



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE 2010

MARKING SCHEME

MATERIALS AND TECHNOLOGY
METALWORK

HIGHER LEVEL

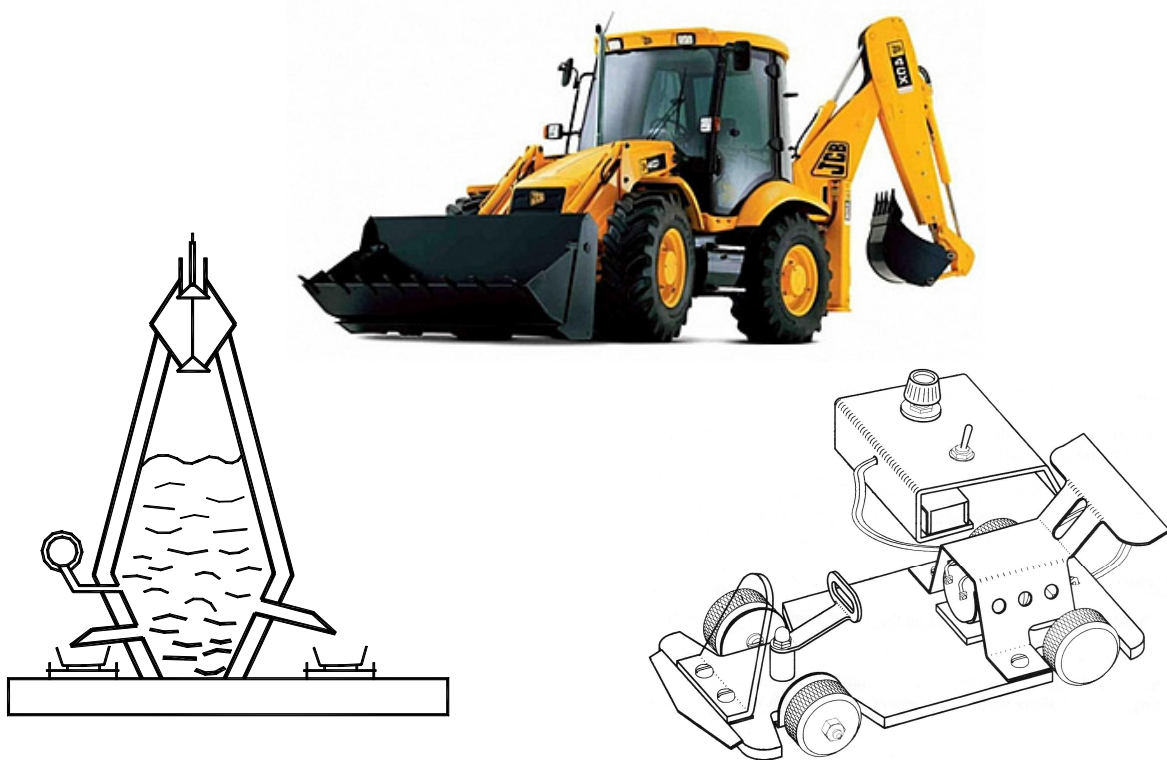
JUNIOR CERTIFICATE EXAMINATION, 2010

MATERIALS AND TECHNOLOGY

METALWORK – HIGHER LEVEL

MARKING SCHEME

**Written Examination, Practical Examination
and Project**



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 One – Section A

20 Marks

Five parts only to be counted

- (a) (i) Part A is the Piston. 2 marks
- (ii) Aluminium or Aluminium alloy would be a suitable material from which to make the Piston. 2 marks **4 Marks**
- (b) (i) Part B is the Connecting Rod (Con Rod). 2 marks
- (ii) Part B is used to connect the Piston to the Crankshaft. 2 marks **4 Marks**
- (c) The Crankshaft is connected to the Pistons. The Pistons are forced to move up and down by the ignition of the fuel / air mixture. This motion is converted to circular motion at the Crankshaft which in turn is transmitted to the wheels of the vehicle. 4 marks **4 Marks**
- (d) The Camshaft is in contact with the end of the Valves. As the cam rotates, its shape forces the Valve to open. The cam continues to rotate and a spring helps the Valve to close. 4 marks **4 Marks**
- (e) (i) Mary Anderson – invented windscreen wipers;
- (ii) Alessandro Volta – invented the electric battery;
- (iii) Linus Yale– invented the Yale lock. 4 Marks
- Any one @ 4 marks each*
- (f) (i) Metals which contain Iron are known as ferrous metals, while metals which do not contain Iron are non-ferrous metals. 2 marks
- (ii) Aluminium, Copper, Zinc, Lead and Tin are examples of non-ferrous metals 4 Marks
- Any two non-ferrous metals @ 1 mark each*
- (g) (i) The component on the left is a Resistor. 1 mark
- The component on the right is a Transistor. 1 mark
- (ii) A resistor restricts the flow of current in a circuit and is used to protect components such as LED's and transistors. 4 Marks
- A Transistor acts as an electronic switching device in a circuit. Any one function @ 2 marks

