for beauty products or food
	<p><u>Foil Lined Board:-</u></p> <ul style="list-style-type: none"> • Good quality card board with a foil lining • Insulates heat • Used for food trays and ready made meals
	<p><u>Corrugated Card:-</u></p> <ul style="list-style-type: none"> • Strong due to inner triangular layer • Usually free of design/printing • Used for packaging for large electrical items such as TVs
	<p><u>White Lined Chip Board:-</u></p> <ul style="list-style-type: none"> • Made from waste paper • Grey on one side with 2-3 layers of white bleach coating on the other • Used for packaging for frozen foods and cereals
	<p><u>Layout Paper:-</u></p> <ul style="list-style-type: none"> • Strong, heavyweight, smooth • Quite transparent • Used for preparing advertising layouts

Materials

Paper & Card



Mounting Board:-

- Stiff, quite thick cardboard
- Used as supporting backgrounds for thinner printed products
- Can be used as framing for photos before placing behind the glass



Cartridge Paper:-

- Usually 100 – 135gsm
- Good quality
- Used for general drawing with pens, felts, pencils etc.



Recycled Paper:-

- Lower density than normal paper
- Fibres get stiffer when recycled
- For basic drawing and printing



Copier Paper:-

- Lightweight and thin compared to cartridge paper (80 – 90 gsm)
- Quite transparent
- Used mainly for photocopying

Finishes



Thermo-chromic Ink:-

- Starts out as one colour
- Changes colour when heat is applied
- Returns to original colour upon cooling



Photo-chromic Ink:-

- Starts out as one colour
- Changes colour when light levels change (light to dark)
- Returns to original colour when light levels return to normal



Laminating:-

- Thin plastic coating (with adhesive) and is applied through heat
- Gives a smooth, shiny finish
- Used on the covers of books to protect from spills / add strength



Gloss:-

- When high levels of light is spread across a surface
- Used in paints and photo prints

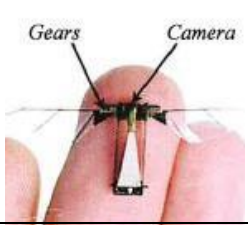
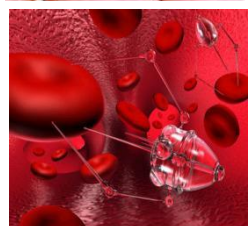



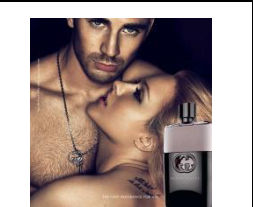

Matt:-

- When low levels of light is spread over a surface
- Used in paints and photo prints

Modern Materials

Modern materials are more sophisticated than traditional materials because they are able to do things or are made in such ways that have only become possible through new technologies.

When analysing products it is important to be able to recognise when modern materials have been used and what their function/purpose is.

Modern Materials				
	<p><u>Micro-Technology:-</u></p> <ul style="list-style-type: none"> • Components are manufactured on a tiny scale • Uses include gears, circuits, cameras • Used in tiny motors, resistors, pumps 			
	<p><u>Nano-Technology:-</u></p> <ul style="list-style-type: none"> • Components and products are controlled and operate on a molecular scale and can be used to target individual blood cells • Microscopes required to see them • Uses include flavouring, medicines, imaging 			
<p><u>Micro-Encapsulation:-</u></p> <ul style="list-style-type: none"> • When tiny particles are surrounded by a thin coating • The particles are then released in different ways • Uses include 'scratch-and-sniff', slow release patches, tamper indicator, scented fragrance inserts, pressure sensitive copy paper <p>(See images below)</p>				
				

Encapsulating

Please note that the process shown to the left is NOT Laminating. It is called **Encapsulating**.

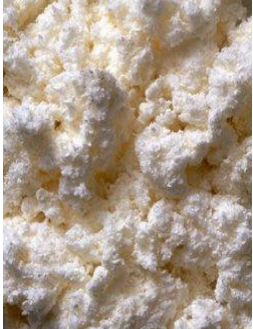
As shown on the previous page, Laminating is when a thin, shiny, clear layer of plastic is applied to one surface through heat and an adhesive.

