

# DESIGN AND TECHNOLOGY - GCSE SAMPLE PAPER 1

## Level 1/Level 2 GCSE (9–1)

Candidate Name	Centre Number					Candidate Number				

### COMPONENT 1

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**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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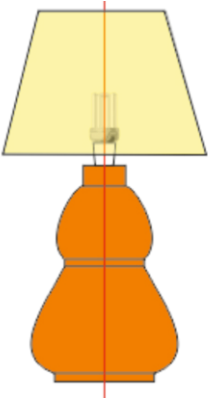
## Section A - CORE

Answer all the questions in this section

**1a.** Materials are selected for the manufacture of products, usually because they exhibit suitable properties.

Complete the table below by adding a description and explain the material's properties.

The first answer has been completed as an example of the layout of the table.

<u>PRODUCT</u>	<u>DESCRIPTION</u>	<u>PROPERTY</u>
 <p>WORLD ASSOCIATION OF TECHNOLOGY TEACHERS <a href="https://www.facebook.com/groups/254963448192823/">https://www.facebook.com/groups/254963448192823/</a> <a href="http://www.technologystudent.com">www.technologystudent.com</a> © 2018 V.Ryan © 2018</p>	PEWTER CASTING JELLEWERY	<i>Pewter can be cast by at low temperatures, forming detailed shapes.</i>
<p>HELPFUL LINK <a href="http://www.technologystudent.com/rmflsh1/pine2.html">http://www.technologystudent.com/rmflsh1/pine2.html</a></p> 	PINE WOOD - LAMP	<i>1 mark awarded for correct property</i>  <i>follow the link for potential answers</i>  <b>1 mark</b>
<p>HELPFUL LINK <a href="http://www.technologystudent.com/joints/pet1.html">http://www.technologystudent.com/joints/pet1.html</a></p> 	FOOD TRAY  POLYETHYLENE TEREPHTHALATE	<i>1 mark awarded for correct property</i>  <i>follow the link for potential answers</i>  <b>1 mark</b>

**PRODUCT**

**DESCRIPTION**

**PROPERTY**

HELPFUL LINK

<http://www.technologystudent.com/joints/nonferrous1.html>



ALUMINIUM  
DRINKS CAN

*1 mark awarded for  
correct property*

*follow the link for potential  
answers*

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**1 mark**  
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HELPFUL LINK

<http://www.technologystudent.com/despro2/prneff2.htm>



POSTER  
UV VARNISHED  
QUALITY PAPER

*1 mark awarded for  
correct property*

*follow the link for potential  
answers*

**1 mark**

HELPFUL LINK

[http://www.technologystudent.com/joints\\_flsh/nylon1.html](http://www.technologystudent.com/joints_flsh/nylon1.html)



NYLON  
WATERPROOF  
CLOTHING

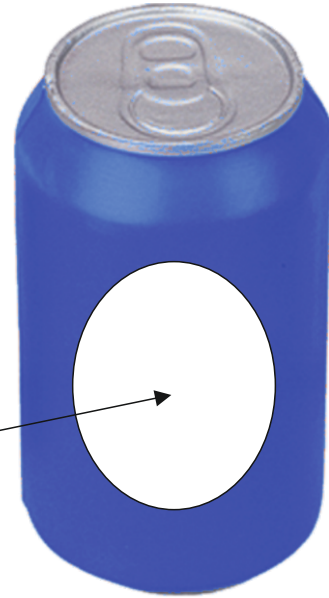
*1 mark awarded for  
correct property*

*follow the link for potential  
answers*

**1 mark**

**1b.** The manufacturer of the can, intend to use a label with thermochromic inks.

LABEL TO BE  
PLACED HERE



**(I)** How could thermochromic inks, applied to the label, improve the presentation of the can? **2 marks**

*Follow the link for potential answers*

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

**(II).** The manufacturers of the aluminium can intend to operate a close loop recycling system. What is this? **2 marks**

*Follow the link for potential answers*

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



2. The photograph shows a modernist 'plastic' chair.



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

*Follow the link for potential answers*

*1 mark for the name.*

*1 mark for at least one property*

2d. A scaled model of the chair has been manufactured and placed in a 'model' room. It stands inside the circle shown below. Calculate the area of the circle. Include your working out and formula. **3 marks**

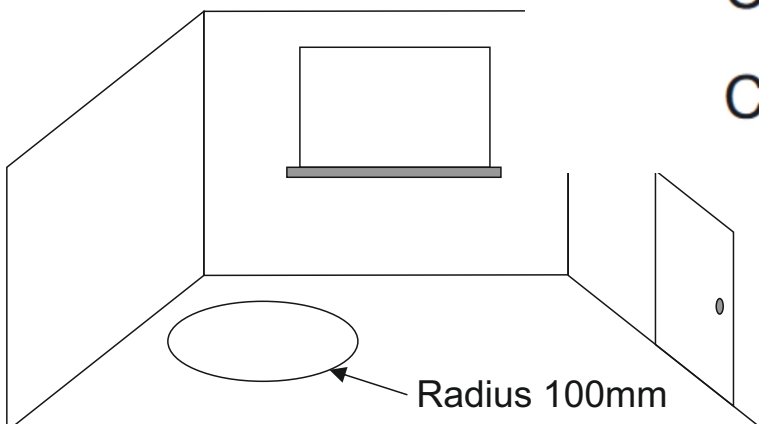
The circle has a radius of 100mm. What is the area of the circle?

$$\text{CIRCUMFERENCE} = 2 \times \pi \times r$$

$$C = 2 \times \pi \times r$$

$$C = 2 \times 3.14 \times 100$$

$$C = 628\text{mm}$$



**2c.** The modernist chair will be supplied with a textile cover manufactured from polyester. List two advantages of using polyester. **2 marks**

(i)

*1 mark per correct advantage.*

*follow the link to potential answers.*

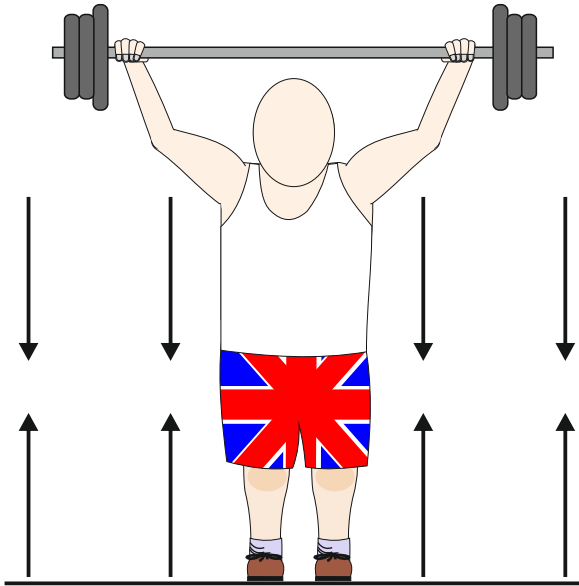
(ii)

**2d.** The chair is to be manufactured on a production line. What is a production line?  
**2 marks**

*1 mark for a basic answer  
2 marks for more detail.*

*follow the link to potential answers.*

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



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

*1 mark for compression / compressive.*

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

*1 mark for correct brief description.*

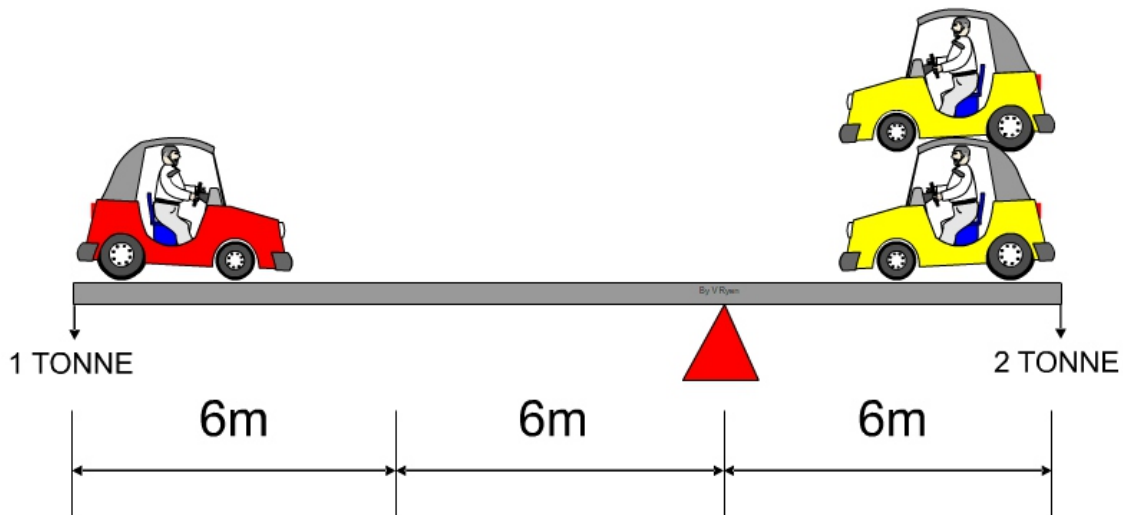
*follow the link to potential answers.*

3b. In terms of 'moments of force, what is a state of equilibrium? **2 marks**

*1 mark for a basic answer (one fact / point)  
2 marks for more detailed answer.*

*follow the link to potential answers.*

**3c.** The diagram below shows a state of equilibrium. Using the formula below, prove that a state of equilibrium exists. **3 marks**



**FORMULA:** CLOCKWISE MOMENTS = ANTI-CLOCKWISE MOMENTS

CLOCKWISE MOMENTS = ANTI-CLOCKWISE MOMENTS

$$1 \text{ TONNE} \times 12\text{m} = 2 \text{ TONNE} \times 6\text{m}$$

$$12 = 12$$

STATE OF EQUILIBRIUM

**3d.** Companies manufacturing cars often work with a system called 'Lean Manufacturing'. What is Lean Manufacturing? **4 marks**

*1 mark for a basic answer (one fact / point)*

*2 marks for two facts / points*

*3 marks for three facts / points*

*4 marks for detailed answer.*

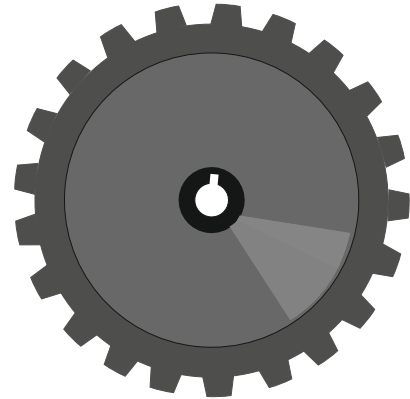
*follow the link to potential answers.*

4a. The object shown opposite is seen in many mechanical devices. What is its name?

1 mark

Gear wheel

Teacher discretion required.

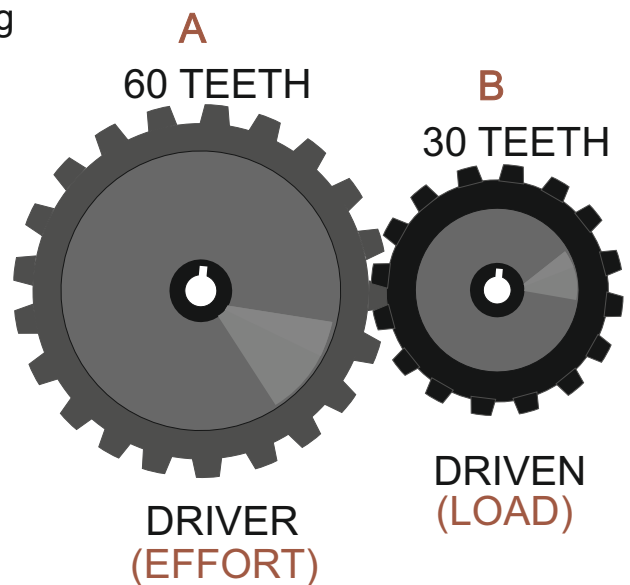


4b. Calculate the Velocity Ratio (Gear Ratio) for the spur gears seen opposite. Include your working out. 4 marks

$$\frac{\text{Distance moved by Effort}}{\text{Distance moved by Load}} = \frac{60T \text{ (GEAR A)}}{30T \text{ (GEAR B)}}$$

$$= \frac{1}{2} = \frac{\text{Input movement}}{\text{Output movement}}$$

$$= \text{Driver : Driven} = 1 : 2$$



4c. Opposite is an example of one way of illustrating a graph.

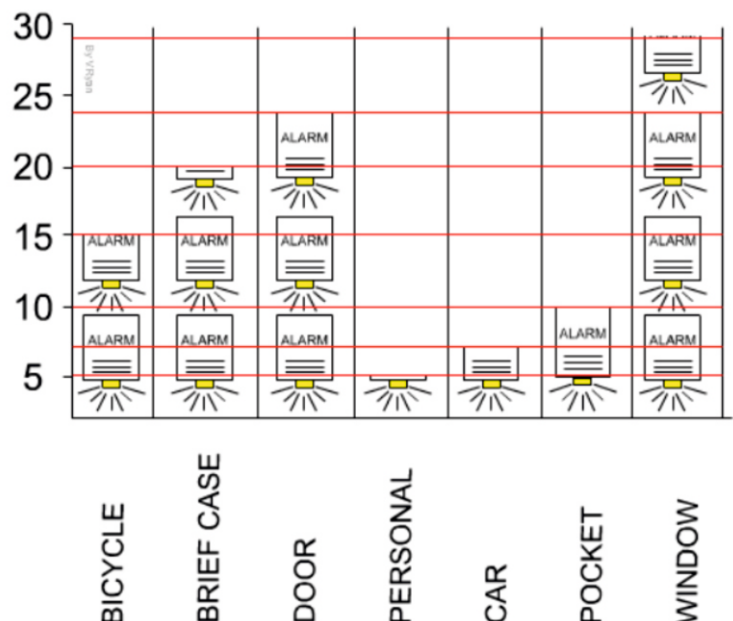
What is this style of graph called?

1 mark

Pictogram

Picture Graph

Teacher discretion required.



The question is about alternative energy.

**4d.** A local wind farm produces 4 terawatt hours of electricity over a year. At the same time, a solar farm produced 0.5 terawatt hours of electrical power. What is the ratio - Wind farm : Solar Power ? **3 marks**

The question is about alternative energy. A local wind farm produces 4 terawatt hours of electricity over a year. At the same time, a solar farm produced 0.5 terawatt hours of electrical power. What is the ratio Wind farm : Solar Power ?

$$\begin{array}{ccc} \text{WIND FARM} & : & \text{SOLAR POWER} \\ 4 & : & 0.5 \end{array}$$

To ensure that final ratio is in whole numbers, divide the wind power total by the solar power total.

$$\frac{\text{WIND FARM}}{\text{SOLAR POWER}} = \frac{4}{0.5} = 8$$

Then take the answer and place it on the wind power side of the ratio and the 1 on the solar power side.

$$\begin{array}{ccc} \text{WIND FARM} & : & \text{SOLAR POWER} \\ 8 & : & 1 \end{array}$$

**4e.** Write three advantages of using wind power to produce electricity. **3 marks**

*1 mark per advantage - max of 3 marks*

*follow the link to potential answers.*

# SECTION B – METALS

Answer ALL questions

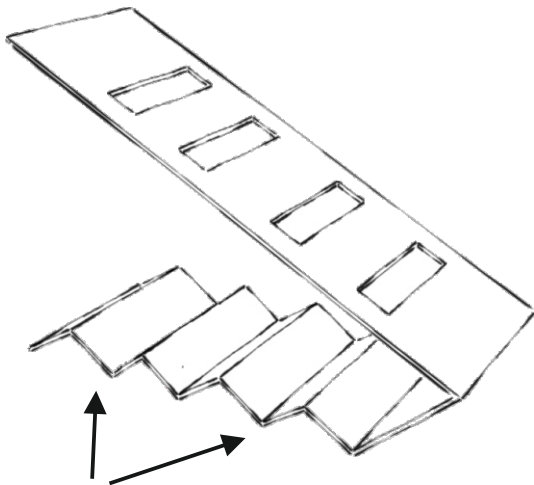
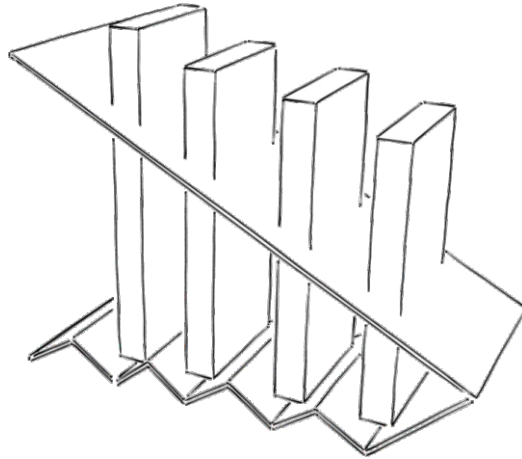
HELPFUL LINK <http://www.technologystudent.com/rmflash1/remote16.html>

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS

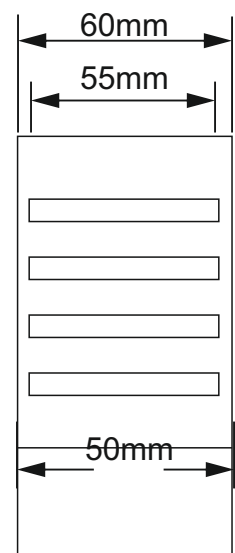
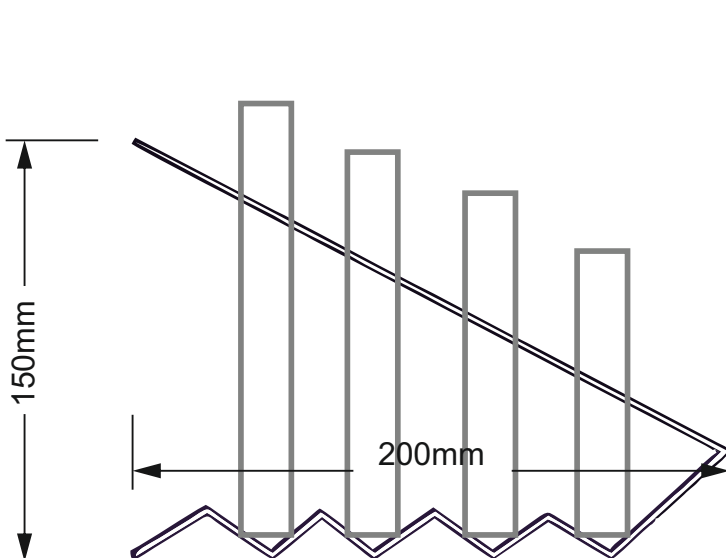
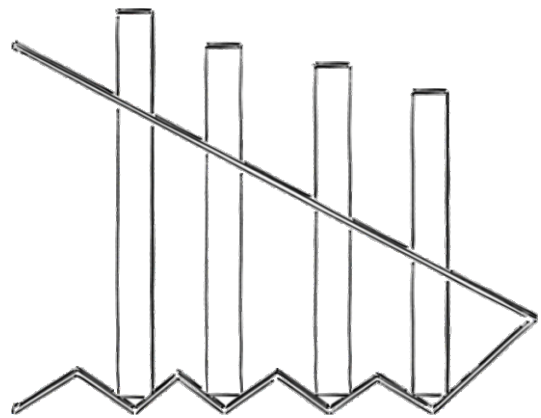
<https://www.facebook.com/groups/254963448192823/>

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5. The Illustrations show a solution for an aluminium remote control organiser.



