

SECTION A

Answer **all** the questions.

- 1 **Fig.1** shows a child's high chair.



Fig.1

- (a) Features of the child's high chair are listed below.

Join each feature to the correct description. One has been done for you.

Feature	Description
Padded seat	A part of the chair that provides extra comfort
Reinforced corners	A part of the chair that is made from sustainable material
Seat back	A part of the chair that has a function that helps its storage
Fairtrade cotton straps	A part of the chair that adds extra strength
Folding legs	A part of the chair that is ergonomically designed

[3]

- (b) Explain how current trends could influence a redesign of the child's high chair.

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..... **[2]**

(c) The food tray of the child's high chair is made from a thermo polymer material.

(i) Name a suitable specific thermo polymer that could be used for the food tray.

..... [1]

(ii) Give **two** properties of thermo polymer materials that make them suitable for the food tray.

1

2 [2]

(d) The legs of the high chair are made from mild steel tubing.

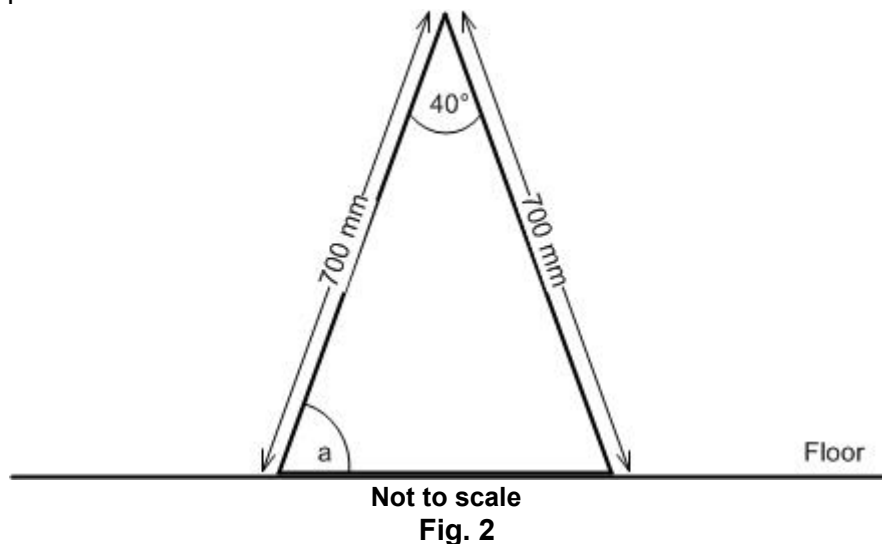
(i) Explain how **one** property of mild steel enables the high chair to function effectively.

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..... [2]

(ii) **Fig. 2** shows an isosceles triangle that is formed from the floor when the chair legs are fully opened.



Calculate angle **a**.

Angle **a** = ... [2]

(e) Anthropometric data is used when designing products.

(i) Give **two** pieces of anthropometric data that the designer of the child's high chair would need to know.

1.....

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..... [2]

(ii)* Evaluate the importance of using anthropometric data when designing. To support your answer, refer to products, other than the high chair, that you are familiar with.

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..... [8]

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Turn over for the next question

- 2 A manufacturer of fashion accessories is developing a range of handbags.

Fig. 3 shows the design of a handbag.

Fig. 4 shows the front panel of the handbag design.

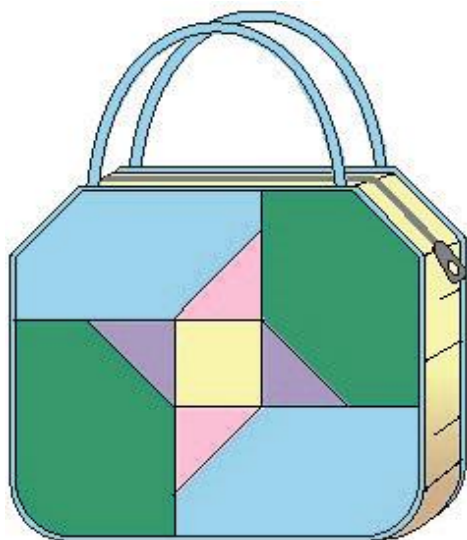


Fig. 3

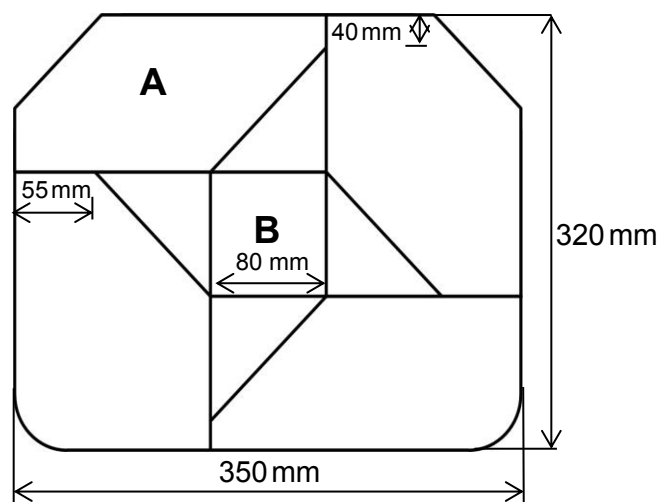
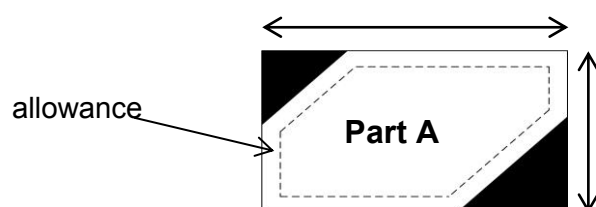


Fig. 4

- (a) In **Fig. 4** Part **B** is a square and all four triangular parts are isosceles triangles.

