

DESIGN AND TECHNOLOGY - GCSE SAMPLE PAPER 1

Level 1/Level 2 GCSE (9–1)

Candidate Name	Centre Number					Candidate Number				

COMPONENT 1

TIME ALLOWED - 1 hour 45 minutes

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>
	PEWTER CASTING JELLEWERY	<i>Pewter can be cast by at low temperatures, forming detailed shapes.</i>
<small>WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2018 V.Ryan © 2018</small>		
HELPFUL LINK http://www.technologystudent.com/rmflsh1/pine2.html		
	PINE WOOD - LAMP	1 mark
HELPFUL LINK http://www.technologystudent.com/joints/pet1.html		
	FOOD TRAY POLYETHYLENE TEREPHTHALATE	1 mark

PRODUCT

DESCRIPTION

PROPERTY

HELPFUL LINK

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



ALUMINIUM
DRINKS CAN

1 mark

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HELPFUL LINK

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



POSTER
UV VARNISHED
QUALITY PAPER

1 mark

HELPFUL LINK

http://www.technologystudent.com/joints_flsh/nylon1.html

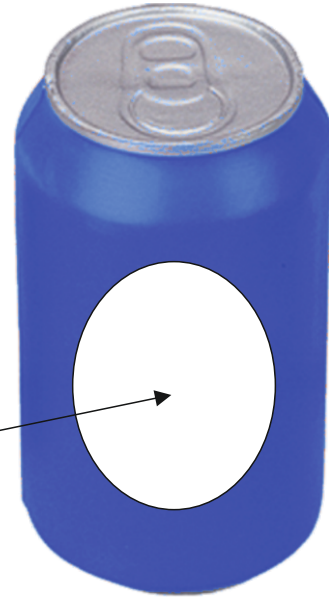


NYLON
WATERPROOF
CLOTHING

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**

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

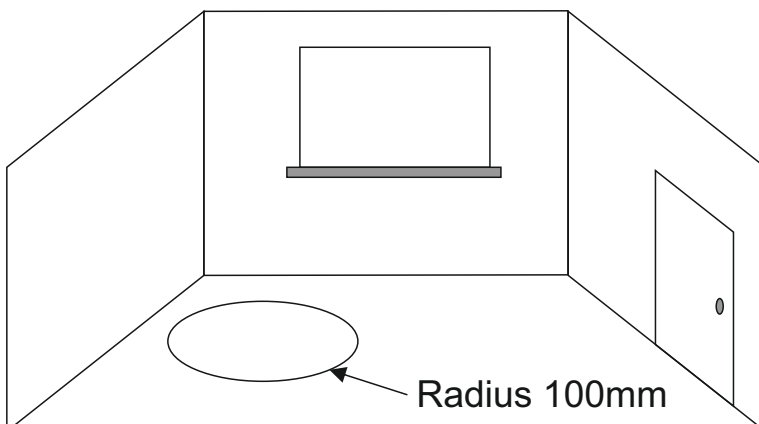
2. The photograph shows a modernist 'plastic' chair.



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

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?



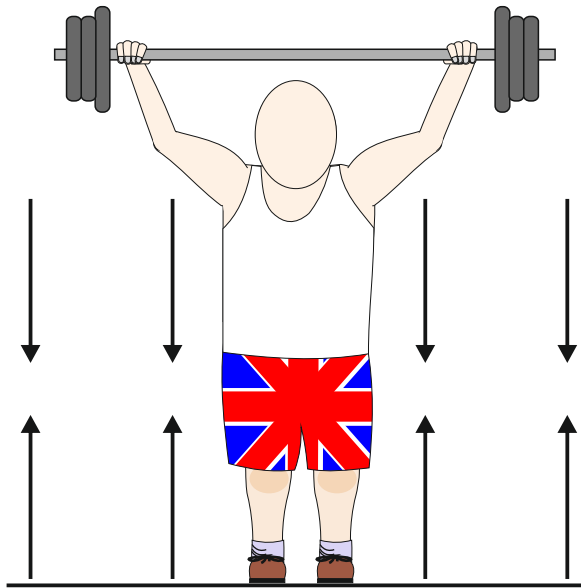
2c. The modernist chair will be supplied with a textile cover manufactured from polyester. List two advantages of using polyester. **2 marks**

(i)

(ii)

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

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

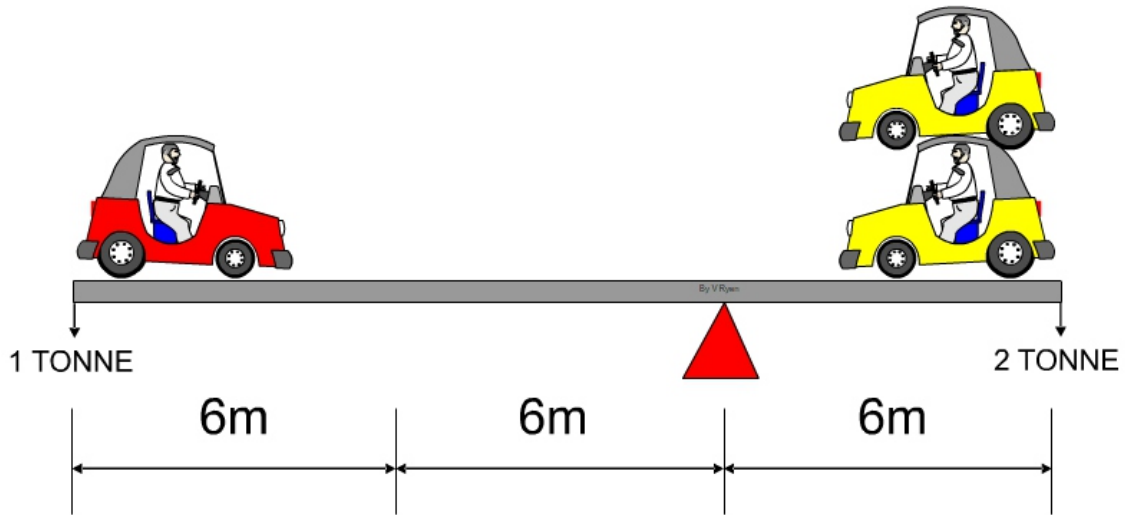


(I) Name the force. **1 mark**

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

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

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

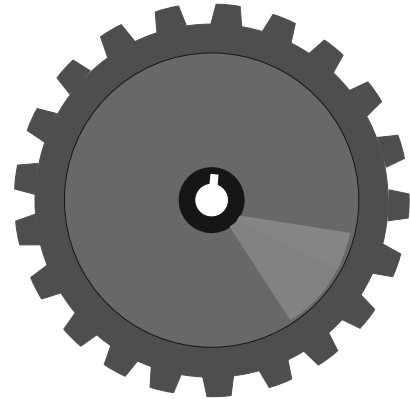


FORMULA: CLOCKWISE MOMENTS = ANTI-CLOCKWISE MOMENTS

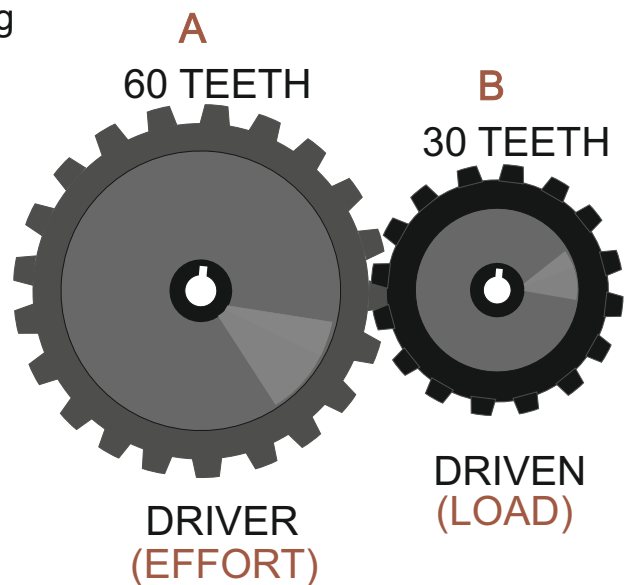
3d. Companies manufacturing cars often work with a system called 'Lean Manufacturing'. What is Lean Manufacturing? **4 marks**

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

1 mark



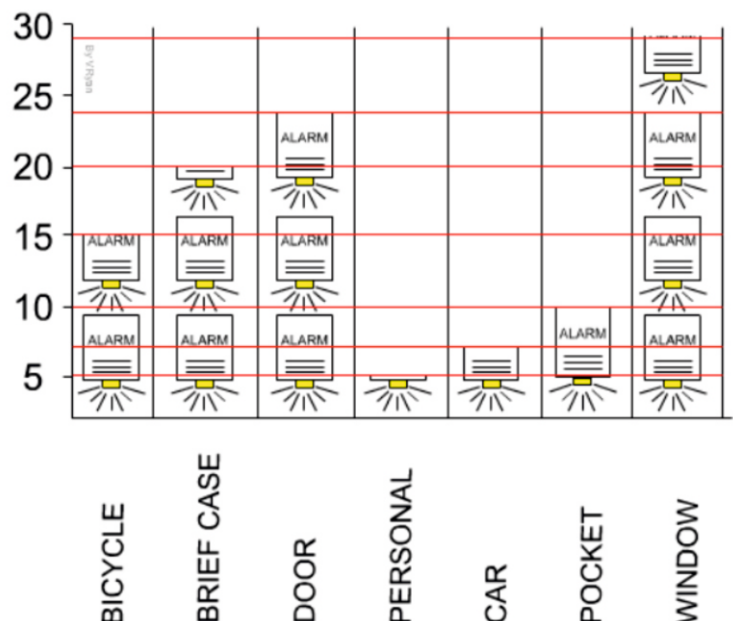
4b. Calculate the Velocity Ratio (Gear Ratio) for the spur gears seen opposite. Include your working out. 4 marks



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

What is this style of graph called?

1 mark



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**

WIND FARM : SOLAR POWER
4 : 0.5

EXPLANATION: _____

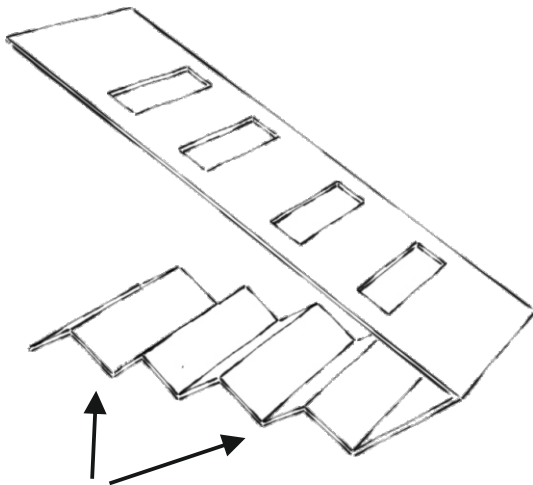
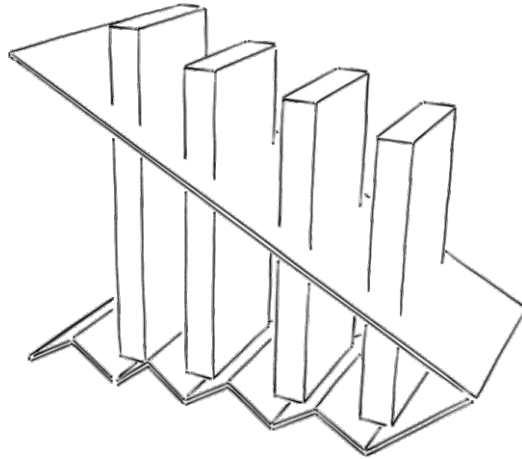
4e. Write three advantages of using wind power to produce electricity. **3 marks**

