Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE 2012

MARKING SCHEME

MATERIALS AND TECHNOLOGY
METALWORK

HIGHER LEVEL

JUNIOR CERTIFICATE EXAMINATION, 2012

MATERIALS AND TECHNOLOGY

METALWORK – HIGHER LEVEL

MARKING SCHEME
Written Examination, Practical Examination and Project

Written Examination – Total: 100 Marks – Summary of Marks

Question 1 – Section A
(Any 5 parts)

(a) (i) Name part **A** @ 2 marks
(ii) Purpose @ 2 marks   **4 MARKS**

(b) (i) Name part **B** @ 2 marks
(ii) Function @ 2 marks   **4 MARKS**

(c) Function @ 4 marks   **4 MARKS**

(d) Any **two** problems @ 2 + 2 marks   **4 MARKS**

(e) Any **one** @ 4 marks   **4 MARKS**

(f) (i) Name **one** @ 2 marks
(ii) Description @ 2 marks   **4 MARKS**

(g) (i) **Both** components @ 1 + 1 mark
(ii) Function of **one** @ 2 marks   **4 MARKS**

Question 1 – Section B
(Any 5 parts)

(a) (i) Description @ 2 marks
(ii) **Two** steps @ 1 mark + 1 mark   **4 MARKS**

(b) (i) Description @ 2 marks
(ii) **Two** methods @ 1 + 1 mark   **4 MARKS**

(c) (i) Description @ 2 marks
(ii) Description @ 2 marks   **4 MARKS**

(d) (i) Finish @ 2 marks
(ii) Explanation @ 2 marks   **4 MARKS**

(e) Diagram @ 2 marks
Explanation @ 2 marks   **4 MARKS**

(f) Design @ 2 marks
Diagram @ 2 marks   **4 MARKS**

Question 2

(a) (i) **Two** @ 2 marks each
(ii) **Three** @ 1 mark each   **7 MARKS**

(b) (i) Elevation @ 3 marks
(ii) Design @ 2 marks, Diagram @ 2 marks
(iii) Design @ 2 marks
(iv) Metal @ 2 marks, Reason @ 2 marks
    13 MARKS

Question 3

(a) (i) Part **A** @ 1 mark, Part **B** @ 1 mark
(ii) **Two** operations @ 1 + 1 mark
(iii) **One** method @ 3 marks
(iv) Name @ 1 mark
Explanation @ 2 marks   **10 MARKS**

(b) 4 marks   **4 MARKS**

(c) (i) Tool **C** @ 2 marks, Tool **D** @ 2 marks
(ii) **One** purpose @ 2 marks   **6 MARKS**

Question 4

(a) (i) 1 mark
(ii) 3 elements @ 1 mark each
(iii) Part **A** @ 1 mark, Description @ 2 marks
(iv) Explanation @ 2 marks
(v) Name @ 1 mark, Outline @ 1 mark
    11 MARKS

(b) (i) **Two** reasons @ 1 mark each
(ii) **Three** processes @ 1 mark each
(iii) Description @ 2 marks
(iv) **One** product @ 2 marks   **9 MARKS**

Question 5

(a) (i) 3 marks
(ii) 2 marks
(iii) 3 marks
(iv) 2 marks   **10 MARKS**

(b) (i) 2 marks
(ii) 2 marks
(iii) Explanation 2 marks, Diagram 2 marks
(iv) **Two** disadvantages @ 1 mark each
    10 MARKS

Question 6

(a) (i) Metal @ 1 mark, Reason @ 2 marks
(ii) Property @ 2 marks
(iii) Labelled diagram @ 3 marks
(iv) Purpose @ 2 marks   **10 MARKS**

(b) (i) Identify @ 2 marks
(ii) **Two** properties @ 1 mark each
(iii) **Two** metals @ 1 mark each
(iv) Differences @ 2 marks
(v) Explanation @ 2 marks   **10 MARKS**

Question 7

(a) (i) Define @ 1 mark, Name @ 1 mark
(ii) **One** method @ 2 marks
(iii) **Two** explanations @ 2 marks each
(iv) Redraw @ 1 mark, three @ 1 mark each
(v) 1 mark + 1 mark   **14 MARKS**

(b) (i) **Two** ways @ 1 mark each
(ii) **One** advantage @ 2 marks
(iii) Reading @ 2 marks
    6 MARKS

Written Examination - Answer Question 1, Section A and B, and three other questions.

