Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Applied, 2004

Vocational Specialism – Engineering
(240 marks)

Monday 14th June, 2004 **Sample solutions**

Morning 9.30 a.m. – 11.00 a.m.

General Directions to Candidates

1. Write your EXAMINATION NUMBER in this space.
2. Answer all questions from Section 1.
3. Answer ANY THREE questions from Section 2.
4. Write your answers in the spaces provided and include sketches as appropriate.
5. Hand up this paper at the end of the examination.
6. If Question 7 is attempted, answer any two topics.

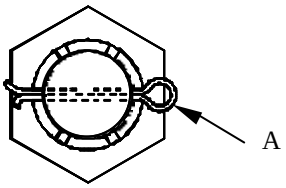
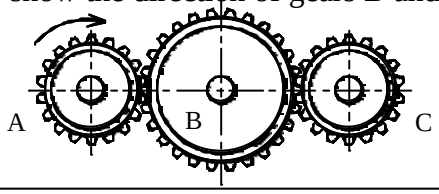
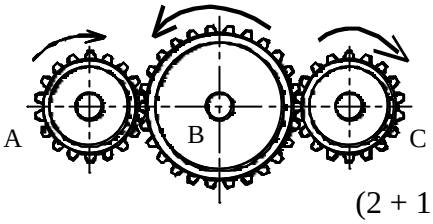
For the Superintendent only	*For the Examiner only*	
Centre Stamp	1. Total of end of page totals	
	2. Aggregate total of all disallowed questions	
	3. Total mark awarded (1 minus 2)	
	4. Bonus mark for answering through Irish (if applicable)	
	5. Total mark awarded if Irish Bonus (3 plus 4)	
	Note: The mark in row 3 (or row 5 if Irish bonus is awarded) must equal the total mark on the flap at the end of the script.	

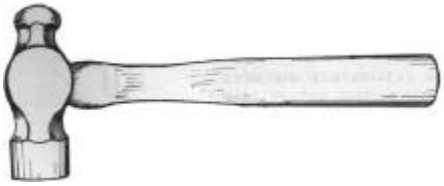
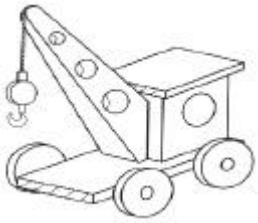
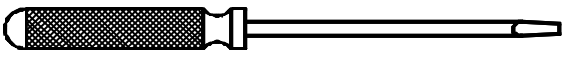
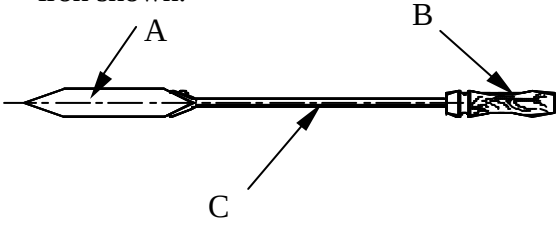
Section 1 (90 Marks)

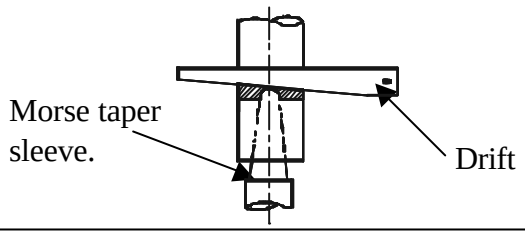
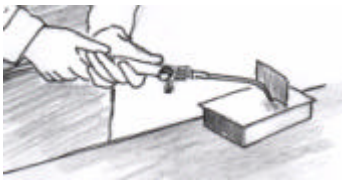
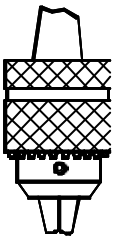
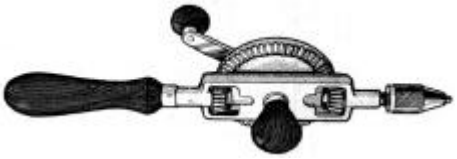
Answer <u>all three</u> questions

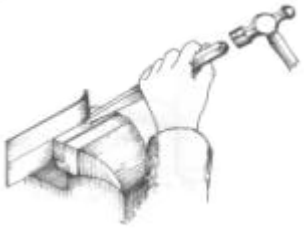
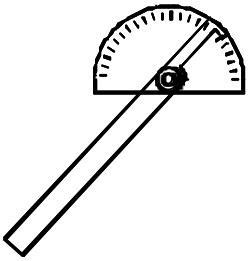
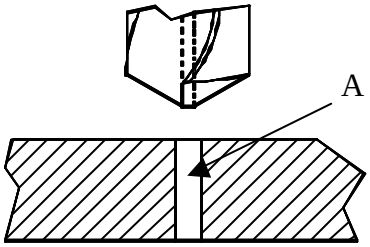
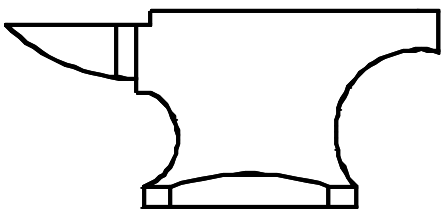
1. **45 marks**

Give brief answers to any <u>fifteen</u> of the following.
(Sketches may be used to explain your answers).