SECTION B – METALS

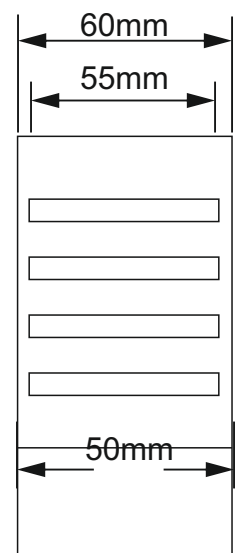
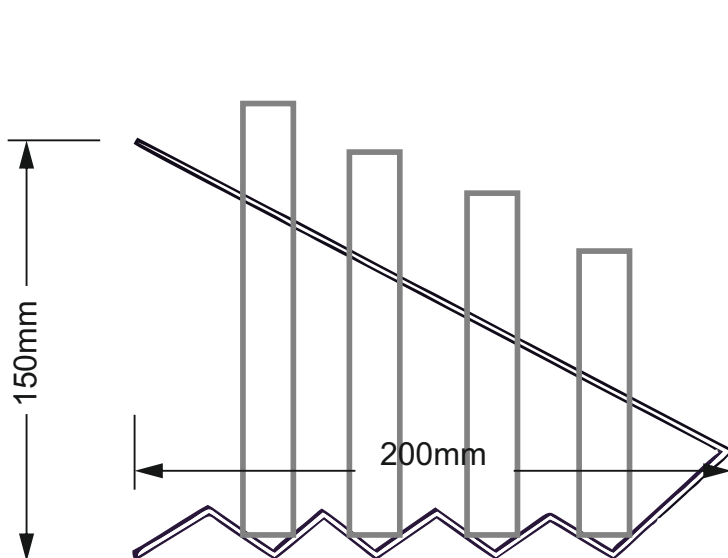
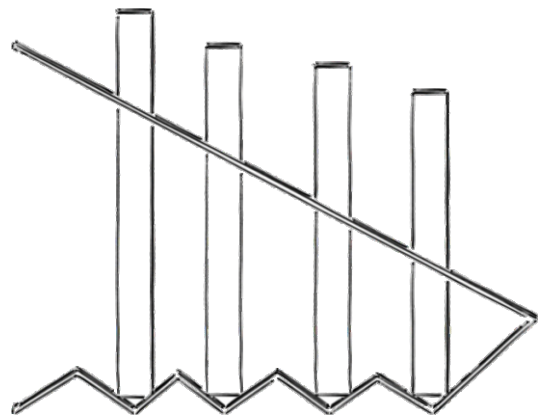
Answer ALL questions

HELPFUL LINK <http://www.technologystudent.com/rmflsh1/remote16.html>

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.

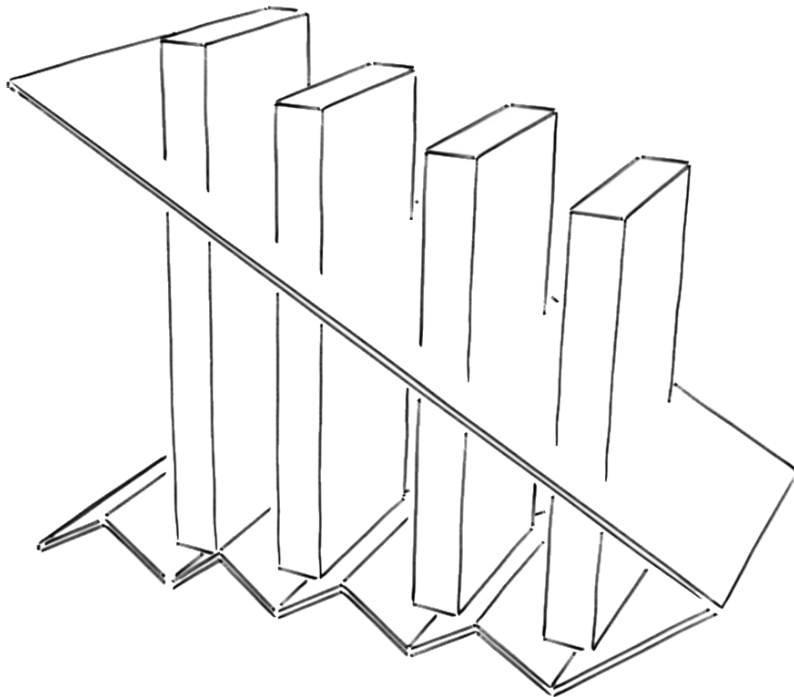
The remote controller must:

- (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.

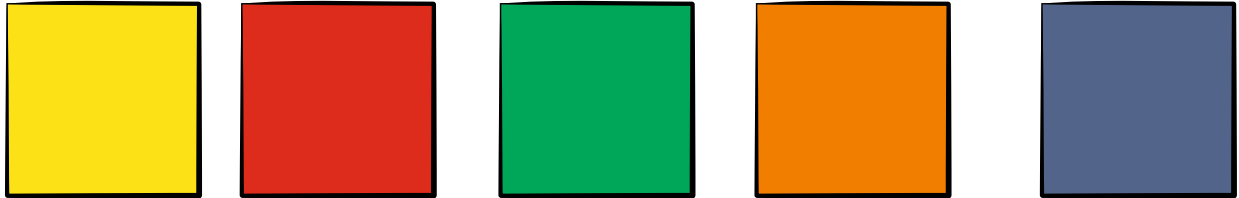
Produce clear drawings / sketches, using the outline of the original design to show how a base can be added and the other specification points met.

6 marks



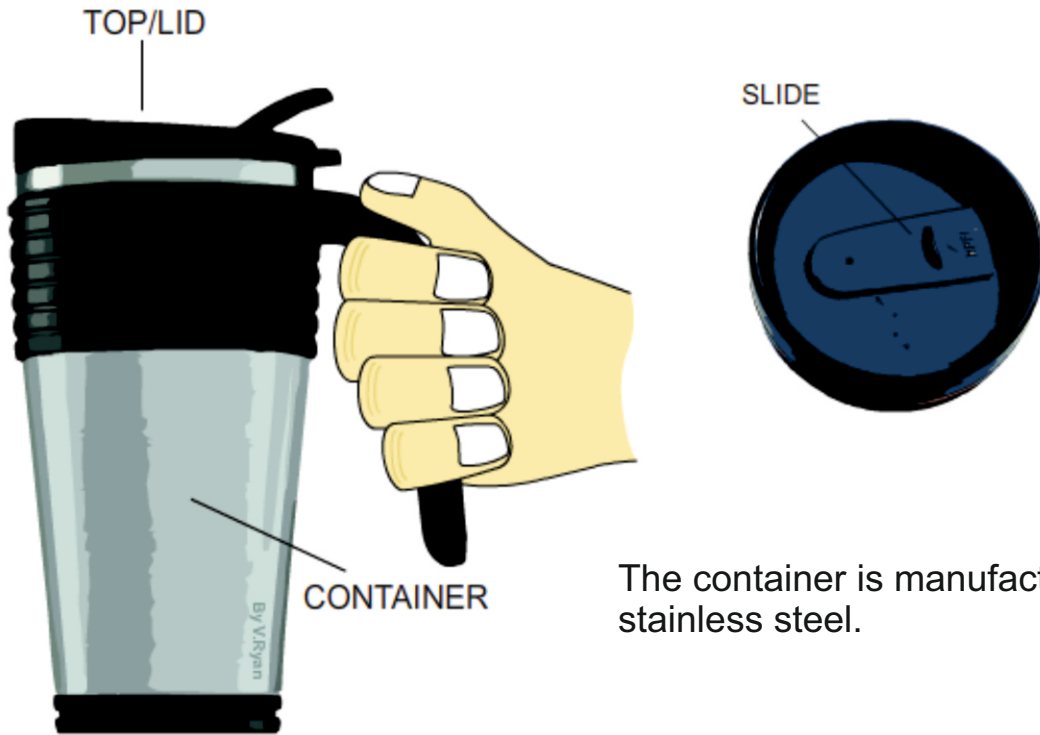
5b. The aluminium remote organiser must be available in a range of durable colours as shown below. This is achieved through an anodised finish.

SAMPLE ANODISED COLOUR FINISHES



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

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)

(II)



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

What is anthropometrics ?

2 marks



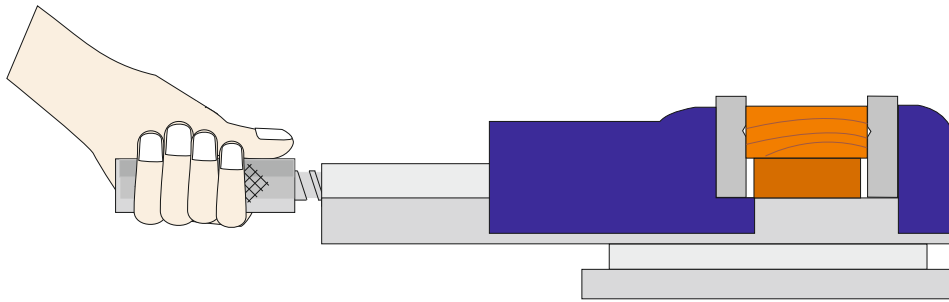
7. The diagram opposite shows a folding trolley. The handle can be adjusted to different heights and the steel shelf folds upright.

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

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

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

$$\text{AREA} = \pi r^2$$
$$\pi (\text{pi}) = 3.14$$

FORMULA

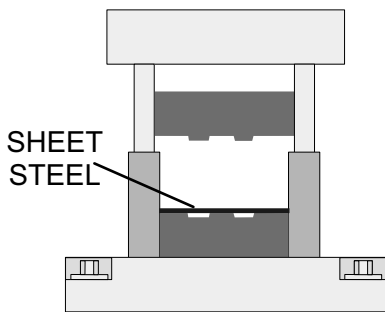
$$\text{CIRCUMFERENCE} = 2 \times \pi \times r$$
$$\pi (\text{pi}) = 3.14$$

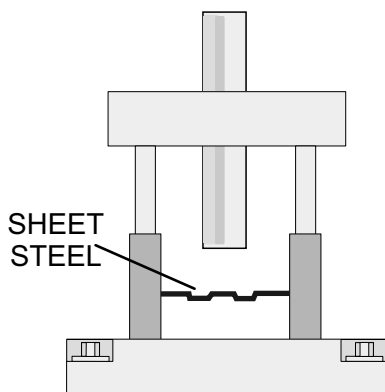


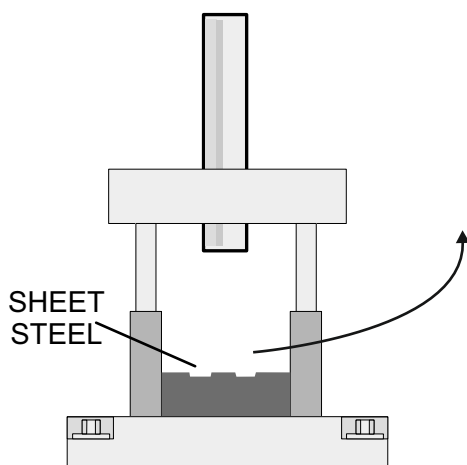
An hydraulic press is used to press shapes into sheet steel and also to cut out shapes. This is how the 'shelf' has been manufactured.

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)**







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

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

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.*

FERROUS METALS		
NON-FERROUS METALS		

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: _____

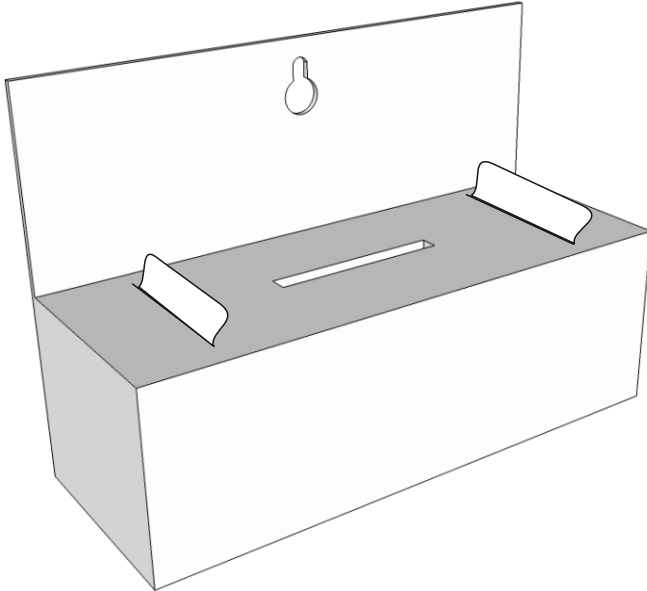
PRACTICAL APPLICATION: _____
(1 mark)

WHY SUITABLE:
(4marks)

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.