CREASES



**5a.** The remote control organiser needs to be improved to include the following specification points.

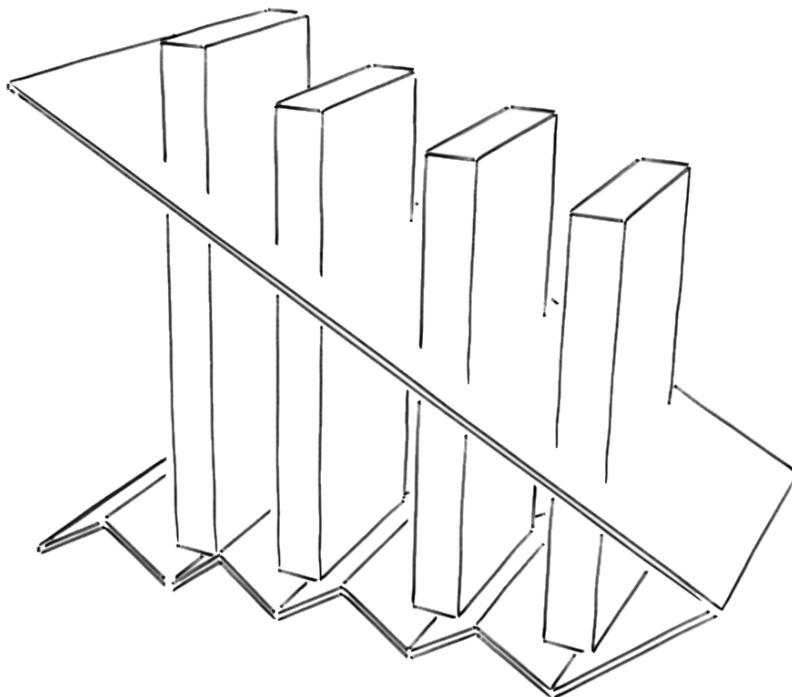
The remote controller must:

- (i) Have a base that adds stability.
- (I) Be interlockable / stackable with other units of the same design.
- (iii) The unit must be easy to pick up, with all the remotes in place.

Use notes and/or sketches to show how the remote control holder 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 a base can be added and the other specification points met.

**6 marks**



*maximum of 2 marks per per modification*

*Only 1 mark for a basic answer to each specification point*

*2 marks per specification point for detailed answer*

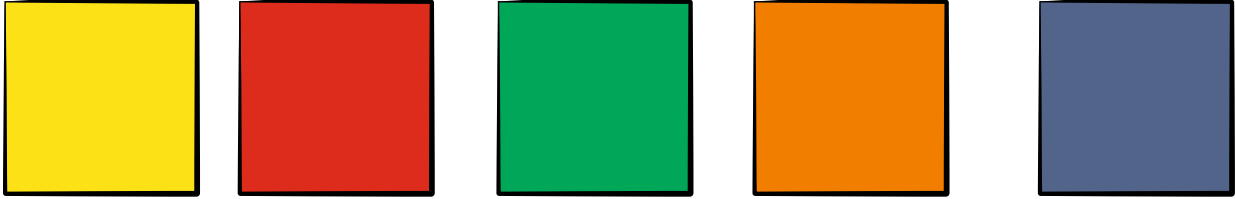
*Teacher discretion required.*

*The link at the top of the page may provide potential solutions*



5b. The aluminium remote organiser must be available in a range of durable colours as shown below. This is achieved through an anodised finish.

SAMPLE ANODISED COLOUR FINISHES



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

*1 mark for a basic answer (one fact / point)*

*2 marks for two facts / points*

*3 marks for three facts / points*

*4 marks for detailed answer.*

*follow the link to potential answers.*

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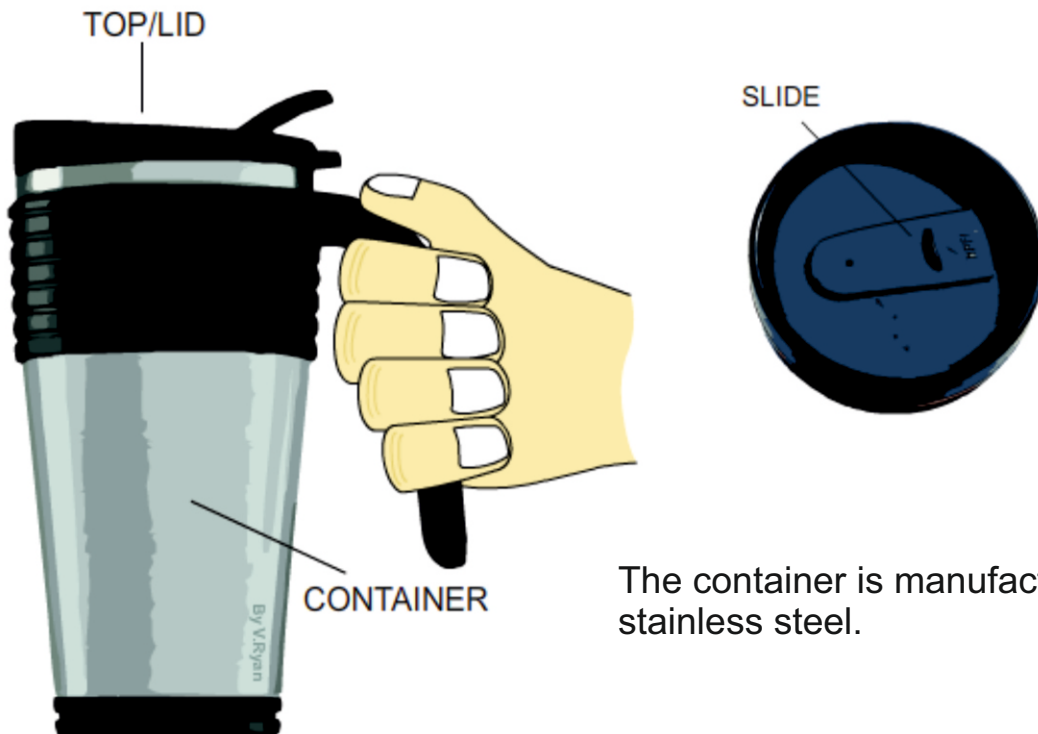
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6a. Carefully study the 'Thermo-cup'. This type of cup keeps a hot drink warm for a reasonable amount of time. The lid helps prevent spillage.



The container is manufactured from stainless steel.

Write two reasons why stainless steel is a suitable material for the container.  
**4 marks**

(I)

*1 mark per relevant / correct reason*

(II)

*1 mark per relevant / correct reason*



**6b.** The pliers seen opposite has case hardened jaws.

Use notes and/or sketches to explain/describe the process of hardening and tempering.

Use clear sketches and notes in your answer.

**4 marks**

*Up to 2 marks for the notes (1 mark for basic notes)*

*up to 2 marks for the sketch(s) (1 mark for a basic sketch)*

*follow the link to potential answers.*

*Teacher discretion required.*



**6c.** The handles / levers of the pliers have been ergonomically designed to fit the hand, using anthropometric data.

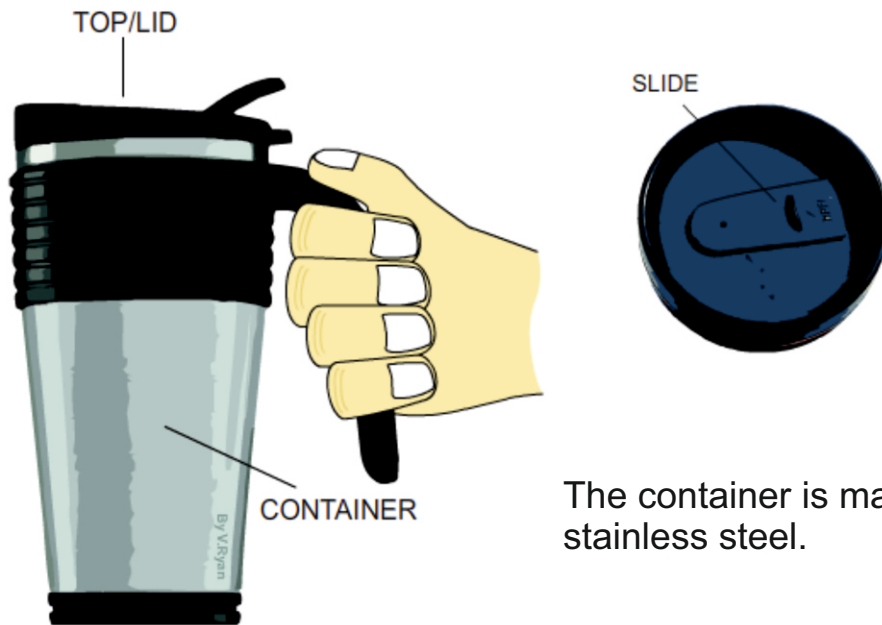
What is anthropometrics ?

**2 marks**

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

6d. The 'container' of the thermo-cup is mass manufactured from stainless steel sheet. In the space below, explain the manufacturing process. Use both notes and sketches. **6 marks**



The container is manufactured from stainless steel.

*Up to 3 marks for the notes (1 mark for basic notes)*

*up to 3 marks for the sketch(s) (1 mark for a basic sketch)*

*follow the link to potential answers.*

*Teacher discretion required.*



7. The diagram opposite shows a folding trolley. The handle can be adjusted to different heights and the steel shelf folds upright.

**7a.** Why is tube the most suitable section to be used in the manufacture of the trolley? **4 marks**

*1 mark for a basic answer (one fact / point)*

*2 marks for two facts / points*

*3 marks for three facts / points*

*4 marks for detailed answer.*

*follow the link to potential answers.*

**7b.** Why has small diameter of steel rod been used as a strengthening piece?  
**1 mark**

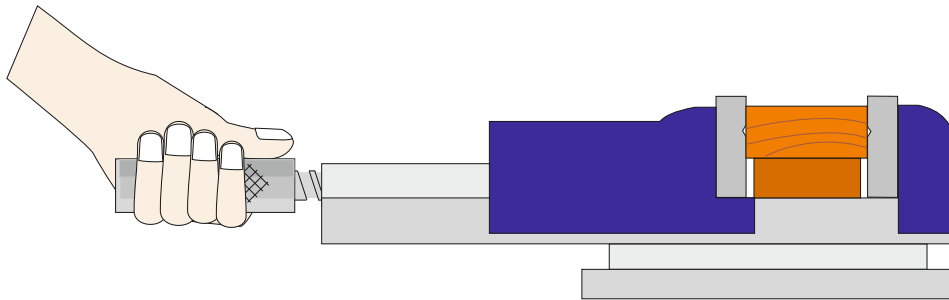
*1 mark for a relevant / correct reason.*

*follow the link for potential answers.*

**7c.** A student measures the dimensions (measurements) for the 'round section' handle of a machine vice, that he intends to manufacture. The student measures the radius of an existing handle and finds it to be 25mm.

What is the circumference of the handle? **3 marks**

What is the area of the end of the handle? **2 marks**



**FORMULA**

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

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

$$\text{AREA} = 3.14 \times (25 \times 25)$$

$$\text{AREA} = 3.14 \times (625)$$

$$\text{AREA} = 1962.5\text{mm}^2$$

**FORMULA**

$$\text{CIRCUMFERENCE} = 2 \times \pi \times r$$

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

$$C = 2 \times \pi \times r$$

$$C = 2 \times 3.14 \times 25$$

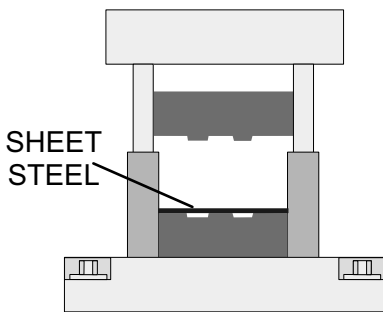
$$C = 157\text{mm}$$



An hydraulic press is used to press shapes into sheet steel and also to cut out shapes. This is how the 'shelf' has been manufactured.

**7d.** The incomplete stages, showing/describing the manufacture of the sheet steel part, are outlined below.

Complete the notes and drawings. Add all the missing parts. **2 marks per stage (6 marks in total)**

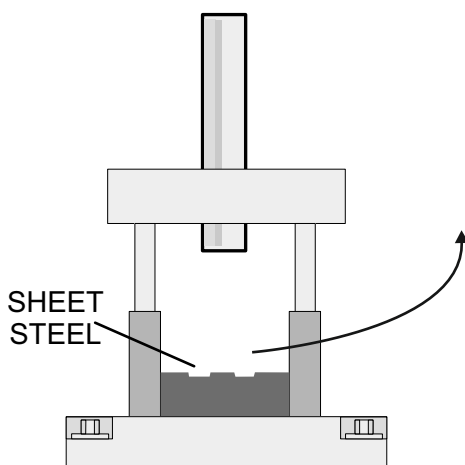
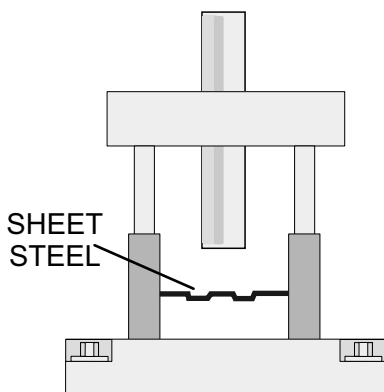


*for each stag - maximum of 2 marks*

*Only 1 mark for a basic answer  
2 marks for detailed answer*

*Teacher discretion required.*

*The link at the top of the page may provide potential solutions*





8. The table shown below, has been manufactured from gilded metal and has a lacquered finish.



**8a.** Gilded metal is metal, that has been coated with a more precious metal, such as bronze or even silver and gold. Why has clear lacquer been applied as a finish?  
**2 marks**

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

**8b.** The process called 'electroplating' has been used to applied a coating of the expensive metal to the cheaper base metal. What is electroplating? Use both notes and a sketch(s) in your answer.

