SPECIMEN MATERIAL

Please write clearly, in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

Level 1/2 Award
MATERIALS TECHNOLOGY

MAT3

Date of Exam Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- Normal writing and drawing instruments.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is **96**.

Section A

Section A consists of multiple choice questions. For each multiple choice question, you should shade in **one** lozenge. If you make a mistake, cross through the incorrect answer.

Questions 1 to 10 in this section relate to the scissors shown as **Figure 1.**

Figure 1

1 Which material are the blades of the scissors made from?

A Lead ⬭

B Stainless steel ⬭

C Cast iron ⬭

D Copper ⬭

[1 mark]

2 How have the polymer handles been coloured?

A By using a colour pigment ⬭

B By applying a varnish ⬭

C By anodising ⬭

D By spray painting ⬭

[1 mark]

3 What method of fastening has been used to fix the blades together?

A Using a nut and bolt ⬭

B By using a split pin ⬭

C With a screw ⬭

D With a rivet ⬭

[1 mark]

4 Which method of manufacture has been used to make the thin sheet metal blades?

A Drop forging ⬭

B Casting ⬭

C Punching ⬭

D Sawing ⬭

[1 mark]

5 Which finish has been applied to the blades?

A No finish ⬭

B Plastic coated ⬭

C Anodised ⬭

D Spray painted ⬭

[1 mark]

6 Which is the most suitable polymer for the handles?

A Acrylonitrile butadiene styrene (ABS) ⬭

B Silicon rubber ⬭

C Urea formaldehyde (UF) ⬭

D Melamine formaldehyde (MF) ⬭

[1 mark]

7 Which type of maintenance would be carried out on the blades?

A Straightening ⬭

B Grinding ⬭

C Painting ⬭

D Polishing ⬭

[1 mark]

8 Why are the materials used to manufacture the scissors considered to be harmful to the environment?

A They cannot be recycled ⬭

B They cannot be re-used ⬭

C They are non-renewable ⬭

D They are expensive ⬭

[1 mark]

9 Why have the ends of the blades been rounded?

A For aesthetic reasons ⬭

B For economic reasons ⬭

C For safety reasons ⬭

D For storage reasons ⬭

[1 mark]

10 Which method of manufacture has been used to make the handles?

A Filing ⬭

B Sawing ⬭

C Blow moulding ⬭

D Injection moulding ⬭

[1 mark]

11 Which method of manufacture is used to make plastic drinks bottles?

A Injection moulding ⬭

B Blow moulding ⬭

C Vacuum forming ⬭

D Calendaring ⬭

[1 mark]

12 Why is it important to carry out a COSHH risk assessment in a workshop environment?

A It ensures that hazardous substances are handled safely ⬭

B It ensures that electrical equipment is safe to use ⬭

C It ensures that machines are operated safely ⬭

D It ensures that the lighting is at a safe level ⬭

[1 mark]

13 Select the correct definition of a durable material.

A A material that can withstand wear and tear ⬭

B A hard material ⬭

C A material that does not corrode ⬭

D A soft material ⬭

[1 mark]

14 Choose the material that has the highest thermal conductivity.

A Pine ⬭

B Aluminium ⬭

C Acrylic (PMMA) ⬭

D Oak ⬭

[1 mark]

15 Select the 'stock form' for a manufactured board.

A Sheet ⬭

B Bar ⬭

C Tube ⬭

D Strip ⬭

[1 mark]

16 Which **two** metals are used to make brass?

A Copper and aluminium ⬭

B Zinc and lead ⬭

C Tin and aluminium ⬭

D Copper and zinc ⬭

[1 mark]

17 Which of the below is a permanent method of joining?

A Nut and bolt ⬭

B Wood screw ⬭

C PVA glue ⬭

D Knock-down fitting ⬭

[1 mark]

18 Which is the simplest type of wood joint to make?

A Butt ⬭

B Dovetail ⬭

C Dowel ⬭

D Comb ⬭

[1 mark]

19 A 'strip heater' is used to produce a bend in which material?

A Plywood ⬭

B Cast iron ⬭

C Urea formaldehyde (UF) ⬭

D Acrylic (PMMA) ⬭

[1 mark]

20 Which finish would be used on a wooden chopping board?

A No finish ⬭

B Wax ⬭

C Paint ⬭

D Powder coating ⬭

[1 mark]

Turn page for next question

Section B

Study the picture of the saw shown as **Figure 2.**

Figure 2

21 The blade is made from high-carbon steel.

State two properties of high carbon steel that make it suitable for the blade of the saw.