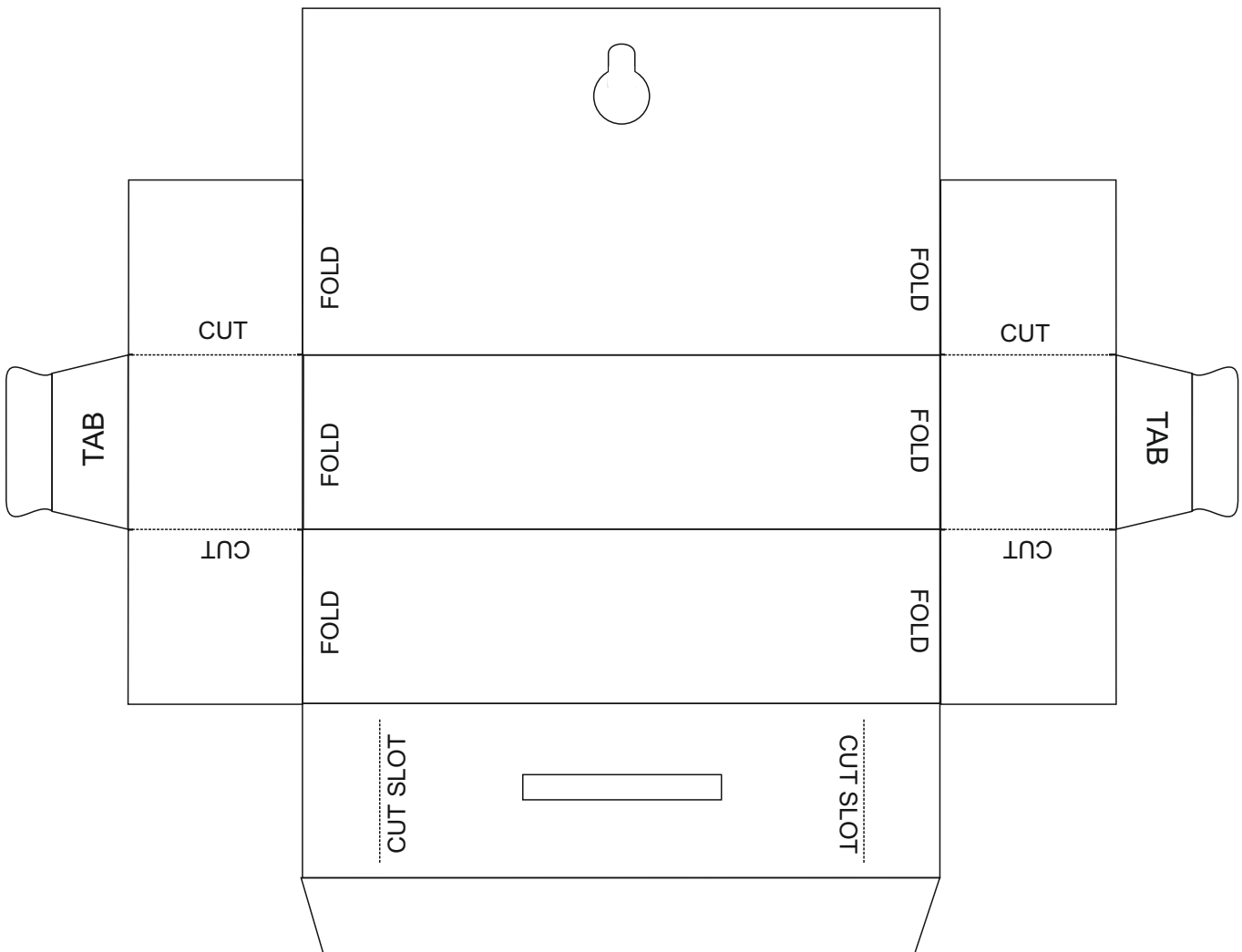
100 % recycleable

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.

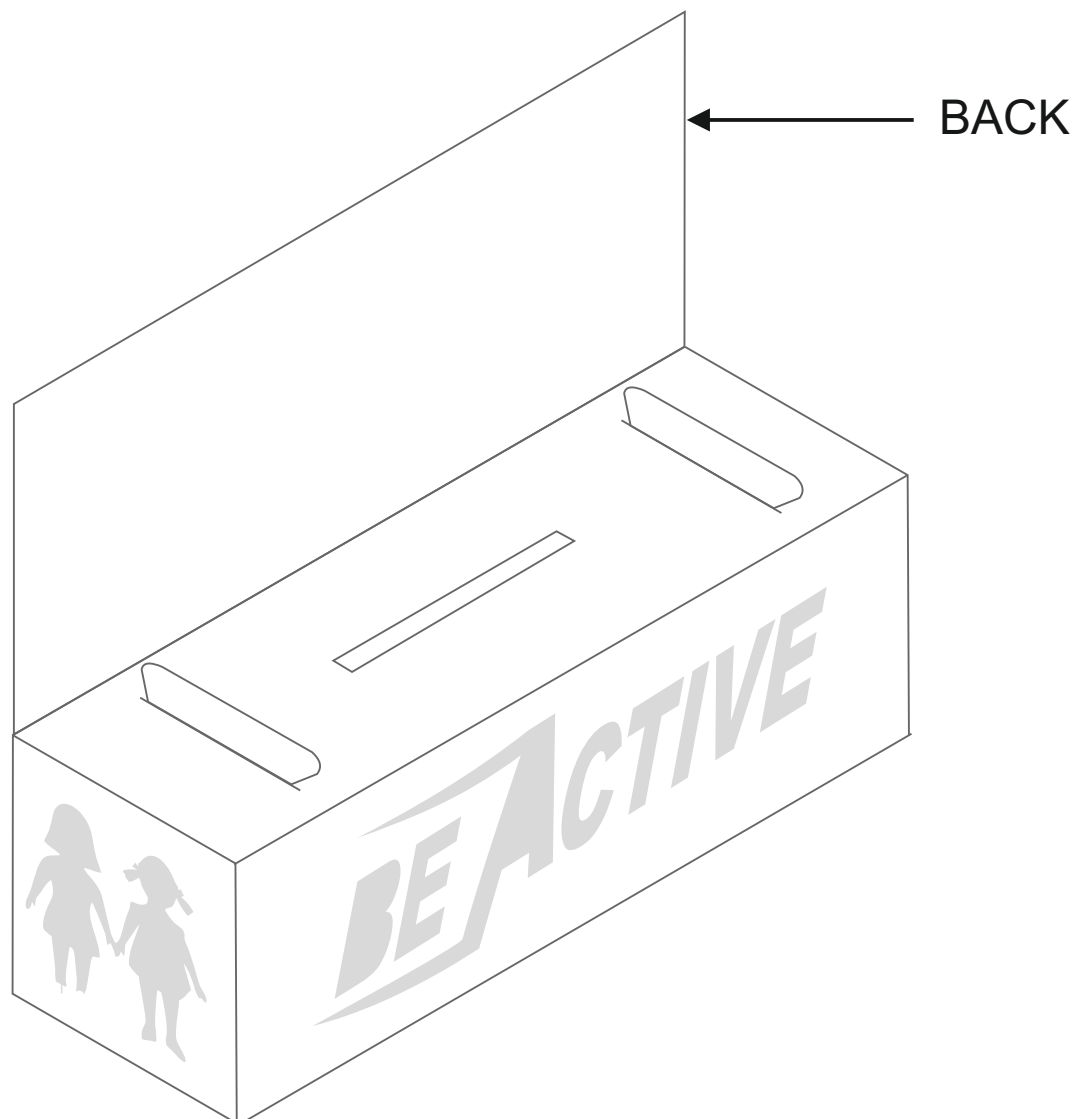
The charity collection box must:

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

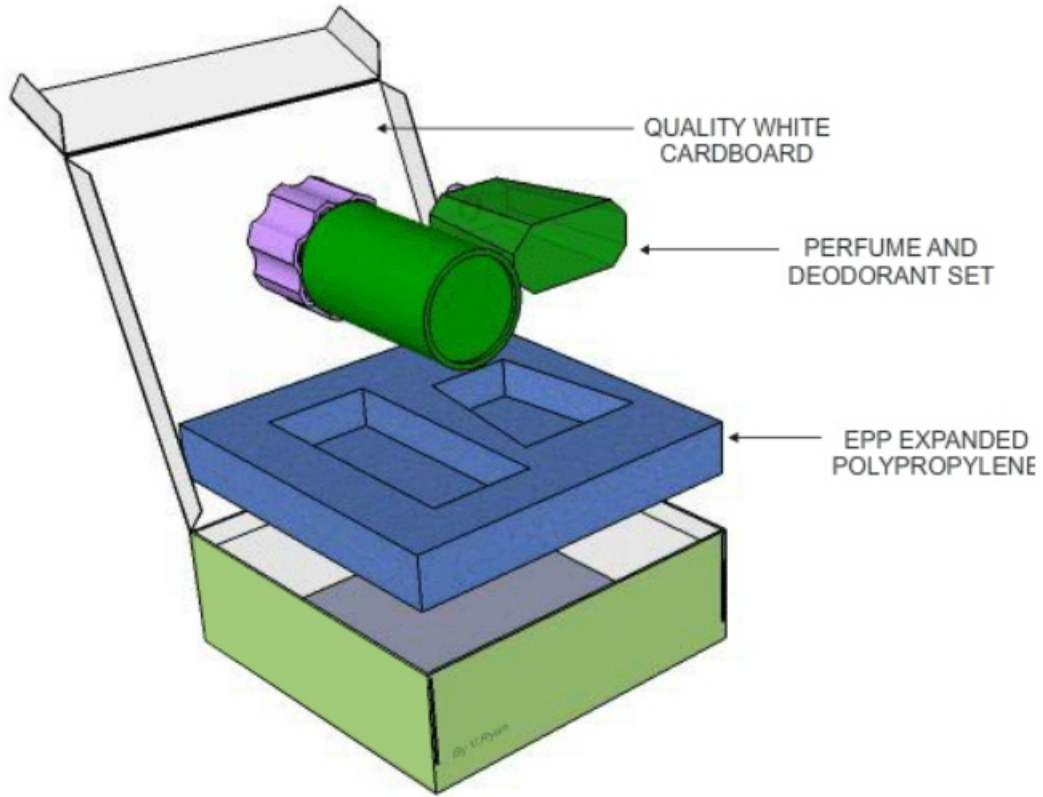
Use notes and/or sketches to show how the collection box could be modified to satisfy the additional specification points, listed above

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

6 marks



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

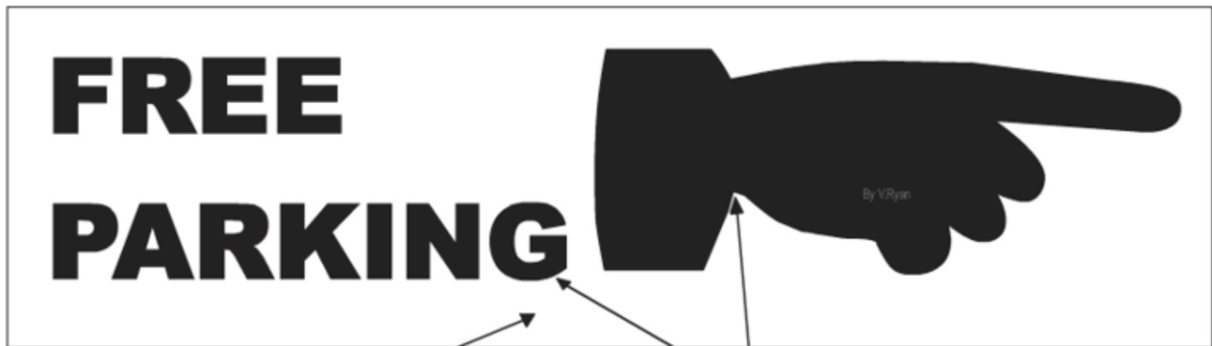
MATERIAL:

EXPLANATION:

MATERIAL:

EXPLANATION:

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



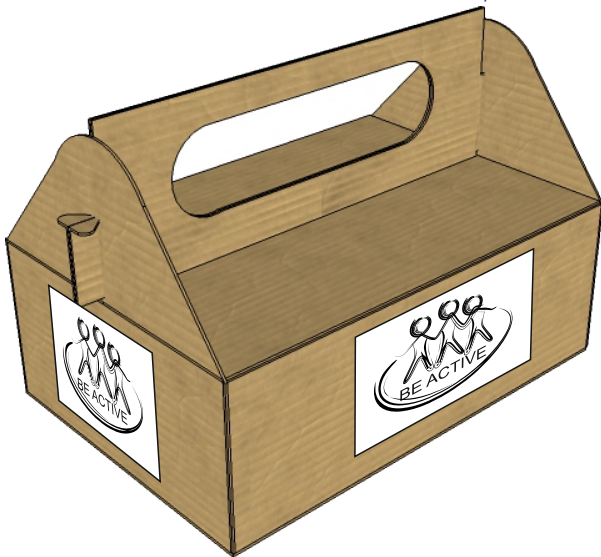
QUALITY CARD

BLACK SELF ADHESIVE VINYL LETTERING

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

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



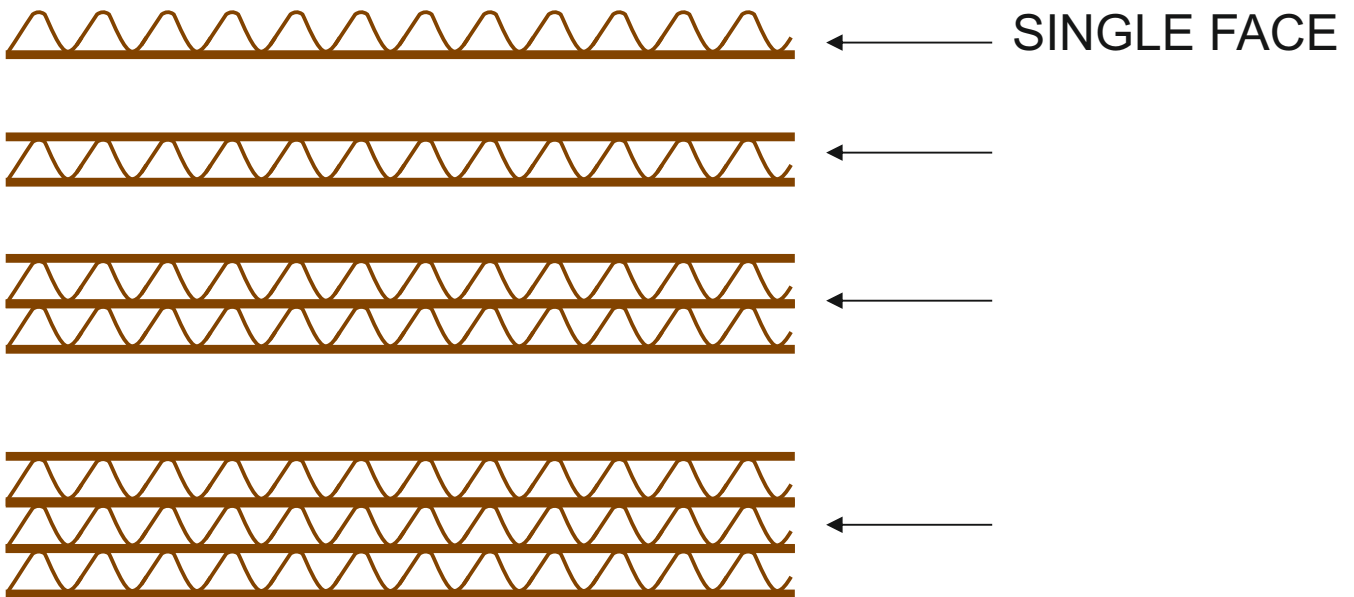


6c. The corrugated card charity collection box shown opposite, is manufactured from recycled card, processed into Corrugated card.

Corrugated board is supplied in different thicknesses.

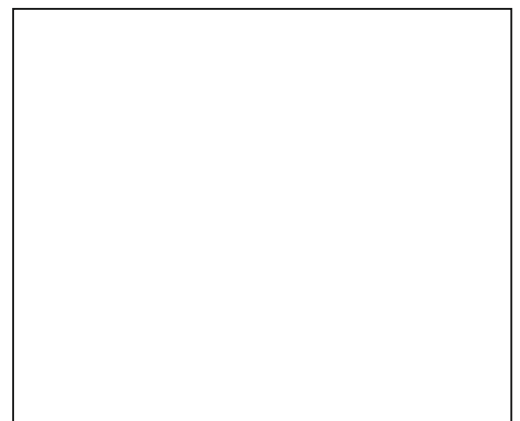
On the diagram below, 4 thicknesses of corrugated card are shown. One has been labelled for you.

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



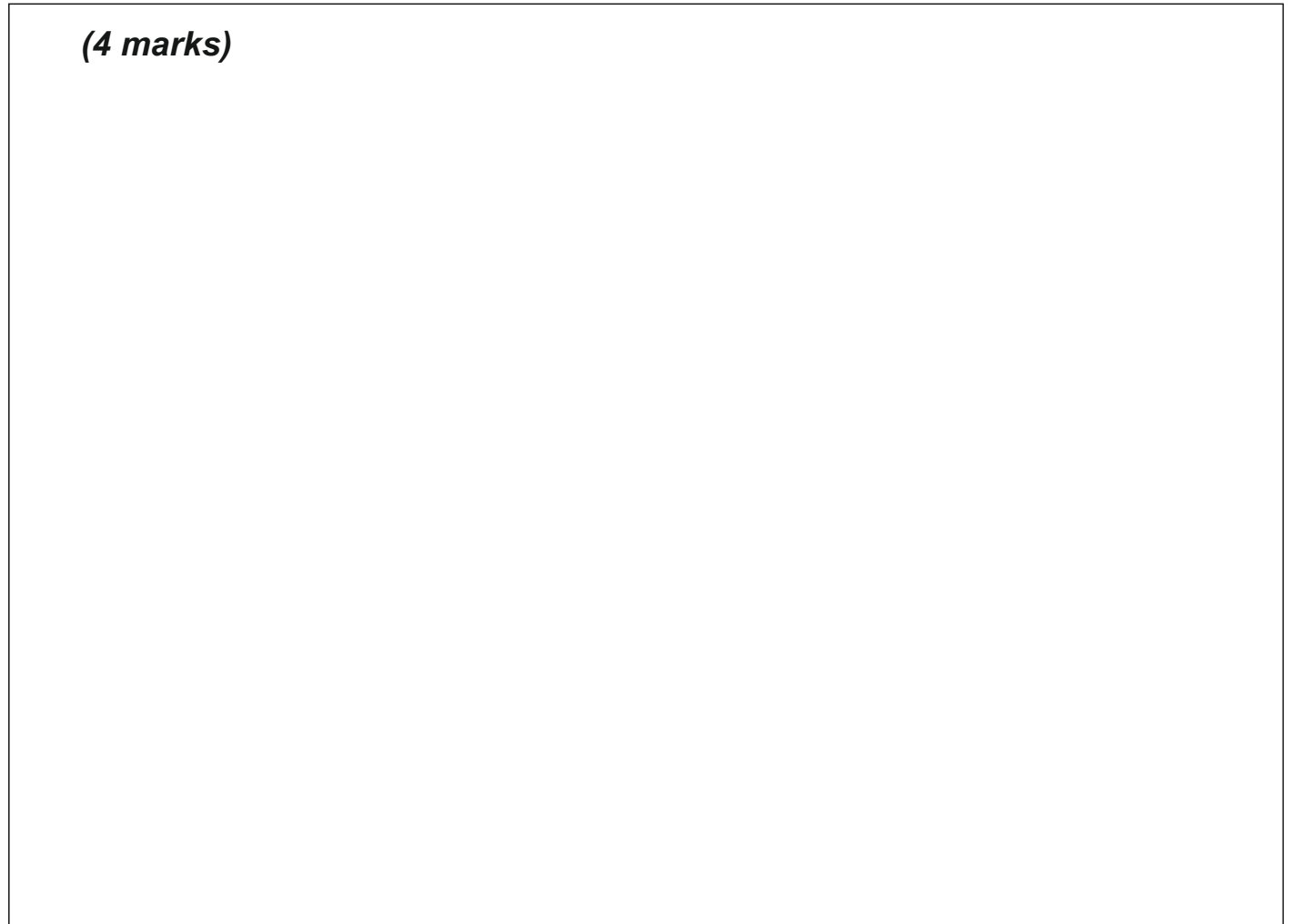
6e. The graphics / colour and decoration is to be added to the packaging for perfumed products (question 5b). In the space below, name a suitable printing process, draw a labelled diagram to represent the process and add notes that explain the process.

Total of 8 marks

PROCESS NAME: _____
(1 mark)

LABELLED DIAGRAM

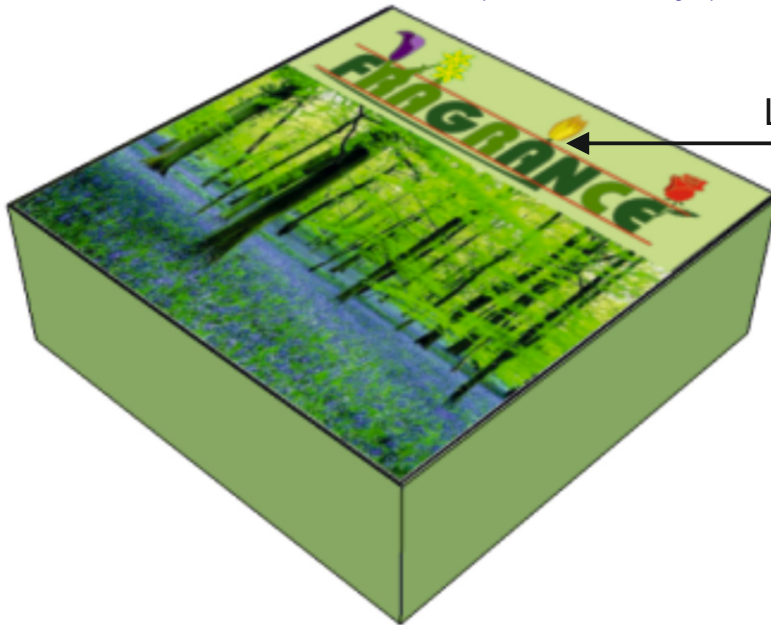
(4 marks)



NOTES: **(3 marks)**

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



LETTERING TO BE FOIL BLOCKED

LABELLED SKETCH (**3 marks**)

NOTES (**2 marks**):

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**

HELPFUL LINK

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

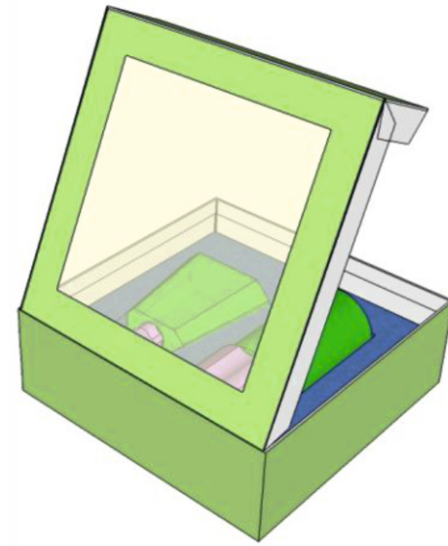
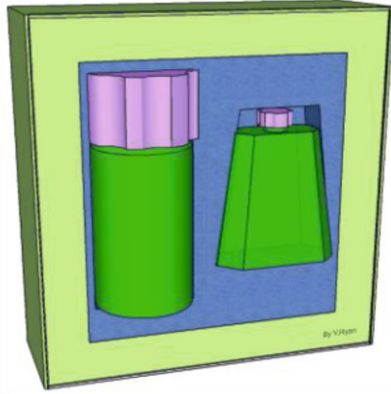
8b. The logo shown opposite is sometimes printed on timber and packaging.

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



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: _____

DISADVANTAGE: _____

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

HELPFUL LINKS

<http://www.technologystudent.com/prddes1/biopola.html>
<http://www.technologystudent.com/prddes1/biopol3.html>

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

4 marks



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.

