



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

Leaving Certificate Applied, 2009

MARKING SCHEME

**Vocational Specialism – Engineering
(240 marks)**

COMMON LEVEL






Marking Scheme and Sample Solutions

Section 1 Q1.

Section 1 (90 Marks) Answer all three questions

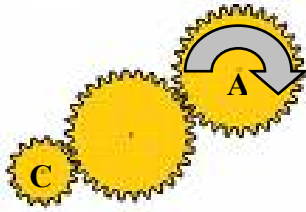
45 marks

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



QUESTION	ANSWER
<p>(a) Name a suitable material that could be used to make the bicycle gear cassette shown opposite.</p> 	<p>Name: of material</p> <p><i>Machined Steel</i> (3)</p>
<p>(b) Identify the hand tool shown and state a suitable use for it.</p> 	<p>Name: <i>Hand clamp</i> (2)</p> <p>Suitable use: <i>To hold sheet metal when drilling.</i> (1)</p>
<p>(c) Name the joining process shown opposite.</p> 	<p>Name of process:</p> <p><i>Oxy-acetylene welding</i> (3)</p>
<p>(d) Identify the tool shown and state a suitable use for it.</p> 	<p>Tool: <i>Scriber</i> (2)</p> <p>Use: <i>To scribe straight lines when marking out a material.</i> (1)</p>
<p>(e) Name the material used in the pipes shown below and suggest a reason for its suitability.</p> 	<p>Name: <i>Copper</i> (2)</p> <p>Reason: <i>Copper is an easy material to bend.</i> (1)</p>

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



Tick the box to indicate correct direction of Gear C

(3)

(g) Name the hand tool shown and state a suitable use for it.



Name: *Adjustable Spanner* **(2)**

Suitable use:
To tighten or loosen nuts **(1)**

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



Copper + Tin
 Copper + Zinc
 Tin + Lead

(3)

(i) Suggest a suitable material that could be used to manufacture the car wheel shown below.



Suitable material:

Aluminium Alloy **(3)**

(j) Identify the tool shown and state a suitable use for it.




Name: *Vice Grips* **(2)**

Use: *To hold two small pieces of material together when drilling* **(1)**

QUESTION	ANSWER
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(k) Name a suitable material used to make the engineer's bench vice shown, and give **one** reason for your choice of material.



Material: *Cast Iron* (2)

Reason: *Cast iron has good shock proof characteristics* (1)

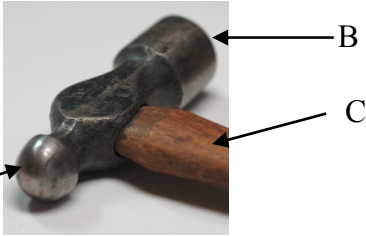
(l) Please tick the correct type of plastic that the strip heater shown can be used to bend.



Thermosetting plastic

Thermoplastic (3)

(m) Name **any two** parts of the hammer shown.

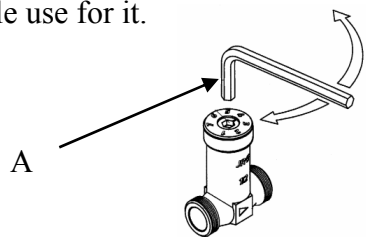


A: *Ball pein* (2)

B: *Face* (1)

C: *Handle*
(One correct answer 2 marks and one further answer award 1 additional mark)


(n) Identify the tool shown marked **A** and state a suitable use for it.



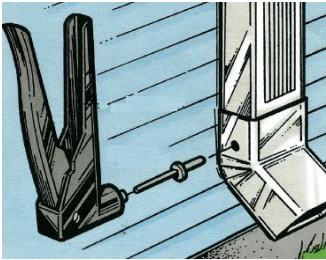




Name: *Allen key* (2)

Use: *To tighten or loosen bolts which have a hexagonal type allen screw head* (1)

(o) Suggest a suitable material for the part labelled **A** on the mini digger shown below.