Question One – Section B

20 Marks

Five parts only to be counted

- (a) (i) The Chassis measures 184mm X 94mm X 5mm. 2 marks
- (ii) Five 6mm holes are drilled as required. An ABRA file is then used to roughly cut out the shape. The slot is then filed to shape and is given a draw file finish. *Any suitable description @ 2 marks*

4 Marks

- (b) (i) Precautions to be taken when drilling acrylic include:-
- Secure the piece in the vice
 - Support the acrylic with a piece of wood
 - Select the most suitable drill speed
 - Apply a suitable feed rate.
- Any two @ 1 mark each*

- (ii) A good quality finish on the acrylic Chassis is achieved by keeping the protective coating on the acrylic while working on it. The edges are smooth file finished and sharp edges are removed before a polish finish is applied. 2 marks

4 Marks

- (c) (i) A Knurl finish is formed on cylindrical bars. The workpiece is rotated at slow speed and a pair of wheels from a knurling tool are pressed against the work creating a diamond or straight pattern. 2 marks

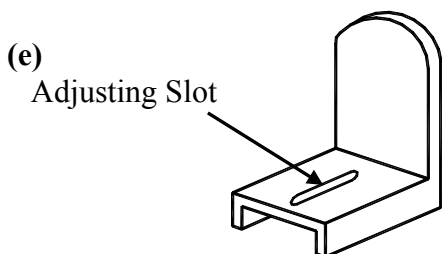
- (ii) The 2 X 45° taper is achieved by setting the top slide at 45° and taking a series of cuts until a 2mm cut has been completed. 2 marks

4 Marks

- (d) (i) The DPDT (double pole, double throw) switch is a switch which will allow the motor to rotate in forward and reverse. This enables the Go-Kart to go forwards and backwards. 2 marks

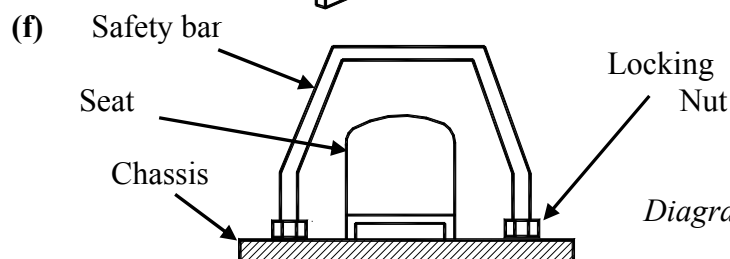
- (ii) The potentiometer is also known as a variable resistor. This allows the amount of current flowing to the motor to be raised or lowered making the Go-Kart to go fast or slow. 2 marks

4 Marks



Suitable design 2 marks
Suitable diagram 2 marks

4 Marks



Suitable design 2 marks
Diagram of attachment 2 marks

4 Marks

Question Two

20 Marks

(a) (i) Sources of information may include -

- People
- Library
- Books
- Magazines
- Internet
- Other relevant sources.

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

(ii) Factors to be considered at the “Evaluation” stage include-

- How well the solution functions
- Does it satisfy the original brief criteria
- Quality of finish
- Possible improvements which could be made
- Any other relevant factors.

7 Marks

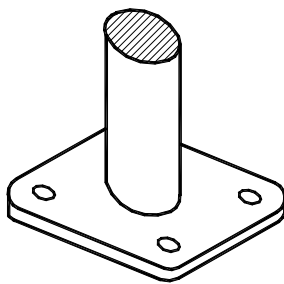
*Any **two** factors @ 2 marks each*

(b) (i)



*Any suitable design @ 2 marks
Diagram of the design @ 3 marks*

(ii)



*Any suitable method to secure @ 2 marks
Diagram of the method to secure @ 2 marks*

(iii) Suitable metals may include Stainless steel, Steel or Brass.

Any suitable metal @ 2 marks

(iv) Finish will depend on metal named. For Steel it should be painted or galvanised, Stainless steel or Brass may be polished.

