Last Minute DT Revision

IMPORTANT RESOURCES:

- [x] ~~Specification: Pearson_Edexcel_GCSE_9_to_1_in_Design_and_Technology_Specification_issue3.pdf~~

Yi Makes It Easy:
https://youtube.com/playlist?list=PLS-TIpNmaiIC8NBd_cTfCxN7X_hr7rw02&si=P0G2ngIQatmmP9lO

Quizlet 1: https://quizlet.com/gb/369037893/design-technology-gcse-flash-cards/
Timbers Quizlet: https://quizlet.com/371596208/design-technology-gcse-timber-flash-cards/
Core Content: https://quizlet.com/gb/759688278/gcse-edexcel-dt-core-content-flash-cards/

General Structure for Answers:
3 MARKERS: BLT
- POINT
- B ecause (why is this an advantage/disadvantage)
- L eading to (what effect does this have)
- T herefore (how does it impact the __ business? product? whatever is the context)

6 MARKERS: BLT BLT
* POINT
* B ecause
* L eading to
* T herefore
x2

9 MARKERS: BLT HBLT BLT HBLT CONC
* POINT
* B ecause
* L eading to
* T herefore

* H owever (what could be a disadvantage? why may this not work? no need to go in depth)
* B ecause
* L eading to
* T herefore

x2

CONCLUSION:
- overall effect
- short term/long term effect
- external factor on this
- conditional (what does this need in order to work)

EXAM QUESTION PRACTICE:

(2019 Paper)

1. Negative effect of reduction in products for the manufacturer:

ANSWERS:

- Smaller workforce required → loss of jobs
- Company may go out of business → lost jobs and reduced profits in the area
- Money used up for old machinery used to make product → highly specialised so can't be used for anything else, still needs to be maintained.

2. Why would calico be used for a prototype?

ANSWERS:

- Calico is cheap → keeps cost down in terms of development
- Calico accepts a range of surface finishes → lots of designs and colours can be tested
- Calico is absorbent → accepts a range of surface finishes
- Calico is rigid when sewn along a seam → it can hold its shape
- Calico is the same on both sides → doesn't matter which round the material is used

3. Why use tracing paper?

ANSWERS:

- Transparent → can be placed over drawing to make a copy of it/trace imag'e
- Can be placed over a drawing and drawn on → can be used to transfer images

4. Why acrylic?

ANSWERS:

- Transparent
- Good electrical insulator
- Lightweight
- Waterproof
- Durable

5. Why stainless steel for support?

ANSWERS:

- Hard material, good compressive strength → can be pushed into ground without deforming
- Resistant to corrosion → won't rust in the wet ground
- Tough → can withstand bumps and knocks

6. How can new and emerging technologies reduce the manufacturer's carbon footprint?

ANSWERS:
- Use renewable energy sources and maximise energy sources → reduces emissions
- Use modern machinery → reduces energy consumption
- Use video conferences → don't have to travel so reduces pollution
- Replacement parts can be sent as files to be printed → transportation pollution is offset
- Any pollution from factories can be cleaned → reduces pollutants released into atmosphere
- Use biofuels → reduces emissions

7. How do new and emerging technologies impact apprentices?

ANSWERS:
- Exposed to the latest technology → trained in the most current methods
- Very employable → Technologies will spread to other companies
- High specialised workers → will be able to command higher salaries
- After training their job may have become obsolete → because technology has replaced manual workers
- Safer working environments → machines can take care of difficult work
- Lower skilled technician roles → will get lower paid positions

(2020 Paper)

1. Advantage of using polyester for school tie?

ANSWERS:
- Stain resistant → will not mark if food gets on it
- Hands well → will look nice
- Dries quickly → can be washed overnight
- Resistant to abrasion → will not get damaged through friction
- Recyclable → will end up in a landfill
- Does not shrink → will not lose shape when washed
- Good colour retention → colour will not fade over time

2. Advantage of using Shape Memory Alloys (SMA)

ANSWERS:
- If plastically deformed into wrong shape they can be heated → goes back to original shape
- Once correct size is achieved the material can be reheated → can be reused

- It is easier to reset/straighten the SMA wire in comparison to copper wire → it can be heated rather than pulled through a die.

3. Why would copper wire be used?

ANSWERS:

- It is malleable → will hold its shape once formed
- It is ductile → can be drawn out into thin long wires
- It is a nice colour → can be left without additional surface finishing
- It will not rust → which would mean no stain or mark on any clothing

4. High Impact Polystyrene Properties?

ANSWERS:

1. Withstands high impacts
2. Good electrical insulator
3. Lightweight
4. Durable

5. Corrugated cardboard?

ANSWERS:

- Impact resistance
- Strength to weight ratio
- Recyclable
- Cost effective material

6. Robotic Materials?

ANSWERS:

- Sensors can detect movement
- Sensors can detect pressure
- Can communicate with users through vibrations
- Can replace internal components doing computational purposes

7. Environmental Issues of release of a new product

ANSWERS:

- Pressure on plastics to make new product
- Old products that are being replaced may not get disposed of properly, should be recycled
- Demand on energy for manufacture and transportation → pollution

8. Wearing protective textiles disadvantages

ANSWERS:

- Stiff → restricts movement

- Not breathable → will sweat
- Heavy to wear → slows them down

(2021 Paper)

1. Advantages of any clean source of energy (Ex: wind)

- Energy generated is free once costs have been paid off
- It is a clean fuel source, reduces emissions
- Sustainable, will never run out

2. Felted Wool Fabric

- Does not fray → will leave a neat finish
- Soft → will not damage any surface

3. Why fibreglass?

- Tough material
- Water resistant
- Can be moulded into complex shapes
- High quality surface finish (reduces friction)
- Lightweight
- Low maintenance
- Can be pigmented

4. Benefits of sports textiles?

- Lightweight
- Inbuilt sensors
- Contain UV blockers
- Can control bacteria
- Waterproof coatings
- Wickening fabrics
- Can stretch and hug the body (less drag)
- Breathable

5. Corrugated cardboard?

- Flexible
- Easily printed on
- Biodegradable
- Impact resistant

6. How to keep to minimal cost

- Same type of material
- Cuttings to reduce surface area
- Regular shapes

7. Internet of things

-

TIMBER SECTION:

8. Advantages of sustainable timber

- Timber stocks will not run out → because as trees are cut down several new ones are planted
- Product can be marketed with the FSC logo → increase sales
- Certification → shows consumers timber is being protected from deforestation

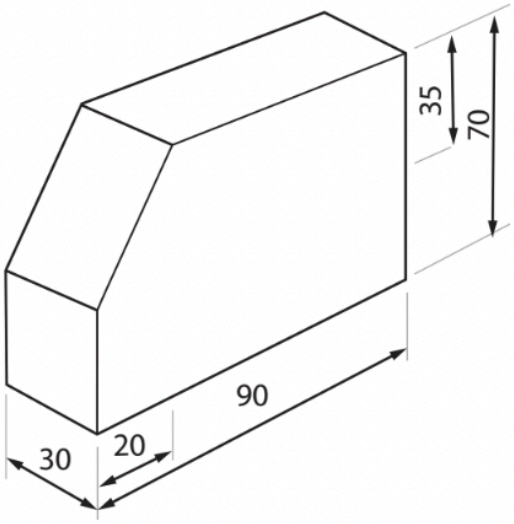
9. Why use different timbers?

- DIfferent timbers have different colours/grains/textures → can show different parts
- Small scraps can be used up for different parts of product → reduces waste

10. Techniques to produce bodies

(d) Figure 13 shows the main body for the toy creature.

The bodies are to be manufactured from pine in a batch of 1000.



All dimensions in mm

Figure 13

Name **two** different techniques that could be used to batch produce the main body.

Explain **one** advantage of using each technique.

(6)

CAM/CNC Machining

- Can repeat cut → makes identical components quickly

Cutting Jigs

- can be used to cut shapes → with little to no marking out

Cutting/sanding/wasting

- corner cut off with a tenon band saw → finished with disc sander

Cutting template

- Profile fixed to work to follow → produces exact copy

11. Why use stock sized materials?

- Can be bulk purchased → no need to make them
- Dowels being a standard size → standard drill bits can be used to make holes
- Wasteful to make them from square stock material → reduces waste

- Time consuming to make them → speeds up production
- Widely available → always in stock somewhere never run out
- Stock sizes available in ranges of sizes → manufacturing decisions made to suit
- Don't have to invest money in machinery → saving capital

THE BIG 6 - 9 MARKERS:

2019:

(c) A film company is considering launching a range of musical jewellery boxes based on its animated characters.

Discuss the different design strategies the company could use to generate initial ideas and to avoid design fixation.

(6)

2020:

(d) Discuss the use of video conference meetings by companies around the world to develop new technologies for firefighters.

(6)

- Saves time travelling and reduces cost of travelling
- Can be recorded and played to those who did not attend
- Serves as a record of what was discussed and agreed
- Allows files to be shared, more opportunities for collaborative design.

- Requires investment into hardware
- Needs access to internet
- Susceptible to hacking so not always able to discuss confidential material
- Takes etiquette

2021:

Internet of old things with old people

- Iot has given rise to services like hive
- Electrical plugs can sense being used and can monitor and provide feedback to relatives to see daily routines are being carried out
- Cameras can be placed in homes to be observed by relatives
- Trackers can be used to see where people are
- Personal alarms can be worn
- Online shopping
- Smart locks
- Smart appliances controlled remotely

ALL TYPES OF CALCULATIONS:

1) Percentage Change (Reduction or Increase):

FORMULA:

(Initial + final) / 2*initial = percentage change

Example:

(b) Figure 2 shows a table with the number of plastic bags given away in England.

Year	Number of bags given away (billions)
2014	7.6
2015	5.4

Figure 2

Calculate the percentage reduction in the number of plastic bags given away between 2014 and 2015.

Give your answer to the nearest whole number.

(2)

(7.6-5.4) ÷ 7.6 = 29%

2) Mechanical Advantage

FORMULA:

Mechanical advantage = load / effort

Example: A 70N effort is needed to lift a 420N load. Calculate Mechanical Advantage.

Load / Effort = MA
420 / 70 = 6

3) Velocity Ratio

FORMULA:

Velocity Ratio = Distance Moved by Effort / Distance Moved by Load

OR

Velocity Ratio = Number teeth on driver gear / Number of teeth on driven gear

Example: A wheelbarrow's handles are lifted 800m while the load is raised 100mm. Calculate the Velocity Ratio.

800/100 = 8

4) **Efficiency**

FORMULA:

MA/VR

Example: Knowing the previous two values calculate efficiency.

