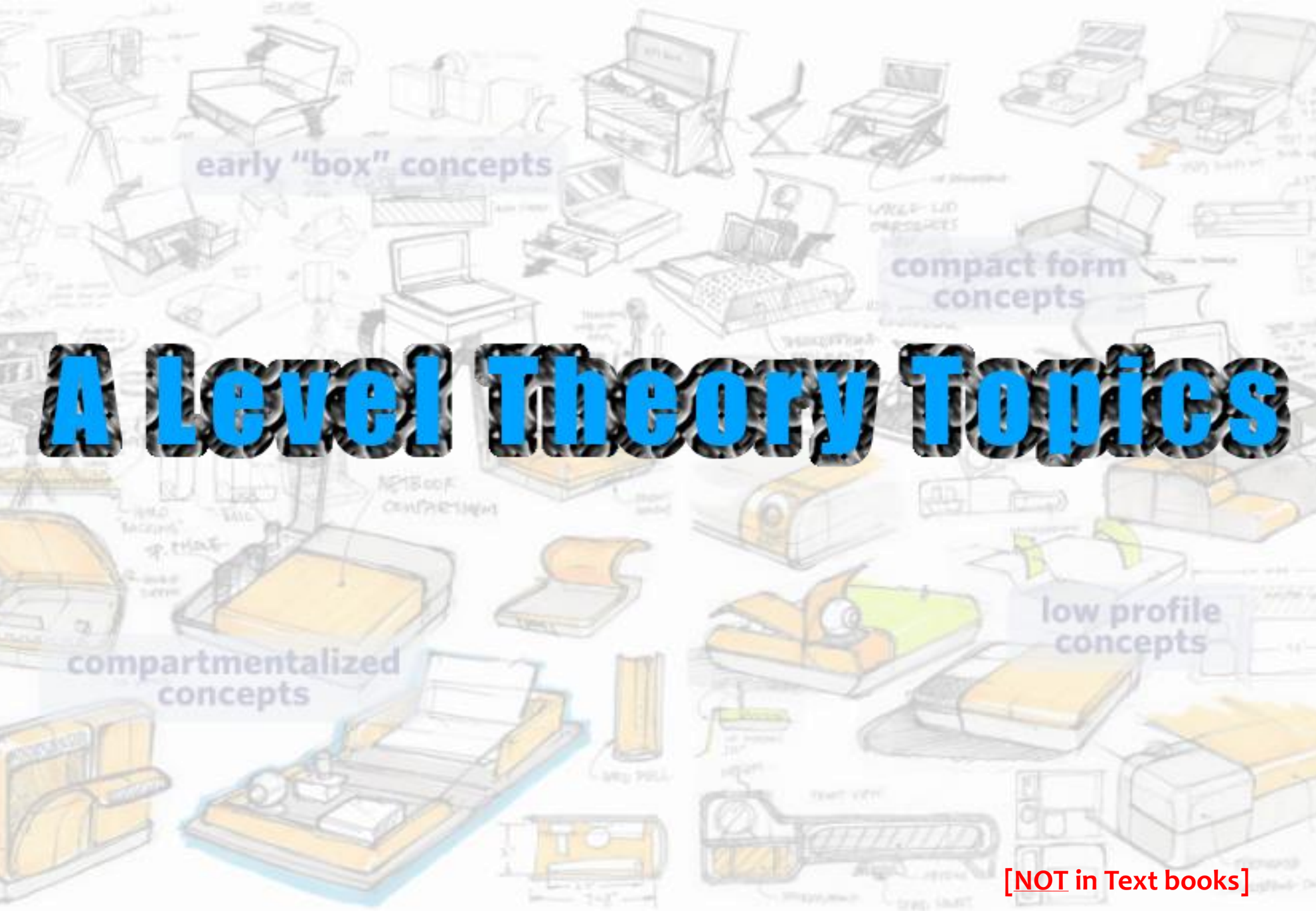


A Level Theory Topics

[NOT in Text books]

A Level Product Design Theory

http://designkmg.weebly.com/metals.html

https://www.youtube.com/watch?v=t_-VaPhKHCY

http://designkmg.weebly.com/smart--new-materials.html

http://www.textileshotline.co.uk/lets-learn/key-knowledge-lets-learn/fibres--fabrics-lets-learn.html

https://getrevising.co.uk/revision-cards/papers_and_boards
https://getrevising.co.uk/revision-notes/paper-and-boards

http://www.mr-dt.com/materials/paperandboard.htm

https://www.open.edu/openlearn/science-maths-technology/science/chemistry/introduction-polymers/content-section-1.3