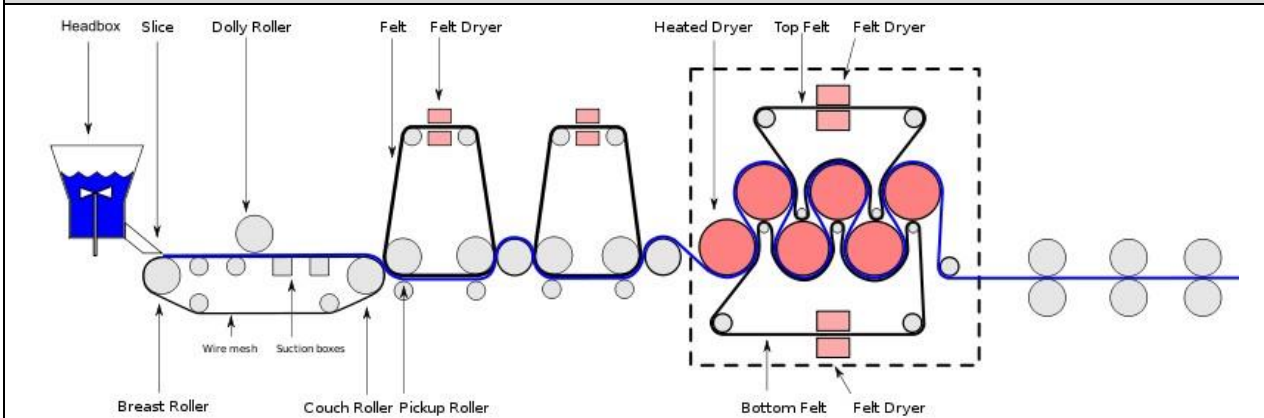
Encapsulating is when the page is completely enclosed in a plastic wallet so that all sides and edges are covered.



How Paper and Card is Made




You will need to know how paper and card is manufactured. During the manufacturing stage, certain things can be changed to have an impact on the final product. E.g. Thickness, Colour etc.

Wood Pulp		
	<p><u>Mechanical Wood Pulp:-</u></p> <ul style="list-style-type: none"> Wood Chips are ground up and mixed with water Steam can be added to reduce the damage done to the fibres Used for products which require less strength E.g. Newspapers and paper boards 	<p><u>Chemical Wood Pulp:-</u></p> <ul style="list-style-type: none"> Wood Chips are ground up and mixed with water and chemicals Chemicals are added to add strength and to change colour Used for stronger products E.g. Books and Food Cartons

The Fourdrinier Machine			
			
Wet End	Wet Press Section	Dryer Section	Calender Section
<p><u>Wet End:-</u></p> <ul style="list-style-type: none"> Wood Chips are ground up and mixed with water to create a slurry The pulp is combined with fillers and colours Forms a wet web of fibre 	<p><u>Wet Press Section:-</u></p> <ul style="list-style-type: none"> Water is removed from the pulp by squeezing the mixture through rollers Some water is also removed through a vacuum This begins to smooth /flatten the pulp 	<p><u>Dryer Section:-</u></p> <ul style="list-style-type: none"> Steam heated rollers reduce the remaining water content from approx. 65% to 5% Glues, starch and resins are added here to make the paper more water resistant 	<p><u>Calender Section:-</u></p> <ul style="list-style-type: none"> Rollers are used for further smoothing of the material A uniform thickness is achieved The pressure placed on the rollers determine the thickness of the material

Scale of Manufacture

In Industry, products are made using the most appropriate scale of manufacture. The scale used depends on the requirements, for example consumer demand, cost of production, quantity required.