Mechanical Advantage is 6
Velocity Ratio is 8

6/8 = 0.75

75%

5) Output Speed of a Pulley System

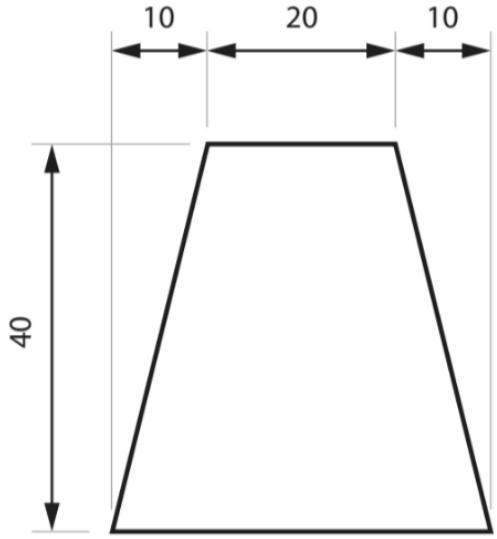
Output speed = Input speed / Velocity Ratio

Example: The input speed is 1800 revolutions per minute. Calculate the output speed of the pulley system.

1800 / ⅓ = 5400 rpm

Other

(c) Figure 15 shows the dimensions for the body of the tumbling figure.



All dimensions in mm

Diagram not to scale

Figure 15

Calculate the maximum number of whole bodies that could be cut from a length of timber measuring 181 cm long by 4 cm wide.

Ignore the width of any cuts.

(5)

181 x 4 = 724
(2 + 1)x4 = 12

724/12 = 60.333

= 60

(d) The solar cell used in the solar powered garden light costs 1/12th of the total cost of the product.

Calculate the cost of the solar cell if each light costs £4.97 to make.

Give your answer to two significant figures.

(2)

4.97/12 = £0.41

RANDOM DEFINITIONS:

Surface finishes/treatments:

- Paint
- Stain
- Varnish
- Wax
- Oil
- Shellac
- Veneer

Open Grain:

Manufactured Timber options:

- MDF
- Plywood
- Chipboard
- Blockboard
- Laminboard

Non Ferrous Metal

- Copper
- Brass
- Bronze

Composite Materials:

- Carbon fibre
- Concrete
- Plywood
- MDF
- Fibreglass

ONLINE NOTES:

TIMBERS (SECTION A):

Can be described using:

- Elasticity
- Tensile strength (pulling apart)
- Compressive strength (being crushed)

HARDWOOD:

deciduous

1. **OAK**

✅	❌
Strong/durable	Expensive as it is becoming rarer
Attractive grain	Corrodes iron and steel (hard to work with)

Uses: building houses/boats, high end furniture

2. **MAHOGANY**

✅	❌
Attractive grain	Expensive
Easy to work with	Oils can trigger allergies
	Difficult to source

Uses: high end furniture

3. **BEECH**

✅	❌
tough, won't break	Expensive
Hard, withstands wear, durable	Not moisture resistant
Dense grain, won't easily splinter	

Uses: toys, cooking material

4. **BALSA**

✅	❌
lightweight	Too soft and weak for most products
Easy to cut	

Uses: model making in school

5. **JETULONG**

✅	❌
Close grain which is easy to cut Easy to work with Lightweight	Not strong, very soft, bad for structure

Uses: model making, moulds

6. **BIRCH**

✅	❌
Even grain, easy to work	Low resistance to rot and insect attack

Uses: to surface cheap materials, for plywood

7. **ASH**

✅	❌
strong, tough	low resistance to rot and insect attack
Flexible	
Finishes well	
Straight grained, less likely to break	

Uses: handles for tools, sports equipments, ladders

SOFTWOOD:

evergreen

1. **PINE**

✅	❌
durable	Expensive as it is becoming rarer
Cheap lightweight	Warps, cracks and splinters more than other woods.

Uses: house construction, furniture, doors

2. **CEDAR**

✅	❌
Resistant to water	More expensive than pine
Resistant to fungal growth	Not as strong than pine

Uses: outdoor furniture

3. **LARCH**

✅	❌

Tough, durable	Expensive
Resistant to water	

Uses: small boats, yachts

MANUFACTURED TIMBERS:

man made, not natural

1. **PLYWOOD**

✅	❌
Flat and structurally sound	Expensive
Resistant to warping, cracking, twisting	Can have risk of water damage if wrong grade of wood is used

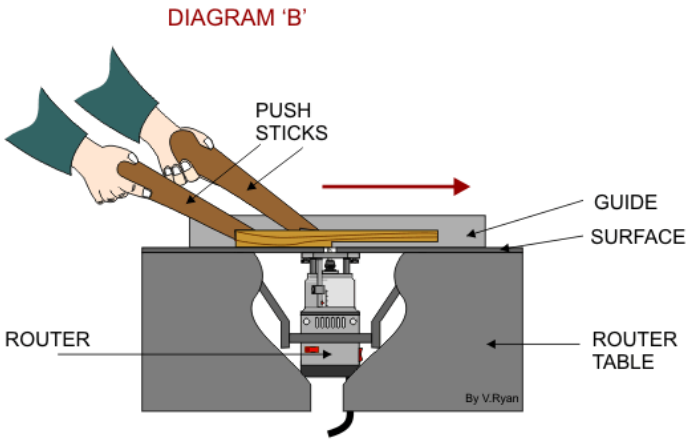
Uses: buildings, furniture panels that need some strength.

2. **MEDIUM DENSITY FIBREWOOD (MDF)**

✅	❌
Cheap (made from waste wood)	Very ugly so needs coating
Smooth surface is good for painting or staining	Weak compared to real wood or plywood
Easy to machine	Tools blunt quickly due to the glue

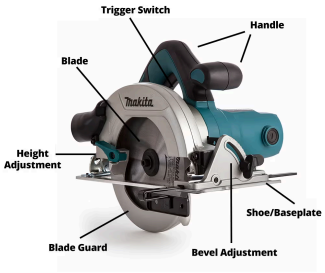
MANUFACTURING PROCESSES:

1. ROUTING



1. Use a jig to cut shapes
2. Cutter protrudes from table and cuts wood
3. Removes material quickly
4. Rub with damp cloth to remove dust
5. Leave to dry

2. SAWING

		
Scroll saw	Circular saw	bandsaw

1. Mark out sections that need to be cut
2. Use guides to funnel wood through and cut them OR hold wood in a sort of vice

3. MORTISER

1. Accurately mark where you want the square hole to be
2. Chisel drills a round hole
3. Square chisels around it cuts the corners out to make a square

4. BAG PRESS

A bag that can be sealed and have the air sucked out of it. A mould and laminates are put inside the bag. When the air is sucked out of the bag. The laminates are forced into the mould and are held while the glue dries. Presses equally on all surface areas

CAM/CNC Machining

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—-

Respect for:
- Social groups (designs incorporate specific needs and desires for that group)
- Economic groups (different groups have different purchasing power)
- Ethnic groups (products should be sympathetic to culture and not offend - e.g., care taken when using symbols)

Sustainability:
- Fairtrade Foundation (Ensure farmers & producers are paid a fair price for their good in developing countries and working conditions are suitable, with no child or enforced labour and no discrimination)
- Carbon offsetting (reduce carbon footprint)
- Energy efficiency (including using renewables)

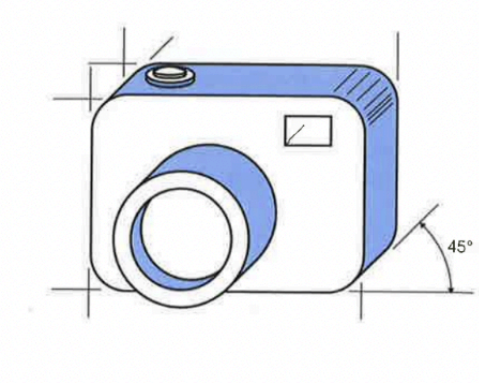
- Product disassembly (product can be recycled/reused and lasts longer as it can be repaired or upgraded)
- Disposal of waste (governed by laws to ensure little impact on environment) - includes using more non-toxic, recyclable, biodegradable materials as well as reducing waste

LCA: systematic inventory to assess environmental impacts relating to every stage of a product's life - makes it easier to identify what areas can be changed to reduce costs & environmental impact

Cost of: raw materials, maintenance, transportation, recycling, disposal[54]

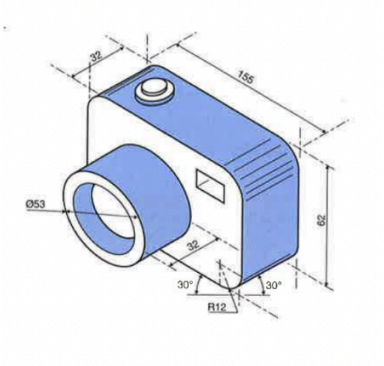
COMMUNICATION TECHNIQUES:

OBLIQUE:



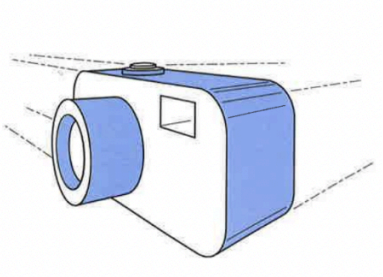
45° angle

ISOMETRIC:



30° angle

PERSPECTIVE:



TWO vanishing points

POLYMERS:

THERMOFORMING:

Easily formed into different shapes by heating, melting and remoulding, making them easily recyclable.