[NOT in Text books]

A Level Product Design Theory

Remember

- **Note taking is not revision, it is preparation for revision.**
- **Reading a textbook is too passive – revision needs to be active.**
- **Vary your revision activities.**

Six hours of Product Design study per week outside of lesson time over the period of the course could lead you to a C grade. If you have not averaged this amount of study then you will need to put more hours in per week to catch up.

An effective revision system could be:

1 – work through a set of questions (could be a past paper, a set of multichoice questions or a worksheet).
2 – self-assess the answers, highlighting weaker areas.
3 – review and strengthen the weaker areas.
4 – repeat the above but in a different area of the course.
5 – a week later find and attempt questions based on the previously identified weaker areas and assess whether or not they have been strengthened.

1. **You will also need to practice drawing activities as this forms at least 20% of the marks on the paper**
2. **Practice your sketching- 3D, Isometric, Orthographic, Nets and Exploded diagrams. There will be several on the past papers when you try them out [This can be completed in your Sketch books and Theory books]**

Strongly recommended:

Read through examiner reports – these highlight the strengths and weaknesses of actual candidate answers.
Read through the exemplar materials – these are written by principle examiners explaining why actual responses did or did not gain a mark. Very useful for 6 -12 mark level of response questions.
Exam questions, mark schemes and examiners' reports are available on an easy to search website here:
https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/design-technology-product-design-2017.coursematerials.html#filterQuery=Pearson-UK:Category%2FExam-materials

You will need to consider that you need to think about your Major Project- Consider ideas and do some research. Look at past projects on the EDEXCEL website
Online sources [from other examination boards] https://www.ocr.org.uk/Images/440641-topic-area-7-manufacturing-processes-and-techniques-design-engineering.pdf
http://www.fastpastpapers.com/page907.html

A Level Product Design Theory

1.1 Woods: http://www.diffen.com/difference/Hardwood_vs_Softwood

a) hardwoods – oak, mahogany, beech, jelutong, balsa
b) Softwoods – pine, cedar, larch, redwood.

1.2 Metals:

a) ferrous metals – mild steel, carbon steels, cast iron
b) non-ferrous metals – aluminium, copper, zinc, tin
c) Alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass.

1.3 Polymers:

a) thermoplastics – acrylic, polyethylene, polyethylene terephthalate (PET), polyvinyl chloride (PVC), polypropylene (PP), acrylonitrile butadiene styrene (ABS)
b) thermosetting plastics – epoxy resins (ER), urea Formaldehyde (UF), polyester resin (PR).
c) Elastomers – rubber.

[NOT in Text books]

A Level Product Design Theory

1.4 Composites

a) Composites – carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood.

1.5 Papers and boards

Papers and boards:

a) drawing papers – layout, tracing, copier, cartridge

b) commercial printing papers – bond, coated

c) boards – mounting board, corrugated board, foam board, folding box board, foil-lined board

b) paper and board finishing process – laminating,

Varnishing, hot foil blocking, embossing (including use of specialist tools).

1.6 Textiles

a) Natural fibres – cotton, Linen, Wood.

b) manmade fibres – nylon, polypropylene, polyester

C) Textile treatments – flame resistant, polytetrafluoroethylene (PTFE)

1.7 Smart and modern materials:

a) thermo-ceramics

b) shape memory alloys (SMA)

c) reactive glass

d) liquid crystal displays (LCD)

e) photo-chromic materials

f) thermo-chromic materials

g) Quantum tunnelling composites.