Note: The solutions presented are examples only.
   All other valid solutions are acceptable and are marked accordingly.

Question 1, Section A – Compulsory - *Five* parts *only* to be counted   20 marks

(a) **(i)**   Part **A** is a valve – inlet or exhaust.   *2 marks*
   (ii)   An inlet valve allows the fuel / air mixture to enter the cylinder when opened. The exhaust valve enables the burned fumes to leave the cylinder when opened. When closed the valves ensure that the fuel / air mixture can be compressed before ignition.
                              Explain the purpose @ 2 marks

4 marks

(b) **(i)**   Part **B** is the Spark Plug.   *2 marks*
   (ii)   The Spark Plug is used to ignite the compressed fuel / air mixture.   *Describe the function @ 2 marks*

4 marks

(c)   The Gudgeon Pin fits inside the piston and enables the connecting rod to be attached to the piston.   *Function @ 4 marks*

4 marks

(d)   The incorrect disposal of engine oil can lead to the pollution of rivers and streams if it enters the water table. If the oil is incorrectly disposed on land it can lead to poor soil fertility and poor crop yields.
                              *Any **two** reasons @ 2 marks each*

4 marks

(e) **(i)**   Robert Boyle - developed laws involving pressure, gas and volume.
   (ii)   James Dyson has many inventions including the bag less vacuum cleaner and the air blade hand dryer.
   (iii)   Mark Zuckerberg is the co-founder of the social networking site, facebook.
                              *Any **one** @ 4 marks*

4 marks

(f) **(i)**   Acrylic (Perspex) is a suitable material for the menu holder.   *Any suitable material @ 2 marks*
   (ii)   The menu holder is bent to shape with the aid of a hot-wire strip heater. The menu holder has three bends to be completed. The two lower bends are checked with an engineers protractor. The top bend requires the material to be folder a full 360°.
                              Description @ 2 marks

4 marks

(g) **(i)**   **C** is a light dependant resistor (LDR).   *1 mark*
            D is a variable resistor / potentiometer.   *1 mark*
   (ii)   **C** the resistance of the LDR varies as light shines on it. The LDR is frequently used in electronic circuits as a light sensor.
            D the resistance can be varied by rotating the central spindle. In a circuit with a lamp / bulb the output intensity may be made bright or dim by the rotation of the spindle.   *Any **one** function @ 2 marks*

4 marks

Five parts *only* to be counted

(a) **(i)** The slot is 8mm X 16mm. The slot can be removed by firstly drilling a diameter 8mm hole in 12mm from the left hand side. The sides are then cut in to the hole. The slot is finished by filing while ensuring not to damage the sides.
Any suitable method @ 2marks

(ii) The Right Side Panel should be secured properly before drilling.
A suitable drill speed should be selected for drilling.
Any two steps @ 1 mark each

4 marks

(b) **(i)** The R13 and R10 ends are firstly shaped using a straight snips. A rough file is then used and the finish is achieved using a smooth file to draw file the ends.
Description @ 2 marks

(ii) A good quality finish is achieved by ensuring that all rough edges are removed using a smooth file. A polish is then applied to achieve a high quality finish.
Any two methods @ 1 mark each

4 marks

(c) **(i)** The 60° and 65° bends are achieved using a bending machine set at the required angle. Alternatively the bends can be formed in a vice with a folding bar and a mallet. A protractor is used to check the angles.
Description @ 2 marks

(ii) The R50, R40 and R10 arcs produced by folding the material around an appropriately sized former, with the aid of a mallet, for each diameter.
Description @ 2 marks

4 marks

(d) **(i)** The edges of the windscreen are smooth filed. The finish is completed when the material is polished.
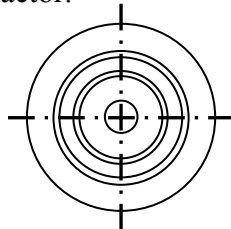*Suitable finish @ 2 marks*

(ii) A hot-wire strip is used. The material is heated and then bent to 60°. The angle is checked using an engineers protractor.
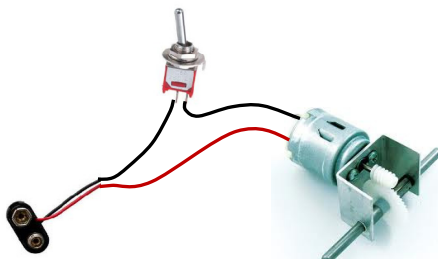*Explanation @ 2 marks*

