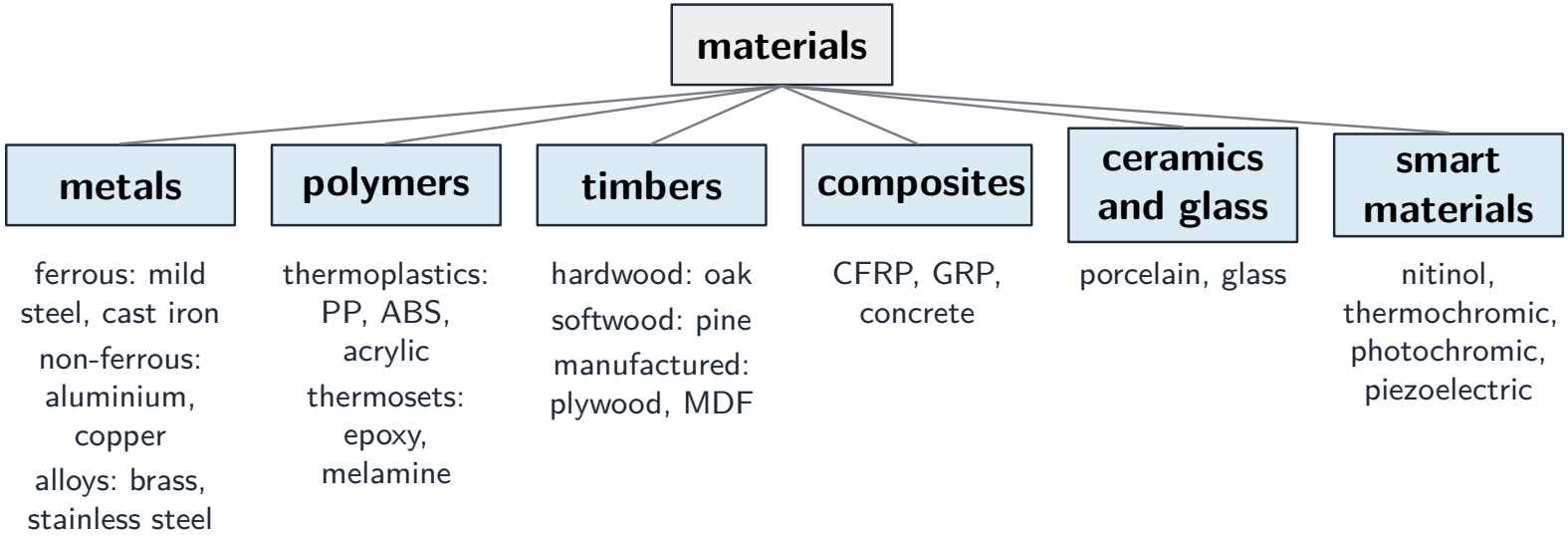
Exercise walk-through

2.4
Manufacturing processes and scales of production

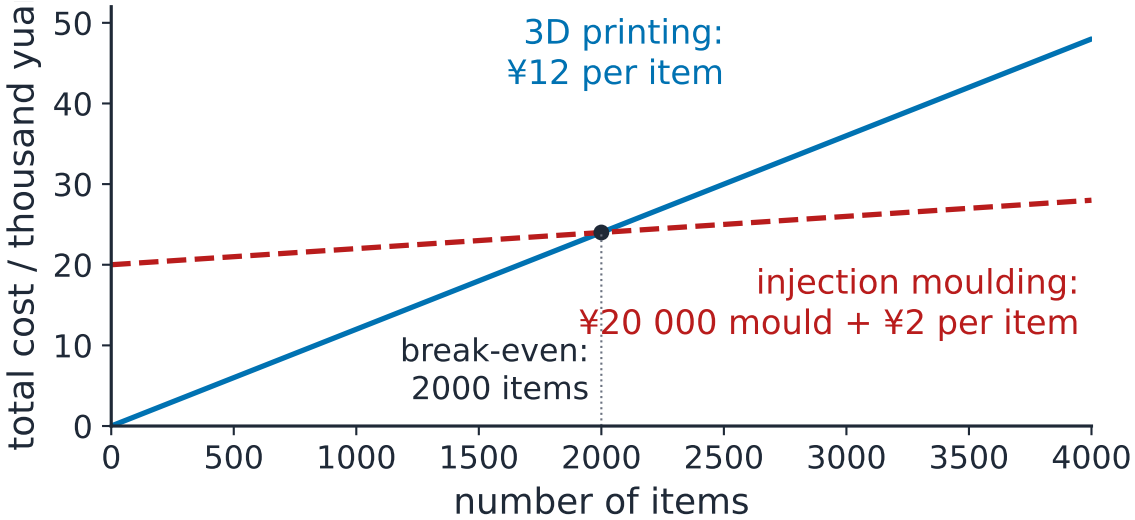
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Six material groups