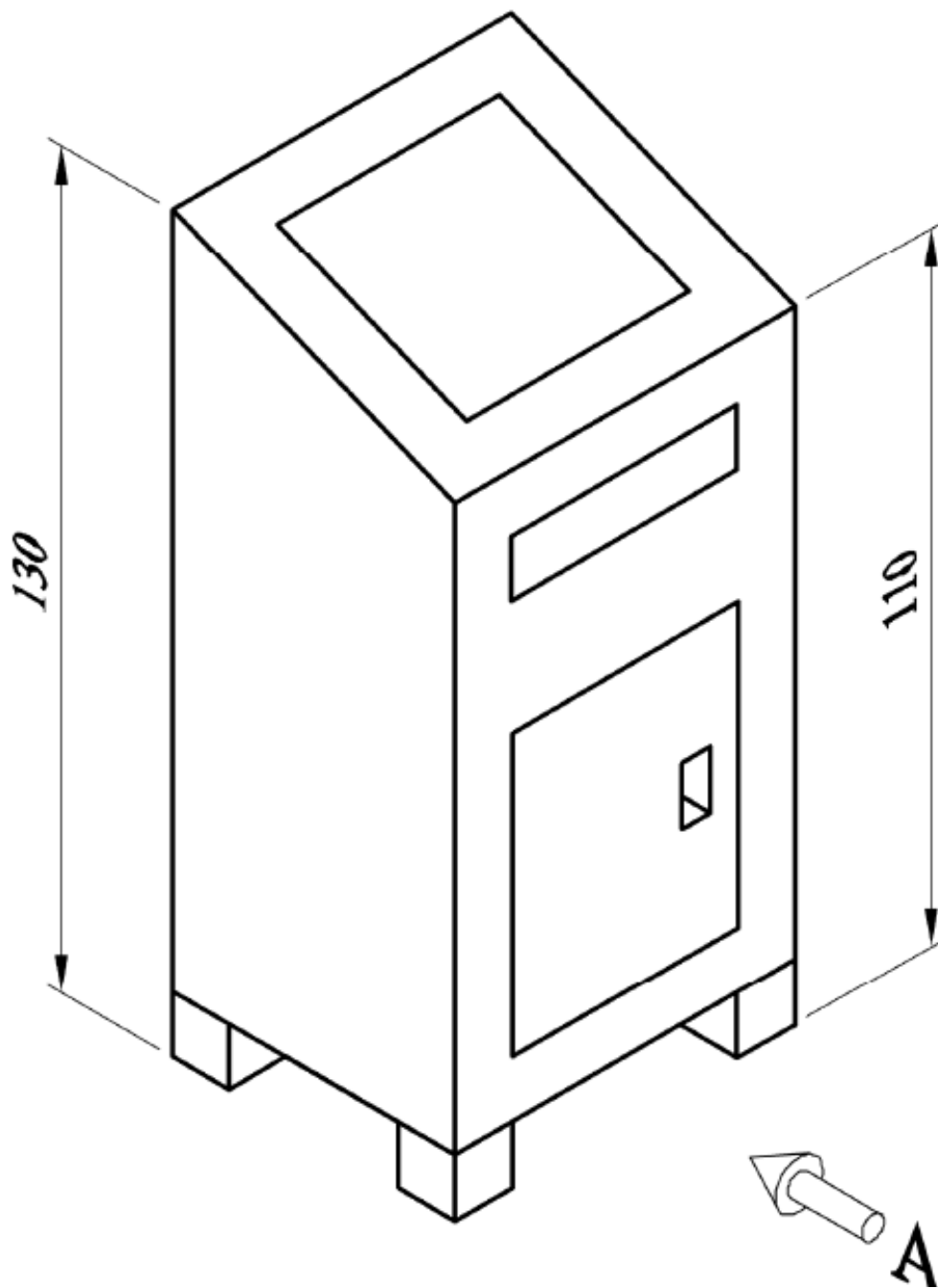


Material for part A:
High Carbon Steel (3)