4 marks

(e) **(i)**

Diagram @ 2 marks

(ii) The groove effect may be produced on the lathe by a combination of facing, parallel turning, drilling and taper turning.
Explanation @ 2 marks

4 marks

(f) **(i)**

Design @ 2 mark
Diagram @ 2 mark

4 marks

(a)   **(i)**   Design ideas may developed following the
'Research Ideas' stage by :
- Detailed sketching and drawing of ideas.
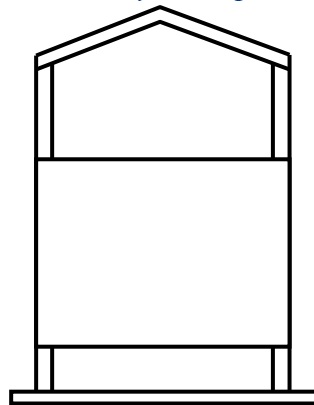- Computer modelling of ideas.
- Prototyping of ideas.

*Any **two** ways @ 2 marks each*

     (ii)   Pieces of information contained in the
production drawings may include -
- dimensions
- materials used
- assembly detail
- client details
- parts list.

*Any **three** pieces of information @ 1 mark each*

7 marks

(b)   **(i)**

Draw elevation of the bin @ 3 marks

     (ii)

Hinged Doors
(for waste removal)

Design of new bin @ 2 marks
Diagram of bin @ 2 marks

     (iii)   The bin has hinged doors, as shown, to allow for the
removal of waste.

Design of method of waste removal @ 2 marks

     (iv)   The bin could be made from stainless steel.
Stainless steel is suitable as it good corrosion
resistance and is attractive in appearance.

Any suitable metal @ 2 marks
*Any suitable reason @ 2 marks*

13 marks

(a)   **(i)**   Part **A** is a three-jaw, self-centring chuck.   *1 mark*
              Part **B** is a tailstock.   *1 mark*

      (ii)   The operations performed by the tailstock include –
- Supporting work
- Centre drilling
- Drilling
- Off centre turning

                                      *Any **two** operations @ 1 mark each*

      (iii)   The cutting tool may be correctly positioned by a number of methods including-
- Adjusting an adjusting screw on a quick change toolpost
- Extending the length of HSS tool bits when held in a tool holder
- Adjusting the amount of packing when using a 4-way toolpost
- Adjusting the angle of the rocker when using an American type toolpost.
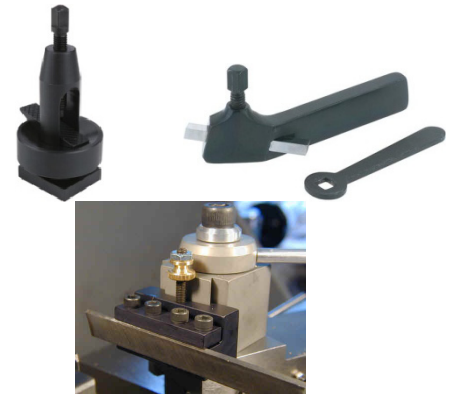
                                      *Any **one** description @ 3 marks*

      (iv)   The operation shown is Knurling.
                         Identification of operation @ 1 mark

The knurling tool shown has three pairs of wheels allowing for three grades of diamond knurl to be produced. The work is rotated at slow speed and the pair of wheels are pressed against it. The wheels then rotate with the work producing the diamond grip finish required.
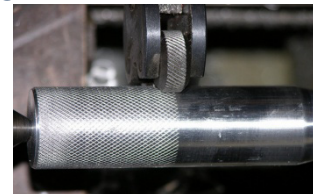
                                Explanation of operation @ 2 marks

                                        10 marks

(b)   The speed is 2800 RPM
                           Correct substitution @ 2 marks   **4 marks**
                           Correct calculation @ 2 marks

(c)   **(i)**   Tool **C** is a centre or slocombe drill.   *2 marks*
              Tool **D** is an odd leg callipers.   *2 marks*

      (ii)   A ***centre drill*** is used for starting the holes when drilling on the lathe.