Part **A** in **Fig. 4** is cut from a rectangular piece of fabric as shown in **Fig. 5** below.



Not to scale
Fig. 5

- (i) Calculate the dimensions of the rectangular piece of fabric needed for Part **A**. There is an allowance of 15 mm.

Dimensions = ...mm × mm [3]

- (ii) When Part **A** is cut from the rectangular piece of fabric, there is fabric left over as waste.

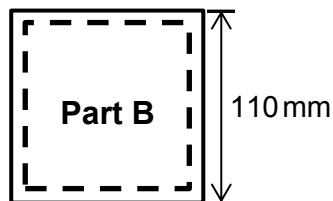
Calculate the fraction of fabric that would be wasted given that Part **A** has an area of $29\,400\text{ mm}^2$ including the allowance.

Show your answer to the lowest fraction.

Fraction of wasted fabric = ... [3]

- (b) The manufacturer needs to work out the cost of each piece of fabric for the handbag.

Part **B** in **Fig. 6** is square.



Not to scale
Fig. 6

12 pieces of Part **B** can be cut from a width of fabric.

Calculate the length of fabric required to cut 180 pieces of Part **B**.

Length of fabric required = ...mm [2]

- (c) The total cost of making one handbag is £28.35. The manufacturer will sell the handbags to retailers at £43.50 each.

Calculate the percentage profit made.

Profit = ...% **[2]**

- (d) The designer of the handbag has chosen to re-use materials from old products to make the bag.

Identify **two** considerations when re-using materials and/or system components to make a new product.

- 1
.....
2
.....**[2]**

- (e) Explain **two** benefits to a manufacturer of designing and making products in a way that reduces environmental impact.

- 1
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2
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.....**[4]**

3 **Fig. 7** shows a robotic lawnmower.

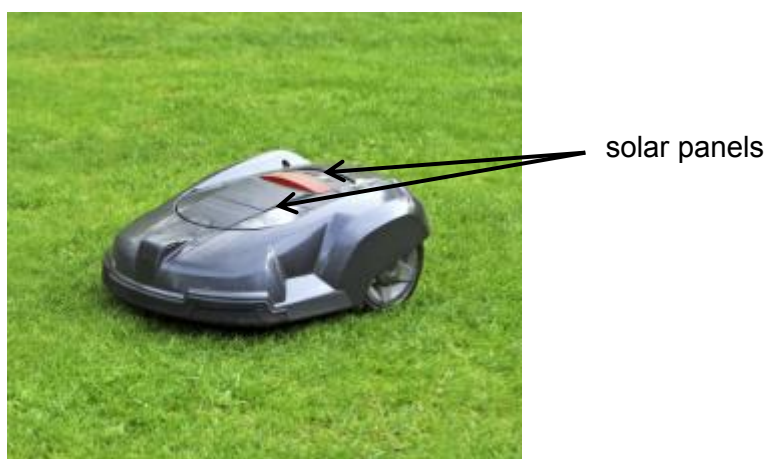


Fig. 7

- (a) The lawnmower has a number of inputs and outputs in its circuit that sense obstacles in its path and allow it to move around them.

The table below shows some of the functions of the robotic lawnmower.

Complete the table with the missing inputs or outputs and electronic components.

Function	Input or Output	Electronic component
Sensing obstacles		Push to make switch / Infra-red
Moving wheels	Output	Motor
Making a sound when it hits an obstacle	Output	
Warning light to show when the power level is low		
Triggers to mower to switch off if it topples over	Input	Tilt switch

[4]

- (b) The robotic lawnmower receives its energy from solar panels.

Explain **one** advantage and **one** disadvantage of using solar panels for receiving energy. Use products you are familiar with to support your answer.

Advantage

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Disadvantage

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[4]

- (c) **Fig. 8** shows a pie chart of the quantity of electricity generated by different types of fuel in the UK in 2015.