Scale of Manufacture	
	<p><u>One-Off Production:-</u></p> <ul style="list-style-type: none"> • When only one product is made at a time • Usually very expensive and requires specialist/expert workers • Usually takes a long time • Examples include bridges, aeroplanes, bespoke homes
	<p><u>Batch Production:-</u></p> <ul style="list-style-type: none"> • When products are made in groups E.g. 10s, 100s, 1000s • Is often be used for 'fad' products E.g. Mobile Phones, Calendars • Fairly cheap way of manufacturing • Can be made to order, which helps stores avoid over-stock
	<p><u>Mass (Continuous) Production:-</u></p> <ul style="list-style-type: none"> • When products are made on a 24 hour basis (non-stop) • Involves an assembly line, which saves time and lowers costs • Workers are employed on a shift basis to keep production going • Examples include pens, car parts, yoghurt pots

Production Lines

When making graphic products, there are usually three main stages completed in order to produce the desired outcome.

You will need to know what is meant by each stage and examples of what takes place at each stage.

The 3 Stages

Pre-Press:-

Everything which takes place before printing begins

On-Press:-

The printing method / equipment being used

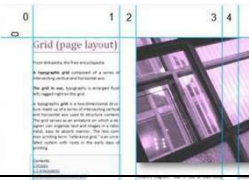



Finishing:-

Things which are done to the printed product to complete the process



Pre-Press Operations

There are a number of things that can be done before printing takes place, depending on what the intended outcome is. For example, is the product going to remain flat? Or is it going to be folded or joined?

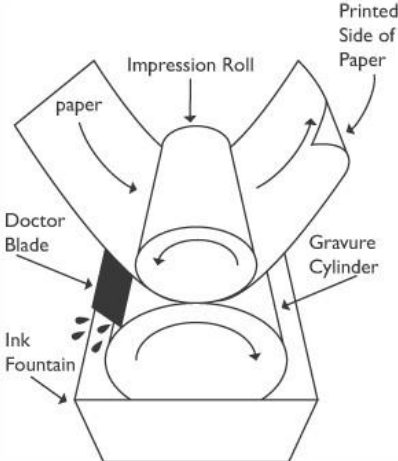
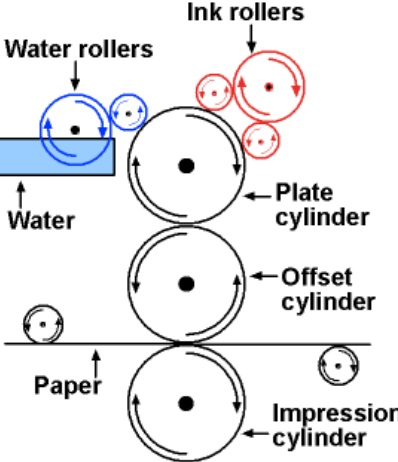
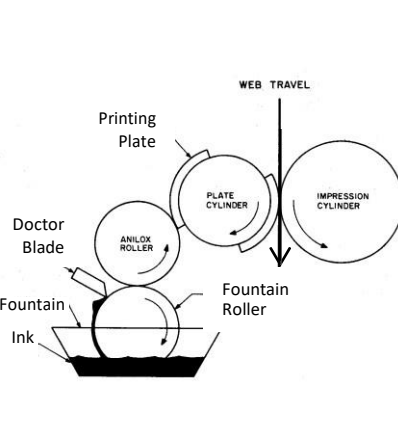
Pre-Press Operations	
	<p><u>Grids:-</u></p> <ul style="list-style-type: none"> • Used to set the sizes of margins, titles, columns, rows, spaces etc. • Commonly used when designing websites, newspapers, magazines etc. • Gives printed products a professional look • Do not appear on the printed documents / designs
	<p><u>Imposition:-</u></p> <ul style="list-style-type: none"> • When more than one page is printed at a time • Pages are not in the correct order when printed • When folded and bound, the pages will be in the correct order • Used when printing brochures, instruction booklets etc.
	<p><u>Layout:-</u></p> <ul style="list-style-type: none"> • Planning where your titles, pictures, columns etc. are to be placed • Deciding the colour schemes and typefaces to use • Setting up your bleed area • Used with grids when planning the layout of magazine pages etc.
	<p><u>Colour Separation:-</u></p> <ul style="list-style-type: none"> • When you separate a colourful image into the CMYK colours • Each colour is printed one at a time until the image is created • Colours are not applied at the same time • In electrical items you would end up with RGB colours