Explain your answers.

[4 marks]

Property 1 _____

Explanation _____

Property 2 _____

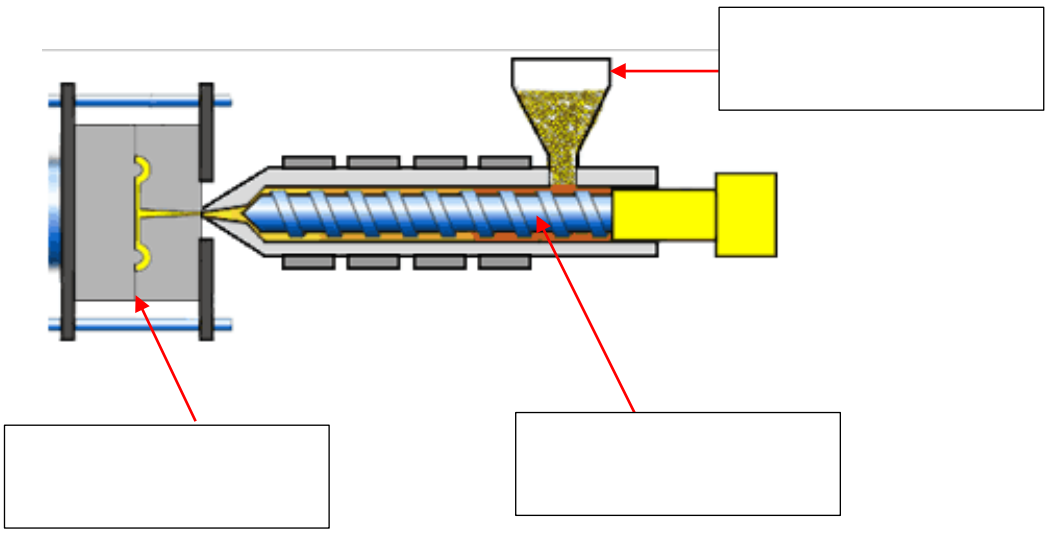
Explanation _____

Turn page for next question

The handle of the saw in **Figure 2** has been made from a polymer that has been manufactured in batches of 10,000 by injection moulding.

22 . 1 Label the three parts of the injection moulding machine.

[3 marks]



22 . 2 Describe the main stages of the injection moulding process.

[4 marks]

22 . 3 Explain why injection moulding is a suitable method of manufacture for 10,000 handles.

[6 marks]

Turn page for next question

23 Give two reasons why it is important to carry out maintenance on tools and equipment.

Explain your answer.

[4 marks]

Reason 1

Reason 2

Turn page for next question

Turn page for next question

Wood must be seasoned before it can be used to manufacture products.

24 . 1 Name one method of seasoning wood.

[1 mark]

24 . 2 Use notes and sketches to describe the method of seasoning wood you have named in **24.1.**

[6 marks]

24 . 3 Explain why it is important to season wood.

[3 marks]

Turn page for next question

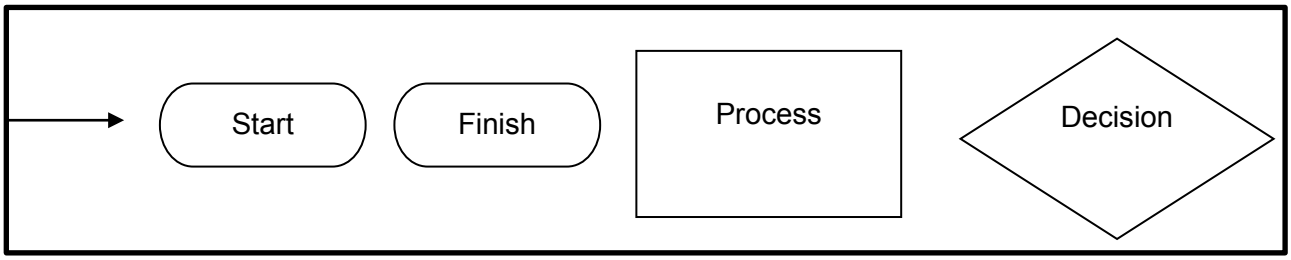
The properties of metals can be changed by heat treatment processes.