Any suitable finish @ 2 marks

13 Marks

Question Three

20 Marks

(a) (i) Tool height B is correct. 4 marks

(ii) B is the correct tool height for the following reasons-

- To ensure the work is cut to the center
- To maintain the correct rake and clearance angles
- Ensures good quality finish.

8 Marks

Any two suitable reasons @ 2 marks each

(b) The speed is 2500RPM.

*Correct substitution 2 marks, calculation 2 marks OR
Correct answer 4 marks*

4 Marks

(c) (i) Facing – the tool is moved at right angles to the axis of rotation of the work, producing a flat surface.

Parallel Turning – the tool move parallel to the axis of rotation, producing a cylinder of reduced diameter.

(ii) Tool Holder – these are used for holding tool bits.

Toolpost – this is mounted on the top slide and carries the tool holder.

(iii) Rake Angle – this angle facilitates the removal of the chip being cut.

Clearance Angle – this ensures that only the cutting edge of the tool comes into contact with the work.

*Best part answered @ 3 marks + 3 marks
Second part answered @ 1 mark + 1 mark*

8 Marks

Question Four

20 Marks

(a) (i) The Blast furnace is shown. *1 mark*

(ii) The charge is made up of coke, limestone and iron ore. *3 marks*

(iii) The double bell charging system helps to prevent heat loss. When charging, the first bell is open, then it is closed. The second bell is then opened to let the charge into the furnace. The second bell closes when the charge is fully in the furnace. This system ensures that the top of the furnace remains sealed, thus preventing heat loss. *3 marks*

(iv) The Basic Oxygen Furnace and the Electric Arc Furnace are steel producing furnaces. *Any two furnaces @ 1 mark each*

9 Marks

(b) (i) Hardness is the ability of a material to resist wear, scratching and indentation.

(ii) Conductivity is the ability of a material to allow heat or electricity to flow through it.

(iii) Ductility is the ability of a material to be permanently stretched.

(ii) Elasticity is the ability of a material to return to its original shape when released from a force. *Any two @ 3 marks each*

6 Marks

(c) (i) Heat treatment processes include, Hardening, Tempering, Annealing, Stress Relieving, Case Hardening and Normalising.

Any two processes @ 1 mark each

(ii) Example – Hardening of high carbon steel:
The steel is heated to a cherry red and then cooled rapidly making it hard and brittle. The exact temperature depends on the carbon content. Quenching media include water, oil and brine. *Any suitable description @ 3 marks*

5 Marks

Question Five

20 Marks

- (a) (i) The Windscreen is made from glass; *1 mark*
The Tyres are made from rubber; *1 mark*
The Bucket is made from high carbon steel. *1 mark*

- (ii) Glass is suitable for the Windscreen as it is transparent; *1 mark*
Rubber is suitable for the tyre as it has a good coefficient of friction and allows the wheels to be inflated. Rubber is also a good insulator; *1 mark*
High Carbon Steel is suitable for the bucket as it is hard and has good wear resistance. *1 mark*

- (iii) Safety features include-
- Warning flashing lights
 - Hydraulic stabilisers
 - Reversing warning siren
 - Any other relevant safety feature.
- Any two safety features @ 1 mark each*

- (iv) Recycling of parts could include-
- Melting and recasting of metal parts
 - Converting of rubber tyres into tiles suitable for a children's play area
 - Any other relevant method of recycling.
- Any two suitable types of recycling @ 1 mark each*

10 Marks

- (b) (i) A bevel gear and worm and wormwheel drive mechanisms are shown. *Name one drive mechanism @ 2 marks*

- (ii) This type of drive mechanism may be used to transmit drive from an axle to another at 90°. *Any suitable application @ 2 marks*

- (iii) Lubricants are used for the following reasons-
- Reduces wear
 - Reduces friction
 - Keeps the surface cool
 - Noise reduction.
- Any two suitable reasons @ 2 marks each*

- (iv) Oil or grease may be suitable lubricants. *Any suitable lubricant @ 2 marks*

10 Marks

Question Six

20 Marks

- (a) (i) Terminal A is the neutral. *1 mark*
Terminal B is the live. *1 mark*
Terminal C is the earth. *1 mark*
- (ii) The neutral wire is blue. *1 mark*
The live wire is brown. *1 mark*
The earth wire is green and yellow. *1 mark*
- (iii) The fuse will blow if there is an electrical surge.
This will prevent the appliance attached to the plug
from being damaged by the electrical surge. *2 marks*
- (iv) Part D is a clip which holds the electrical flex in
place. *2 marks*