**7 marks**

*Up to 3 marks for the notes (1 mark for basic notes)*

*up to 3 marks for the sketch(s) (1 mark for a basic sketch)*

*1 additional mark awarded at the discretion of the teacher.*

*follow the link to potential answers.*

**8c.** Complete the table of ferrous and non-ferrous metals by adding two examples of each. **4 marks**

**FERROUS METALS - *Metals that contain iron.***

**NON-FERROUS METALS - *Metals that do not contain iron.***

<b>FERROUS METALS</b>	<i>1 mark per relevant / correct reason.</i>
<b>NON-FERROUS METALS</b>	<i>follow the link for potential answers.</i>

HELPFUL LINKS <http://www.technologystudent.com/joints/ferous1.html>  
<http://www.technologystudent.com/joints/fermetal1.html>  
<http://www.technologystudent.com/joints/nonferrous1.html>

**8d.** Either a FERROUS or NON-FERROUS metal from your completed table. Describe a suitable practical application for your chosen metal and explain why each is suitable. **Total of 5 marks**

**METAL:** \_\_\_\_\_

**PRACTICAL APPLICATION:** *1 mark for a relevant / correct application*  
*(1 mark)*

*follow the link for potential answers.*

**WHY SUITABLE:**  
*(4marks)*

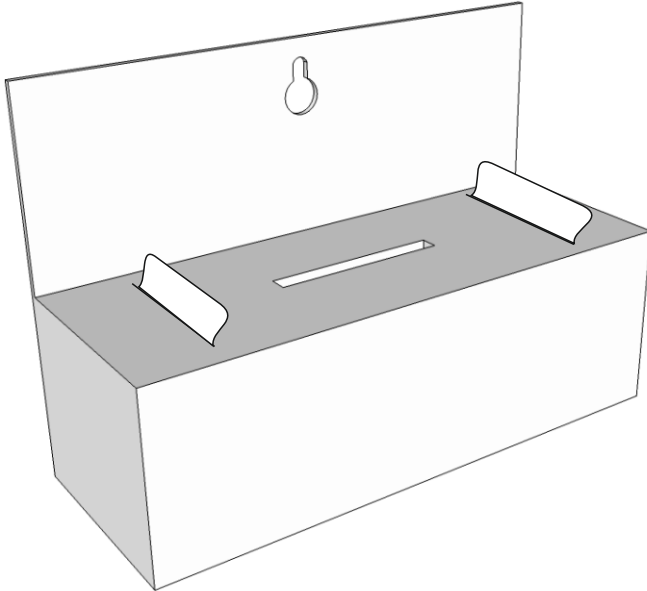
*1 mark for each relevant / correct suitability.*

*follow the link for potential answers.*

# SECTION B – PAPER AND BOARDS

Answer ALL questions

5. A design solution for a Charity Collection Box, for a charity called 'Be Active' is shown below. The charity aims to promote active life styles to all age groups.



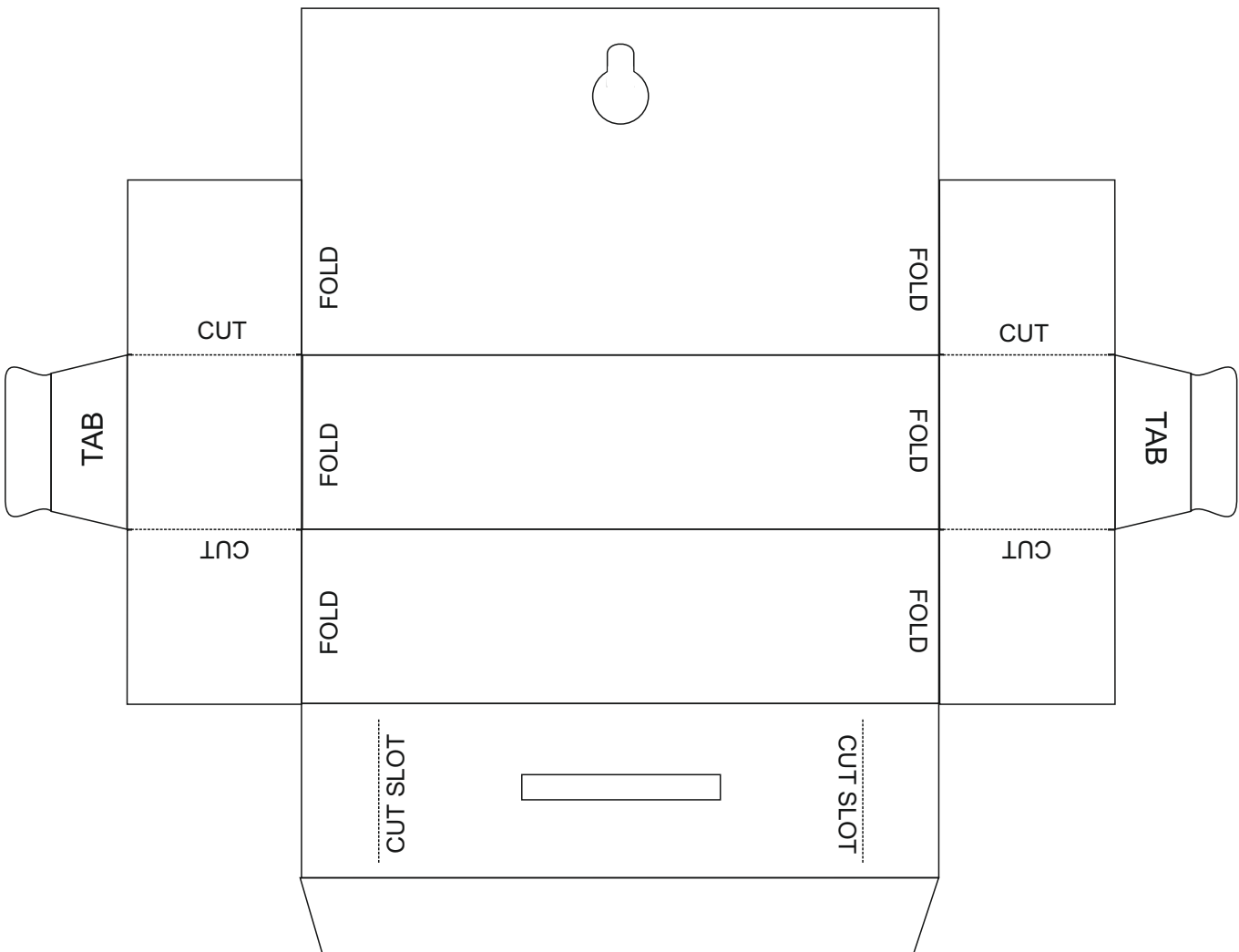
100 % recyclable

Lightweight

Environmentally friendly material.

Materials supplied from a certified sustainable source.

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



**5a.** The charity collection box for the charity 'Be Active', needs to be improved to include the following specification points.

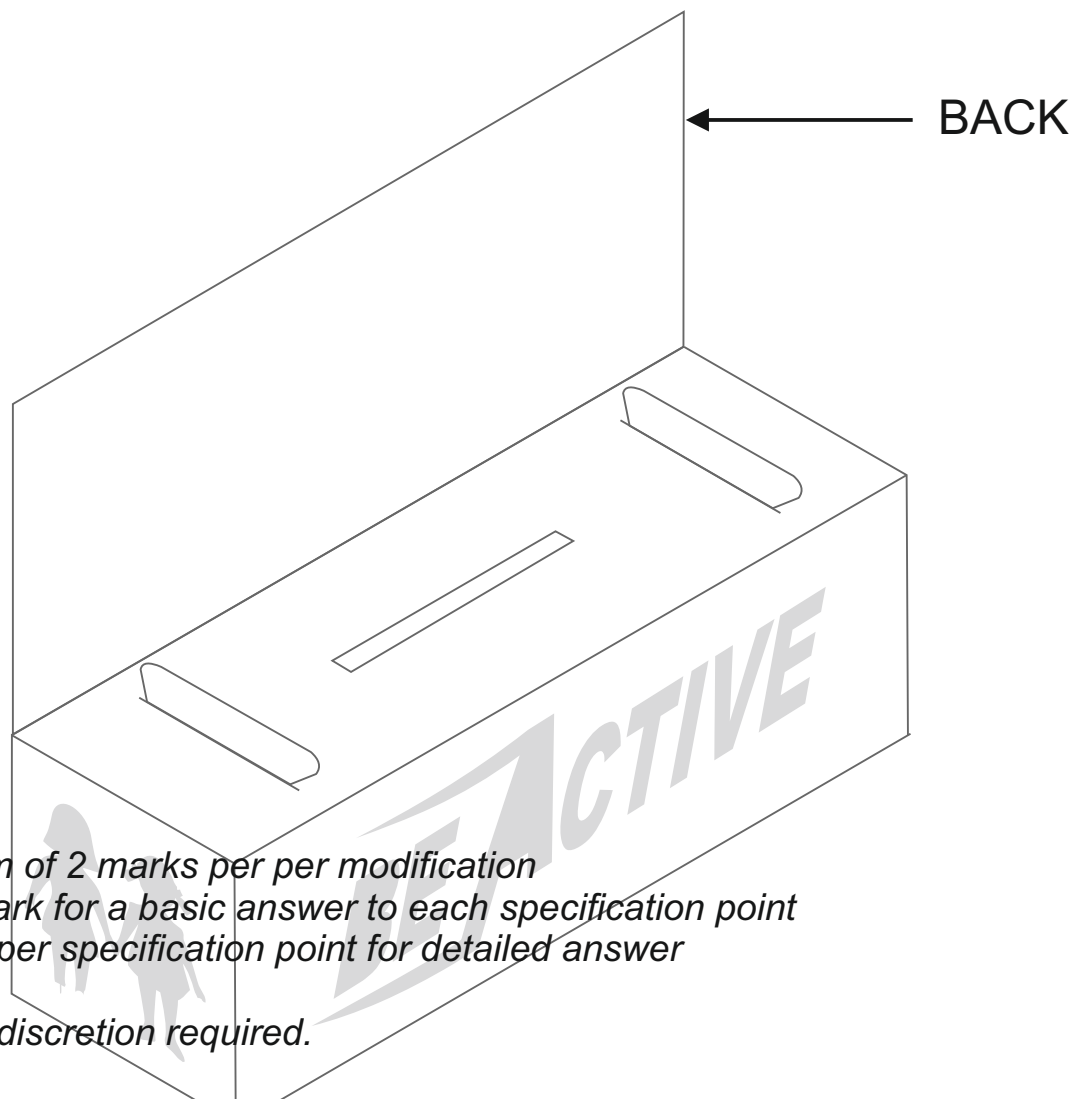
The charity collection box must:

- (i) Have an appealing logo applied to the back, that reflects 'be active'.
- (ii) Appeal to all age groups.
- (iii) The unit must be easy to pick up and must have a simple handle.

Use notes and/or sketches to show how the collection box 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**

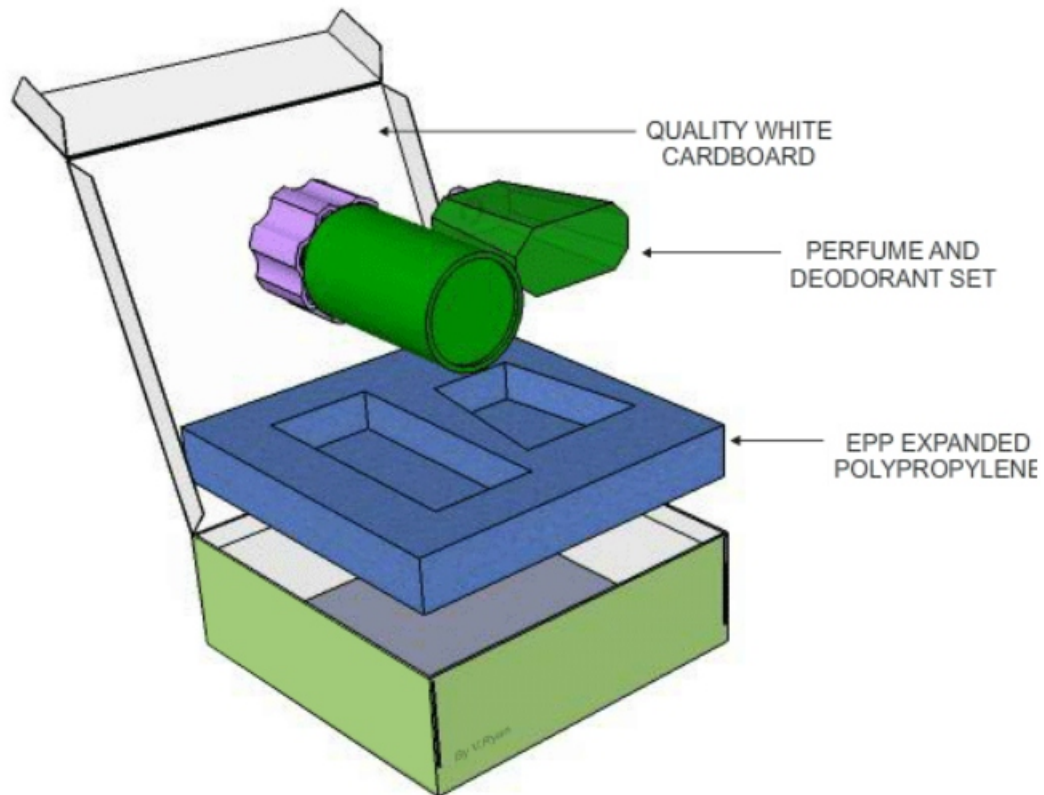


*maximum of 2 marks per per modification  
Only 1 mark for a basic answer to each specification point  
2 marks per specification point for detailed answer*

*Teacher discretion required.*

*The link at the top of the page may provide potential solutions*

5b. The drawing below shows the packaging for perfumed products.



Explain why the materials identified on the diagram, are suitable for the packaging.  
**4 marks**

MATERIAL: *Material must be identified for any marks*

EXPLANATION:

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

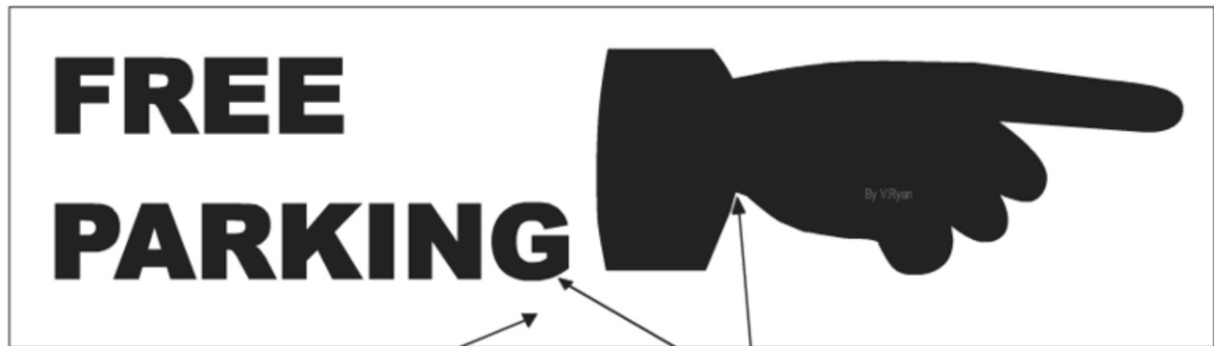
MATERIAL: *Material must be identified for any marks*

EXPLANATION:

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

6a. The free car park sign has been produced by the Design and Technology Department of a school, for an Open Evening.



QUALITY CARD

BLACK SELF ADHESIVE VINYL LETTERING

Explain why a vinyl cutter is the most appropriate way of cutting the 'vinyl lettering'.  
**2 marks**

*1 mark per relevant / correct reason.*

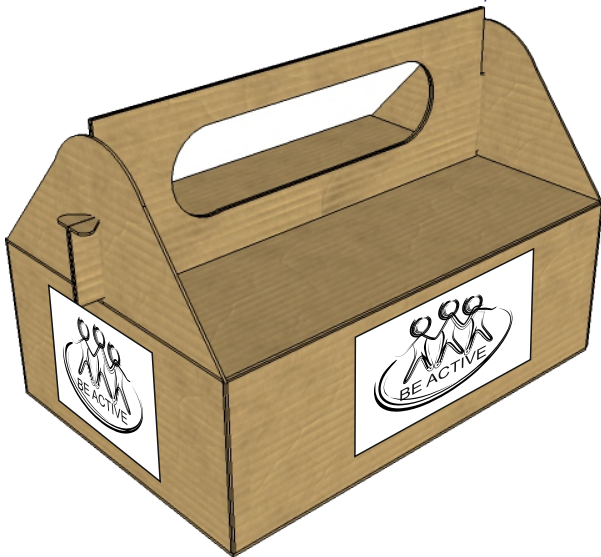
*follow the link for potential answers.*

6b. Drinks cartons such as those manufactured by Tetra Pak, are manufactured from laminated card. Why is this? **2 marks**



*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

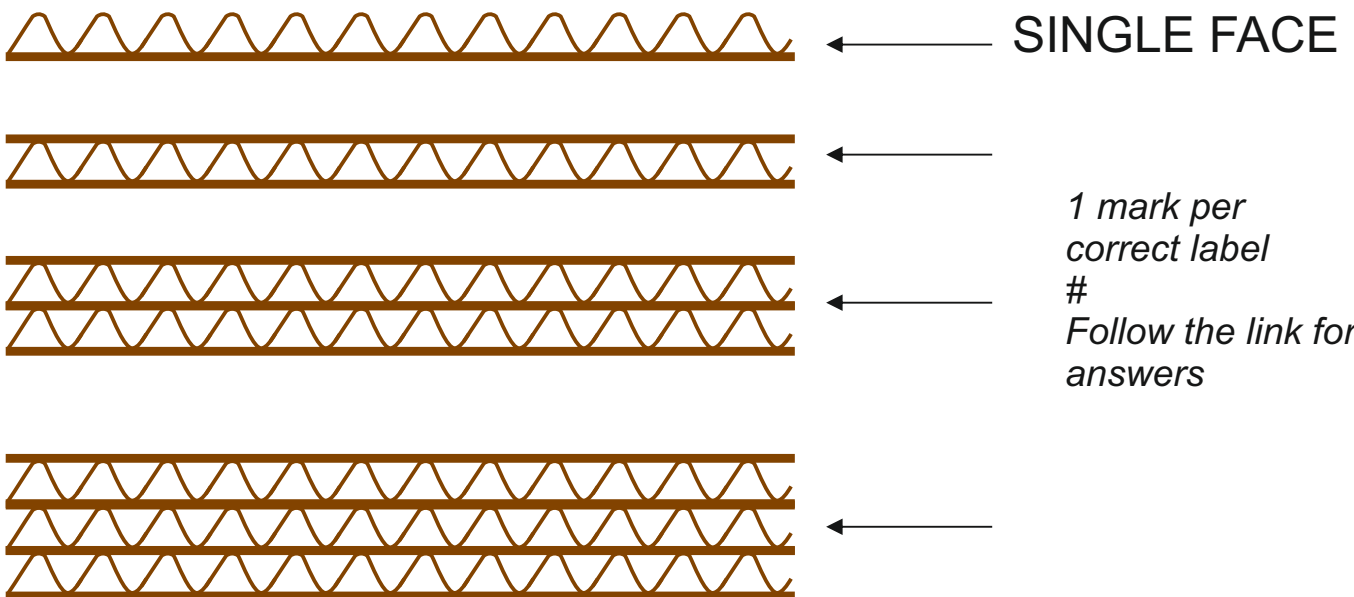


**6c.** The corrugated card charity collection box shown opposite, is manufactured from recycled card, processed into Corrugated card.

