Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Applied 2013

Marking Scheme

ENGINEERING

Common Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

Leaving Certificate Applied, 2013

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.

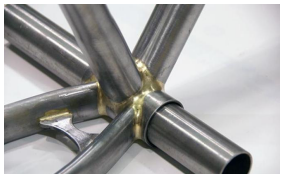
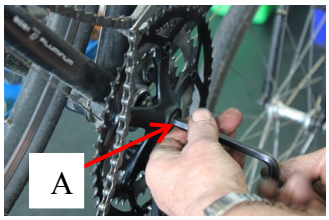
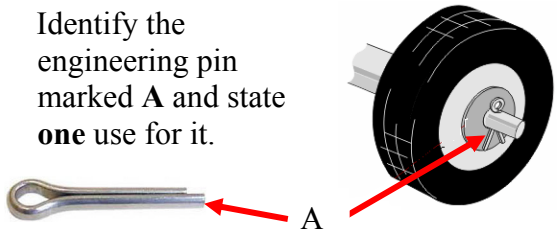
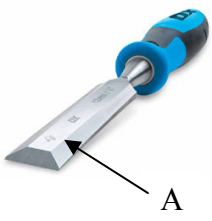
Note: **The solutions presented are examples only.**
All other valid solutions are acceptable and are marked accordingly.

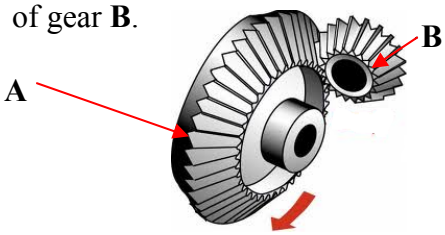
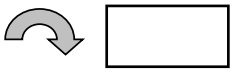
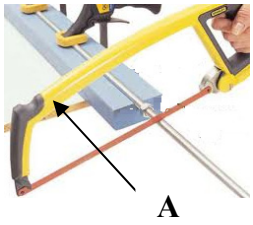
Section 1 (90 Marks)

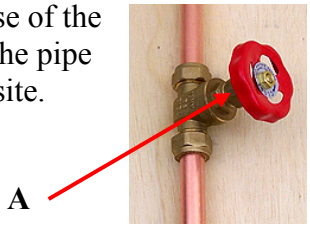
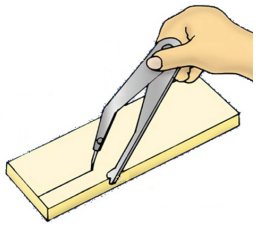
Answer **all three** questions

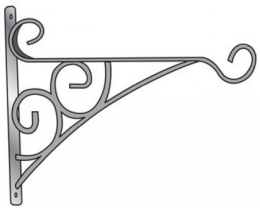
Section 1 **Q1.** **45 marks**

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

QUESTION	ANSWER
(a) State a suitable use for the tin snips shown opposite. 	Use: *The tin snips can be used to cut sheet metal.* ***3 Marks***
(b) Identify a suitable process for joining the metals in the frame shown opposite. 	Joining Process: *The metals can be joined by brazing.* ***3 Marks***
(c) Name the tool marked **A** being used to adjust the bottom bracket of the bicycle. 	Name of tool : *The tool used to adjust the bottom bracket on the bicycle is an allen key.* ***3 Marks***
(d) Identify the engineering pin marked **A** and state **one** use for it. 	Name : *Split Pin* ***2 Marks*** Use : *The split pin is used to keep the wheel from coming off the axel.* ***1 Mark***
(e) Name a suitable material to make the blade of the chisel marked **A** and give **one** reason for your choice of material. 	Name of material : *High Carbon Steel* ***2 Marks*** Reason : *It is hard and strong.* ***1 Mark***

QUESTION	ANSWER
(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 show the direction of Gear **B**.  ☐  √ ***3 Marks***
(g) Identify the cutting tool marked **A** and give **one** safety precaution that should be observed when using this tool.  	Name : *Hacksaw* ***2 Marks*** Safety precaution : *Hold the hacksaw straight with both hands on the frame.* ***1 Mark***
(h) Name the special nut shown and give a suitable use for it. 	Name : *Lock nut* ***2 Marks*** Use : *This type of nut is often used on machines that vibrate to prevent moving parts coming loose.* ***1 Mark***
(i) Suggest a suitable material that could be used to manufacture the mudguard marked **A**, on the motorbike shown opposite.  	Suitable material *Nylon* ***3 Marks***
(j) Tick the correct box to indicate the **two** metals used to make the alloy brass in the door knocker shown opposite. 	Lead and Tin ☐ Copper and Zinc √ ***3 Marks*** Copper and Tin ☐

