



Coimisiún na Scrúduithe Stáit
State Examinations Commission

**LEAVING CERTIFICATE
APPLIED 2011**

MARKING SCHEME

ENGINEERING

COMMON LEVEL

Leaving Certificate Applied, 2011

Vocational Specialism – Engineering
(240 marks)

Written Examination
Sample Answers *and* Marking Scheme

1. Answer **all** questions from Section 1.
2. Answer **any three** questions from Section 2.
3. If Question 7 is attempted, answer **any two** topics.

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




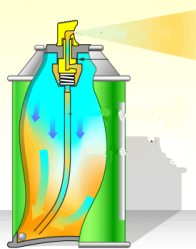
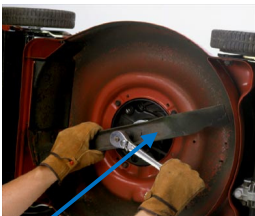
Section 1 (90 Marks)

Answer **all three** questions

Section 1 Q1.

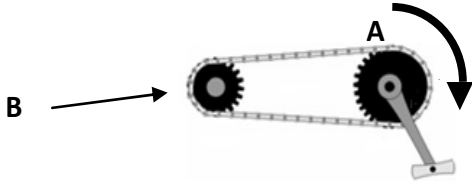
45 marks

Give brief answers to **any fifteen** of the following:
(sketches may be used to explain your answers)



QUESTION	ANSWER
<p>(a) Identify the joining process shown opposite and give a practical example of where it could be used.</p> 	<p>Joining process: <i>Brazing</i></p> <p>Use: <i>To attach tubular steel parts in a bicycle frame</i></p> <p style="text-align: right; color: red;">3 marks</p>
<p>(b) State a reason why vice clamps are being used to hold the metal shown.</p> 	<p>Reason: <i>To ensure the vice jaws do not damage the piece being held</i></p> <p style="text-align: right; color: red;">3 marks</p>
<p>(c) Name a suitable material to make the car wheel shown.</p> 	<p>Name of material: <i>Chrome or alloy metals</i></p> <p style="text-align: right; color: red;">3 marks</p>
<p>(d) Outline one safety precaution that should be observed when using aerosol paint.</p> 	<p>Safety precaution: <i>Wear a mask to prevent inhalation of the fumes of the aerosol paint.</i></p> <p style="text-align: right; color: red;">3 marks</p>
<p>(e) Suggest a suitable material that could be used in making a lawnmower blade and give a reason for its suitability.</p>  <p style="margin-left: 20px;">Blade</p>	<p>Material: <i>Carbon Steel</i></p> <p>Reason: <i>Carbon steel is a tough material that does not shatter on impact.</i></p> <p style="text-align: right; color: red;">3 marks</p>

QUESTION	ANSWER
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(f) Gear A is moving in the direction shown. Tick the correct box to show the direction of gear B.




Tick the correct box to indicate direction of Gear B.

3 marks

(g) Identify the special nut shown and state **one** advantage for its use.

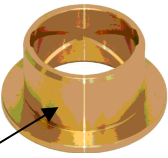


Name: *Wing nut or butterfly nut*

Advantage: *The projections give thumb and forefinger leverage in turning.*

3 marks

(h) Tick the correct box opposite, to indicate the two metals used to make the alloy brass.




Tin + Lead

Copper + Zinc

Copper + Lead

3 marks

(i) Suggest a suitable material that could be used to manufacture the seat of the go-kart shown.




Suitable material:

Plastic or carbon fibre

3 marks

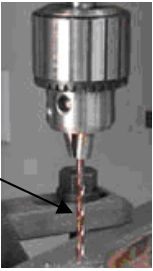



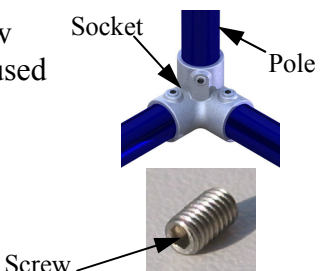
(j) Name the clip shown and give a suitable use for it.



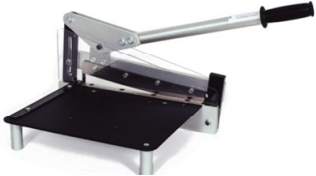

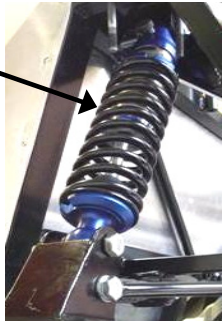


Name: *Jubilee Clip*

Use: *The clip is designed to hold a soft, pliable hose onto a rigid circular pipe of smaller diameter eg attaching a nozzle to a hose pipe.*