Corrugated board is supplied in different thicknesses.

On the diagram below, 4 thicknesses of corrugated card are shown. One has been labelled for you.

Add labels to the other three thicknesses.  
**3 marks**



**6d.** Corrugated board can be recycled. In the space opposite, draw / sketch the recycling symbol that applies to corrugated board.

**1 mark**

*1 mark awarded for the correct answer.*

*Follow the link for the answer.*



**6e.** The graphics / colour and decoration is to be added to the packaging for perfumed products (question 5b). In the space below, name a suitable printing process, draw a labelled diagram to represent the process and add notes that explain the process.

**Total of 8 marks**

PROCESS NAME: *1 mark for a correct process*  
**(1 mark)**

LABELLED DIAGRAM

**(4 marks)**

*1 mark for a sketch without labels*

*Up to 2 marks for the notes (1 mark for basic sketch and labels)*

*up to 3 marks for more detail.*

*4 marks for detailed sketch and detailed labels*

*follow the link to potential answers.*

*Teacher discretion required.*

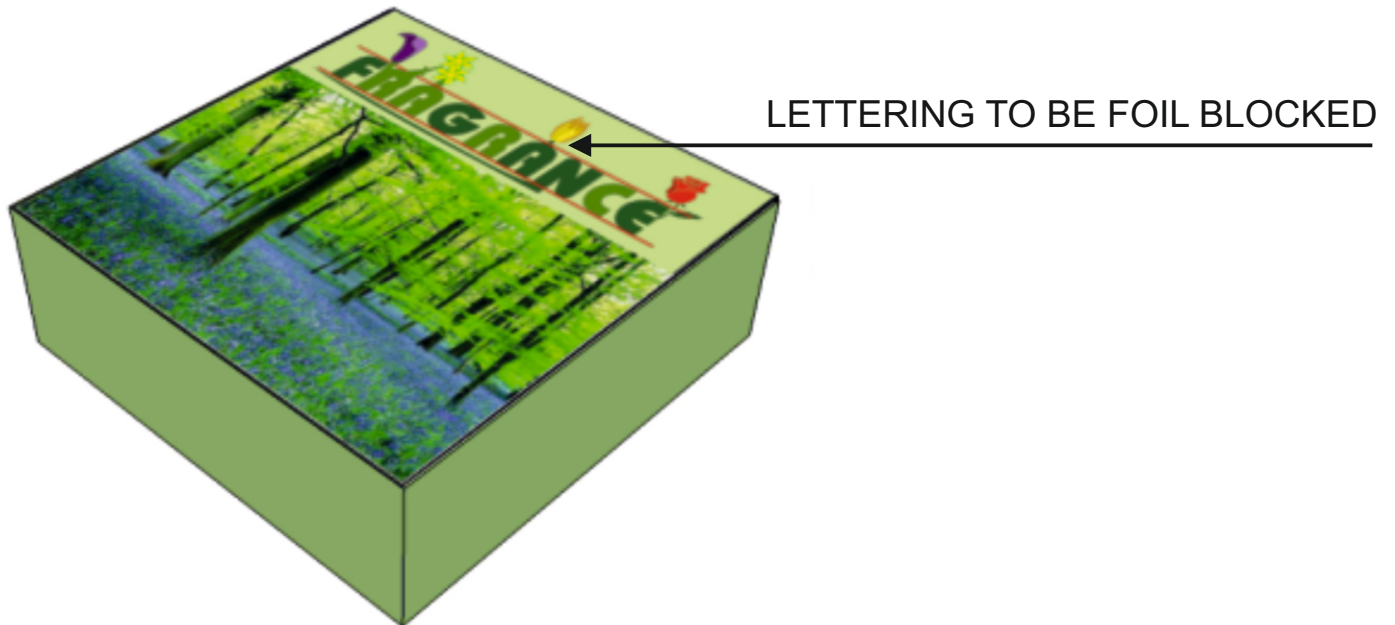
**NOTES: (3 marks)**

*1 mark per relevant / correct fact.*

*follow the link for potential answers.*

**6f.** The design team working on the packaging for a perfumed product, have decided to add the name of the product (in gold / silver lettering) through 'Foil Blocking'. In the space below, explain the foil blocking process. Use notes and sketches in your answer.

**Total of 5 marks**



**LABELLED SKETCH ( 3 marks)**

1 mark for any correct sketch without labels

2 marks for basic sketch with labels

3 marks for detailed sketch and labels

follow the link for potential answer

**NOTES (2 marks):**

1 mark for a basic explanation

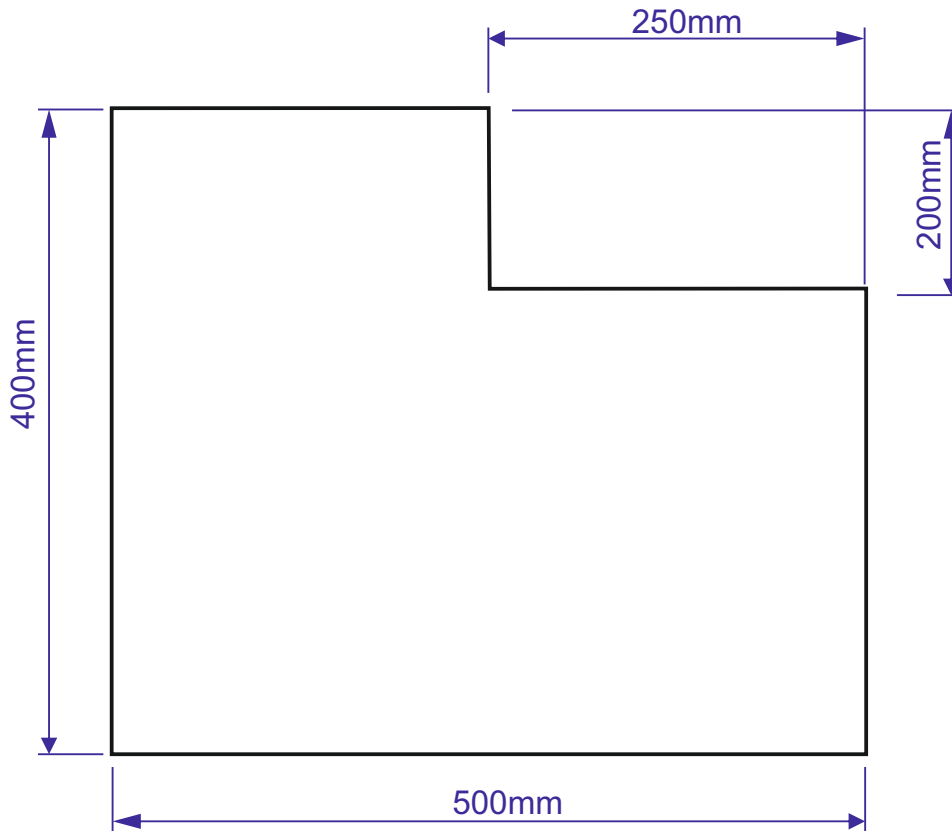
2 marks for more detail

follow the link for a potential answer.

A new lid has been designed for the packaging (see below). The packaging has been redesigned to suit this shape.

**7a.** Calculate the area of the material required for the lid, before it is cut to shape (the overall rectangle of material required, before it is cut to an L shape). **2 marks**

**7b.** Calculate the area of the final L shaped lid. **3 marks**



First, calculate the area of the uncut acrylic, by treating it as a rectangle 500mm x 400mm.

$$\begin{aligned} \text{AREA} &= \text{LENGTH} \times \text{HEIGHT} \\ \text{AREA} &= 500 \times 400 \\ \text{AREA} &= 200000\text{mm}^2 \end{aligned}$$

Now, calculate the area of the smaller rectangular piece to be cut away, during the shaping of the panel

$$\begin{aligned} \text{AREA} &= \text{LENGTH} \times \text{HEIGHT} \\ \text{AREA} &= 250 \times 200 \\ \text{AREA} &= 50000\text{mm}^2 \end{aligned}$$

Now subtract the smaller area from the area of the uncut plywood.

$$200000 - 50000 = 150000$$

**AREA OF FINAL SHAPED PIECE IS 150000mm<sup>2</sup>**

HELPFUL LINKS

<http://www.technologystudent.com/prddes1/susenv1.html>

<http://www.technologystudent.com/joints/sustain1.html>

**8a.** Manufacturers of the packaging are encouraged to source their materials from sustainable forests.

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

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

HELPFUL LINK

<http://www.technologystudent.com/joints/sustain1.html>

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

Explain the meaning of this logo. **3 marks**

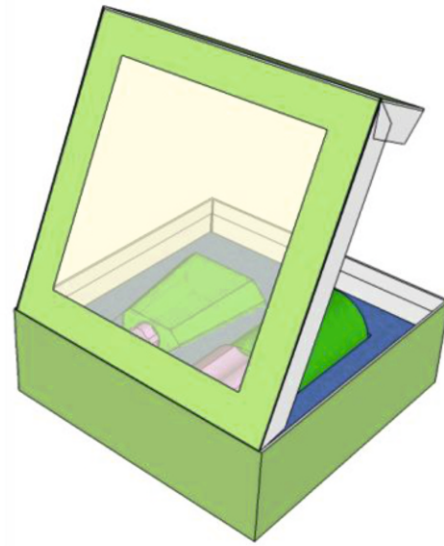
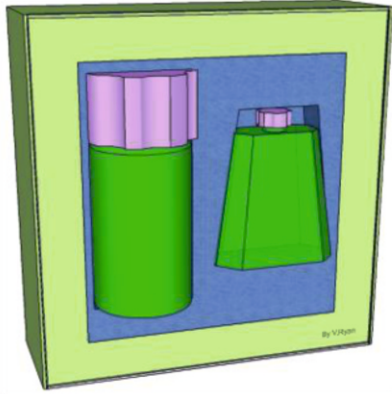


*1 mark per relevant / correct fact.*

*follow the link for potential answers.*

**8c.** A clear window has been added to the packaging for a perfumed product.

List one advantage of adding a window and one disadvantage. **2 marks**



ADVANTAGE:

*1 mark per correct advantage / disadvantage*

*follow the link for potential answers.*

DISADVANTAGE:

**8d.** The clear window is manufactured from BIOPOL. Describe / explain three reasons why this material is a good choice. **3 marks**

*1 mark per relevant / correct reason.*

*follow the link for potential answers.*

**8e.** In the space below, sketch a labelled diagram that represents the life cycle of Biopol.

**4 marks**

*Only 1 mark for a correct sketch without labels*

*2 marks for an adequate sketch and labels*

*up to 3 marks for the sketch more detail sketch and labels*

*4 marks for a detailed sketch and labels*

*follow the link to potential answers.*

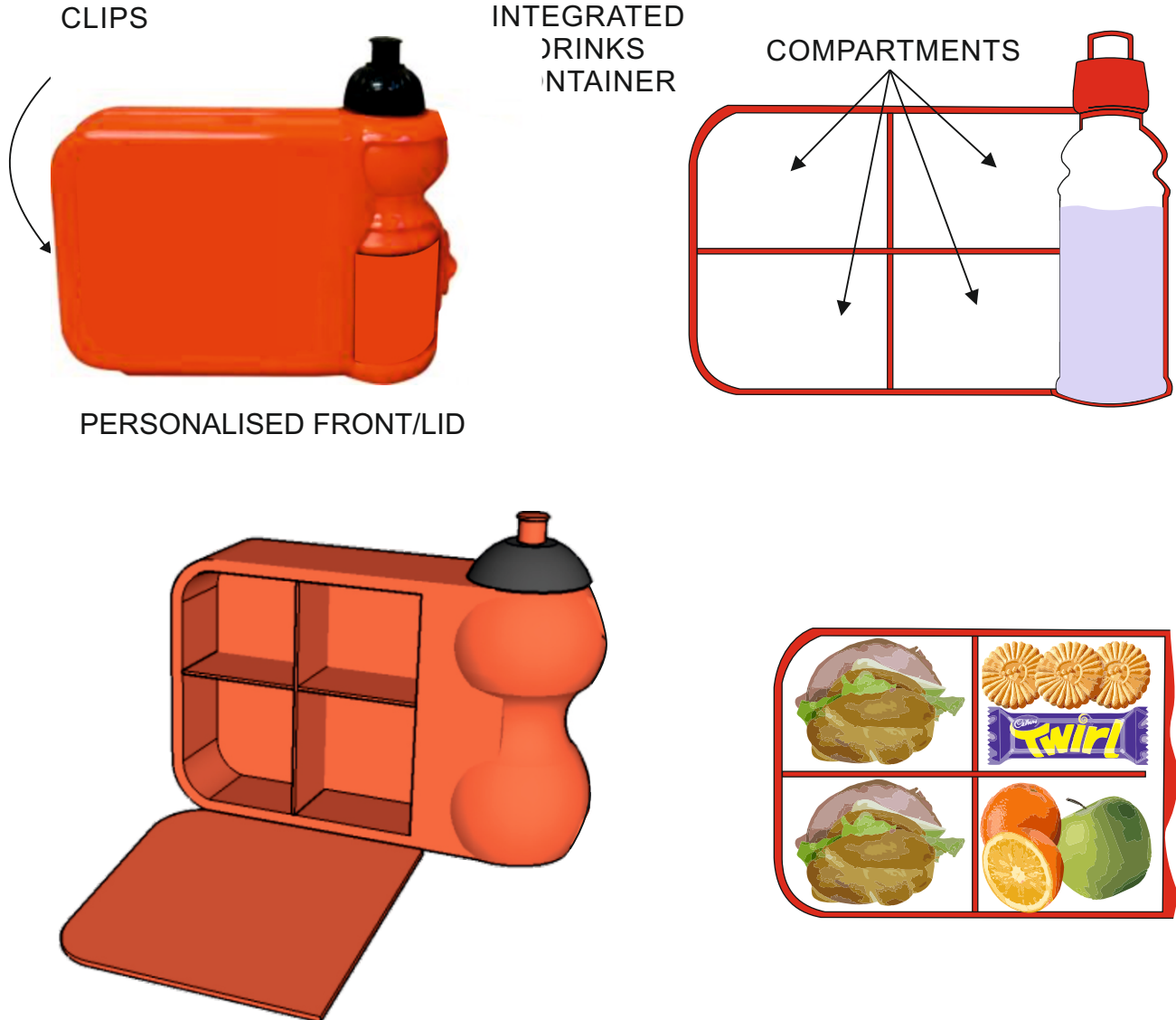
**9a.** Packaging has a variety of functions. Complete the table below by stating a function, followed by an explanation. The first row has been completed for you.  
**Total of 9 marks**

<b>FUNCTION</b>	<b>EXPLANATION</b>
<p><i>To protect a product from damage or contamination by micro-organisms and air, moisture and toxins.</i></p>	<p><i>Protected against being dropped, crushed, and the vibration it suffers during transport. Delicate products such as fruits need to be protected by a rigid package such as a laminated container.</i></p> <p><i>It must also be protected against micro-organisms, chemicals, soil and insects.</i></p>
<p><i>1 mark for a correct function</i></p> <p><b>1 mark</b></p>	<p><i>1 mark for each correct explanation.</i></p> <p><i>maximum of 2 marks</i></p> <p><b>2 marks</b></p>
<p><i>1 mark for a correct function</i></p> <p><b>1 mark</b></p>	<p><i>1 mark for each correct explanation.</i></p> <p><i>maximum of 2 marks</i></p> <p><b>2 marks</b></p>
<p><i>1 mark for a correct function</i></p> <p><b>1 mark</b></p>	<p><i>1 mark for each correct explanation.</i></p> <p><i>maximum of 2 marks</i></p> <p><b>2 marks</b></p>

# SECTION B – POLYMERS

Answer ALL questions

## TYPICAL FOOD CARRIER



Manufactured from a food safe material. Free from chemicals such as BPA, PVC and Phthalates.