QUESTION	ANSWER
(a) State the name and use for part A. 	Name Split pin. Use To prevent the nut from becoming loose. (2 + 1 marks)
(*b*) If gear A is rotating as shown use arrows to show the direction of gears B and C. 	 (2 + 1 marks)
(c) What does this safety symbol indicate and where would it be used? 	This indicates Flammable substance. Use White spirits or other chemicals. (2 + 1 marks)
(d) Name the tool shown and state its use. 	Tool Dot punch Use To mark the centre of a hole before drilling. (2 + 1 marks)
(e) Explain why stainless steel is used for making cutlery. 	Reason It does not rust when exposed to water. (3 marks)

QUESTION	ANSWER
(f) Name the type of fastener shown and give an example of where it is used. 	Name Pop rivet. Use To join sheet metal. (2 + 1 marks)
(g) Name the type of hammer shown. 	Type Ball pein hammer. (3 marks)
(h) Name a suitable material for children's toys and give a reason. 	Material Plastic. Reason Easily cleaned. Cheap to manufacture. (2 + 1 marks)
(i) State the reason for knurling the handle of a screwdriver. 	Reason To provide grip for the hand when applying a torque force (2 + 1 marks)
(j) Name **any two** parts of the soldering iron shown. 	A Soldering bit. B Handle. C Shaft. (2 + 1 marks)

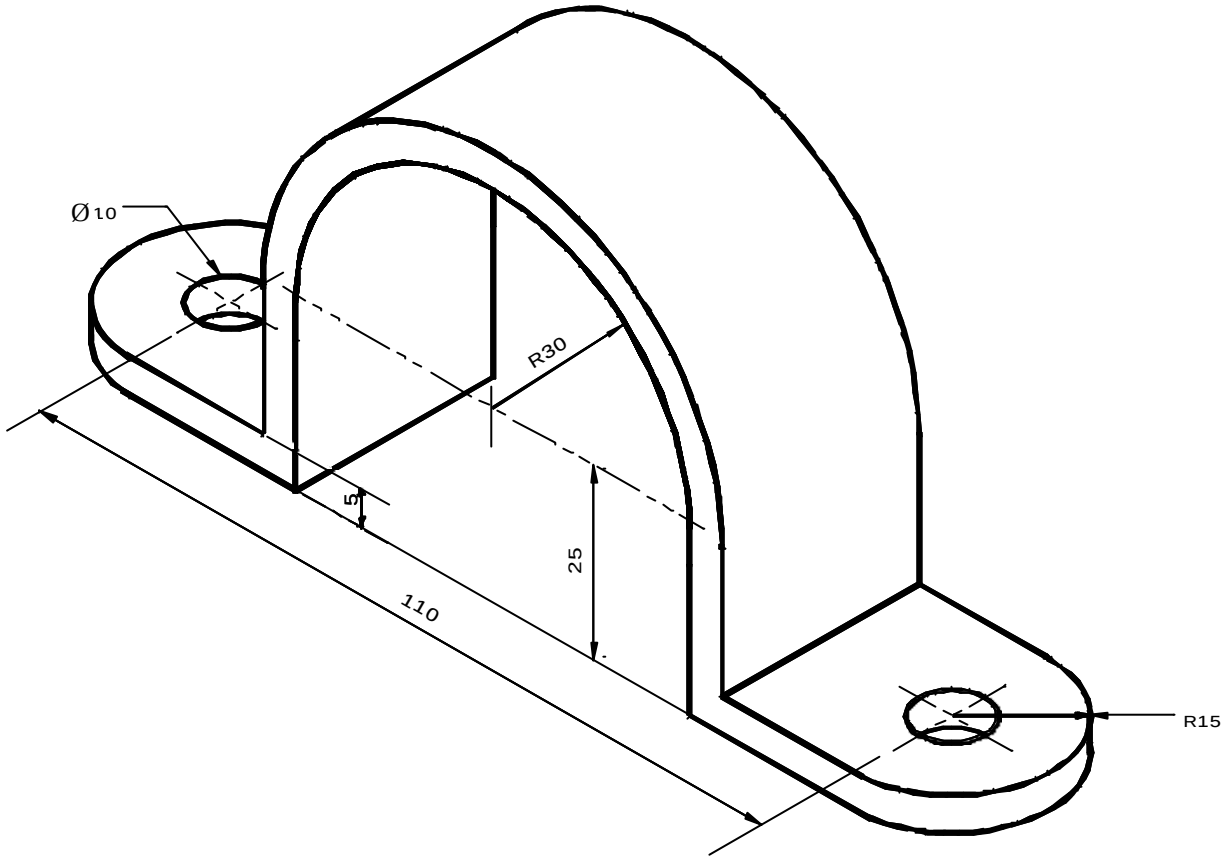
QUESTION	ANSWER
(k) How is a Morse taper sleeve removed from a drilling machine?  	The application of a horizontal force to the drift by the hammer will knock out the morse taper. (3 marks)
(l) State **one** safety precaution that should be observed when welding. 	Safety precaution Wear appropriate eye protection. (3 marks)
(m) Name the machine tool shown and state its use. 	Name Drill chuck. Use To hold a drill bit when using a drilling machine. (2 + 1 marks)
(n) Why is a hand drill sometimes used instead of an electric drilling machine? 	Reason Electrical power may not be available (3 marks)
(o) Name the electrical device shown. 	Name Electric motor. (3 marks)