QUESTION	ANSWER
<p>(p) Identify the joining process shown here.</p> 	<p>Name of joining process:</p> <p><i>Pop Riveting</i> (3)</p>
<p>(q) Name and give a use for the special nut shown below.</p> 	<p>Name of nut: <i>Lock Nut</i> (2)</p> <p>Use: <i>The lock nut is useful on devices which are subject to vibration. The plastic insert stops the nut from becoming loose.</i> (1)</p>
<p>(r) Identify one safety precaution that should be used when hack sawing metal.</p> 	<p>Safety precaution:</p> <p><i>Ensure the hacksaw is held with both hands during the sawing process.</i> (3)</p>
<p>(s) State a suitable use for the clip shown.</p> 	<p>Use:</p> <p><i>The clip is used to tighten a hose pipe on a fitting.</i> (3)</p>
<p>(t) Name the tool shown and give a use for it in the engineering room.</p> 	<p>Name: <i>Spring Dividers</i> (2)</p> <p>Use: <i>To mark out circles or arcs on metal</i> (1)</p>

A pictorial view of a design of a post box is shown below.
Draw the following **two** views of the post box 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

Elevation -	11 Marks
Plan -	4 Marks
Proportion/ Quality	10 Marks
Total	25 Marks

Complete the Elevation

2 Marks

2 Marks

(a) Name the **two** engineering processes shown at **A** and **B** below. State **two** examples of good safety precautions being observed in **each** case.

A



B



A - Name of engineering process:

Welding (1)

Safety Precaution 1:

Ensure a face mask is used to protect the eyes. (1)

Safety Precaution 2:

Ensure protective gloves are used to prevent burns to the hand. (1)

B - Name of engineering process:

Turning on the Centre Lathe (1)

Safety Precaution 1:

Safety glasses are being worn to prevent swarf from entering the eyes. (1)

Safety Precaution 2:

The student's hair is tied back to prevent it catching in the revolving chuck. (1)

(b) The diagram shows a school engineering workshop. Identify **two** safety precautions that should be observed by students when working in this type of classroom environment.

Safety Precaution 1:

Do not run while working in the metalwork room. (2)

Safety Precaution 2:

Ensure no materials are left lying on the floor of the metalwork room. (2)



(c) Describe **any two** safety precautions that are being observed by the operator using the angle grinder shown.

Safety Precaution 1:

A protective face mask is being used to prevent sparks from entering the eyes. (2)

Safety Precaution 2:

Protective gloves are being used to prevent burn to the hands. (2)



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

Ensure the electrical cable is kept clear of the blade at all times. (2)



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



Symbol A:

Toxic Material – Do not touch (2)



Symbol B:

Danger flammable material (2)

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 backlight for the bicycle shown to be mounted underneath the saddle of the bicycle.



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

- (i) A method for attaching the bracket to the light
- (ii) How the bracket is attached to the bicycle

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

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



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

Grid A – IDEAS

(30)

Sketch showing the bracket connected to the light.

Sketch showing the bracket attached to the bicycle.

Award 20 marks for sketch of one of the above. Award 10 marks for the other criteria (sketch).

If there is only one sketch showing both criteria mark out of 30 marks. There are keys illustrated below to assist in consistent awarding of marks.

		One sketch (Both criteria) 0-30	One sketch (One criteria) 0-20	Second sketch (Second criteria) 0-10
Key	Excellent	25-30	17-20	9-10
	Very Good	19-24	13-16	7- 8
	Good	13-18	9-12	5- 6
	Fair	7-12	5- 8	3- 4
	Poor	0- 6	0- 4	0- 2