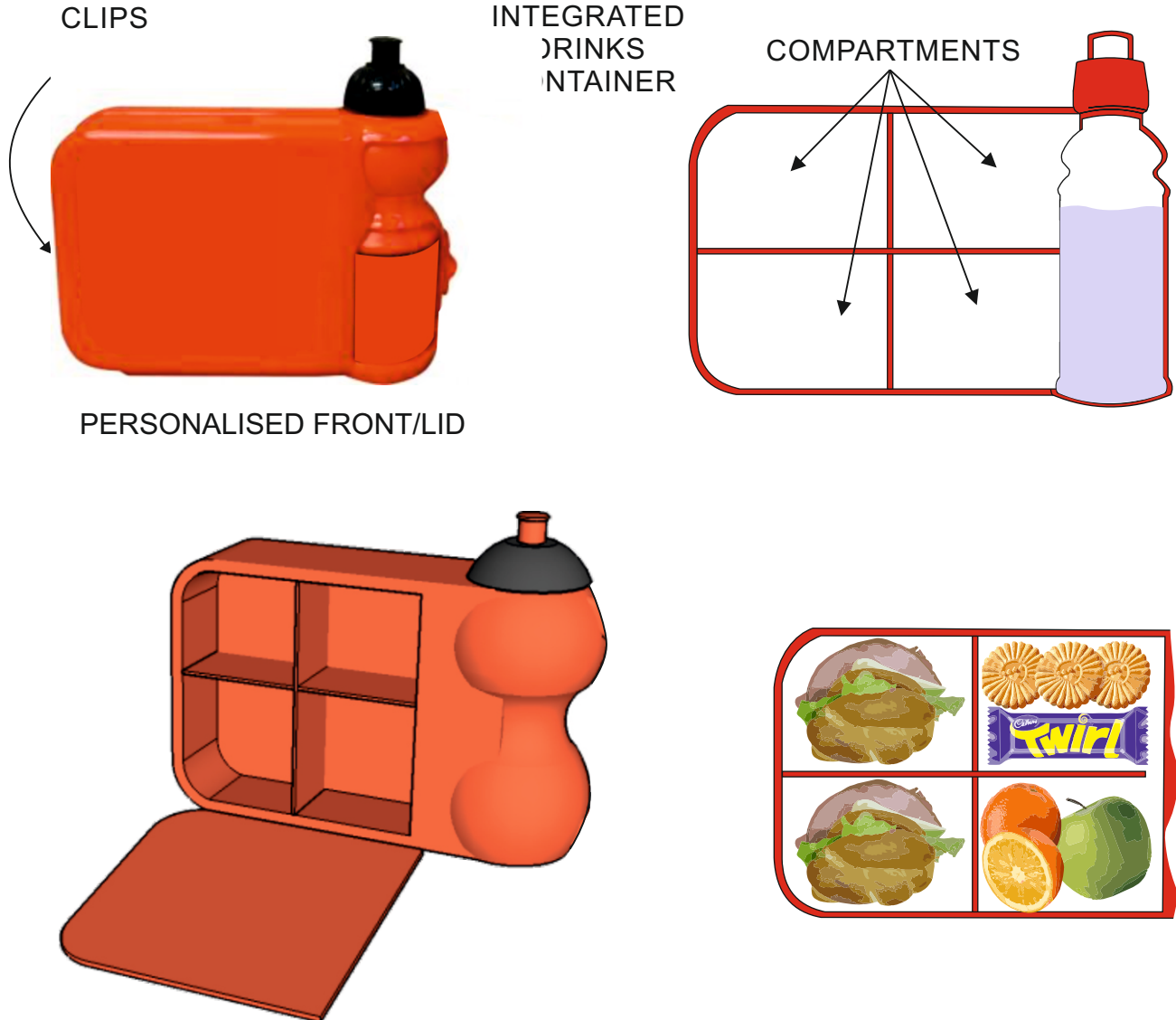
Total of 9 marks

FUNCTION	EXPLANATION
<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. It must also be protected against micro-organisms, chemicals, soil and insects.</i></p>
<p>1 mark</p>	<p>2 marks</p>
<p>1 mark</p>	<p>2 marks</p>
<p>1 mark</p>	<p>2 marks</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/carrier6.html

http://www.technologystudent.com/prddes_2/carrier1.html

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

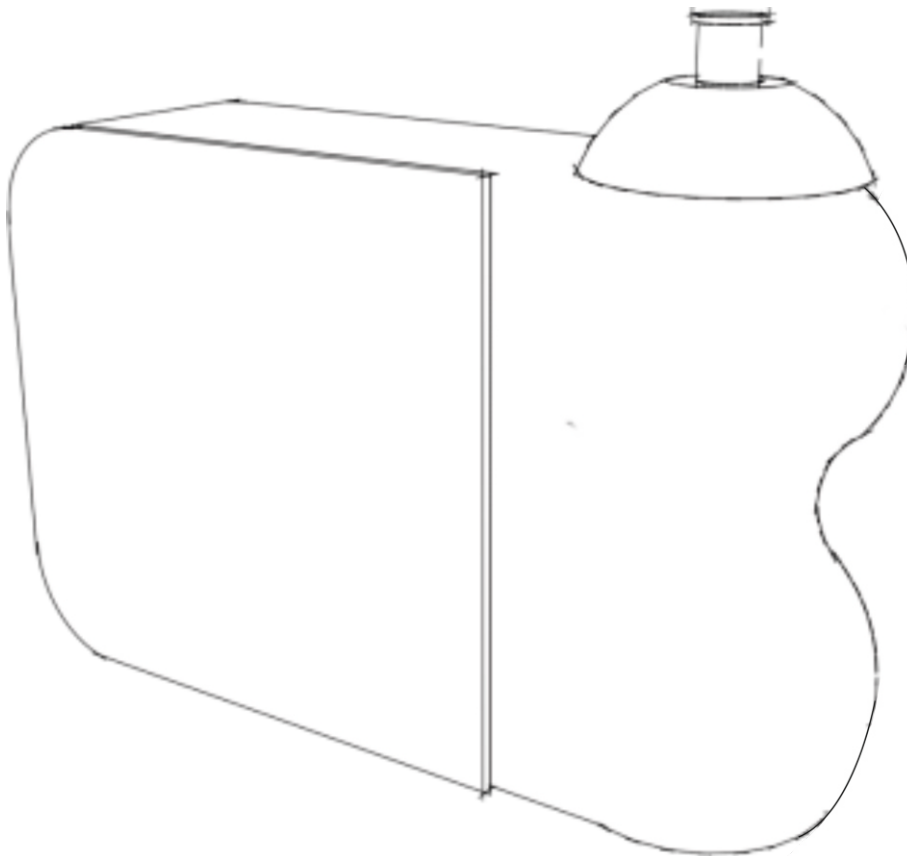
The food carrier must:

- (i) Have an ergonomically designed handle.
- (i) 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 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



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



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

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

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

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

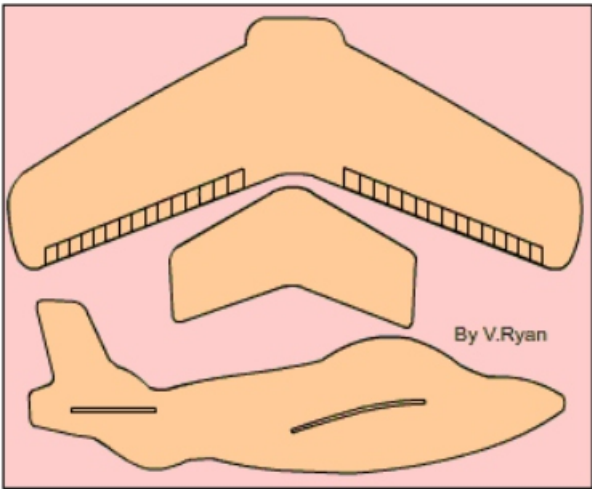
NAME:

WHY SUITABLE:

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



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:

(1 Mark)

SKETCH

NOTES (Marks) :

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**

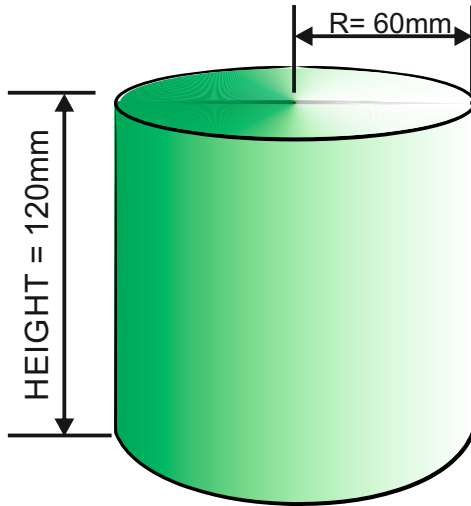
(ii) Although oxo-degradable polymers decay over several months, when buried in soil, they are derived from crude oil. What is it that allows them to decay?

2 marks

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

2 marks

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

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

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

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

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)

(ii)

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

2 marks

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

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**

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

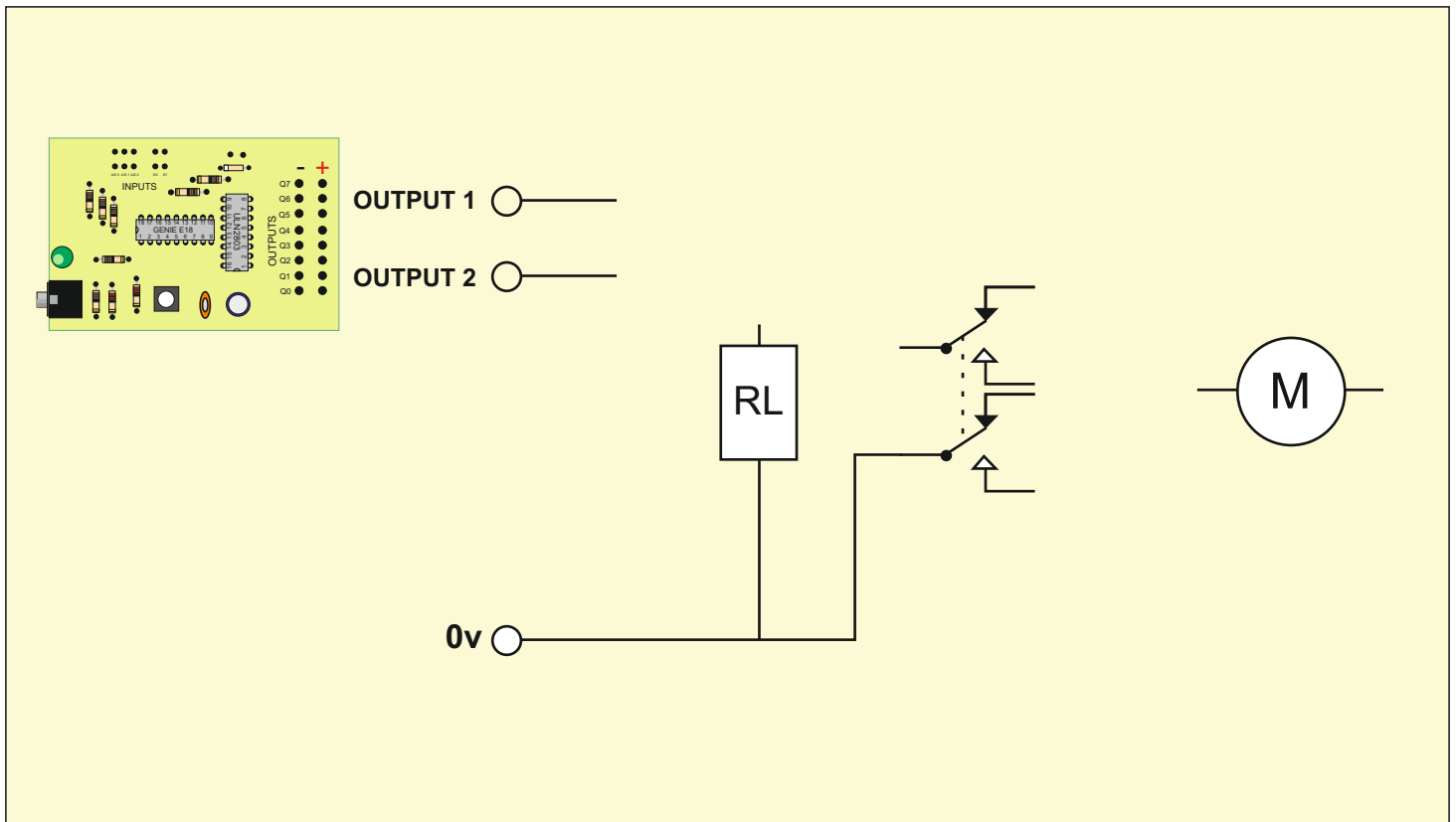
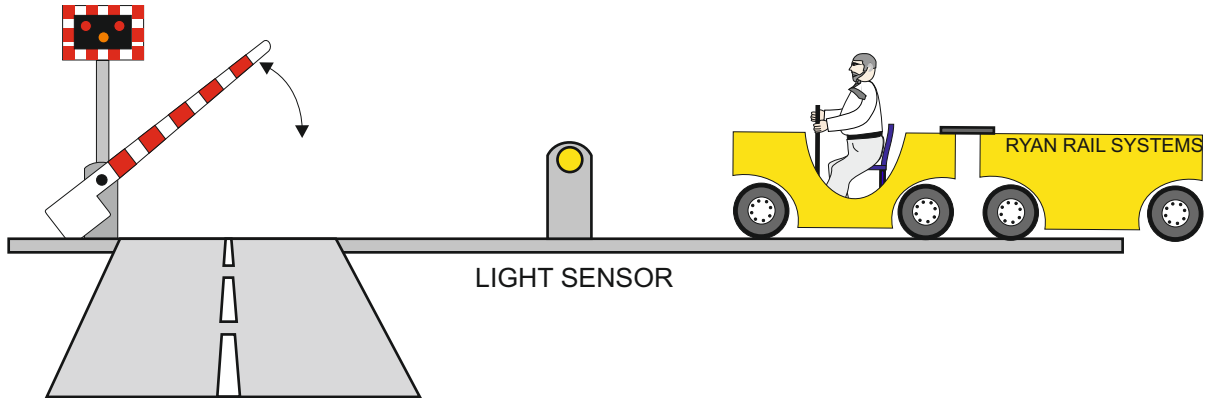
9c. The food container undergoes Quality Control and Quality Assurance during the manufacturing process. What is the difference between Quality Control and Quality Assurance? **4marks**

