Model Answer

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
		Important Instructions to examiners: 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate. 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills). 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn. 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer. 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding. 7) For programming language papers, credit may be given to any other program based on equivalent concept.		

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
1.		**Attempt any NINE of the following:**		**18**
	a)	**Write two applications of copper.** 1) For making electrical wires, cables and conducting apparatus. 2) As a coinage metal and in ornaments, jewelry for making them hard. 3) For making water stills, kettles, vacuum pans, steam pipes and fire boxes of locomotive engines. 4) In electroplating and electrotyping. 5) Copper salts are largely used as insecticides and coloring materials. 6) For making scientific apparatus such as hypsometers, colorimeters, etc. 7) For making alloys like brass, bronze, gun metal, etc.	**1 Mark each**	**2**
	b)	**Write two ores of copper with their chemical formulae.** **(Any two ores of Copper with formula: 1 mark each)**	**1 Mark each**	**2**
	c)	**Write the action of water on Aluminium.** Pure aluminium is not affected by pure water. However, impure aluminium is readily corroded by water containing salts (seawater). It decomposes boiling water with evolution of hydrogen. **$2\,Al + 6H_2O \longrightarrow 2\,Al(OH)_3 + 3H_2 \uparrow$**	**1** **1**	**2**
	d)	**Define corrosion. Write its types.** **Corrosion**: Any process of chemical or electrochemical decay or destruction of a metal due to the action of surrounding medium is called as corrosion. **Types of corrosion:** 1) Atmospheric corrosion (or direct chemical corrosion or Dry corrosion) 2) Immersed corrosion (or electro chemical corrosion or wet corrosion)	**1** **½ mark each**	**2**

Sr .No.	Name of the ore	Chemical formula
1	Cuprite or ruby copper	Cu_2O
2	Copper glance	Cu_2S
3	Copper pyrite	$CuFeS_2$
4	Malachite	$CuCO_3.Cu(OH)_2$
5	Azurite	$2CuCO_3.Cu(OH)_2$

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1.	**e)**	**Why galvanized containers cannot be used for storage of foodstuff?** Galvanized containers (zinc coated) cannot be used for preparing and storing food stuff, which are acidic in nature because zinc gets dissolved in dilute acids in food forming poisonous zinc compounds which will poison the content.	2	**2**
	f)	**Which oxide film is most protective against corrosion? Why?** **Non-porous stable oxide film** is most protective oxide film. This oxide film is extremely adherent and non-porous (protective). Due to the absence of pores or cracks in the oxide film, it forms barrier for further action and therefore, the rate of corrosion of metal decreases rapidly.	1 1	**2**
	g)	**State the factors affecting the rate of electrochemical corrosion.** i) Position of metal in electrochemical series ii) Purity of metal iii) Solubility of corrosion product iv) Nature of oxide film v) Relative areas of anode and cathode vi) Physical state of the metal vii) Effect of pH viii) Differential aeration ix) Conductance of the medium x) Presence of impurities in the atmosphere xi) Presence of moisture in the atmosphere **(Any two factors)**	1 Mark each	**2**
	h)	**Define specific conductance. Write its unit.** **Specific conductance** is the conductance offered by 1 cm^3 of the substance or 1ml solution. **OR** The conductance offered by a solution or a conducting material having unit length & unit area of cross section is known as **specific conductance**. **Unit of specific conductance**: ohm^{-1} cm^{-1} or mhos-cm^{-1} or S.cm^{-1}	1 1	**2**
	i)	**Why does a dry cell become dead after a long time, even if it has not been used?** Dry cell become dead after a long time, even if it has not been used because acidic NH_4Cl corrodes the zinc vessel.	2	**2**