Test Yourself

- (1) What are the 5 main stages of the Design Process?
- (2) Give at least 2 examples of activities which can take place in each of the stages.
- (3) When analysing packaging products, why is it important to consider the Ergonomics?
- (4) What is the difference between a font being 'easy to read' and being 'legible'?
- (5) Explain what gsm means.
- (6) Why do manufacturers use White Lined Chipboard to make things like cereal boxes?
- (7) Name two types of Smart or Modern materials and describe what they do/used for.
- (8) What is the difference between 'Encapsulating' and 'Laminating'?
- (9) How do 'Scratch and Sniff' stickers/labels work?
- (10) What machine is used to manufacture paper/card?
- (11) What happens at the Calendar Section of the above machine?
- (12) What are the three stages of a production line when making Graphic Products?
- (13) Describe what takes place during Colour Separation.

On-Press Operations

On-Press Operations are concerned with the type of printing method being used to create the product. The method used depends on the quality required in the finished product and the type of material being printed onto.

On-Press Operations	
	<p style="text-align: right;">★★★★★</p> <p><u>Gravure (Rotogravure):-</u></p> <ul style="list-style-type: none"> • Used to make very high quality products such as stamps and expensive packaging • Ink fills the gaps in the Gravure Cylinder and the excess ink is removed by the Doctor Blade • The Impression Roll presses the material onto the Gravure Cylinder for the ink to be applied • The detailed Gravure Cylinder is made from copper rather than aluminium, which makes it more durable and much more expensive than Lithography. This is why it is used on large production runs
	<p style="text-align: right;">★★★★★</p> <p><u>Lithography (Offset):-</u></p> <ul style="list-style-type: none"> • Runs on the principle that oil and water don't mix • The water and oily ink is applied to the Plate Cylinder • There is one Plate Cylinder for each of the CMYK colours • The Plate Cylinder is a negative of the final image • The ink is applied to the Offset Cylinder, which in turn applies the ink to the material, which is being pushed up by the Impression Cylinder • Used to make high quality products such as magazines, posters, cereal boxes • Not as high quality as Gravure (because the Plate Cylinder here is made from rubber or aluminium)
	<p style="text-align: right;">★★★</p> <p><u>Flexography:-</u></p> <ul style="list-style-type: none"> • Similar to Lithography but not as good quality and cheaper to run • Ink is applied in separate colours (CMYK) • Ink is applied to the Fountain Roller, which is then passed onto the Anilox Roll (Metre Roll) • The Plate Cylinder (negative of image) and the Impression Cylinder push together to apply the ink to the material • Sometimes a Doctor Blade is used to remove excess ink • Used when printing onto flexible materials rather than flat, rigid materials E.g. Carrier Bags, Yoghurt Pot Lids