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.

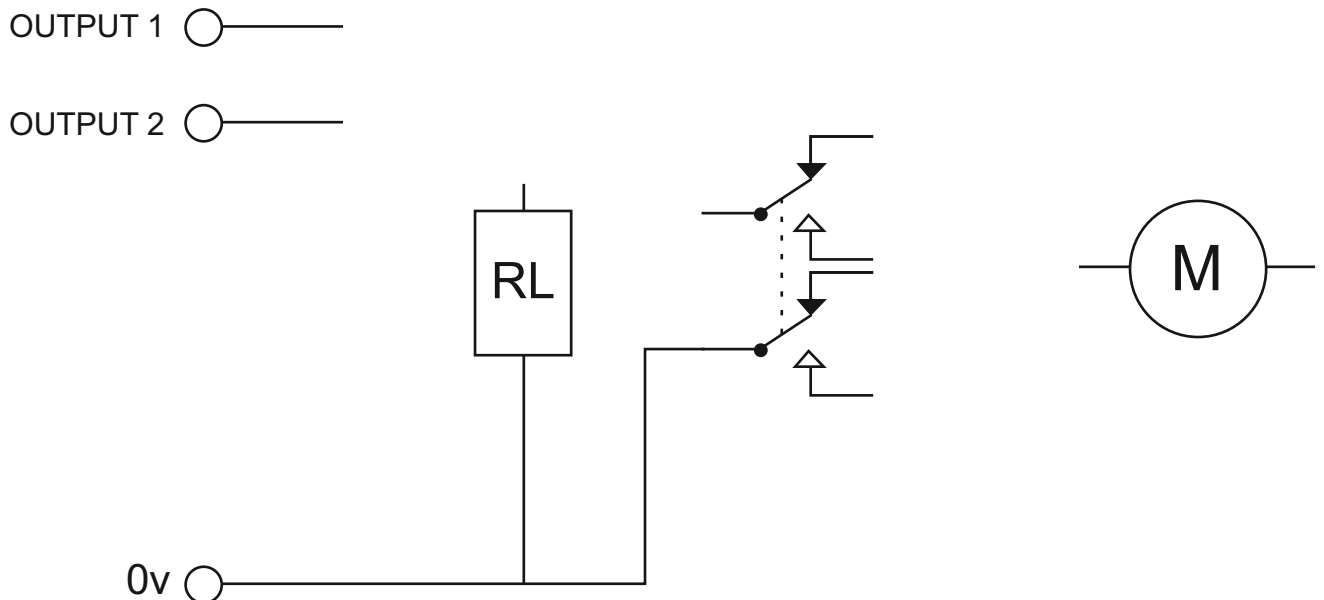
The circuit must:

- (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.

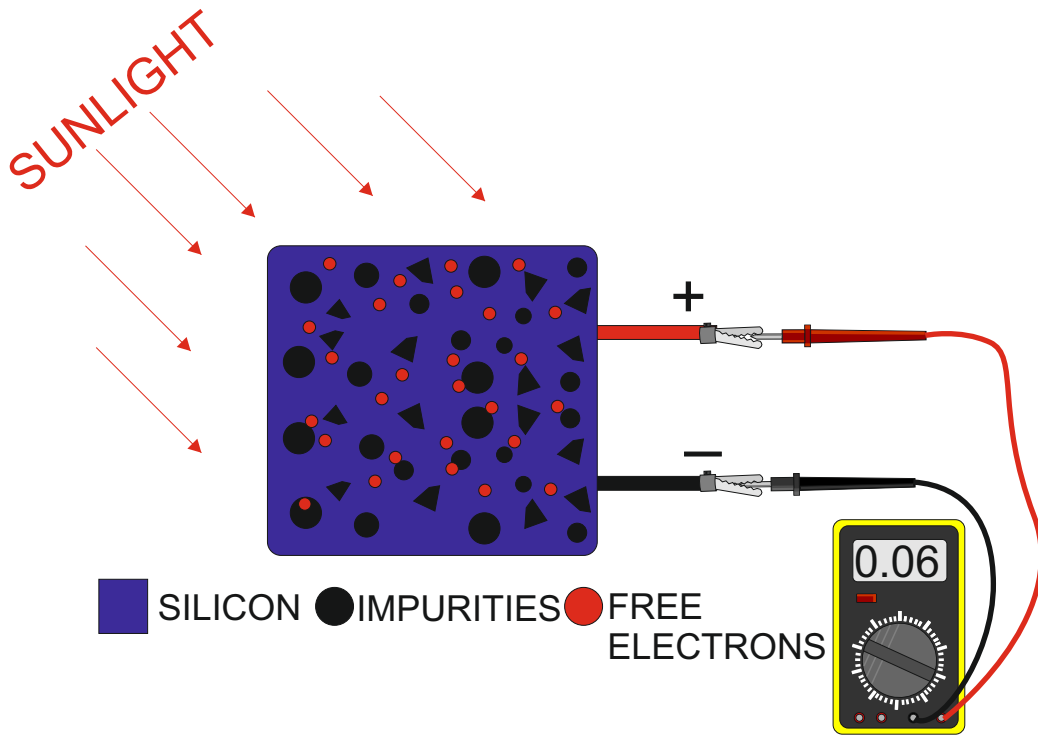
Use notes and/or sketches to show how the circuit could be modified to satisfy the addition specification points, listed above

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

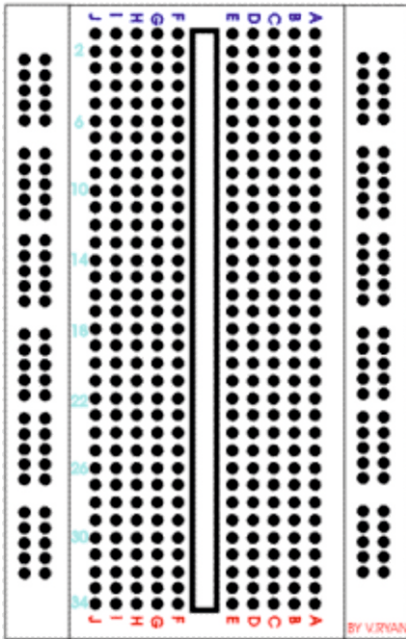
6 marks



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



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

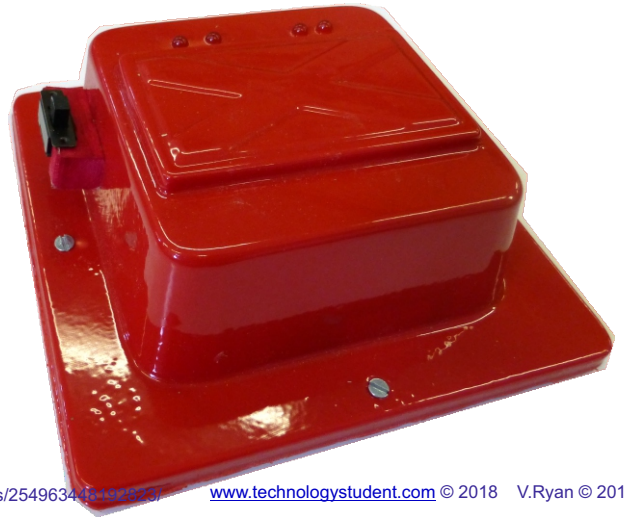


6a. The breadboard shown opposite is used to test circuits. Describe one advantage of using a breadboard. **2 marks**

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**

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

When the switch is 'on', the LEDs flash.



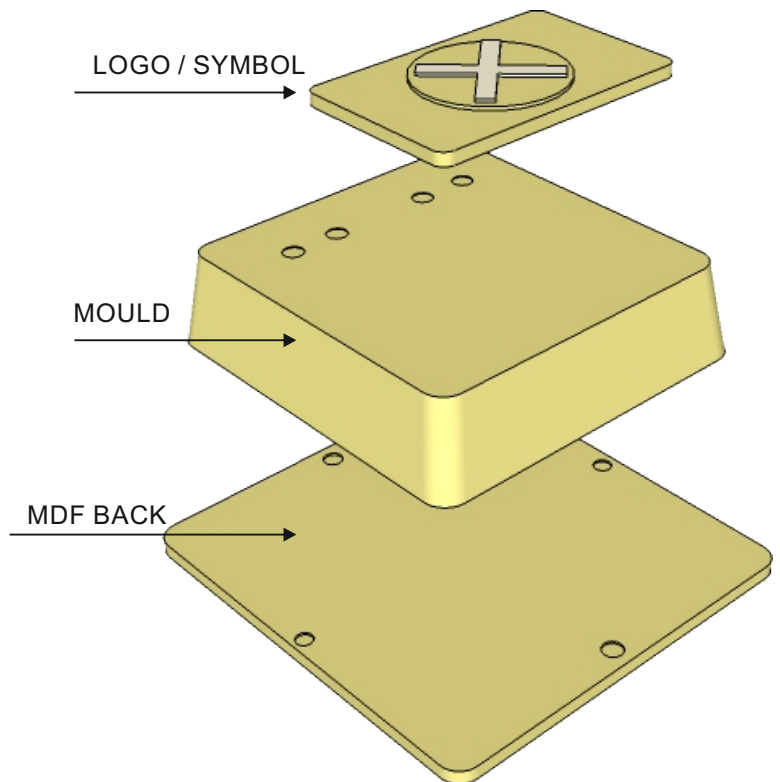
HELPFUL LINK <http://www.technologystudent.com/gprep07/vac2.html>

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

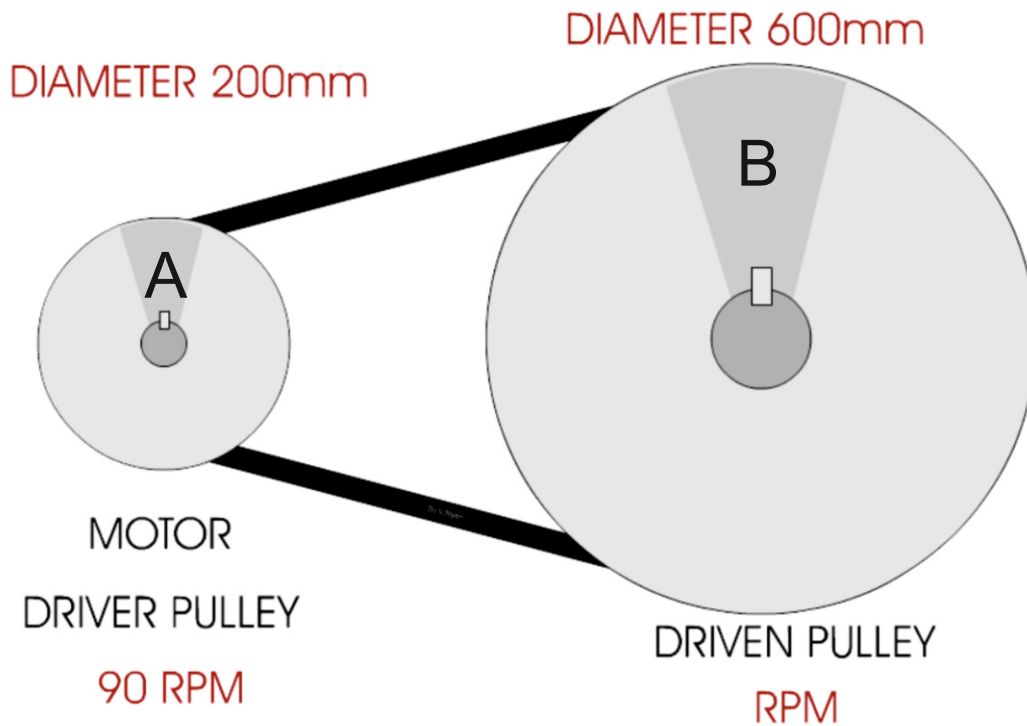
HELPFUL LINK <http://www.technologystudent.com/equip1/vacform1.htm>

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

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



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).