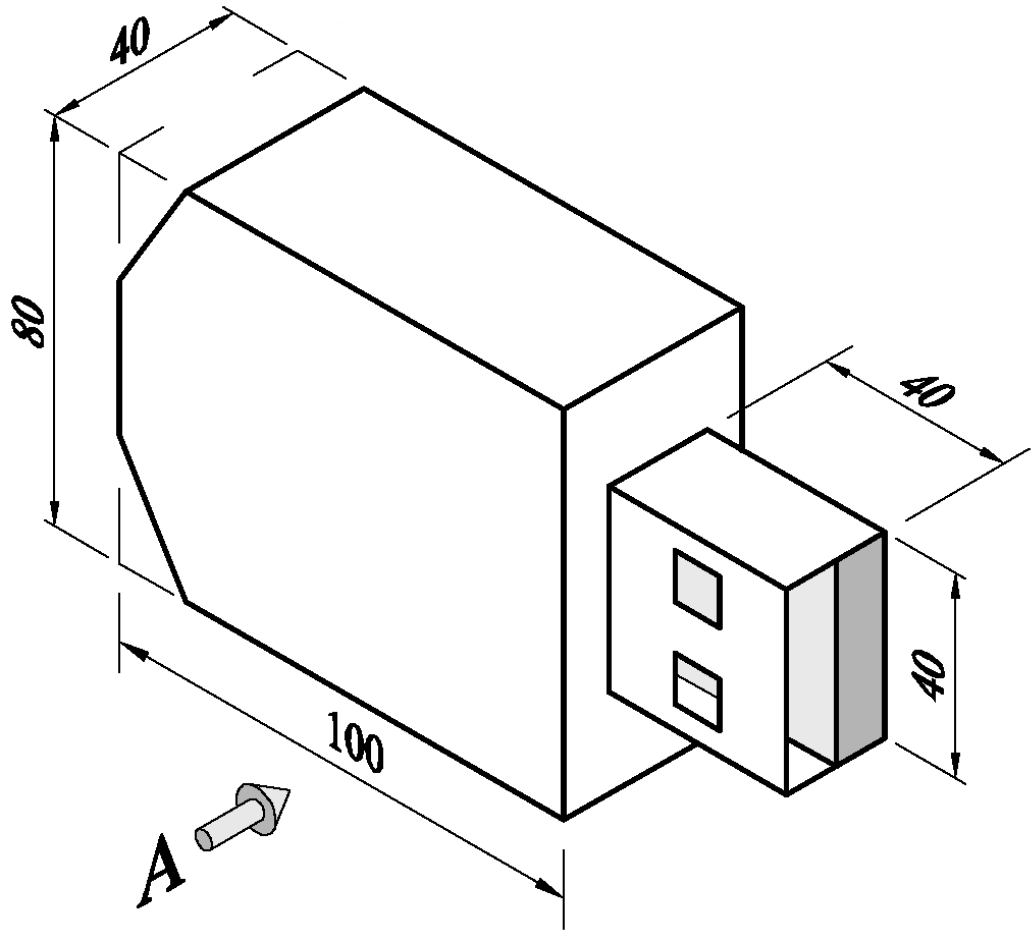
QUESTION	ANSWER
(k) Name the tool shown opposite and state **one** use for it in the Engineering room. 	Tool : *Long nosed pliers* **2 Marks** Use : *Long nose pliers have a very long and lean profile that lets them squeeze easily into tight spaces to grip and manipulate wires.* **1 Mark**
(l) Explain the purpose of the part marked **A** in the pipe work shown opposite. 	Purpose of part **A** *This is a gate valve that can regulate or stop the flow of water in the pipe.* **3 Marks**
(m) Identify the marking-out tool shown. 	Name of marking-out tool *Odd leg callipers or jenny calipers* **3 Marks**
(n) Name the engineering item shown opposite and state a suitable metal that could be used in manufacturing it. 	Name of item : *Engineer's bench vice* **2 Marks** Suitable metal : *Cast Iron* **1 Mark**
(o) Identify the screw shown and state one advantage of using this type of screw. 	Name of screw : *Thumb screw or butterfly screw* **2 Marks** Advantage : *This screw can be tightened and loosened by hand.* **1 Mark**

