

DESIGN AND TECHNOLOGY - GCSE SAMPLE PAPER 2

Level 1/Level 2 GCSE (9–1)

Candidate Name	Centre Number					Candidate Number				

COMPONENT 1

TIME ALLOWED - 1 hour 45 minutes

MARK SCHEME

EQUIPMENT REQUIRED

Drawing and writing equipment, coloured pencils and a calculator

INSTRUCTIONS

You are to answer all questions.

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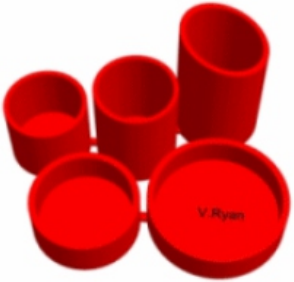

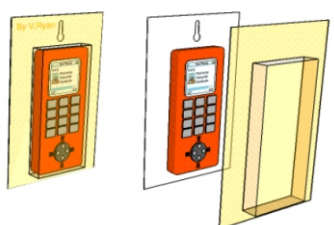
Section A - CORE

Answer all the questions in this section

1a. The table below is divided into three columns. Column 'A', shows an image of a product. Column 'B' identifies the manufacturing process and Column 'C' names a material(s) suitable for the manufacturing process.

Complete the table below by adding the missing information.




The first answer has been completed for you.

<u>(A) PRODUCT</u>	<u>DESCRIPTION</u>	<u>PROPERTY</u>
	<p>DESKTIDY <u>INJECTION MOULDING</u></p>	<p><i>Thermoplastics such as polystyrene, nylon, polypropylene and polythene are ideal plastics for this type of manufacturing process.</i></p>
<p>WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2018 V.Ryan © 2018</p>	<p>HELPFUL LINK http://www.technologystudent.com/prddes1/rotate2.html</p>	
	<p>'PLASTIC' TROPHY <u>ROTATIONAL MOULDING</u></p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a correct answer</i></p> <p style="text-align: right;">1 mark</p>
<p>WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2018 V.Ryan © 2018</p>	<p>HELPFUL LINK http://www.technologystudent.com/gprep07/vac2.html</p>	
	<p>BLISTER PACKAGING <u>VACUUM FORMING</u></p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a correct answer</i></p> <p style="text-align: right;">1 mark</p>

PRODUCT

DESCRIPTION

PROPERTY

<p>HELPFUL LINK http://www.technologystudent.com/equip1/hypress1.htm</p>  <p>WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2018 V.Ryan © 2018</p>	<p>STEEL TRAY <u>COMPRESSION</u> <u>MOULDING</u></p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a correct answer</i></p> <p>1 mark</p>
<p>HELPFUL LINK http://www.technologystudent.com/despro_fish/charity9.html</p> 	<p>PACKAGING <u>DIE CUTTING</u></p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a correct answer</i></p> <p>1 mark</p>
<p>HELPFUL LINK http://www.technologystudent.com/rmprep09/inject1.html</p> 	<p>WHEELIE BIN <u>BLOW</u> <u>MOULDING</u></p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a correct answer</i></p> <p>1 mark</p>

1b. The manufacturer of the greetings card has included aroma pigments, in the form of a 'scratch and sniff' patch.



SCRATCHABLE
AROMA PATCH

(I) How could aroma pigments, applied to the scratch and sniff patch, improve the appeal of the greetings card? **2 marks**

Follow the link for information / the answer

*1 mark for a partial correct answer
#2 marks for a complete answer.*

(II) The greetings card is manufactured by a web-fed printer. What is web-fed printing? **2 marks**

Follow the link for information / the answer

*1 mark for a partial correct answer
#2 marks for a complete answer.*

2. The photograph shows a roll of foam, which will be used to manufacture cushions.

2a. Name a suitable polymer for the manufacture of this product? In your answer explain the physical properties that make it suitable. **2 marks**



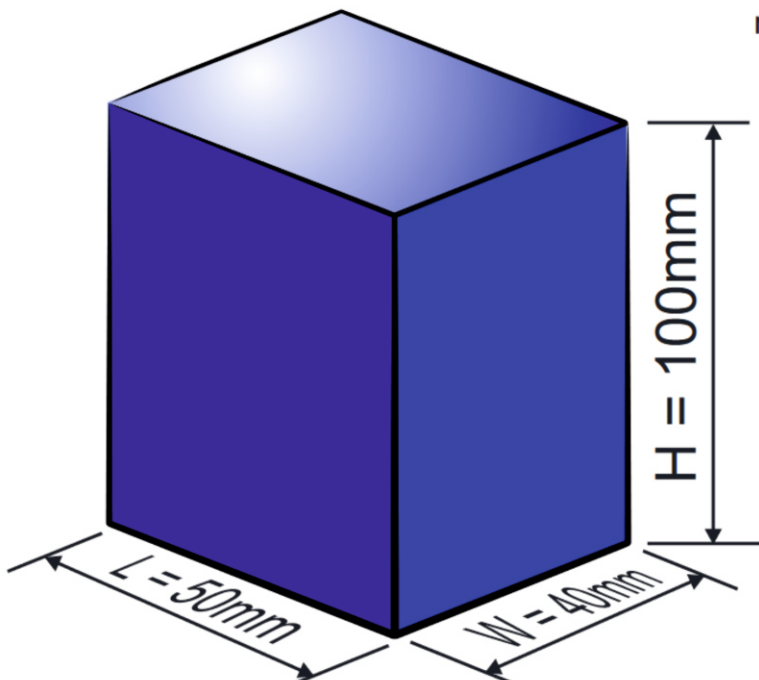
Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*

FOAM RUBBER

2b. The manufacturer has switched suppliers and the foam is now supplied in the shape of a rectangular prism, NOT a roll of foam. What is the volume of the rectangular prism, shown below. **3 marks**

EXAMPLE: What is the volume of the rectangular prism shown opposite?



$$V=L \times W \times H$$

$$V=50 \times 40 \times 100$$

$$V=200000\text{mm}^3$$

or

$$V=200\text{cm}^3$$

2c. The foam cushions will be covered with nylon, woven into a textiles materials
List two physical properties of nylon. **2 marks**

(i) *Follow the link for information / the answer*

1 mark for a correct answer

(ii) *Follow the link for information / the answer*

1 mark for a correct answer

2d. Briefly describe how nylon is manufactured. **2 marks**

Follow the link for information / the answer

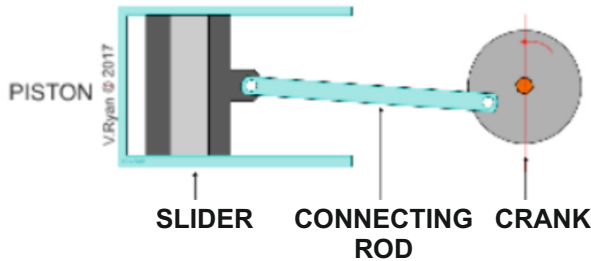
1 mark for a partial correct answer

2 marks for a complete answer.

3a. The diagram below represents a type of movement.

(I) Name the movement. **1 mark**

RECIPROCATING MOTION



(I) Describe the movement. **1 mark**

Reciprocating motion is a repetitive movement left to right OR up and down. A good example of this type of motion is a piston, such as found in an engine.

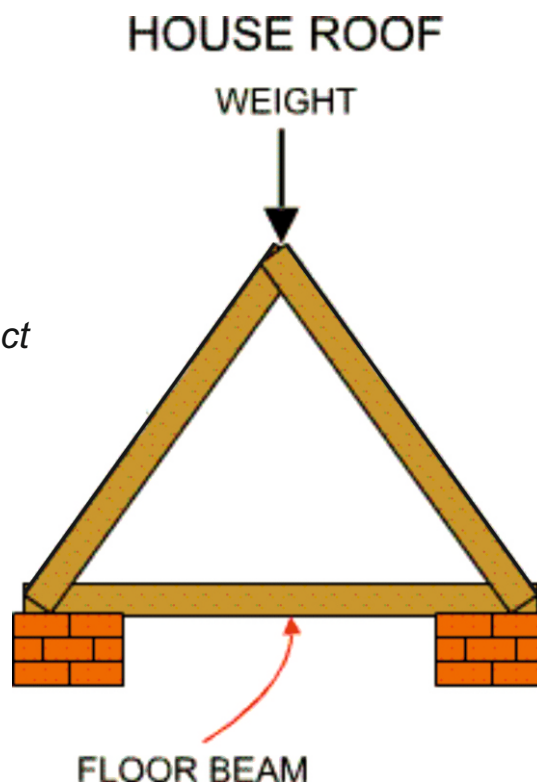
Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*

3b. The diagram below, shows the structure holding up roof of a house. In terms of forces, label the struts and ties? **2 marks**

Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*



3c. The diagram shows the practical application of a lever. Clearly identify the EFFORT, LOAD and FULCRUM **3 marks**

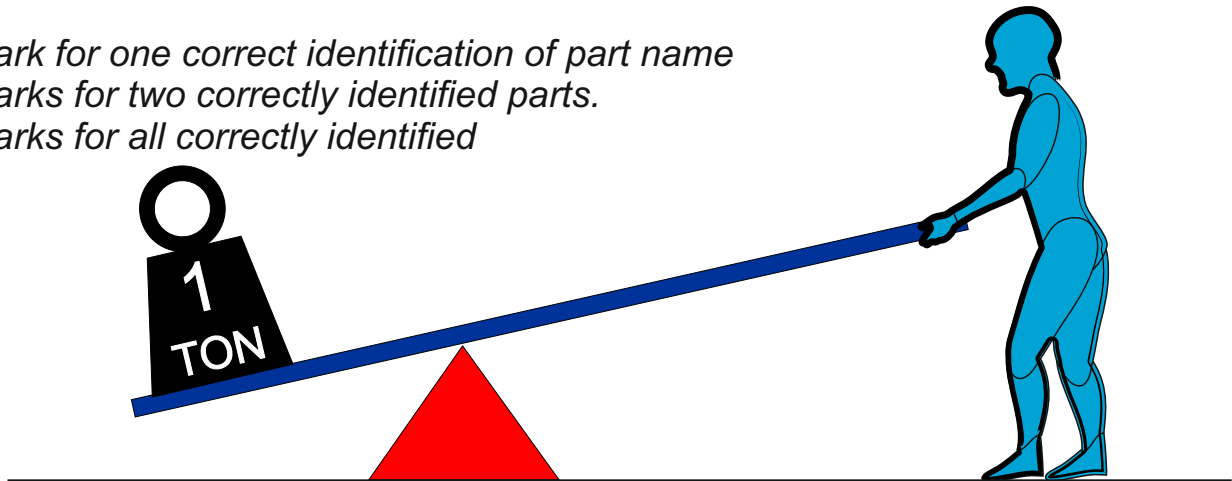
EFFORT LOAD FULCRUM

Follow the link for information / the answer

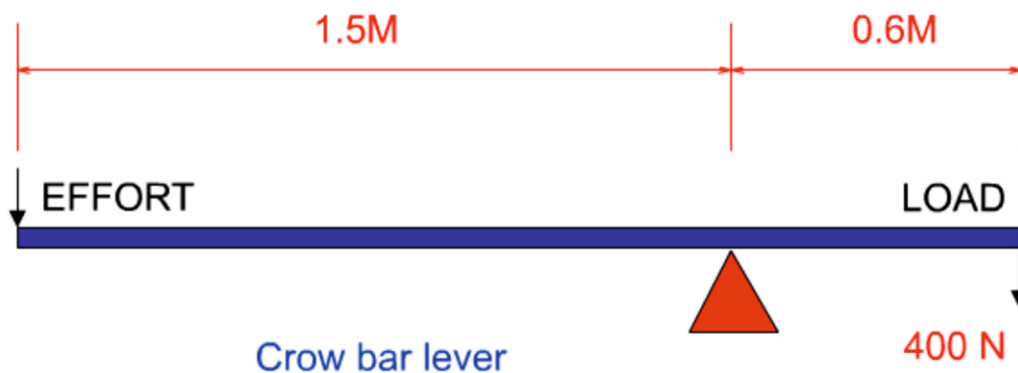
1 mark for one correct identification of part name

2 marks for two correctly identified parts.

3 marks for all correctly identified



3d. The simplified diagram below, represents a crow-bar being used to move a 400n load. What EFFORT is required to move the load? **4 marks**



$$\text{Clockwise moments} = 400 \text{ N} \times 0.6 \text{ m}$$

$$\text{Anticlockwise moments} = \text{effort} \times 1.5\text{m}$$

In equilibrium;

clockwise moments = anti-clockwise moments

$$400 \times 0.6 = \text{effort} \times 1.5 \quad 1 \text{ mark}$$

$$\text{effort} = \frac{400 \times 0.6}{1.5} \quad 1 \text{ mark}$$

$$\text{effort} = \frac{240}{1.5} \quad 1 \text{ mark}$$

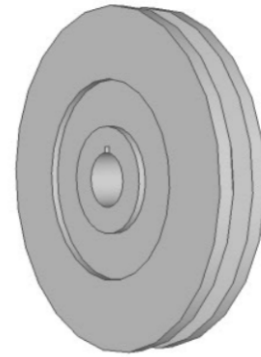
$$= 160 \text{ N} \quad 1 \text{ mark}$$

4a. Why does a pulley wheel have a grooved edge?

1 mark

Follow the link for information / the answer

1 mark for a correct answer



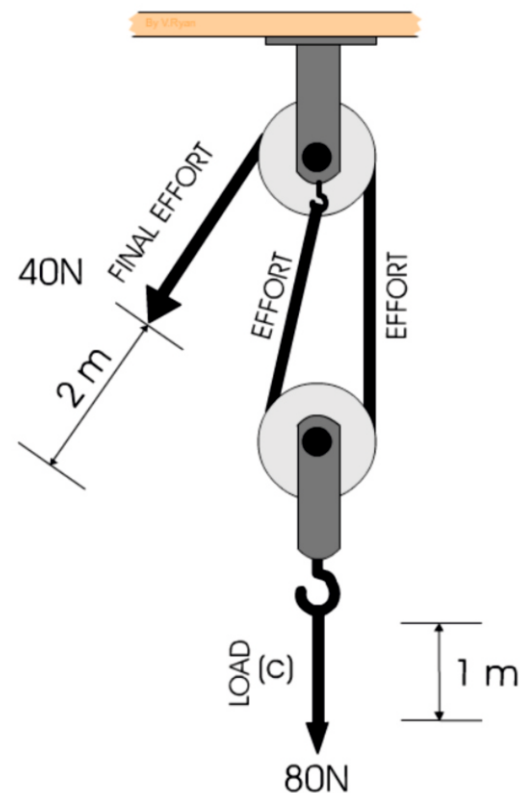
A GROOVED PULLEY WHEEL

4b. A simple pulley system is seen opposite. Calculate the velocity ratio 2 marks

$$\text{MECHANICAL ADVANTAGE} = \frac{\text{LOAD}}{\text{EFFORT}} = \frac{80}{40} = 2$$

$$\text{OR } \frac{80\text{N}}{40\text{N}} = 2$$

$$\begin{aligned} \text{VELOCITY RATIO} &= \frac{\text{DISTANCE MOVED BY EFFORT}}{\text{DISTANCE MOVED BY LOAD}} \\ &= \frac{2}{1} = 2 \end{aligned}$$



4c. What is the efficiency of the pulley system? 2 marks

$$\begin{aligned} \text{EFFICIENCY} &= \frac{\text{MECHANICAL ADVANTAGE}}{\text{VELOCITY RATIO}} \times 100\% \\ &= \frac{2}{2} \times 100\% = 100\% \end{aligned}$$

4d. The total amount of renewable energy produced in 2016 was 90 Terawatt hours (Twh).

