LEAVING CERTIFICATE EXAMINATIONS 2002
ENGINEERING MATERIALS AND TECHNOLOGY

ORDINARY LEVEL

Solutions & Marking Scheme
Required: Answer Question 1 and 3 others

QUESTION No. 1 65 MARKS **Marks**

SECTION A - 30 MARKS **6 parts @ 5 marks each**
For two part answers award 3 + 2

SECTION B – 35 MARKS **2 parts @ 12 marks each**
1 part @ 11 marks
Award 6 + 6 or 6+ 5 as Appropriate

SECTION A – 30 MARKS

		MARKS
(a)	Capillary action results in liquid being drawn upwards in narrow gaps between adjacent parts due to surface tension in the liquid.	5 Marks
(b)	Transistor	5 Marks
(c)	Beating copper work	5 Marks
(d)	(i) acme (ii) V thread (iii) Square (iv) Buttress	3+ 2 Marks
(e)	The gauge is a Vernier gauge and is a precision measuring instrument. Used for external and internal measuring.	3+ 2 Marks
(f)	Silver Soldering and Brazing	3+ 2 Marks
(g)	Vice, magnetic vice and clamping	3+ 2 Marks
(h)	Machine set to correct speed, safety goggles , material securely clamped	3+ 2 Marks

SECTION B – 35 MARKS (continued) **MARKS**

(i)

(i) Multimeter: An electrical instrument used to measure voltage, Current and resistance.

(ii) Scanner: A piece of hardware connected to the computer, used to scan text and graphics to software packages.

Good clear description
Award 12 marks
Total (12)

(iii) An electrical component, whose resistance decreases with light.

(j) WWW: World Wide Web
Computer Control: Computer is used to operate CNC lathe, Robot, traffic lights.
Desk Top Publishing: A software package used to produce Graphics and text. (Preparation of project folder)

Good clear description
for one, award 6
for two, award 12
Total (12)

(k) A universal joint, allows for flexible movement of shafts Used on drive shafts of motor vehicles.

Good clear description
Award 12 marks
Total (12)

(i) "Charging bells" and "tuyeres" are part of the construction of the Blast Furnace

Good clear description
Award 6+5 marks
Total (11)

(m) Rack and pinion mechanism used pillar drilling machine and the steering mechanism of some automobiles.

Good clear description
Award 6+5 marks
Total (11)

QUESTION NO.2

(a) (i) Hardening: The hardness of a metal is its ability to resist wear, indentation and scratching.

(ii) Annealing: This heat treatment is applied to copper after being work hardened. (softens material)

Good description
Award **2 @** 5marks
Total (10)

(b)

(i) The centre punch is heated to a suitable temperature, which is identified by a tempering colour, ranging from ***pale straw*** to ***blue.*** The centre punch is then quenched in water or oil.

Good description
Award **8+7** 5marks
Total (15)

(ii) A centre punch is tempered after hardening to remove some of the hardness from the steel, but it also improves its toughness considerably.

(c) (i) Screwdriver made from mild steel is case-hardened. This increases the carbon content of the outer surface to a depth of about 1mm and this 'case' or 'skin' can then be hardened

(ii) Copper candle holder which is being hammered into shape must be constantly annealed to soften the material.

Good description
Award **2 @** 5marks
Total (10)

(d) (i) Conductivity: ability of a metal to allow heat or electricity to flow through it. (Silver, copper and aluminium)

(ii) Elasticity: ability of a metal to return to its original shape After deformation. (Spring steel)

Good description
Award **2 @** 5marks
Total (10)

Question No.3

(a) (i) Pig Iron: Produced in Blast Furnace
(ii) Steel: Produced in Basic Oxygen Furnace
(iii) Cast Iron: Produced in Cupola Furnace

Name process
Award **3 @** 5marks
Total (15)

(b) Operation of the Blast Furnace

The operation of the blast furnace is continuous. As the slag builds up on the surface of the molten metal, it is constantly tapped off. Similarly as a sufficient quantity of molten iron accumulates beneath the slag, it is tapped off ready for the steel furnaces.

Input - Coke + Iron + Limestone
Output – Pig Iron + Slag.

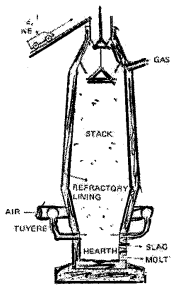
(b) Operation of the Basic Oxygen Furnace

The Basic Oxygen Furnace is pear shaped as shown and has up to 300 tonne capacity. A charge containing up to 40% scrap is loaded into the converter followed by lime and molten pig iron. Oxygen is then blown at the surface of the molten charge from a water-cooled lance, which is lowered through the mouth of the converter to with in 0.5m of the surface of the charge. Impurities in the charge are oxidised and form a slag on the surface. At the end of the blow, the slag is run off first and the steel is transferred to a ladle preparatory to being cast as ingots.

Good Description for any one furnace award 10 marks

Total (10)

Cast Iron is produced by smelting pig iron in a Cupola furnace Using limestone as flux to trap impurities.