10 Marks

- (b) (i) Lead and Tin are the two main alloying metals of
Solder. *Name any two alloys of solder @ 1 mark each*
- (ii) Soft Solder has a low melting point (183°).
Soft Solder is a good conductor of heat and
electricity. *Any two suitable properties @ 1 mark each*
- (iii) Flux cleans the joint and prevents oxidisation
during the soldering process. *2 mark*
- (iv) 110V stands for 110 volts. This is the value of the
force driving the current in the electrical circuit. *1 mark*
- 15W stands for 15 watts. This is the power rating
for the Soldering Iron. *1 mark*

- (v) Safety precautions to be observed include:

- Never touch the hot tip of the Iron.
- Replace the Iron in the holder when not in use.

Any two suitable safety precautions @ 1 mark each

10 Marks

Question Seven

20 Marks

- (a) (i) A is a Keyboard. Used to type information. *1 mark*
B is a Digital Camera. Used to take pictures. *1 mark*
C is a Mouse. This is a pointing device. *1 mark*
D is a pair of Speakers. These emit Sound. *1 mark*

- (ii) A Keyboard is an input device. *1 mark*
A Digital Camera is an input device. *1 mark*
A Mouse is an input device. *1 mark*
Speakers are output devices. *1 mark*

- (iii) The physical parts that make up the computer are called hardware. *1 mark*

The programs, language and procedures used in a computer system are called the software. *1 mark*

- (iv) Scanner – used to copy and input material which can then be altered.
CD Writer – used to burn information onto a CD.
Broadband – is a high speed form of internet connection.
Twitter – is a website where users can keep a diary or blog
Any two explanations @ 1 mark each

- (v) A computer may be protected from a virus by the instillation of anti-virus software. *1 mark*

A surge protected socket or extension lead will prevent electrical surges from damaging a computer. *1 mark*

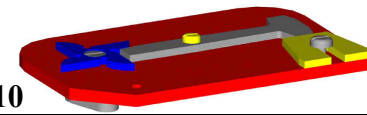
14 Marks

- (b) (i) E is a depth gauge. *1 mark*
F is a drill gauge. *1 mark*

- (ii) The depth gauge measures the depth of a hole or slot.
The drill gauge measures the size of drill bits.
Any application of one tool @ 2 marks

- (iii) The micrometer reading shown is 2.75mm *2 mark*

6 Marks

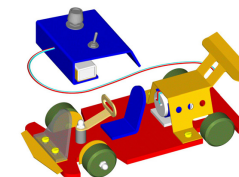


Subjective Grading /10		9-10 Excellent	7-8 Very Good	5-6 Good	3-4 Poor	1-2 Very Poor
Subjective Grading /5		5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor
Section	Part Number	Pictorial Sketch / Description	Concept		Mark	Mark
1	Parts 1, 2, 3, 4 & 5		Complete Piece	Assembly: Subjective Grade 1 - 5	5	20
				Finish: Subjective Grade 1 - 5	5	
				Function: Subjective Grade 1 - 10	10	
2	Parts 1 & 4		Backplate	Marking Out	3	20
				Backplate Profile	5	
				M5 & M6 Tapped Holes	2	
				Ø4.2 Hole & Ø 10.5 Hole	2	
			Anvil	Marking Out	2	
				Anvil Profile	3	
3	Part 2		Hammer	Marking Out	4	20
				Length 50mm	2	
				Length 30mm	2	
				Head Profile & 2mm Radii	6	
				Handle Profile & 5mm Hole	6	
4	Part 3		Sprocket	Marking Out	4	20
				Profile	10	
				Ø 5.5mm CSK	2	
				Holes x 4	4	
5	Part 5		Knob	Marking Out	4	20
				Lengths 17.5, 8 & 4mm	3	
				Cam Profile	9	
				Turn, Drill & Tap	4	

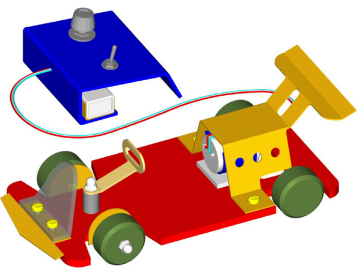
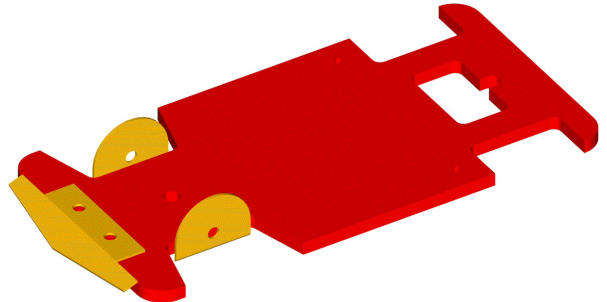
100 Marks
(× 1.5 = 150 Total)