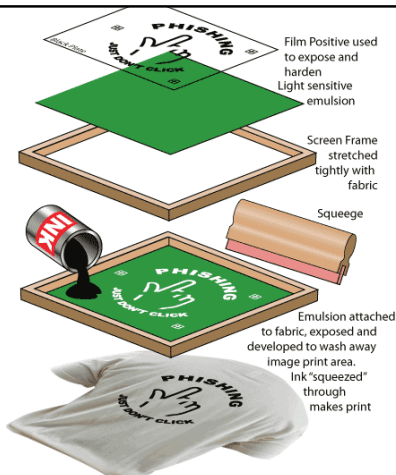
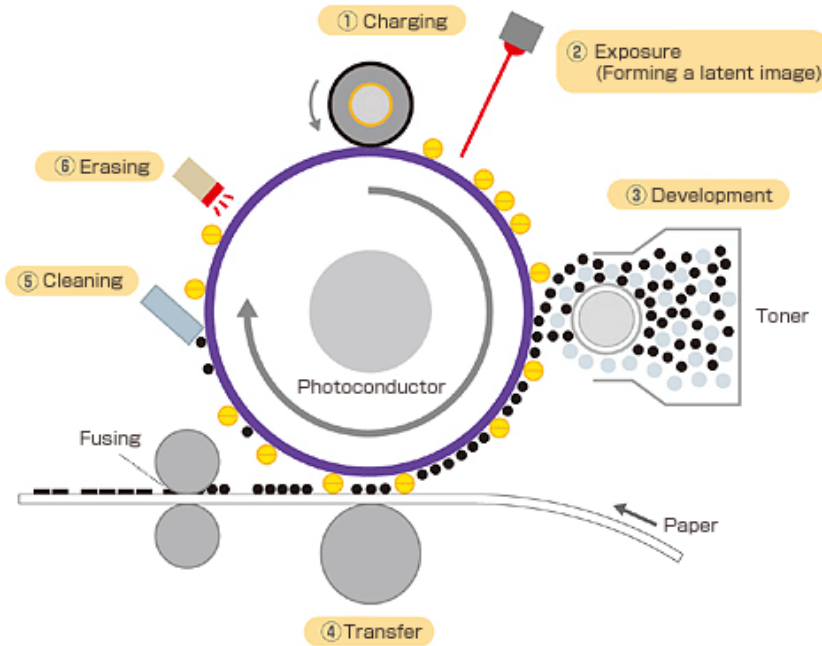
On-Press Operations

On-Press Operations

Xerography:-



- Used for low/medium quality prints or copies
1. An electric charge is applied to the drum
 2. The scanned document is projected over the drum surface
 3. A mix of toner and carrier particles are added, which charge the drum. This causes the toner to 'stick' to the drum
 4. The Transfer Cylinder is oppositely charged which causes the toner to pull onto the material
 5. Excess toner is removed by a brush or vacuum
 6. Any remaining charge on the drum is erased through light



Screen Printing:-


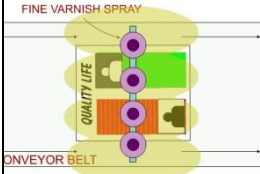
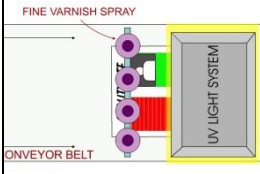





- Used when printing simple shapes with little or no detail
- Ink is forced through a stencil, which has holes in the pattern of the shape being printed
- A nylon mesh holds the stencil in place and helps give a smoother finish
- Can be used to print onto rough or uneven surfaces, which cannot be passed through a printer
- The stencil can be made from paper or card
- Used to print onto surfaces such as T-Shirts, Remote Controls, a PC Mouse

Finishing Operations



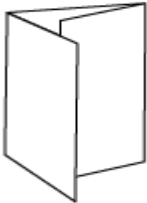
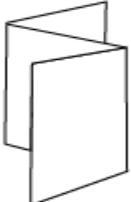
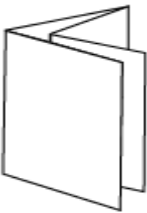
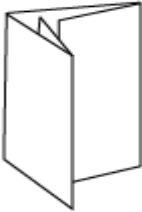
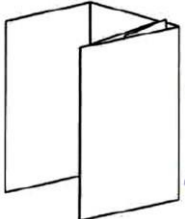
Once a document or product has been printed, there are still a number of options, which you can carry out in order to 'finish' the product off.

For example you can apply different coatings to achieve various textures or shine. You can also, score, fold, cut and bind products to create booklets etc.