Acrylic (PMMA)

Attributes	Purposes
Hard	Motorcycle helmets visors
Stiff	Baths
Shiny	Signs
Weather resistant	

Polyethylene terephthalate (PET)

Attributes	Purposes
light	See-through drink bottles
strong	Fibres for clothing
tough	

Polyvinyl Chloride (PVC)

Attributes	Purposes
light	See-through drink bottles
strong	Fibres for clothing
tough	Rain coats

High density polyethylene(HDPE)

Attributes	Purposes
stiff	Washing-up bowls
strong	baskets
lightweight	Folding chairs
	Gas and water pipes

High impact polystyrene (HIPS)

Attributes	Purposes
Rigid	Vacuum forming
Cheap	CD cases
Toxic fumes when burned	Smoke detector casings

Polypropylene (PP)

Attributes	Purposes
tough	Plastic chairs
flexible	
Variety of colours	

THERMOSETTING:

Undergo a chemical change when heated or moulded, permanently becoming hard and rigid, hence why they can easily be recycled

- Epoxy resin (ER)

Attributes	Purposes
Rigid	Circuit boards
Durable	Wind turbine rotor blades
Corrosion-resistant	
Good electrical Insulator	

- Melamine formaldehyde (MF)

Attributes	Purposes
strong	Laminate chipboard
scratch-resistant	Plates and bowls

- Polyester resin (PR)

Attributes	Purposes
Hard	Add to glass fibre for GRP
stiff	Kayaks
Cheap	Garden furniture
Good electrical insulator	
Waterproof	

- Urea formaldehyde (UF)

Attributes	Purposes
Hard	Plug socket
Brittle	Toilet seat
Good electrical Insulator	Cupboard handles

- Phenol formaldehyde (PF)

Attributes	Purposes
Hard	Bottle caps
Heat-resistant	Snooker balls
Easily moulded	Mixed with other materials to form a composite

METALS:

RANDOM QUESTIONS EDEXCEL SHITS ON US:

NEW AND EMERGING TECHNOLOGIES:

IN TERMS OF CARBON EMISSIONS:

- Use renewable energy sources and maximise energy sources → reduces emissions
- Use modern machinery → reduces energy consumption
- Use video conferences → don't have to travel so reduces pollution
- Replacement parts can be sent as files to be printed → transportation pollution is offset
- Any pollution from factories can be cleaned → reduces pollutants released into atmosphere
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IN TERMS OF APPRENTICESHIPS

- Exposed to the latest technology → trained in the most current methods
- Very employable → Technologies will spread to other companies
- High specialised workers → will be able to command higher salaries
- After training their job may have become obsolete → because technology has replaced manual workers
- Safer working environments → machines can take care of difficult work
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PAPER NOTES

Next page

Design Technology Revision — Page 1 — core content (40%)

1.1 The Impact of new and emerging technologies

1.1.1 Industry

ADVANTAGE AND DISADVANTAGE

	ADVANTAGES	DISADVANTAGES
Unemployment	- costs cut by adapting to ↑ efficient manufacturing processes. - bigger transportation vehicles for products in bulk. - less employment means less human error. - this reduces cost and ↑ revenue.	- advancements in tech mean less jobs available - costs can be reduced but in long run low skilled workers ↓↓. makes them lose their job more.

DEFINITION — Workforce Skillset: Employers must ensure employees are well trained and competent enough to utilize skills w/ new and emerging technologies.

ADVANTAGE — ⊕ - ↓ mistakes - ↑ efficiency, productivity.

Demographic Movement

	COUNTRIES LOSING POPULATION	GAINING POPULATION
ADVANTAGES ⊕	- less people to house/feed. - less pressure on resources - could lose highly skilled workers to more affluent countries.	- helps fix labour shortages - migrants are prepared to take lower paid jobs - ↑ cultural diversity
DISADVANTAGES ⊖	- lose young/able workers - lose ↓ education skills - families get divided.	- language barriers/cultural differences. - pressure on housing / health services.

Science & Technology Parks: ⊕ Encourages collaboration → faster technology development → faster time for product to be sold on market.

1.1.2 ENTERPRISE

Privately Owned	- owner has full control over direction of business. - not accountable to outsiders - can quickly adapt to market	- may not have sufficient funding for larger products (lack of capital)
Crowd-Funding	- less risky and w/out interest payments for bank loans.	- have to pitch on a website and convince people to invest - may have to split profit.
Government Funding	will financially support business if it could help the economy.	
Non Profit	Profit is reinvested, it is a social enterprise, exists for the good of the community, can be privatised or government funded.	

Page 2 — Core Content (40%)

(cont)

1.7

CKD: completely knocked down
- needs to be assembled on arrival

CBU: completely built units
- shipped in one piece, don't need assembling.

1.1.3 SUSTAINABILITY

	DISADVANTAGE	HOW TECHNOLOGIES HELP?
TRANSPORTATION COSTS	Business incurs costs is direct to consumer. ↑ carbon footprint	- use electric vehicles - revise routes for less journeys - lighter/compact products.
POLLUTION	Types: sound, light, air. Can get tax/fine if business produces too much CO_2.	- using machines more energy efficient - dispose/reuse more responsibly
DEMAND ON NATURAL RESOURCES	Will run out of fossil fuels in 54 years	- use alternate methods of energy creation: dams, turbines, solar panels
WASTE GENERATED	To be efficient materials are often wasted.	- purchasing new and efficient machines, doesn't rely on employee time and brainpower.

1.1.4 PEOPLE

HOW DOES TECHNOLOGY HELP

WORKFORCE - working from home, cuts out transport time, but could lead to overworking

CONSUMERS ↑ in demand due to globalisation, different companies must spend more on marketing to find a customer base.

CHILDREN can provide new platforms for child's development of fine motor skills, can aid in entertainment and education, but could also mean excessive long screentimes which should be monitored.

PEOPLE W/ DISABILITIES Assistive technology aids lots with motor control. As tech progresses treatments for cerebral palsy, cardiovascular and visual conditions ↑.

HIGHLY SKILLED WORKERS
- hybrid skill set workers = more valuable
- workers must keep developing technical skills to remain competitive in job market.

APPRENTICESHIPS

1.1.5 CULTURE

MIGRATION AND SEGREGATION
- can use outside perspective to better market products.
- migrants may stick to products from own community
- offensive packaging or marketing could ↓ buyers ↑

1.1.6 SOCIETY

CHANGES IN WORKING HOURS AND SHIFT PATTERNS: Technology makes work more accessible, laws protect employees ~~and~~ and their time.

INTERNET OF THINGS: Refers to interconnected automated systems. Uses sensors to collect data, sends to cloud to analyse. Helps optimize processes, reduce costs and time, maximises profits ~~and~~ or implements new ideas and business models.

Page 3 — Core content (40%.)

(cont)

7.1 The impact of New and Emerging Technologies

CONTINUATION OF: 1.1.6 SOCIETY

REMOTE WORKING
- flexible hours
- sick can still work
- ↓ $ on transportation
- ↓ distractions.
- Break in routine
- Less workplace/social interaction.
- Less IT support — blurs work/life balance
- Could lead to breach in information.

VIDEO CONFERENCE MEETINGS
- saves time
- members can be ~~scattered~~
- travel costs ↓
- may not be as productive
- may lead to security breach
- difficult to navigate across time zones
- no social interactions

1.1.7 ENVIRONMENT

*** POLLUTION/ WASTE DISPOSAL ALREADY DISCUSSED**

things to be considered

PACKAGING: - ↓ volume and packaging size enables more products to be produced and delivered.
- ☺ = metal, glass, paper, cardboard
- ☺ = packaging that is recyclable or biodegradable

1.1.8 PRODUCTION TECHNIQUES & SYSTEMS

(+) (−)

STANDARDISED DESIGN/ COMPONENTS

same components used across many designs.
- consistent safety/quality
- speeds product development
- difficult to customize
- quality of product may suffer

JUST IN TIME MANUFACTURING

Raw material aligned directly with production schedules
- ↑ efficiency, ↓ waste
- flexibility in production
- very susceptible to delays in production
- more deliveries = ↑ cost
- fewer ~~bulk~~ bulk buying discount

LEAN MANUFACTURING
- multiskilled teams = ↑ efficient
- needs time consuming data analysis

BATCH
- could lower capital cost
- resetting production system each batch = downtime

CONTINUOUS

Production line running 24 hours a day.
- Economies of scale = ↓ cost
- more consistent
- ↑ initial cost
- needs lots of storage space if demand is low.
- automation → staff redundancy.

ONE-OFF

single unique product made by skilled workers.
- high quality products
- ↑ production cost
- long production times
- labour intensive

} price of product becomes v expensive.

MASS

uses machinery, large scale
Product @ cheap price.
- materials cheaper in high quantities
- ↑ init set up cost
- repetitive
- susceptible to production delays on conveyor belt.

page (4) — core content (40%.)

1.2 Evaluating New & Emerging Technologies to inform design decisions.

just a bunch of questions you need to ask, will give 1-2 examples.

1.2.1

BUDGET CONSTRAINTS
- can costs be saved via speed of manufacturing, reduction in materials ...?
- will technology improve value + maximize profit?

TIMESCALE
- How long do staff take to train
- what lead time do customers want?

USER
- Target Market Research?
- Did it help customer needs?

MATERIAL USED
- Material testing?
- sustainable?

MANUFACTURING CAPABILITIES
- still high quality?
- Flexible to demand?

1.2.2

NATURAL DISASTER
- is building protected against disaster?

MEDICAL ADVANTAGES
- biotechnology
- med equipment

TRAVEL
- Environmentally friendly?

GLOBAL WARMING
X greenhouse gases
zero carbon technologies

COMMUNICATION - don't assume demographic has access to hardware/software/power source.

1.2.3

Where was it made? ← don't exploit worker rights

Who made this? ← are they ethical?

- Fair Trade
- sustainable
- ethical
- if not followed could lose customers.

Who will this benefit? ← does this improve quality of life?

1.2.4

USE OF MATERIALS: use most sustainable properties of woods (MDF)
CARBON FOOTPRINT: reducing CO_2, use renewable energy.
ENERGY USAGE/CONSUMPTION: use renewable/less energy
LIFE CYCLE ANALYSIS: Takes into account environmental impacts at each stage of product life.
↳ 1. Material Extraction, 2. Assembly, 3. Transport/Distribution, 4. Use, 5. Disposal/recycling

1.3 Energy

SOURCE	ADVANTAGES	DISADVANTAGES
Oil	-cheap -large scale -high power	-polluting -makes landscape ugly
Gas	↳ -cleaner than coal/oil	-highly polluting
Coal	↳ -reliable	-hella toxic -impacts landscape
Wind (turbines)	-freely available -can be used in remote area -no emmisions	-unreliable -expensive
Solar	-reliable -more accessible -↑energy	-expensive -environment damaging
Hydroelectric	-↑power, ↓cost -multipurpose (water reserve)	-expensive -could cause flooding -could ruin ecosystem

page 5 - core content (40%)

CONT 1.3 Energy

1.4 Modern/smart, composite materials, technical textiles

1.3 ENERGY (cont.)

1.3.2

	How?		How?	for power
BATTERIES 3 CELLS	chemical → electrical - easy to manufacture, cheap, long life	MAINS ELECTRICITY	- alternating current, needs to be plugged - can be harmful - non-renewable	
SOLAR CELLS	- sunlight → electrical - photovoltaic cells	WIND POWER	= mechanical → electrical - depends on strength of wind, unreliable	

1.3.3 Factors of choosing, mostly commonsense / self explanatory

a) portability b) environmental impact c) power output d) system connections e) cost

