

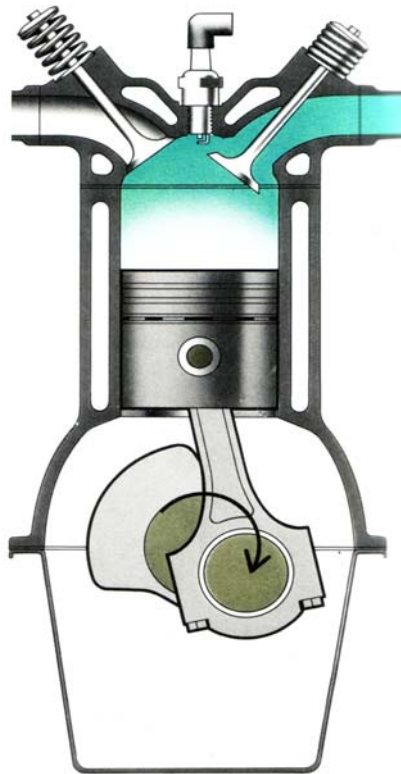


**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

Junior Certificate Examinations 2004

Materials and Technology

Metalwork – Higher Level



Sample Answers and Marking Scheme

Answer Question 1, Section A and B, and three others.

Only five parts to be counted

(a) Fr. Nicholas Callan – Induction coil (1828)
 Michael Faraday – Electric motor and dynamo (1831)
 The Wright brothers – Aeroplane (1903)

Any one **4 Marks**

(b) (i) Spark plug *2 Marks*
 (ii) To ignite / light the fuel *2 Marks*

4 Marks

(c) (i) Piston *2 Marks*
 (ii) Aluminium *2 Marks*

4 Marks

(d) This is the con rod. It connects the piston to the crank and as a result the downward motion of the piston forces the crank to rotate.

4 Marks

(e) This inlet valve opens to allow the fuel / air mixture into the cylinder. It then closes to allow compression to take place.

4 Marks

(f) (i) Thermoplastic - include Acrylic, Polyethylene, Polypropylene, polystyrene, PVC and Nylon. *Any One 1 Mark*

Thermosetting – include Phenolic Resins (Bakelite), Polyester Resins and Polyurethanes. *Any One 1 Mark*

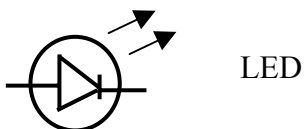
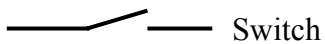
(ii) *Example -* PVC used in guttering.
 Phenolic Resins used in electrical fittings. *2 @ 1 Mark each*

4 Marks

(g) (i) Switch (i)
 Resistor (ii)
 LED (iii)
 Transistor (iv)

Name 2 @ 1 Mark each

(ii) Draw any one symbol



Draw symbol 2 Marks

4 Marks

Only five parts to be counted

- (a) Bevel/protractor is used to mark –out part 11. **4 Marks**
- (b) Heat on strip heater/bender – bend to angle. **4 Marks**
- (c) (i) Brass. *1 Mark*
 It is heavy metal (alloy). *1 Mark*
- (ii) - drill a hole using the lathe to allow the piece slip onto the rotating arm.
 - drill tapping size hole through the piece.
 - tap the hole to allow for locking onto the rotating arm. *2 Marks* **4 Marks**
- (d) The potentiometer allows the resistance in the electrical circuit to be varied. This in turn varies the output speed of the motor. **4 Marks**
- (e) The slip rings allow the electrical contact be maintained while the helicopter rotates. **4 Marks**
- (f) Sketch showing landing surface and means to attach to base.
 Description of features. *Sketch 2 Marks*
Description 2 Marks **4 Marks**