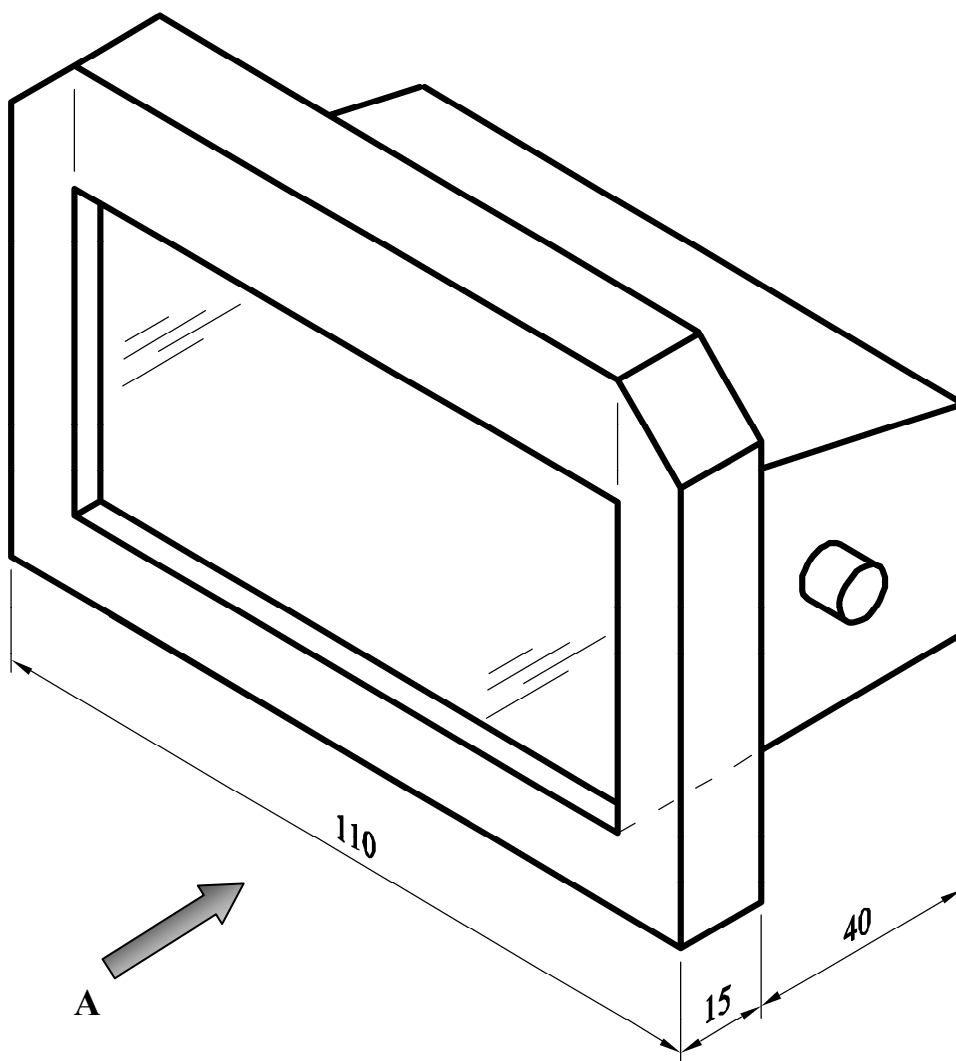
3 marks

QUESTION	ANSWER
<p>(k) Name a suitable material used to make the drill bit A shown, and give one reason for your choice of material.</p> 	<p>Material: <i>High Speed Steel</i></p> <p>Reason: <i>High Speed Steel is resistance to heat and can be used at high cutting speeds.</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(l) Please tick the correct type of plastic that could be used to allow the waste-water pipe shown to be bent using heat.</p> 	<p>Thermosetting plastic <input type="checkbox"/></p> <p>Thermoplastic <input checked="" type="checkbox"/></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(m) Identify the joining technique used to join the light sheet-metals shown.</p> 	<p>Joining technique:</p> <p><i>Pop Riveting</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(n) Name the tool shown and state a suitable use for it.</p> 	<p>Name: <i>Long Nose Pliers</i></p> <p>Use: <i>Used in electrical work to access tight spaces</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(o) Identify the screw shown which is used to hold the pole securely in the socket.</p> 	<p>Name of screw:</p> <p><i>Grub Screw</i></p> <p style="text-align: right;"><i>3 marks</i></p>

QUESTION	ANSWER
<p>(p) Choose a suitable material for the casing of the Satellite Navigation Unit (GPS) shown and give a reason for your choice of material.</p> 	<p>Suitable material: <i>Plastic</i></p> <p>Reason: <i>Plastic is easy to manufacture to shape and is a durable material.</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(q) Name the tool shown below and state a use for it.</p> 	<p>Name of tool: <i>Chuck Key</i></p> <p>Use: <i>The chuck key is used to tighten or loosen drill bits while being held in the chuck of a drilling machine.</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(r) Identify one safety precaution that should be observed when using the table shears shown.</p> 	<p>Safety precaution:</p> <p><i>Ensure the fingers are kept clear of the cutting blade.</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(s) Name the piece of equipment shown and state a suitable use for it.</p> 	<p>Name: <i>Scissor jack for a car</i></p> <p>Use: <i>This scissor mechanism lifts the car slowly and easily and can be useful in changing the wheel of a car.</i></p> <p style="text-align: right;"><i>3 marks</i></p>
<p>(t) Identify the mechanism marked A and give a use for it in the engineering world.</p> 	<p>Name: <i>Spring</i></p> <p>Use: <i>Suspensions of cars</i></p> <p style="text-align: right;"><i>3 marks</i></p>

A pictorial view of an outdoor light is shown below.
Draw the following **two** views of the outdoor light on the grid paper opposite:

- (a) A front elevation in the direction of arrow 'A'.
- (b) A plan projected from view (a).