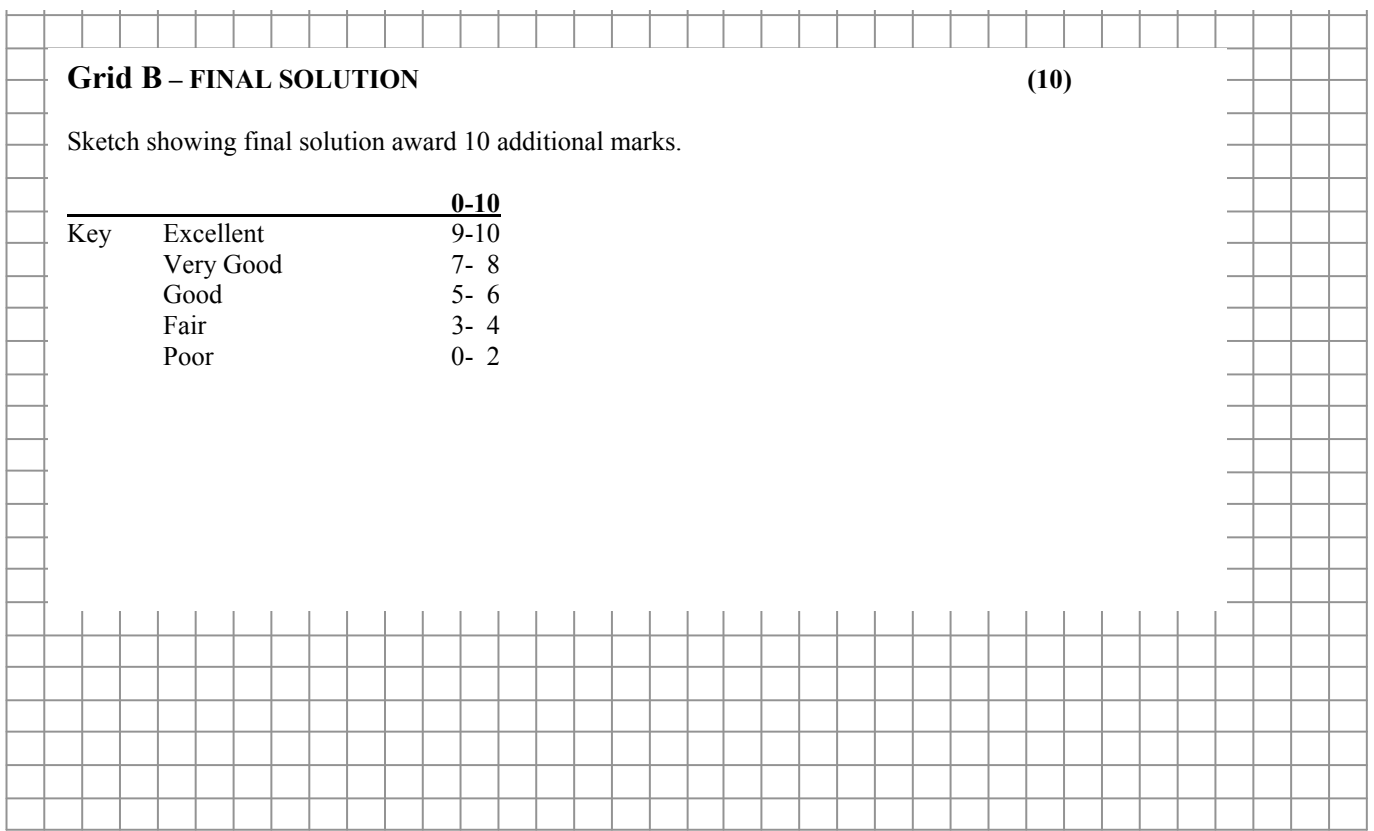
A sketch of the **final solution** for the bracket should be drawn below in **Grid B**.

Grid B – FINAL SOLUTION

(10)

Sketch showing final solution award 10 additional marks.

		0-10
Key	Excellent	9-10
	Very Good	7- 8
	Good	5- 6
	Fair	3- 4
	Poor	0- 2



- (b)** A quick release mechanism for attaching a bicycle wheel is shown opposite.



Quick release mechanism lever

- (i)** Suggest a suitable material for manufacturing the lever of the mechanism.

Aluminium Alloy

(4)

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

The material can be cast into the shape shown.

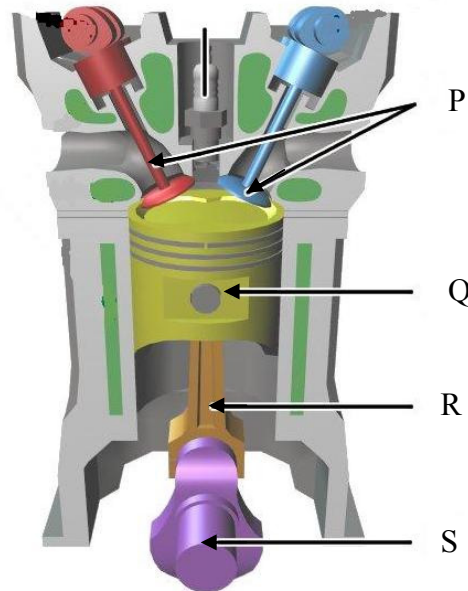
(3)

- (iii)** Outline **one** reason why the lever is manufactured to the shape shown.