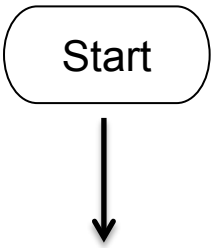
The high-carbon steel centre punch shown in **Figure 3** is an example of a product that has been heat treated.

Figure 3

25 . 1 Use the symbols shown below to help you produce a flow chart that describes the process of hardening.

[6 marks]





25 . 2 Use notes and sketches to describe the process of tempering the centre punch.

Name all the tools and equipment used.

[6 marks]

25 . 3 Give two reasons why it is necessary to temper a hardened centre punch.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

Turn page for next question

26 . 1 Name **three** pieces of Personal Protection Equipment (PPE) you would wear when carrying out processes that use heat**.**

[3 marks]

PPE1 _____

PPE 2 _____

PPE 3 _____

26 . 2 Describe two safety precautions you would take when chiselling the housing joint shown in **Figure 4.**

Explain why each safety precaution is necessary.

[4 marks]

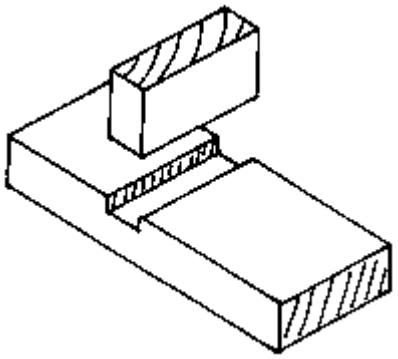


Figure 4

Safety precaution 1 _____

Safety precaution 2 _____

27 Complete the table by naming the tool and briefly describing a process that you would carry out with the tool.

[9 marks]

Tool	Name	Process
	Cold chisel	…… …… ……
	……	…… …… ……
	……	…… …… ……
	……	…… …… ……
	……	…… …… ……

Study the two toy trains.

Plastic train

Hardwood train

28 . 1 Name a suitable specific material for each train**.**

[2 marks]

Hardwood train _____

Plastic train _____

28 . 2 A manufacturer is producing a batch of 10,000 toy trains. They are concerned about the impact on the environment.

Which material would you advise the manufacturer to use?

Justify your response.

[9 marks]

29 Throughout this course you will have had the opportunity to investigate employment opportunities in the Materials Technology sector.

Briefly describe one of the jobs that you are familiar with.

[4 marks]

END OF QUESTIONS

Level 1/2 Award
MATERIALS TECHNOLOGY

MAT3

Mark scheme

Specimen materials

Version 0.2

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the learners' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of learners' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of learners' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a learner's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the learner's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the learner has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the learner's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Learners do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

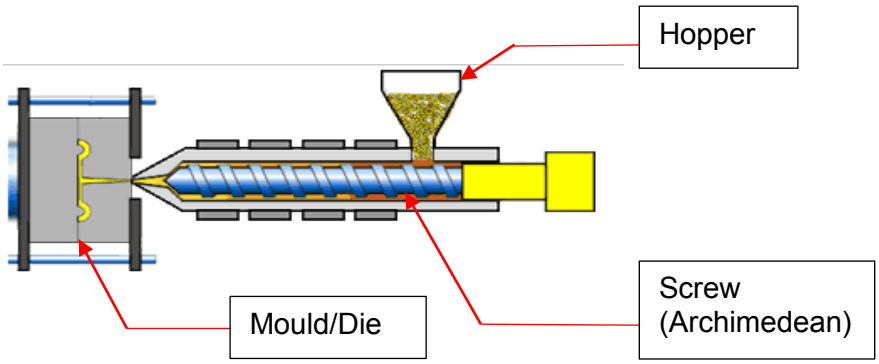
An answer which contains nothing of relevance to the question must be awarded no marks.