QUESTION	ANSWER
(p) State **one** safety precaution to be taken when using a cold chisel? 	Hold the cold chisel steady and apply the force away from the body. (3 marks)
(q) Name the tool shown and state its use. 	Name Engineers protractor. Use To measure and mark angles. (2 + 1 marks)
(r) What is the purpose of the pilot hole A? 	To guide a larger drill (3 marks)
(s) Name the joining process. 	Process Riveting. (3 marks)
(t) Name the tool shown and state its use. 	Name Anvil Use To shape metal when forging. (2 + 1 marks)

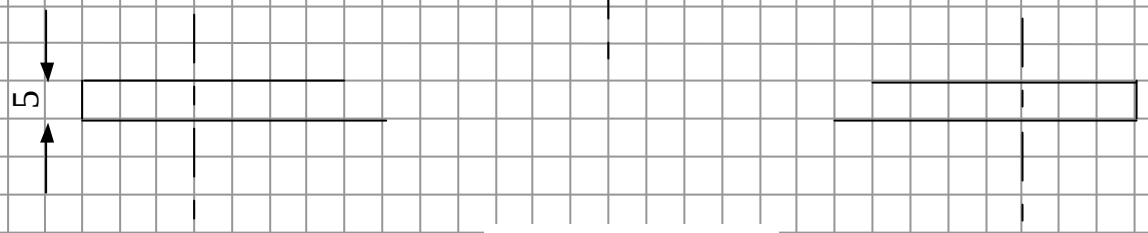
2. **25 marks**

A pictorial view of a pipe bracket drawn full size is shown below.

(a) Complete the elevation and plan of the pipe bracket on the grid paper opposite.



(b) One dimension is shown. Insert **three** others on your drawing.



Complete the Elevation

Appropriate drawings with dimensions

Elevation	**10 marks**
(Top circles	5 marks)
(Vertical lines	3 marks)
(Dotted detail	2 marks)
Plan	**6 marks**
(Rectangle	3 marks)
(Semi-circle	2 marks)
(Holes	2 marks)
Proportion	3 marks
Quality	3 marks
Dimensions	3 x 1 mark each

Draw the Plan

3. **20 marks**

(a) The diagram shows a person brazing. List **two** safety precautions observed and give a reason for each. One example is already listed.

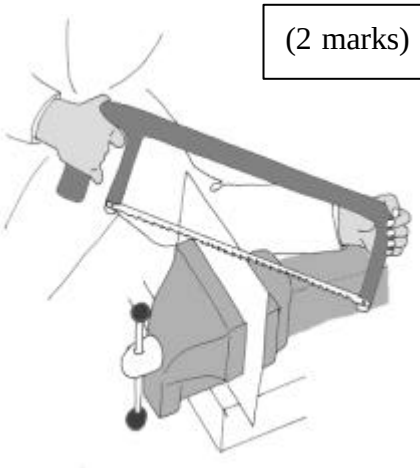
(2 x 2 + 1 marks)

Safety precaution	Reason
Example: An apron is worn.	To protect clothes from being burnt by sparks.
1. Eye protection is worn.	To prevent sparks entering the eyes
2. Protective gloves are worn.	To prevent the hands getting burnt.

(b) The diagram below shows a person using a hacksaw to cut sheet metal. State a danger involved in this process.

(2 marks)

Danger The hacksaw may slip on the sheet metal.



(c) When using the drilling machine shown, identify **any two** dangers and briefly describe the safety precautions that should be taken in each case.

(2 x 2 + 1 marks)

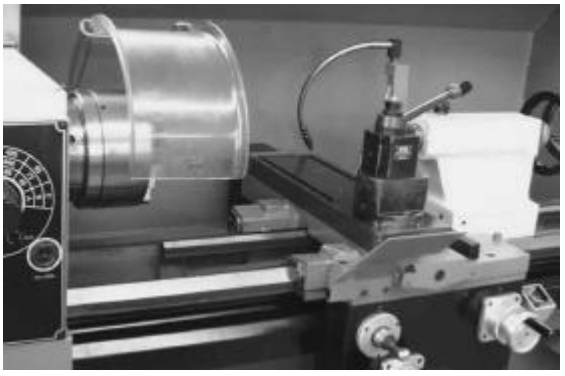
Danger Work not being held securely

Safety precaution Secure workpiece in the drill vice or clamp to the table.

Danger No eye protection worn.

Safety precaution Ensure safety glasses are being worn when drilling

(d) State **two** safety precautions when using a lathe.



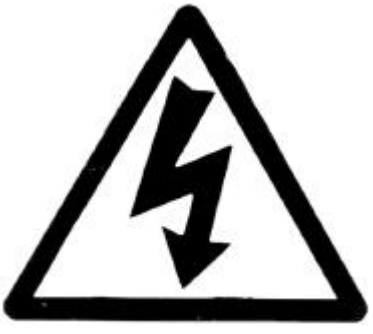
Safety precaution 1 Ensure safety glasses are worn.

Safety precaution 2 Chuck key must be removed before starting centre lathe.

(2 x 2 marks each)

(e) What does this safety symbol indicate and where would it be used?