The ratio of hydroelectricity compared to other renewable energy forms was 1:12.

What amount of energy was produced through hydroelectricity ? **3 marks**

HYDROELECTRICITY : OTHER RENEWABLE FORMS
1 : 12

Add both numbers (1 and 12)
together. This gives us 13

Then, divide the total amount of renewable energy (90 terawatt hours) by
13

$$\frac{90}{13} = 6.92 \text{ terawatt hours}$$

4e. If total amount of renewable energy produced in 2016 was 100 Terawatt hours (Twh) AND the ratio of hydroelectricity compared to other renewable energy forms was 1:9.

What amount of energy was produced through hydroelectricity ? **3 marks**

HYDROELECTRICITY : OTHER RENEWABLE FORMS
1 : 9

Add both numbers (1 and)
together. This gives us 10

Then, divide the total amount of renewable energy (100 terawatt hours) by
10.

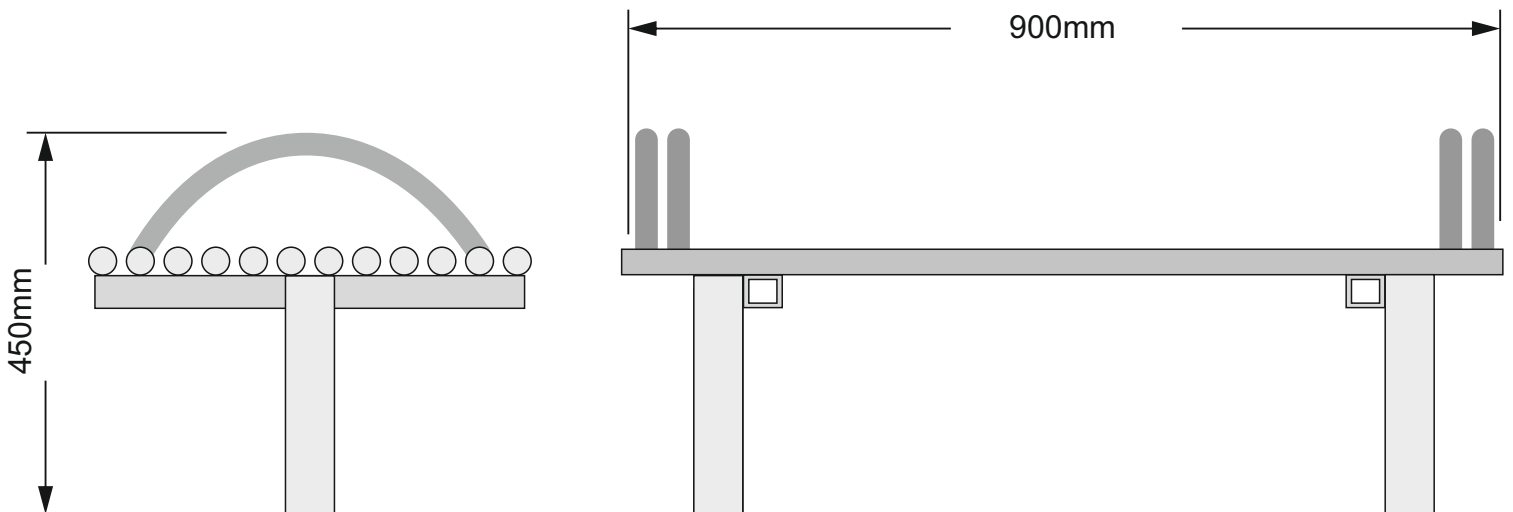
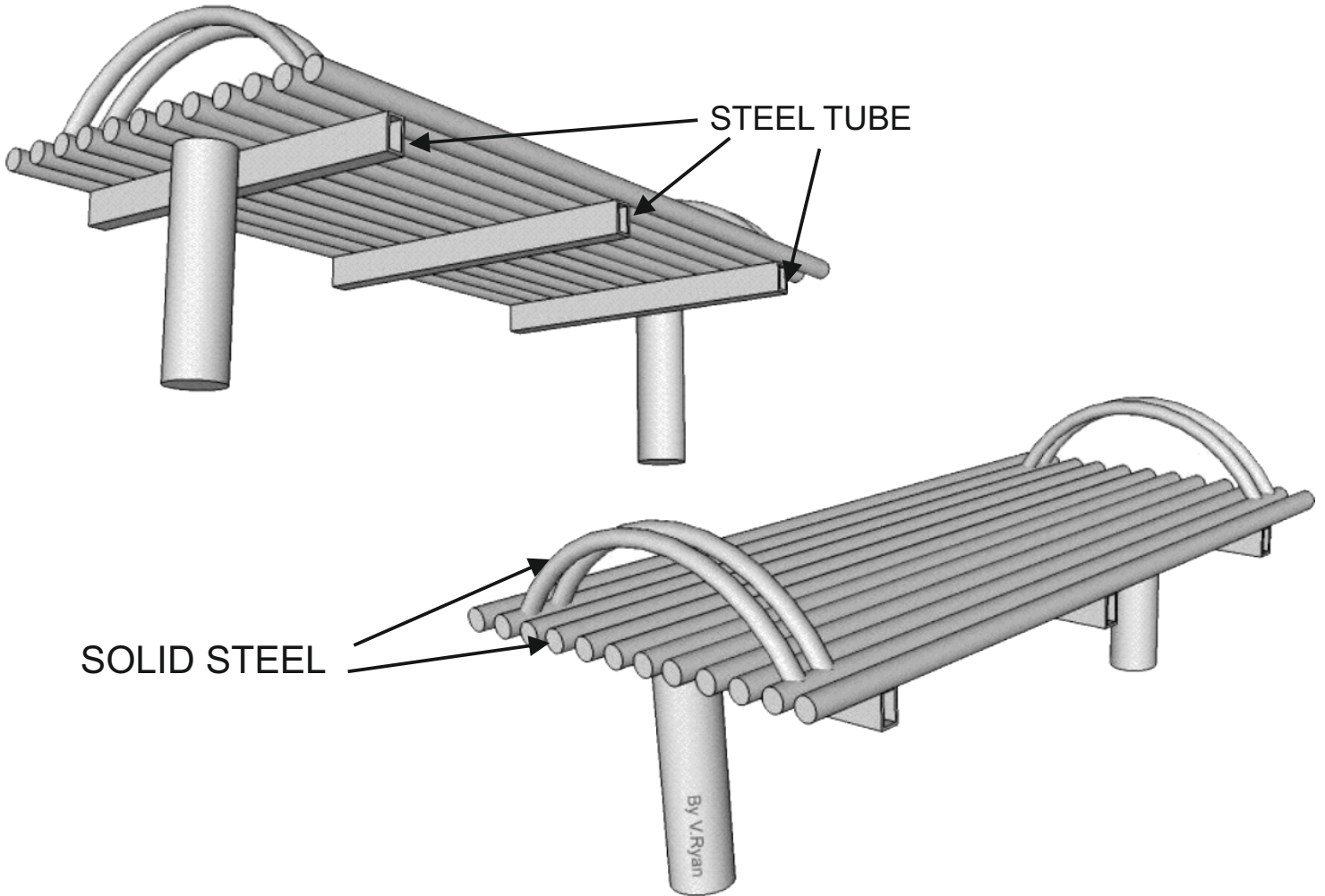
$$\frac{100}{10} = 10 \text{ terawatt hours}$$

SECTION B – METALS

Answer ALL questions

HELPFUL LINK <http://www.technologystudent.com/joints/steelbnch1.html>

5. The Illustrations show a solution for a steel public bench.



5a. The steel bench needs to be improved to include the following specification points.

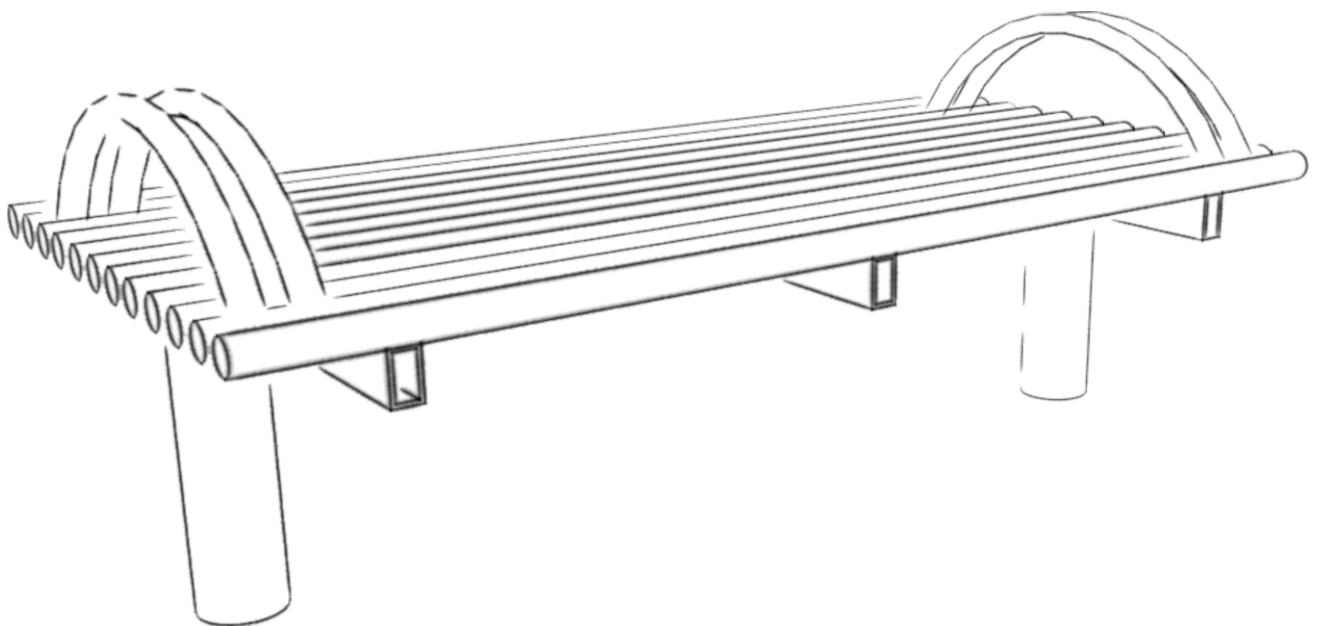
The steel bench must:

- (I) Have a support for the user's back.
- (I) Be interlockable / stackable with other units of the same design.
- (iii) The steel bench must weigh less, than suggested by the original design.

Use notes and/or sketches to show how the public seat could be modified to satisfy the addition specification points, listed above.

Produce clear drawings / sketches, using the outline of the original design to show how the additional specification points can be satisfied.

6 marks



5b. The steel bench must be available in a range of durable colours as shown below. This is achieved through a process called **Powder Coating**.

SAMPLE POWDER COATING COLOUR FINISHES

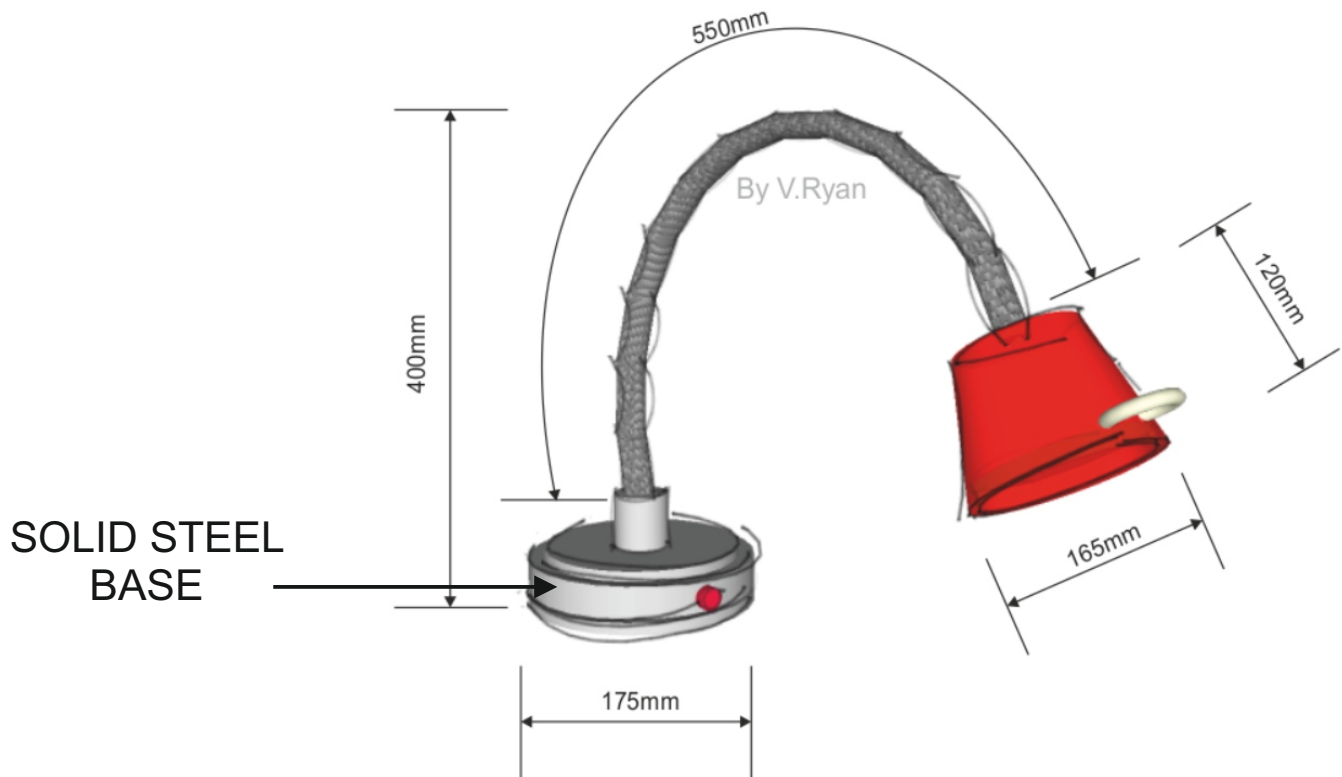


In the space below explain / describe the powder coating process. **4 marks**

Follow the link for information / the answer

- 1 mark for a basic description OR sketch*
- 2 marks basic description AND sketch.*
- 3 - 4 marks for increased detail.*

6a. Carefully study the adjustable 'table top lamp'. The base is made from chromed, solid steel.



Write two reasons why chromed solid steel is suitable for the base of the lamp.
2 marks

(I)

Follow the link for information / the answer

1 mark for a correct answer

Adds weight and therefore stability.

Has a smooth machine finish

(II)

Follow the link for information / the answer

1 mark for a correct answer

Chrome provides a reflective and decorative finish.

Chrome protects the steel from corrosion

6b. The steel components seen below have been ‘chemically blacked’ using a chemical blacking solution.



Use notes and/or sketches to explain/describe the process of chemical blacking.

Use clear sketches and notes in your answer.

4 marks

Follow the link for information / the answer

*1 mark for a basic description OR sketch
 2 marks basic description AND sketch.
 3 - 4 marks for increased detail.*

6c. The components have been machined, prior to being chemically blacked.

What is a machined finish?