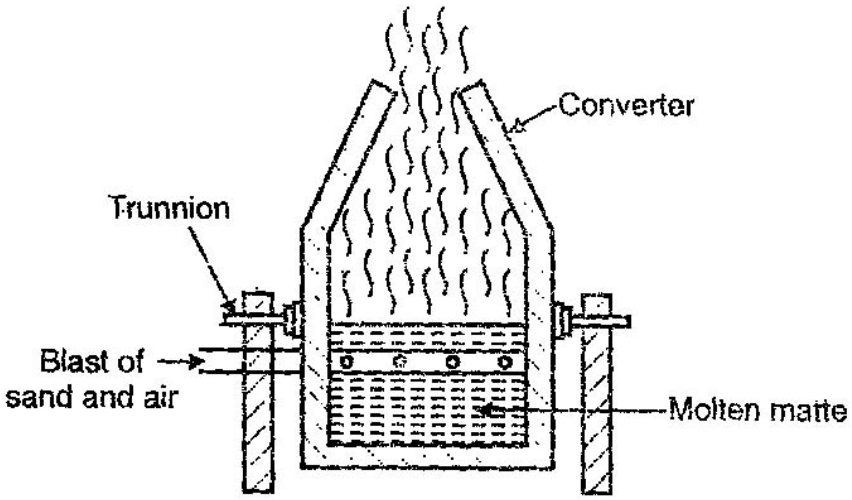
<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>1</td><td>j)</td><td>Distinguish between dielectrics and insulators.
<table>
<tr><th>Dielectrics</th><th>Insulators</th></tr>
<tr><td>1. The materials, which are used to prevent the loss of electricity through certain parts of an electrical system, are known as dielectrics.</td><td>1. Insulators or insulating materials are the substances that retard the flow of heat or electricity or sound through them.</td></tr>
<tr><td>2. The main function is storage of electrical charge.</td><td>2. The main function of such materials is that of insulation.</td></tr>
<tr><td>3. All dielectrics are insulators because they avoid the flow of electric current through them.</td><td>3. All insulators are not dielectrics because they can not store charges like dielectrics.</td></tr>
<tr><td>4. They have electrical conductivity less than 10-6 mohs/cm</td><td>4. They are bad conductors of electricity</td></tr>
<tr><td>5. Examples- Air, N_2 gas , CO_2 gas, Silicon fluid etc</td><td>5. Examples-Rubber, Plastics etc.</td></tr>
</table>
(Any two points 1 mark each)</td><td>1 Mark each</td><td>2</td></tr>
<tr><td></td><td>k)</td><td>Write two applications of phenol formaldehyde resin.

1) For making electric insulator parts like switches, plugs, switch-boards, heater-hands, sockets for light bulb, etc. and in wire insulation.
2) Used for making moulded articles like telephone parts, cabinets for radio and television.
3) Its resin is used as adhesive for grinding wheels & brake lining.
4) For impregnating fabrics, wood, paper for producing decorative laminates, wall coverings and industrial laminates for electrical parts including printed circuits.
5) For making photograph records, bearings used in industries and rolling mills etc.
6) In paints and varnishes.
7) It is used as hydrogen- exchanger resin in water softening.
(Any two applications)</td><td>1 Mark each</td><td>2</td></tr>
<tr><td></td><td>l)</td><td>Define insulators. Write its types.

Insulators: Insulators or insulating materials are the substances which retard the flow of heat or electricity or sound through them.

Types of insulators:
1) Gaseous insulating materials.
2) Liquid insulating materials.
3) Solid insulating materials.
(Any two types)</td><td>1

½ Mark each</td><td>2</td></tr>
</table>

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
2		**Attempt any FOUR of the following.**		**16**
	a)	**Describe Bessemerisation process for extraction of copper.**		**4**
			**1**	
		After smelting the molten matte is then transferred to a Bessemer converter which is a pear shaped furnace made up of steel and internally lined with lime or magnesia. It is mounted on trunnions and can be tilted in any position. Furnace is provided with pipes known as twyers through which sand and hot air is blown into it. Following chemical reactions takes place in the Bessemer converter.	1	
		(a) Conversion of FeS to slag **$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2 \uparrow$** **$FeO + SiO_2 \longrightarrow FeSiO_3$**	**2**	
		(b) Partial oxidation of Cu_2S to Cu_2O **$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2 \uparrow$**		
		(c) Reduction of Cu_2O by Cu_2S to metallic copper **$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2 \uparrow$**		
		The molten metal obtained from the Bessemer converter is then poured into sand moulds and allowed to cool. On cooling dissolved SO_2 escapes out causing blisters on the surface of copper hence it is called as blister copper. It is 96 to 98% pure.		