Qu	Part	Marking guidance	Total marks	AO
		Section A		
1		**B** Stainless steel	1 mark	AO1
2		**A** By using a colour pigment	1 mark	AO1
3		**D** With a rivet	1 mark	AO1
4		**C** Punching	1 mark	AO1
5		**A** No finish	1 mark	AO1
6		**A** Acrylonitrile butadiene styrene (ABS)	1 mark	AO1
7		**B** Grinding	1 mark	AO1
8		**C** They are non-renewable	1 mark	AO1
9		**C** For safety reasons	1 mark	AO1
10		**D** Injection moulding	1 mark	AO1
11		**B** Blow moulding	1 mark	AO1
12		**A** It ensures that hazardous substances are handled safely	1 mark	AO1
13		**A** A material that can withstand wear and tear	1 mark	AO1
14		**B** Aluminium	1 mark	AO1
15		**A** Sheet	1 mark	AO1

16		**D** Copper and zinc	1 mark	AO1
17		**C** PVA glue	1 mark	AO1
18		**A** Butt	1 mark	AO1
19		**D** Acrylic (PMMA)	1 mark	AO1
20		**A** No finish	1 mark	AO1

Section B

21		Award **one** mark for each correctly identified property of the high-carbon steel used to make the blade of the saw. Award a **second** mark for a correct explanation. **Indicative content** • The steel is strong **therefore** it will not break. • The steel is durable **therefore** it will last a long time. • The steel is hard **therefore** it can cut other materials. • The steel is elastic **therefore** it will return to its original shape if bent. Other appropriate responses must also be credited.	4 marks	AO3

22	1	Award **one** mark for each correctly labelled part.  	3 marks	AO1

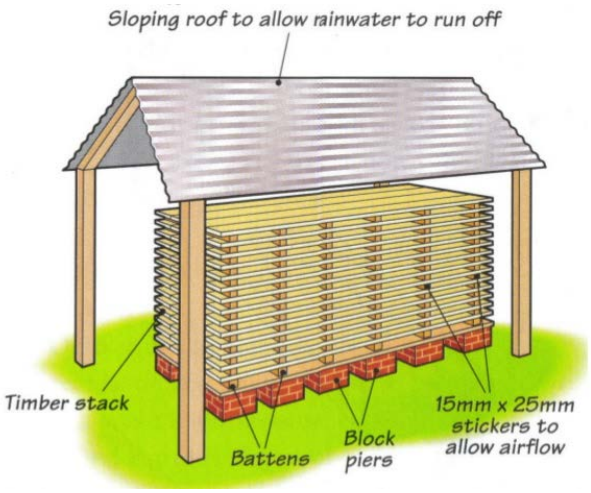
22	2	Award **one** mark for each correct stage in the process of injection moulding. **4 marks** – Full description, referencing four or more stages in the injection moulding process and using correct terminology. **3 marks** – Partial description, referencing three of the stages in the injection moulding process and using correct terminology. **2 marks** – Incomplete description, with two stages in the injection moulding process described correctly. **1 mark** – Only one stage in the injection moulding process described correctly. **0 mark** – No response worthy of credit. **Indicative content** • Polymer granules are fed into the hopper. • Polymer granules then enter the heating chamber. • The screw (Archimedean) then transports the polymer granules	4 marks	AO1

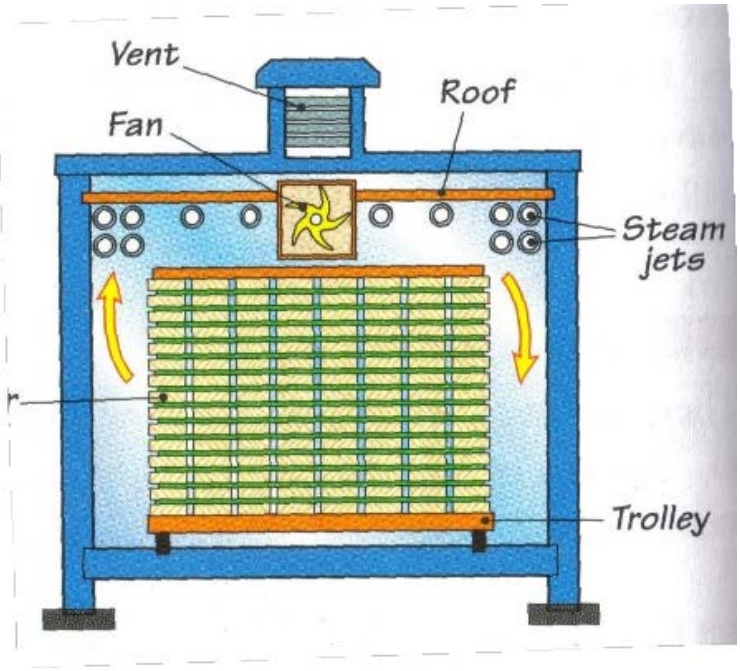
		along the heating chamber. • The polymer granules become molten. • The molten polymer is then injected through the sprue into the mould. • The die is cooled. • The die is opened and the product removed using ejector pins. Other appropriate responses must also be credited.		