1.4 Modern/smart and composite materials, technical textiles

1.4.1 Modern and smart Materials

		(+)	(-)	USES
SHAPE MEMORY ALLOYS	can be plastically deformed. Will return to original shape when heated or current applied Ex: gold - cadmium, nickel - titanium	- lengthens life of product - reduced overall size - less complexity	- expensive - continued use → metal fatigue.	- glasses frames - medical stents - tweezers - orthodontic wires
NANOMATERIALS	Tiny components less than 100 nm. Can be robust, scratch resistant and ~~lightweight~~ lightweight	- ↑ Surface Area : volume Ratio = ↑ chemical properties	- needs risk assessment for health + environment	- fire retardant - sunscreen - tennis rackets - car bumpers
REACTIVE GLASS	can change opacity based on voltage	- instant privacy - retains heat ↓ bills	- expensive - requires electricity source	- welding masks/goggles - windows
PIEZOELECTRIC MATERIALS	when sensors compressed = small electric charge	- sustainable - low maintenance - compact size	- can wear out - has temp, load, voltage limitations	- generating energy - in sensors - in actuators
TEMPERATURE RESPONSIVE POLYMERS	change in temp = change in physical properties EX: (PNIPAM)	- ~~unaffordable~~ - useful in biomedics	- still being researched	- deliver drugs to patients in controlled way. - used as gel activators
CONDUCTIVE INKS	Pigments that allow small current to flow Ex: silver, carbon, graphite	- easy to use, low waste - cheaper → circuit boards	- silver: $$$ - difficult to manipulate	- drawing working circuits on paper - ~~refe~~ print RFID tags

1.4.2 composites

CONCRETE	sand, cement, water.	- ↑ compressive strength - cheap and mega durable	- damage thru corrosion, fire, freezing trapped water.	Mainly for construction
PLYWOOD	layers of wood veneers glued together	- strong - stable	- can come apart if wet.	- sheds - cladding - flooring - furniture

CONT 1.4 Moden/smart and composite materials,

CONTINUATION OF SMART/COMPOSITE MATERIALS, TECHNICAL TEXTILES : 1.4.2 Composites

Fibre/carbon/glass
- used as reinforcement to make ↑ strength:weight ratio
- fibres woven → fabric.

Ex. Glass Reinforced Plastic
easily formed into shapes – big structures
EX: Carbon Fibre Reinforced Plastic
More expensive than GRP but stronger

Breathing in fibres can be very dangerous.

REINFORCED POLYMERS
Resin + Fabric = laminated sheets. - high melting point
-light -strong - inflammable

Gears
Bearings

Can be expensive

ROBOTIC MATERIALS
React to surroundings. ~~Can~~ Has sensors, actuators, computation + communication.

Prosthetics. Color changing vehicles. some plane wings.

expensive + complex

1.4.3 Technical Textiles

AGRO TEXTILES	Nylon, polyester, polyethene, polypropene, jute and wood	- durable - cheap - ↓need pesticides - biodegradable	- protection from UV + solar	Could affect ecosystems	- shading - thermal insulation - netting
CONSTRUCTION TEXTILES	To help construction appearance/longevity	- strong & light - stable even in heat	- ?expensive - could degrade w/ time.		- waterproof membrane - concrete reinforcement
GEOTEXTILES	Stabilizes soil or rock	- doesn't rot - cost effective	- easily blocked by sediment - ineffective if damaged		- non-woven or woven mats reinforce banks.
DOMESTIC TEXTILES	Used in houses	- hard wearing - absorbent - stain resistant	- potential fire risk - difficult to clean?		- cleaning wipes - furniture - carpets
ECO FRIENDLY TEXTILES	organic Fibres: hemp, wool, cotton	- made w/ less chemicals - resistant to mould/pests	- ?expensive		- Geotextiles - Agrotextiles
PROTECTIVE TEXTILES	Protect against heat, ~~chemicals~~ chemicals, gases, pesticides, or bullets.	still breathable and light	- expensive - ↓eco friendly		Heat/Radiation protection for firefighters. Tents for bad weather. Parachutes.
SPORTS TEXTILES	combines function with comfort for high performance. Senses heart rate.	- improves athletic performance - can be lightweight - streamlined/breathable - remove moisture - senses heart rate - controls bacteria - block UVA/UVB rays - Impact Resistant	~~If~~ if too effective, may not be allowed to wear when competing		- running shoes - cycling shorts - rugby tops - swimsuits

1.5 Mechanics

1.5.1 Types of Movement.

LINEAR one direction, straight line

Ex: Train on track

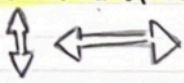
ROTARY Turning in a circle

Ex: wheel turning

OSCILLATION curved back and forth, swings on axis

Ex: A swing or clock pendulum

RECIPROCATION Repeated up and down motion



Ex: Piston or pump

1.5.2 Classification of Levers

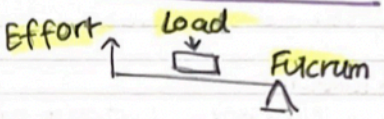
Tips to memorize: Class 1: (F) Class 2: (L) Class 3: (E) — whichever letter is in the middle, THAT is the class.

CLASS 1 LEVER L(F)E or EFL

load and effort at opposite sides/ fulcrum in between

Ex: Seesaw, scissors, crowbar

CLASS 2 LEVER E(L)F or FLE



Effort and fulcrum are opposites. Load in between.

Ex: wheelbarrow, nutcracker

CLASS 3 LEVER F(E)L or LEF

Fulcrum and load = opposite effort in middle

Ex: Tweezers, Spade

KEYWORDS

Effort: force applied by user **Fulcrum**: where lever pivots **Load**: weight that needs to be moved

CALCULATIONS: *Mechanical Advantage, Velocity Ratio, Efficiency.*

1. **Mechanical Advantage**

Load / MA | Effort

Example: A 50N effort is needed to lift a 300N load. Calculate MA.

Load ÷ Effort = MA

300 ÷ 50 = 6 MA = 6

2. **Velocity RATIO**

Distance Moved by Effort / Velocity Ratio | Distance Moved by Load

A wheelbarrow's handles are lifted 800mm while the load is raised 100mm. Calculate the velocity ratio.

Distance by effort ÷ distance by load = VR

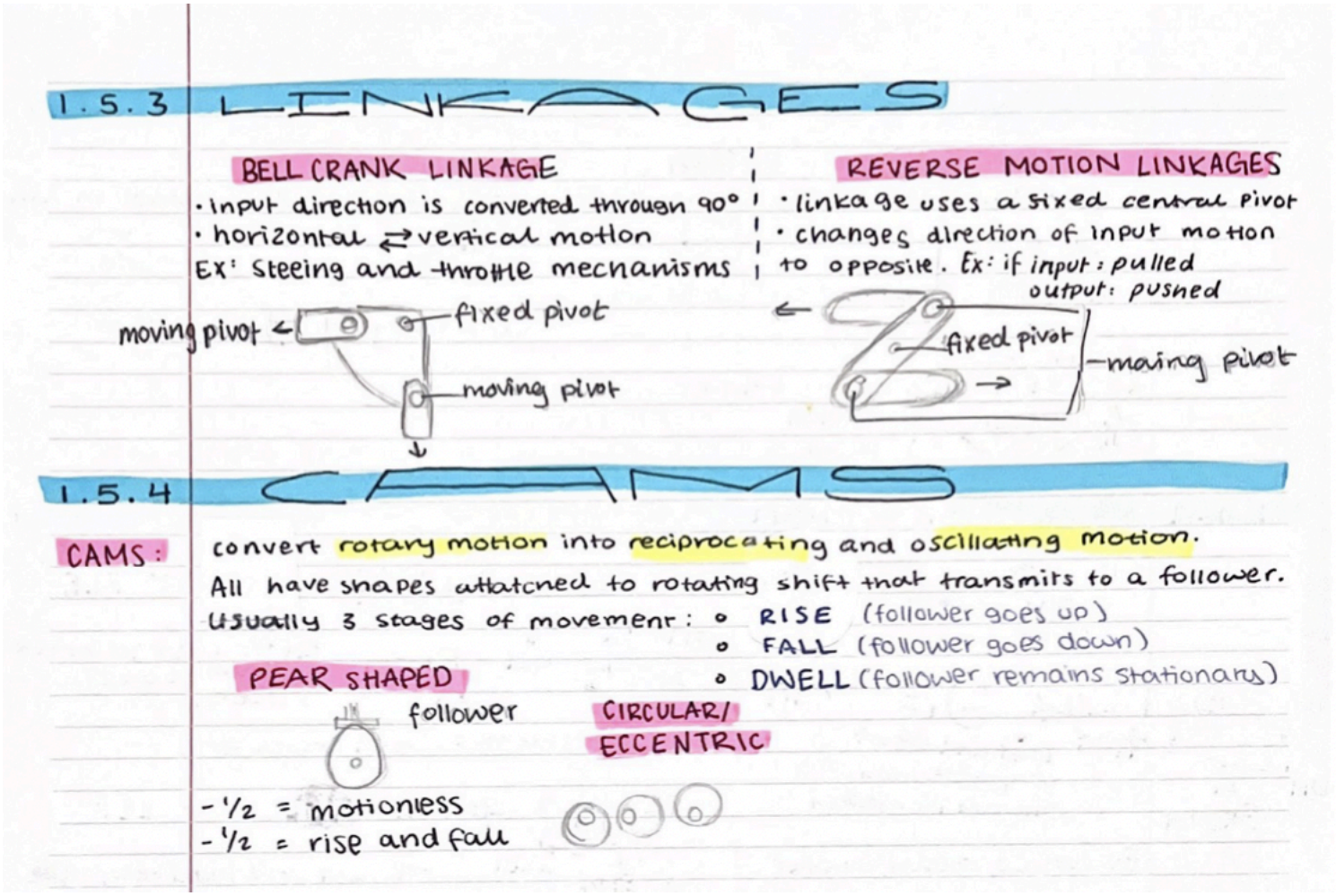
800 ÷ 100 = 8

3. **Efficiency**

Mechanical Advantage / Velocity Ratio x100

If MA is 6 and VR is 8, calculate efficiency?

$\frac{6}{8} = 0.75$ $0.75 \times 100 = 75\%$



WE ARE COOKED TODAY

Goats Ima star this so I can use this to revise.