2 marks

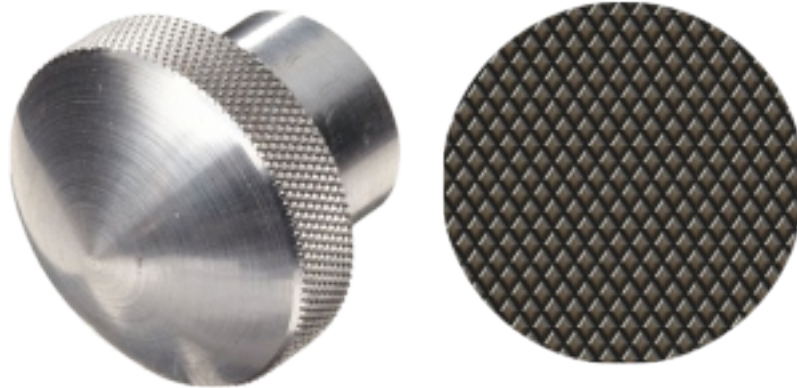


Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*

*An accurate finish,
produced by a machine
such as an engineers lathe
/ milling machine / surface
grinder or any other
suitable machine capable of
machining metals.*

6d. The component seen below has a knurled pattern finish. In the space below, explain the knurling process. Use both notes and sketches. **6 marks**



Follow the link for information / the answer

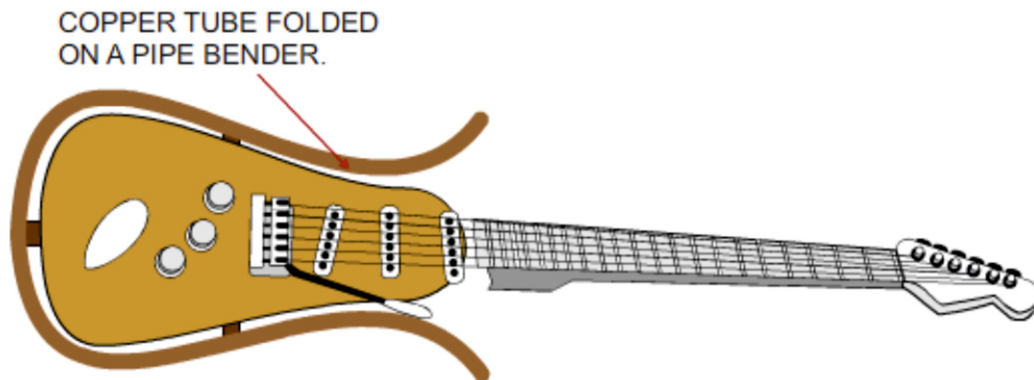
1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

5-6 marks for very good detail including clear sketches.

7. The electric guitar shown below, has a decorative copper tube, shaped to follow the contours of the guitar body. A pipe bender has been used to shape the copper tube.



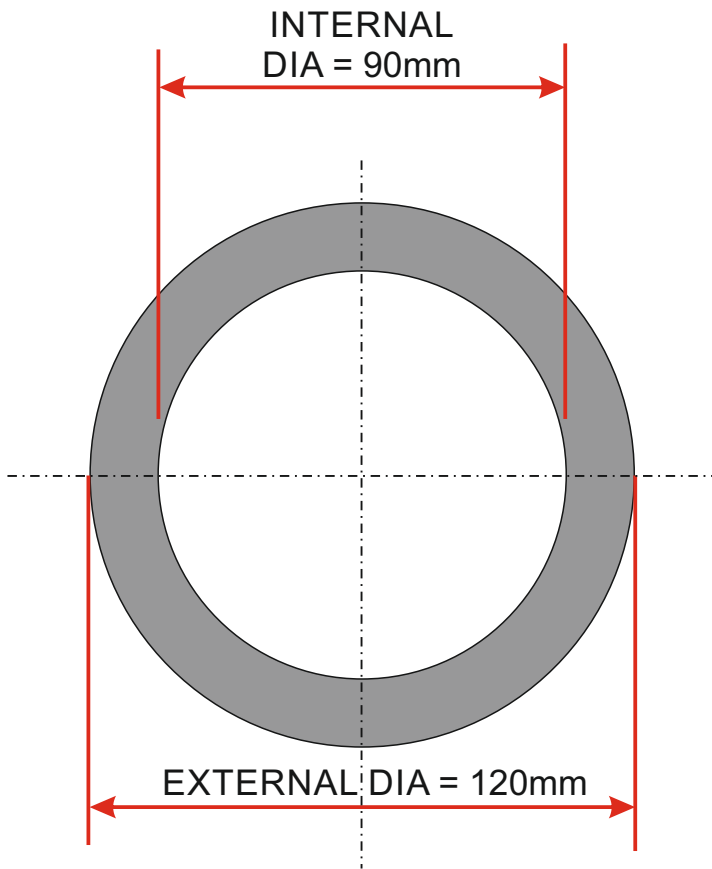
7a. In the space below, draw a pipe bender and explain how it could be used to manufacture the shaped copper tube. **4 marks**

Follow the link for information / the answer

*1 mark for a basic description OR sketch
2 marks basic description AND sketch.
3 - 4 marks for increased detail.*

7b. Name another piece of equipment that could be used to shape the copper tube. **1 mark**

*A spring for bending / forming a copper tube.
A set of rollers that form the curves.*



7c. A piece of steel tube can be seen opposite. The external and internal diameters can be read from the diagram.

What is the area of the surface at one end of the steel? **5 marks**

FORMULA

$$\text{AREA} = \pi r^2$$

$$\pi (\text{pi}) = 3.14$$

2 marks

EXTERNAL DIAMETER

$$\text{AREA} = \pi r^2$$

$$\text{AREA} = 3.14 \times (60 \times 60)$$

$$\text{AREA} = 3.14 \times (3600)$$

$$\text{AREA} = 11304\text{mm}^2$$

2 marks

INTERNAL DIAMETER

$$\text{AREA} = \pi r^2$$

$$\text{AREA} = 3.14 \times (45 \times 45)$$

$$\text{AREA} = 3.14 \times (2025)$$

$$\text{AREA} = 6358.5\text{mm}^2$$

Then, subtract the area of the internal circle from the area of the external circle, to find the total surface area of the tube.

EXTERNAL CIRCLE
11304mm²

INTERNAL CIRCLE
6358.5mm²

1 mark

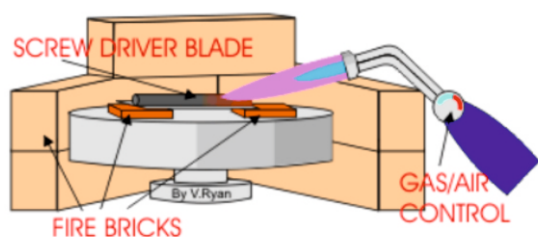
$$11304 - 6358.5 = 4945.5\text{mm}^2$$

The total surface area of one end of the tube is **4945.5mm²**



7. The screwdriver shown opposite has been manufactured in a school workshop. The steel blade has been through the heat treatment process called hardening and tempering.

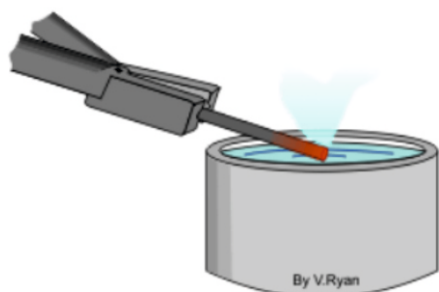
7d. Complete the stages explaining the hardening and tempering process (below). The first stage has been completed, as an example. **6 marks**



STAGE ONE:

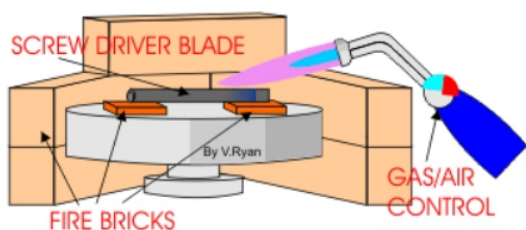
The screw driver blade is heated, slowly at first, warming up the whole blade. Then the heat is concentrated on the area at the end of the blade. This gradually becomes 'red' hot.

STAGE TWO:



Follow the link for information / the answer

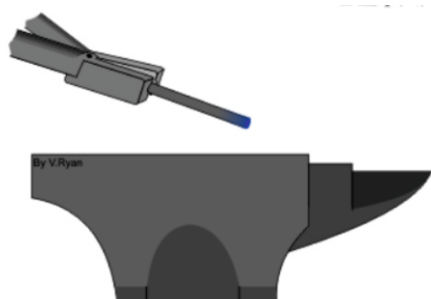
*1 mark for a partial correct answer
2 marks for a complete answer.*



STAGE THREE:

Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*



STAGE FOUR:

Follow the link for information / the answer

*1 mark for a partial correct answer
2 marks for a complete answer.*

8. The products show below have been electroplated, to give them a 'quality' finish.

GOLD PLATED
WATCH



COPPER PLATED
MUG



SILVER PLATED
TEAPOT



SILVER PLATED
GOBLET



CHROME
ELECTROPLATED
TAP



8a. Using notes and a sketch(s), describe the electroplating process, used on the products above.

9 marks (4 marks - notes and 5 marks - sketch(s))

NOTES:

SKETCH(S)

Follow the link for information / the answer

1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

5-6 marks for very good detail including clear sketches.

7 - 9 marks excellent detail and explanation

8b. What is an alloy? 3 marks

Follow the link for information / the answer

1 mark for a basic description

2 marks for reasonable detail

3 marks for increased detail / full answer.

8c. Alloying agents (such as chromium, vanadium and nickel) enhance the properties of the parent metal. Complete the table, by adding Properties and Uses, for each alloying agent. 6 marks

ALLOYING AGENT	PROPERTIES	USES
CHROMIUM	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for property</i> <i>2 marks for uses</i></p>	
VANADIUM	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for property</i> <i>2 marks for uses</i></p>	
NICKEL	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for property</i> <i>2 marks for uses</i></p>	

SECTION B – PAPER AND BOARDS

Answer ALL questions

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS

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5. A design solution for packaging of a toothbrush set, is shown below. The aim is to encourage younger people to clean their teeth thoroughly (improving oral hygiene and general health).

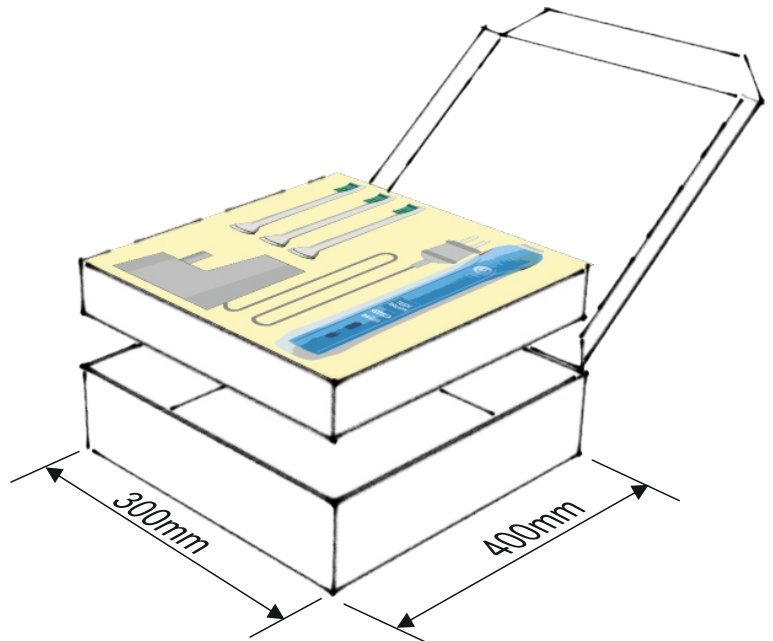
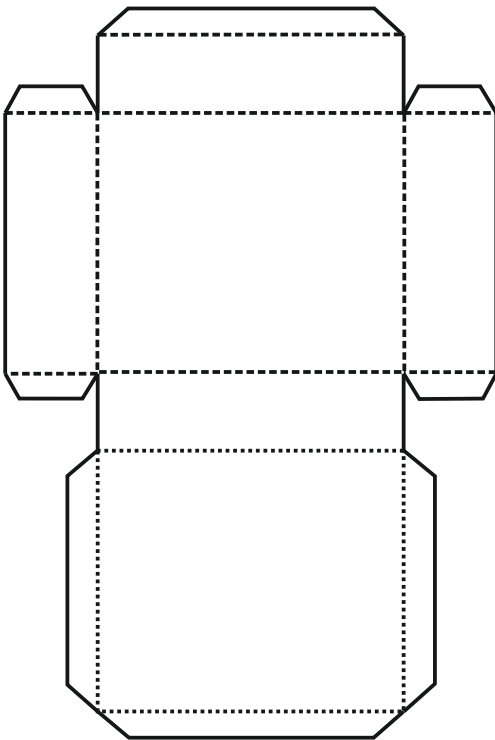
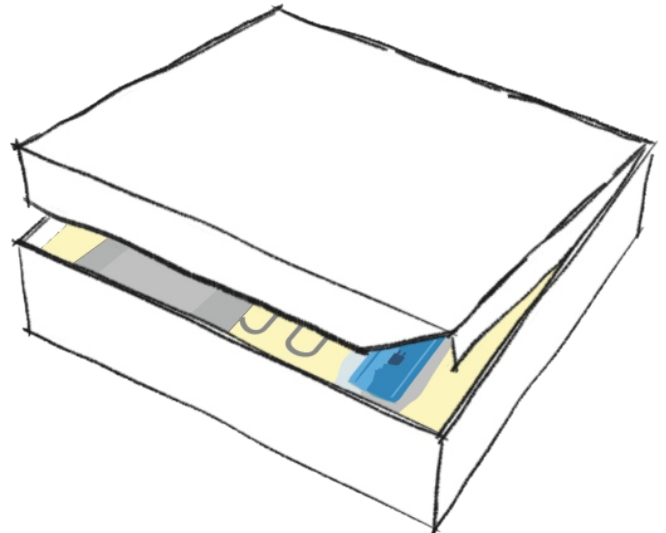
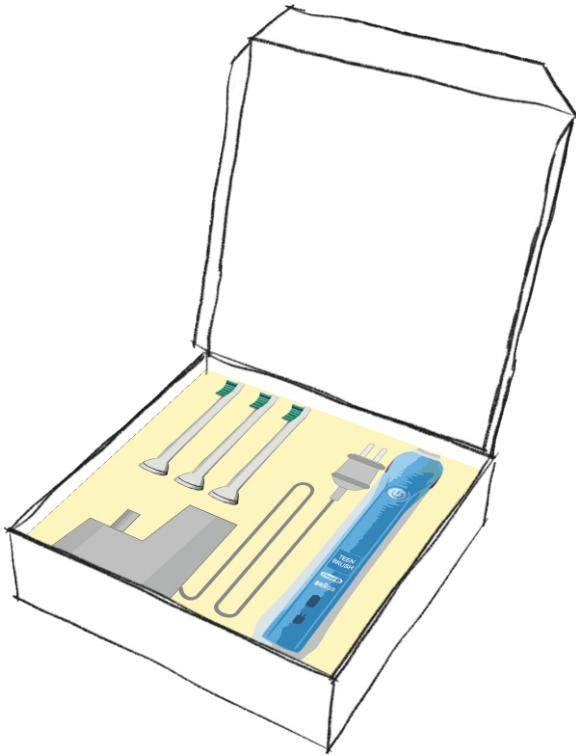
100 % recyclable

Lightweight

Environmentally friendly material.

Materials supplied from a certified sustainable source.

Supplied in flat sheet form and folded to form the 3D version.