(2 x 1 marks each)



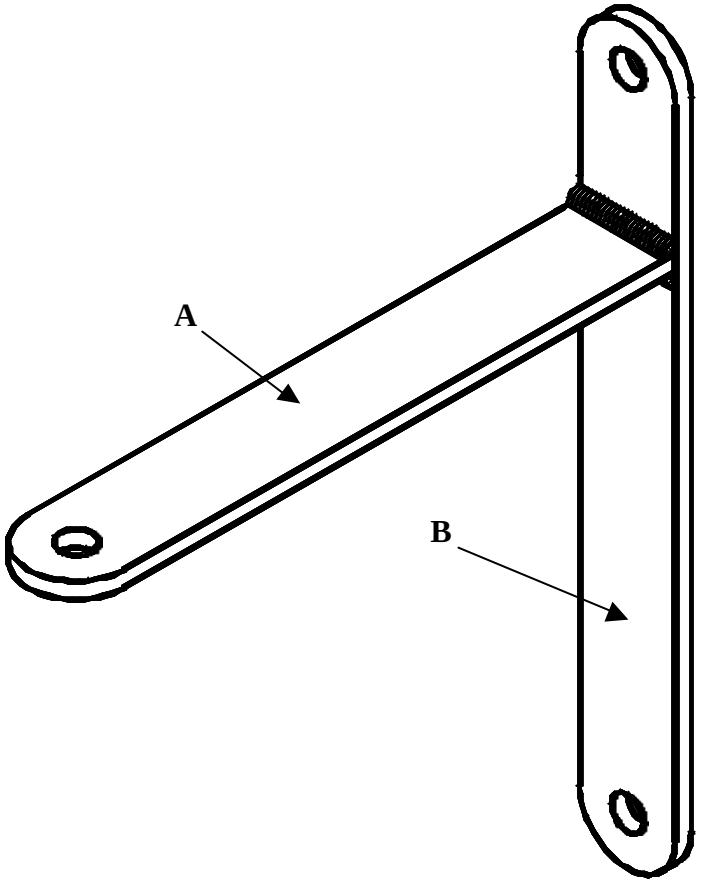
Symbol indicates High voltage.

Used Electrical poles.

Section 2 (150 Marks)
Answer <u>any three</u> questions

4. **50 marks**

The wall bracket is used to support a hanging basket for flowers. It is made from two pieces of steel, A and B that are welded together.



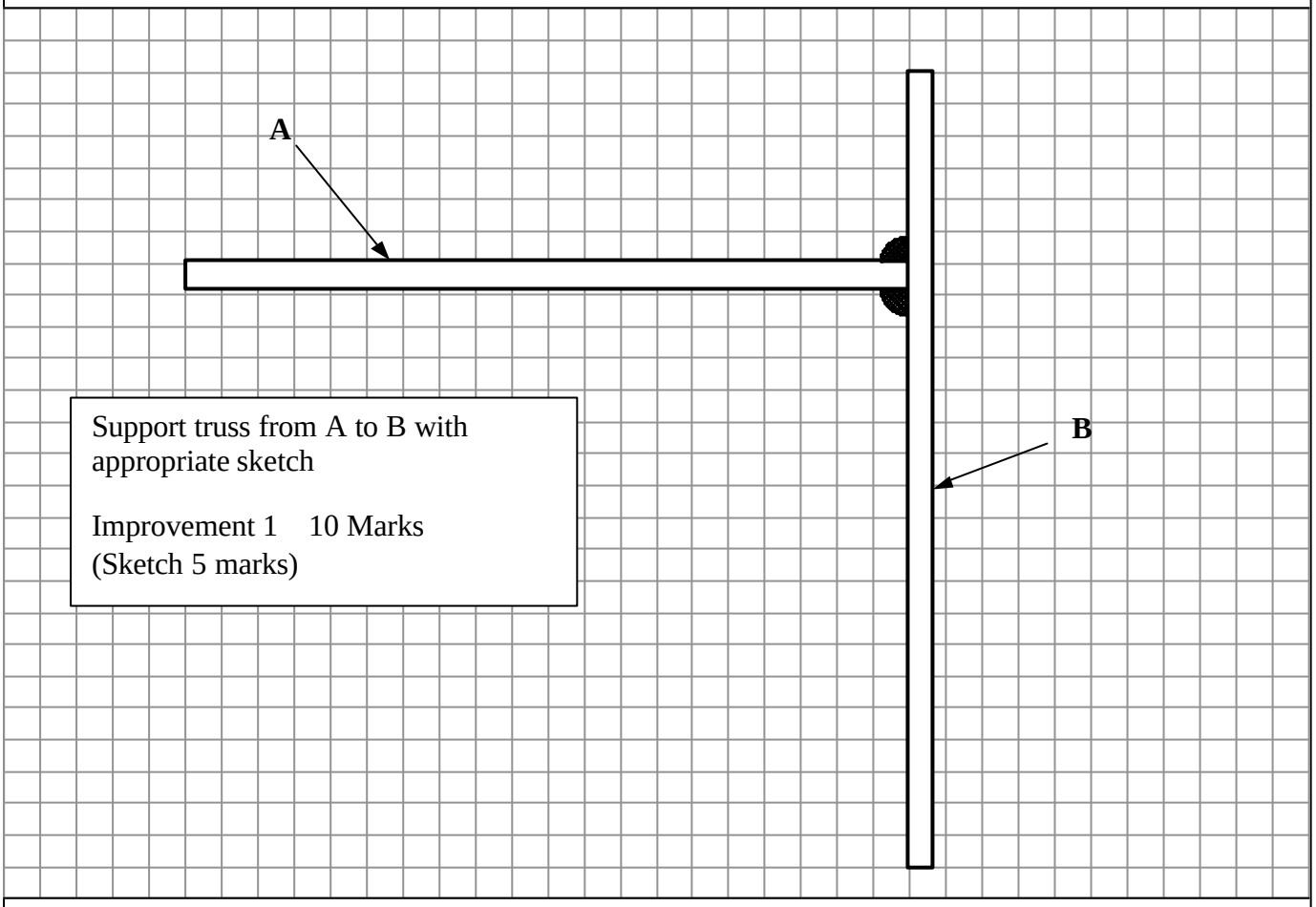
(a) Outline **<u>any two</u>** shortcomings with this design.