QUESTION	ANSWER
(p) Outline a suitable method for putting a name in the space marked **A** on the key ring shown opposite. 	Suitable method : *Engraving* ***3 Marks***
(q) Name and give a use for the tool shown below. 	Name of tool : *Adjustable spanner* Use : *This spanner can be used with different sizes of fastener head (nut, bolt, etc.) rather than just one fastener, as with a conventional fixed spanner.* ***3 Marks***
(r) Identify **one** major difference between the portable drilling machines shown below.  	Major difference *The yellow drill is cordless powered by a rechargeable battery pack while the blue drill is corded and requires an electrical supply.* ***3 Marks***
(s) Give a suitable use for the needle files shown below. 	Use : *Needle files are used in applications where the surface finish takes priority over metal removal rates.* ***3 Marks***
(t) Suggest a suitable finish for the external wall pot hanger shown opposite and give **one** reason for your choice. 	Suitable finish : *Dip coating* ***2 Marks*** Reason : *This is a good decorative and protective coating that will prevent rust forming on the metal surface.* ***1 Mark***

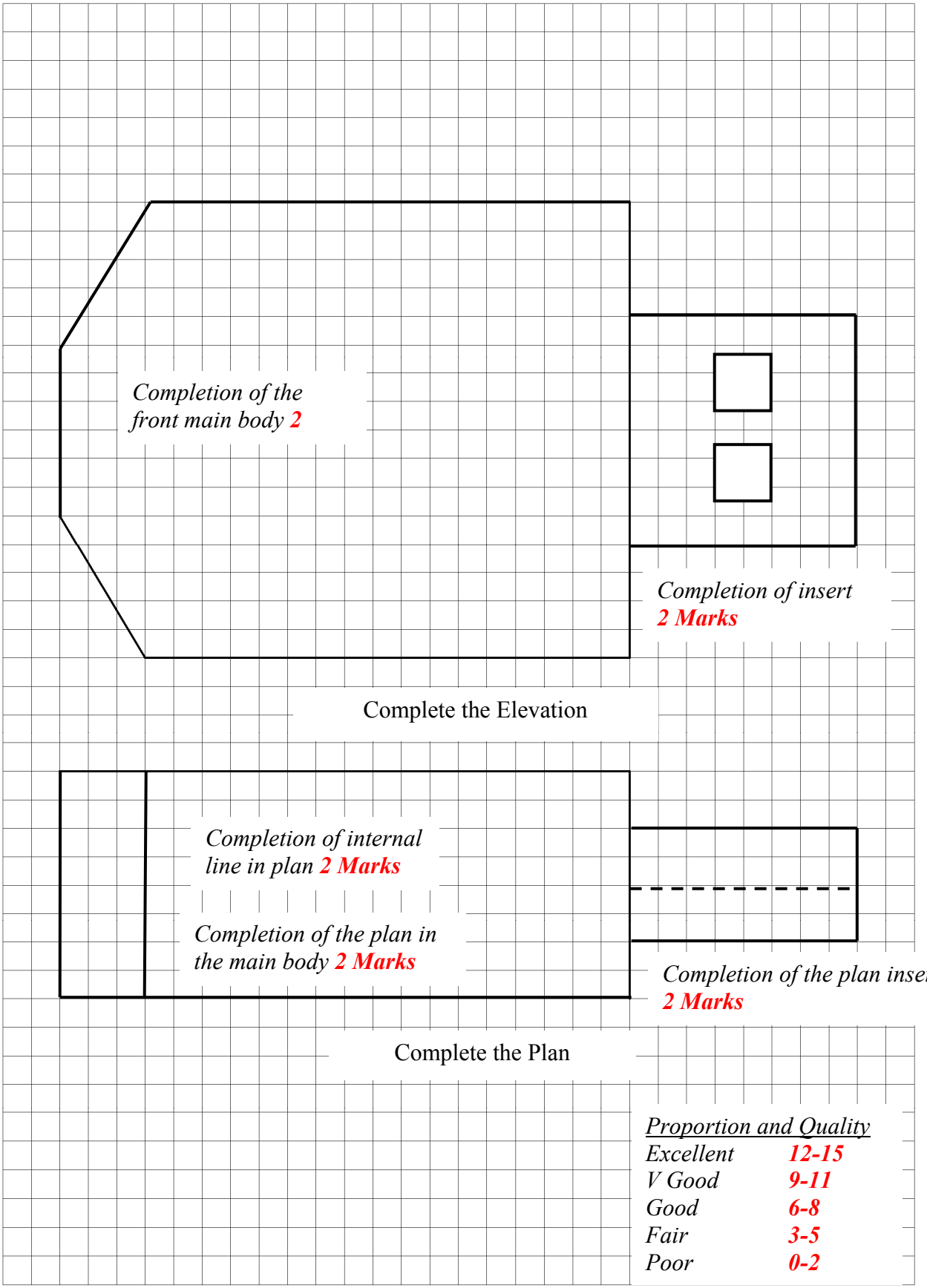
A pictorial view of a logo for a USB flash drive is shown below.
Draw the following **two** views of the logo on the grid paper opposite:

(a) A front elevation in the direction of arrow **A**.

(b) A plan projected from view **(a)**.



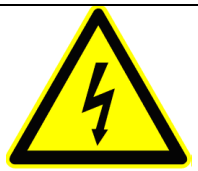
Note: Each grid square represents 5 mm



Proportion and Quality	
Excellent	***12-15***
V Good	***9-11***
Good	***6-8***
Fair	***3-5***
Poor	***0-2***

Section 1 **Q3.** **20 marks**

(a) Describe in the spaces provided the *'danger'* represented by **each** of the **five** safety symbols shown below.

	Symbol	Description
(i)		*Toxic materials* ***1 Mark***
(ii)		*Highly flammable* ***1 Mark***
(iii)		*Corrosive materials* ***1 Mark***
(iv)		*High voltage* ***1 Mark***
(v)		*Explosive materials* ***1 Mark***

(b) Identify **two** safety precautions that should be observed by students when welding metals.

Safety Precaution 1 : *Ensure proper eye protection is used.*
2 Marks

Safety Precaution 2 : *Ensure proper protective clothing is worn.*
2 Marks

(c) Describe **any two** safety precautions to be observed when using the scroll saw.

Safety Precaution 1 : *Ensure your hand does not come into contact with the moving blade.*

2 Marks

Safety Precaution 2 : *Wear proper eye protection to prevent dust or swarf from entering the eyes.*

2 Marks

(d) State **one** safety requirement for the safe operation of the electric angle grinder shown.

Ensure the angle grinder is held properly with the protective guard in place. ***3 Marks***

(e) The diagram opposite demonstrates a weight being lifted by two different methods, one of these methods is correct and one is incorrect.
Tick **one** of the boxes below to indicate the correct method for lifting the weight and then give **one** reason for your answer.

Method **A** Method **B**

Method **A** ☐

Method **B** √ ***2 Marks***

Reason : *It is important to keep the back straight and bend the knees while squatting down to reach for the load to prevent injury.* ***2 Marks***

Section 2 **Q4.**

Section 2 (150 Marks)
Answer **any three** questions

50 marks

(a) Design, in the spaces provided, a suitable bracket for attaching the closed circuit television camera (cctv) to the gable wall of a house.

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

(i) A method to enable the bracket to be attached to the gable wall;

(ii) A method to enable the camera to be attached to the bracket.

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

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

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

Grid A - IDEAS

10 marks available for ideas/sketches presented contributing to the final solution.

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

Grid B – FINAL SOLUTION

Final Solution : ***30 Marks***

Key

Excellent	***25-30 Marks***
Very Good	***20-24 Marks***
Good	***15-19 Marks***
Fair	***10-14 Marks***
Attempt	***0-9 Marks***

(b) A traditional bicycle is shown at **A** and a modern bicycle is shown at **B**. Outline **three** main differences in the design features of the two bicycles.