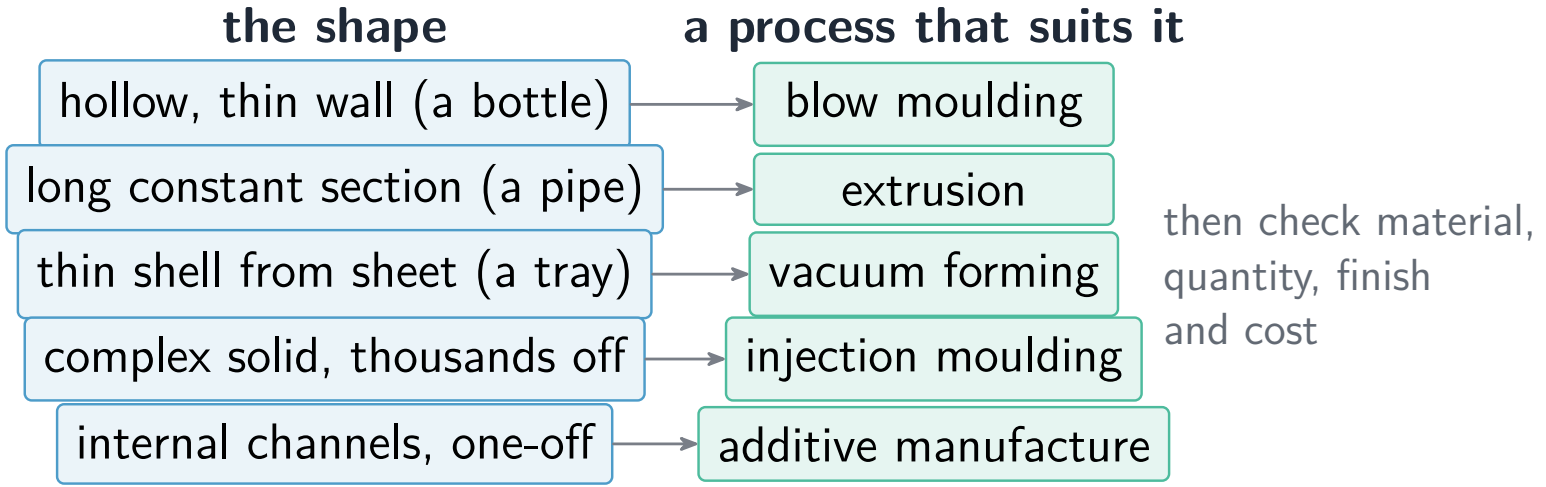
> Name the group, then the family, then the material

Break-even



- Printing ¥12 per item, no tooling.
- Moulding ¥20 000 mould, then ¥2 per item.