              An ***odd leg callipers*** is used to mark distances on round bars on the lathe. It may also be used to scribe parallel lines to straight edges or to locate the centre of a round bar.   **6 marks**
                                *Any **one** purpose @ 2 marks*

(a) **(i)** The furnace is a basic oxygen furnace.   *1 mark*

(ii) The charge is made up of the following materials;
- Molten Iron
- Scrap metal
- Lime.

3 elements @ 1 mark each

(iii) Part **A** is an oxygen lance.   *1 mark*
The lance is water cooled. While the lance is
lowered into the furnace for the blow, a flow
of water runs down the lance, keeping it cool
and preventing it from melting.

Description @ 2 marks

(iv) Part **B** is the fume hood. This sits over the furnace
during operation. The toxic gasses produced by
the furnace are safely removed by being sucked
up by the fume hood.

Explanation of the purpose @ 2 marks

(v) Molten steel is produced by the basic oxygen
furnace.   *1 mark*
The molten steel is removed by rotating the
furnace and pouring the steel out the pouring
spout.   *Explanation @ 1 mark*

11 marks

(b) **(i)** Materials are heat treated to improve their
mechanical properties.
Materials are heat treated to allow them to be
worked, rolled or drawn.   *Any **two** reasons @ 1 mark each*

(ii) Heat treatment processes include –
- Hardening
- Tempering
- Annealing
- Normalising.   *Any **three** processes @ 1 mark each*

(iii) Hardening – a piece of high carbon steel is
heated to a cherry red. It is then quenched
rapidly in water or oil to make the steel hard.
The hard steel will also be brittle and may
need to be tempered to make it suitable for
use.   *Description @ 2 marks*
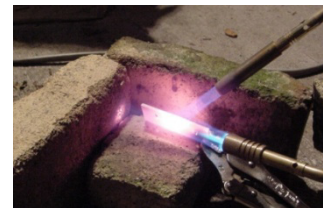
(iv) Cold chisels, drill bits, screw cutting taps and
hacksaw blades are all heat treated before they
are suitable for use.

*Any **one** product @ 2 marks*

9 marks

Question 5   20 marks

(a)   **(i)**   The safety features featured in a modern car, but not in a vintage car, include –
- Hazard warning lights
- Air bags
- Side impact protection
- Rear and side view mirrors.   *3 marks*

     (ii)   The wheels on the vintage car have spokes while on a modern car wheels tend to be in the form of a solid drum. Tyres on the vintage car are solid rubber while on the modern car tyres are air filled (pneumatic).   *2 marks*

     (iii)   The design features featured in a modern car, but not in a vintage car, include –
- Fully enclosed body
- Better aerodynamics
- Air conditioning
- Built-in entertainment system.   *3 marks*

     (iv)   The vintage car was mainly made from metal which allowed for parts to be recycled easily. The modern car uses a wide range of materials which has a greater impact on the environment. Modern cars use a catalytic converter to reduce the effects of exhaust fumes.   *2 marks*

     10 marks

(b)   **(i)**   The drive mechanism shown is a belt and pulley system.   *2 marks*

     (ii)   200 RPM.   *2 marks*

     (iii)   The direction of rotation of the driven is reversed by simply crossing the belt before fitting it around the driven pulley.
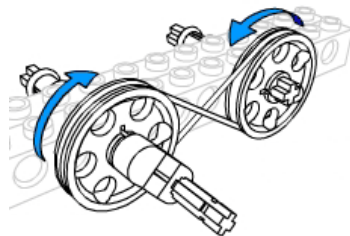
Explanation @ 2 marks
Diagram @ 2 marks

     (iv)   Disadvantages of a belt and pulley mechanism include –

- Loss of mechanical efficiency due to the belt slipping.
- The belt is prone to wear and may break.
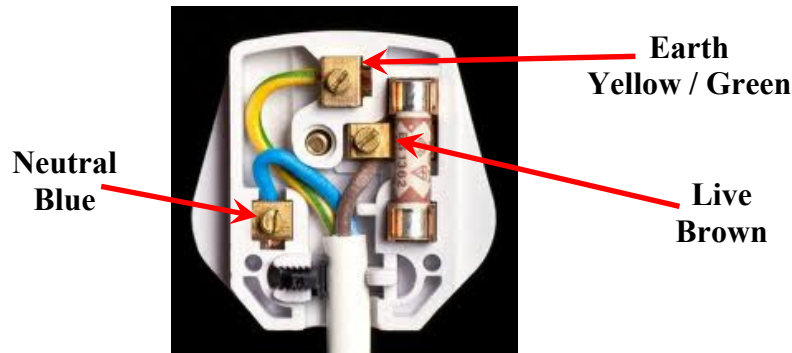
*Any **two** disadvantages @ 1 mark each*