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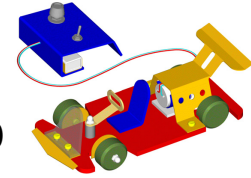
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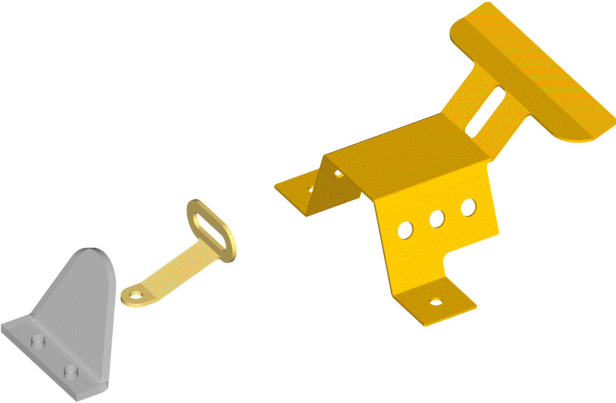
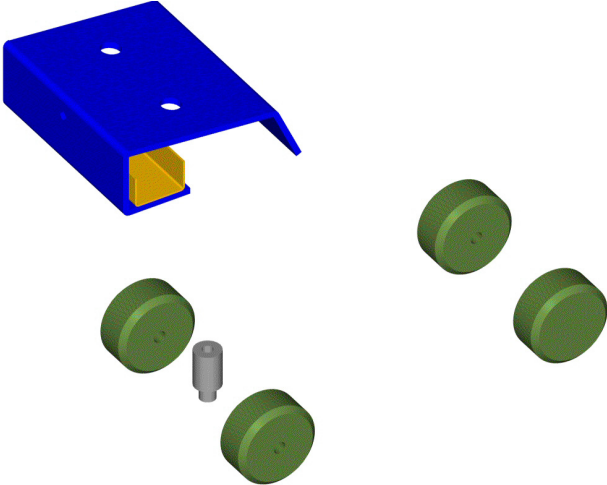
Subjective Grading 1/10		9-10 Excellent	7-8 Very Good	5-6 Good	3-4 Poor	1-2 Very Poor		
Subjective Grading 1/5		5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor		
Section	Part Number	Pictorial Sketch/Description	Concept			Mark	Mark	
1	Complete Model (Not including Design Element)	 <p>Assembly, Finish & Function</p>	Assembly: Subjective Grade 1-5			5	20	
			Finish: Subjective Grade 1-5			5		
			Mechanical Function: Subjective Grade 1-5			5		
			Electrical Function: Subjective Grade 1-5			5		
2	Design Feature	(i) Design, make and attach a Seat capable of linear adjustment for the model. (ii) Design and make a Safety Bar for the model and attach behind the seat.	Design: Subjective Grade 1-10			10	20	
			Make: Subjective Grade 1-5			5		
			Attach: Subjective Grade 1-5			5		
3	Parts 1, 2 & 3		Front Spoiler	3	Marking Out	1	20	
					Drill, Shape & Bend	2		
			Front Axle	5	Marking Out	1		
					Drill, Shape & Bend	4		
			Chassis	12	Marking Out	2		
					Drill & Tap	5		
Shape	5							



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Junior Certificate Higher Level Metalwork Project Marking Scheme 2010



4	Parts 4, 5 & 6		Motor Cover / Spoiler	13	Marking Out	2	20
			Drill		4		
			Shape & Bend		7		
			Windscreen	3	Marking Out	1	
			Drill, Shape & Bend		2		
			Steering Arm	4	Marking Out	1	
Drill, Shape & Bend	3						
5	Parts 7, 8, 9, 10 & 11		Wheels × 4	8	Width & Drill	4	20
			Knurl & Chamfer		4		
			Steering Column	3	Turn, Drill & Length	3	
			Control Panel	7	Marking Out	2	
					Drill, Shape & Bend	5	
			Battery Holder	2	Marking out, Shape & Bend	2	

100 Marks
(× 1.5 = 150 Total)