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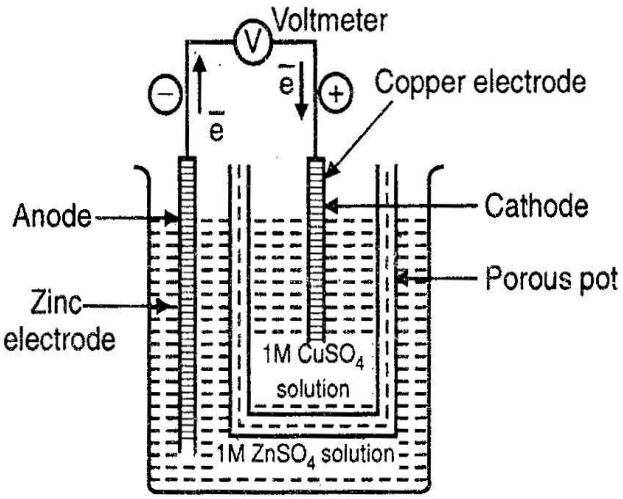
2	b)	**Describe Bayer's process for extraction of Aluminium.**		4
		i) The powered bauxite ore is roasted to convert ferrous oxide (FeO) to ferric oxide (Fe_2O_3).	1	
		ii) This roasted ore is then heated with conc. NaOH. Aluminium oxide dissolves forming sodium meta aluminate, while Fe_2O_3 remains undissolved.		
		$\mathbf{Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O}$ Sodium meta aluminate	1	
		iii) Undissolved Fe_2O_3 is removed by filtration.		
		iv) The filtrate is diluted with water to form a precipitate of aluminium hydroxide [$Al(OH)_3$].		
		$\mathbf{NaAlO_2 + 2H_2O \longrightarrow NaOH + Al(OH)_3\downarrow}$	1	
		v) The precipitate of $Al(OH)_3$ is then filtered out, dried and heated at 1500^oC to get pure alumina.		
		$\mathbf{2Al(OH)_3 \xrightarrow[1500^0C]{\triangle} Al_2O_3 + 3H_2O\uparrow}$	1	
	c)	**Write two applications and two properties of Rose metal.**		4
		Properties: **1.** It is easily fusible alloy. **2.** It's melting point is 89 ^oC.	2	
		Applications: **1**. It is used for making fire – alarms, fuses wires. **2**. It is used for casting dental works **3**. It is used in automatic sprinkler system. **(Any two applications)**	2	
	d)	**Define adhesives. Write three characteristics of adhesives.**		4
		Adhesives:-Any substance that is capable of holding the materials together by surface attachment is called as an adhesive.	1	
		Characteristics:- i) Adhesive should form rigid, strong and durable bond. ii) It should be economical in use. iii) It should be odorless. iv) It should not lose the adhesion property on storage. v) It should be resistant to heat, chemicals and water. **(Any three characteristics)**	3	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2	**e)**	**Distinguish between primary and secondary cell.**	**1 mark each**	**4**

Primary cell	**Secondary cell**
1. Non- rechargeable cells are known as primary cells	1. Rechargeable cells are known as secondary cells.
2. Chemical reaction is irreversible.	2. Chemical reaction is reversible.
3. They are light in weight.	3. They are heavy.
4. They have short life.	4. They have long life
5. They can not be recharged & reused.	5. They can be recharged & reused.
6. e.g. Dry cell, Daniel cell, Leclanche cell	6. e.g. Lead acid storage cell, Nickel- cadmium storage cell

(Any four points)

f) **Describe construction and working of Daniel cell with the help of diagram.** **1**



4

Construction:-

It consists of zinc electrode dipped in $ZnSO_4$ Solution & copper electrode dipped in $CuSO_4$ solution.