     10 marks

(a) **(i)** Brass is a suitable material for the pin   *1 mark*
Brass is a good conductor making it suitable for the pin.   *2 marks*

(ii) The material for the plug casing should be a good insulator.   *2 marks*

(iii)

Earth
Yellow / Green

Neutral
Blue

Live
Brown

Labelled diagram @ 3 marks

(iv) The purpose of the fuse is to protect the appliance connected to the plug. In the event of an electrical surge the fuse will blow   *2 marks*

10 marks

(b) **(i)** The soldering iron shown is an electrical soldering iron.   *2 marks*

(ii) Properties of soft solder include –
- Low melting point
- Good electrical conductor
- Soft.   *Any **two** properties @ 1 mark each*

(iii) The metals used to make soft solder include –
- Lead
- Tin
- Antimony.   *Any **two** metals @ 1 mark each*

(iv) The main differences between passive and active flux include –
A passive flux is protective and prevents oxidation during soldering.
An active flux firstly removes oxides (cleans) and then prevents further oxidation during soldering.   *Differences @ 2 marks*

(v) Silver solder is also known as hard solder. Silver solder is an alloy of silver, copper and zinc. Silver solder has a melting point of between 680° and 800°, depending on the composition.   *2 marks*

10 marks

(a) **(i)** Computer hardware refers to the physical parts of the computer. *1 mark*

Computer hardware devices include –
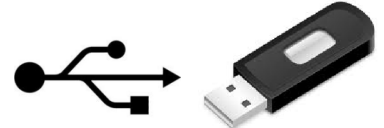
- Monitor
- CPU
- Mouse
- Keyboard. *1 mark*

(ii) Personal information may be protected by –

- Password protection
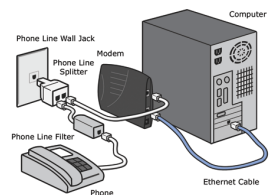- Encryption. *Any **one** method @ 2 marks*

(iii) **USB** – stands for universal serial business connection. This is a means of connecting devices to a computer.

RAM – stands for random access memory. This is a form of temporary memory storage on a computer. Data stored in RAM is lost when the computer is switched off.

Modem – A modem is a device in a computer which enables the computer to connect to the internet.

Skype – is a free telephone / video communication system which is operated via a computer and the internet. *Any **two** @ 2 marks each*

(iv)

Name	Input/Output	Application
VDU	Output	Display information on the screen
Scanner	Input	Copy a document onto the computer
Keyboard	Input	Type in information

Redraw @ 1 mark
***Three** answers @ 1 mark each*

(v) Advantage – computer systems can monitor pollution, radiations, weather etc. *1 mark*

Disadvantage – machines need to be replaced frequently. Large amounts of packaging waste is also produced by the supply of new computer *1 mark*

14 marks

(b) **(i)** The Vernier Callipers and be used to measure –

- External dimensions
- Internal dimensions
- Depth. *Any **two** ways @ 1 mark each*

(ii) The Vernier Callipers is versatile and very accurate *Any **one** advantage @ 2 marks*
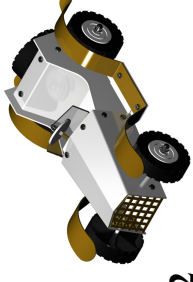
(iii) 19.55mm *2 marks*