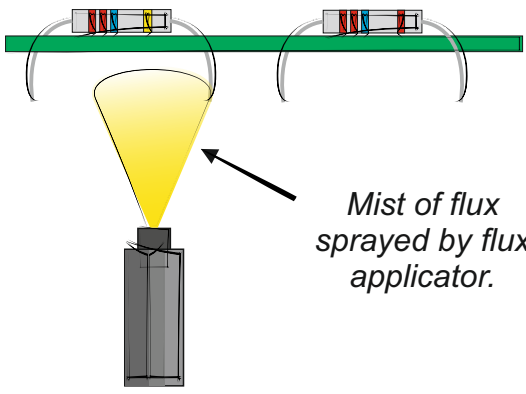
(I) Calculate the Velocity Ratio of the pulley system. Include all your working out **2 marks**

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

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.

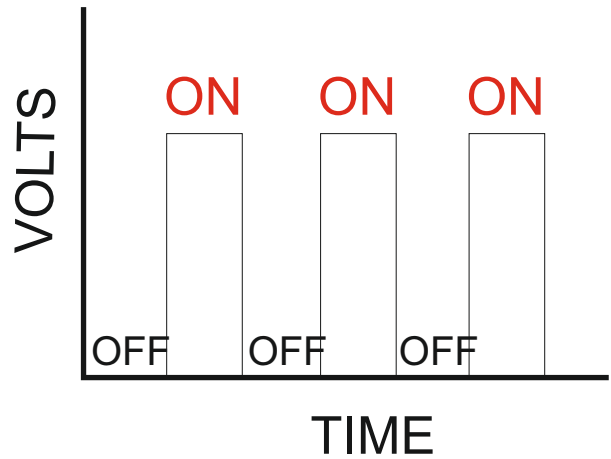
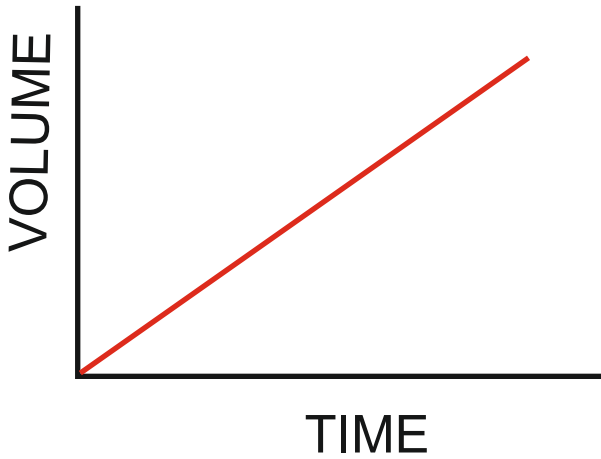
6 marks

NOTES / EXPLANATION	DIAGRAM / SKETCH
<p style="text-align: center;">APPLICATION OF FLUX</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;">HEATING OF THE CIRCUIT BOARD</p>	
<p style="text-align: center;">THE WAVE SOLDERING TANK</p>	

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

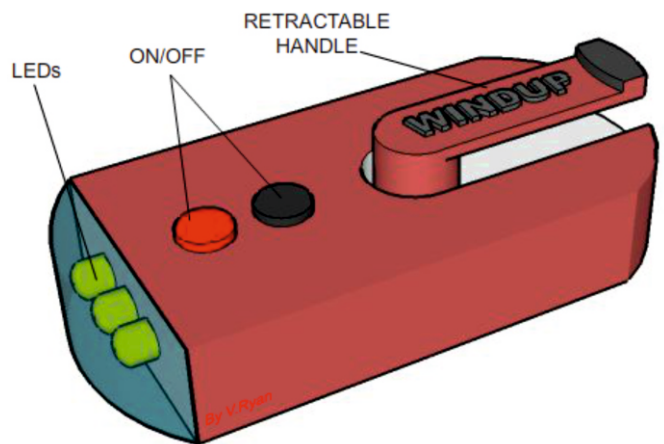
SIGNAL: _____

SIGNAL: _____

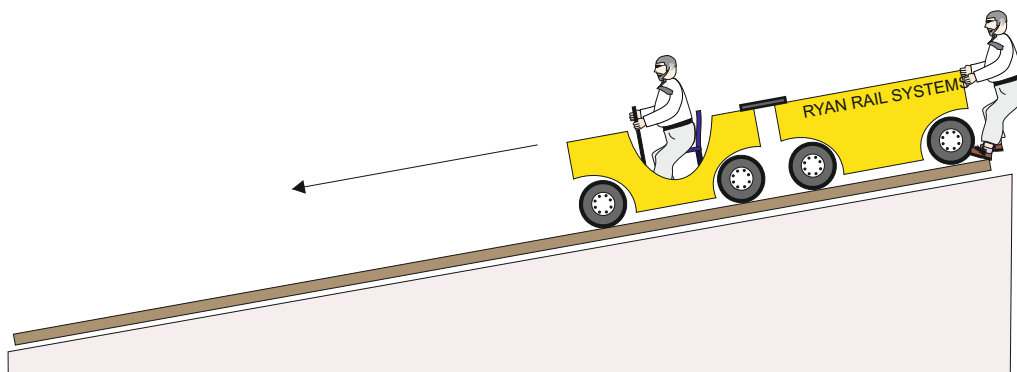


8c. A range of wind-up rechargeable devices exist, such as the torch seen opposite. Give three advantages of modern rechargeable torches.

3 marks



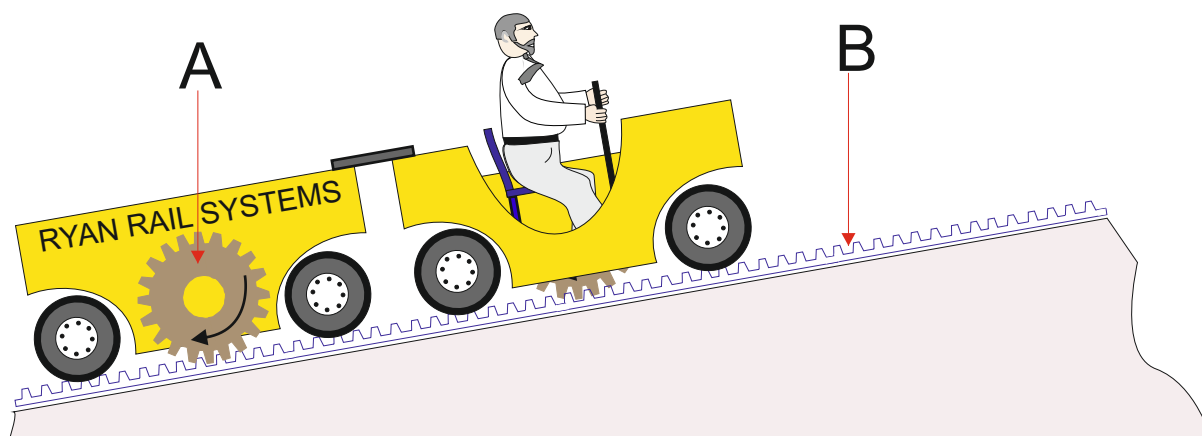
9a. The carriage of a roller coaster seen below is at the top of an incline. At any point it could roll downwards, gathering speed. What is potential energy?



(I) Potential energy is (1 mark):

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

(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 ?



