BrightRED PUBLISHING

CfE HIGHER DESIGN AND MANUFACTURE

BrightRED Study Guide

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CfE HIGHER

DESIGN AND MANUFACTURE

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PROCESS

MOOD BOARDS

A mood board is similar to a lifestyle board in bringing together visual images from a range of sources to act as a stimulus for design. The difference is that a mood board should create an impression or atmosphere which reflects a chosen mood and it is used to help give a product a particular aesthetic.

WHAT IS A MOOD BOARD?

DON'T FORGET

The mood of a product is the feeling or emotion aroused in us when that product is first seen.

A person's mood can be described in many ways and the images and feelings each of us experience as a result of these moods are often different. Therefore, a mood board can be a very personalised thing and may be unique to each individual.

One of the main considerations must therefore be who should produce the mood board. Should it be the designer, the client, the consumer or should it be someone who has nothing at all to do with the product? There may be a case for each producing a mood board then comparing their responses.

MOOD BOARDS AND VISUAL IMAGERY

DON'T FORGET

Mood boards provide a good communication tool for everyone associated with the design process, from the client and consumer through to the design team.

Working with the visual images on a mood board can give a product a particular feel and an aesthetic quality that may otherwise be missing. It is not unusual for some products to appeal to certain people when they are in a particular mood or mindset. This can sometimes lead to impulse buying and consumers responding to **fashions** or **fads**. Many adjectives can be used to describe a mood and a few are listed below to consider:

Happy	Sad	Aggressive	Sexy	Outgoing	Fun
Immature	Relaxed	Confident	Lonely	Stressed	Playful

A mood board can also be a way of visual brainstorming where some of the images evoked by a mood are recorded and then pictures found to illustrate them. In contrast, a lifestyle board is the result of a much more analytical process where a particular market segment is studied and visual images are then collected that reflect their lifestyle.

A mood board has an important role to play in establishing the styling requirements and overall image of a product. Once created, it needs to be studied and the shapes, lines, colours, textures and patterns found in the imagery need to be explored and used to develop the styling and aesthetics of the product being designed. This will increase the likelihood that consumers will subconsciously make their own visual association with the product and be attracted to it.

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and watch the video to find out more about how to create a mood board and how they are used.

Example of a mood board and completed product

A pupil was set the task of designing a product to be sold in a retail shop that sells handmade soap, natural oils and fragrances. She decided to design a make-up mirror which could be sold as an accessory in the shop. The shop has a reputation for using environmentally friendly products and promoting green issues. Clearly this has been reflected both in the mood board and the finished product, both shown on page opposite.

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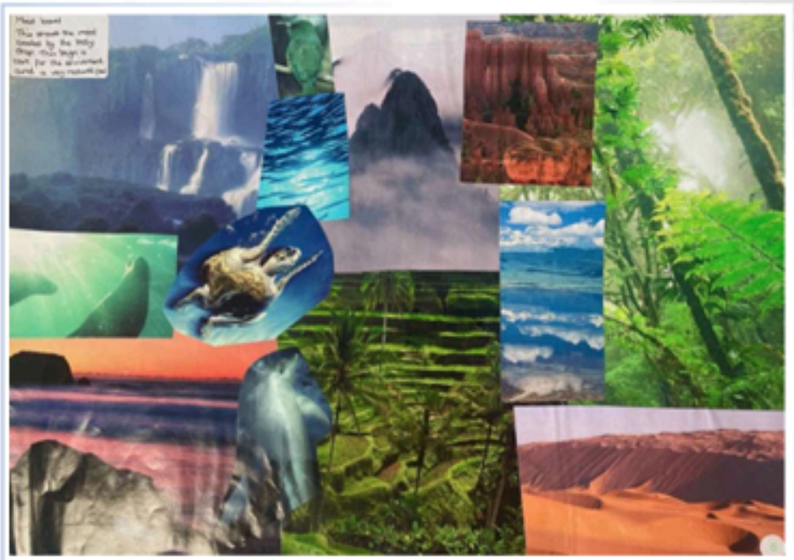

Pupil mood board

FOCUS ON MANUFACTURING

The components of the pupil's mirror prior to assembly are shown below.