Copy of Last Minute DT Revision

IMPORTANT RESOURCES:

Specification:
https://drive.google.com/file/d/1qg2LVrczzjNY_ggyhe3InTrmDwhsUuD6/view?usp=sharing

Yi Makes It Easy:
https://youtube.com/playlist?list=PLS-TIpNmaiIC8NBd_cTfCxN7X_hr7rw02&si=P0G2ngIQatmmP9lO

Quizlet 1: https://quizlet.com/gb/369037893/design-technology-gcse-flash-cards/
Timbers Quizlet: https://quizlet.com/371596208/design-technology-gcse-timber-flash-cards/
Core Content: https://quizlet.com/gb/759688278/gcse-edexcel-dt-core-content-flash-cards/

General Structure for Answers:
3 MARKERS: BLT
- POINT
- B ecause (why is this an advantage/disadvantage)
- L eading to (what effect does this have)
- T herefore (how does it impact the __ business? product? whatever is the context)

6 MARKERS: BLT BLT
* POINT
* B ecause
* L eading to
* T herefore
x2

9 MARKERS: BLT HBLT BLT HBLT CONC
* POINT
* B ecause
* L eading to
* T herefore

* H owever (what could be a disadvantage? why may this not work? no need to go in depth)
* B ecause
* L eading to
* T herefore

x2

CONCLUSION:
- overall effect
- short term/long term effect
- external factor on this
- conditional (what does this need in order to work)

EXAM QUESTION PRACTICE:

(2019 Paper)

12. Negative effect of reduction in products for the manufacturer:

ANSWERS:

- Smaller workforce required → loss of jobs
- Company may go out of business → lost jobs and reduced profits in the area
- Money used up for old machinery used to make product → highly specialised so can't be used for anything else, still needs to be maintained.

13. Why would calico be used for a prototype?

ANSWERS:

- Calico is cheap → keeps cost down in terms of development
- Calico accepts a range of surface finishes → lots of designs and colours can be tested
- Calico is absorbent → accepts a range of surface finishes
- Calico is rigid when sewn along a seam → it can hold its shape
- Calico is the same on both sides → doesn't matter which round the material is used

14. Why use tracing paper?

ANSWERS:

- Transparent → can be placed over drawing to make a copy of it/trace image
- Can be placed over a drawing and drawn on → can be used to transfer images

15. Why acrylic?

ANSWERS:

- Transparent
- Good electrical insulator
- Lightweight
- Waterproof
- Durable

16. Why stainless steel for support?

ANSWERS:

- Hard material, good compressive strength → can be pushed into ground without deforming
- Resistant to corrosion → won't rust in the wet ground
- Tough → can withstand bumps and knocks

17. How can new and emerging technologies reduce the manufacturer's carbon footprint?

ANSWERS:
- Use renewable energy sources and maximise energy sources → reduces emissions
- Use modern machinery → reduces energy consumption
- Use video conferences → don't have to travel so reduces pollution
- Replacement parts can be sent as files to be printed → transportation pollution is offset
- Any pollution from factories can be cleaned → reduces pollutants released into atmosphere
- Use biofuels → reduces emissions

18. How do new and emerging technologies impact apprentices?

ANSWERS:
- Exposed to the latest technology → trained in the most current methods
- Very employable → Technologies will spread to other companies
- High specialised workers → will be able to command higher salaries
- After training their job may have become obsolete → because technology has replaced manual workers
- Safer working environments → machines can take care of difficult work
- Lower skilled technician roles → will get lower paid positions

(2020 Paper)

9. Advantage of using polyester for school tie?

ANSWERS:
- Stain resistant → will not mark if food gets on it
- Hands well → will look nice
- Dries quickly → can be washed overnight
- Resistant to abrasion → will not get damaged through friction
- Recyclable → will not end up in a landfill
- Does not shrink → will not lose shape when washed
- Good colour retention → colour will not fade over time

10. Advantage of using Shape Memory Alloys (SMA)

ANSWERS:
- If plastically deformed into wrong shape they can be heated → goes back to original shape
- Once correct size is achieved the material can be reheated → can be reused

- It is easier to reset/straighten the SMA wire in comparison to copper wire → it can be heated rather than pulled through a die.

11. Why would copper wire be used?

ANSWERS:

- It is malleable → will hold its shape once formed
- It is ductile → can be drawn out into thin long wires
- It is a nice colour → can be left without additional surface finishing
- It will not rust → which would mean no stain or mark on any clothing

12. High Impact Polystyrene Properties?

ANSWERS:

5. Withstands high impacts
6. Good electrical insulator
7. Lightweight
8. Durable

13. Corrugated cardboard?

ANSWERS:

- Impact resistance
- Strength to weight ratio
- Recyclable
- Cost effective material

14. Robotic Materials?

ANSWERS:

- Sensors can detect movement
- Sensors can detect pressure
- Can communicate with users through vibrations
- Can replace internal components doing computational purposes

15. Environmental Issues of release of a new product

ANSWERS:

- Pressure on plastics to make new product
- Old products that are being replaced may not get disposed of properly, should be recycled
- Demand on energy for manufacture and transportation → pollution

16. Wearing protective textiles disadvantages

ANSWERS:

- Stiff → restricts movement

- Not breathable → will sweat
- Heavy to wear → slows them down

(2021 Paper)

8. Advantages of any clean source of energy (Ex: wind)

- Energy generated is free once costs have been paid off
- It is a clean fuel source, reduces emissions
- Sustainable, will never run out

9. Felted Wool Fabric

- Does not fray → will leave a neat finish
- Soft → will not damage any surface

10. Why fibreglass?

- Tough material
- Water resistant
- Can be moulded into complex shapes
- High quality surface finish (reduces friction)
- Lightweight
- Low maintenance
- Can be pigmented

11. Benefits of sp orts textiles?

- Lightweight
- Inbuilt sensors
- Contain UV blockers
- Can control bacteria
- Waterproof coatings
- Wickening fabrics
- Can stretch and hug the body (less drag)
- Breathable

12. Corrugated cardboard?

- Flexible
- Easily printed on
- Biodegradable
- Impact resistant

13. How to keep to minimal cost

- Same type of material
- Cuttings to reduce surface area
- Regular shapes

14. Internet of things

-

TIMBER SECTION:

19. Advantages of sustainable timber

- Timber stocks will not run out → because as trees are cut down several new ones are planted
- Product can be marketed with the FSC logo → increase sales
- Certification → shows consumers timber is being protected from deforestation

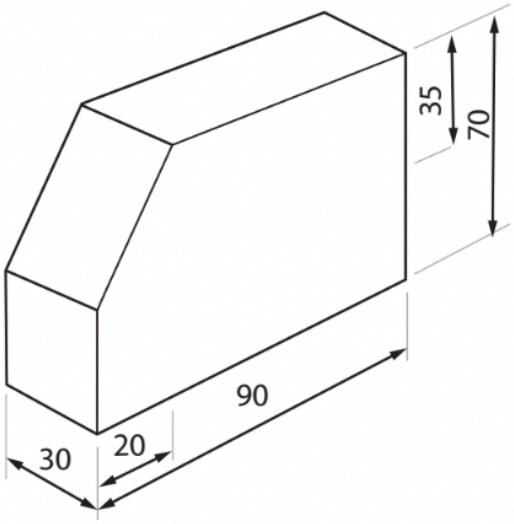
20. Why use different timbers?

- DIfferent timbers have different colours/grains/textures → can show different parts
- Small scraps can be used up for different parts of product → reduces waste

21. Techniques to produce bodies

(d) Figure 13 shows the main body for the toy creature.

The bodies are to be manufactured from pine in a batch of 1000.



All dimensions in mm

Figure 13

Name **two** different techniques that could be used to batch produce the main body.

Explain **one** advantage of using each technique.

(6)

CAM/CNC Machining

- Can repeat cut → makes identical components quickly

Cutting Jigs

- can be used to cut shapes → with little to no marking out

Cutting/sanding/wasting

- corner cut off with a tenon band saw → finished with disc sander

Cutting template

- Profile fixed to work to follow → produces exact copy

22. Why use stock sized materials?

- Can be bulk purchased → no need to make them
- Dowels being a standard size → standard drill bits can be used to make holes
- Wasteful to make them from square stock material → reduces waste

- Time consuming to make them → speeds up production
- Widely available → always in stock somewhere never run out
- Stock sizes available in ranges of sizes → manufacturing decisions made to suit
- Don't have to invest money in machinery → saving capital

THE BIG 6 - 9 MARKERS:

2019:

(c) A film company is considering launching a range of musical jewellery boxes based on its animated characters.

Discuss the different design strategies the company could use to generate initial ideas and to avoid design fixation.

(6)

2020:

(d) Discuss the use of video conference meetings by companies around the world to develop new technologies for firefighters.

(6)

- Saves time travelling and reduces cost of travelling
- Can be recorded and played to those who did not attend
- Serves as a record of what was discussed and agreed
- Allows files to be shared, more opportunities for collaborative design.

- Requires investment into hardware
- Needs access to internet
- Susceptible to hacking so not always able to discuss confidential material
- Takes etiquette

2021:

Internet of old things with old people

- Iot has given rise to services like hive
- Electrical plugs can sense being used and can monitor and provide feedback to relatives to see daily routines are being carried out
- Cameras can be placed in homes to be observed by relatives
- Trackers can be used to see where people are
- Personal alarms can bee worn
- Online shopping
- Smart locks
- Smart appliances controlled remotely

ALL TYPES OF CALCULATIONS:

6) Percentage Change (Reduction or Increase):

FORMULA:

(Initial - final) / initial = percentage change

Example:

(b) Figure 2 shows a table with the number of plastic bags given away in England.

Year	Number of bags given away (billions)
2014	7.6
2015	5.4

Figure 2

Calculate the percentage reduction in the number of plastic bags given away between 2014 and 2015.

Give your answer to the nearest whole number.

(2)

(7.6-5.4) ÷ 7.6 = 29%

7) Mechanical Advantage

FORMULA:

Mechanical advantage = load / effort

Example: A 70N effort is needed to lift a 420N load. Calculate Mechanical Advantage.

Load / Effort = MA
420 / 70 = 6

8) Velocity Ratio

FORMULA:

Velocity Ratio = Distance Moved by Effort / Distance Moved by Load

OR

Velocity Ratio = Number teeth on driver gear / Number of teeth on driven gear

Example: A wheelbarrow's handles are lifted 800m while the load is raised 100mm. Calculate the Velocity Ratio.

800/100 = 8

9) **Efficiency**

FORMULA:

MA/VR

Example: Knowing the previous two values calculate efficiency.