5a. The packaging for a toothbrush set needs improving, so that it meets the additional specification points:

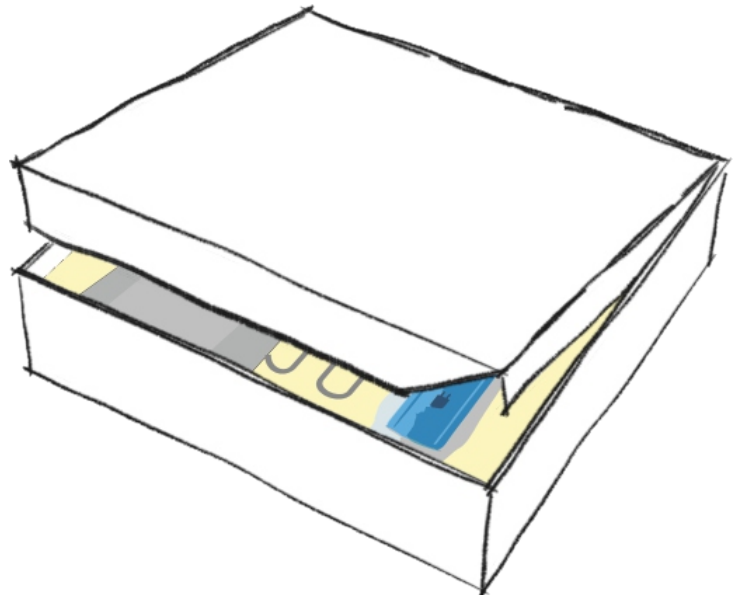
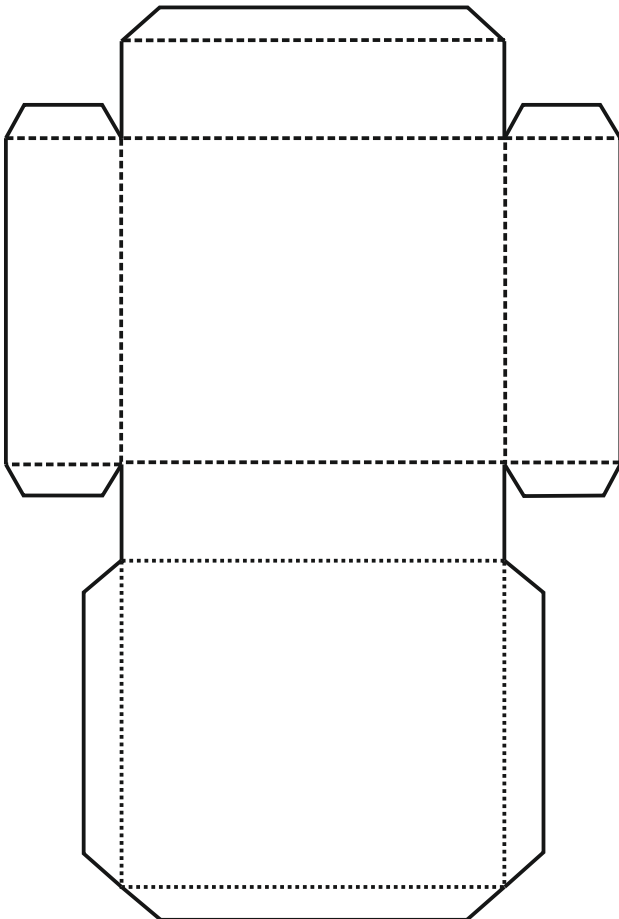
The packaging must:

- (I) Have a clear 'window', allowing potential customers to view the products inside the packaging.
- (II) The packaging must have a folding handle, allowing the customer to carry the product to the checkout.
- (III) The packaging must be environmentally friendly, displaying recycling logos, a logo associated to the use of sustainable materials AND a logo that shows that the contents satisfy British and European Standards.

Use notes and/or sketches to show how the packaging could be modified to satisfy the additional specification points, listed above

Produce clear drawings / sketches, using the outline of the original design, to show how the additional specification points can be met.

6 marks



*1 mark for a basic description OR sketch
2 marks basic description AND sketch.
3 - 4 marks for increased detail.
5-6 marks for very good detail including clear sketches.*

5b. Quick Response Codes are usually seen on packaging (see example below). What is a QR Code? **4 marks**



Follow the link for information / the answer

- 1 mark for a basic description.*
- 2 marks for increased detail*
- 3 - 4 marks for a full answer, at the discretion of the teacher.*

6a. The image on the T Shirt seen opposite, has been 'printed' through a process called 'screen printing'. This process is also often used on card / board products.



Explain the screen printing process. Include both notes and a sketch(s) in your answer **4 marks**

SKETCH(S)

Follow the link for information / the answer

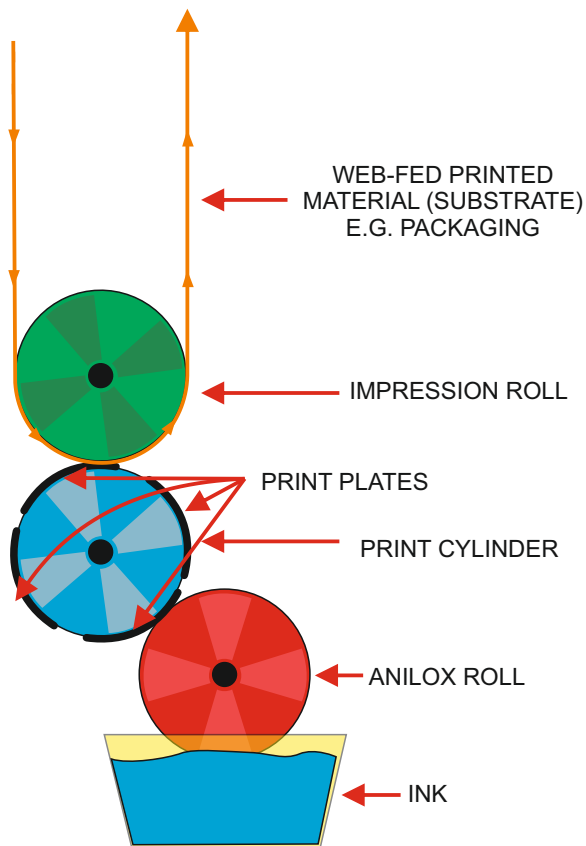
1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

NOTES:

6b. These products have received their illustrations and decoration through flexographic printing (also called 'Flexo').



Explain the flexographic printing process shown opposite. **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

6c. Explain two advantages of the flexographic printing process. **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

6d. When the packaging is manufactured, the various shapes are cut out, as a flat net / development. How is this achieved? In the space below, name a suitable process, draw a labelled diagram to represent the process and add notes that explain the process. **Total of 8 marks**

PROCESS NAME: Die Cutter
(1 mark)

LABELLED DIAGRAM

(4 marks)

Follow the link for information / the answer

1 mark for a basic sketch

2 marks for some detail presented as a sketch.

3 - 4 marks for increased detail. At the discretion of the teacher.

NOTES: (3 marks)

Follow the link for information / the answer

1 mark for a basic written answer

2 marks for increased detail

3 marks for a full answer - discretion shown by the teacher.

6e. Greeting cards and quality writing paper, often have areas that have been embossed. This gives the card / paper a more luxurious feel, when it is handled. Embossing is also visually appealing (see the example).

In the space below, explain the embossing process. Use notes and sketches in your answer.

Total of 5 marks



EMBOSSSED AREA

LABELLED SKETCH (**3 marks**)

Follow the link for information / the answer

1 mark for a basic sketch

2 marks for a reason sketch, with some detail.

3 marks for increased detail and clarity of sketch.

NOTES (**2 marks**):

Follow the link for information / the answer

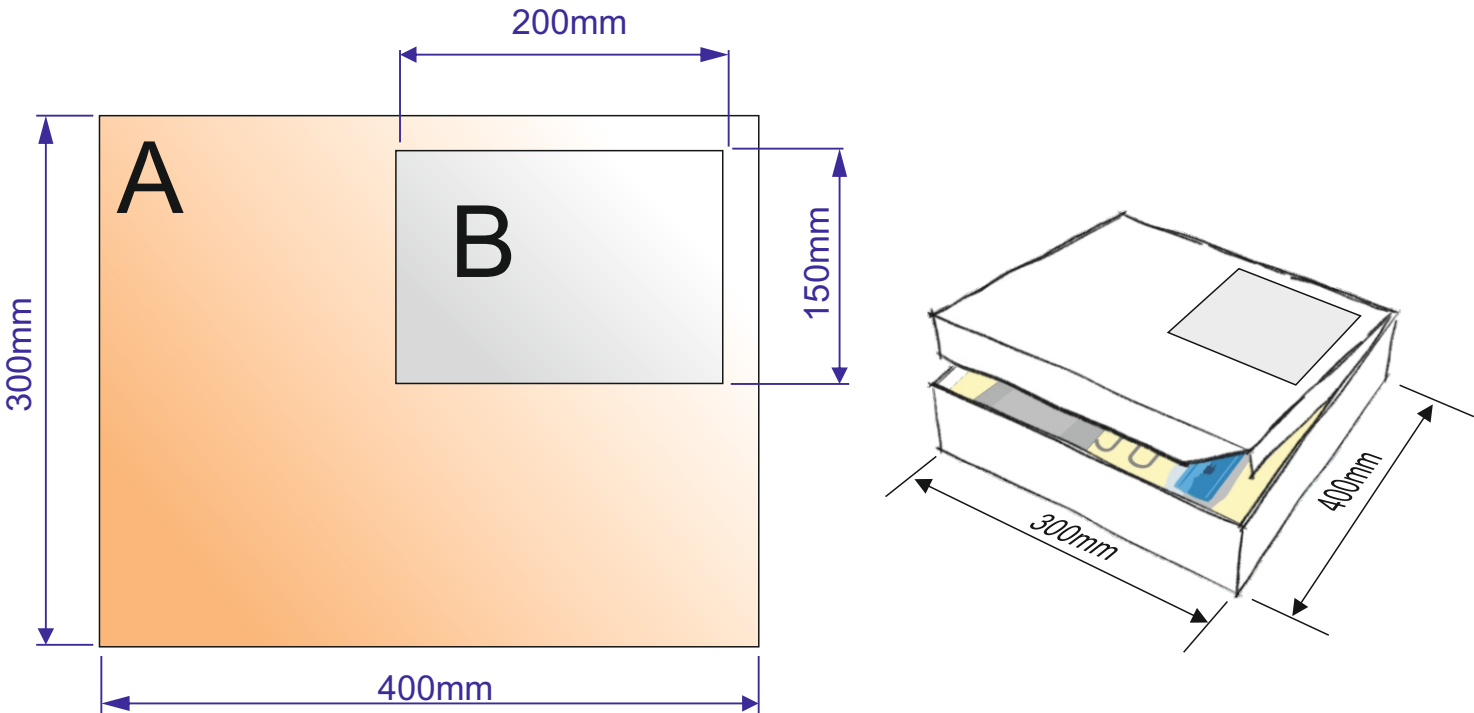
1 mark for a basic answer

2 marks for increased detail

7. A rectangular transparent window is to be added to the lid of the packaging seen in question 5.
The window allows the customer to view some of the products inside the package.

7a. Calculate the area of piece A (the entire lid) **2 marks**

7b. Calculate the area of piece. B (the window only) **3 marks**



First, calculate the entire area of 'A', without the smaller piece being removed, by treating it as a rectangle 400mm x 300mm.

AREA = LENGTH X HEIGHT
 AREA = 400 X 300
 AREA = 120000mm²

2 marks

Now, calculate the area of the smaller rectangular piece 'B', which is also the size of the piece to be removed from 'A'.

AREA = LENGTH X HEIGHT
 AREA = 200 X 150
 AREA = 30000mm²

3 marks

Now subtract the smaller rectangular area 'B' from the total area of rectangle 'A'. The answer will be the area of 'A', with the smaller rectangle of waste acrylic being removed.

120000 - 30000 = 90000mm²

AREA OF FINAL SHAPED PIECE 'A' WITHOUT THE SMALLER PIECE IS 90000mm²

AREA OF PIECE 'B' IS 30000mm²

8a. Two symbols, often seen on card packaging are seen below. What do they represent?
2 marks (1 mark per answer)

(I) *This way up*



(II) *Handle with care*



8b. The logo shown opposite is sometimes printed on packaging.

Explain the meaning of this logo. **4 marks**

Follow the link for information / the answer

1 mark for a basic description.

2 marks for a reasonable description

3 - 4 marks for increased detail, awarded at the discretion of the teacher.



9a. Designers make models throughout the design and development of a product? Why is model making important? **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

9b. Name two model making materials used by designers and describe the characteristics that make them suitable for model making. **3 marks**

Modelling Material:

1 mark for a suitable model making material

Characteristics:

Follow the link for information / the answer

*1 mark for a single characteristic
2 marks for two characteristics*

9c. Biodegradable inks are slowly increasing in popularity, for the printing of text and illustrations on packaging.

(I) What are biodegradable inks? **1 mark**

Follow the link for information / the answer

1 mark for a correct answer

(II) What are the advantages of biodegradable inks? **3 marks**

Follow the link for information / answers

1 mark per correctly identified advantage

10a. A range of paper and boards exist. Complete the table below by describing each material and giving a practical application. The first row has been completed for you.

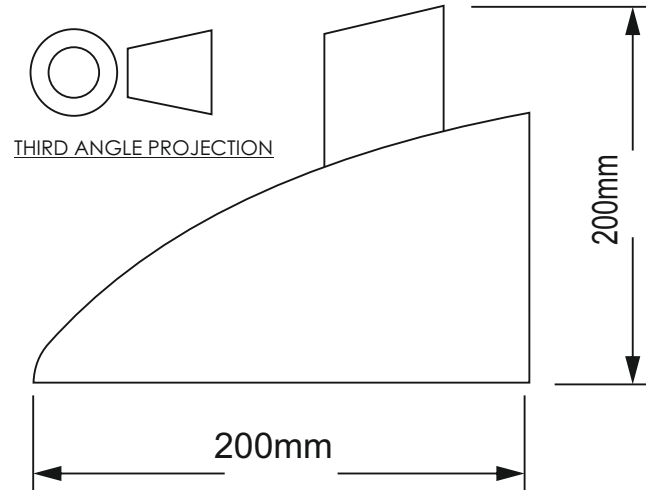
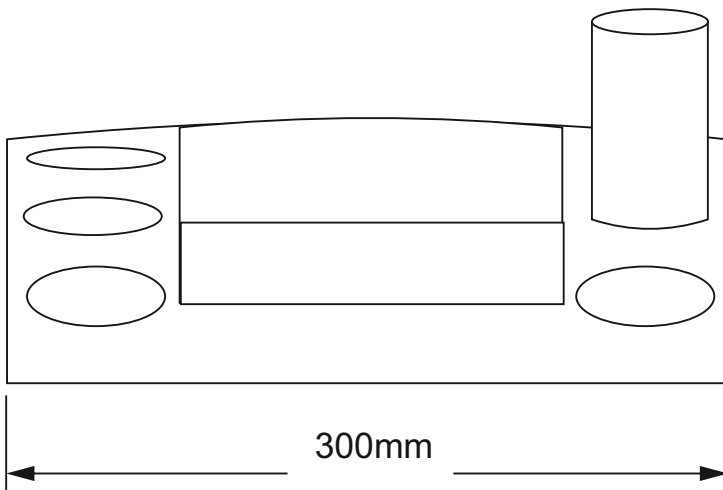
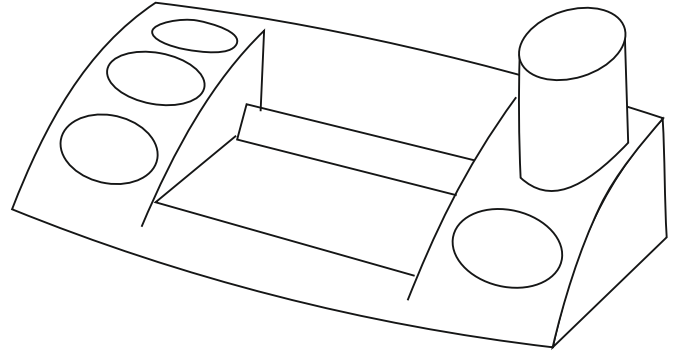
Total of 9 marks

MATERIAL	DESCRIPTION
<p>CORRUGATED BOARD</p>	<p><i>This type of board is often used for packaging large electrical items. These large boxes (often brown in colour) protect the contents from damage. Corrugated board is strong because it is composed of a top and bottom layer and in between there is a triangulated section. A triangular section is very strong compared to its weight.</i></p>
<p>DUPLEX BOARD</p> <p>3 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description</i> <i>2 marks for a more detailed description</i> <i>For 3 marks - all the above plus a practical application</i></p>
<p>TRACING PAPER</p> <p>3 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description</i> <i>2 marks for a more detailed description</i> <i>For 3 marks - all the above plus a practical application</i></p>
<p>FOIL LINED BOARD</p> <p>3 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description</i> <i>2 marks for a more detailed description</i> <i>For 3 marks - all the above plus a practical application</i></p>

SECTION B – POLYMERS

Answer ALL questions

OFFICE DESKTOP ORGANISER



The desktop organiser is manufactured from a suitable polymer

It is drop resistant, relatively unbreakable.