Clips hold the lid tightly shut and contents sealed in. Secure food storage.

Drop resistant, relatively unbreakable.

Integrated drinks container

Separate food compartments.

Personalised photographic lid, simple logo/symbol.

Recycling and Healthy Eating symbols.



## HELPFUL LINKS

[http://www.technologystudent.com/prddes\\_2/carrier14.html](http://www.technologystudent.com/prddes_2/carrier14.html)

[http://www.technologystudent.com/prddes\\_2/carrier6.html](http://www.technologystudent.com/prddes_2/carrier6.html)

[http://www.technologystudent.com/prddes\\_2/carrier1.html](http://www.technologystudent.com/prddes_2/carrier1.html)

**5a.** The Food Carrier, needs to be improved to include the following specification points.

The food carrier must:

(i) Have an ergonomically designed handle.

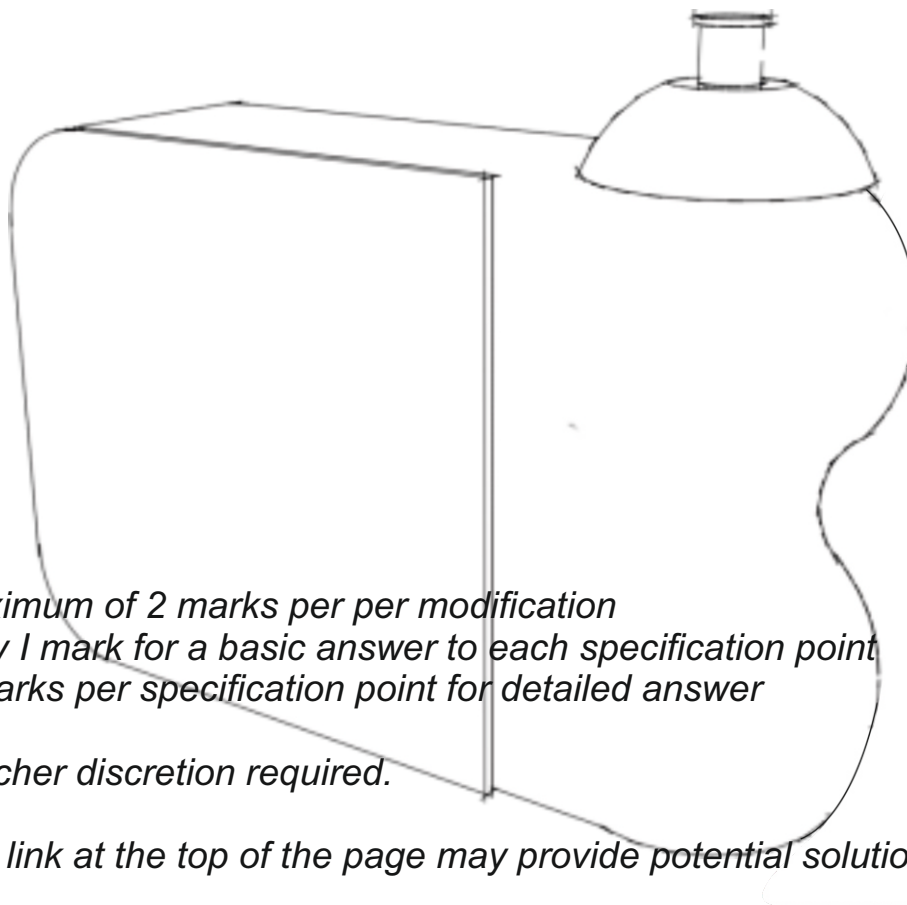
(ii) Have an area that includes a logo, representing healthy eating.

(iii) The drinks container must be detachable, so that it can be used separately.

Use notes and/or sketches to show how the food carrier 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**



*maximum of 2 marks per per modification*

*Only 1 mark for a basic answer to each specification point*

*2 marks per specification point for detailed answer*

*Teacher discretion required.*

*The link at the top of the page may provide potential solutions*

**5b.** Name a suitable material for the manufacture of the food carrier.  
**1 mark**

*1 mark for a suitable material. Follow link for potential answer*

**5c.** The food carrier is manufactured through a process called Blow Moulding. Describe blow moulding. **3 marks**

*1 mark for a basic statement.  
2 marks for reasonable detail  
3 marks for detailed answer.*

*follow the link for potential answer.*

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

*Only 1 mark for a diagram without labels*

*2-3 marks for a diagram/sketch and labels*

*4 marks for detailed sketch / diagram and labels.*

*follow the link to potential answers.*

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

*1 mark per relevant / correct justification.*

*follow the link for potential answers.*

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

NAME:

*1 mark for a suitable material (polymer)  
Teacher discretion required.*

WHY SUITABLE:

*1 mark for a correct justification*

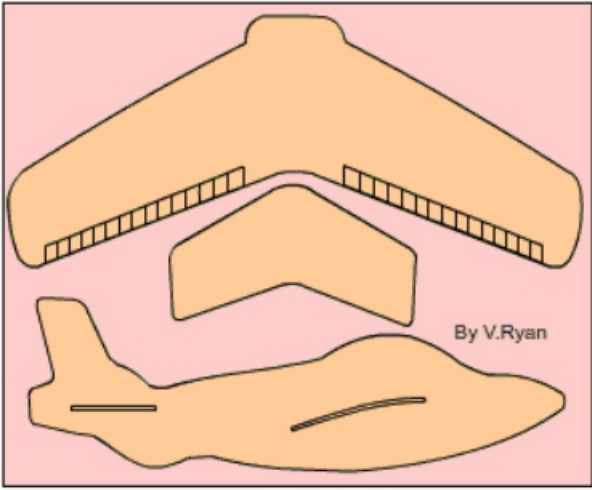
**5g.** in the space opposite, sketch the recycling symbol for material you named in question 5b. **2 marks**

1 mark for a basic but recognisable symbol  
2 marks for a higher level of detail

Follow the link for the answer



**6a.** The lunch carrier has proved popular with young children, because it comes with the free gift of a model glider. The parts of the glider push out of a polystyrene sheet and fit together.



Name and describe the industrial process that is capable of producing the free gift. You must include notes and a sketch(s) in your answer. **6 marks**

PROCESS NAME: Die cutting / die cutter

(1 Mark)

SKETCH

- 1 mark for a accurate sketch without notes
- 1 mark for a basic description without a sketch
- 2-3 for increased detail (notes and sketch)
- 4-5 for very good detail (notes and sketch)

Teacher discretion required.

Follow the link for a potential answer.

NOTES ( Marks) :

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7a. The products seen below are manufactured from oxo-degradable polymers

VENDING MACHINE  
CUPS



PLASTIC GLOVES



LEVER ARCH  
FOLDERS



CARRIER BAG



(i) What are Oxo-degradable Polymers? **1 mark**

1 mark awarded for an accurate, brief description.  
Follow the link for a potential answer.

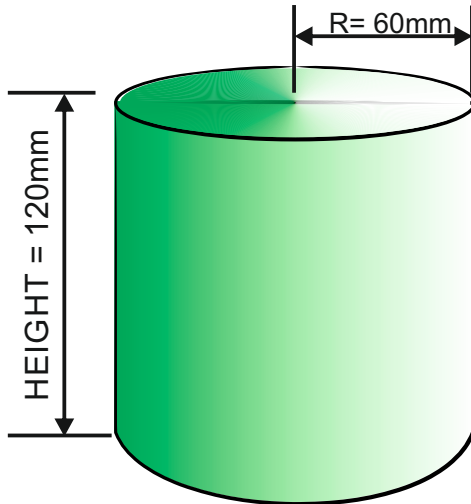
(ii) Although oxo-degradable polymers decay over several months, when buried in soil, they are derived from crude oil. What is it that allows them to decay?  
**2 marks**

*1 mark awarded for simple explanation  
2 marks for increased detail.  
Follow the link for a potential answer.*

(iii) Describe two products that are often manufactured from oxo-degradable polymers.  
**2 marks**

*1 mark awarded for 1 correct identification of a product  
2 marks for 2 products.  
Follow the link for a potential answer.*

8a. An engineering company has manufactured a 'plastic / polymer' cylinder. This is for a company that will machine the part for the automotive industry.



What is the volume of the cylinder?

**5 marks**

**FORMULA**

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

$$\text{volume} = \pi \times \text{radius}^2 \times \text{height}$$

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

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

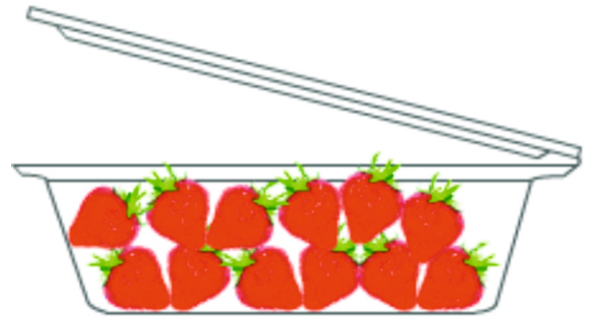
$$\text{volume} = 3.14 \times 60\text{mm} \times 60\text{mm} \times 120\text{mm}$$

$$\text{volume} = 1356480\text{mm}^3$$

or

$$\text{volume} = 1356.480\text{cm}^3$$

**9a.** The food container seen opposite, is manufactured from polyethylene terephthalate, pet, pete, (polyester).



Write two reasons why this material is suitable for the food container.

**Total of 4 marks**

**(i)**

*1 mark per correct reason.*

*follow the link for potential reasons.*

**(ii)**

**(iii)** List two other products that are manufactured from polyethylene terephthalate.

**2 marks**

*1 mark per correctly identified product.*

*Follow the link for potential answers.*

**(iv)** Name and describe the process used to manufacture the food container. **2 marks**

*For any marks the process must be named.*

*An additional mark for a basic description.*

*Follow the link to potential answers.*

HELPFUL LINK <http://www.technologystudent.com/joints/petevac1.html>

**9b.** Produce a labelled sketch(s) that represents the manufacturing process you named and describe in the previous question (5k (iv)) **3 marks**

*1 mark for a suitable sketch without labels*

*2-3 marks for a sketch and labels, depending on the detail.*

*Follow the link to potential answers.*

HELPFUL LINK <http://www.technologystudent.com/prddes1/quality1.html>

**9c.** The food container undergoes Quality Control and Quality Assurance during the manufacturing process. What is the difference between Quality Control and Quality Assurance? **4marks**

*1 mark for a basic answer*

*2 marks for detailed answer*

*3-4 marks for further detail*

**NO MARKS FOR A DESCRIPTION OF EITHER QUALITY CONTROL AND / OR QUALITY ASSURANCE.**

*Teacher discretion required*

*Follow the link to a potential answer.*



HELPFUL LINKS

[http://www.technologystudent.com/joints\\_flsh/oxodegrad1.html](http://www.technologystudent.com/joints_flsh/oxodegrad1.html)

<http://www.technologystudent.com/joints/pla1.html>

<http://www.technologystudent.com/prddes1/closetloop1.html>

<http://www.technologystudent.com/prddes1/closetloop2.html>

[http://www.technologystudent.com/despro\\_flsh/morals2.pdf](http://www.technologystudent.com/despro_flsh/morals2.pdf)

Page 5 onwards

**10.** Describe how 'polymers' can significantly contribute to the sustainability of our use of materials. **9 marks**

*1 mark per fact / correct statement up to a maximum of 9 marks*

*Bio plastics, oxo-degradable, recycling, closed loop recycling.*

*Teacher discretion required.*

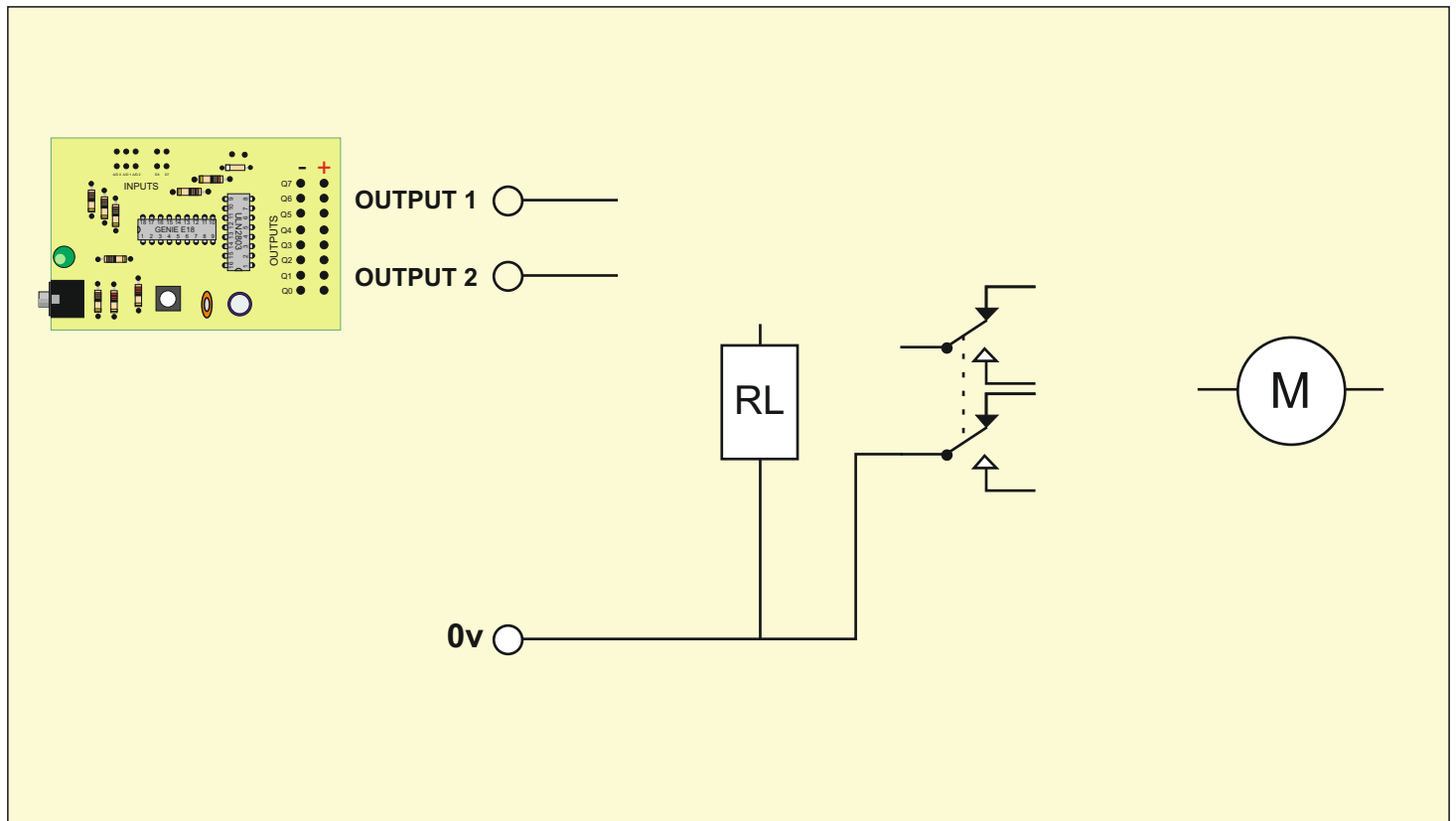
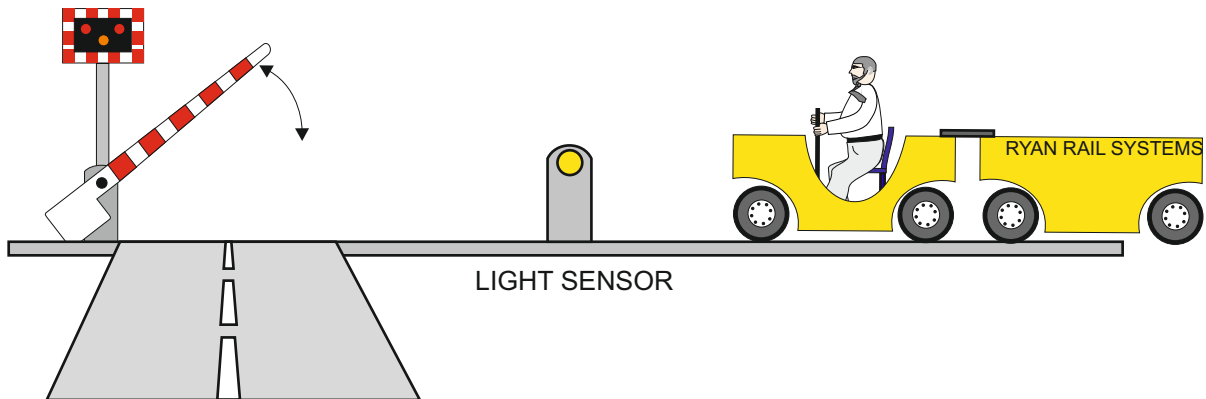
*The link at the top of the page may provide potential information for the answer.*

# SECTION B – SYSTEMS

Answer ALL questions

An engineer has designed a barrier system for a roller coaster. The specification drawn up by the client says - "As a carriage approaches the platform, it breaks a light beam and the barrier is lowered, stopping excited and unruly riders getting too close to the stopping carriages.