Standard components include six wooden beech balls that have been drilled and stained and two circular mirrors. There are several parts made from aluminium that have been turned on the metal lathe then threaded. Both face plates that hold the mirrors have been cast in aluminium then faced off on a metal lathe before threading. The two wooden hemispheres and the cupped holder are made from solid beech wood and turned on a wood lathe. The stone base was reused from an old candle holder and the aluminium insert has been cemented in place.

THINGS TO DO AND THINK ABOUT

1. Explain the difference between a mood board and a lifestyle board.
2. Find an example of a product whose appearance is designed to reflect a mood or feeling.
3. List examples of the types of images that would be included in a mood board.

ONLINE

Go online to the Digital Zone at www.brightredbooks.net/subjects to watch a video and find out more about mood boards.

Designed by Julie Ross, S4

PRINCIPLES

MARKETING STRATEGY

Few products, if any, can be said to appeal to everyone. Most companies now practice **target marketing**, directing their products at one or more groups of consumers. This is called **market segmentation**.

MARKET SEGMENTS

Market segments can be thought of as groups of people who have something in common that will influence their choice of product. There are many ways to define a particular market group, using a variety of factors, but generally they can be grouped into four major categories:

- Geographic, such as countries, regions, cities
- Demographic, such as age, gender, income, education, race
- Psychographic, such as personality, lifestyle, social class
- Behaviouristic, such as purchase frequency, usage, benefits sought, brand loyalty.

Each of these **market segments** can be broken down further and products can be targeted at a much narrower group of people. For example, if we look at age and divide the population into six segments, they may look something like this:

- **5–10 years** - This age group could be classified as **fun/play** years.
- **11–17 years** - These are often **fashion**-driven years.
- **18–25 years** - Most people become **independent.**
- **26–35 years** - Many people are motivated by their **career**.
- **36–55 years** - Often **family** becomes the major priority.
- **56+ years** - This is a time when more **choice** is available.

Some firms often find it useful to divide the population into even smaller segments and the six age bands above can be divided further using other demographic or even behaviouristic factors. This strategy of identifying a specialist segment is called **niche marketing**.

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and watch the video to find out more about what is meant by the term '**branding**'.

NICHE MARKETS

A niche market is a small group of consumers that can be defined in specific terms. The group will normally have very distinctive characteristics which may involve some area of their lifestyle, hobbies or interests.

Consider teenagers attending high school. Generally, people in this age group are motivated by style and appearance and are very image conscious. They may find themselves following clothing trends or buying products that allow them to be easily identified as part of that group. Examples include grunge, skateboarders and goths.

Market segmentation requires the market to be divided into distinct groups of potential consumers. These groups may find certain products inappropriate and may need a different type of the same product. Consider the three cameras on the page opposite. They all take photographic images and therefore can be classed as being of the same **product type**. However, they are aimed at different market groups who have different needs and different lifestyles. Each camera can be said to be **fit for its purpose**.

MARKETING MIX

To enable a well-designed product to compete successfully requires a good marketing strategy. Although the designer may not be directly involved in the selling, advertising or marketing of their product, it is useful for them to have an understanding of what is involved and have the opportunity to contribute.

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Once a target market group has been identified, the company is ready to begin planning the details of the **marketing mix**. The marketing mix consists of everything that can be done to influence the demand for the product and is often referred to as the four Ps of marketing: **product, price, place and promotion**.

Product

The product is anything that can be offered to the market for use to satisfy a **want** or a **need**. Often a product will be part of a range produced by the same company. This range will offer consumers choice within the same brand and include products at the top, middle and bottom in terms of features and facilities.

Price

The company must consider the selling price carefully. It should reflect the image that they are trying to promote for the product. For example, designer labels have hugely inflated price tags to create the impression of quality products which are reliable and safe. Paying more money for a top-of-the-range product can give consumers that feel-good factor.