Mechanical Advantage is 6
Velocity Ratio is 8

6/8 = 0.75

75%

10) Output Speed of a Pulley System

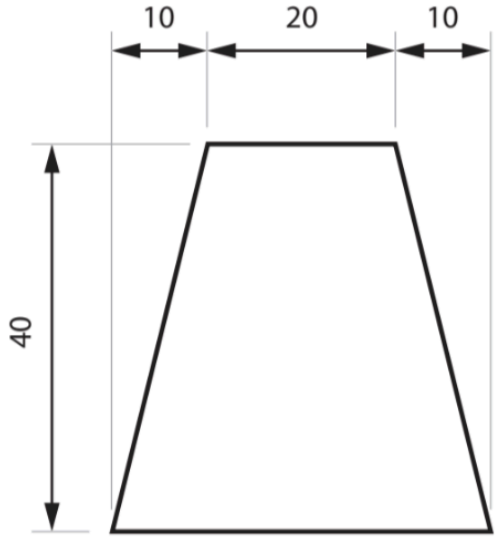
Output speed = Input speed / Velocity Ratio

Example: The input speed is 1800 revolutions per minute. Calculate the output speed of the pulley system.

1800 / ⅓ = 5400 rpm

Other

(c) Figure 15 shows the dimensions for the body of the tumbling figure.



All dimensions in mm

Diagram not to scale

Figure 15

Calculate the maximum number of whole bodies that could be cut from a length of timber measuring 181 cm long by 4 cm wide.

Ignore the width of any cuts.

(5)

181 x 4 = 724
(2 + 1)x4 = 12

724/12 = 60.333

= 60

(d) The solar cell used in the solar powered garden light costs 1/12th of the total cost of the product.

Calculate the cost of the solar cell if each light costs £4.97 to make.

Give your answer to two significant figures.

(2)

4.97/12 = £0.41

RANDOM DEFINITIONS:

Surface finishes/treatments:

- Paint
- Stain
- Varnish
- Wax
- Oil
- Shellac
- Veneer

Open Grain:

Manufactured Timber options:

- MDF
- Plywood
- Chipboard
- Blockboard
- Laminboard

Non Ferrous Metal

- Copper
- Brass
- Bronze

Composite Materials:

- Carbon fibre
- Concrete
- Plywood
- MDF
- Fibreglass

ONLINE NOTES:

TIMBERS (SECTION A):

Can be described using:

- Elasticity
- Tensile strength (pulling apart)
- Compressive strength (being crushed)

HARDWOOD:

deciduous

8. **OAK**

✅	❌
Strong/durable	Expensive as it is becoming rarer
Attractive grain	Corrodes iron and steel (hard to work with)

Uses: building houses/boats, high end furniture

9. **MAHOGANY**

✅	❌
Attractive grain	Expensive
Easy to work with	Oils can trigger allergies
	Difficult to source

Uses: high end furniture

10. **BEECH**

✅	❌
tough, won't break	Expensive
Hard, withstands wear, durable	Not moisture resistant
Dense grain, won't easily splinter	

Uses: toys, cooking material

11. **BALSA**

✅	❌
lightweight	Too soft and weak for most products
Easy to cut	

Uses: model making in school

12. JELUTONG

✅	❌
Close grain which is easy to cut Easy to work with Lightweight	Not strong, very soft, bad for structure

Uses: model making, moulds

13. **BIRCH**

✅	❌
Even grain, easy to work	Low resistance to rot and insect attack

Uses: to surface cheap materials, for plywood

14. ASH

✅	❌
strong, tough	low resistance to rot and insect attack
Flexible	
Finishes well	
Straight grained, less likely to break	

Uses: handles for tools, sports equipments, ladders

SOFTWOOD:

coniferous

4. **PINE**

✅	❌
durable	Expensive as it is becoming rarer
Cheap lightweight	Warps, cracks and splinters more than other woods.

Uses: house construction, furniture, doors

5. **CEDAR**

✅	❌
Resistant to water	More expensive than pine
Resistant to fungal growth	Not as strong than pine

Uses: outdoor furniture

6. **LARCH**

✅	❌
Tough, durable	Expensive
Resistant to water	

Uses: small boats, yachts

MANUFACTURED TIMBERS:

man made, not natural

3. **PLYWOOD**

✅	❌
Flat and structurally sound	Expensive
Resistant to warping, cracking, twisting	Can have risk of water damage if wrong grade of wood is used

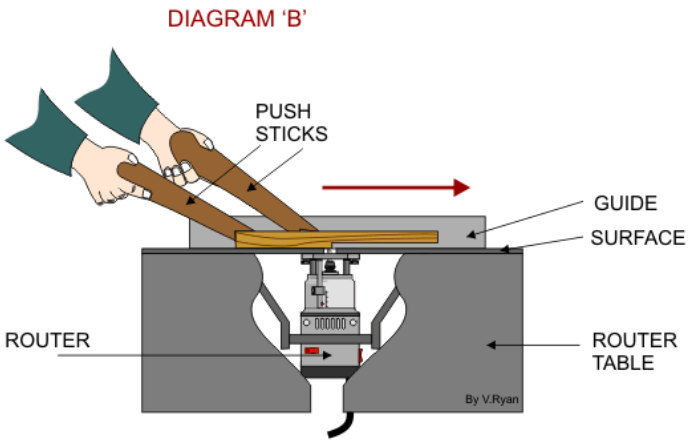
Uses: buildings, furniture panels that need some strength.

4. **MEDIUM DENSITY FIBREWOOD (MDF)**

✅	❌
Cheap (made from waste wood)	Very ugly so needs coating
Smooth surface is good for painting or staining	Weak compared to real wood or plywood
Easy to machine	Tools blunt quickly due to the glue

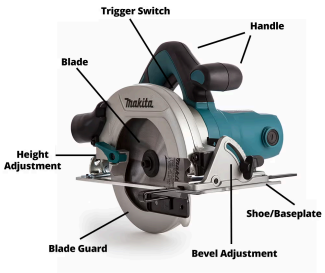
MANUFACTURING PROCESSES:

5. ROUTING



6. Use a jig to cut shapes
7. Cutter protrudes from table and cuts wood
8. Removes material quickly
9. Rub with damp cloth to remove dust
10. Leave to dry

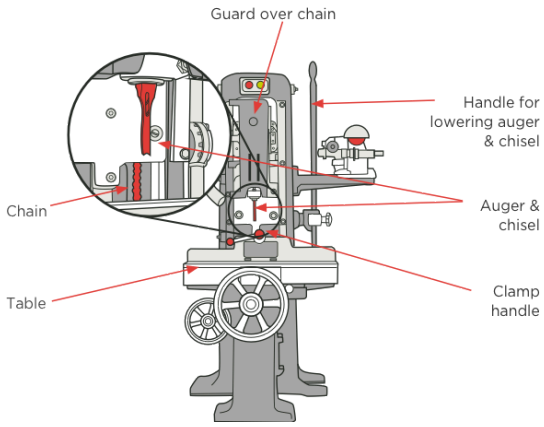
6. SAWING

		
Scroll saw	Circular saw	bandsaw

3. Mark out sections that need to be cut
4. Use guides to funnel wood through and cut them OR hold wood in a sort of vice

7. MORTISER

4. Accurately mark where you want the square hole to be
5. Chisel drills a round hole
6. Square chisels around it cuts the corners out to make a square
   https://www.bing.com/videos/riverview/relatedvideo?&q=how+to+use+a+mortiser&&mid=39E7E2CAE1B13991322C39E7E2CAE1B13991322C&mmscn=mtsc&aps=9&FORM=VRDGAR



(don't get too confused- video explains it clearly!)

8. BAG PRESS

A bag that can be sealed and have the air sucked out of it. A mould and laminates are put inside the bag. When the air is sucked out of the bag. The laminates are forced into the mould and are held while the glue dries. Presses equally on all surface areas

CAM/CNC Machining

- Can repeat cut → makes identical components quickly

Cutting Jigs

- can be used to cut shapes → with little to no marking out

Cutting/sanding/wasting

- corner cut off with a tenon band saw → finished with disc sander

Cutting template

- Profile fixed to work to follow → produces exact copy

—-

Respect for:
- Social groups (designs incorporate specific needs and desires for that group)
- Economic groups (different groups have different purchasing power)
- Ethnic groups (products should be sympathetic to culture and not offend - e.g., care taken when using symbols)

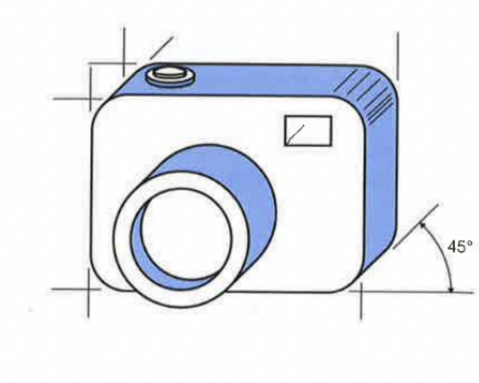
Sustainability:
- Fairtrade Foundation (Ensure farmers & producers are paid a fair price for their good in developing countries and working conditions are suitable, with no child or enforced labour and no discrimination)
- Carbon offsetting (reduce carbon footprint)
- Energy efficiency (including using renewables)
- Product disassembly (product can be recycled/reused and lasts longer as it can be repaired or upgraded)
- Disposal of waste (governed by laws to ensure little impact on environment) - includes using more non-toxic, recyclable, biodegradable materials as well as reducing waste

LCA: systematic inventory to assess environmental impacts relating to every stage of a product's life - makes it easier to identify what areas can be changed to reduce costs & environmental impact

Cost of: raw materials, maintenance, transportation, recycling, disposal[54]

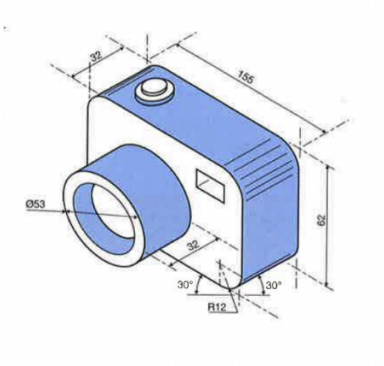
COMMUNICATION TECHNIQUES:

OBLIQUE:



45° angle

ISOMETRIC:



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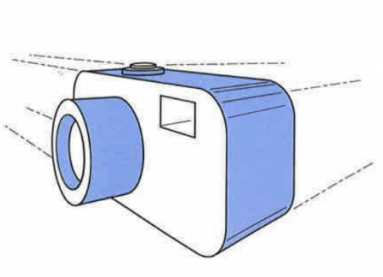
PERSPECTIVE:



TWO vanishing points

STUFF THAT NEEDS TO BE INCLUDED FOR THIS TOPIC

a freehand sketching (2D and/or 3D)
b annotated sketches
c cut and paste techniques
d digital photography/media
e 3D models
h orthographic and exploded views
i assembly drawings
j system and schematic diagrams
k computer-aided design (CAD) and other specialist computer drawing programs.