The engineer has decided to use a PIC microcontroller, to control the motor that raises and lowers the barrier. The student uses outputs 1 and 2 to control the motor. Output 1 will turn the motor on and off. Output 2 changes the direction of the motor.



**5a.** The circuit, needs to be improved to include the following specification points.

The circuit must:

- (i) The relay must have diode protection.
- (i) The motor must lift and lower the barrier.
- (iii) The circuit must have a simple on/off switch, that can be used in event of an accident / emergency situation.

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

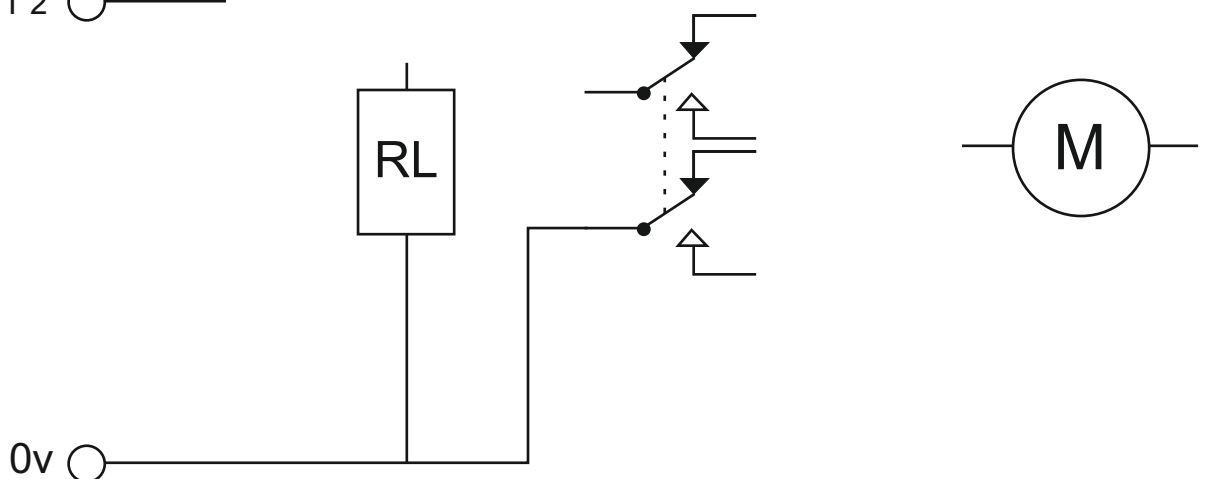
Produce clear drawings / sketches, using the outline of the original design to show how the additional specification points can be met.

**6 marks**

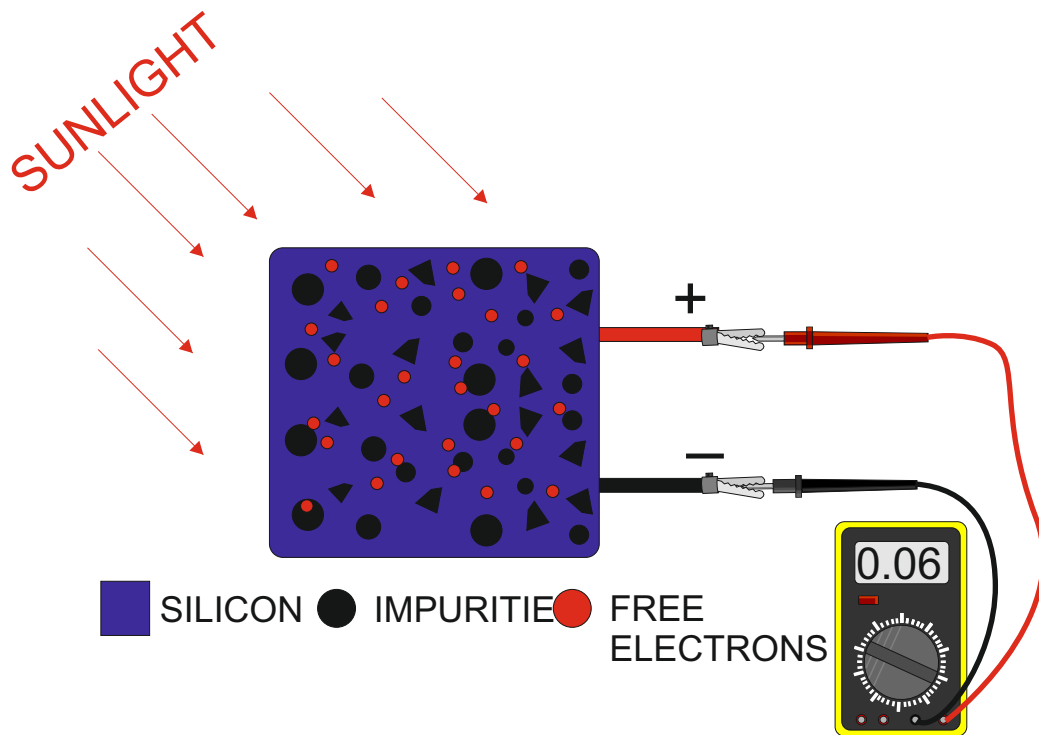
- 1 mark for correct positioning of the diode (follow link above).*
- 1 mark for correct positioning of the motor (follow link above) 2*
- marks for the motor being reversible.*
- 1 mark the positioning of the switch.*
- 2 additional marks for the clarity of the circuit diagram.*

OUTPUT 1 ○ —

OUTPUT 2 ○ —



**5b.** Photovoltaics is a form of solar power. Explain, in simple terms, how a photovoltaic panel works. **2 marks**



*1 mark for a basic explanation (follow link for potential answer)*

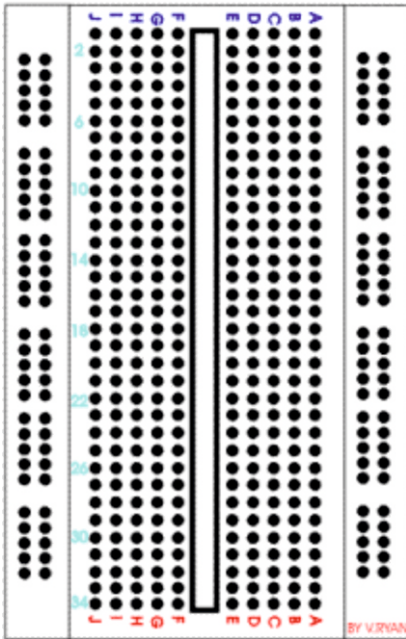
*2 marks for increased detail.*

*Teacher discretion required.*

**5c.** Describe two practical applications of solar power. **2 marks**

*1 mark per correctly described practical application.*

*Follow the link for potential practical applications.*



**6a.** The breadboard shown opposite is used to test circuits. Describe one advantage of using a breadboard. **2 marks**

*1 mark per advantage.*

*follow link to potential answers.*

**6b.** Software can be used to design a circuit and then to simulate the circuit working. What are the advantages of using software to simulate circuits in operation? **2 marks**

*1 mark per advantage*

*Follow the link to potential answers.*

The product seen opposite, is a warning light system, composed of a 'plastic' casing and an electronic circuit.



HELPFUL LINK <http://www.technologystudent.com/gprep07/vac2.html>

**6c.** What thermoplastic material, is most suitable for the manufacture of the casing?  
**1 mark**

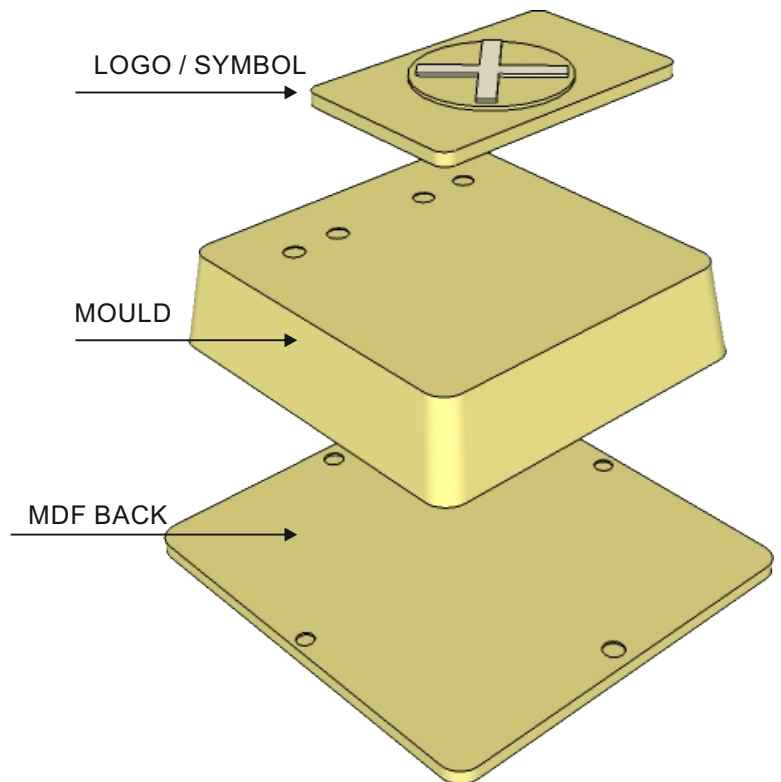
*1 mark for the correct identification of a thermoplastic material.  
Follow the link for potential answers.*

HELPFUL LINK <http://www.technologystudent.com/equip1/vacform1.htm>

**6d.** What is the name of the process, that results in the base being manufactured?  
**1 mark**

*1 mark for vacuum forming*

**6e.** The mould for the casing is seen opposite. How is the mould finished, to ensure that it can be removed from the moulded 'plastic', after vacuum forming? **2 marks**



*angle / draft*

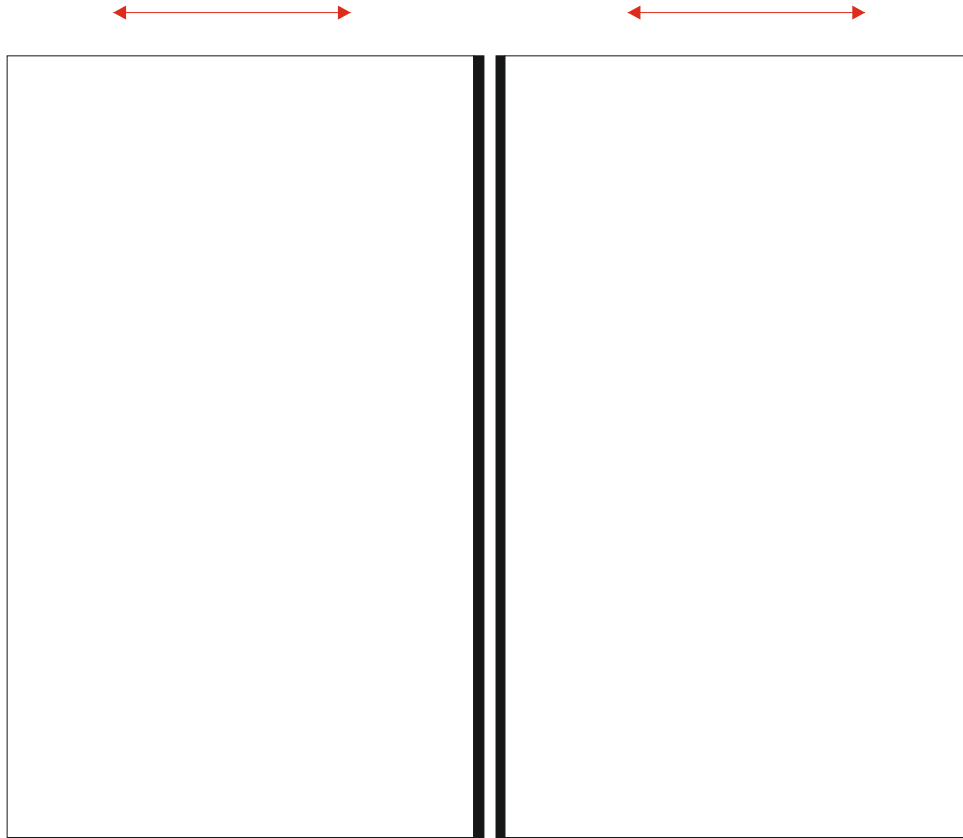
*smooth surfaces*

*Using parting powder / talcum powder for ease of removal of the mould.*

*A mark awarded for each correct statement / fact.*



**7a.** Sliding doors have electromechanical systems to enable them to work. The two doors are shown below. Add to the drawing, a suitable mechanical system, that would allow the doors to be opened and closed, in the event of an electronic / electrical failure. Add explanatory notes and labels. **5 marks**



## NOTES

*only 1 mark for either notes or a sketch.*

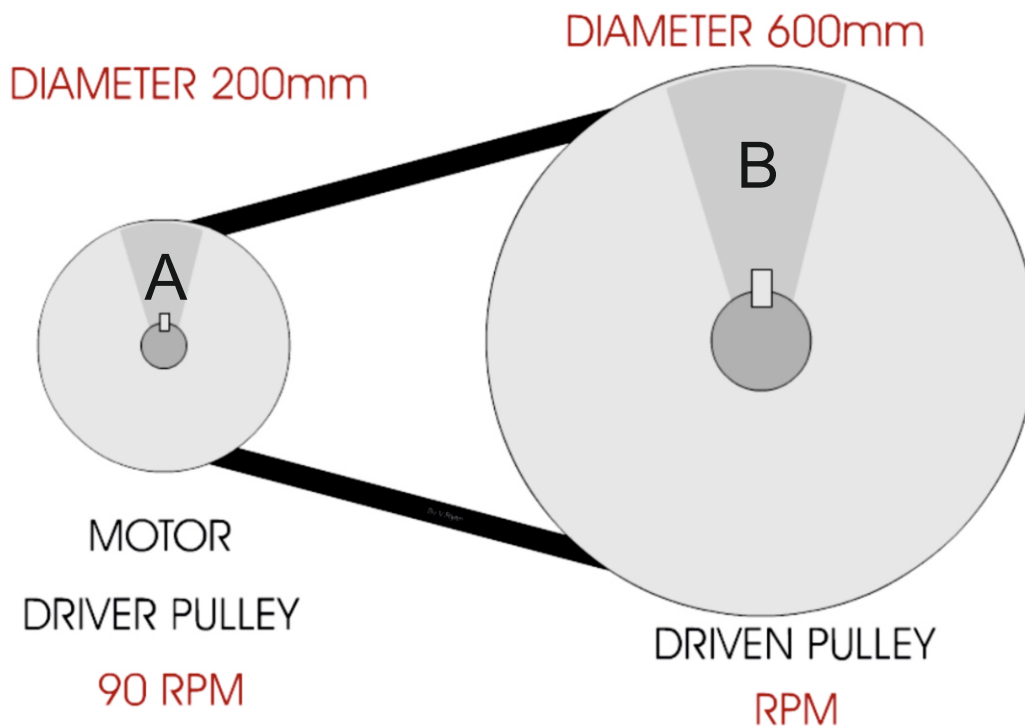
*2-3 marks for a basic sketch and notes*

*4-5 for increased detail.*

*Follow the link to a potential answer.*



7b. The sliding doors are to be updated again, so that they work automatically, the through a system of pulleys (shown in the diagram below).



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

METHOD ONE:

$$\frac{\text{DISTANCE MOVED BY DRIVEN PULLEY}}{\text{DISTANCE MOVED BY DRIVER PULLEY}} = \frac{600\text{mm}}{200\text{mm}} = 3 \quad \text{OR} \quad 3:1$$

DRIVER : DRIVEN

METHOD TWO:

$$\text{VELOCITY RATIO} = \frac{\text{DRIVER PULLEY MOVES 3 REVOLUTIONS}}{\text{DRIVEN PULLEY MOVES 1 REVOLUTION}} = \frac{3}{1} \quad \text{OR} \quad 3:1$$

DRIVER : DRIVEN

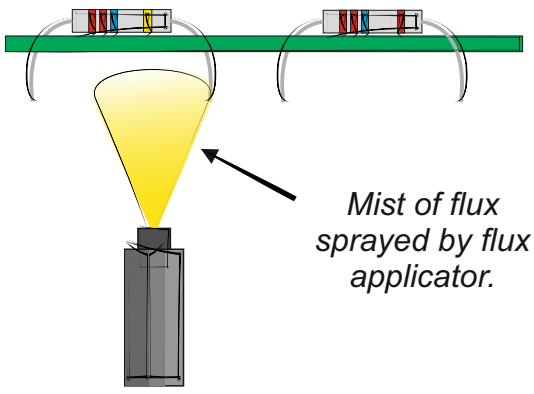
(ii). Calculate the RPM of pulley 'B'. Include all your working out. **3 marks**

$$\frac{\text{VELOCITY / SPEED OF ROTATION OF DRIVEN PULLEY WHEEL}}{\text{RPM OF DRIVER PULLEY}} = \frac{90 \text{ rpm}}{3} = 30 \text{ rpm at Driven pulley wheel}$$

**8a.** Industrial wave soldering is a process, whereby circuit boards and their components, are solder, on a mass production line. This is the way thousands of circuits are manufactured.