Bicycle A
(Traditional Bicycle)

Bicycle B
(Modern Bicycle)

1. *Both bicycles have a different braking system; shoe and calipers on the traditional bicycle and disc brakes on the modern bicycle.* ***4 Marks***

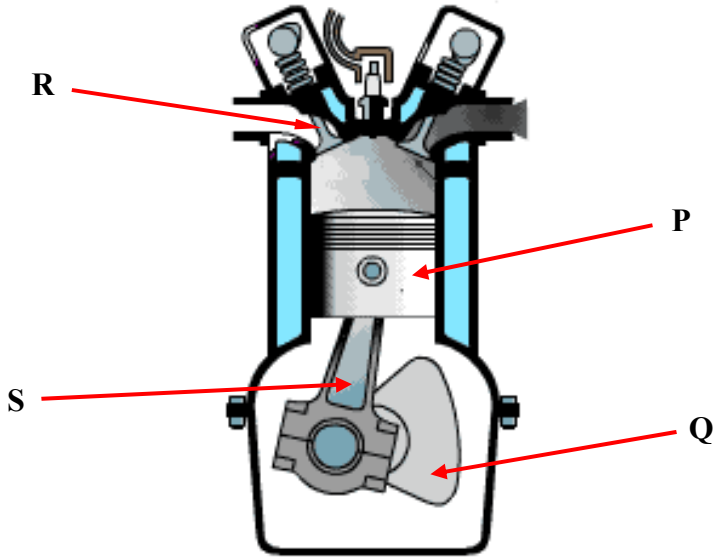
2. *The frame on the modern bicycle has a suspension system while the traditional bicycle has a rigid frame.* ***3 Marks***

3. *The modern bicycle has a gearing system while the traditional bicycle has a fixed gear crankset.* ***3 Marks***

Section 2 **O5.** **50 marks**

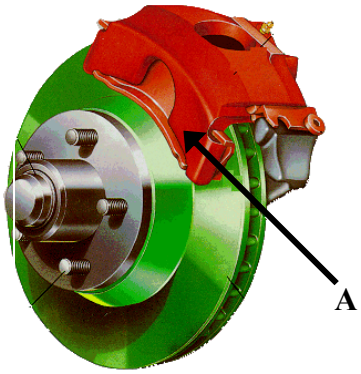
(a) A diagram of a model engine is shown below.

Identify and describe the function of **each** of the labelled parts, **P**, **Q**, **R** and **S**.



Part	Name of Part	Function
P	*Piston*	*The purpose of the piston is to transfer force from expanding gas in the cylinder to the crankshaft via the connecting rod.*
	3 Marks	***3 Marks***
Q	*Crankshaft*	*The crankshaft is the part of an engine that translates reciprocating linear piston motion into rotation.*
	3 Marks	***3 Marks***
R	*Valve*	*The inlet valve lets fuel and air into the combustion chamber while the exhaust valve lets out the burnt gases.*
	3 Marks	***3 Marks***
S	*Connecting Rod or Conrod*	*The conrod connects the piston to the crank or crankshaft.*
	3 Marks	***3 Marks***

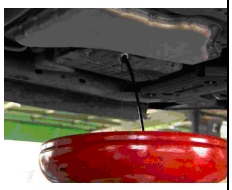
(b) Identify the car mechanism labelled **A** in the diagram opposite and describe the function of it.



Name : *The brake caliper* ***3 Marks***

Function : *The function of the brake caliper is to slow the car's wheels by creating friction with the rotors. When you step on the brake, brake fluid from the master cylinder creates hydraulic pressure on one or more pistons in the brake caliper, forcing the brake pads against the rotor, thus slowing the car down.* ***3 Marks***

(c) Describe in the spaces below the key steps involved in changing the oil in a car engine. The photographs shown may assist you in answering the question.

	Steps	**Description**
1		*Remove the oil sump plug and ensure there is a container in place to allow the old oil to pour into.* ***4 Marks***
2		*Allow the oil to pour into the container via a funnel. When the old oil has emptied out of the sump make sure to replace the oil sump plug.* ***4 Marks***
3		*Remove the old oil filter carefully.* ***4 Marks***
4		*Place the new oil filter in the engine and secure properly.* ***4 Marks***
5		*Using a funnel, pour in the correct volume of new oil. When the oil has settled, the correct level can be checked with the dipstick.* ***4 Marks***

Section 2 **Q6.** **50 marks**

(a) Describe briefly, in the spaces below, **any three** stages used to produce the decorative scroll in the safety rail 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 scrolling machine with the required jig and bend to shape (Cold Method).