Ferrous metals, including: a mild steel b stainless steel c cast iron. 1.8.2 Non-ferrous metals, including: aluminium b copper c brass. 1.8.3 Properties, including: a ductility b malleability c hardness.

POLYMERS:

THERMOFORMING:

Easily formed into different shapes by heating, melting and remoulding, making them easily recyclable.

Acrylic (PMMA)

Attributes	**Purposes**
Hard	Motorcycle helmets visors
Stiff	Baths
Shiny	Signs
Weather resistant	

High density polyethylene(HDPE)

Attributes	**Purposes**
stiff	Washing-up bowls
strong	baskets
lightweight	Folding chairs

Polyethylene terephthalate (PET)

Attributes	Purposes
light	See-through drink bottles
strong	Fibres for clothing
tough	

Polyvinyl Chloride (PVC)

Attributes	Purposes
light	See-through drink bottles
strong	Fibres for clothing
tough	Rain coats

	Gas and water pipes

High impact polystyrene (HIPS)

Attributes	Purposes
Rigid	Vacuum forming
Cheap	CD cases
Toxic fumes when burned	Smoke detector casings

Polypropylene (PP)

Attributes	Purposes
tough	Plastic chairs
flexible	
Variety of colours	

BIOPOL- ADV (advantages) DSV (disadvantages)
ADV-reduces carbon dioxide emissions, biodegradable, reduces waste
DSV-expensive, may produce methane in landfills,

POLYESTER RESIN
ADV- cheap, durable, corrosion resistant
DSV- prone to shrinkage, low temperature resistance, strong odor, brittle, not eco-friendly

THERMOSETTING:

Undergo a chemical change when heated or moulded, permanently becoming hard and rigid, hence why they can easily be recycled

- Epoxy resin (ER)

Attributes	Purposes
Rigid	Circuit boards

Durable	Wind turbine rotor blades
Corrosion-resistant	
Good electrical Insulator	

- Melamine formaldehyde (MF)

Attributes	**Purposes**
strong	Laminate chipboard
scratch-resistant	Plates and bowls

- Polyester resin (PR)

Attributes	**Purposes**
Hard	Add to glass fibre for GRP
stiff	Kayaks
Cheap	Garden furniture
Good electrical insulator	
Waterproof	

- Urea formaldehyde (UF)

Attributes	**Purposes**
Hard	Plug socket
Brittle	Toilet seat
Good electrical Insulator	Cupboard handles

- Phenol formaldehyde (PF)

Attributes	**Purposes**
Hard	Bottle caps
Heat-resistant	Snooker balls
Easily moulded	Mixed with other materials to form a composite

METALS:

<u>Ferrous metals,</u>
mild steel- weaker than high-strength steel, poor corrosion resistance, ductile
stainless steel-corrosion resistant
cast iron- durable , easy to cast, high compressive strength (used for cooking- pots and pans and stuff)

<u>Non-ferrous metals:</u>

Aluminium- lightweight, durable, recyclable, corrosion resistant, malleable and ductile, good conductor of electricity and heat, non toxic, not very strong
Copper-recyclable, ductile, good conductor of electricity and heat, antimicrobal properties ,expensive, heavy
Brass- corrosion resistance, good conductivity, can tarnish, soft, expensive

<u>Properties:</u>
Ductility-how much can a material be drawn (stretched into the thin line) without breaking?
malleability-When the material can form any shape when heated without breaking/cracking
Hardness- how much do knocks and scratches damage the surface?

RANDOM QUESTIONS EDEXCEL SHITS ON US:

NEW AND EMERGING TECHNOLOGIES:

IN TERMS OF CARBON EMISSIONS:

- Use renewable energy sources and maximise energy sources → reduces emissions
- Use modern machinery → reduces energy consumption
- Use video conferences → don't have to travel so reduces pollution
- Replacement parts can be sent as files to be printed → transportation pollution is offset
- Any pollution from factories can be cleaned → reduces pollutants released into atmosphere
- Use biofuels → reduces emissions

IN TERMS OF APPRENTICESHIPS

- Exposed to the latest technology → trained in the most current methods
- Very employable → Technologies will spread to other companies
- High specialised workers → will be able to command higher salaries
- After training their job may have become obsolete → because technology has replaced manual workers
- Safer working environments → machines can take care of difficult work
- Lower skilled technician roles → will get lower paid positions

PAPER NOTES

Next page

Design Technology Revision — Page 1 — core content (40%)

1.1 The Impact of new and emerging technologies

1.1.1 Industry

ADVANTAGE AND DISADVANTAGE

	ADVANTAGES	DISADVANTAGES
Unemployment	- costs cut by adapting to ↑ efficient manufacturing processes. - bigger transportation vehicles for products in bulk. - less employment means less human error. - this reduces cost and ↑ revenue.	- advancements in tech mean less jobs available - costs can be reduced but in long run low skilled workers ↓↓. makes them lose their job more.

DEFINITION — Workforce Skillset: Employers must ensure employees are well trained and competent enough to utilize skills w/ new and emerging technologies.

ADVANTAGE — ⊕ - ↓ mistakes - ↑ efficiency, productivity.

Demographic Movement

	COUNTRIES LOSING POPULATION	GAINING POPULATION
ADVANTAGES ⊕	- less people to house/feed. - less pressure on resources - could lose highly skilled workers to more affluent countries.	- helps fix labour shortages - migrants are prepared to take lower paid jobs - ↑ cultural diversity
DISADVANTAGES ⊖	- lose young/able workers - lose ↓ education skills - families get divided.	- language barriers/cultural differences. - pressure on housing / health services.

Science & Technology Parks: ⊕ Encourages collaboration → faster technology development → faster time for product to be sold on market.

1.1.2 ENTERPRISE

Privately Owned	- owner has full control over direction of business. - not accountable to outsiders - can quickly adapt to market	- may not have sufficient funding for larger products (lack of capital)
Crowd-Funding	- less risky and w/out interest payments for bank loans.	- have to pitch on a website and convince people to invest - may have to split profit.
Government Funding	will financially support business if it could help the economy.	
Non Profit	Profit is reinvested, it is a social enterprise, exists for the good of the community, can be privatised or government funded.	

Page 2 — Core Content (40%)

(cont)

1.7

CKD: completely knocked down
- needs to be assembled on arrival

CBU: completely built units
- shipped in one piece, don't need assembling.

1.1.3 SUSTAINABILITY

	DISADVANTAGE	HOW TECHNOLOGIES HELP?
TRANSPORTATION COSTS	Business incurs costs is direct to consumer. ↑ carbon footprint	- use electric vehicles - revise routes for less journeys - lighter/compact products.
POLLUTION	Types: sound, light, air. Can get tax/fine if business produces too much CO_2.	- using machines more energy efficient - dispose/reuse more responsibly
DEMAND ON NATURAL RESOURCES	Will run out of fossil fuels in 54 years	- use alternate methods of energy creation: dams, turbines, solar panels
WASTE GENERATED	To be efficient materials are often wasted.	- purchasing new and efficient machines, doesn't rely on employee time and brainpower.

1.1.4 PEOPLE

HOW DOES TECHNOLOGY HELP

WORKFORCE - working from home, cuts out transport time, but could lead to overworking

CONSUMERS ↑ in demand due to globalisation, different companies must spend more on marketing to find a customer base.

CHILDREN can provide new platforms for child's development of fine motor skills, can aid in entertainment and education, but could also mean excessive long screentimes which should be monitored.

PEOPLE W/ DISABILITIES Assistive technology aids lots with motor control. As tech progresses treatments for cerebral palsy, cardiovascular and visual conditions ↑.

HIGHLY SKILLED WORKERS
- hybrid skill set workers = more valuable
- workers must keep developing technical skills to remain competitive in job market.

APPRENTICESHIPS

1.1.5 CULTURE

MIGRATION AND SEGREGATION
- can use outside perspective to better market products.
- migrants may stick to products from own community
- offensive packaging or marketing could ↓ buyers ↑

1.1.6 SOCIETY

CHANGES IN WORKING HOURS AND SHIFT PATTERNS: Technology makes work more accessible, laws protect employees ~~and~~ and their time.

INTERNET OF THINGS: Refers to interconnected automated systems. Uses sensors to collect data, sends to cloud to analyse. Helps optimize processes, reduce costs and time, maximises profits ~~and~~ or implements new ideas and business models.

Page 3 — Core content (40%.)

(cont)

7.1 The impact of New and Emerging Technologies

CONTINUATION OF: 1.1.6 SOCIETY

REMOTE WORKING
- flexible hours
- sick can still work
- ↓ $ on transportation
- ↓ distractions.
- Break in routine
- Less workplace/social interaction.
- Less IT support — blurs work/life balance
- Could lead to breach in information.

VIDEO CONFERENCE MEETINGS
- saves time
- members can be ~~scattered~~
- travel costs ↓
- may not be as productive
- may lead to security breach
- difficult to navigate across time zones
- no social interactions

1.1.7 ENVIRONMENT

*** POLLUTION/ WASTE DISPOSAL ALREADY DISCUSSED**

things to be considered

PACKAGING: - ↓ volume and packaging size enables more products to be produced and delivered.
- ☺ = metal, glass, paper, cardboard
- ☺ = packaging that is recyclable or biodegradable

1.1.8 PRODUCTION TECHNIQUES & SYSTEMS

(+) (−)

STANDARDISED DESIGN/ COMPONENTS

same components used across many designs.
- consistent safety/quality
- speeds product development
- difficult to customize
- quality of product may suffer

JUST IN TIME MANUFACTURING

Raw material aligned directly with production schedules
- ↑ efficiency, ↓ waste
- flexibility in production
- very susceptible to delays in production
- more deliveries = ↑ cost
- fewer ~~bulk~~ bulk buying discount

LEAN MANUFACTURING
- multiskilled teams = ↑ efficient
- needs time consuming data analysis

BATCH
- could lower capital cost
- resetting production system each batch = downtime

CONTINUOUS

Production line running 24 hours a day.
- Economies of scale = ↓ cost
- more consistent
- ↑ initial cost
- needs lots of storage space if demand is low.
- automation → staff redundancy.

ONE-OFF

single unique product made by skilled workers.
- high quality products
- ↑ production cost
- long production times
- labour intensive

} price of product becomes v expensive.

MASS

uses machinery, large scale
Product @ cheap price.
- materials cheaper in high quantities
- ↑ init set up cost
- repetitive
- susceptible to production delays on conveyor belt.

page (4) — core content (40%.)

1.2 Evaluating New & Emerging Technologies to inform design decisions.

just a bunch of questions you need to ask, will give 1-2 examples.