The two solutions are separated by a porous pot. The two solutions can seep through the pot & so comes in contact with each other automatically. Thus, porous partition acts as a salt bridge. **1**

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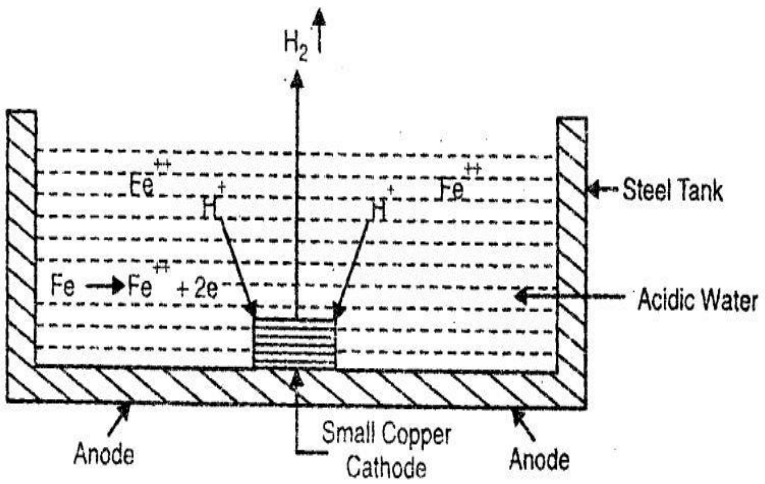
2.	**f)**	**Working:-** The tendency of Zn to form Zn^{++} is greater than the tendency of Zn^{++} to get deposited as Zn on the electrode. Therefore Zn goes into the solution forming Zn^{++}. On the other hand tendency of copper to go into the solution is less than the tendency of Cu^{++} to get deposited as Cu & hence copper electrode becomes positively charged. The emf of cell is 1.1 volt. **Cell reactions:-** At Anode: $Zn \longrightarrow Zn^{++} + 2e^-$ At Cathode: $Cu^{++} + 2e^- \longrightarrow Cu$ Net Reaction: $Zn + Cu^{++} \longrightarrow Zn^{++} + Cu$	2	
3		**Attempt any FOUR of the following.**		**16**
	a)	**Explain mechanism of immersed corrosion with evolution of hydrogen gas.**		**4**
			**1**	
		Steel tank: - Anode **Cu – strip:- Cathode** Such type of corrosion occurs usually in acidic environments like acidic industrial waste, solutions of non – oxidizing acids. Consider a steel tank containing acidic industrial waste and small piece of copper scrap in contact with steel. The portion of the steel tank in contact with copper is corroded most with the evolution of hydrogen gas.	**1**	