The lever is shaped as shown to make it easy to release and tighten.

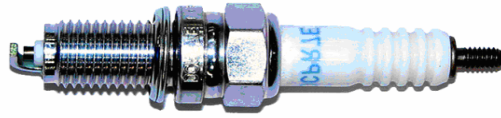
(3)

- (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	Valves	The valves enable the fuel to enter the cylinder and the exhaust gases to escape. The timing is controlled by the rotation of the camshaft
	(3)	(3)
Q	Piston	The piston compresses the fuel mixture entering the cylinder prior to the power stroke.
	(3)	(3)
R	Con rod	The con rod connects the piston to the crankshaft.
	(3)	(3)
S	Crankshaft	The crankshaft turns and transmits power during the cycle.
	(3)	(3)

(b) Identify and explain the function in an engine of the part shown.



Name: *Spark Plug* (4)

Function:
The spark plug provides the spark which creates combustion in the cylinder chamber. (4)

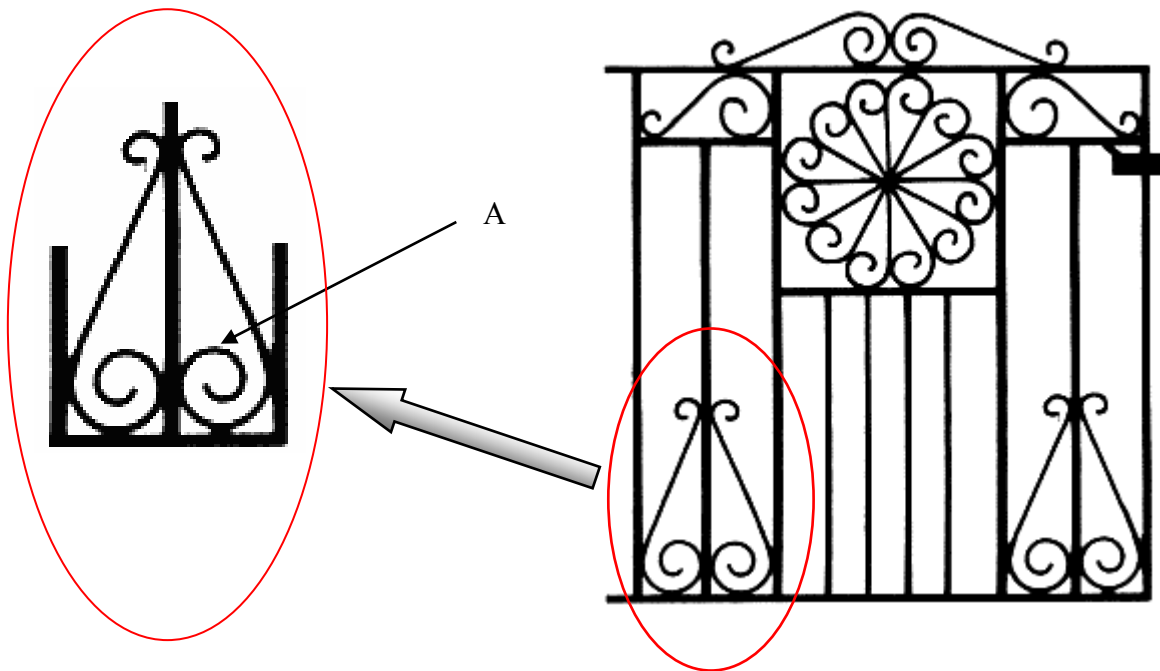
(c) A quad bike used on many farms is shown with three parts labelled X, Y and Z. Identify the **three** parts and explain the function of **each**.



Part	Name of Part	Function
X	<i>The Throttle</i> (3)	<i>The throttle is used to assist in regulating the speed of the quad bike.</i> (3)
Y	<i>The Carrier</i> (3)	<i>The carrier is used to assist in transporting a load safely on the quad bike.</i> (3)
Z	<i>Mud Guard</i> (3)	<i>The mud guard helps to reduce mud and water being splashed when the quad is moving.</i> (3)

(a) Describe briefly, in the spaces below **any three** stages used to produce the decorative scroll shown at A. This scroll is part of the gate shown.

(Use sketches as appropriate).