22	3	Use the following mark descriptors based on the indicative content and the quality of the answer. 5-6 marks: Detailed response demonstrating knowledge and understanding of three or more advantages of the injection moulding process with clear justification of the advantages of its use in the context of high-volume production. 3-4 marks: Response demonstrates knowledge and understanding of two or three advantages of the injection moulding process with some justification of the advantages of its use in the context of high volume production. 1-2 marks: Response demonstrates limited knowledge and understanding of one or two advantages of the injection moulding process in the context of high volume production. Response may give a few points that are unjustified or one point that is justified. 0 mark: No response worthy of credit. **Indicative content** • It is cost-effective. • It is a quick manufacturing process. • It has a high initial set-up cost that makes it only viable for high volume production. • Waste and scrap products can be recycled. • It produces a consistent product; the products are made from the same mould/die. • It produces an accurate product; the mould/die is produced to very high tolerances. Other appropriate responses must also be credited.	6 marks	AO3

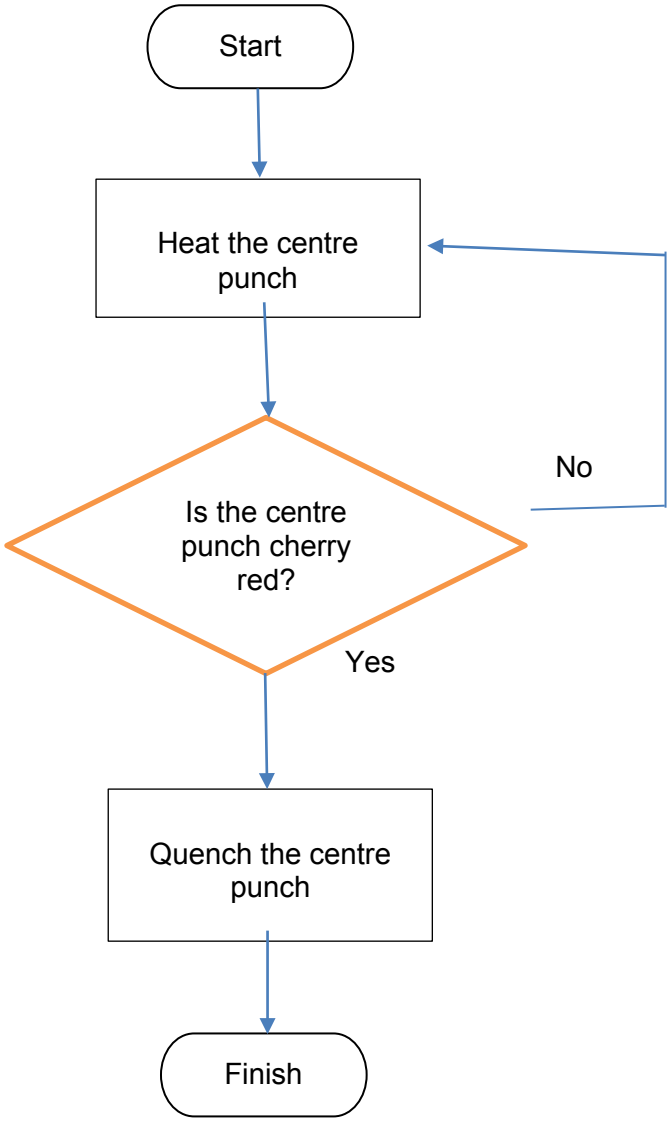
23		Award **one** mark for each correct reason as to why it is important to carry out maintenance on tools and equipment. Award a **second** mark for a correct explanation. **Indicative content** • It will extend the life of the tool and **therefore** it will save you money. • It will keep the tool in good working order and **therefore** it will work efficiently. • It is cost-effective **because** it would cost more to keep buying new tools. • It is good for the environment **as** you don't have to keep using raw materials. Other appropriate responses must also be credited.	4 marks	AO3

