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Design & Technology
Eduqas GCSE

Timber: forces, stresses, reinforcing and stiffening

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don’t spend too much time on one question

Good luck!

Q1. Which force pulls materials apart?

A Compression

B Tension

C Torsion

Q2. A loaded bookshelf is mainly subjected to which force?

A Bending

B Shear

C Torsion

Q3. Doubling the depth of a timber beam makes it about how many times stiffer?

A Two times

B Four times

C Eight times

Q4. Why does plywood always have an odd number of layers?

A It keeps the outer grain running the same way and the sheet balanced, so it does not warp

B It makes the sheet cheaper to produce

C It makes the edges easier to finish

Q5. Which of these joints is the simplest and weakest?

A Dovetail

B Mortise and tenon

C Butt

Q6. Which of these is a disadvantage of laminated timber?

A It can only be made in straight lengths

B It can delaminate if it gets wet

C It is weaker than solid wood of the same size

Q7. A flower vase is cut from a single piece of timber. Two side pieces of the main body are bent outwards and held apart by a small top part that is pushed in between them. State the type of force the top part is subjected to from the two side pieces. **(1 mark)**

Q8. The timber parts of a bookcase were cut along the grain. Describe one advantage of cutting wood along the grain. **(2 marks)**

Q9. A dinner tray is manufactured from plywood. The plates, glasses, knife and fork sit in slots that are 9 mm deep. Explain one benefit of manufacturing the dinner tray from plywood. **(2 marks)**

Q10. A wooden toolbox has plywood panels. The toolbox is constructed using pins and glue. Explain why pins and glue are used in the construction of the toolbox. **(2 marks)**

Q11. A child's ride-on buggy has a curved seat made from plywood. The upright, which the child steers with, is joined to the front axle using a mortise and tenon joint.

Q11a. Name the specific process that has been used to manufacture the curved plywood seat. **(1 mark)**

Q11b. Explain two working properties of plywood that make it an ideal material for the curved seat. **(4 marks)**

Q11c. Explain two benefits of using a mortise and tenon joint to join the upright to the front axle. **(6 marks)**

Q12. A curved shape is formed by laminating three identical thin pieces of wood around a former. Explain two reasons for using a bag press (vacuum bag) to form the curved shape. **(6 marks)**

Q13. A butt joint is used to join two pieces of softwood, each 60 mm wide × 15 mm thick, at a corner. Use sketches and notes to show two different ways the butt joint could be strengthened. **(3 marks)**

Q14. A children's easel has a frame made from a hardwood. Give two different wood joints that could be used to join the bottom rail to an upright of the frame. For each wood joint, explain one advantage of using it to join the bottom rail and the upright. **(6 marks)**

Answers

Q1. B
Q2. A
Q3. C
Q4. A
Q5. C
Q6. B

Q7.

Compression (1).

Q8.

1 mark for an advantage and 1 mark for a description. For example:

- Improved strength or rigidity, as timber is strongest along the grain (1)
- Longer strips of wood can be cut (1), reducing the number of pieces needed (1)
- The finish is much better, as cutting against the grain can leave bumps and knots visible (1)
- It suits the long shape of the bookcase parts (1)

Q9.

A benefit (1) and a linked justification (1). For example:

- Plywood has very good dimensional stability (1), so the tray will not warp or twist and will stay flat (1)
- It is available in large flat sheets (1), so the tray can be cut as a single piece rather than from smaller strips joined together (1)
- Its layers are at 90° to each other (1), so the tray is less likely to split or bend when the slots are machined (1)

Q10.

One mark for each correct reason, up to 2 marks. For example:

- Together they make a permanent, strong joint that can take the weight of the tools stored in the box (1)

- The glue adds strength to the joint; it is applied before the pins are added (1)
- The panels are thick enough for the pins to be hammered in without splitting the panel (1)
- A nail punch is used to set the pins below the surface so that a finish can be applied (1)

Q11a.

Any one (1): lamination or laminating; vacuum lamination; steam bending.

Q11b.

Two working properties (1 mark each), each with a linked justification (1 mark each). For example:

- Plywood is flexible (1), so it can be bent over the former or mould to make the seat shape (1)
- Plywood has good strength in all directions (1), so it can hold the weight of a small child and will not break when formed into the curve (1)
- Plywood has good resistance to splitting (1), so there is little risk of splinters or delamination harming the child (1)

Q11c.

Two benefits (1 mark each), each with two linked justifications (1) + (1). Do not accept “won’t break easily” on its own. For example:

- There is a large gluing or surface area (1), so there is more contact between the parts (1), giving a stronger joint (1)
- There is a physical connection between the two parts (1), so when the upright is turned with the handlebars the axle turns too (1), making sure the buggy turns (1)
- Only a small amount of material is removed from the axle (1), so the axle is less likely to bend (1), reducing the risk of it snapping and harming the child (1)

Q12.

Two reasons (1 mark each), each with two linked justifications (1) + (1). For example:

- The clear bag lets you see what is happening inside (1), so you can check all the pieces have lined up correctly (1), avoiding errors and waste (1)
- As the air is sucked out you can help shape the pieces around the curve (1), bending them around the former (1), so they sit neatly and accurately on the former (1)
- Once the former has been made it can be used again and again (1), so many curved parts can be made (1), all identical (1)
- The vacuum applies an even pressure (1), so the glue lines are even with no gaps (1), giving a shape that keeps its form and a strong bond between the layers (1)

Q13.

Up to 3 marks for two different, appropriate methods shown clearly. Adhesive on its own is not needed. For example: a wooden corner block; a knock down (KD) fitting; dovetail nailing; dowels; screws; pins and glue; screws and glue.

Q14.

Two suitable joints (1 mark each), each with two linked justifications (1) + (1). For example:

- Dowel joint (1): the dowels make a more mechanical joint with a larger gluing area (1), so it is less likely to break apart as part of each dowel is in both pieces (1)
- Mortise and tenon (1): increases the gluing or contact area (1), so the joint is less likely to be pulled apart and can take greater loads without breaking (1)
- Bridle (1): increases the gluing or contact area (1), so the joint is less likely to be pulled apart and can take greater loads (1)
- Tee halving or lap (1): material is removed from both parts (1), giving a mechanical joint with a bigger gluing area that can take bigger compressive loads (1)
- Screwed joint (1): holes are drilled in the upright (1), so a screw pulls the rail into the upright, and it can be strengthened with adhesive (1)

- Dovetail or dovetail halving (1): the tail and pin are cut in separate parts (1), giving a mechanical joint with a bigger gluing area (1)