Question 2

20 Marks

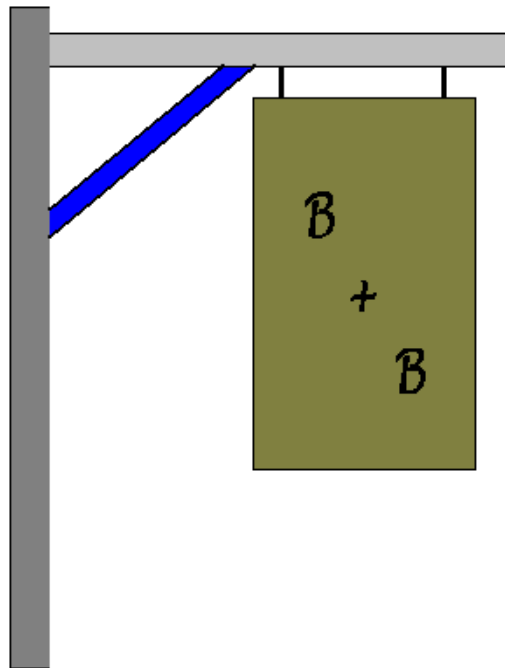
(a) (i) Sources could include books, magazines and the internet.
3 sources @ 1 Mark each

(ii) Factors to consider include strength, weight, corrosion properties and cost.
3 factors @ 1 Mark each

6 Marks

(b) (i) Mild steel.
Easy to shape, easy to join and strong.
Suitable metal 2 Marks
2 reasons @ 1 Mark each

(ii) Sketch.



Sketch 4 Marks
Notes 2 Marks

(iii) Paint the mild steel. Galvanise the mild steel.
Suitable finish 4 Marks

14 Marks

- (a) (i) A is parallel turning
B is Taper turning
C is Knurling
D is Facing

Name any three @ 1 Mark each

- (ii) A – Parallel turning. The tool moves parallel to the axis of the rotation of the work and cylindrical forms are produced.
B – Taper turning. The top slide is used for cutting the short taper. It is set to half the included angle of the taper and cuts are then made.
C – Knurling is the operation of impressing serrations on articles to enable them to be gripped securely by hand.
D – Facing produces a flat surface by using the cross slide to move the tool at right angles to the axis of rotation of the work.

Explain any three @ 2 Marks each

9 Marks

- (b) So that different diameters of material may be turned.

So that different materials may be machined. e.g. hard or soft.

2 reasons @ 2 + 1 Marks

3 Marks

- (c) Correct substitution in formula, Correct answer
Answer 1500RPM – (if correct answer only – 4 marks).

2+2 Marks

4 Marks

- (d) (i) X is a centre or Slocombe drill
Y is an outside callipers.

Name both @ 1 Mark each

- (ii) The centre or Slocombe drill (X) is used for drilling countersunk holes to accommodate lathe centres and also for starting the holes when drilling on the lathe.
The outside callipers (Y) are used together with a ruler for measuring diameters and are also used for comparing dimensions.

Explain one @ 2 Marks

4 Marks

Question 4

20 Marks

(a) The Basic oxygen furnace.

1 Mark

(b) The charge is made up of molten iron, scrap metal and lime.

3 Marks

(c) (i) **A** is the fume hood.
B is the oxygen lance.

1 Mark

1 Mark

(ii) **A** The fume hood is used to extract the fumes produced.

1 Mark

B The oxygen lance is lowered in through mouth of the furnace and oxygen is blown through the lance onto the surface of the molten metal at high speed. This causes a rise in temperature, which burns the unwanted impurities from the charge.

1 Mark

4 Marks

(d) The oxygen lance is water-cooled.

1 Mark

(e) The furnace is tilted and the molten steel is poured from underneath the slag, out the tapping hole, into a ladle. The furnace is tilted in the opposite direction to empty the slag.

Description 2 Marks

2 Marks

(f) (i) Steel is produced.
(ii) The electric arc furnace.

1 Mark

1 Mark

2 Marks

(g)

Component	Alloy	Property
Iron + Carbon	Steel	Strong and tough
Copper + Tin	Bronze	Good corrosion resistance
Copper + Zinc	Brass	Good ware resistance

*Redraw the table 1 Mark
3 named alloys @ 1 Mark each
3 named properties @ 1 Mark each*

7 Marks

- (a) **A** - Rubber for the tyres.
- B** - Leather or Kevlar for the saddle.
- C** - Aluminium tubing for the frame.