Total electrical energy is measured in Terrawatt-hours (TWh)

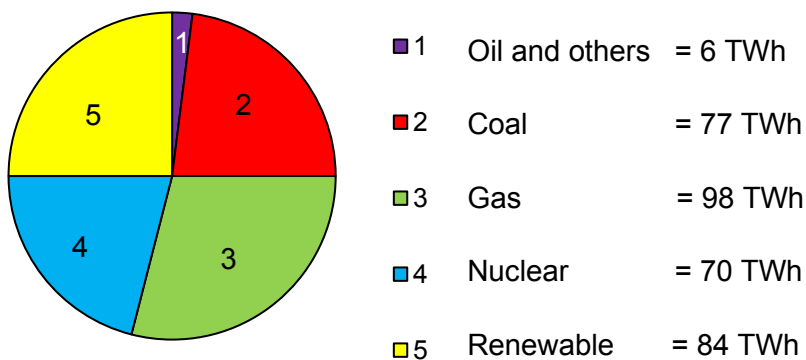


Fig. 8

- (i) Calculate the fraction of total electrical energy that is generated by renewable fuels. Give your answer as a fraction in its lowest form.

Fraction of renewable fuels = ...[1]

- (ii) Hydro-electricity is one type of renewable energy shown in **Fig. 8**.

The ratio, hydro-electricity to other renewable energy is 1 : 12.

Calculate the energy generated by hydro-electricity to the nearest decimal.

Energy generated = ...TWh [2]

- (d)** New and emerging technologies influence the design of many products.

Discuss how new and emerging technologies have been used to improve the function and/or performance of products.

Use examples to support your answer.

[6]

SECTION B

Answer **all** the questions.

For **all** questions in Section B you **must** refer to the **Insert** which contains images and information about products that you would find in a train station.

4 Refer to page 8 of the Insert.

(a) The information leaflets shown in **Image A** are made from paper.

Give **two** reasons why paper is suitable for this product.

- 1
-
- 2
- **[2]**

(b) The leaflet display in **Image A** uses the polymer acrylic to hold the leaflets in place.

Give **one** benefit of acrylic being used.

-
- **[1]**

(c) The person in **Image B** is wearing a red coat made from a natural fibre.

(i) Name **one** natural fibre.

- **[1]**

(ii) Explain **one** property of natural fibres that make them suitable for the coat shown.

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- **[2]**

- (d) **Image C** on the insert shows a locking device on a luggage trolley. **Fig. 9** below shows how to use the device. The £1 coin is inserted into the device. The key is released and pops out.

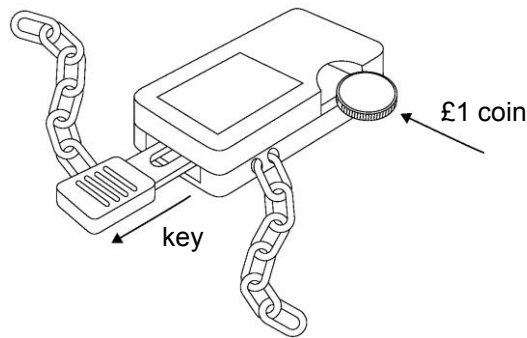


Fig. 9

- (i) State the type of force that is required to insert a £1 coin into the locking device.

.....[1]

- (ii) State the type of motion that takes place when the key is released from the locking device.

.....[1]

- (e) The bench shown in **Image D** has a metal frame and wooden seat and back.

Explain why a hardwood has been used to make the seat and back of the bench rather than a softwood.

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.....[2]

You need to answer questions **5** and **6** in relation to **one** of the products listed below covering an area you have studied in depth.

Information about the products is contained in the **Insert**.

Before you choose a product, read all parts of questions 5 and 6.

You **must** tick **one** box below to indicate your chosen product.

☐

Product 1: Coffee cup - (papers and boards)

☐

Product 2: High visibility jacket - (fibres and fabrics)

☐

Product 3: Customer satisfaction panel - (design engineering)

☐

Product 4: Retractable tape barrier - (polymers)

☐

Product 5: Toilet sign - (metals)

☐

Product 6: Flower planter - (timbers)

You should spend approximately 20 minutes on Question 5 (a).

5 Designers make prototypes to show their designs to key stakeholders.

- (a)** Study and use the images and technical information about your chosen product given on the Insert.

Produce a step-by-step plan to explain the stages that you would take if you were making a **final prototype** of your chosen product in a school workshop.

You **must** include details of:

- specific materials and components you would use to make the prototype
- the processes, techniques or skills you would use
- tools you would use, including digital technology as appropriate
- how you would ensure accuracy when making the prototype
- how you would finish it to present it to stakeholders.

[12]

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This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(b) Designers use different approaches when designing to ensure stakeholders opinions are considered.

(i) Explain **one** approach that might be used to ensure the main stakeholders are given full consideration when designing.

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.....[2]

(ii) Explain the importance of prototypes in discussions between designers and stakeholders.

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.....[3]

- (c)** 'Inclusivity is an important consideration in the design of products.'

Discuss the above statement in relation to products and/or systems located in a train station environment; use the images in the Insert to help you.

.....[6]

6 You should use the same product you chose for Question 5 to answer this question.

(a) Materials need to be sourced and processed in order to be used to make products.

For **one** specific material from your chosen product:

- state the source of the material and
- describe how it is processed into a workable form.

Specific material

Source of material[1]

Description

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(b)* Discuss how the selection of materials or components is influenced by social and ethical issues.

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Summary of updates

Date	Version	Details
April 2022	3.1	Updated copyright acknowledgements.
May 2024	3.2	Correction of answer in mark scheme for question 3 (c) (i)

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