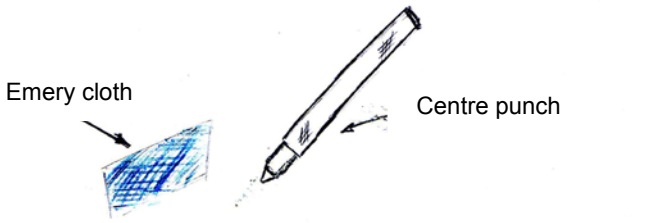
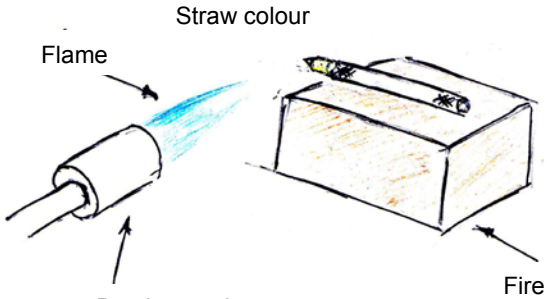
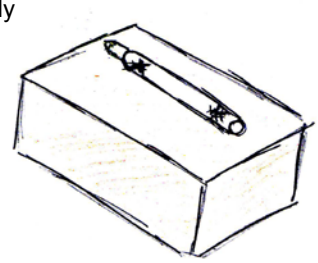
24	1	Award **one** mark for correctly naming a method of seasoning wood. **Possible answers** • Air/natural seasoning. • Kiln seasoning.	1 mark	AO1

24	2	Use the following mark descriptors based on the indicative content and the quality of the answer. **5-6 marks** – Detailed response demonstrating thorough knowledge and understanding of the selected seasoning process. Most features are described correctly, with clear and accurate accompanying sketches. **3-4 marks** – Response demonstrates knowledge and understanding of the selected seasoning process. Three or four features of the seasoning process are described correctly, with clear and mostly accurate accompanying sketches. **1-2 marks** – Response identifies one or two features of the seasoning process correctly. Accompanying sketches may be incomplete or contain inaccuracies. **0 mark** – No response worthy of credit. **Indicative content** Look for details relating to: **Air seasoning** • Boards are stacked on brick piers. • Boards are separated using sticks. • Air flows around the boards. • The process takes a long time. • Approx. 1 year per 25mm thickness of timber. • The seasoning shed has a roof to keep the weather off but no walls. • The floor has good drainage. • The floor is treated to supress weeds.  	6 marks	AO1

		Kiln seasoning • Boards are stacked on a trolley. • Boards are separated using stickers. • Steam flows around the boards. • The process is quicker than air seasoning. • The seasoning building is fully enclosed. • The moisture content of the steam is gradually reduced from 50+% to less than 22%.  Other appropriate responses must also be credited.		

24	3	Award **one** mark for each correct reason as to why wood needs to be seasoned. Award a **second** mark for a correct explanation. **Indicative content** • Newly converted wood contains high moisture content, 50%+. • Newly converted wood is known as 'green timber'. • Unseasoned wood will dry out in an uncontrolled manner leading to defects such as splitting, cupping, warping and twisting. • Unseasoned wood is susceptible to insect and attack by mould and fungi. • Wood has limited use in its 'green' state as it is difficult to glue together. • Unseasoned wood is heavy, weak and soft. • Unseasoned wood will not last as long as seasoned wood. Other appropriate responses must also be credited.	3 marks	AO3

25	1	Award marks using the following guide. • One stage correctly identified - **1 mark.** • Two stages correctly identified- **2 marks.** • Three stages correctly identified - **3 marks.** • All stages correctly sequenced – **1 mark.** • The correct use of all the symbols- **1 mark.** • The correct use of the flow arrows, including the return arrow- **1 mark.** 	6 marks	AO1

25	2	Award **one** mark for a correctly identified stage and one mark for each correctly identified tool in the process of tempering. **Indicative content** • Clean the centre punch with emery cloth. • Heat the centre punch using a brazing torch. • Heat to the tempering colour of light straw (200°C). • Use a brazing torch or tempering kiln. • Allow to cool naturally.  Clean the end of the scriber  Heat to a straw colour Allow to cool naturally  Other appropriate responses must also be credited.	6 marks	AO1

25	3	Award **one** mark for identifying a reason why a centre punch should be tempered and a second mark for the explanation. **Indicative content** • A hardened centre punch is hard but brittle. • Tempering retains much of the hardness but takes away most of the brittleness. Other appropriate responses must also be credited.	2 marks	AO3