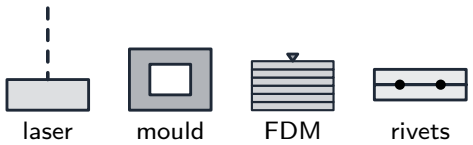
Choose the process from the shape



> The shape and the quantity choose the process

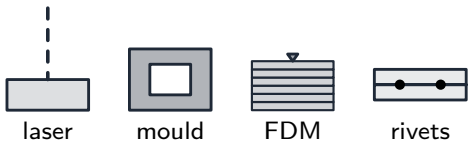
Exercise 2.1

2.1 Identify the process family for each process: laser cutting, injection moulding, FDM printing, riveting. [2]



Exercise 2.1

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2.1

laser cutting: wasting; injection moulding: forming; FDM printing: additive; riveting: joining: all four; two or three

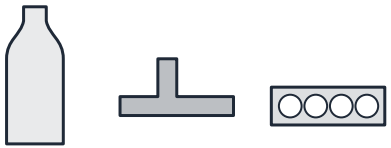
Exercise 2.2

2.2 Identify a suitable process to make each product:

(a) a plastic drinks bottle; [1]

(b) a long aluminium window-frame section; [1]

(c) a thin plastic tray for chocolates. [1]



(a) (b) (c)

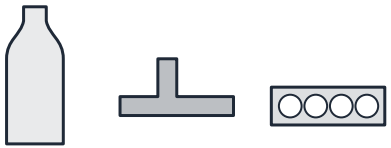
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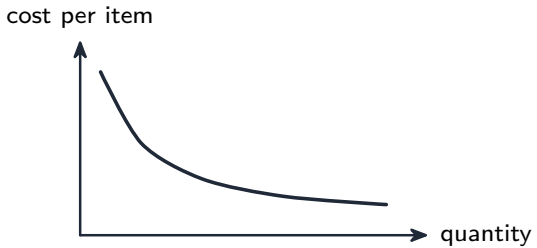
(a) blow moulding

(b) extrusion

(c) vacuum forming

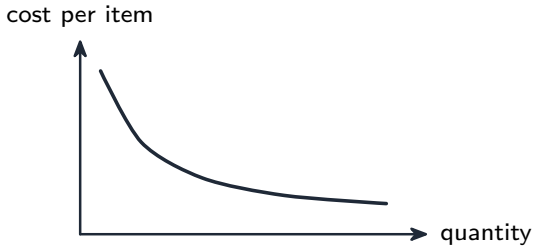
Exercise 2.3

2.3 Explain why the cost per item falls as the scale of production rises. [2]



Exercise 2.3

2.3 Explain why the cost per item falls as the scale of production rises. [2]



2.3

fixed costs such as moulds and machines are shared between more items; automation reduces labour per item / bulk buying lowers material costs

Exercise 2.4 (a)

2.4 A phone stand can be 3D printed for ¥15 each, or injection moulded for ¥5 each after a mould costing ¥25,000.

(a) Calculate the number of stands at which the two methods cost the same. [2]

Exercise 2.4 (a)

2.4 A phone stand can be 3D printed for ¥15 each, or injection moulded for ¥5 each after a mould costing ¥25,000.

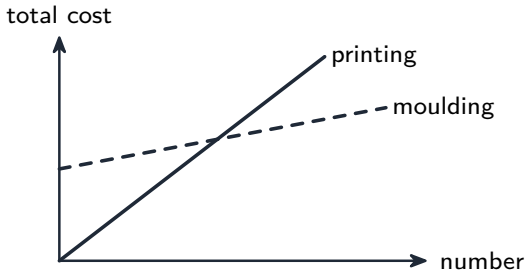
(a) Calculate the number of stands at which the two methods cost the same. [2]

(a) $15n = 25\,000 + 5n$, $n = \mathbf{2500}$

Exercise 2.4 (b)