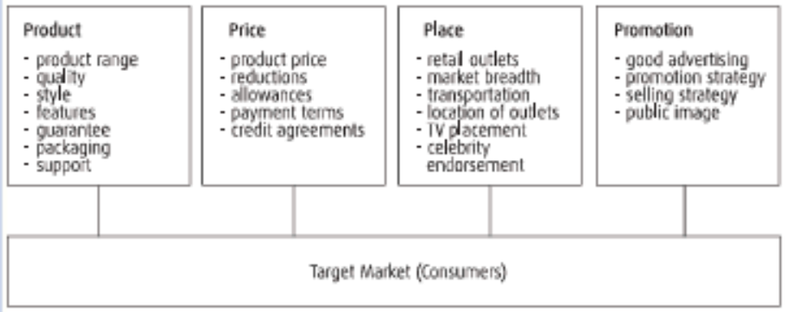
Place

Traditionally, place would almost exclusively mean high-street shopping. Now the way we buy products will include buying on the internet, by mail catalogue and even via interactive TV. The company must be sure that the product is being seen in the right places and in the right way by their target market group and they often consider **celebrity endorsements** and **product placement**.

Promotion

This is any activity which will advertise the product and its benefits to potential buyers. To a certain extent this relates to **technology push**. Consumers need to be given information about this new product and be made aware of its benefits and the advantages it holds over its competitors.

An effective marketing campaign will combine **all four** elements into an effective strategy designed to promote the product.



THINGS TO DO AND THINK ABOUT

1. Explain how the four Ps can influence demand for a product.
2. Using examples other than those given above describe what is meant by the term *market niche*.
3. Describe three factors that contribute to the final sale price of a product.

Hangrui kids' digital camera has a 2-inch screen, 32GB memory, built in puzzle games, USB rechargeable battery and comes with a soft shockproof protective silicone ABS case. Around £20.

With the Instax mini camera, photographs will pop out immediately they're taken and can be scanned into a phone later or pinned to a wall. Available in a range of colours it may appeal to older children and young adults on holiday or at parties. Around £70.

Nikon D850 DSLR full frame 47 mega pixel camera. Used mainly by professional photographers. Price range around £2500.

PRACTICE

POLYETHYLENE (PE) 2 HDPE 4 LDPE

Polyethylene (PE) has now become one of the most commonly produced plastics today. It is relatively cheap and easy to mould. It can be transparent, translucent or opaque and is available in a variety of different colours. The two most commonly used types are low-density polyethylene (LDPE) and high-density polyethylene (HDPE).

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to find out more about LDPE.

DON'T FORGET

While both LDPE and HDPE are recyclable, they cannot be recycled together.

LOW-DENSITY POLYETHYLENE (LDPE)

Low-density polyethylene (LDPE) is soft and squeezable. Its flexibility means it can be stretched considerably before it breaks. It is a non-toxic, non-contaminating material that's resistant to moisture, making it popular in the food industry.

It is often used in the form of cling film or plastic bags to keep food fresh. LDPE has many benefits, such as its resistance to most chemicals, its impact strength, and its relatively inexpensive production costs. Thanks to its low density and high strength, very thin sheets of LDPE can be used to hold relatively high loads (think of grocery bags or soda-can six-pack rings).

Some of the drawbacks to LDPE include its poor heat resistance and that it is prone to thermal expansion, which means it will grow wide, soft and weak in higher temperatures. Additionally, LDPE plastics are very low in stiffness/rigidity and are not suited for applications where structural strength is required. Its melting point is around 115°C.

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to find out more about HDPE.

HDPE milk bottles are one of the most widely recycled items of packaging in the UK, with recoup figures showing that HDPE bottles are recycled around 79% of the time. On average, HDPE milk bottles in the UK are now 15% lighter than they were just a few years ago.

HIGH-DENSITY POLYETHYLENE (HDPE)

High-density polyethylene (HDPE) is an ideal material for food and beverage containers and it is frequently used in outdoor furniture and play equipment, due to its lightweight and high-strength properties. It is less flexible than LDPE and is stronger and more durable. It also has a better chemical resistance and a higher melting point than LDPE, making it robust enough to survive prolonged use. As one of the most versatile plastic materials around, HDPE plastic is widely used in a variety of products, including plastic bottles, milk jugs, cutting boards, fuel tanks and piping. Its large strength-to-density ratio allows it to be used to carry relatively heavy weights easily without adding to the overall weight. Its melting point is around 135°C.