Note: Each grid square is 5 mm long

Proportion and Quality: **15 marks**

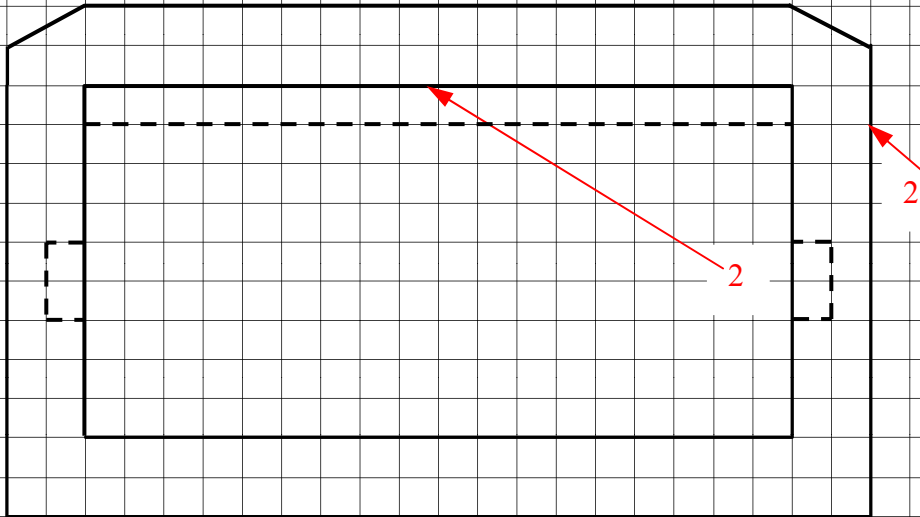
Excellent 12-15

V Good 9-11

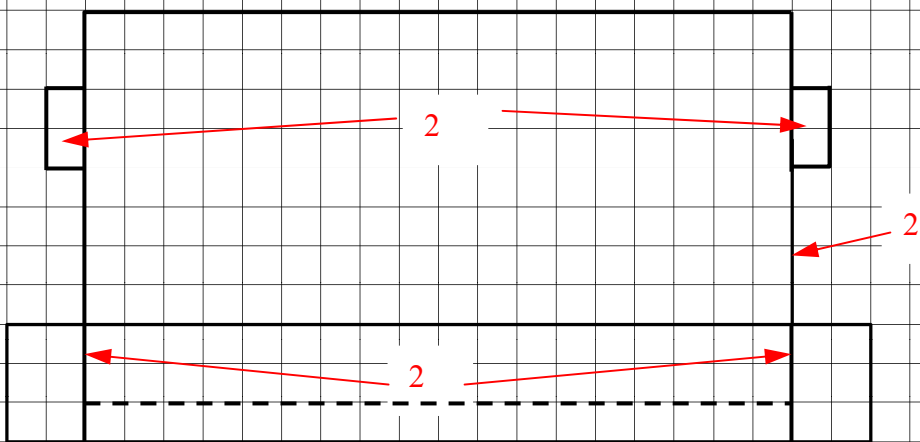
Good 6-8

Fair 3-5

Poor 0-2



Complete the Elevation

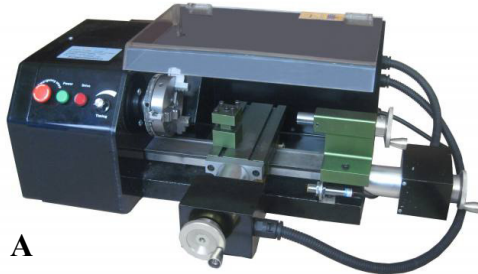


Complete the Plan

Section 1 Q3.

20 marks

(a) Name the **two** pieces of equipment shown at **A** and **B** below. State **two** safety precautions that should be observed when operating **each** piece of equipment.



A



B

A - Name of engineering equipment:

Computer Numerically Controlled Lathe
1 Mark

Safety Precaution 1

Ensure the guard is in place before starting the machine.
1 Mark

Safety Precaution 2

Make sure safety goggles are worn to prevent swarf from entering the eyes.
1 Mark

B - Name of engineering equipment:

Drilling Machine
1 Mark

Safety Precaution 1

Ensure the work is held securely in the machine vice when drilling.
1 Mark

Safety Precaution 2

Make sure safety goggles are worn to prevent swarf from entering the eyes.
1 Mark

(b) The diagram shows a spot welder which is commonly used to join sheet metals. Identify **two** safety precautions that should be observed by students when using a spot welder.

Safety Precaution 1: *Do not touch the hot metal during the welding process.*
2 Marks

Safety Precaution 2: *Wear suitable eye protection to prevent any sparks from entering the eyes.*
2 Marks



(c) Describe **any two** safety features on the grinding machine shown below.

Safety Feature 1:

There is a safety screen to decrease the amounts of sparks generated from the grinding process.

2 Marks



Safety Feature 2:

There is a prominent safety switch on the front of the grinding machine to enable the operator to turn on/off quickly.