[NOT in Text books]

Material description

Image

Include a diagram

Structural diagram of material

Include a diagram

Example Product using the material

Products made from the material [Diagrams] include any design classics e.g. Coca Cola Bottle manufactured form Glass

Step by Step [How manufactured from its raw state *N.B. not for all materials*]

Bullet point each stage e.g. Linen is woven

Properties/Advantages

In use

Manufacturing/Construction/Machining/Assembly/ Joining process

Linked to the material e.g. Linen sewn or glued

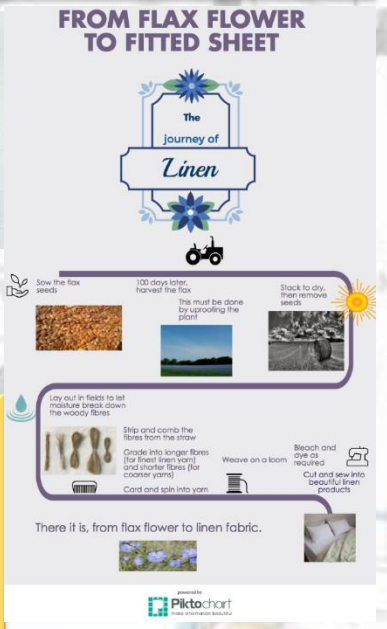
Properties/Disadvantages

In use

LINEN: *Linen is a textile made from the fibres of the flax plant. Linen is laborious to manufacture, but the fibre is very strong, absorbent and dries faster than cotton. Garments made of linen are valued for their exceptional coolness and freshness in hot and humid weather.*

Linen

Step by Step [How manufactured from its raw state *N.B. not for all materials*]



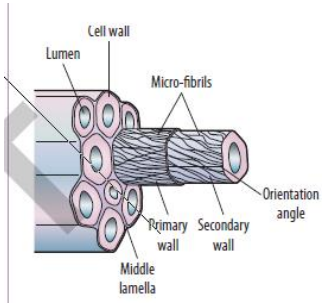
Manufacturing/Construction/Machining/Assembly/ Joining process

Textile materials are made in three stages:

1.spinning: fibres are spun into yarns
2.weaving or knitting: yarns become fabrics
3.finishing: fabrics are finished to make them more useful

Structural diagram of material

Coarse, stiff Fibre



Properties/Advantages

Used for summer clothing, tea towels and tablecloths and has the following qualities:

- *fresh and cool to wear*
- *very absorbent, dries quickly*
- *stiffer handle*
- *good drape*
- *durable*
- *creases badly*
- *can be washed and ironed*
- *More absorbent than cotton*
- *Hardwearing*
- *Strong especially when wet*
- *Comfortable to wear*

Properties/Disadvantages

- *creases badly*
- *No drape*
- *Poor elasticity and resilience*
- *Creases easily, dull lustre*

Drape: a fabric's ability to form waves or the desired shape as it is hung

Example Product using the material

Tableware, bedding, clothing

Product made from the material [Diagrams] include any design classics e.g. Coca Cola Bottle manufactured form Glass

A Level Product Design Theory

2.1 Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately:

- conductivity
- strength
- elasticity
- plasticity
- Malleability
- ductility
- hardness
- toughness
- durability
- Biodegradability.

[NOT in Text books]

A Level Product Design Theory

3.1 Processes, applications, characteristics, advantages and disadvantages of the following, in order to discriminate between them and select appropriately including the selection of specific and relevant tools to be used for domestic, commercial and industrial products and systems, and use safely when experimenting, improving and refining in order to realise a design:

- ✓ **heat treatments – hardening and tempering, casehardening, annealing, normalising (including use of specialist tools)**
- ✓ **alloying (including use of specialist tools)**
- ✓ **printing – offset lithology, flexography, screen-printing, gravure (including use of specialist tools)**
- ✓ **casting – sand (to include investment), die, resin, plaster of Paris (including use of specialist tools)**
- ✓ **machining – milling/routing, drilling, turning, stamping, pressing (including use of specialist tools)**
- ✓ **moulding – blow moulding, injection moulding, vacuum forming, extrusion, rotational moulding (including use of specialist tools)**
- ✓ **lamination (including use of specialist tools)**

Marking out techniques – woods, metals, polymers, paper and boards (including use of specialist tools).