FOCUS ON MANUFACTURING

When manufacturing sheet, LDPE plastic pellets are first melted then pressed (extruded) through a circular gap to form a continuous tube of plastic. It is then inflated and stretched to the size and thickness required.

THINGS TO DO AND THINK ABOUT

1. Describe the difference between LDPE and HDPE.
2. Find two products that have been made from each material.
3. Why are these materials appropriate to use for the products you have chosen?

POLYPROPYLENE (PP) 5 PP

Polypropylene has similar properties to HDPE, but is slightly harder, tougher and more heat resistant. It has a waxy feel, and its key properties are its high chemical resistance, impressive tensile strength and its excellent heat resistance. It's also lightweight and is resistant to moisture and wear.

USES AND PROPERTIES

When comparing polypropylene to LDPE and HDPE, they have a lot in common. The main differences are that polypropylene is lighter and more resistant to high temperatures, abrasive agents and chemical solvents. However, it is less flexible.

Key properties of polypropylene

- High strength, toughness and impact resistance
- High melting temperature of around 160°C
- Good chemical resistance, including to acids and organic solvents, making it a suitable choice for use in harsh environments
- Low coefficient of friction
- Good wear resistance
- Excellent moisture barrier properties

These properties make polypropylene a versatile material that is used in a wide range of products including toys, furniture and automotive parts. It is also used in the production of medical devices, such as syringes, tubing, and other components that are exposed to harsh environments. However, polypropylene is highly flammable, has a poor resistance to chlorinated solvents and is prone to UV degradation.

The first injection-moulded polypropylene stacking chair was designed by Robin Day in 1963. The design brief was to design a low-cost mass-produced stacking chair.

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and watch the video to find out more about polypropylene and how it is used.

DON'T FORGET

Polypropylene is easy to recycle making it a desirable material for eco-conscious brands. However, the process of manufacturing polypropylene contributes to global warming and fossil resource depletion and there is a growing demand for more sustainable alternatives such as bio-based plastics which could significantly reduce the carbon footprint of all plastics.

FOCUS ON MANUFACTURING

The one-piece polypropylene seat has been injection moulded. The injection point is clearly visible in the photograph, along with strengthening webs, ribs and two bosses which allow screws to securely hold the steel frame in place. The tubular steel legs have been extruded, bent around a former then powder coated. The legs have been welded to two steel cross pieces to create a strong frame.

THINGS TO DO AND THINK ABOUT

1. Do an internet search and find five examples of products that are made from polypropylene.
2. List three disadvantages of polypropylene

Polypropylene is commonly used for the main body of domestic kettles as it can withstand boiling water and steam sterilisation.

PRACTICE

WOOD

Solid wood can be classified as being either **softwood** or **hardwood**. However, these terms can be misleading and don't always accurately describe the properties of specific woods. For example, balsa wood is a hardwood which is very soft and lightweight and can be scored and scratched by pressing your nail into it, whilst several softwoods are dense and hardwearing.

ONLINE

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to find out more about the different characteristics of wood.

PROPERTIES OF WOOD

The strength and appearance of each wood is determined by a number of factors including the specific species of tree, the method of drying used once it has been cut down and the angle of sawing used to produce battens of timber. How the tree is cut into battens will determine the direction of the grain of the wood, which in turn affects its **strength**, **durability** and **working** properties.

Wood is a natural, organic material that grows as trees. It is not a stable material and its sap, moisture content and how it reacts to temperature will cause it to change even after the tree has been felled. All wood requires to be seasoned and dried to create a more stable, useful material. This is an important process and, unless done well, defects such as **warping**, **twisting**, **bowing** and splitting can occur.

Exotic hardwoods

Exotic hardwoods such as mahogany, rosewood and teak are very expensive and often hard to come by, due to their place of origin, desirability and their slow rate of growth. Many of these woods are now protected by international law and permits are required before trees can be cut down and the wood traded.