2 Marks

(d) State **one** safety precaution that should be observed when using the saw shown.

Safety Precaution:

Ensure that the fingers do not come into contact with the blade of the saw.

2 Marks



(e) The safety symbols below may be found in an engineering room. Give a brief explanation for **each** of the symbols shown.

A



Symbol A: *Wear a breathable mask.*

2 Marks

B



Symbol B: *First aid kit available*

2 Marks

Section 2 (150 Marks)

Answer **any three** questions

Section 2 Q4.

50 marks

- (a) Design, in the spaces provided, a suitable support bracket to enable the bicycle shown, to be transported on the back of the camper van.

The design should clearly show **each** of the following:

- (i) A method for attaching the support bracket to the camper van;
- (ii) A method to ensure the bicycle is held securely in the support bracket.

Draw in **Grid A** at least **two** sketches of different ideas you considered for the design of the support bracket.

Draw in **Grid B** a sketch of the **final solution** for the support bracket.



At least **two sketches** for the support bracket should be drawn below in **Grid A**.

Grid A - IDEAS

Ideas: 30 marks

Excellent Idea **25-30 Marks**

Good Idea **19-24 Marks**

Satisfactory **13-18 Marks**

Fair Idea **7-12 Marks**

Poor Idea **0-6 Marks**

Half marks awarded if only **one** of the following is shown:

- Method of attachment of the support bracket to camper van
- Method to ensure the bicycle is held securely in the support bracket.

A sketch of the **final solution** for the support bracket should be drawn below in **Grid B**.

Grid B – FINAL SOLUTION

Final Solution: 10 marks

Excellent Solution	9-10 Marks
Good Solution	7-8 Marks
Satisfactory Solution	5-6 Marks
Fair Solution	3-4 Marks
Poor Solution	0-2 Marks

- (b) (i) Suggest a suitable material for manufacturing the frame of the baby stroller.

Aluminium *4 Marks*

- (ii) Give a reason for your choice of material.

Aluminium is a light metal which would enable the baby stroller to be carried easily.

3 Marks

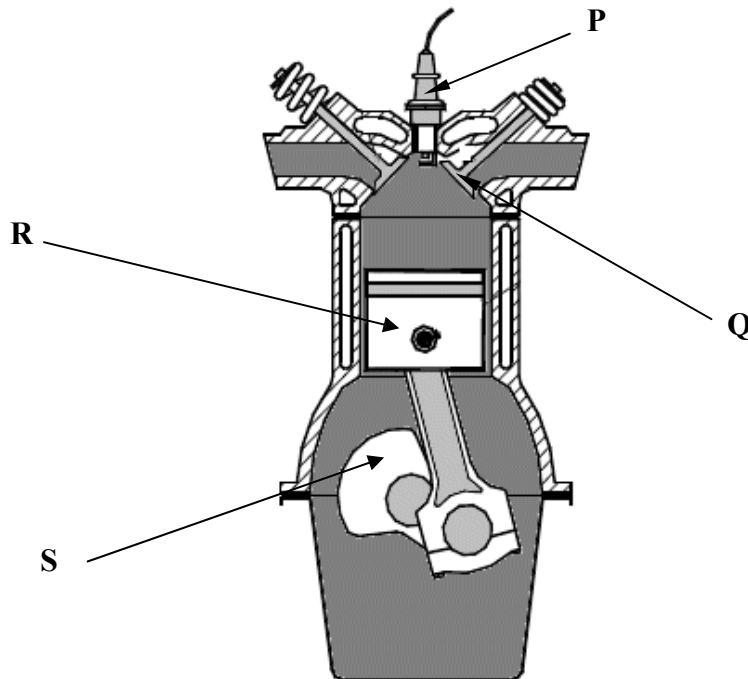
- (iii) Outline **one** reason why the wheels on the front of the stroller are smaller than those on the back.

The wheels on the front are smaller than those on the back to enable the pusher of the stroller to manoeuvre the stroller in tight spaces. The small wheels on the front give increased control while the larger ones on the back can negotiate bumpy surfaces.

3 Marks

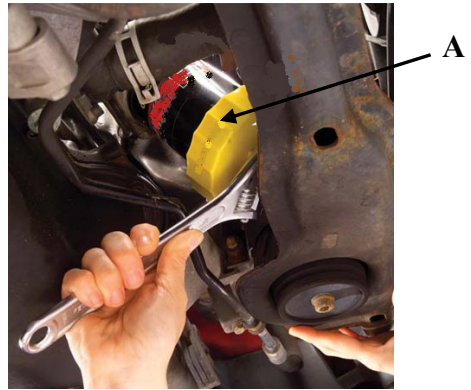


- (a) A cross-sectional diagram of a four-stroke engine is shown below. Identify and describe the function of **each** of the labelled parts, **P**, **Q**, **R** and **S**.