Using the table below, explain each of the stages in the wave soldering process, adding notes and diagrams / sketches. The first stage has been completed for you.

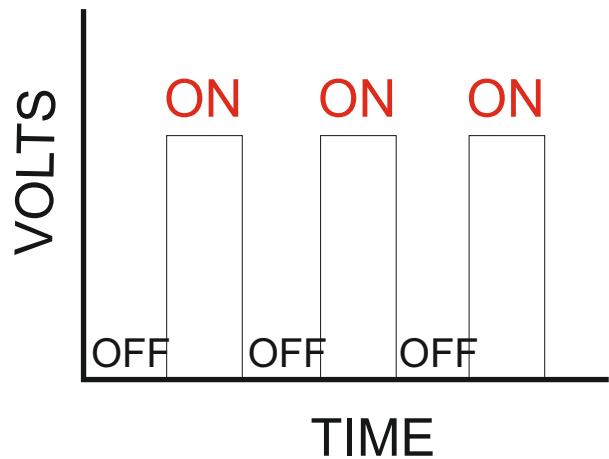
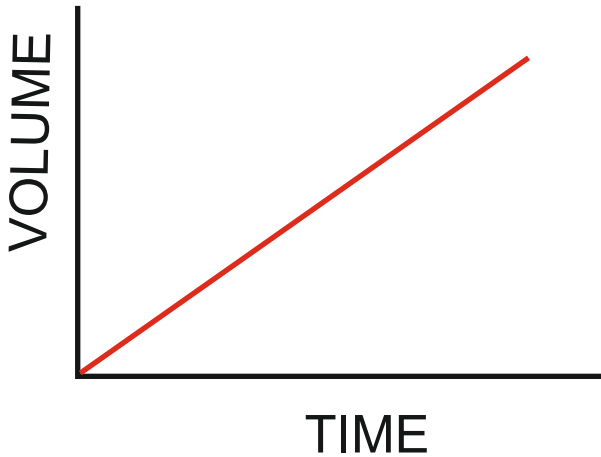
**6 marks**

NOTES / EXPLANATION	DIAGRAM / SKETCH
<p style="text-align: center;"><b>APPLICATION OF FLUX</b></p> <p><i>The first stage is the application of flux. This is a substance that helps keep the circuit board clean, by preventing oxidisation, during the heating process. The flux is sprayed in the form of a fine mist, onto the underneath of the board, covering the tracks and exposed 'pins' of the components.</i></p>	 <p style="text-align: right;"><i>Mist of flux sprayed by flux applicator.</i></p>
<p style="text-align: center;"><b>HEATING OF THE CIRCUIT BOARD</b></p> <p style="text-align: center;"><i>1 mark for a sketch or notes. 2-3 marks for notes and sketch, depending on detail. Follow the link for a potential answer.</i></p>	
<p style="text-align: center;"><b>THE WAVE SOLDERING TANK</b></p> <p style="text-align: center;"><i>1 mark for a sketch or notes. 2-3 marks for notes and sketch, depending on detail. Follow the link for a potential answer.</i></p>	

**8b.** The two graphs shown below, visually represent signals. Name each of the graphs with the correct type of signal. **2 marks**

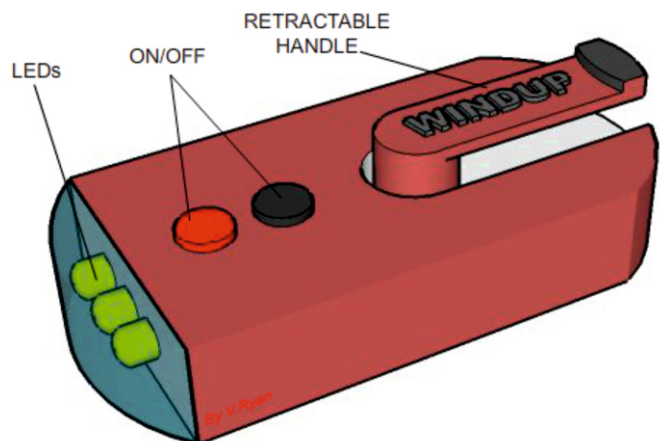
SIGNAL: *ANALOG / ANALOGUE*

SIGNAL: *DIGITAL*



**8c.** A range of wind-up rechargeable devices exist, such as the torch seen opposite. Give three advantages of modern rechargeable torches.

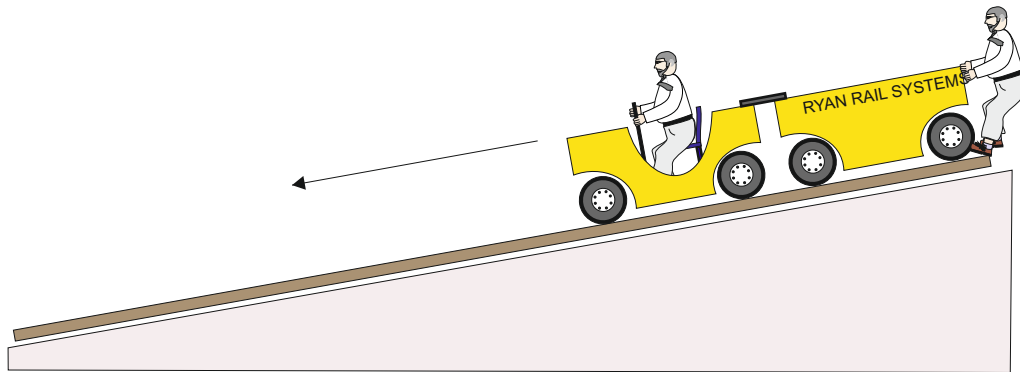
**3 marks**



*1 mark per advantage.*

*Follow the link to potential advantages.*

**9a.** The carriage of a roller coaster seen below is at the top of an incline. At any point it could roll downwards, gathering speed. What is potential energy?



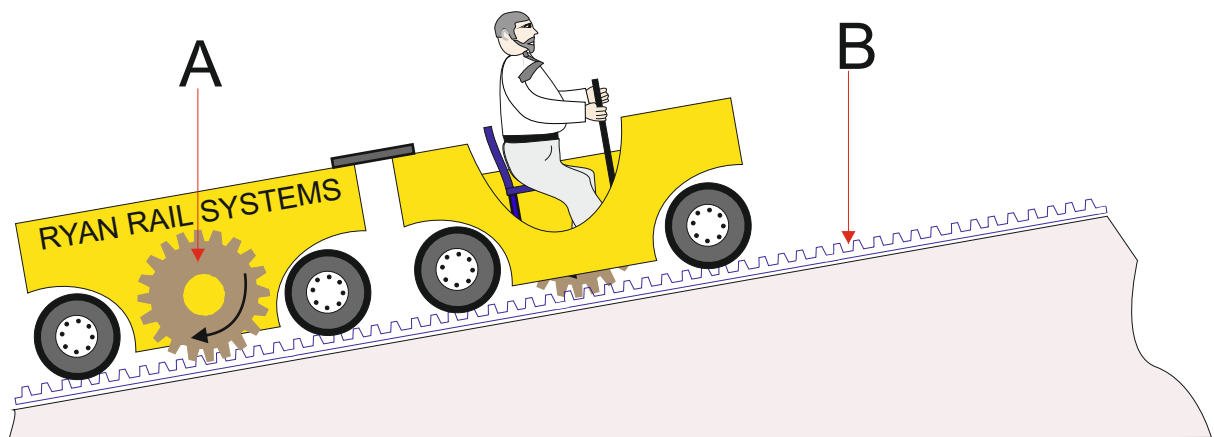
**(I)** Potential energy is (**1 mark**):

*1 mark for “The energy which a body has because of its position, eg. a coiled spring or a train at the top of a hill” or similar.*

**(II)** What is Kinetic Energy (**1 mark**)?

*1 mark for “The energy a body possesses because it is moving” or similar.*

(iii). The carriage at the bottom of the roller coaster incline has a special gear system. On the diagram, the gear system is marked A and B. What are the correct names for parts A and B ?



PART A: *Pinion* **1 mark**

PART B: *Rack* **1 mark**

**10.** Environmental damage, pollution and climate change, are serious global problems, affecting everyone. Discuss some of the problems we face and potential solutions. **9 marks**

*Some of the issues:*

*Energy production and alternative energy, pollution, climate change, Six R's, life cycle analysis, material selection, materials extraction, conspicuous consumption. throw away society, corporate responsibility, planned obsolescence etc...*

*1-2 marks for a very basic answer.*

*3-4 for additional detail OR a simple list of issues*

*for 5 - 9 marks, a genuine discussion must take place.*

*Teacher discretion required.*

## SECTION B – TIMBERS

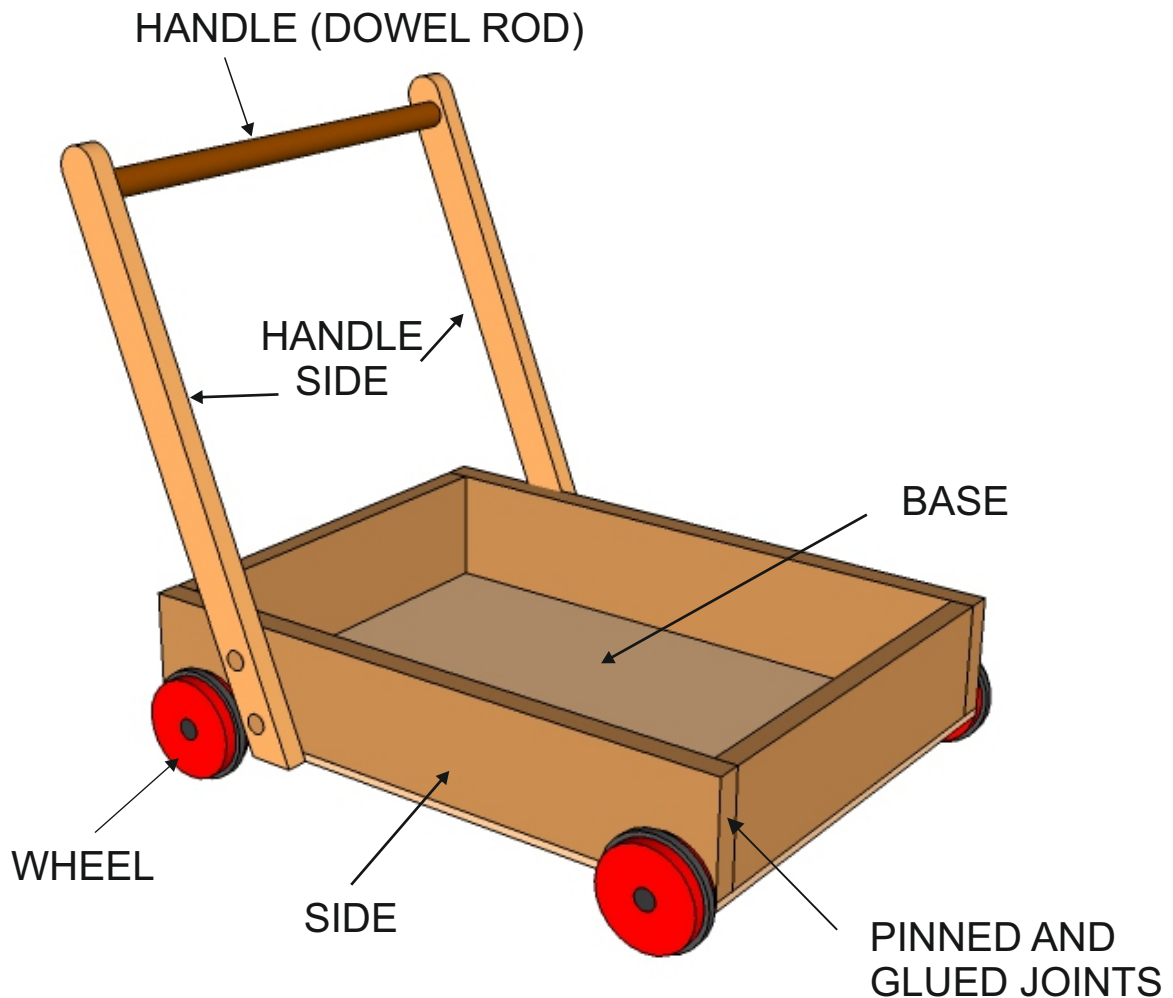
Answer ALL questions

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS

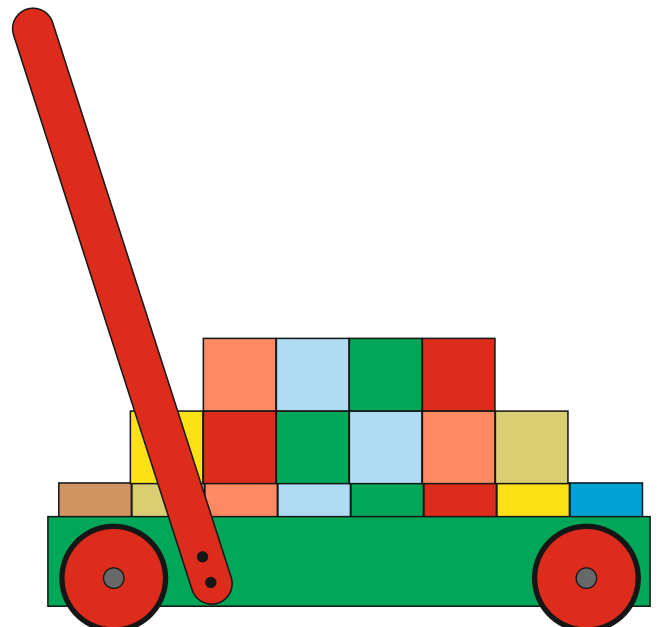
<https://www.facebook.com/groups/254963448192823/>

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5. The drawing below shows the basic solution to a children's trolley, which stores building blocks.



The trolley has a fixed handle, that is permanently in one position. The corners of the storage unit are 'pinned and glued', for speed of manufacture. The handle is plain, being manufactured from dowel. The trolley is spray painted in a variety of colours.



**5a.** The children's trolley, needs to be improved to include the following specification points.

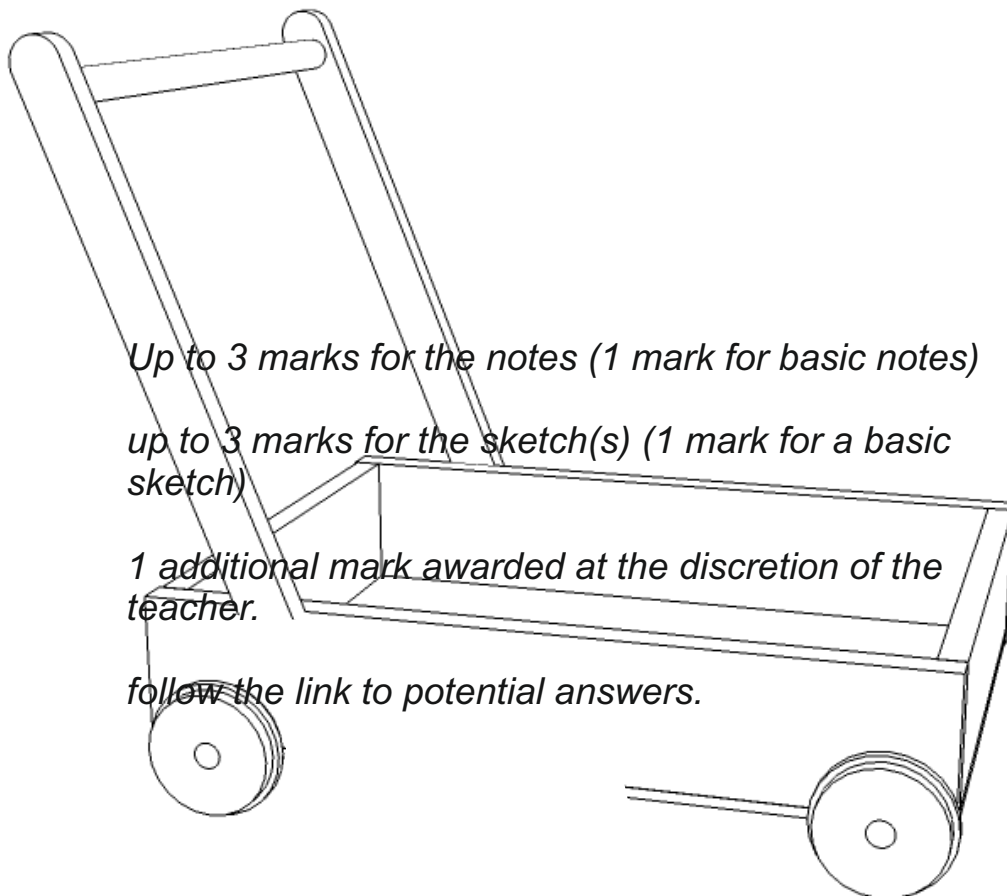
The trolley must:

- (i) Have an ergonomically designed handle.
- (ii) The handle must fold flat, so that the trolley can be stored, saving space.
- (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 children's trolley 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**





**5b.** The recycling bin shown opposite is suitable for a kitchen. It has three separate storage bins, for different materials.