Wood is an environmentally beneficial material. It is biodegradable and can be recycled. Trees also absorb carbon dioxide as they grow; however once they mature and begin to die or rot this carbon dioxide is released back into the atmosphere contributing to global warming. By cutting down trees in a planned responsible way and committing to replanting forests we can maintain a **balanced carbon cycle**.

VIDEO LINK

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to watch a video showing what properties to look out for when selecting which wood to use.

Veneers

Veneers can be produced by cutting very thin strips of wood from logs. These can be as thin as 1mm and are either rotary cut from the log or sliced from across the width of the log. These thin sheets of solid wood veneers are very often used to cover the surface of engineered boards such as MDF and plywood, giving these materials a more attractive appearance. This is done by bonding the veneer to the surface of the manufactured board with strong adhesives and high pressure.

Manufactured boards

Manufactured boards – often referred to as **engineered wood** – are strong, stable and economical. They are particularly suited to the mass production of furniture as most boards are available in large widths. Ecologically they are beneficial as they use up the waste products from the sawmill, such as scrap wood, wood fibres and sawdust. These are combined with adhesives and then made into chipboard, fibreboard and blockboard.

Thin sheets of wood veneer can be applied to most manufactured boards giving these materials the appearance of solid wood, achieved at a much lower cost.

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Exotic hardwoods such as this Burmese rosewood have an attractive but unusual grain. This expensive wood is hard, tough and very strong.

Solid oak panelling is often used in reception areas because it is durable and creates a stylish, professional image.

FOCUS ON DESIGN

Michael Thonet designed the solid beech wood No.14 chair almost 200 years ago in the 1830s. He was one of the first designers to embrace the idea of mass production. He wanted to design a chair that was lightweight, graceful and elegant that could be manufactured in great numbers. He had begun experimenting with bending wood and invented a process whereby solid beech could be bent beyond its normal flexible limits using a combination of steam and metal clamps. Beech was used to make the chair as it doesn't crack as easily as other hardwoods. One of the original moulds for the chair is shown. The chairs were made in sections and were able to be flat-packed allowing 36 chairs to be packed into a space no bigger than one cubic metre. The original chair was made from six pieces of wood, ten screws and two nuts and was easily assembled when it reached its destination. The chair is still manufactured today. Could the No. 14 chair have been a source of inspiration for IKEA?

THINGS TO DO AND THINK ABOUT

1. Why is it necessary to apply a surface finish to solid timber?
2. Find out more about manufactured boards and list the advantages and disadvantages they have over solid timber.
3. Find out more about how veneers are produced. Explain the difference between rotary-peeled and slice cut veneers.

PRACTICE

MAHOGANY

Mahogany is an exotic hardwood known for its durability, workability and elegant appearance. It has a pink or reddish-brown colour that deepens over time. The grain is straight and uniform, typically with relatively few knots or blemishes.

It's crucial to source mahogany from responsible suppliers who adhere to sustainable forestry practices to mitigate environmental impacts.

ONLINE

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to find out more about the many different types of mahogany that are available.

PROPERTIES AND USES OF MAHOGANY

Mahogany wood comes from *Swietenia macrophylla* trees, which are native to South America and Mexico. These are very slow-growing trees that can reach over 60 metres tall, with trunks as wide as 1.5 metres. There are three species of mahogany:

- Honduran mahogany which can be found anywhere between Mexico and the southern Amazon rainforest in Brazil.
- Cuban mahogany which is native to southern Florida and the Caribbean.
- Pacific Coast mahogany found in dry forest region of Central America.

However, there are multiple other woods and trees that are labelled as being types of mahogany including African mahogany and Philippine mahogany, often referred to as meranti.

Mahogany has excellent dimensional stability and doesn't shrink or expand significantly, even when it comes into contact with water, making it popular for marine applications and boatbuilding. It also remains very stable under extreme weather conditions, making it a useful material for outdoors especially as it is also resistant to termites, although it can be attacked by insects.