The organiser will help the client complete tasks such as writing, drawing and general office work.

Manufactured from recycled material.

Lightweight but very strong.

Manufactured in a range of colours.

The cost to the customer is £7.50.

5a. The office desktop organiser, needs to be improved to include the following specification points.

The desktop organiser must:

(I) Have an ergonomically designed handle, so that it can be transported from table to table, with ease.

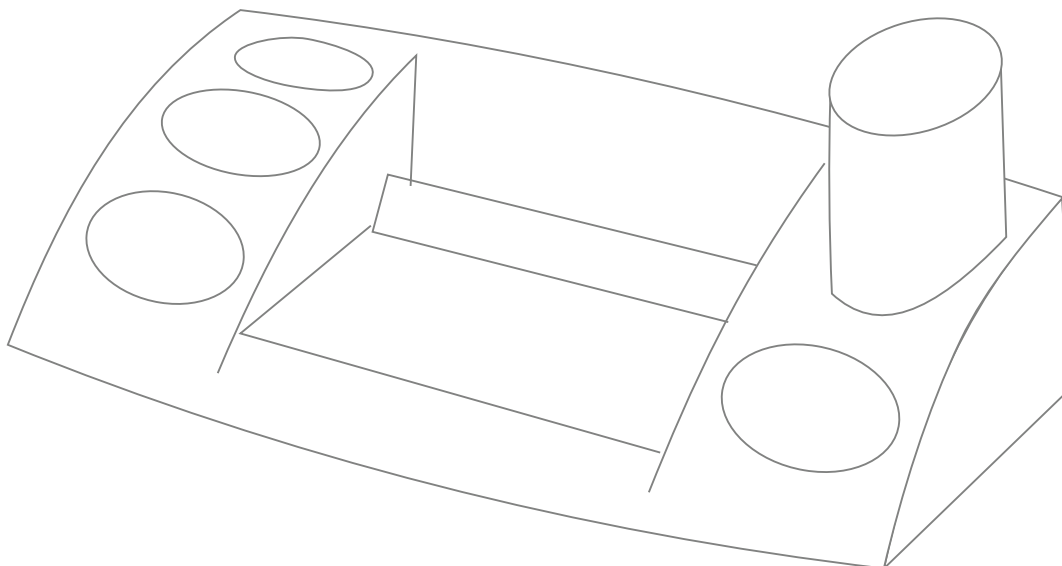
(II) The desktop organiser must store an increased range of stationary equipment; Pens, pencils, ruler, scissors, glue, paper clips, compass, protractor, calculator, stapler, mobile phone etc....

(III) The organiser must have an area that is a safe resting place for a hot drink.

Use notes and/or sketches to show how the Desktop Organiser could be modified to satisfy the additional specification points, listed above

Produce clear drawings / sketches, using the outline of the original design to show how the additional specification points can be met.

6 marks



1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

5-6 marks for very good detail including clear sketches.

5b. Name a suitable material for the manufacture of the desktop organiser.
1 mark

SUGGESTIONS: HIPS, HDPE, LDPE, PP, ACRYLIC (PMMA), ABS.

5c. The desktop organiser is manufactured through a process called injection Moulding. Describe injection moulding. **3 marks**

Follow the link for information / the answer

1 mark for a basic description.

2 marks for a reasonable description

3 marks for increased detail, awarded at the discretion of the teacher.

5d. In the space below, draw a labelled diagram that represents the injection Moulding process. **4 marks**

Follow the link for information / the answer

1 mark for a basic sketch

2 marks for a reason sketch, with some detail.

3 - 4 marks for increased detail and clarity of sketch.

5e. Why is the material you named in question 5b, suitable for the manufacture of this desktop organiser. **2 marks**

Follow the link for information / the answer

1 mark per material characteristic

5f. Name another material that would be suitable for the desktop organiser and explain why it is suitable. **2 marks**

NAME: *Any suitable polymer (see link) 1 mark*

WHY SUITABLE:

Follow the link for information / the answer

1 mark for a correct characteristic / suitability

5g. in the space opposite, sketch the recycling symbol for material you named in question 5b. **2 marks**

1 mark for a basic sketch fairly close to the correct symbol.

Variety of possible answers



6a. The desktop organiser manufacturer is considering using TPEs. What are Thermoplastic Elastomers (TPEs)? **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

6b. What are the general properties of TPEs? **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

6c. Describe some uses of TPEs. **2 marks**

Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

6d. Why is a thermoplastic Elastomer (TPE) suitable for the manufacture of the TV remote control seen opposite?

Make reference to General Properties, Product function, aesthetics, and product manufacture in your written answer.

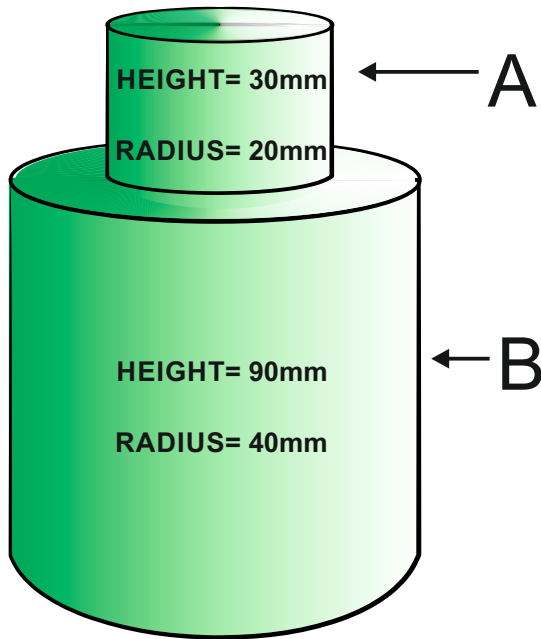
5 marks



Follow the link for information / the answer

- 1 mark for a basic description only referring to 1 aspect as outlined by the question.*
- 2 marks including two aspects. General properties, function etc.....*
- 3 marks including three aspects. General properties, function etc.....*
- 4 marks including four aspects. General properties, function etc.....*
- 5 marks including five aspects. General properties, function etc.....*

7a. The solid 'polymer' object seen below, has been manufactured on an engineering centre lathe. It is one solid piece. Calculate the total volume. **5 marks**



FORMULA

$$v = \pi r^2 h$$

volume = pi x radius² x height

π (pi) = 3.14

In order to calculate the entire volume of the engineered solid, it is treated as two separate parts. Part A is the smaller cylinder and part B is the larger cylinder.

PART A

$$v = \pi r^2 h$$

$$\text{volume} = 3.14 \times 20\text{mm} \times 20\text{mm} \times 30\text{mm}$$

$$\text{volume} = 37680\text{mm}^3$$

or

$$\text{volume} = 37.680\text{cm}^3$$

1 mark

PART B

$$v = \pi r^2 h$$

$$\text{volume} = 3.14 \times 40\text{mm} \times 40\text{mm} \times 90\text{mm}$$

$$\text{volume} = 452160\text{mm}^3$$

or

$$\text{volume} = 452.160\text{cm}^3$$

1 mark

Then add both volumes together, to find the overall volume of the engineered object.

3 marks

$$\text{FINAL VOLUME} = A + B$$

$$\text{FINAL VOLUME} = 37680\text{mm}^3 + 452160\text{mm}^3$$

$$\text{FINAL VOLUME} = 489840\text{mm}^3 \text{ or } 489.84\text{cm}^3$$

8a. The carrier bag seen opposite is manufactured from polylactide (PLA), an environmentally friendly polymer.



Write **four** reasons why this material is suitable for the carrier bag. Justify each 'reason'.

Total of 8 marks (1 mark per reason, 1 mark per justification)

(i)

Follow the link for information / the answer

*1 mark for a reason
2 marks for a justification*

(ii)

Follow the link for information / the answer

*1 mark for a reason
2 marks for a justification*

(iii)

Follow the link for information / the answer

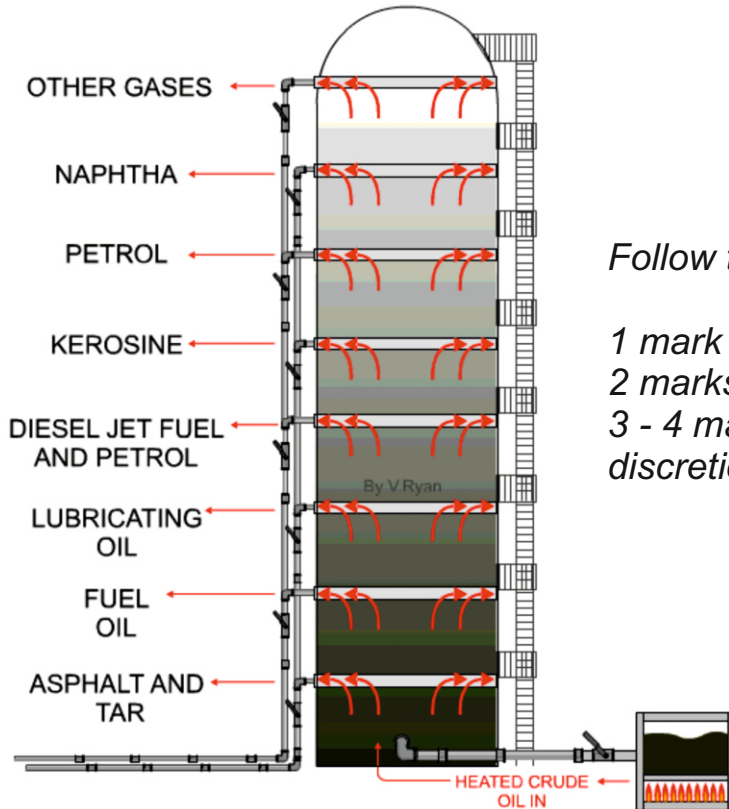
*1 mark for a reason
2 marks for a justification*

(iv)

Follow the link for information / the answer

*1 mark for a reason
2 marks for a justification*

9a. Most polymers are manufactured from refined crude oil, using a process called **distillation**. Briefly describe this process. **4 marks**



Follow the link for information / the answer

1 mark for a basic description.

2 marks for a reasonable description

3 - 4 marks for increased detail, awarded at the discretion of the teacher.

9b. What are thermosetting plastics? **3 marks**

Follow the link for information / the answer

1 mark for a basic description.

2 marks increased detail.

3 marks for a full answer.

10a. Large supermarkets are aware of the damage plastics cause to the environment. How are supermarkets changing the way they use plastics, so that they are viewed by the customer, as being environmentally friendly? **9 marks**

Follow the link for information / the answer

1 mark for a basic statement

2 marks including at least two relevant points

3 marks including at least three relevant points

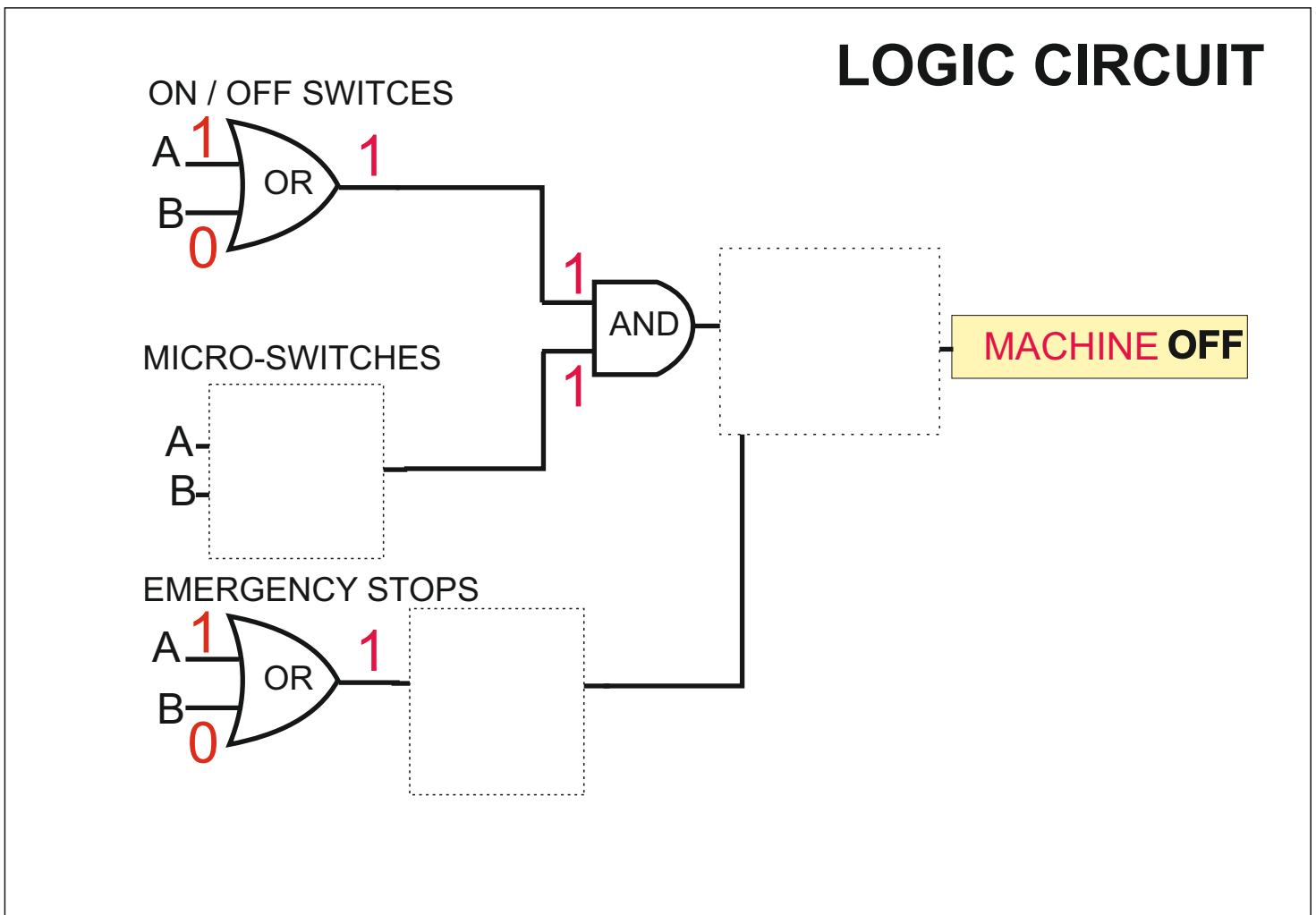
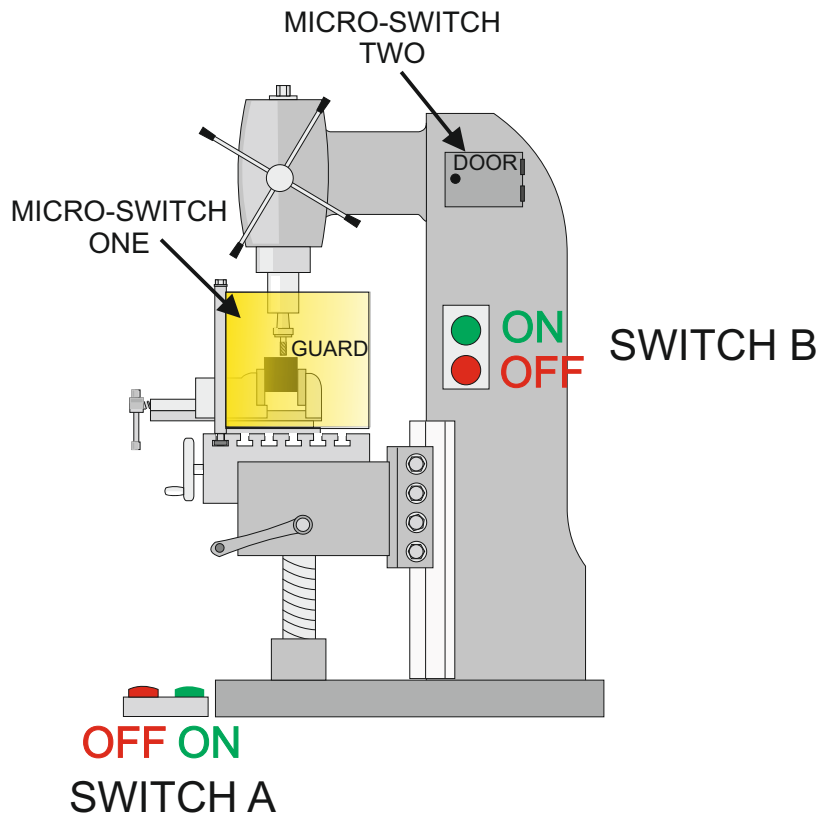
etc..... 9 marks for the inclusion of at least 9 relevant points.