2.4 A phone stand can be 3D printed for ¥15 each, or injection moulded for ¥5 each after a mould costing ¥25,000.

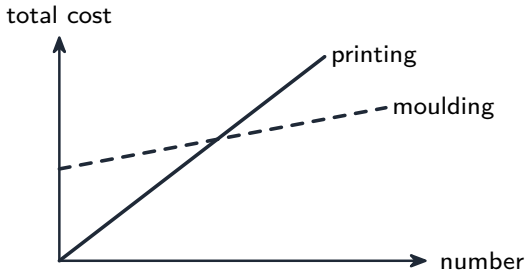
(b) Calculate how much the firm saves by moulding 4000 stands instead of printing them. [1]



Exercise 2.4 (b)

2.4 A phone stand can be 3D printed for ¥15 each, or injection moulded for ¥5 each after a mould costing ¥25,000.

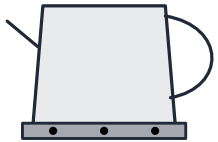
(b) Calculate how much the firm saves by moulding 4000 stands instead of printing them. [1]



(b) printing $60\,000$; moulding $25\,000 + 20\,000 = 45\,000$; saving = **¥15 000**

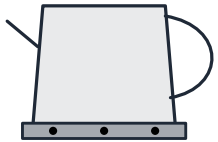
Exercise 2.5

2.5 Explain **one** advantage and **one** disadvantage of joining the case of a kettle with screws rather than adhesive. [4]



Exercise 2.5

2.5 Explain **one** advantage and **one** disadvantage of joining the case of a kettle with screws rather than adhesive. [4]



2.5

advantage: screws can be undone; so the kettle can be repaired, or parts separated for recycling; disadvantage: more parts and assembly time; so the cost per kettle may rise / the joint may need a seal against water

Exercise 3.1 (a)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(a) Define **mass customization**. [2]

Exercise 3.1 (a)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

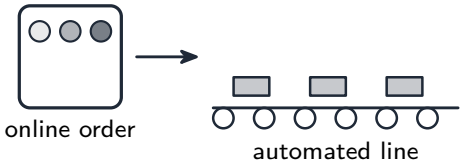
(a) Define **mass customization**. [2]

(a) mass production combined with choice for each buyer; e.g. buyers choose colours, sizes or features and flexible automated lines make each order

Exercise 3.1 (b)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

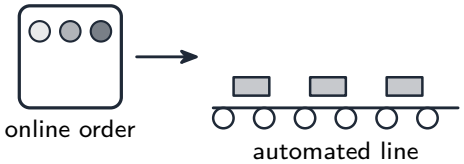
(b) Explain how CAD/CAM makes mass customization possible. [3]



Exercise 3.1 (b)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(b) Explain how CAD/CAM makes mass customization possible. [3]



(b) each order changes the CAD data, e.g. size and colours; the CAM software sends this straight to CNC machines / printers; so each shoe can differ with no new tools or set-up time

Exercise 3.1 (c)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(c) StrideFit uses just-in-time stock control. Explain **one** risk of this. [3]

Exercise 3.1 (c)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(c) StrideFit uses just-in-time stock control. Explain **one** risk of this. [3]

(c) parts arrive only when needed, so there is no buffer stock; a late delivery from a supplier, e.g. of foam, would stop the line; orders are delayed and customers may cancel

Exercise 3.1 (d)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(d) Evaluate the plan to automate the sole production line. [8]

Exercise 3.1 (d)

3.1 StrideFit makes running shoes by mass production. It plans to offer **mass customization**: customers choose colours, insoles and sizes online, and the soles are made on an automated line.

(d) Evaluate the plan to automate the sole production line. [8]

(d) award up to [8]: automation gives consistent quality and accurate soles for each custom order; works around the clock, so faster delivery; lower labour cost per pair in the long run; but high set-up cost for machines and software; needs skilled technicians for set-up and repair; some workers may lose their jobs or need retraining, which has a social cost; a breakdown stops all production; judgement: worth it if sales volume is high enough to cover the investment