3 Names @ 1 Mark each

- A** – Easy to mould. Makes good frictional contact with the road.
- B** – Comfortable material to sit on.
- C** – Light but allows for a solid frame to be produced.

3 Reasons @ 1 Mark each

6 Marks

- (b) (i) Gear ratio is 1:4
- (ii) 160 RPM

3 Marks

3 Marks

6 Marks

- (c) (i) Riveting.
- (ii) Used to build the Eiffel tower.

2 Marks

2 Marks

4 Marks

- (d) (i) Pneumatic tyres are tyres filled (compressed) with air.

3 Marks

- (ii) John B. Dunlop. While born in Scotland he lived much of his life in Belfast.

1 Mark

4 Marks

Question 6

20 Marks

- (a) (i) A is the bit or tip. The bit is normally made from copper.

Name 2 Marks, Material 2 Marks

- (ii) Lead and Tin is used to produce soft solder.

2 Materials @ 1 Mark each

- (iii) Plug in the iron to heat the bit.
Tin the bit by applying a thin layer of solder.
Apply to the joint area.

3 steps @ 1 Mark each

- (iv) Place iron in holder when not in use.
Avoid contact with bare hands.
Wash hands after use.

3 precautions @ 1 Mark each

12 Marks

- (b) Passive fluxes prevent oxidation during the soldering process.
Active fluxes remove oxides from the surfaces and prevent further oxidation during soldering.

4 Marks

- (c) (i) Conductivity – This is the ability of a material to allow heat or electricity to flow through it.
- (ii) Melting point – The temperature at which bonds are broken causing solids to turn to liquids.
- (iii) States of matter – Matter exists as either a Solid, Liquid or Gas.
- (iv) Transformer – Used with electric soldering irons to step down to a safe working voltage.

Explain any two @ 2 Marks each

4 Marks

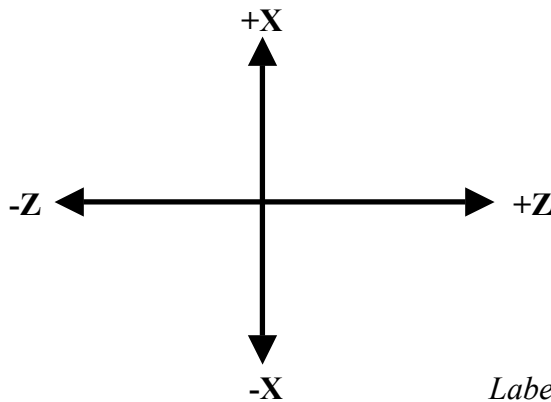
Question 7

20 Marks

(a) (i) A computer numerical control (CNC) lathe is shown. *1 Mark*

(ii) The acrylic guard.
The emergency stop button.
A test run is required before operation. *3 features @ 1 Mark each*

(iii)



Redraw 1 Mark

Label 4 keys @ 1 Mark each

(iv) Canned cycle – allows a number of repetitive operations to be carried out by a single block of a program.

G-codes – are used for controlling the tool movements.

Menu – a table of commands from which a selection can be made.

Test run – a simulation of the program on the screen to ensure it is correct before starting the cutting process.

Explain any two @ 1 Mark each

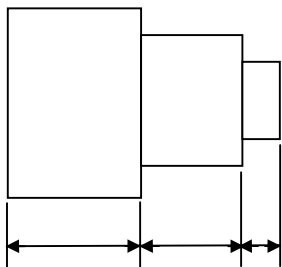
(v) Repeatability / Mass production.
Greater accuracy / better finish.

2 advantages @ 1 Mark each

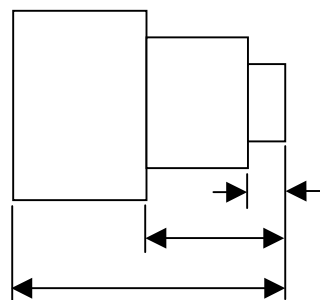
13 Marks

(b)

Incremental dimensioning



Absolute dimensioning



Redraw 1 Mark

Illustrate Absolute 3 Marks

Illustrate Incremental 3 Marks

7 Marks