Describe TWO other ways in which this design meets the design requirements for a recycle bin.

**4 marks**

**(I)**

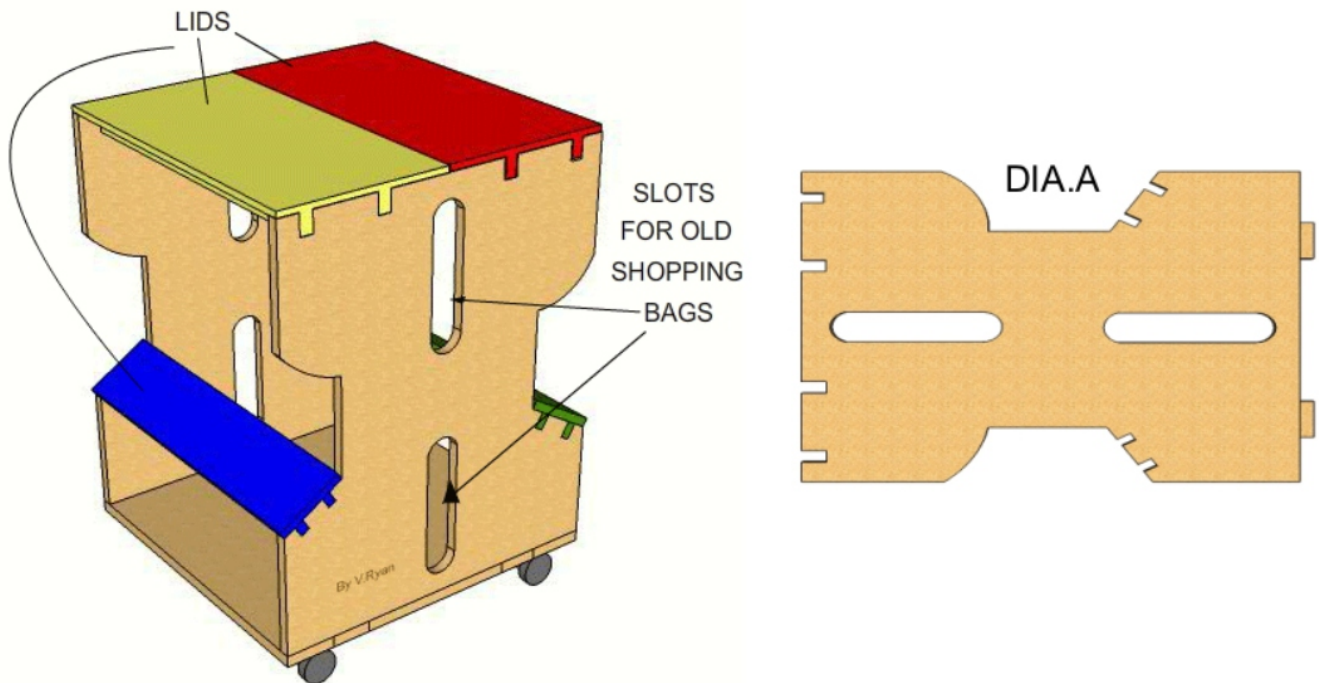
*1 mark for a basic answer  
2 marks for a more detail explanation.  
Follow the link for potential answers*

**(II)**

*1 mark for a basic answer  
2 marks for a more detail explanation.  
Follow the link for potential answers*



**5c.** The modern recycling bin seen below, is manufactured from MDF or PLYWOOD. Old plastic shopping bags can be 'hung' inside each compartment on hooks. There is a central compartment for used shopping bags. It is delivered to the customer as a flat pack and can be assembled within ten minutes. It rests on casters for ease of movement. As it is wood based and can be recycled at the end of its useful working life.



**(I)** Explain why a 'template' is useful when manufacturing a number of these bins.  
**2 marks**

*1 mark for a basic correct statement.  
 2 marks for a detailed statement.*

*follow the link for potential answers.*

**(I)** Explain why a fretsaw or bandsaw could be useful when cutting the sides of the bin.  
**2 marks**

*1 mark for a basic correct statement.  
 2 marks for a detailed statement.*

*follow the link for potential answers.*

**5d.** The panels / sides of the bin are to be painted, producing a high quality finish.

**(I)** Using notes and sketches, describe the stages involved in preparing the surface of the 'wood' panels / sides and the application of a quality paint finish.

**4 marks**

*Only one mark for a sketch OR notes*

*2 marks for the a basic sketch(s) and basic notes.*

*3 marks for a detailed sketch /and basic notes (vise-versa)*

*4marks for detailed notes and detailed sketch(s)*

*Follow the link for a potential answer.*

**(II)** Why is the use of water based paints more environmentally friendly, than using oil / solvent based paints? **2 marks**

*1 mark for one correct fact.*

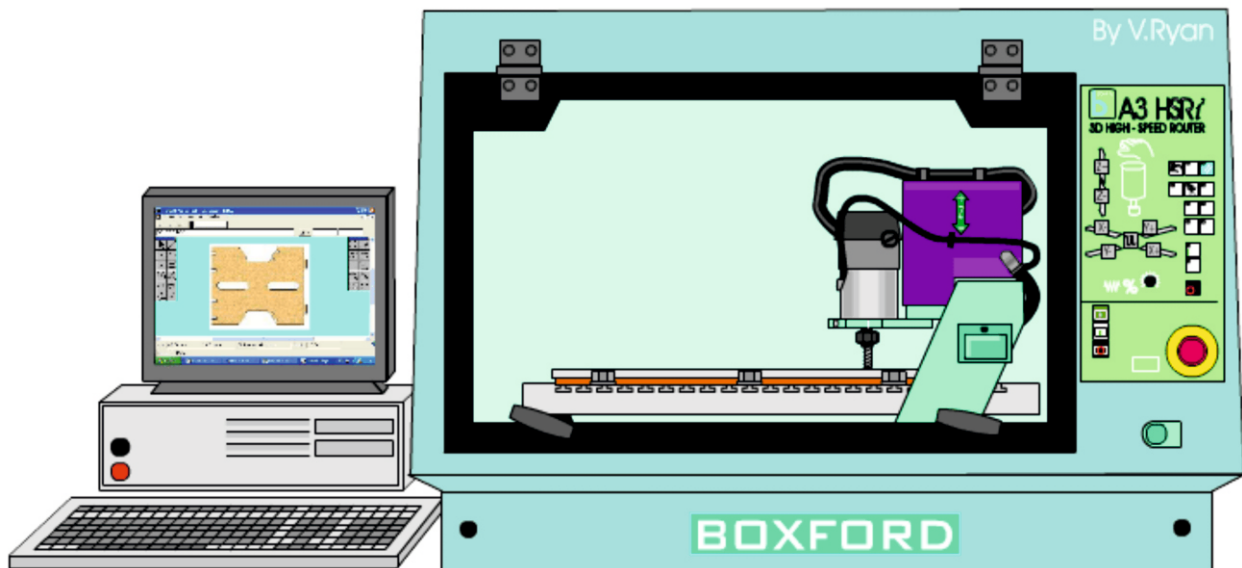
*2 marks for 2 correct facts*

*follow the link for potential answers.*

HELPFUL LINKS <http://www.technologystudent.com/cam/cncman4.htm>  
<http://www.technologystudent.com/rmprep09/shop1.html>

**6a.** A retailer has ordered a large number of the 'wood' based recycle bins. It has been decided to manufacture the bins using CAM, such as the CNC Router seen below. To start with, the sides are drawn using CAD software.

WORLD ASSOCIATION OF TECHNOLOGY TEACHERS <https://www.facebook.com/groups/254963448192823/> [www.technologystudent.com](http://www.technologystudent.com) © 2018 V.Ryan © 2018



**(I)** Describe 6 advantages of using CAD and CAM in the manufacture of large numbers of this design of bin. **6 marks**

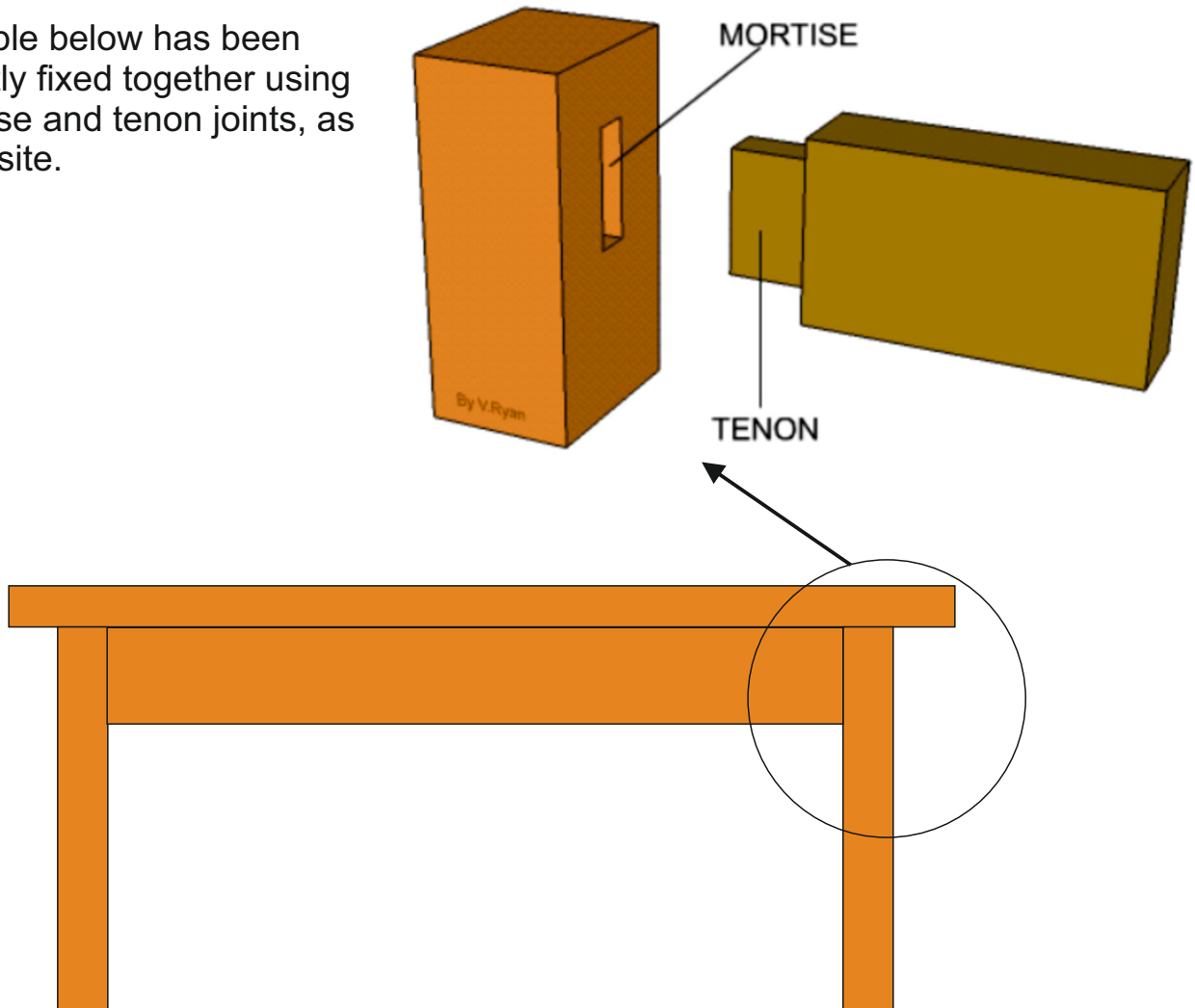
*Follow the link for potential advantages.*

*1 mark per correct advantage.*

HELPFUL LINKS

<http://www.technologystudent.com/joints/mort1.htm>  
<http://www.technologystudent.com/joints/joints4.htm>  
<http://www.technologystudent.com/joints/mort2.htm>

7a. The table below has been permanently fixed together using plain mortise and tenon joints, as seen opposite.



The table has been found to be weak. Name and produce a labelled sketch, of a more sophisticated mortise and tenon joint, that is likely to strengthen the table.  
**5 marks**

*Up to 2 marks for the notes (1 mark for basic notes)*

*up to 2 marks for the sketch(s) (1 mark for a basic sketch)*

*1 further mark awarded at teacher discretion.*

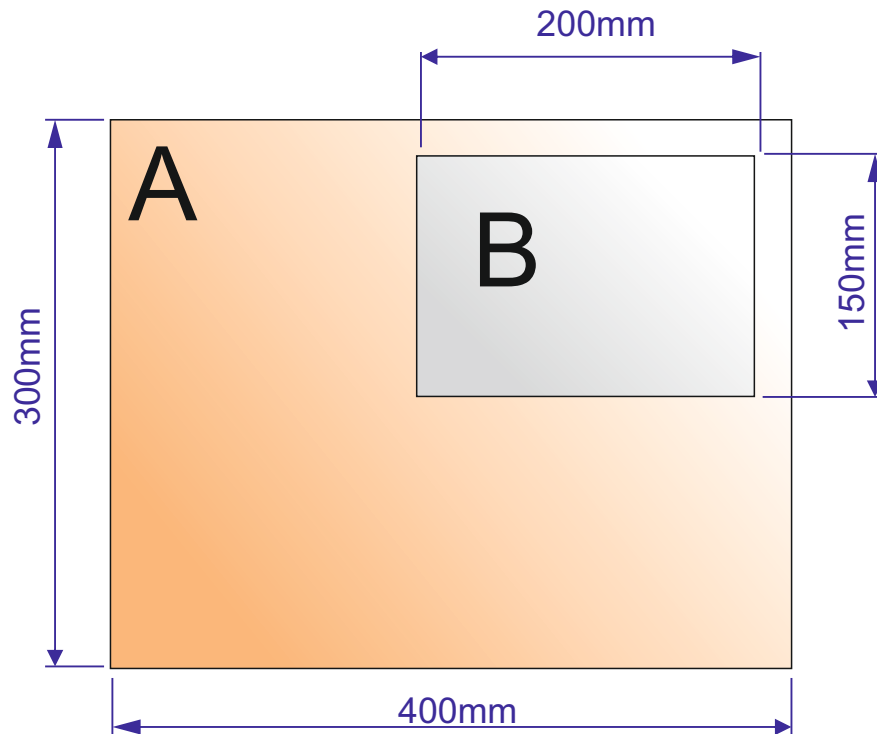
*follow the link to potential answers.*

The plain table top is to be modified. A rectangular acrylic window is to be added. The top is now composed of two rectangular pieces, accurately cut to size on a CNC router. They fit perfectly together.

**7b.** Calculate the total area of piece A, before 'B' is removed **2 marks**

**7c.** Calculate the area of piece B. **2 marks**

**7d.** Calculate the area of A, after 'B' is removed. **1 mark**



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 = 120000mm<sup>2</sup>

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 = 30000mm<sup>2</sup>

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 = 90000mm<sup>2</sup>

AREA OF FINAL SHAPED PIECE 'A' WITHOUT THE SMALLER PIECE IS 90000mm<sup>2</sup>

AREA OF PIECE 'B' IS 30000mm<sup>2</sup>

**7e.** European Beech has been selected for the manufacture of the table. Explain why this is a good choice. **4 marks**

*1 mark per property of the material*

*Follow the link for potential answers*

**7f.** Name another natural wood that would be suitable for the manufacture of the table. Explain why you consider it to be suitable. **2 marks**

**NAME:** *1 mark for naming a suitable wood*

**WHY SUITABLE:**

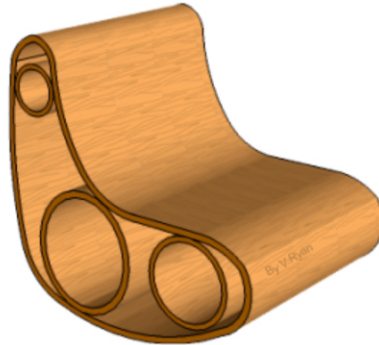
*1 mark for a simple / basic justification of the materials selection.*

8. The products shown below have been manufactured from flexi-ply.

MP3 STATION



ROCKING CHAIR



BOOKCASE



(I) Why is flexi-ply a suitable material for these shapes / forms of products? **5 marks**

*1 mark per working property of the material*

*Follow the link for potential answers*

(II) Another way of producing curves in woods is to use layers of veneers / plywood and to 'steam bend'. Describe the process called 'steam bending'. **4 marks**

*1 mark for a simple correct statement  
2 - 3 marks for more detail (2 to 3 facts)  
4 marks for a detailed answer.*

**9.** Describe how natural wood can significantly contribute to the sustainability of our use of materials. **9 marks**

*Some of the issues to be raised:*

*Sustainable forests. An understanding of sustainability, recycling, up/down cycling, understanding of life cycle.*

*1 to 4 marks for showing and understanding of the issues.*

*5 - 9 marks for a genuine discussion.*

*Teacher discretion required.*



**ADD YOUR OWN TEXTILES  
SPECIFIC EXAMINATION  
QUESTIONS**