Part	Name of Part	Function
P	Spark Plug	The spark plug is used to ignite the compressed fuels in the combustion chamber.
	3 Marks	3 Marks
Q	Valve	Valves are used in most piston engines to open and close the intake and exhaust ports in the cylinder head.
	3 Marks	3 Marks
R	Piston	In an engine, the piston is used to transfer force from the expanding gas in the cylinder to the crankshaft via a piston rod and/or connecting rod.
	3 Marks	3 Marks
S	Crankshaft	The crankshaft is the part of an engine which translates reciprocating linear piston motion into rotational motion.
	3 Marks	3 Marks

(b) Identify the part **A** being removed by the mechanic in the diagram opposite and state the function of this part.



Name: *Oil Filter*

7 Marks

Function: *An oil filter is a filter designed to remove contaminants from engine oil, transmission oil, lubricating oil, or hydraulic oil.*

3 Marks

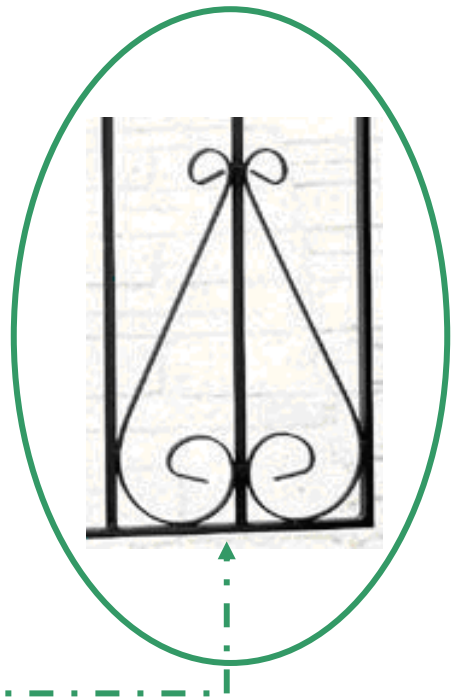
(c) Some important parts of a car engine are shown below. Identify the parts labelled **U**, **V**, **W** and **X** and state the function of each.



Part	Name of Part	Function
U	<i>Upper hose connection</i> <i>2 Marks</i>	<i>The upper hose is usually connected to the thermostat which regulates the temperature.</i> <i>2 Marks</i>
V	<i>Radiator Cap</i> <i>2 Marks</i>	<i>The radiator cap is the location from which the radiator is filled with water and a mixture of anti-freeze solution during the winter months.</i> <i>2 Marks</i>
W	<i>Cooling Fan</i> <i>2 Marks</i>	<i>This radiator is paired with a fan that blows air through the radiator. Air is an important part of the heat transfer process because it takes the heat away from the radiator.</i> <i>2 Marks</i>
X	<i>Cooling Fins</i> <i>2 Marks</i>	<i>The fins assist in radiating the heat transferred by the internal tubes to the surrounding air.</i> <i>2 Marks</i>

- (a) Describe briefly, in the spaces below, **any three** stages in the production of the decorative scroll, in the gate shown. Your description can refer to a hot **or** a cold treatment method of forming the scroll.

(Use sketches as appropriate.)



Stage 1:

Measure and mark out the length of scroll required.

8 Marks

Stage 2:

Heat the metal until it is cherry red and twist around a jig or shape with the hammer. The metal may be needed to be reheated during this stage. (Hot Method).

Place the metal in the cold jig and twist into the required shape (Cold Method).

8 Marks

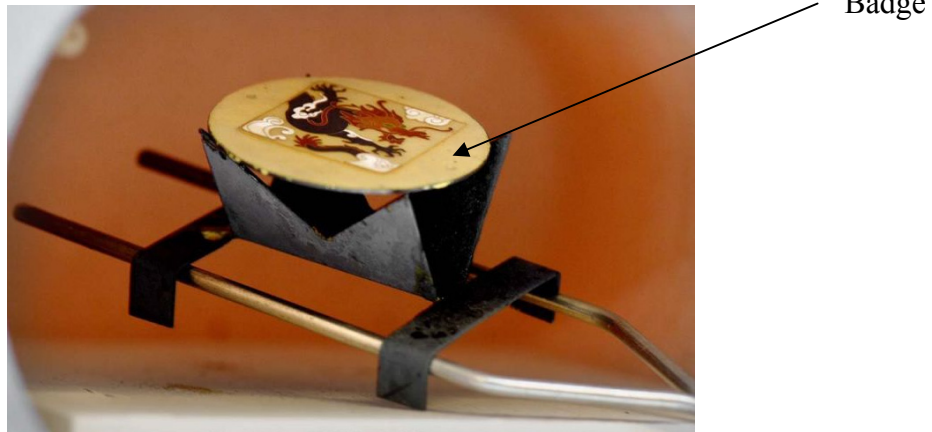
Stage 3:

Cool the metal carefully and clean it before painting (Hot Method)

Clean the scroll carefully and apply an appropriate finish (Cold Method).

8 Marks

- (b) The badge shown below is being decorated using an enamelling process. Describe briefly, in the spaces below, **any four** key stages used to produce the enamelled design on the badge. (Use sketches as appropriate.)



Stage 1: *Clean the material well. Regardless of the type of metal that is being enamelled, it needs to be free of dirt or oil.*

5 Marks

Stage 2: *Place material to be enamelled onto a piece of paper and sprinkle on the enamel powder.*

5 Marks

Stage 3: *Place the material in a heated kiln to enable the enamel powder to melt.*

5 Marks

Stage 4: *Allow the piece to cool and make sure you do not touch it when hot.*

5 Marks

- (c) State **two** safety precautions to be observed during the enamelling process.