SECTION B – SYSTEMS

Answer ALL questions

5. A metal cutting milling machine has two ON/OFF switches, either will allow the cutter to run. The first switch is on the side of the machine (B) and the second is a foot operated switch (A).

The machine has two micro-switches (one on the 'door and one on the guard) if any of these are released the cutter will stop. The first micro-switch is on a guard, if this is opened the machine will stop. The second micro-switch is on a door which allows access to the moving mechanism of the milling machine. If this is opened the machine will stop.



5a. The logic circuit needs to include the following specification points.

The circuit must:

- (i) Include two emergency stop switches, found on the walls of the workshop, either capable of stopping all machines in the workshop.
- (ii) The machine must stop if a guard or machine door is opened.
- (iii) Either of the ON / OFF switches must activate / deactivate the machine.

Use notes and/or sketches to show how the circuit could be modified to satisfy the specification points, listed above

Complete the logic circuit/diagram (adding suitable gates and their logic outputs), using the circuit diagram below, showing how the specification points can be met.

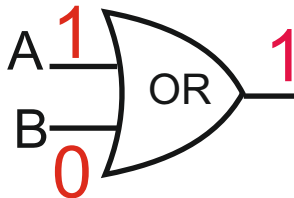
6

marks

The micro-switches are normally logic '1' (true, high, on) when pressed. Draw the logic diagram for this machine.

up to two marks per logic gate drawn in the three empty boxes, of the circuit.

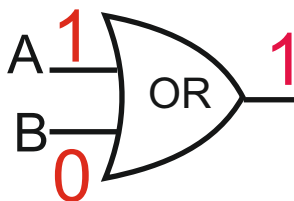
ON / OFF SWITCHES



MICRO-SWITCHES

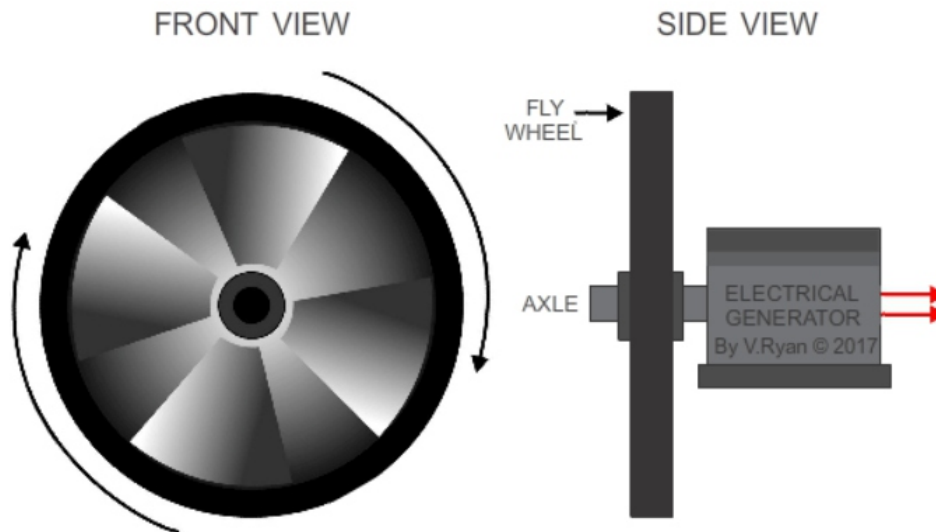


EMERGENCY STOPS



MACHINE OFF

5b. Flywheels are one efficient way of storing energy. In simple terms, explain how a flywheel works. **2 marks**



Follow the link for information / the answer

*1 mark for a basic answer
2 marks for increased detail*

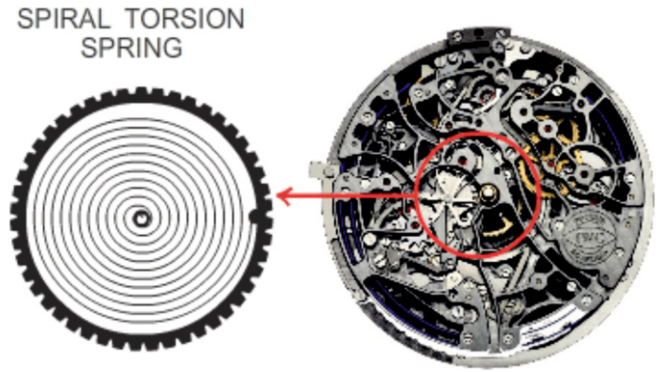
5c. Describe one modern practical application of a flywheel system. **2 marks**

Follow the link for information / the answer

*1 mark for a basic description of a practical application.
2 marks for increased detail*

6a. Springs have a variety of uses. They are often seen in expensive ‘mechanical’ / wind-up (analog) watches, such as seen opposite. How does the spiral torsion spring contribute to the movement of the hands?

1 mark



Follow the link for information / the answer

1 mark for a correct answer

6b. Describe one way in which springs have been applied to a system, that can store excess electrical energy and release it when required. Include notes and a simple diagram. **3 marks**

Follow the link for information / the answer

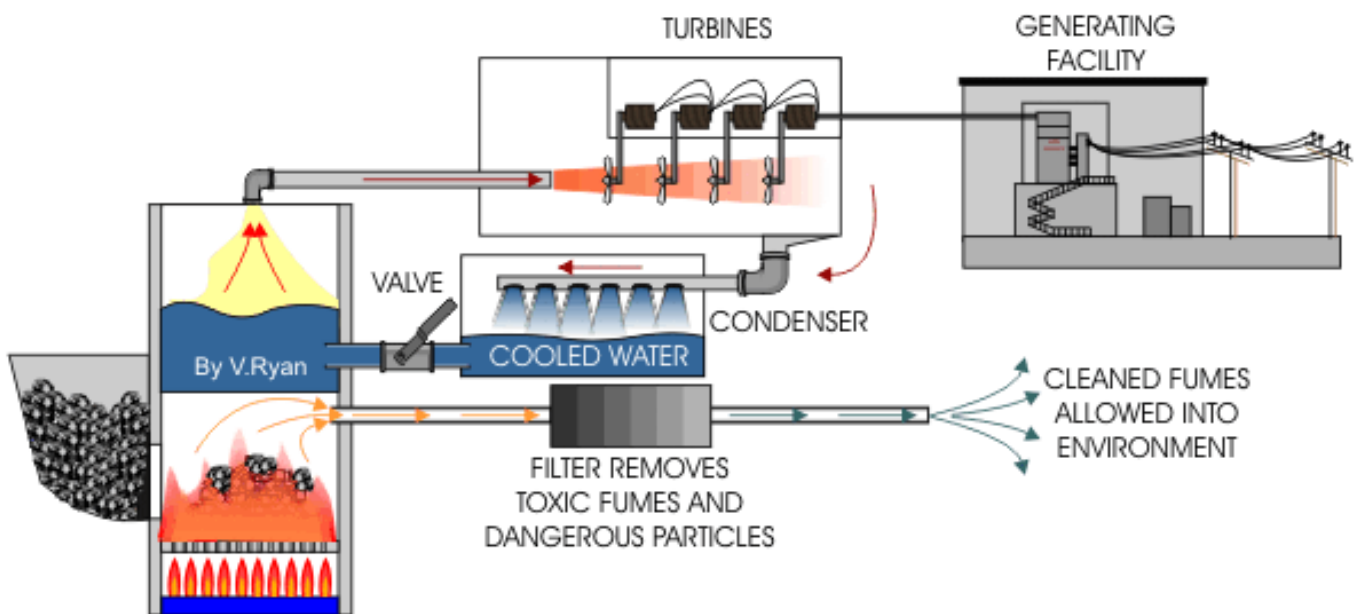
1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 marks for increased detail.

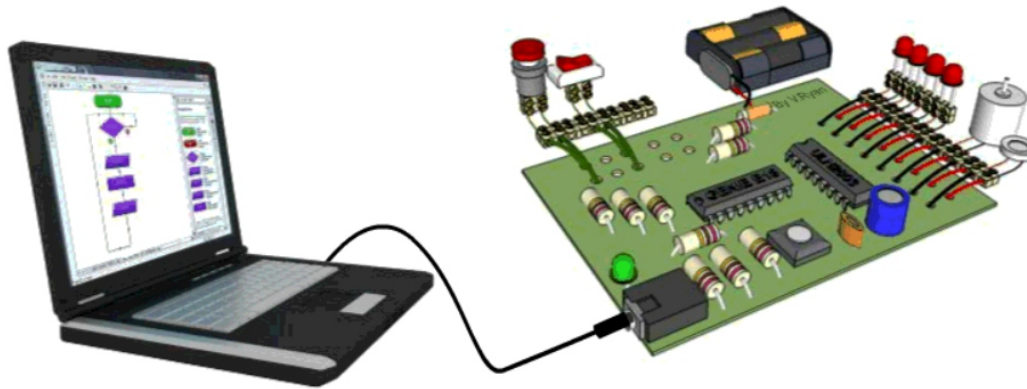
7a. The diagram below outlines the production of electricity and its distribution. Explain each of the three aspects of the overall process. **4 marks**

FUEL AND FURNACE	TURBINES AND GENERATING FACILITY	DISTRIBUTION TO NATIONAL GRID
_____	_____	_____
<i>Follow the link for information / the answer</i>		
<p><i>1 mark for a basic description in at least one column</i> <i>2 - 3 marks for reasonable descriptions in all three columns</i> <i>3 - 4 marks for increased detail.</i></p>		
_____	_____	_____
_____	_____	_____



8a. A typical PIC microcontroller, connected to a computer, is shown below. What is the full terminology for PIC ? **1 mark**

PIC= Programmable Interface Controllers



CIRCUIT WIZARD SOFTWARE -
USED TO PROGRAM THE
GENIE PIC MICROCONTROLLER

A GENIE PIC MICROCONTROLLER
PROGRAMMABLE CIRCUIT

8b. PIC microcontrollers are programmed via computer software. Other than programming, how is the software used? **4 marks**

Follow the link for information / the answer

1 mark for a basic description.

2 marks for a reasonable description

3 - 4 marks for increased detail, awarded at the discretion of the teacher.

8c. LDRs are often used as inputs to PIC microcontrollers. How does the resistance of an LDR change, depending on the light level? **3 marks**

LIGHT DEPENDENT RESISTOR



By V.Ryan

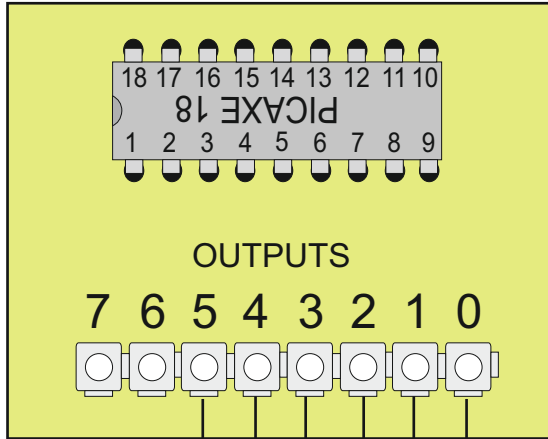
Follow the link for information / the answer

1 mark for a basic answer

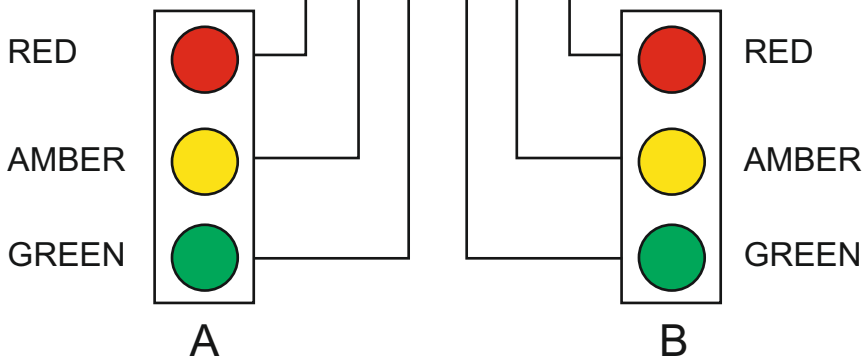
2 marks for increased detail

3 marks for a full explanation.

9. Trains are often controlled by traffic lights. These tell the train driver when to stop and when it is safe to move the train forwards. The lights are controlled by the outputs of a microcontroller circuit (seen below). The table shows the operating cycle.