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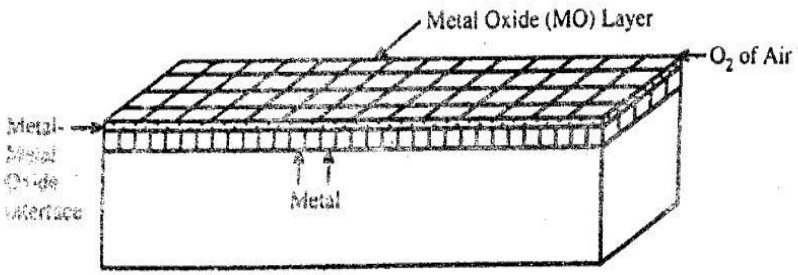
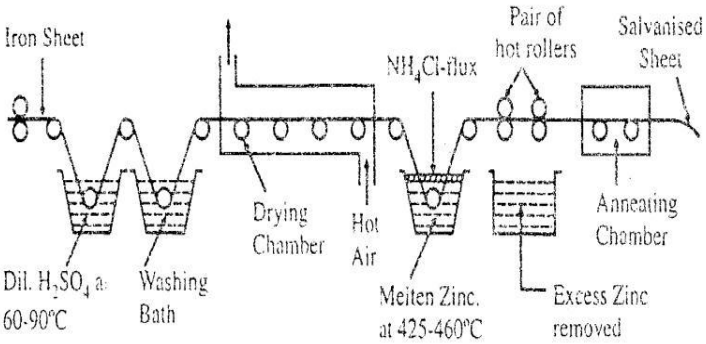
3	a)	**Reactions:** **At Anode:** **$Fe \longrightarrow Fe^{++} + 2e^-$**	**1**	
		These electrons flow through the metal from anode to the cathode **At cathode:** H^+ ions are eliminated as H_2 gas **$2H^+ + 2e^- \longrightarrow H_2\uparrow$ (Reduction)** Thus, over all reaction is **$Fe + 2H^+ \longrightarrow Fe^{++} + H_2\uparrow$** **[Note: 1mark each to be given to reaction at anode & cathode.]**	**1**	
	b)	**Describe mechanism of corrosion of metal due to action of oxygen.**		**4**
			**1**	
		Mechanism: When metal atoms present on the metal surface comes in contact with the atmospheric oxygen then they undergo oxidation liberating electrons. The electrons lost by metal atoms are then accepted by atmospheric oxygen to form oxide ion (O^{2-}). The metal ion M^{2+} & oxide ion O^{2-} then combines together due to electrostatic force of attraction to form metal oxide molecule. Thus as a result of atmospheric corrosion due to oxygen there is formation of A thin layer of metal oxide on the surface of metal	**1**	
		$M \longrightarrow M^{2+} + 2e^-$ (loss of electrons) **$^1/_2O_2 + 2e^- \longrightarrow O^{2-}$ (gain of electrons)** **$M + O \longrightarrow M^{2+} + O^{2-} \longrightarrow MO$ (Metal oxide)**	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
3.	**c)**	**Describe galvanizing process with suitable diagram.**  It is the process of coating iron or steel sheets with a thin coat of zinc to prevent it from rusting. **Process:** The iron or steel sheet to be galvanized is first cleaned with dilute H_2SO_4 to remove any oxide layer or impurities. It is then washed with water to remove acid completely.It is then passed through drier to dry it completely. Then it is dipped in a bath of ammonium chloride solution which helps in adhesion of the molten zinc particles to steel sheet . It is then dipped in a bath of molten zinc at 425^0C to 460^0C temperature and passed through series of rollers to remove excess zinc and in order to get uniform coating. Finally it is annealed at 650^0C.	**2** 2	**4**
	d)	**Explain discharging and charging process of lead acid storage cell.** **Discharging:** - While discharging chemical energy gets converted into electrical energy. **<u>At anode</u>**: - The lead electrode loses electrons, which flow through the wire. $\mathbf{Pb \rightarrow Pb^{2+} + 2e^-}$ The Pb^{2+} ions then react with sulphate SO_4^{2-} ions $\mathbf{Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4 + 2e^-}$ The electrons released from the anode flow to the cathode electrode. **At cathode:-** Lead undergoes reduction at the cathode from oxidation state +4 (PbO2) to +2 (PbSO4). $\mathbf{PbO_2 + 4H^+ + 2e^- \rightarrow Pb^{2+} + 2H_2O}$ The Pb^{++} ions then combine with SO4- - ions. $\mathbf{Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4}$ **Net reaction during Discharging: -** $\mathbf{Pb + PbO_2 + 4H^+ + 2SO_4^{2-} \rightarrow 2PbSO_4 + 2H_2O + Energy}$ Lead sulphate is precipited at both the electrodes. As sulphuric acid is utilized & H_2O is formed in the process, concentration of H_2SO_4 will decrease, then battery should be charged.	2 2	**4**