Precaution 1: *Make sure you do not inhale the enamel powder when sprinkling on the material.*

Wear a breathable mask.

3 Marks

Precaution 2: *Make sure you do not touch the heated piece and be careful when placing and removing the piece from the kiln. Wear safety heat resistant gloves.*

3 Marks

Systems Module

(Any two topics comprise a full module)

Answer **any two** from the following five topics.

Topic (a) – Computer Aided Design (CAD)

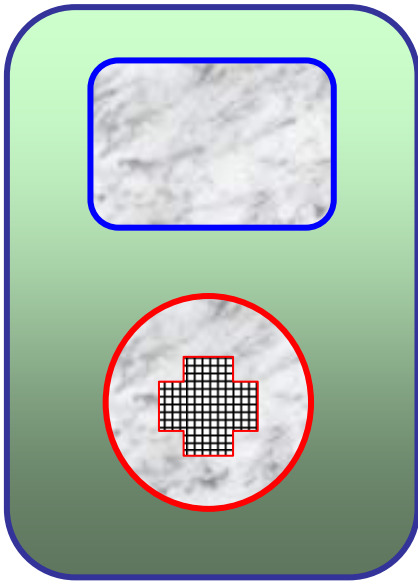
Topic (b) – Electricity

Topic (c) – Electronics

Topic (d) – Mechanisms

Topic (e) – Pneumatics

- (a) A CAD drawing of an MP3 player is shown below. List **any four** CAD commands necessary to produce the drawing.



Command 1: *Line*

4 Marks

Command 2: *Rectangle*

4 Marks

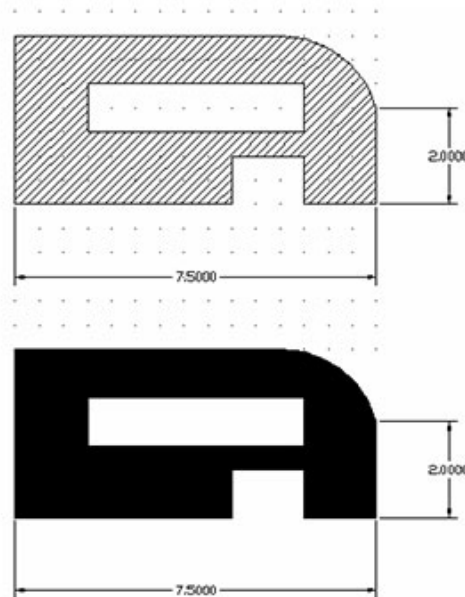
Command 3: *Fillet*

4 Marks

Command 4: *Circle*

4 Marks

- (b) The drawing below is produced by a CAD package. Explain the procedure involved in hatching an area on a CAD drawing.



Procedure:

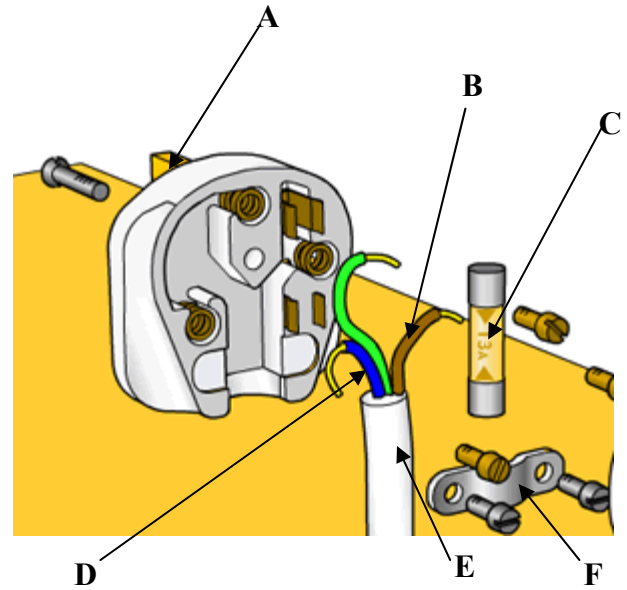
Select the 'Hatch' command and choose the style of hatch. Highlight the area to be hatched and apply the format. Preview the hatch to ensure it is correct.

9 Marks

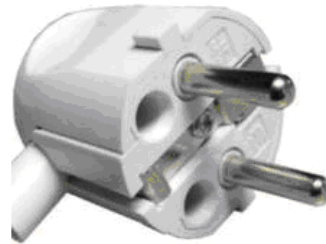
(a) Match **each** of labelled electrical parts with the correct name in the table. The first one is completed as an example.

5 x 1 Mark

A	→	Neutral Wire
B	→	Cable
C	→	Live Wire
D	→	Earth Pin
E	→	Fuse
F	→	Cable Clamp



(b) Two different plugs are shown below. Explain why some electrical devices have a three-pin plug while other devices have a two-pin plug.