8 Marks

Stage 3

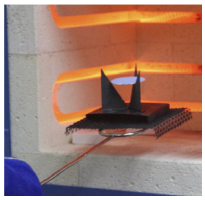
Cool the metal carefully and clean it before painting (Hot Method)

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

8 Marks

(b) The necklace at **A** below is produced using the enamelling process. Briefly describe, in the spaces below, any **four** key stages used to produce the necklace.
The photographs shown may assist you in answering the question.
(Use sketches as appropriate.)





A

Stage 1 : *Cut out the template design and ensure the piece is cleaned properly.*

5 Marks

Stage 2 : *Shake the enamelling powder on over the design template using a sieve.*

5 Marks

Stage 3 : *When the powders have been applied place the piece in a preheated oven using a tongs and trivet.*

5 Marks

Stage 4 : *Allow the enamel to melt in the oven at about 750-820℃ and then remove from the oven*

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

Precaution 1 : *Wear a dust mask or respirator intended to keep enamel dusts out of your nose when you are using enamel in dry form e.g. sifting or sieving.* ***3 Marks***

Precaution 2 : *Wear gloves that are heat resistant to prevent burns to the skin.*

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)

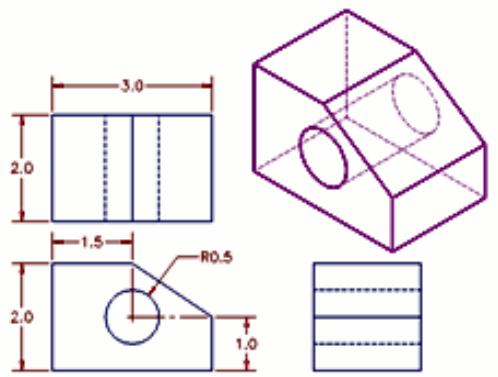
Topic (b) – Electricity

Topic (c) – Electronics

Topic (d) – Mechanisms

Topic (e) – Pneumatics

(a) A simple CAD drawing is shown below. List **any four** CAD commands necessary to produce the drawing below.



Command 1 : Line ***4 Marks***

Command 2.: Circle ***4 Marks***

Command 3 : Linetype ***4 Marks***

Command 4 : Dim ***4 Marks***

(b) In the table below list **three** advantages of using CAD drawings compared to traditional pencil drawings.

Advantage 1	*The CAD drawings are easier to save and carry around instead of a huge amount of papers.* ***3 Marks***
Advantage 2	*The CAD drawings are much easier to correct and change.* ***3 Marks***
Advantage 3	*The CAD drawings are more accurate and they also can be moved, rotated and viewed in 3-D relatively easily.* ***3 Marks***

(a) The diagrams opposite show a typical electrical meter box and readings. Answer the questions in the spaces provided.

(i) What is the number *24621* shown at **A** measuring?

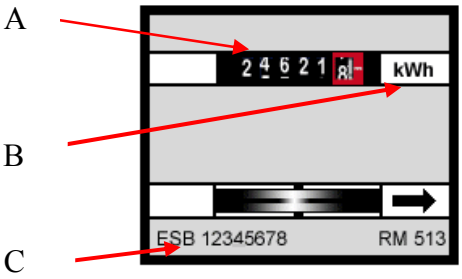
This number records the electrical usage.
3 Marks

(ii) What is the meaning of *kWh* shown at **B**?

Kilowatt hours - *The kilowatt hour is most commonly known as a billing unit for energy delivered to consumers by electric utilities.*
3 Marks

(iii) Why is the number shown at **C** important?

This is the unique number of the ESB meter and is specific to the address of the property.
3 Marks



(b) Explain why three pin-plugs are used in some appliances while other appliances use two-pin plugs.

Explanation : *The reason that some plugs come with three pins is that they are 'grounded.' This means that the third pin connects directly through a series of wires to the ground outside of the building.* ***4 Marks***

(c) Name and state a suitable use for **each** of the tools shown, which are used by an electrician.