Blast Furnace

(c) Soft Solder: Lead 39% Tin 60% Antimony 1%
(melts 200 centigrade)

Composition
Award 2 @ 5 Marks
Total (10)

(d) Two non-ferrous metals: Copper, Aluminium. Lead

Name two metals
Award 2 @ 5 marks
Total (10)

OR

(d) Series Circuit , Series/Parallel Circuit , Parallel Circuit

Name two circuits
Award 2 @ 5marks

Total (10)

QUESTION NO. 4

(a) (i) Electric Soldering iron

(ii) Selection of suitable flux is very important for the following reason:

A non-corrosive flux is essential for electrical work (resin)

(iii) Flux is contained in the cored solder

(iv) Melting point of solder 200 degrees centigrade

Name the process
award 4 @ 5marks each

Total (20)

(b) (i) Neutral Flame: equal amounts of acetylene/oxygen

(ii) Oxygen in excess of that required for complete combustion

produces an oxidising flame.

(iii) Carbonising Flame. Is caused by excess acetylene.

Explain the difference
award 3 @ 5marks each

Total (15)

(c) Ensure that: (i) Safety goggles are worn

(ii) Cables are in good condition

(iii) Good ventilation

Name three 10 marks
Name two 8 marks
Name one 5 marks
Total (10)

QUESTION NO. 5

(a) Methods of joining plastics:
(i) Welding (ii) Adhesives (iii) Screwing & Tapping

Name three 3@ 5 marks

Total (15)

(b) (i) Blow Moulding (ii) Vacuum forming (iii) Extrusion

(c) (i) Blow Moulding:
Is used to produce hollow articles such as bottles and containers.
The plastic is first softened by heating and is then blown out against the walls of a mould by means of air pressure

Name the Processes
3 @ 5 marks
Describe one 7 + 3
Total (25)

(ii) Vacuum Forming :

This process is used to make articles from thermoplastic plastic sheet.
The sheet is cut to size and clamped in a special mould. A heater raises the temperature of the sheet until it becomes soft and flexible.
Air is evacuated from beneath the sheet and this allows atmospheric pressure to push down on the sheet, forcing it to take up the shape of the mould

(iii) Extrusion Process

This process is used to make the following products, drain Pipes and curtain rail. Plastic granules are fed from a hopper to a rotating screw. The screw forces the plastic through a heated tube, where it becomes molten before being forced under pressure through a die. The die contains a hole whose shape corresponds to the required article. As it leaves the die the extruded A jet of water or air-cools piece.

Name two safety Precautions 3+2
Award 5 Marks

(d) (i) Wear gloves and goggles (ii) Heat component to correct temperature

(ii) Ensure you have good ventilation (iv) Water tank close by to cool Component.

QUESTION No. 6

(a) (i) Revolving centre, used with centre lathe when turning between centres.

Two uses 4+4+7
Award 15 Marks

(ii) Fixed steady, used to support long shafts, when turning

(b) (i) For taper turning (ii) for drilling between centres

Two uses 5 + 5
Award 10 Marks

(c) Reaming used to finish a drilled hole to a standard tolerance dimension

Explanation
Award 10 Marks

(d) (i) Good vibrating properties

(ii) Good bedding in properties high in graphite

(iii) Allows for smooth movement

Two reasons 5+ 5
Award 10 Marks

OR

(d) Advantages of CNC lathe over conventional lathe

(i) Higher levels of productivity

(ii) Uniformity of end product (even with a complex shape)

(iii) Less operational involvement in production

(iii) Safer machining (v) Improved quality control.

Two reasons 5+ 5
Award 10 Marks

Question No. 7

(a) Interference fit: smallest shaft is larger than the hole
Clearance fit: largest shaft must be smaller than the Smallest hole.

Award 2 @ 5 marks

Total (10)

(b) (i) Maximum diameter of shaft = 80.05mm
(ii) Minimum diameter of shaft = 79.95mm
(iii) Tolerance on shaft = 0.1mm

Award 3 @ 5 marks

Total (15)

(i) Screw Pitch Gauge: used to determine the pitch of screw threads

(i) Plug gauge: is used to determine whether a particular hole is within specific limits of accuracy.

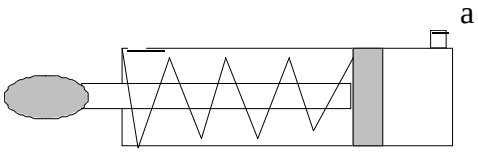
Award 3 @ 5 for names
5 marks for function.

Total (20)

(iii) feeler gauge: Used to estimate, by sence of touch, the clearance between two separate components by inserting the different blades or combination of blades until the thickness is foundthat wil just go between the two surfaces.

OR (c)

(i) Single acting pneumatic cylinder



Air entering port a of the cylinder will push the piston Positive. Spring will push the piston negative.

Very good clear description

Award 20 marks

(ii) Transistor:

A transistor is an electronic component which can function as a fast switch or as

an amplifier in a circuit.