Explanation: *All three pin plugs have a fuse to protect against short circuits. There is an earth connection that will cause a current on metal casing to go to ground. The two pin plug does not have an earth terminal and is usually found on appliances with plastic casings.* 5 Marks

(c) Name and state a suitable use for **each** of the components shown below.



Name: *Extension lead* 3 Marks

Use: *Used to plug more than one electrical appliance into the mains supply* 2 Marks



Name: *Wire Strippers* 3 Marks

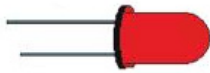
Use: *Used to strip back the plastic coating to connect wires* 2 Marks



Name: *Phase Tester* 3 Marks

Use: *Used to indicate if there is a current flow in the circuit* 2 Marks

(a) Name and state a suitable use for **each** of the components shown below.

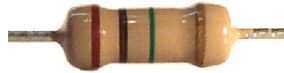


Name: *Light Emitting Diode*

2 Marks

Use: *LEDs are used as indicator lamps in many devices.*

2 Marks



Name: *Resistor*

2 Marks

Use: *A resistor is an electronic component which implements electrical resistance.*

2 Marks



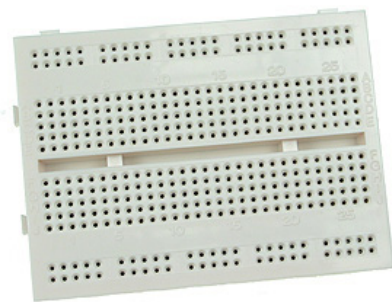
Name: *Potentiometer*

2 Marks

Use: *A potentiometer is a 3 terminal resistor with a sliding contact that forms an adjustable voltage divider.*

2 Marks

(b) Identify the electronic equipment shown and explain its function.



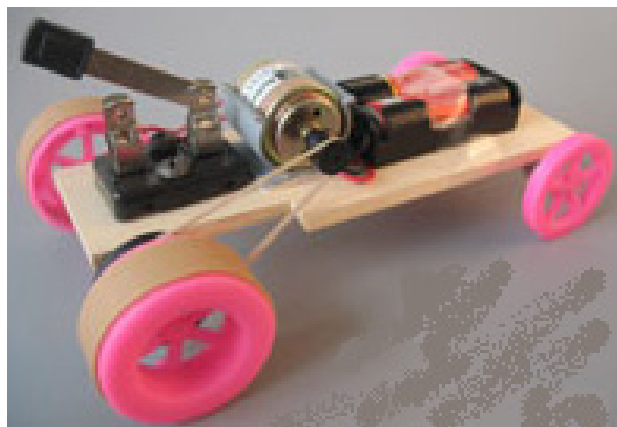
Name: *Circuit Breadboard*

2 Marks

Function: *The breadboard is used to assemble temporary circuits for testing or to try out an idea.*

2 Marks

(c) An electronic toy buggy is shown below. Describe briefly, in the space provided, how the toy buggy works.

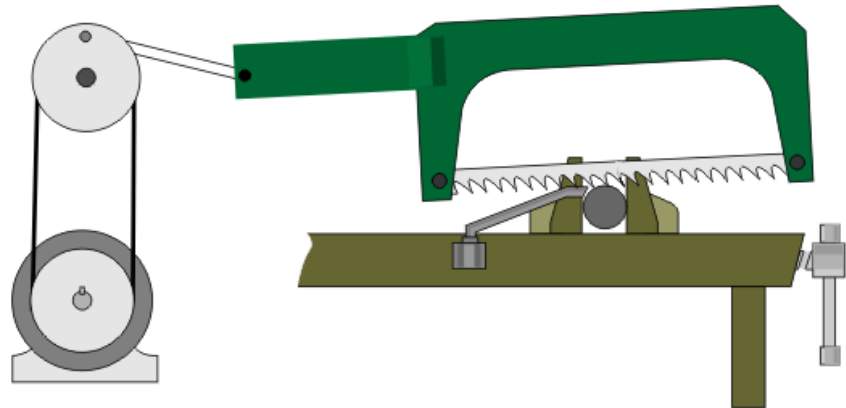


Description:

When the switch lever is put into the 'on' position the circuit is completed. Current flows from the battery which turns the motor. The motor has a small pulley on the shaft which is connected by a large pulley on the back axel by a belt system. The rotary motion of the motor shaft turns the wheels via the belt.

9 Marks

- (a) The diagram opposite shows a mechanism to operate a power saw. Explain how the mechanism works.

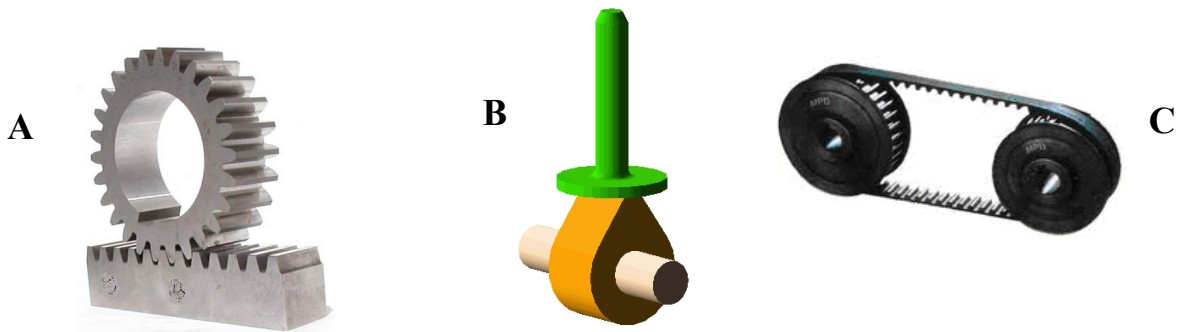


Explanation:

The electric motor turns the pulley on the drive shaft which is connected to the driven shaft via the vee-belt. The vee-belt then turns the driven pulley which has a crank arm attached. The oscillating movement moves the saw frame in a linear motion and the saw blade goes back and forth cutting the metal.

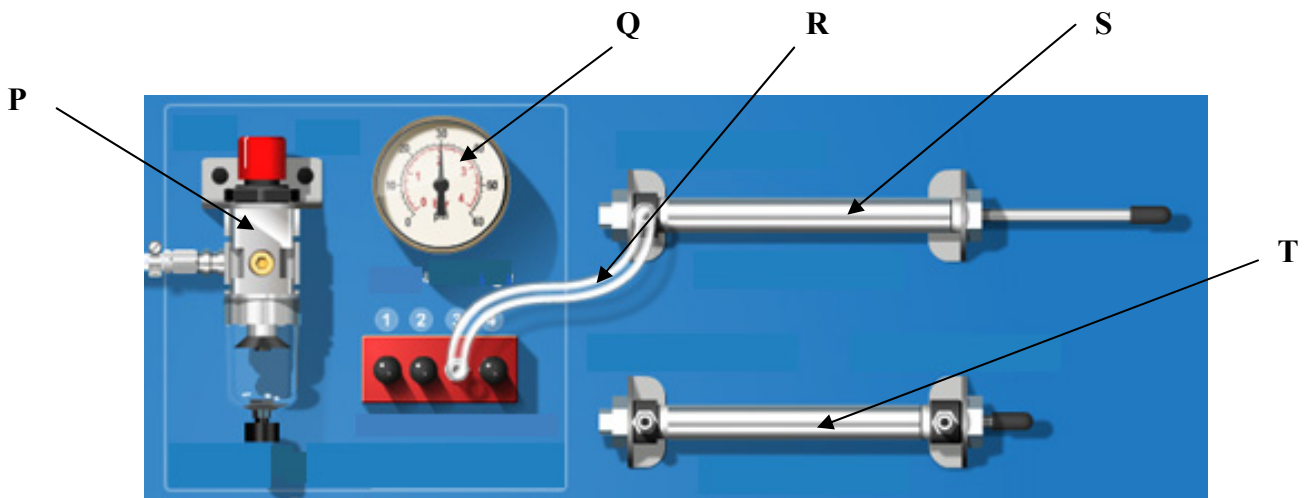
7 Marks

- (b) Identify the **three** mechanisms A, B and C shown below and state **one** use of each.



	Name	Use
Mechanism A	<i>Rack and Pinion</i> 3 Marks	<i>The rack and pinion mechanism turns rotary motion into linear motion eg the drill handle moves up and down the drill chuck.</i> 3 Marks
Mechanism B	<i>Cam and Follower</i> 3 Marks	<i>The cam and follower mechanism is used to convert rotary motion to linear motion eg the cam shaft in a car engine opens and closes the valves.</i> 3 Marks
Mechanism C	<i>Pulley and toothed belt</i> 3 Marks	<i>The pulley and belt transmits rotary motion eg in the headstock of a drilling machine.</i> 3 Marks

(a) Identify the pneumatic components shown below and state the function of each.



	Name	Function
P	<i>Air Supply with Filter</i> <i>2 Marks</i>	<i>The compressed air supply creates the pressure within the pneumatic circuit.</i> <i>2 Marks</i>
Q	<i>Pressure Gauge</i> <i>2 Marks</i>	<i>The pressure gauge measures the pneumatic pressure in the circuit.</i> <i>2 Marks</i>
R	<i>Connecting Pipe</i> <i>2 Marks</i>	<i>The connecting pipes connect the pneumatic parts together and carry the air supply throughout the circuit.</i> <i>2 Marks</i>
S	<i>Single Acting Cylinder</i> <i>2 Marks</i>	<i>A single acting cylinder uses the pressure imparted by compressed air to create a driving force in one direction (usually out), and a spring to return to the 'home' position.</i> <i>2 Marks</i>
T	<i>Double Acting Cylinder</i> <i>2 Marks</i>	<i>A double acting cylinder (DAC) uses the force of air to move in both directions. They have two ports to allow air in, one for outward stroke and one for return stroke.</i> <i>2 Marks</i>

(b) Pneumatic systems require safe work-practices. Give **two** examples of specific safety precautions to be observed when working with pneumatic systems.

- 1 *Always wear safety glasses when working with pneumatics.* *3 Marks*
- 2 *Compressed air should never be directed towards or applied to any part of the human body.* *2 Marks*

Note: First safety precaution answered correctly, award 3 marks, subsequent safety precaution award 2 marks.