Stage 1

Measure, mark out and cut the metal to the correct length.

(8)

Stage 2

Heat the metal until cherry red in the forge. Alternatively, the scroll could be placed in a cold bending machine.

(8)

Stage 3

Bend the metal around a metal jig to the desired shape. Cool in cold water if using a heat process.

(8)

Sketches as appropriate.

(b) Describe briefly **any four** stages used to make the decorative copper leaf shown. The piece is made from a flat piece of copper of dimensions 200mm x 100mm x 0.75mm
(Use sketches as appropriate).



Stage 1

Mark out and cut the copper piece to the correct shape. **(4)**

Stage 2

Anneal and clean the copper piece. **(4)**

Stage 3

Hammer into the required shape using a mallet and sandbag. **(4)**

Stage 4

Use a repousse tool to create the required detail on the leaf shape. Clean and polish. **(4)**

Sketches as appropriate.

(c) State **two** safety precautions to be observed during the manufacture of the copper leaf.

Precaution 1:

Ensure all sharp edges are removed to prevent cuts to the hand. **(5)**

Precaution 2:

When annealing the copper ensure protective gloves are worn to prevent burns to the hands. **(5)**

Systems Module

(Any two topics comprise a full module)

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

Topic (a) – Computer Aided Design (CAD)

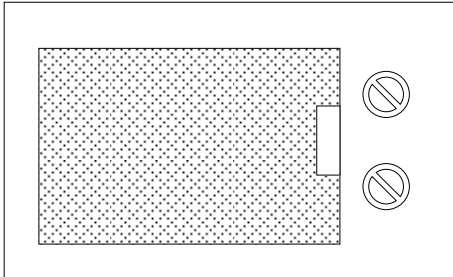
Topic (b) – Electricity

Topic (c) – Electronics

Topic (d) – Mechanisms

Topic (e) – Pneumatics

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



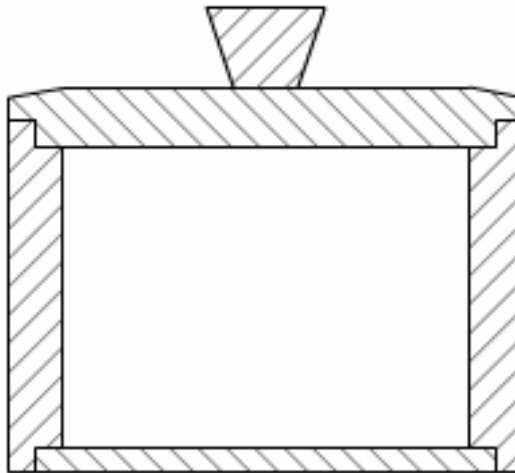
Command 1 Line (4)

Command 2 Rectangle (4)

Command 3 Circle (4)

Command 4 Pattern (4)

- (b) The cross sectional view of a wooden box with some hatching is produced by a CAD package. Explain the procedure involved in hatching an area on a CAD drawing.



Procedure:

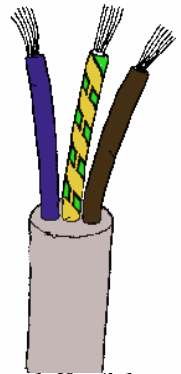
Select the required areas to be hatched. Choose the hatch command and apply to each of the selected areas. The hatch command can be found on the draw toolbar, or the draw drop down menu. When entered, a dialogue box appears and the hatching area can be customised.

(9)

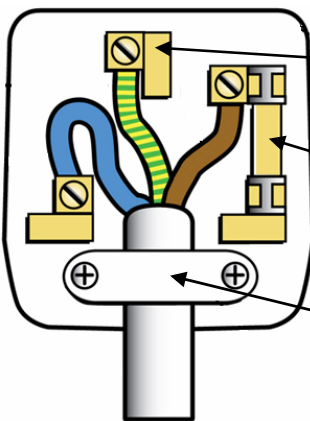
- (a) A section of mains cable with the wires coloured as indicated is shown opposite. Complete the table below giving the correct name for each coloured wire.

Colour	Name of Wire	
Blue	<i>Neutral</i>	(2)
Green/Yellow	<i>Earth</i>	(1)
Brown	<i>Live</i>	(1)

[One correct answer – award 2 marks. and each additional correct answer award 1 mark each]



- (b) The cable is to be fitted to a mains plug, shown below. Name the parts A, B and C of the plug shown.