FOCUS ON THE ENVIRONMENT

Although mahogany looks great and is easy to work with, there are concerns over the environmental damage being done through illegal harvesting, **deforestation** and **transportation** of the wood. For example, Honduran mahogany, which only grows in tropical forests in Central and South America, has been driven to the point of extinction by illegal logging of the Amazon and surrounding forests. Mahogany trees can take up to 80 years before they are ready for harvesting. Therefore, overharvesting can lead to a decline in the population of these trees and disrupt the ecosystem they support.

Its reddish-brown colour make mahogany an attractive wood which is popular with furniture makers.

The trade of mahogany is governed internationally by the Convention on International Trade in Endangered Species (CITES). The exporting of mahogany is now regulated by them to ensure that international trade does not threaten its survival. There are now plantations in many regions of Central and South America which provide a controlled environment where mahogany trees are grown and selectively harvested to meet demand in a more sustainable way. These plantations help maintain a healthy forest ecosystem.

Mahogany is a tonewood which makes it one of the best woods for making musical instruments. It possesses tonal properties that are perfect for making the necks and bodies of wooden string instruments, especially guitars. One of the most iconic guitars of all time, the Gibson Les Paul uses mahogany for the main body.

THINGS TO DO AND THINK ABOUT

1. Explain why it is important that designers now only use mahogany that has been sourced through regulated trade.
2. What does the term *dimensional stability* mean?
3. Find your own examples of products that have been made from mahogany wood. Explain why mahogany is a suitable choice of material for each of the products.

OAK

Oak is a heavy and highly durable hardwood which has been used in building, construction and furniture making for thousands of years. Most oak woods will gradually darken over time and acquire a more amber tone. This is as a result of being exposed to oxygen and ultraviolet light although most people won't notice as the shift is so slow and subtle.

PROPERTIES AND USES OF OAK

Oak has remained a popular choice for furniture making in the UK, Europe and America for centuries due mainly to its availability as a local timber. It is an exceptionally strong and hardwearing wood that will withstand most knocks and extended wear and tear without denting or damaging its appearance. Oak also has a high level of water resistance due to its dense, non-porous grain structure, making it ideal for exterior use without the need for waterproofing. For this reason, it is a commonly used wood in boatbuilding and barrel making.

Air dried oak is particularly good for outside use as the drying process makes it impervious to most of the environmental factors that affect other hardwoods. It will not absorb water or warp and as oak contains a high proportion of tannin it is resistant, if not poisonous, to insects and fungus.

The superior strength of oak is enhanced by the high levels of this tannic acid within the wood. This is corrosive to ferrous metals and is a particular problem for the iron in steel screws as eventually the tannin will corrode the screws.

Oak is a slow-growing hardwood and can take up to 150 years before it is ready to use, resulting in it having a naturally dense, hard structure compared to other hardwoods. Its density and hardness make it difficult to work with and oak can very quickly blunt the blades of planes, chisels and lathe tools.

The cultivation and use of oak is closely monitored by the Forestry Stewardship Council (FSC) and the Programme for the Endorsement of Forestry Certification (PEFC). Both ensure that felling and logging is responsibly managed and replanting is maintained.

Oak and sycamore are used extensively throughout the debating chamber in the Scottish parliament.

FOCUS ON DESIGN

The inspiration for this oak chair came from examining fish, skeletons and organic shapes. This pupil has used the waney edged oak, with its attached bark and colour variation to create interest and a talking point. This is an example of biomorphism.

THINGS TO DO AND THINK ABOUT

1. Explain why steel screws shouldn't be used with oak.
2. Carry out an internet search and find examples of where oak has been used other than in furniture.

One of the main features that attract consumers to oak is its distinctive grain and golden colour.

DON'T FORGET

When using metal fixings in oak it is advisable to use brass wood screws, stainless steel screws or galvanised steel bolts to avoid the metal reacting with the tannic acid.

ONLINE

Go to our Digital Zone at www.brightredbooks.net/subjects and click the link to find out more about the properties of oak and how it is used in furniture design.

Designed by Scott Horton, S4