1.2.1

BUDGET CONSTRAINTS
- can costs be saved via speed of manufacturing, reduction in materials ...?
- will technology improve value + maximize profit?

TIMESCALE
- How long do staff take to train
- what lead time do customers want?

USER
- Target Market Research?
- Did it help customer needs?

MATERIAL USED
- Material testing?
- sustainable?

MANUFACTURING CAPABILITIES
- still high quality?
- Flexible to demand?

1.2.2

NATURAL DISASTER
- is building protected against disaster?

MEDICAL ADVANTAGES
- biotechnology
- med equipment

TRAVEL
- Environmentally friendly?

GLOBAL WARMING
X greenhouse gases
zero carbon technologies

COMMUNICATION - don't assume demographic has access to hardware/software/power source.

1.2.3

Where was it made? ← don't exploit worker rights

Who made this? ← are they ethical?

- Fair Trade
- sustainable
- ethical
- if not followed could lose customers.

Who will this benefit? ← does this improve quality of life?

1.2.4

USE OF MATERIALS: use most sustainable properties of woods (MDF)
CARBON FOOTPRINT: reducing CO_2, use renewable energy.
ENERGY USAGE/CONSUMPTION: use renewable/less energy
LIFE CYCLE ANALYSIS: Takes into account environmental impacts at each stage of product life.
↳ 1. Material Extraction, 2. Assembly, 3. Transport/Distribution, 4. Use, 5. Disposal/recycling

1.3 Energy

SOURCE	ADVANTAGES	DISADVANTAGES
Oil	-cheap -large scale -high power	-polluting -makes landscape ugly
Gas	↳ -cleaner than coal/oil	-highly polluting
Coal	↳ -reliable	-hella toxic -impacts landscape
Wind (turbines)	-freely available -can be used in remote area -no emmisions	-unreliable -expensive
Solar	-reliable -more accessible -↑energy	-expensive -environment damaging
Hydroelectric	-↑power, ↓cost -multipurpose (water reserve)	-expensive -could cause flooding -could ruin ecosystem

page 5 - core content (40%)

CONT 1.3 Energy

1.4 Modern/smart, composite materials, technical textiles

1.3 ENERGY (cont.)

1.3.2

	How?		How?	for power
BATTERIES 3 CELLS	chemical → electrical - easy to manufacture, cheap, long life	MAINS ELECTRICITY	- alternating current, needs to be plugged - can be harmful - non-renewable	
SOLAR CELLS	- sunlight → electrical - photovoltaic cells	WIND POWER	= mechanical → electrical - depends on strength of wind, unreliable	

1.3.3 Factors of choosing, mostly commonsense / self explanatory

a) portability b) environmental impact c) power output d) system connections e) cost

1.4 Modern/smart and composite materials, technical textiles

1.4.1 Modern and smart Materials

		(+)	(-)	USES
SHAPE MEMORY ALLOYS	can be plastically deformed. Will return to original shape when heated or current applied Ex: gold - cadmium, nickel - titanium	- lengthens life of product - reduced overall size - less complexity	- expensive - continued use → metal fatigue.	- glasses frames - medical stents - tweezers - orthodontic wires
NANOMATERIALS	Tiny components less than 100 nm. Can be robust, scratch resistant and ~~lightweight~~ lightweight	- ↑ Surface Area : volume Ratio = ↑ chemical properties	- needs risk assessment for health + environment	- fire retardant - sunscreen - tennis rackets - car bumpers
REACTIVE GLASS	can change opacity based on voltage	- instant privacy - retains heat ↓ bills	- expensive - requires electricity source	- welding masks/goggles - windows
PIEZOELECTRIC MATERIALS	when sensors compressed = small electric charge	- sustainable - low maintenance - compact size	- can wear out - has temp, load, voltage limitations	- generating energy - in sensors - in actuators
TEMPERATURE RESPONSIVE POLYMERS	change in temp = change in physical properties EX: (PNIPAM)	- ~~unaffordable~~ - useful in biomedics	- still being researched	- deliver drugs to patients in controlled way. - used as gel activators
CONDUCTIVE INKS	Pigments that allow small current to flow Ex: silver, carbon, graphite	- easy to use, low waste - cheaper → circuit boards	- silver: $$$ - difficult to manipulate	- drawing working circuits on paper - ~~refe~~ print RFID tags

1.4.2 composites

CONCRETE	sand, cement, water.	- ↑ compressive strength - cheap and mega durable	- damage thru corrosion, fire, freezing trapped water.	Mainly for construction
PLYWOOD	layers of wood veneers glued together	- strong - stable	- can come apart if wet.	- sheds - cladding - flooring - furniture

CONT 1.4 Moden/smart and composite materials,

CONTINUATION OF SMART/COMPOSITE MATERIALS, TECHNICAL TEXTILES : 1.4.2 Composites

Fibre/carbon/glass
- used as reinforcement to make ↑ strength:weight ratio
- fibres woven → fabric.

Ex. Glass Reinforced Plastic
easily formed into shapes – big structures
EX: Carbon Fibre Reinforced Plastic
More expensive than GRP but stronger

Breathing in fibres can be very dangerous.

REINFORCED POLYMERS
Resin + Fabric = laminated sheets. - high melting point
-light -strong - inflammable

Gears
Bearings

Can be expensive

ROBOTIC MATERIALS
React to surroundings. ~~Can~~ Has sensors, actuators, computation + communication.

Prosthetics. Color changing vehicles. some plane wings.

expensive + complex

1.4.3 Technical Textiles

AGRO TEXTILES	Nylon, polyester, polyethene, polypropene, jute and wood	- durable - cheap - ↓need pesticides - biodegradable	- protection from UV + solar	Could affect ecosystems	- shading - thermal insulation - netting
CONSTRUCTION TEXTILES	To help construction appearance/longevity	- strong & light - stable even in heat	- ?expensive - could degrade w/ time.		- waterproof membrane - concrete reinforcement
GEOTEXTILES	Stabilizes soil or rock	- doesn't rot - cost effective	- easily blocked by sediment - ineffective if damaged		- non-woven or woven mats reinforce banks.
DOMESTIC TEXTILES	Used in houses	- hard wearing - absorbent - stain resistant	- potential fire risk - difficult to clean?		- cleaning wipes - furniture - carpets
ECO FRIENDLY TEXTILES	organic Fibres: hemp, wool, cotton	- made w/ less chemicals - resistant to mould/pests	- ?expensive		- Geotextiles - Agrotextiles
PROTECTIVE TEXTILES	Protect against heat, ~~chemicals~~ chemicals, gases, pesticides, or bullets.	still breathable and light	- expensive - ↓eco friendly		Heat/Radiation protection for firefighters. Tents for bad weather. Parachutes.
SPORTS TEXTILES	combines function with comfort for high performance. Senses heart rate.	- improves athletic performance - can be lightweight - streamlined/breathable - remove moisture - senses heart rate - controls bacteria - block UVA/UVB rays - Impact Resistant	~~If~~ if too effective, may not be allowed to wear when competing		- running shoes - cycling shorts - rugby tops - swimsuits

1.5 Mechanics

1.5.1 Types of Movement.

LINEAR one direction, straight line

Ex: Train on track

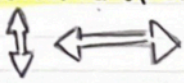
ROTARY Turning in a circle

Ex: wheel turning

OSCILLATION curved back and forth, swings on axis

Ex: A swing or clock pendulum

RECIPROCATION Repeated up and down motion



Ex: Piston or pump

1.5.2 Classification of Levers

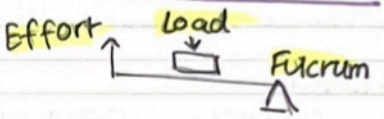
Tips to memorize: Class 1: (F) Class 2: (L) Class 3: (E) — whichever letter is in the middle, THAT is the class.

CLASS 1 LEVER L(F)E or EFL

load and effort at opposite sides/ fulcrum in between

Ex: Seesaw, scissors, crowbar

CLASS 2 LEVER E(L)F or FLE



Effort and fulcrum are opposites. Load in between.

Ex: wheelbarrow, nutcracker

CLASS 3 LEVER F(E)L or LEF

Fulcrum and load = opposite effort in middle

Ex: Tweezers, Spade

KEYWORDS

Effort: force applied by user **Fulcrum**: where lever pivots **Load**: weight that needs to be moved

CALCULATIONS: *Mechanical Advantage, Velocity Ratio, Efficiency.*

1. **Mechanical Advantage**

Load / MA | Effort

Example: A 50N effort is needed to lift a 300N load. Calculate MA.

Load ÷ Effort = MA

300 ÷ 50 = 6 MA = 6

2. **Velocity RATIO**

Distance Moved by Effort / Velocity Ratio | Distance Moved by Load

A wheelbarrow's handles are lifted 800mm while the load is raised 100mm. Calculate the velocity ratio.

Distance by effort ÷ distance by load = VR

800 ÷ 100 = 8

3. **Efficiency**

Mechanical Advantage / Velocity Ratio x100

If MA is 6 and VR is 8, calculate efficiency?

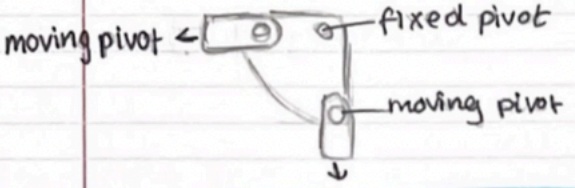
$\frac{6}{8} = 0.75$ $0.75 \times 100 = 75\%$

1.5.3 LINKAGES

BELL CRANK LINKAGE

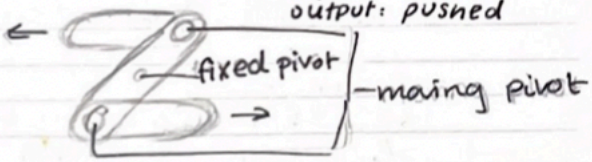
- input direction is converted through 90°
- horizontal ⇄ vertical motion

Ex: steering and throttle mechanisms



REVERSE MOTION LINKAGES

- linkage uses a fixed central pivot
- changes direction of input motion to opposite. Ex: if input: pulled output: pushed



1.5.4 CAMS

CAMS: convert rotary motion into reciprocating and oscillating motion.

All have shapes attatched to rotating shift that transmits to a follower.

Usually 3 stages of movement:
- RISE (follower goes up)
- FALL (follower goes down)
- DWELL (follower remains stationary)

PEAR SHAPED

- ½ = motionless
- ½ = rise and fall

CIRCULAR/ ECCENTRIC

WE ARE COOKED TODAY