(2 x 10 marks each)

1 The overhang on part A is large and will require support

2 The holes in part b need to be countersunk to ensure screws fit flush with bracket

(b) A side view of the wall bracket is shown below.
With the aid of sketches indicate any improvement you would make to this design.



Support truss from A to B with appropriate sketch

Improvement 1 10 Marks
(Sketch 5 marks)

(c) You are required to mark out and shape the semicircle at the top of the bracket below.

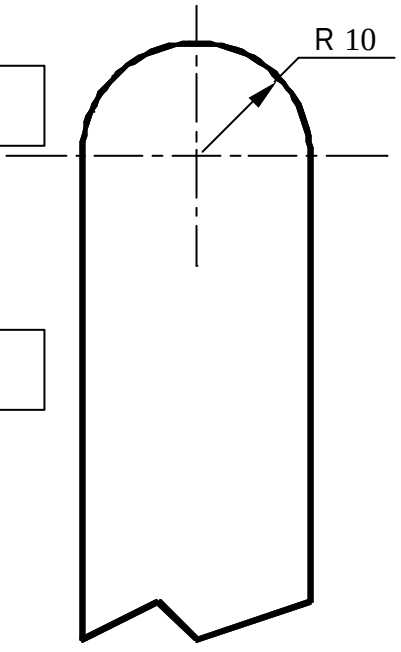
(1) List **three** marking out tools you would use.

1 Scriber

2 Dot punch

3 Engineer's dividers

(3 x 4 marks each)



(2) List **two** shaping tools you would use.

(2 x 4 marks each)

1 _____

2 Hand file

5. **50 marks**

(a) Name **any five** parts of the engine shown.

A Piston rings

B Piston

C Camshaft

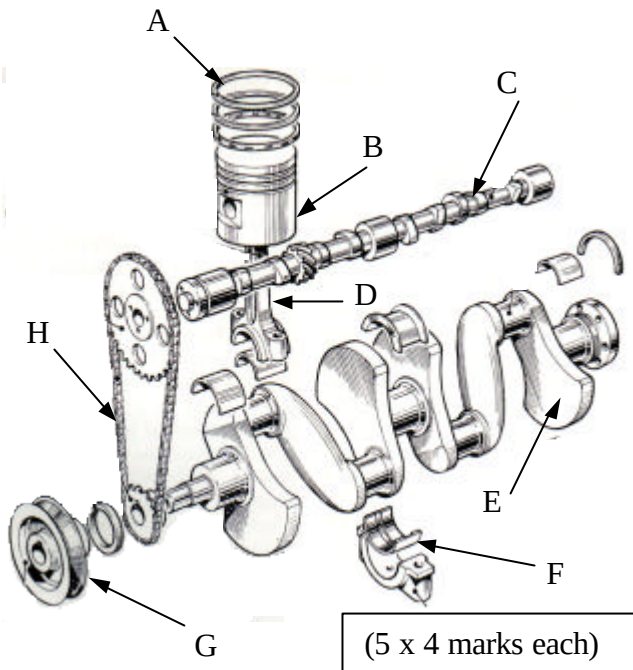
D Conrod

E Crankshaft

F Shell bearing

G Pully

H Timing chain



(5 x 4 marks each)

(b) Most modern engines operate on the four-stroke cycle; induction, compression, power and exhaust. Explain the operation of the induction and compression strokes (use sketches as appropriate).

(2 x 7 marks each)

Induction The piston starts at the top, the intake valve opens and the piston moves down to let the engine take in a cylinder-full of air and gasoline. This is the intake stroke.

Compression The valves are closed and the piston moves up to compress the fuel/air mixture. Compression makes the explosion more powerful.

(c) You are required to change the engine oil in a motorcar. Describe **four** steps necessary to complete this procedure safely (use sketches as appropriate).

(4 x 4 marks each)

Step 1 Raise the car up.

Step 2 Get appropriate container and loosen the nut allowing the oil to drain out of the sump.

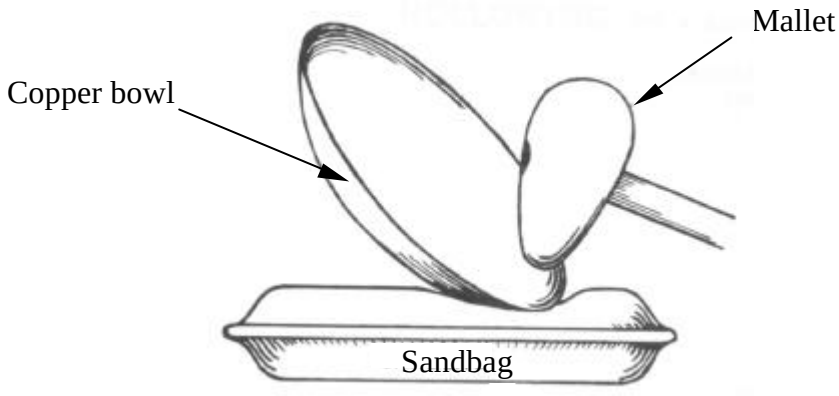
Step 3 Replace the nut on the sump.