[NOT in Text books]

3.2 Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended.

woods, metals, Polymers, composites, Textiles

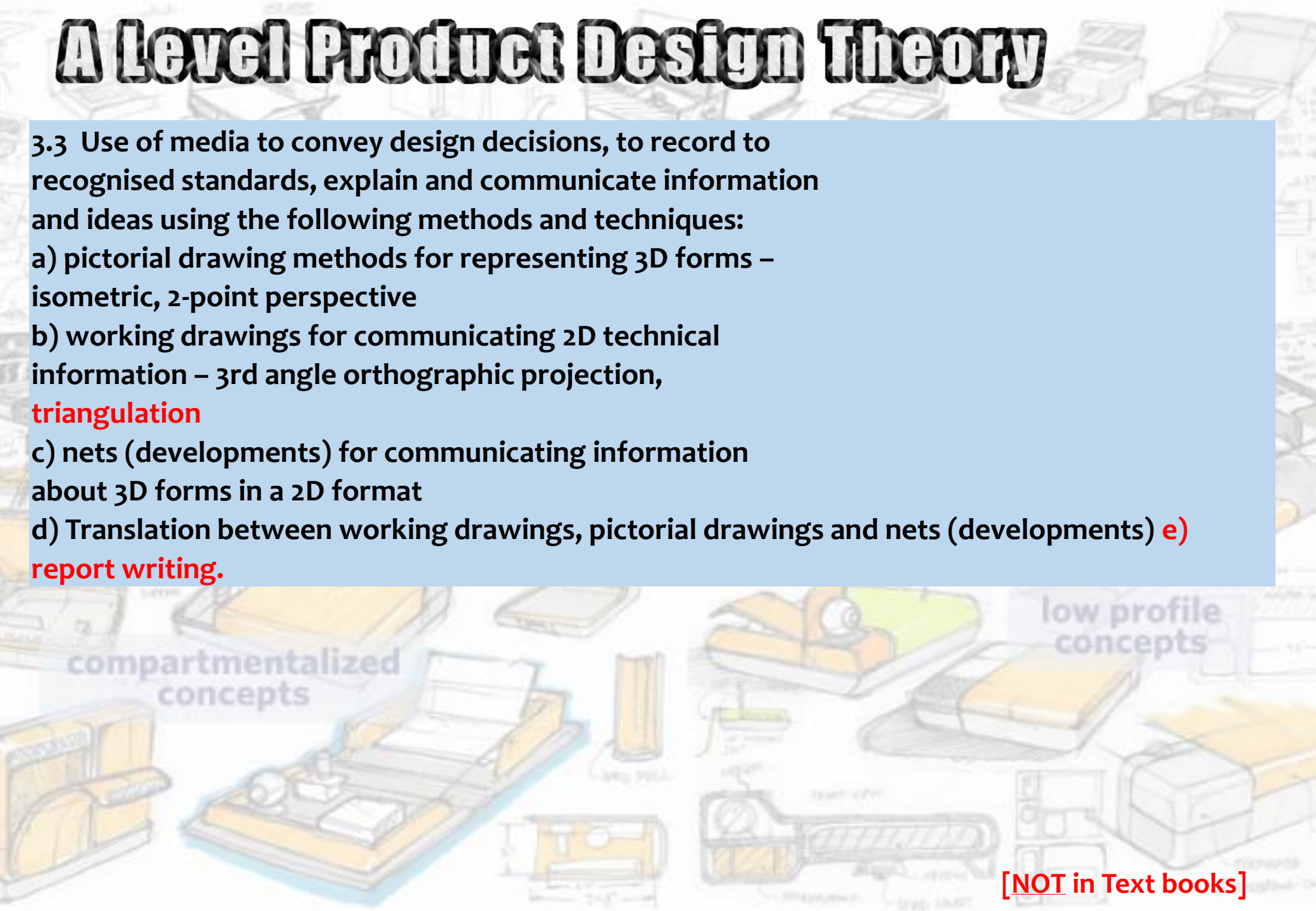
select appropriately the specialist tools below:

e) Machining – turning, (including use of specialist tools).
g) Lamination (including use of specialist tools).
Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended.
a) marking, cutting and mortise gauges [wood, metals and composites]
b) odd leg, internal and external callipers [for metal]
c) squares (set, try, engineers and MITRE) [wood, metals and composites]
d) micrometre and Vernier callipers [used for checking measurements internal and external]
e) densitometer *[For research and information A densitometer is a device that measures the degree of darkness (the optical density) of a photographic or semi-transparent material or of a reflecting surface. The densitometer is basically a light source aimed at a photoelectric cell.]*
f) dividers *[For research and information Dividers are used to mark out shapes onto sheet metal. They are used just like compasses to scrape circles and arcs onto the metal. They work best if a small indent is placed on the sheet metal using a centre punch for one of the legs to rest in.]*
g) jigs and fixtures *[For research and information Jigs and fixtures are special purpose tool which are used to facilitate production (machining, assembling and inspection operations), when work piece is based on the concept of interchangeability according to which every part will be produced within an established tolerance.]*
h) go and no-go gauges *[For research and information A **go/no-go gauge** refers to an inspection tool used to check a workpiece against its allowed tolerances via a **go/no-go** test. Its name is derived from two tests: the check involves the workpiece having to pass one test (**go**) and fail the other (**no-go**). ISO 1502 sets a standard for threads and gauging to test them.]*