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3.	**d)**	**Charging: -** To recharge a lead storage cell, the reactions taking place during discharging are reversed by passing an external e.m.f. greater than 2 volts from a generator. **At anode** **$PbSO_4 + 2e^- \rightarrow Pb + SO_4^{2-}$** **At cathode** **$PbSO_4 + 2\ H_2O + 2e- \rightarrow PbO_2 + 4H^+ + 2SO_4^{2-}$** **Net reaction during Charging:** **$2PbSO_4 + 2H_2O$ + Energy $\rightarrow Pb + PbO_2 + 4\ H^+ + 2SO_4^{2-}$** Thus H_2SO_4 is regenerated & specific gravity will go on increasing. When it comes to 1.215, cell is said to be charged fully. **The net reaction of Discharging & Charging is :** **$Pb + PbO_2 + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$**	**2**	
	e)	**Write two characteristics and two uses of Ni-Cd battery.** **Characteristics:** 1. The e.m.f. of cell is 1.4 V when fully charged. 2. It has low internal resistance & longer life span (5 years). 3. It is expensive in cost. 4. It can be recharged because no products are lost and no gas is evolved. The reaction products stick to the electrodes. **(Any two characteristics)** **Uses:** 1. It is used in industrial services such as trucks, mine locomotives. 2. It is used in railway car lighting and air conditioning because of its long life & low maintenance cost. 3. It is widely used in calculators.	**2** **2**	**4**
	f)	**Describe construction and working of hydrogen-oxygen fuel cell.** **Construction :-** i) One of the simplest & most successful fuel cell is hydrogen – oxygen fuel cell. ii) It consists essentially of an electrolytic solution such as 25% KOH or NaOH solution, & two inert porous electrodes (like porous carbon) containing suitable catalyst. iii) Hydrogen & oxygen gases are bubbled through the anode & cathode compartment respectively.	1	**4**

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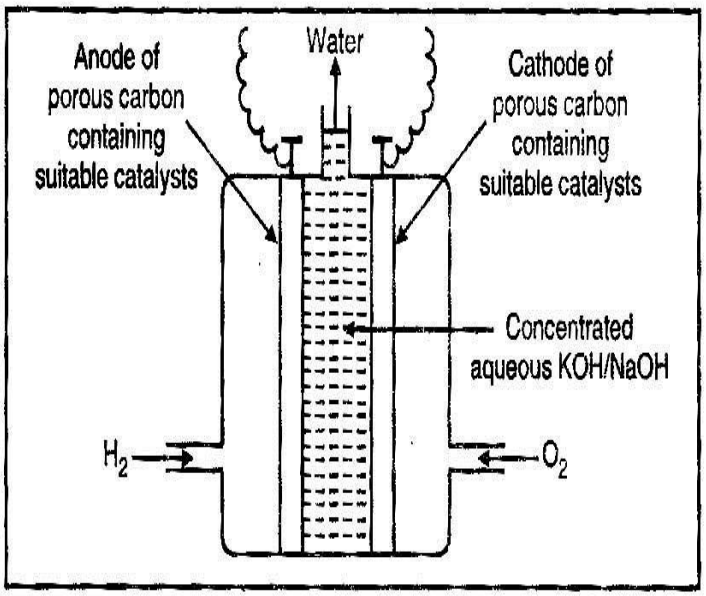
3	**f)**		**1**	
		Working: - **At anode: -** Hydrogen gas is oxidized as follows - **$2H_2 + 4\ OH^- \rightarrow 4H_2O + 4e^-$** **At cathode: -** Oxygen gas is reduced as follows- **$O_2 + 2\ H_2O + 4e^- \rightarrow 4OH^-$** **Net Reaction: $2H_2 + O_2 \rightarrow 2H_2O$** **[1mark each to be given to reaction at anode & cathode.]**	2	