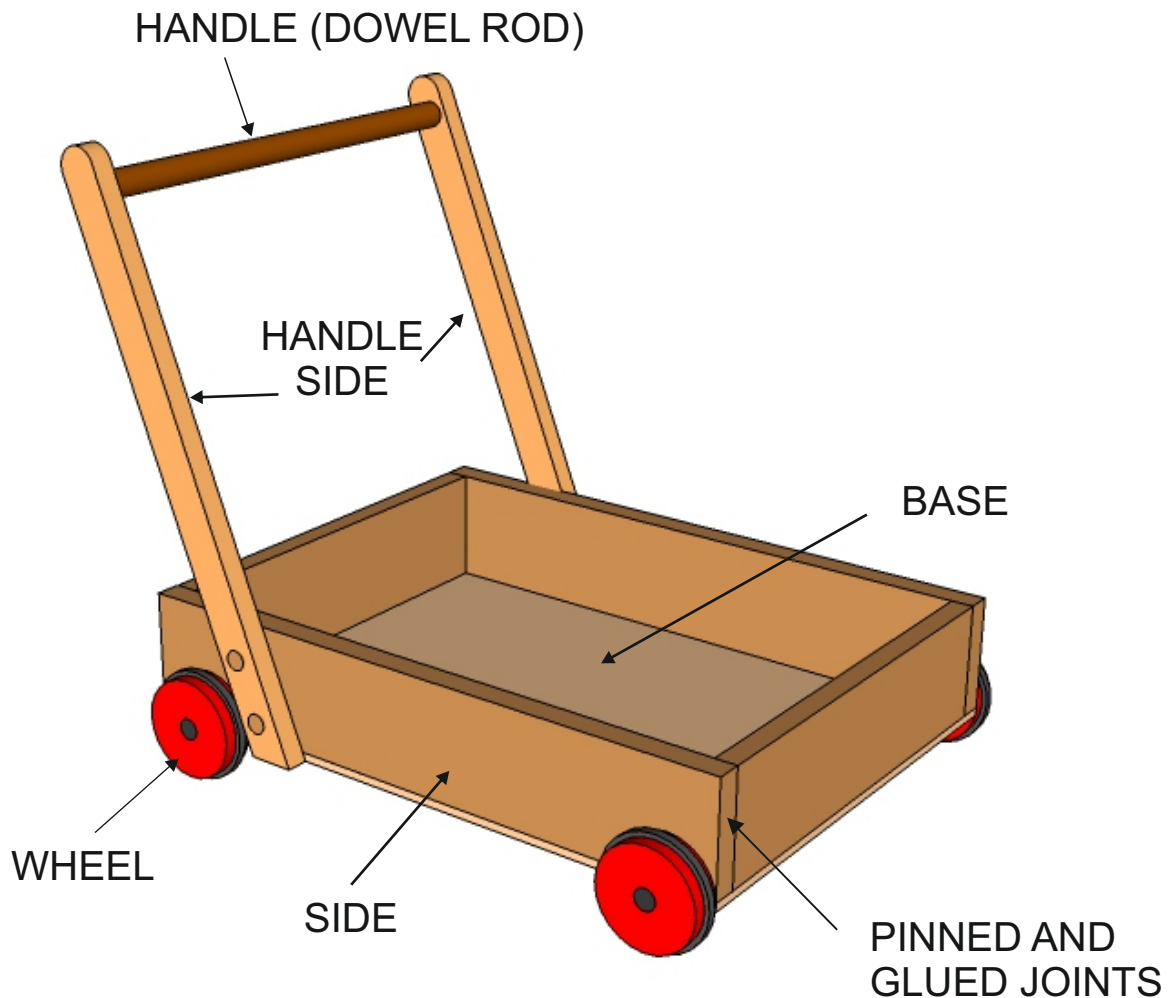
PART A: _____ 1 mark

PART B: _____ 1 mark

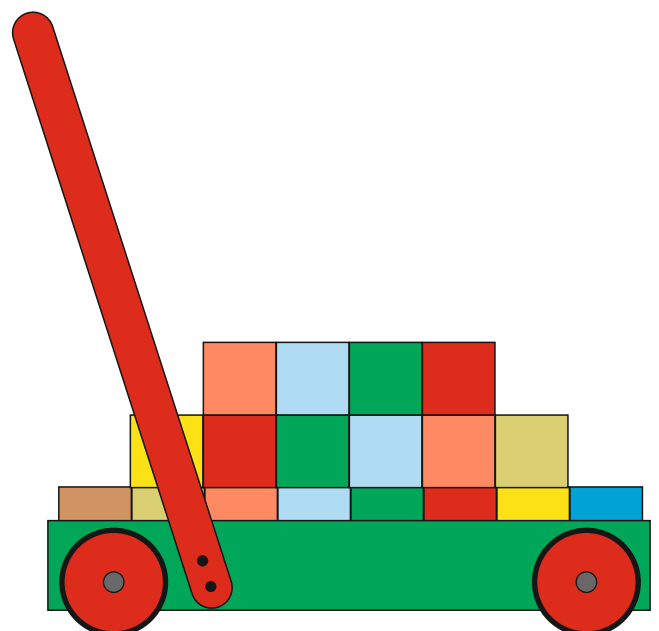
SECTION B – TIMBERS

Answer ALL questions

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.

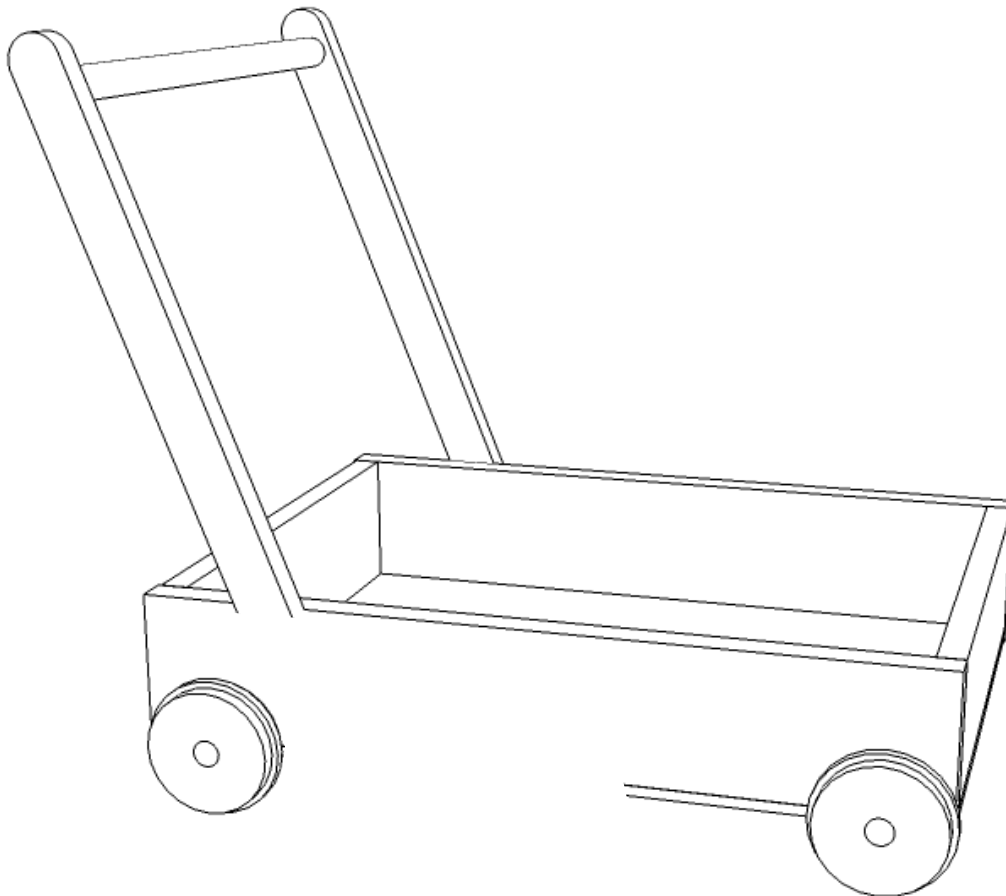
The trolley must:

- (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.

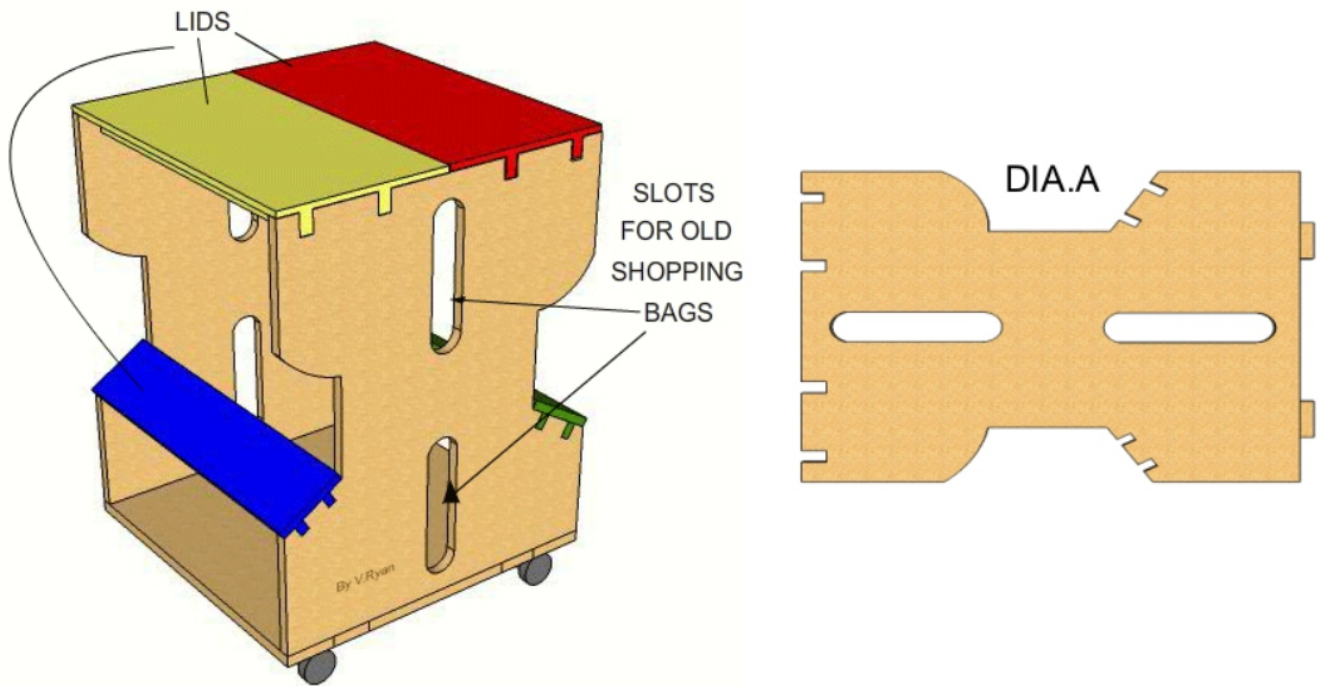
Describe TWO other ways in which this design meets the design requirements for a recycle bin.

4 marks

(I)

(II)

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

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

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.

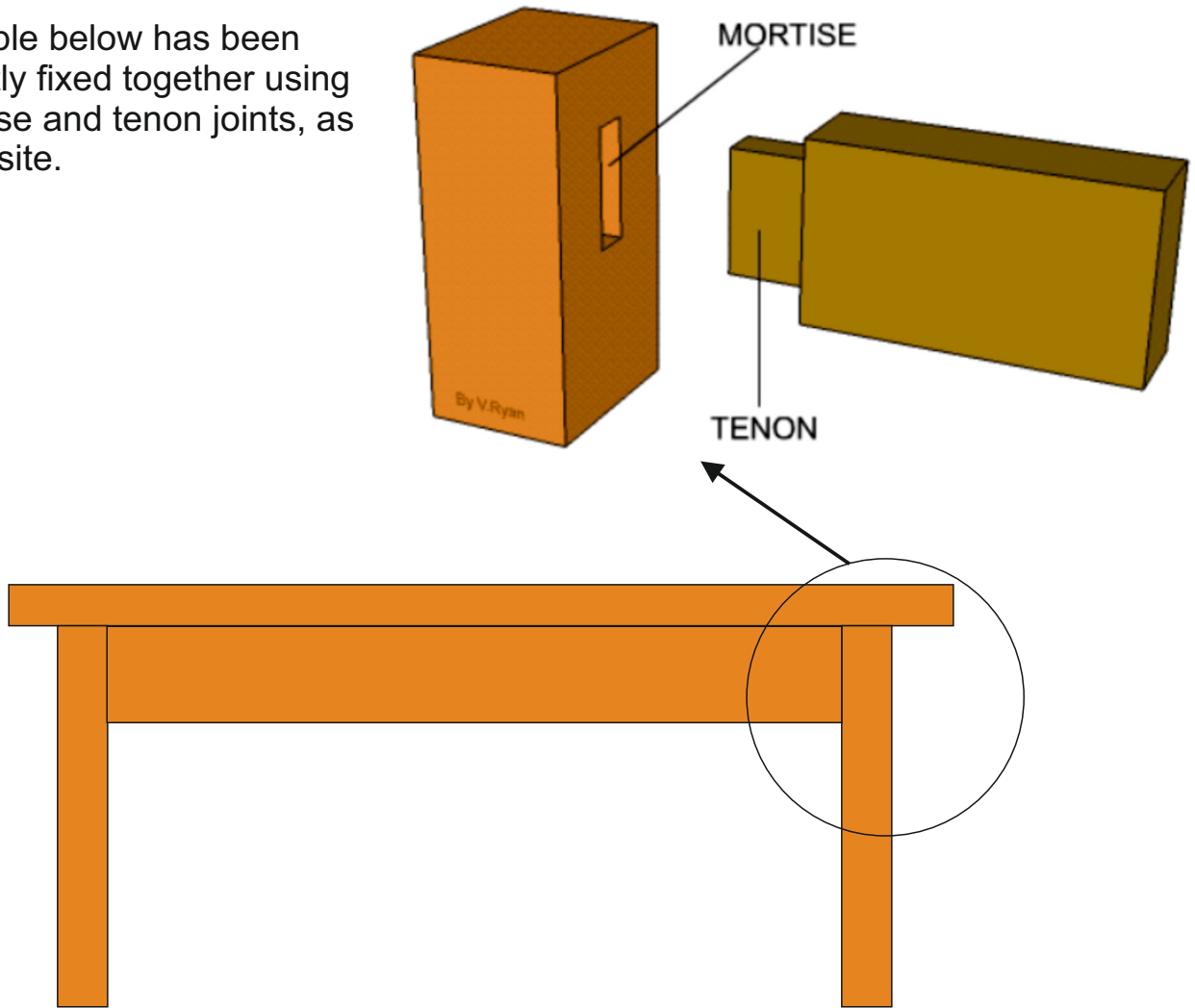
4 marks

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

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.

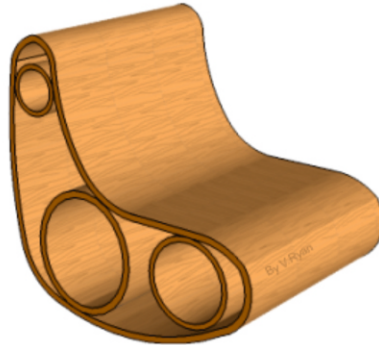
5 marks

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**

(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**

**ADD YOUR OWN TEXTILES
SPECIFIC EXAMINATION
QUESTIONS**