A. *Earth Pin* (2)

B. *The Fuse* (2)

C. *The Cable Grip* (2)

- (c) Explain the function that each part, indicated on the diagram above has for electrical safety.

Part	Function for Electrical Safety	
A	<i>To ensure the electrical device has an earth connection.</i>	(1)
B	<i>To provide protection to ensure the correct electrical current is flowing.</i>	(1)
C	<i>To prevent the cable from being pulled out of the plug.</i>	(1)

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



Name: *Electrical Extension Cable* (2)
 Use: *To enable multiple electrical devices to be connected to one power outlet.* (2)






Name: *Earth Leakage Circuit Breaker (ELCB)* (2)
 Use: *To provide protection to an electrical circuit* (2)




Name: *Wire Strippers* (2)
 Use: *To strip back the plastic covering on electrical cable.* (2)

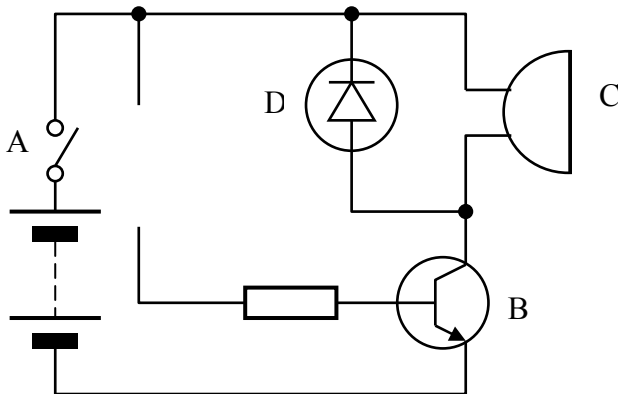
(a) Name and state a suitable use for **each** of the components shown below.

 <p>Name: <i>Light Emitting Diode (LED)</i> (2)</p> <p>Use: <i>To indicate power is flowing in a circuit.</i> (2)</p>	 <p>Name: <i>Variable Resistor</i> (2)</p> <p>Use: <i>To vary the resistance in a circuit.</i> (2)</p>	 <p>Name: <i>Light Dependent Resistor</i> (2)</p> <p>Use: <i>To vary the resistance in a circuit and is dependent on light.</i> (2)</p>
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(b) Identify the tool shown and explain its use in electronics.

	<p>Name: <i>Soldering Iron</i> (2)</p> <p>Use: <i>The soldering iron is used to solder electronic components. The solder is melted and applied to the terminals of the electronic components.</i> (2)</p>
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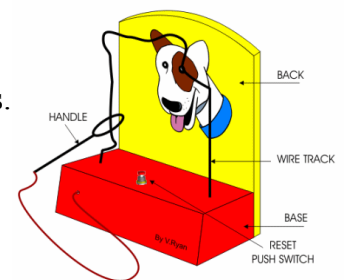
(c) Identify **each** of the electronic components used in the electronic circuit for the steady hand game shown. Write your answers in the table provided.



	Name of Electronic Component	
A	<i>Switch</i>	(1)
B	<i>Transistor</i>	(1)
C	<i>Buzzer</i>	(1)
D	<i>Diode</i>	(1)

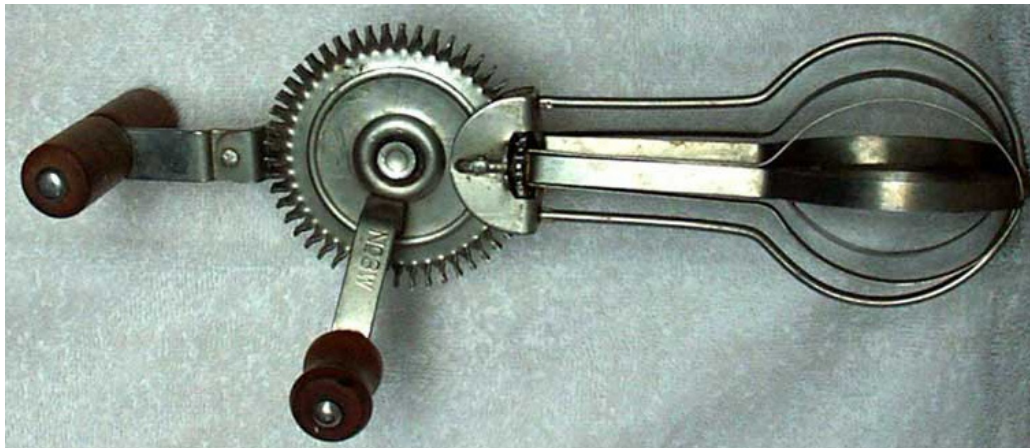
(d) Explain how the circuit of the steady hand game shown above works.