Name : *Wire strippers* ***2 Marks***

Use : *To strip the plastic protective coating from electrical wires* ***2 Marks***

Name *Phase tester* ***2 Marks***

Use : *To determine the presence or absence of an electric voltage in equipment under test* ***2 Marks***

Name : *Digital multimeter* ***2 Marks***

Use : *To check for AC or DC voltages, resistance and small amounts of current* ***2 Marks***

Section 2 Q7 (c) Electronics — 25 marks

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

Name : *Light Emitting Diode* **2 Marks**

Use : *To indicate there is power present in a circuit* **2 Marks**

Name : *Light Dependent Resistor* **2 Marks**

Use :*This is a variable resistor whose value changes with light intensity.* **2 Marks**

Name : *Transistor* **2 Marks**

Use : *A device used to amplify and switch electronic signals* **2 Marks**

(b) Identify the electronic component shown and explain the function of the coloured bands on the body of the component.

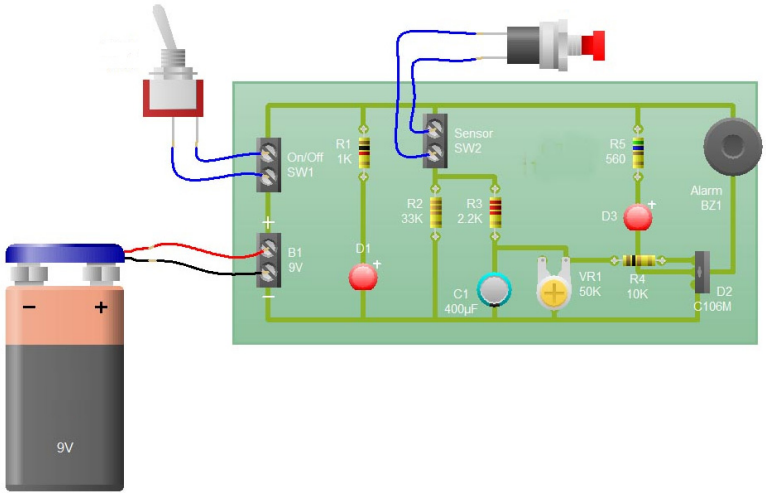
Name : *Resistor*

2 Marks

Function of bands : *The bands represent the resistance value of the resistor measured in ohms. Each coloured band and its location has a numerical value.*

2 Marks

(c) An electronic diagram of a sensor alarm is shown below. Describe in the space provided how the electronic circuit works.

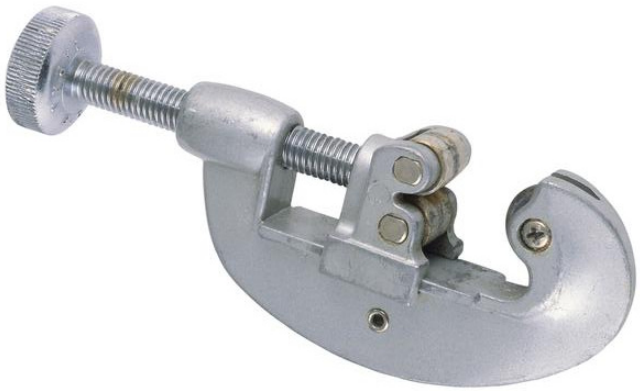


Description :

When the sensor loop circuit is connected the capacitor is charged and activates the transistor which then proceeds to activate the alarm. The circuit is powered by a 9V DC battery. The on/off switch enables the user to switch the alarm system on/off manually.

9 Marks

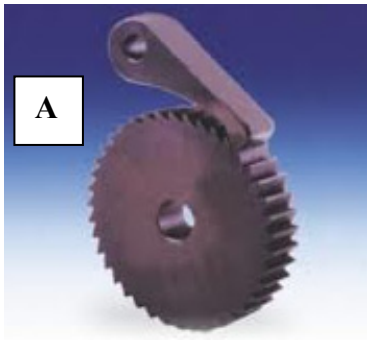
(a) The diagram below shows a hand-operated pipe cutter. Explain how the pipe cutter mechanism works.