26	1	Award **one** mark each for correctly identifying an item of PPE that you would use when carrying out a process that uses heat. **Indicative content** • Apron. • Goggles/visor/face mask. • Gloves/gauntlets. • Spats. Other appropriate responses must also be credited.	3 marks	AO1

26	2	Award **one** mark for identifying each safety issue concerned with chiselling a housing joint. Award a **second** mark for a detailed answer. **Indicative content** • Make sure the chisel is sharp. Blunt tools are more dangerous than sharp ones. • Keep both hands behind the cutting edge. It is easy to slip and cut your front hand. • Make sure the work is clamped down to the bench/held in a vice. A loose piece of wood is hard to control. Other appropriate responses must also be credited.	4 marks	AO1

27		Award **one** mark for each correctly named tool and a **second** mark for a correctly identified process. Other appropriate responses must also be credited.	9 marks	AO1

Tool	Name	Process
	Cold chisel	When cutting metal
	Hammer	When hitting a centre punch
	Hacksaw	When cutting a piece of low-carbon steel bar
	Coping saw	When cutting a curve in a piece of wood/acrylic
	Plane	When smoothing a piece of wood

<table>
<tr>
<td>28</td>
<td>1</td>
<td>Award one mark for correctly identifying a material for the wooden train.

Indicative content

• Beech.
• Sycamore.
• Maple.
• Or any suitable lightly-coloured hardwood.

Award one mark for correctly identifying a material for the plastic train.

Most thermoplastics could be used except acrylic.

Indicative content

• LDPE
• HDPE
• PP
• PVC
• PC

Other appropriate responses must also be credited.</td>
<td>2 marks</td>
<td>AO1</td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td>
<table>
<tr><td>7 - 9 marks</td><td>A detailed response showing thorough understanding of material properties and their environmental impact. There is excellent analysis of the advantages and disadvantages of each of the materials and justification for the material chosen.</td></tr>
<tr><td>4 – 6 marks</td><td>Response shows good understanding of material properties and their environmental impact. There is good analysis of the advantages and disadvantages of each of the materials with four or more points made to justify the material chosen.</td></tr>
<tr><td>1 - 3 marks</td><td>Response shows a basic understanding of material properties and their environmental impact. There is some analysis of the advantages and disadvantages of materials. Analysis may be incomplete with a focus only on one material or does not provide a clear justification for choice.</td></tr>
<tr><td>0 mark</td><td>No response worthy of credit.</td></tr>
</table>
Award marks for details relating to the environmental issues a manufacturer should think about before producing a batch of toy trains.

Look for details relating to:

Which material should be used?

Using wood:</td>
<td>9 marks</td>
<td>AO1(4 marks)

AO3 (5 marks)</td>
</tr>
</table>

		• wood is renewable. More trees can be planted • wood should be sourced from managed forests FSC • relative to polymers wood uses less energy and causes less pollution to convert the trees into the planks • at the end of its life wood can be recycled and reused • waste wood is biodegradable • manufacturing with wood uses less energy and pollution than manufacturing with polymers. Using a polymer: • polymers are not renewable. Polymers come from oil which is a finite resource • relative to wood, converting oil into a polymer in a refinery uses more energy and creates more pollution • most polymers (thermoplastics) can be recycled • most polymers are non-biodegradable • manufacturing with polymers uses sophisticated machines (injection moulding/blow moulding machines). Compared to using wood this uses more energy and produces toxic gases.		

29		<table><tr><td>3-4 marks</td><td>A good understanding of the work with some detail of the processes involved. There may be a slight lack of detail/clarity but this will not detract from the overall quality of the response.</td></tr><tr><td>1-2 marks</td><td>Limited understanding of the work with little detail. There will be elements of confusion and a lack of clarity.</td></tr><tr><td>0 mark</td><td>No response worthy of credit.</td></tr></table> The answer may apply to any of the 12 job roles in the specification, or any other relevant occupation. The indicative content below suggests the kind of things that may be included, using 1 of the 12 jobs as an example. Not all of the points below need to be covered in order to gain 4 marks. **Indicative content** A plumber • installs pipework within the home • can work with water, gas or sewage pipes • installs household appliances • installs central heating systems • can repair pipework • will work with plumbing equipment • will have completed an apprenticeship. Other appropriate responses must also be credited.	4 marks	AO1

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