Finishing Operations	
	<p><u>Die Cutters:-</u></p> <ul style="list-style-type: none"> • A plate with metal blades is pressed into a sponge or plastic base • The material between the plate and the base is then cut and/or scored • Very cheap and used to make many exact copies of the same thing
	<p><u>Spirit Varnishing:-</u></p> <ul style="list-style-type: none"> • A fine layer of varnish is sprayed over the surface of the printed document • Varnish types include Shellac, Lacquer and Resin • Used on menus etc. to give a shiny, smooth finish (and protection)
	<p><u>UV (Ultra Violet) Varnishing:-</u></p> <ul style="list-style-type: none"> • When UV light is applied immediately after Spirit Varnishing to dry the varnish much more quickly, therefore leaving a thicker layer • This improves the quality and is more expensive • Used on high quality books and posters
	<p><u>Cropping:-</u></p> <ul style="list-style-type: none"> • Usually takes place on Photoshop or PhotoPlus • Involves removing the area around part of an image, which you do not want to see • Done to improve neatness or make something look bigger
	<p><u>Embossing:-</u></p> <ul style="list-style-type: none"> • When part of a surface is raised, giving a 3D effect • It is achieved by stamping into the back of a piece of card or paper • Can give higher quality appearance
	<p><u>Debossing:-</u></p> <ul style="list-style-type: none"> • The opposite to embossing • The design is below the surface, not raised • It is achieved by stamping into the front of the card or paper





Types of Folds

Depending on the type of product you are making, you may need to fold the printed document. There are a number of folds, which you will need to be able to recognise and create.

Folds	
	<p><u>Simple Fold:-</u></p> <ul style="list-style-type: none"> • Commonly used in Birthday Cards, Christmas Cards etc.
	<p><u>Short Fold:-</u></p> <ul style="list-style-type: none"> • Sometimes used in novelty cards (less traditional Birthday Cards)
	<p><u>Barrel Fold:-</u></p> <ul style="list-style-type: none"> • Used in promotional material
	<p><u>Accordion Fold (Z-Fold):-</u></p> <ul style="list-style-type: none"> • Used commonly when making maps
	<p><u>Parallel Fold:-</u></p> <ul style="list-style-type: none"> • Used on products where a landscape view is important
	<p><u>Gate Fold:-</u></p> <ul style="list-style-type: none"> • Used in promotional material
	<p><u>Complex Barrel Fold:-</u></p> <ul style="list-style-type: none"> • Used in promotional material

Types of Binding Methods

When putting a document together you will need to bind the pages in some way to stop them from coming apart. The method you use could depend on the quality of the finished product or the number of pages you have in your document.

Binding Methods	
	<p><u>Thermal Binding:-</u></p> <ul style="list-style-type: none"> • Provides a sturdy binding and is neat with or without covers • An adhesive bonds the plastic spine to the pages through heating • The heating device takes time to warm up • Used mainly on books or important documents
	<p><u>Perfect Binding:-</u></p> <ul style="list-style-type: none"> • The edges of the folded pages are glued to the cover • No need for sewing but glue is used so could be messy • Not the most reliable method of binding • Used on cheap books or manuals
	<p><u>Coil Binding (Spiral Binding):-</u></p> <ul style="list-style-type: none"> • Holes are punched into the pages and the coil is fed through them • Good for binding large documents • Pages can be moved and/or replaced easily • Used commonly in calendars or phone books
	<p><u>Comb Binding:-</u></p> <ul style="list-style-type: none"> • Square holes are punched into the pages using the binding machine • Plastic comb is fed in quickly and easily (much quicker than Thermal) • Can bind up to 450 pages • Used commonly on large notebooks or manuals

Test Yourself

- (1) Gravure (Rotogravure) gives a higher quality print than Lithography. True or False? (2) Why is Flexography most useful when printing on things such as plastic bags?
- (3) Describe the Plate Cylinder in Lithography printing.
- (4) What does the Doctor Blade do in Rotogravure printing?
- (5) Give two reasons why Rotogravure is a very expensive method of printing.
- (6) What causes the toner to stick to the drum in Xerography printing?
- (7) What is the difference between Spirit Varnishing and UV Varnishing?
- (8) Describe the difference between Embossing and Debossing.
- (9) If you were making a map, which type of fold would you use?
- (10) What two things are needed in order for Thermal Binding to take place?
- (11) It is easy to remove/replace pages when a document has been Coil Bound. True or False?