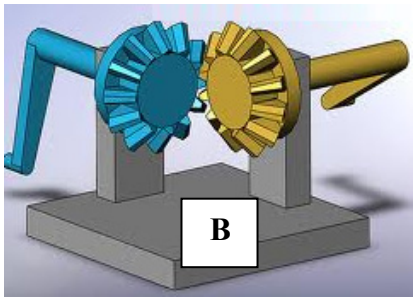


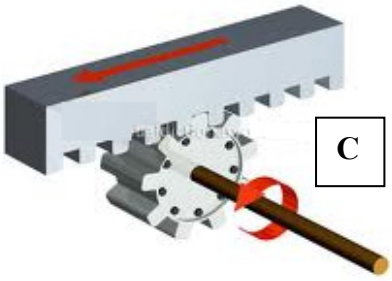
Explanation

The pipe cutter is clamped onto the pipe, then the cutter is turned in a rotary action around the pipe. Every turn or two the cutter is tightened by the hand screw so the blade cuts further into the pipe until it cuts through the pipe completely. The user must be careful to keep rotating the pipe cutter as tension is applied to the blade via the screw. ***7 Marks***

(b) Identify the mechanisms shown below and give a suitable use for **each** of them.

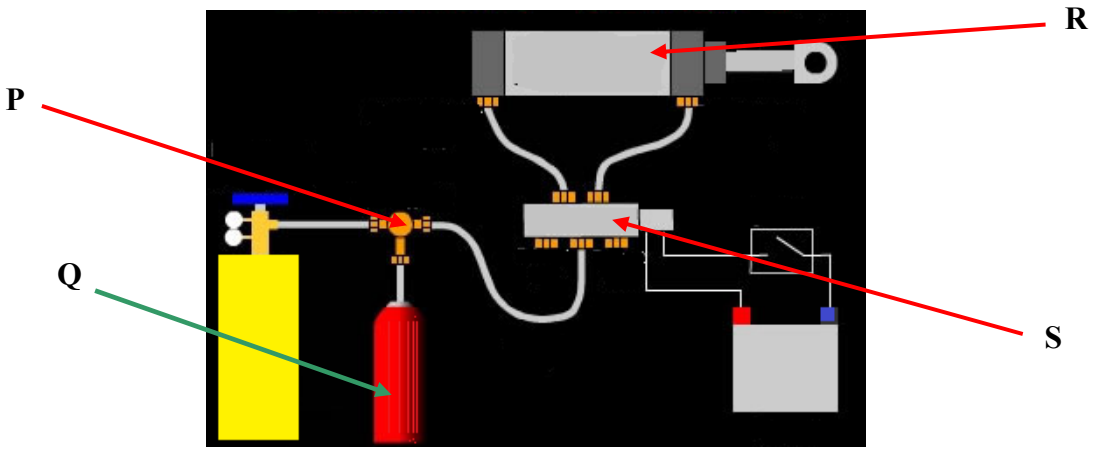






	Name	**Use**
Mechanism **A**	Ratchet and Pawl ***3 Marks***	*This device imparts forward motion and prevents backward motion. It is used to tighten wire.* ***3 Marks***
Mechanism **B**	Bevel Gears ***3 Marks***	*Bevel gears are used to change rotary motion between planes. They are often found in hand drills.* ***3 Marks***
Mechanism **C**	Rack and Pinion ***3 Marks***	*This device comprises a pair of gears which converts rotational motion* into linear motion. ***3 Marks***

(a) Identify the pneumatic components **P**, **Q**, **R** and **S** shown below and state the function of **each**.



	Name	Function
P	*Tee joint* ***2 Marks***	*The Tee joint is used for connecting different pneumatic pipes together.* ***3 Marks***
Q	*Pneumatic Reservoir* ***2 Marks***	*The pneumatic reservoir is used for storing compressed air to operate pneumatic equipment.* ***3 Marks***
R	*Double-Acting Cylinder* ***2 Marks***	*Double-acting cylinders use the force of air to move in both extend and retract strokes. They have two ports to allow air in, one for outstroke and one for instroke.* ***3 Marks***
S	*5-Port Valve* ***2 Marks***	*The valve is used to isolate and simultaneously bypass a passage way for the fluid which for example should retract or extend a double-acting cylinder.* ***3 Marks***

(b) A pneumatic drill (jackhammer) is shown opposite. Describe briefly the role of pneumatics in the operation of the jackhammer.

The jackhammer combines a hammer directly with a chisel and is typically powered by compressed air. A jackhammer operates by driving an internal hammer up and down. The hammer is first driven down to strike the back of the bit and then back up to return the hammer to the original position to repeat the cycle. The bit usually recovers from the stroke by means of a spring. The effectiveness of the jackhammer is dependent on how much force is applied to the tool by the pneumatic system. ***5 Marks***