LIGHT A	LIGHT B
GREEN	RED
AMBER	RED + AMBER
RED	GREEN
AMBER + RED	AMBER



Outputs 0 to 5 are used to control the sequence of lights

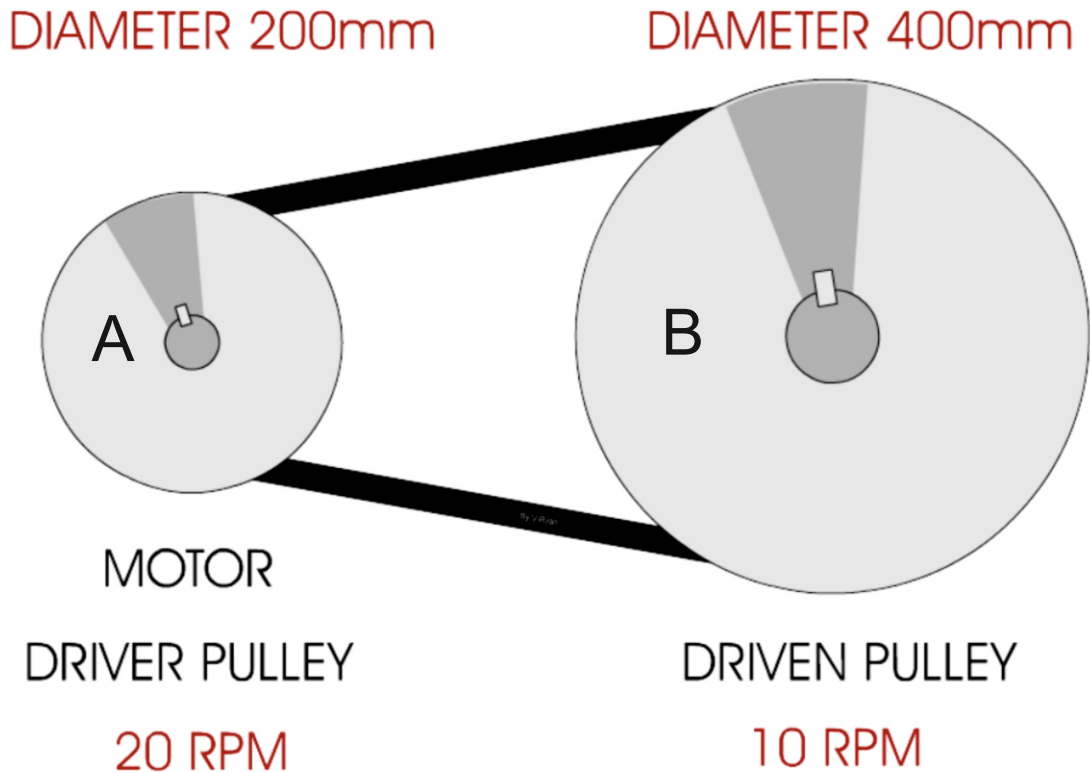
9a. Complete the table below to show the output bit pattern required to run the traffic lights for one cycle. Begin with light A on GREEN and light B on RED. **5 marks**

ANSWER

Every mistake removes a single mark from the total marks available

OUTPUT BIT	7	6	5	4	3	2	1	0
			0	0	1	0	0	1
			0	1	0	0	1	1
			1	0	0	1	0	0
			1	1	0	0	1	0

10a. Pulleys, such as the combination shown below, are regularly used in machines and mechanical devices.



(I) Calculate the Velocity Ratio of the pulley system. Include all your working out **2 marks**

METHOD ONE:

$$\frac{\text{DISTANCE MOVED BY DRIVEN PULLEY}}{\text{DISTANCE MOVED BY DRIVER PULLEY}} = \frac{400\text{mm}}{200\text{mm}} = 2 \quad \text{OR} \quad \frac{2}{1} \quad \text{DRIVER : DRIVEN}$$

METHOD TWO:

$$\text{VELOCITY RATIO} = \frac{\text{DRIVER PULLEY MOVES 2 REVOLUTIONS}}{\text{DRIVEN PULLEY MOVES 1 REVOLUTIONS}} = \frac{2}{1} \quad \text{OR} \quad \frac{2}{1} \quad \text{DRIVER : DRIVEN}$$

(ii). Calculate the RPM of pulley 'B'. Include all your working out. **3 marks**

$$\text{VELOCITY / SPEED OF ROTATION OF DRIVEN PULLEY WHEEL} = \frac{\text{RPM OF DRIVER PULLEY}}{2} = \frac{20 \text{ rpm}}{2} = 10 \text{ rpm at Driven pulley wheel}$$

11a. The process of soldering circuits in a school workshop, involves using a soldering iron. Explain each stage of the soldering process, adding notes and sketches (sketches - only if required). The first stage has been completed for you.

6 marks

NOTES

SKETCHES

1. Inspect the tip to make sure that it is not past good operation. If it looks in bad condition it will not help you solder a good joint.

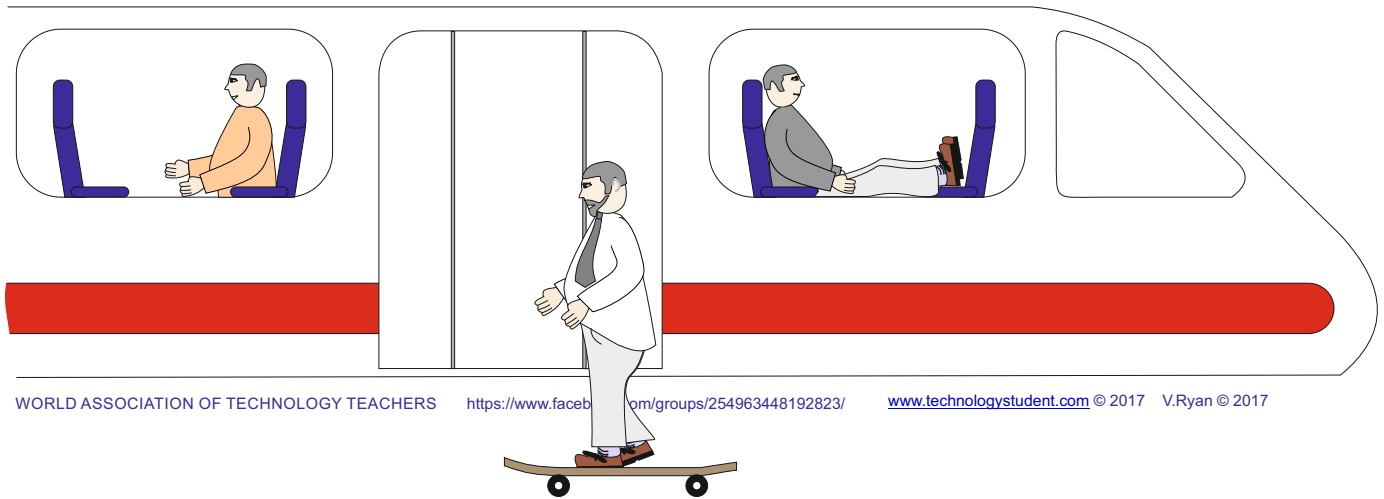
Follow the link for information / the answer

1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

5-6 marks for very good detail including clear sketches.

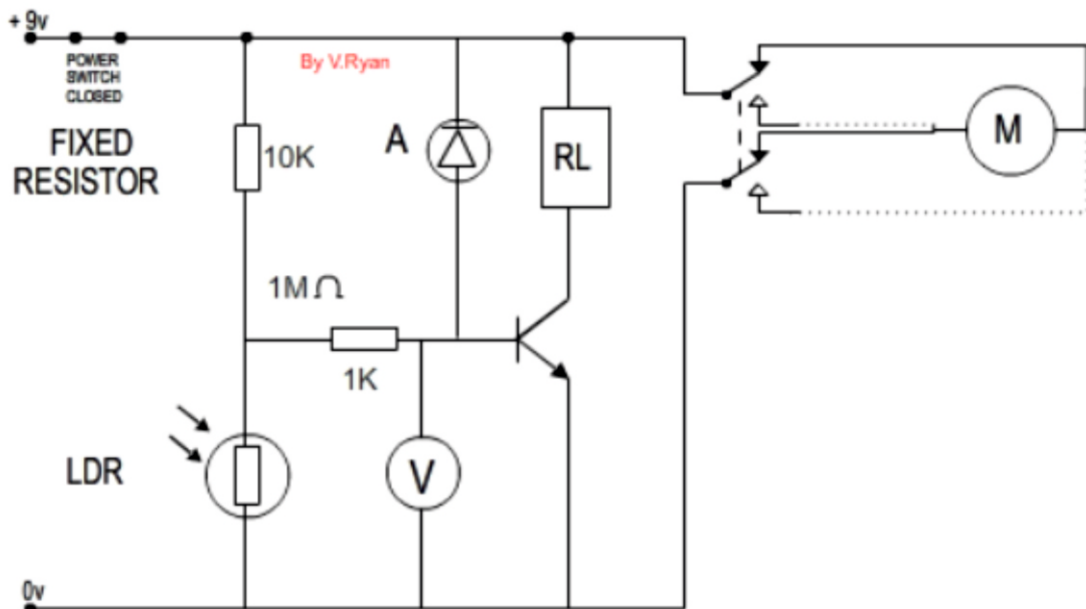


The drawing shows one of the passenger doors to a train. The passenger doors will only open when the train is stationary at the platform. A sensor circuit controls the opening and closing of doors which open automatically when a passenger approaches.

12a. Name a suitable sensor for this procedure. **1 mark**

LDR (LIGHT DEPENDENT RESISTOR)

12b. The incomplete circuit for the operation of the doors is seen below. Complete the circuit by adding the components required to represent your sensor. **3 marks**

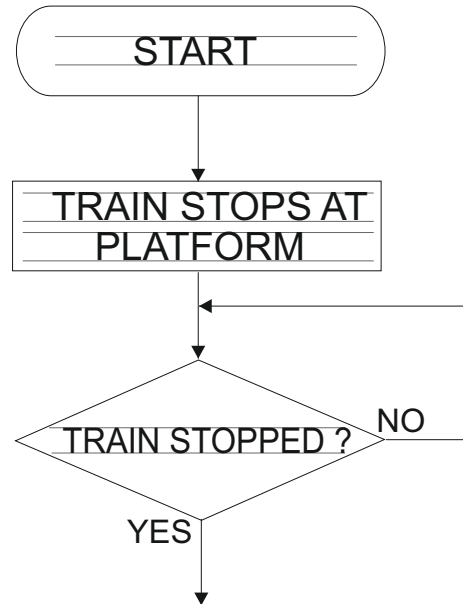


12c. Describe one safety feature the door control system should have. **1 mark**

Sample answer: A pressure sensor could be added to each door so that if the door closed on a passenger a circuit would detect this and open the doors immediately.

12d. The sensor circuit has been replaced with a programmable microcontroller circuit. In the space below, complete the flow chart that represents the programming for the opening and closing of the doors.

Alongside the flow chart, explain each stage. **4 marks**



Follow the link for information / the answer

1 mark for a very limited number of flowchart boxes being correct.

2 marks for most of the flowchart being correct

3 marks for an increased number of flowchart boxes being correct.

4 marks for a completely correct answer.

13. Most electronic products are financed, manufactured and distributed through a system called Globalisation.

13a. In general terms, what is globalisation? **4 marks**

Follow the link for information / the answer

1 mark for a basic description.

2 marks for a reasonable description

3 - 4 marks for increased detail, awarded at the discretion of the teacher.

13b. Describe / explain some of the disadvantages of globalisation. **5 marks**

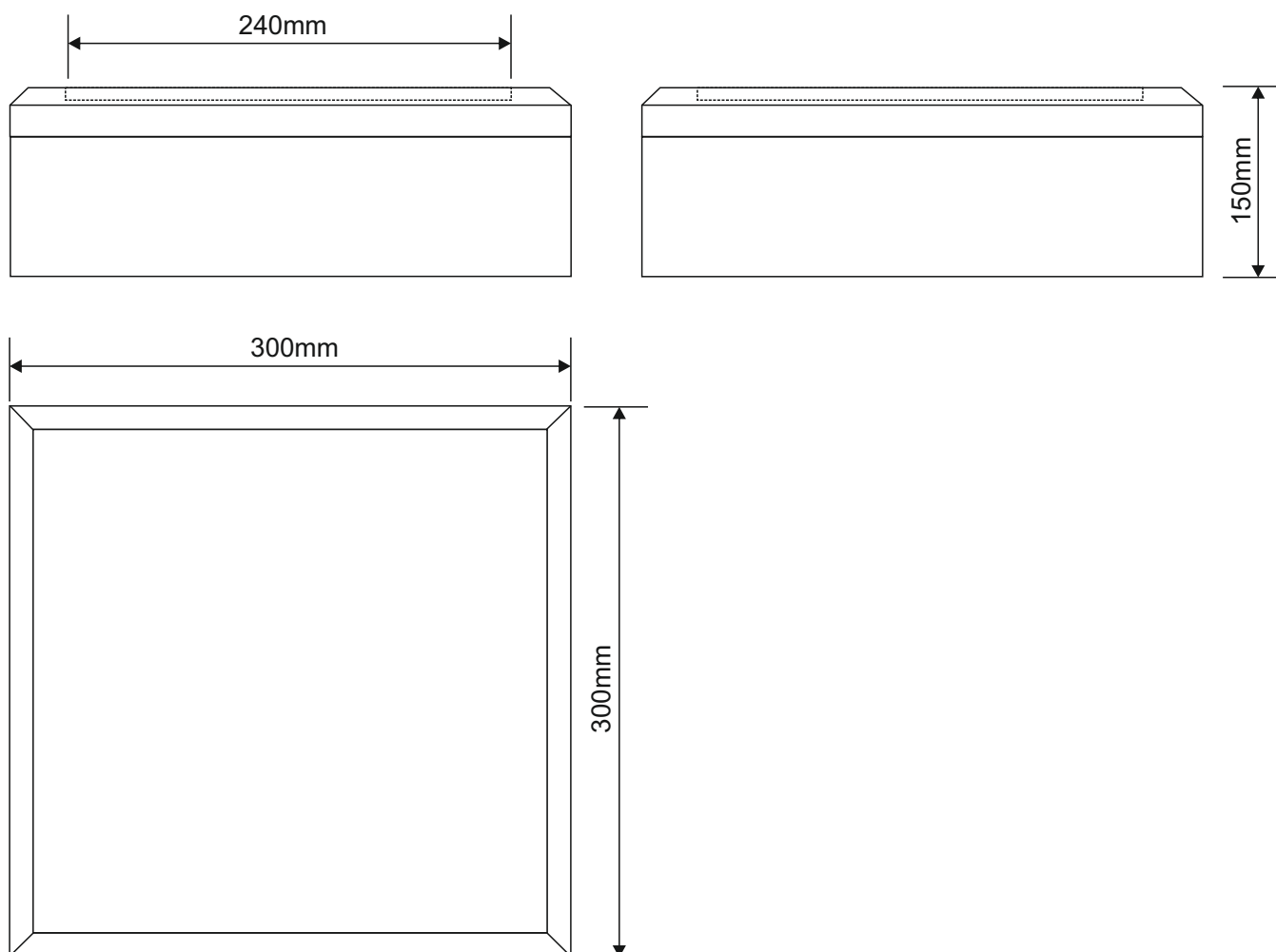
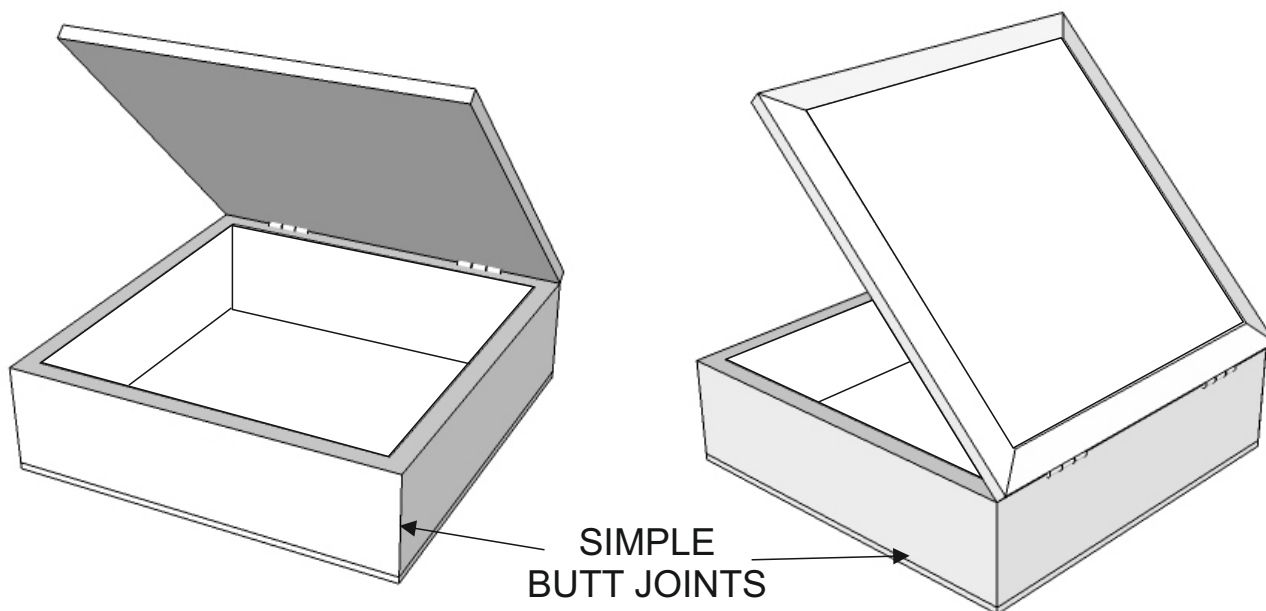
Follow the link for information / the answer

1 mark per disadvantage included. Maximum of 5 marks in total.