When the battery is connected power is supplied to the circuit. Touching the copper handle and the wire rack for a split second activates the circuit. The transistor activates the diode which allows the buzzer to sound.



(5)

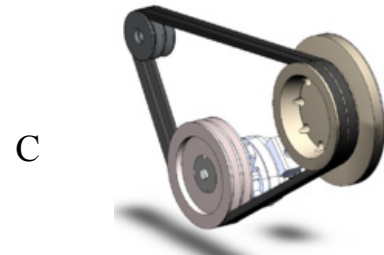
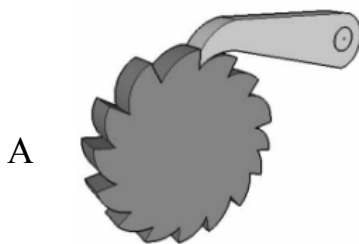
- (a) The diagram below shows an egg beater commonly found in kitchens. Explain how the mechanism works.



Explanation:

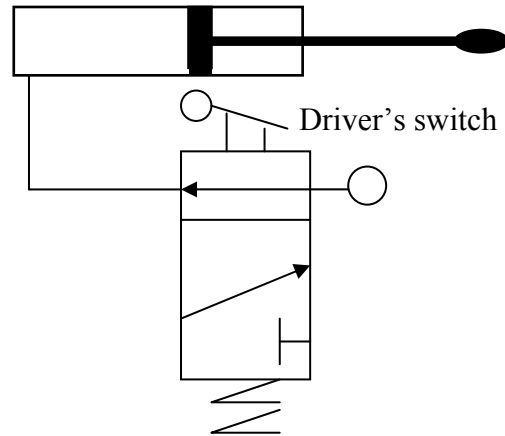
The handle is turned which moves the set of bevel gears. This translates rotary motion from the vertical plane to the horizontal plane turning the whisks of the beater. The wheel is turned by a crank arm whose knob is grasped by the other hand of the operator. (7)

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



	Name	Use
Mechanism A	<i>Ratchet and Sprocket</i> (3)	<i>This can be used to tighten something in one direction. It is often used to tighten wire.</i> (3)
Mechanism B	<i>Cam and Follower</i> (3)	<i>This is used to open and close the valves in a car engine. Rotary motion is translated to linear motion.</i> (3)
Mechanism C	<i>Vee Belt and Pulleys</i> (3)	<i>This is used to transmit rotary motion and is similar to a gearing system. They can be found on drilling machines.</i> (3)

- (a) The door of the school bus is operated using pneumatic control. The pneumatic circuit diagram is shown below.



The driver requires the door to open slowly and smoothly when the switch is activated. From the list below select **any two** devices which could make the door operate the way the driver wants.

- | | | | | | | |
|--------------|--------------------------|------------|--------------------------|------------|--------------------------|-----|
| 3-Port valve | <input type="checkbox"/> | Compressor | <input type="checkbox"/> | Reservoir | <input type="checkbox"/> | (5) |
| Solenoid | <input type="checkbox"/> | Spring | <input type="checkbox"/> | Restrictor | <input type="checkbox"/> | (5) |

- (b) Shown below is a pneumatic system with cylinder A operating a press.

- (i) Cylinder A is a double acting cylinder. What is the benefit of this over a single acting cylinder?

The double acting cylinder allows linear movement in both directions. (5)

- (ii) Suggest a suitable material for the manufacture of the cylinder.

Stainless Steel would be suitable. (5)

- (iii) Why do you think this material is suitable?

The material could be machined to the appropriate size and would be hardwearing. (5)