Step 4 Refill the oil and dispose of the old oil in an appropriate way.

6. **50 marks**

(a) The bowl shown below is formed from a flat copper disk using a mallet and sandbag. Briefly describe **any two** of the following processes used; annealing, cleaning and hollowing (use sketches as appropriate).

(2 x 10 marks each)



Annealing This is used to soften the metal. Heat the copper and cool very slowly.

Cleaning Clean the copper in a pickeling bath after annealing it. The pickeling bath contains acid.

Hollowing Concentric circles are drawn. The copper is beaten with a bossing mallet on a leather sandbag.

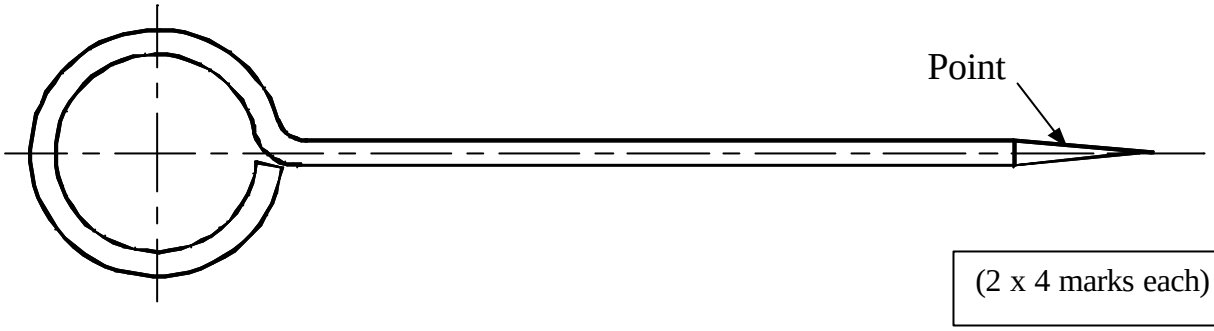
(b) List **two** safety precautions that should be observed during the annealing process.

1 Wear eye protection when heating.

2 Wear gloves when heating the workpiece.

(2 x 5 marks each)

(c) You are required to forge a point at the end of the poker as shown. Briefly describe **any two** stages of this process (use sketches as appropriate).



(2 x 4 marks each)

1 Mark out the length of point required.

2 Heat the tip of the poker until red and hammer to shape using the anvil.

(d) Plastic dip coating is a suitable finish for the poker handle. Describe **three** stages of plastic dip coating.

Stage 1 Clean the poker handle using emery paper.

Stage 2 Heat the handle ensuring it does not become too hot.

Stage 3 Dip into powder plastic and allow to cool slowly.

(3 x 4 marks each)

7. **50 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

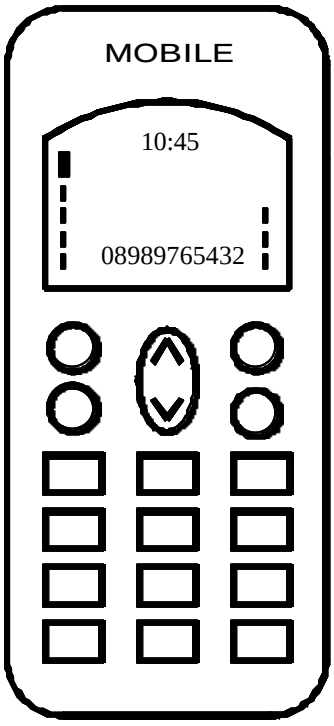
Topic (d) – Mechanisms

Topic (e) – Pneumatics

7 (a) Computer Aided Design — 25 marks

(a) A drawing of the face of a mobile phone is shown. List any five CAD commands necessary to produce the drawing.

(5 x 3 marks each)



1 Draw.

2 Rectangle.

3 Fillet.

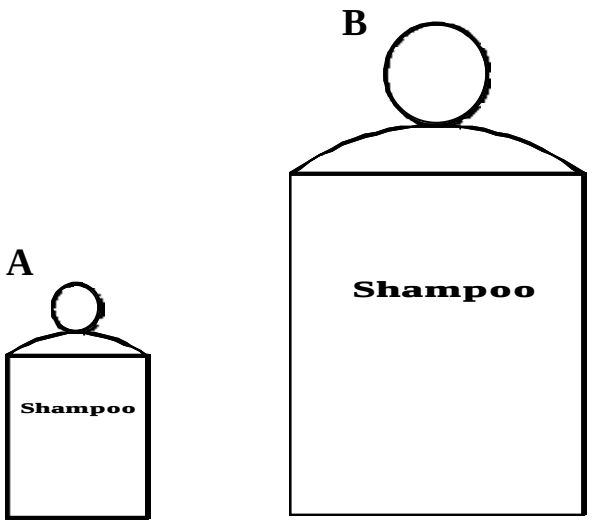
4 Circle.

5 Ellipse

(b) Having drawn the small shampoo bottle A using a CAD package, name the main command and procedure used to draw the bottle B.