SECTION B – TIMBERS

Answer ALL questions

Bits and Bobs Storage (timbers)



This storage box is available in a variety of natural woods. Traditional jointing methods have been used during its manufacture. It has a quality finish and can be locked for security.

5a. The storage box, needs to be improved to include the following specification points.

The storage box must:

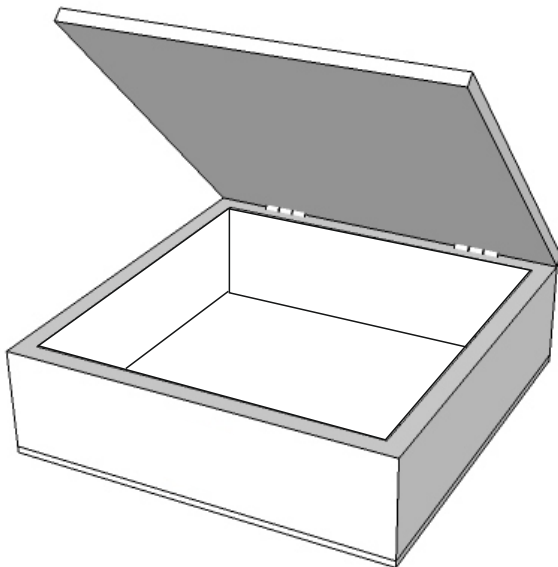
- (i) Have an ergonomically designed handle, to enable easy transport.
- (ii) They must be divided within the storage unit, to store different types of 'small' items.
- (iii) The corner joints of the storage unit, need to be upgraded so that they are strong and can withstand 'knocks'.

Use notes and/or sketches to show how the storage box could be modified to satisfy the additional specification points, listed above

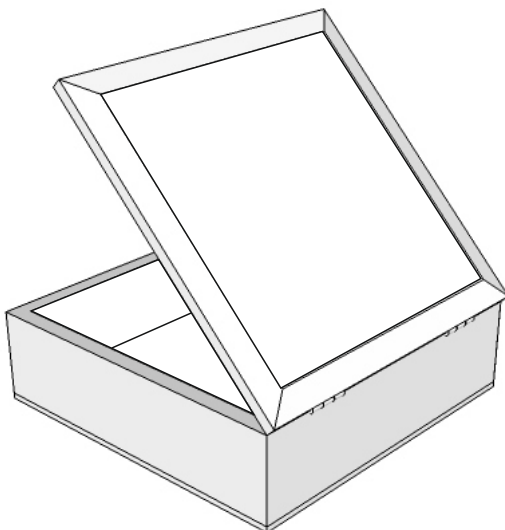
Produce clear drawings / sketches, using the outline of the original design and the space alongside, to show how the additional specification points can be met.

6 marks

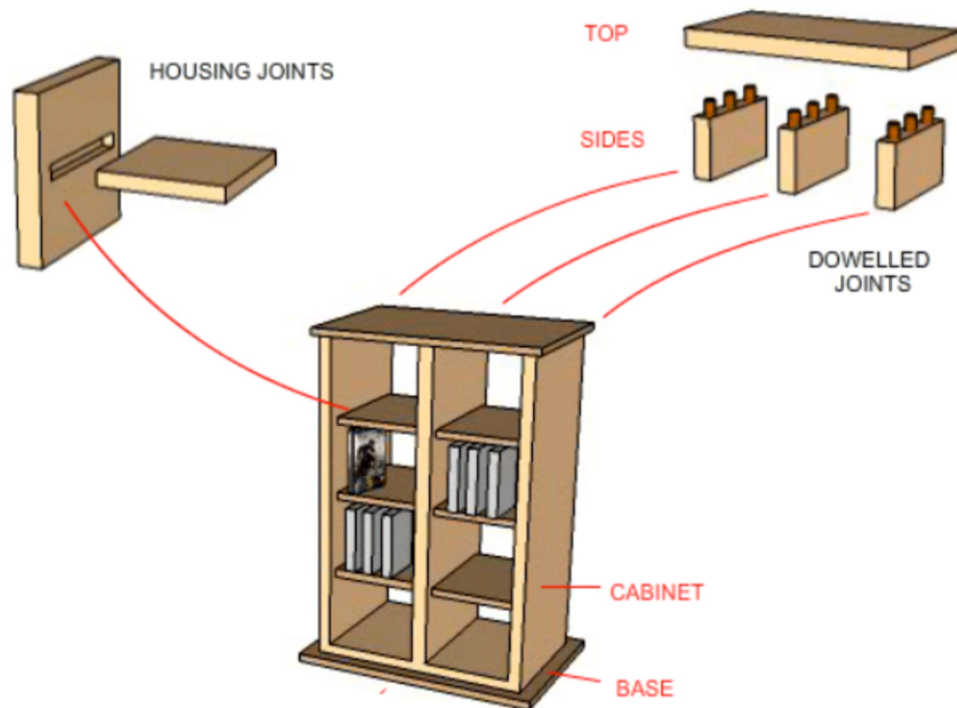
ORIGINAL DESIGN



SKETCHING AREA



5b. The DVD storage unit is manufactured from Pine or any other suitable natural wood, as requested by the customer.



(I) Explain why a plain housing joint is suitable for the DVD storage unit.
2 marks

Follow the link for information / the answer

1 mark for a basic answer

2 marks for increased detail / two reasons.

(II) Explain why dowelled joints are suitable for the top and sides.
2 marks

Follow the link for information / the answer

1 mark for a basic answer

2 marks for increased detail / two reasons.

5c. The panels / sides of the DVD storage unit are to be varnished, producing a high quality finish.

(I) Using notes and sketches, describe the stages involved in 'sanding' / 'glass papering', the surface of the 'wood' panels / sides, in preparation for varnish.

4 marks

Follow the link for information / the answer

1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

(II) How can varnish be applied to natural wood, ensuring a good finish? **2 marks**

Follow the link for information / the answer

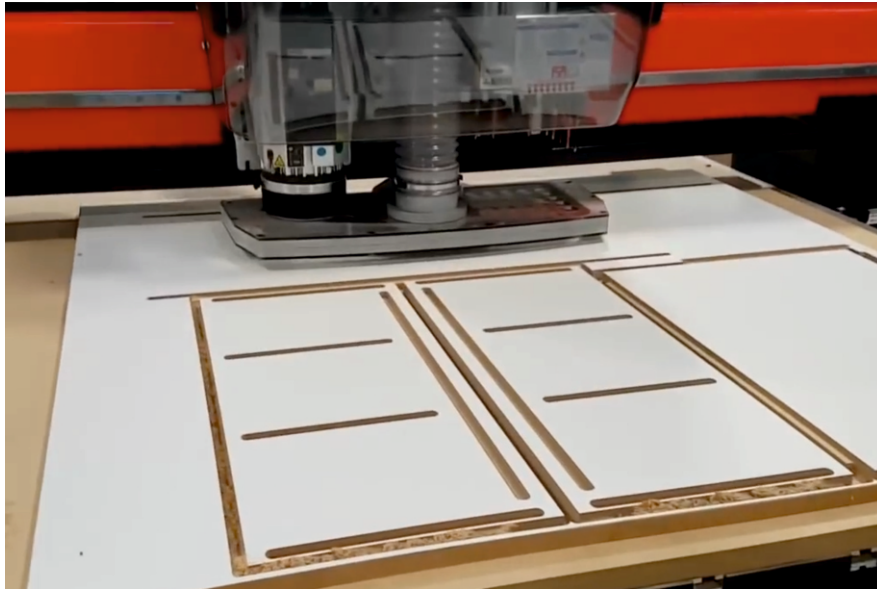
1 mark for a basic answer

2 marks for increased detail

6a. A retailer has ordered a large number of natural wood DVD storage units, manufactured by a CNC Router, as seen below.

(I) What is the meaning of CNC. **1 mark**

COMPUTER NUMERICAL CONTROL



(II) Describe 2 **advantages** of using CAM in the manufacture of large numbers of this product. **2 marks**

Follow the link for information / the answer

1 mark per advantage - maximum of two marks.

(III) Describe 3 **disadvantages** of using CAM in the manufacture of large numbers of this product. **3 marks**

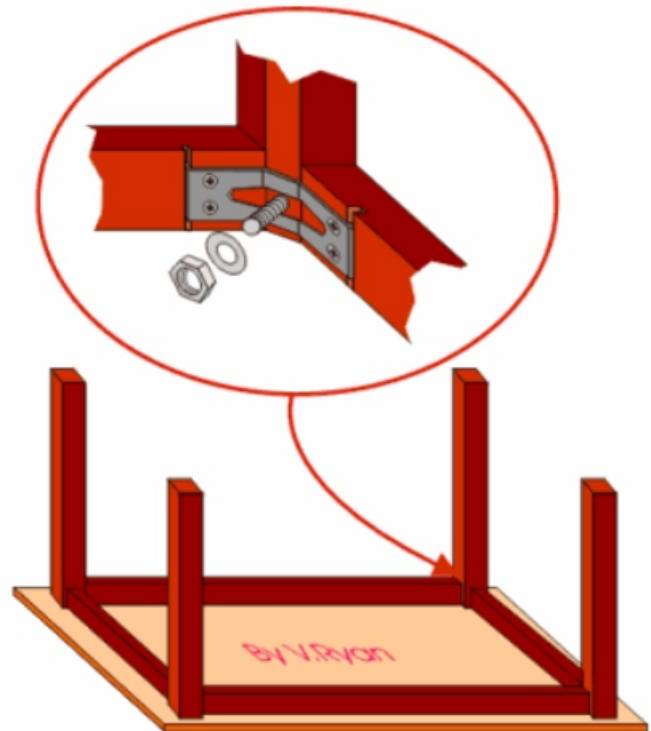
Follow the link for information / the answer

1 mark per disadvantage - maximum of three marks.

7. The table seen opposite is a piece of 'knock-down' furniture, held together by a common 'knock-down' joint.

7a. What is the name of the knock-down joint? **1 mark**

Table Plate



7b. The table is to be updated, with the joints being permanently glued together. In the space below, name and sketch a suitable joint that can replace the knock-down joint.
4 marks

Follow the link for information / the answer

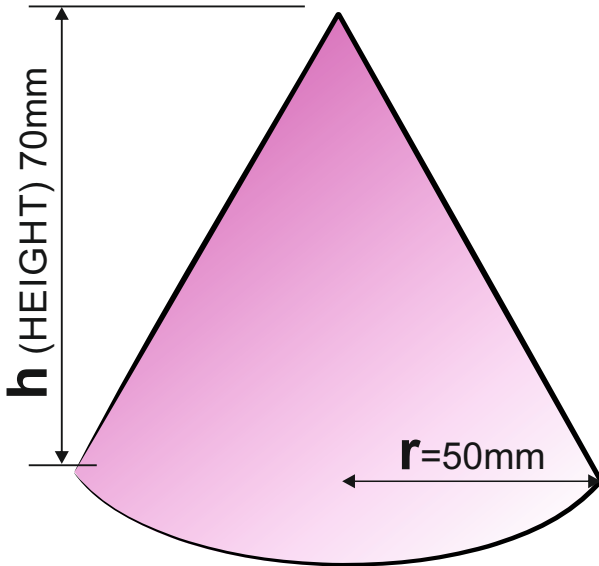
1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.

8a. The cone seen below has been turned on a woodworking lathe. Calculate the volume of the cone. **5 marks**

If the height (h) is 70mm and the radius is 50mm



FORMULA

$$v = \frac{1}{3} \pi r^2 h$$

the same as $v = \frac{\pi r^2 h}{3}$

pi (π) is 3.14

If the height (h) is 70mm and the radius is 50mm

$$v = \frac{1}{3} \pi r^2 h$$

1 mark $v = \frac{1}{3} \times 3.14 \times (50 \times 50) \times 70$

1 mark $v = \frac{1}{3} \times 3.14 \times (2500) \times 70$

1 mark $v = \frac{1}{3} \times 549500$

2 marks $v = \frac{549500}{3} = 183166.66\text{mm}^3$

9a. Explain why plywood can be described as a composite material. Include both notes and a sketch(s) in your answer **4 marks**

Follow the link for information / the answer

1 mark for a basic description OR sketch

2 marks basic description AND sketch.

3 - 4 marks for increased detail.



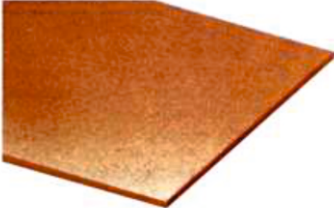
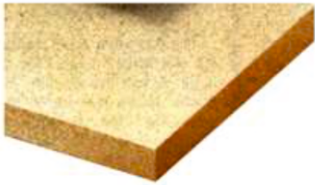
9b. What are the advantages of using plywood over other natural woods? **2 marks**

Follow the link for information / the answer

1 mark per advantage - maximum of 2 marks

10a. List one standard size of a wood based composite board: **1 mark**

10b. A number of wood based boards are listed below. Write a description of each board, alongside its name / picture. **8 marks in total**

BOARD	DESCRIPTION
<p>BLOCKBOARD</p>  <p>2 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description 2 marks for increased detail</i></p>
<p>CHIPBOARD</p>  <p>2 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description 2 marks for increased detail</i></p>
<p>HARDBOARD</p>  <p>2 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description 2 marks for increased detail</i></p>
<p>MEDIUM DENSITY FIBREBOARD (MDF)</p>  <p>2 marks</p>	<p><i>Follow the link for information / the answer</i></p> <p><i>1 mark for a basic description 2 marks for increased detail</i></p>

11a. What is a sustainable forest and why are sustainable forests important? **3 marks**

Follow the link for information / the answer

*1 mark for a basic description / explanation
2 -3 marks for increased detail.
Teacher discretion required.*

11b. The logo shown opposite is sometimes printed on timber and packaging.
Explain the meaning of this logo. **3 marks**



Follow the link for information / the answer

*1 mark for a basic description / explanation
2 -3 marks for increased detail.
Teacher discretion required.*

11c. The logo shown opposite is sometimes printed on timber and packaging.
Explain the meaning of this logo. **3 marks**



Follow the link for information / the answer

*1 mark for a basic description / explanation
2 -3 marks for increased detail.
Teacher discretion required.*

**ADD YOUR OWN TEXTILES
SPECIFIC EXAMINATION
QUESTIONS**