6 marks

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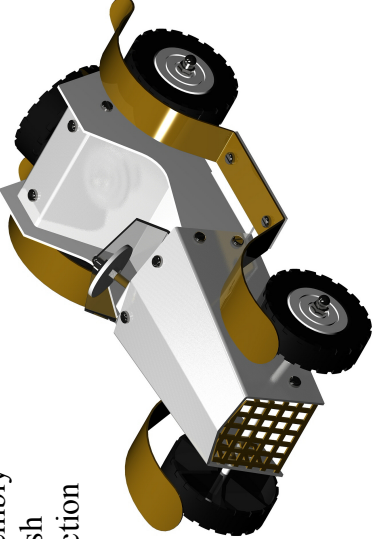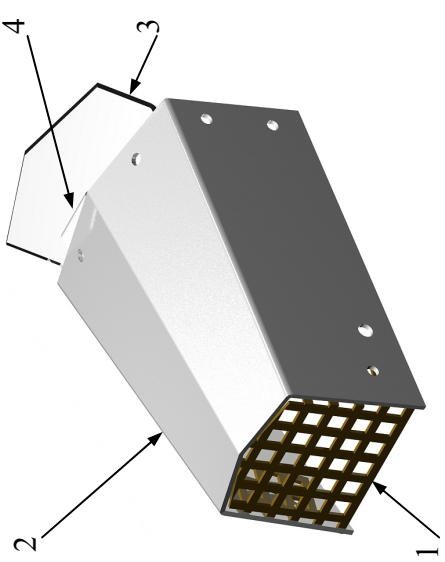
Subjective Marking 1-10	9-10 Excellent	7-8 Very Good	5-6 Good	3-4 Poor	1-2 Very Poor
Subjective Marking 1-5	5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor

Section	Part Number	Pictorial Sketch / Description	Concept		Description	Mark	Marks
1	Parts 1, 2, 3, 4, 5, 6 & 7		Complete Piece		Assembly: Subjective Marking 1-5	5	20
					Finish: Subjective Marking 1-5	5	
					Function: Subjective Marking 1-10	10	
2	Parts 1 & 2		Part 1 Backplate	12	Mark Out & Shape	6	20
					Holes	6	
			Part 2 Front Cover	8	Mark Out & Shape	4	
					Holes	4	
3	Part 3		Part 3 Bottom Housing		Mark Out	4	20
					Ø48 mm Hole & 26 mm Width	12	
					Lengths & Holes	4	
4	Parts 4, 5 & 7		Part 4 Rotor	5	Ø30 mm and CSK Hole	5	20
			Part 5 Vane	6	Profile	6	
			Part 7 Knob	9	Lengths	4	
					Diameters & Tapped Hole	5	
5	Part 6		Part 6 Top Housing		Mark Out	5	20
					Slot	5	
					R24 mm Profile	6	
					Lengths & Holes	4	

100 Marks (× 1.5 = 150 Total)

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State Examinations Commission
Junior Certificate Higher Level Metalwork Project - Marking Scheme 2012

Subjective Grading 1-10	9-10 Excellent	7-8 Very Good	5-6 Good	3-4 Poor	1-2 Very Poor
Subjective Grading 1-5	5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor

Section	Part Number	Pictorial Sketch/Description	Concept		Mark	Marks
1	**Complete Model** (Design Element not included)	Assembly Finish Function	**Assembly:** Subjective Grade 1-10		10	20
			Finish: Subjective Grade 1-5		5	
			Mechanical Function:		5	
2	**Design**	Design and attach a **Transmission Unit**, to drive the model. This assembled unit may consist of a motor, simple gearbox, gear train or pulleys. The power source for the unit, controlled by an **on/off** switch may be battery or solar powered.	**Electro-Mechanical Design:** Subjective Grade 1-10		10	20
			Make: Subjective Grade 1-5		5	
			Attach: Subjective Grade 1-5		5	
3	**Parts 1, 2, 3 & 4**		**Part 1** Grill	4	**Mark Out, Shape & Bend**	4	20
			Part 2 Bonnet	10	**Mark Out**	2	
					Drill	3	
					Shape	3	
					Bend	2	
			Part 3 Windscreen	3	**Mark Out, Drill, Shape & Bend**	3	
			Part 4 Steering Wheel Bracket	3	**Mark Out, Drill, Shape & Bend**	3	

4	Parts 5, 6, 7 & 8					20
		Part 5 Seat/Rear Panel	6	Mark Out, Drill, Shape & Bend	6	
		Part 6 Mudguard (*right*)	6	Mark Out, Drill, Shape & Bend	6	
		Part 7 Mudguard (*left*)	6	Mark Out, Drill, Shape & Bend	6	
		Part 8 Seat Bracket × 2	2	Mark Out, Drill, Shape & Bend	2	
5	Parts 9, 10 & 11					20
		Part 9 Steering Wheel & Wheel Embellisher × 5	4	Drill, Face, Groove & Part	4	
		Part 10 Right Side Panel	8	Mark Out & Drill	4	
				Shape & Bend	4	
		Part 11 Left Side Panel	8	Mark Out & Drill	4	
				Shape & Bend	4	

100 Marks (× 1.5 = 150 Total)