(2 x 5 marks each)

Command Scale.



Procedure Select command. Select object to be scaled. Select ratio, select base point and enter.

7 (b) Electricity — 25 marks

(a) (1) Electric current can be supplied as AC or DC. What do these terms represent?

AC Alternating current.

DC Direct current.

(2 x 4 marks each)

(2) In what form is current supplied to our homes?

Alternating current (AC).

(1 x 4 marks)

(b) Three wires A, B and C are to be connected to the ceiling rose below.

(1) Name the three wires.

A Live

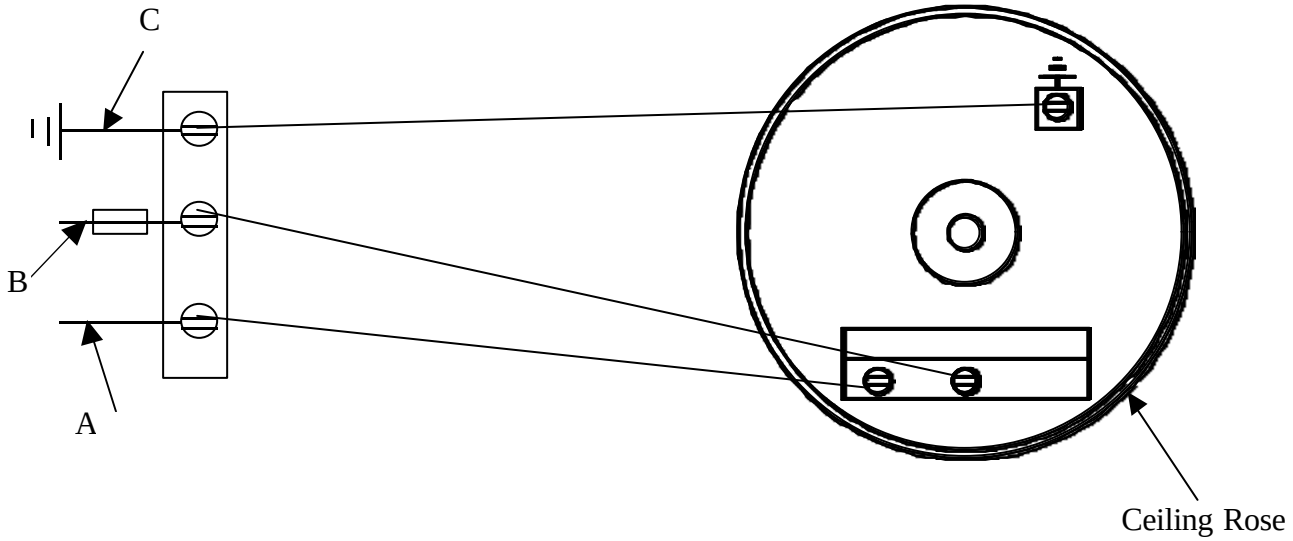
B Neutral.

C Earth.

(3 x 3 marks each)

(2) Using the drawing below, connect wires A, B and C to the ceiling rose.

(2 + 1 + 1 marks)



7 (c) Electronics — 25 marks

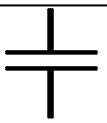
(a) Name and give a use for **any four** of these electronic symbols and components.

Name Bulb.

Use To provide light.

Name Push button switch.

Use To turn current on and off.



Name Capacitor

Use To store charge.

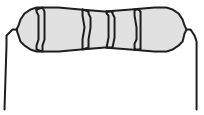
(4 x 3 + 2 marks)

Name Toggle switch.

Use To turn current on and off.

Name Variable resistor.

Use To vary the current flowing.



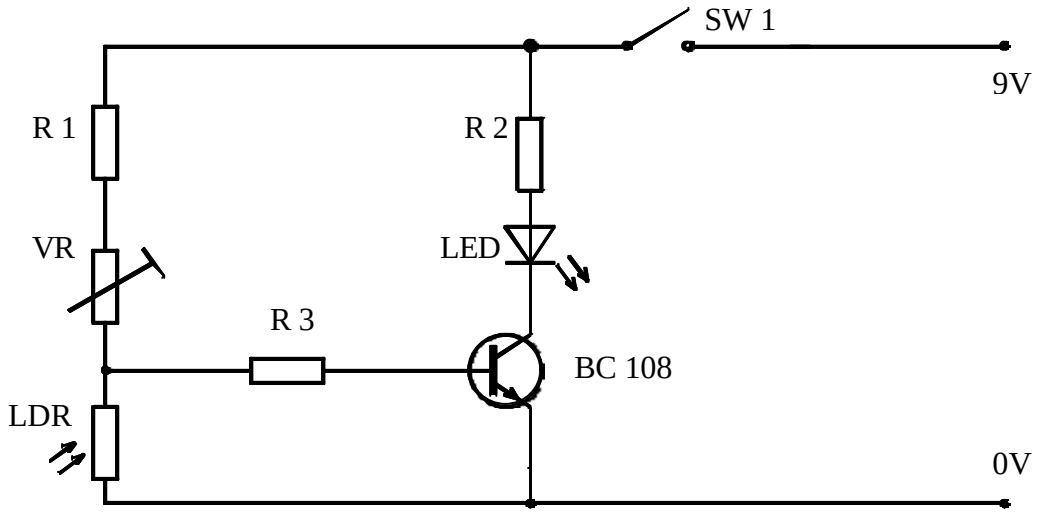
Name Resistor.