[NOT in Text books]

A Level Product Design Theory

3.3 Use of media to convey design decisions, to record to recognised standards, explain and communicate information and ideas using the following methods and techniques:
a) pictorial drawing methods for representing 3D forms – isometric, 2-point perspective
b) working drawings for communicating 2D technical information – 3rd angle orthographic projection, triangulation
c) nets (developments) for communicating information about 3D forms in a 2D format
d) Translation between working drawings, pictorial drawings and nets (developments) e) report writing.



[NOT in Text books]

A Level Product Design Theory

3.4 Uses, characteristics, advantages and disadvantages of the following permanent and semi-permanent joining techniques in order to discriminate between them, select appropriately and use safely:

- ✓ a) adhesives – contact adhesive, acrylic cement, epoxy resin, polyvinyl acetate (PVA), hot melt glue,
- ✓ cyanoacrylate (superglue), polystyrene cement (including use of specialist tools)
- ✓ b) mechanical – screws, nuts, bolts, washers, rivets, press (including use of specialist tools)
- ✓ c) heat – oxy-acetylene welding, MIG welding, brazing, hard soldering, soft soldering (including use of specialist tools)
- ✓ d) Jointing – traditional wood joints, knock-down fittings (including use of specialist tools).

3.5 Application, advantages and disadvantages of the following finishing techniques and methods of preservation in order to discriminate between them and select appropriately for use, including for the prevention of degradation:
a) finishes – paints, varnishes, sealants, preservatives, anodising, electro-plating, powder coating, oil coating, galvanisation, cathodic protection (including use of specialist tools)
b) Paper and board finishing process – laminating, varnishing, hot foil blocking, embossing (including use of specialist tools).

[NOT in Text books]

A Level Product Design Theory

Digital Technologies

4.1 Set up, safe and accurate operation, advantages and disadvantages of the following digital technologies

- ✓ **a) a) computer-aided design – 2D and 3D design to create and, modify designs and create simulations, 3D modelling for Creating 'virtual' products.**
- ✓ **b) computer-aided manufacture and rapid prototyping – CNC lathes, CNC routers, CNC milling machine, CNC Laser, CNC vinyl cutters, rapid prototyping.**

Factors influencing the development of products

5.1 The importance and influence of user centred design in ensuring products are fit-for-purpose and meet the criteria of specifications when designing, making and evaluating in relation to:

a) user needs, wants and values
b) purpose
c) functionality
d) innovation
e) authenticity

[NOT in Text books]

Factors influencing the development of products

5.2 Principles, applications and the influence on design of anthropometrics and ergonomics:

a) sources and applications of anthropometric data

b) ergonomic factors for a designer to consider when developing products and environments with which humans react.

5.3 The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products:

a) form over function

b) Form follows function.

5.4 Design theory through the influences and methods of the following key historical movements and figures:

a) Arts and Crafts – William Morris https://www.theartstory.org/movement/art-nouveau/

b) Art Nouveau – Charles Rennie Mackintosh https://designmuseum.org/designers/charles-rennie-mackintosh

c) Bauhaus Modernist – Marianne Brandt http://www.core77.com/posts/36776/Marianne-Brandt-Bauhaus-Powerhouse

d) Art Deco – Eileen Gray https://designmuseum.org/designers/eileen-gray

e) Post Modernism – Philippe Starck http://www.scottishschools.info/Websites/SchSecWhitehill/UserFiles/file/Higher%20Art%20Homework/Product%20designer%20PHILIPPE%20STARCK.pdf

f) Streamlining – Raymond Loewy http://www.raymondloewy.com/

g) Memphis – Ettore Sottsass. http://designmuseum.org/designers/ettore-sottsass

[NOT in Text books]