Use To reduce current.

(b) Part of a sensor circuit to control street lighting is shown below.
State the name and use of **any two** of the following components.

(2 + 1) + (1 + 1) marks

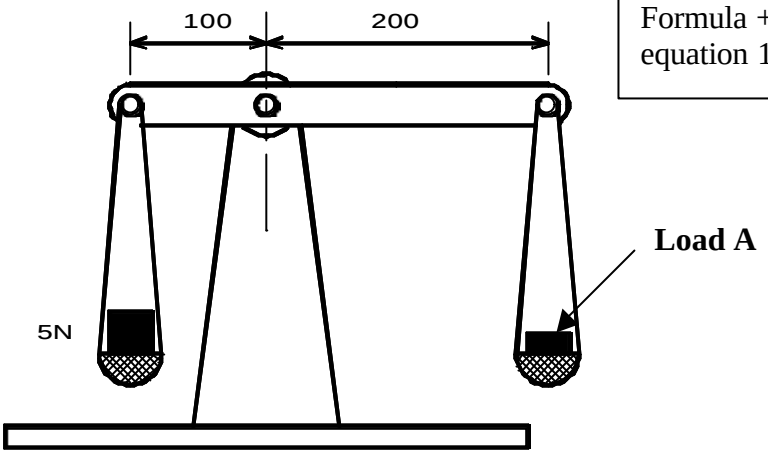
Component	Name	Use
SW 1	Switch.	To turn current on and off.
LED	Light emitting diode.	To show current is flowing.
VR	Variable resistor	To vary current flowing.
LDR	Light dependent resistor.	Resistance depends on light.



7 (d) Mechanisms 25 marks

(a) A load of 5N is acting downward 100mm from the fulcrum as shown below. Calculate the load A on the right required to balance the scales.

(Calculation 13 marks)
Formula + numbers in equation 10 marks



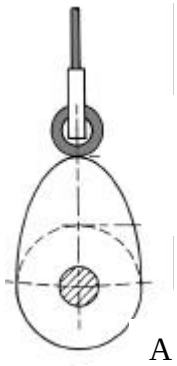
Calculation 100 x 5N = 200N x A

200A = 500

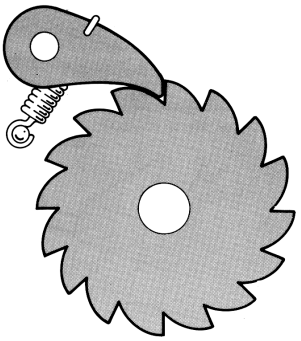
A = 500/200 = 2.5N

(b) Identify **any two** of the mechanisms A, B or C and state where they are used.

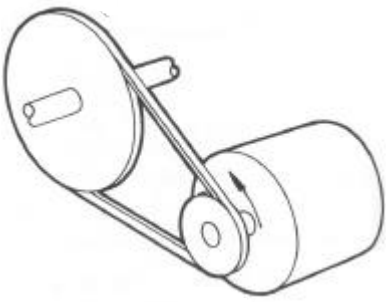
(2 x 3 + 3 marks)



A



B



C

	Name	Where used
Mechanism A	Cam and follower.	Used in engine to open and close valves.
Mechanism B	Ratchet and pawl.	Used to tighten wire acting as a strainer.
Mechanism C	Pulley and vee belt	Drilling machines.

7 (e) Pneumatics — 25 marks

(a) Give a name and use for **any two** of the pneumatic symbols shown below. (2 x 3 + 2 marks)

Name Single acting cylinder.

Use Testing frames in engineering.

Name Tee connector.

Use To branch an airline in pneumatics.

Name Three-port valve.

Use To control the air flow in a circuit.

(b) A common type of pneumatic cylinder, controlled by a valve, is shown below. (3 x 3 marks)

(1) Name the type of cylinder shown.

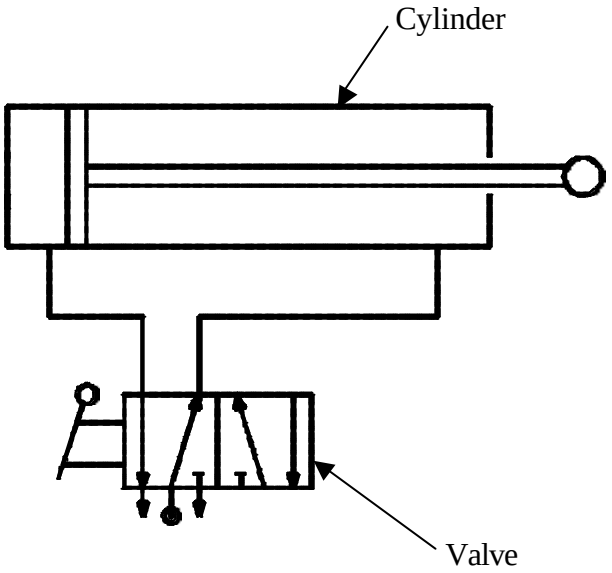
Double-acting cylinder.

(2) Name the type of valve shown.

Five-port valve.

(3) Give a practical application of its use.

To open and close doors.



(c) Give **two** safety precautions when using compressed air. (2 x 3 marks)

1 Always work at safe working pressures.

2 Never point a live airline at yourself or anybody else.