WINTER– 16 EXAMINATION

Model Answer Subject Code: 17208

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.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any NINE of the following:**	**18**
	a)	**State different products of blast furnace.** i) Pig Iron ii) Slag iii) Flue Gases **(any two)** ----------	**2** 1 mark each
	b)	**State two uses of slag.** 1) It is used as filler for rail roads. 2) It is used in the manufacturing of cement for road making. 3) It is used as a fertilizer & for soil conditioning. ----------	**2** 1 mark each
	c)	**Define (i) Metallurgy (ii) Flux** **i) Metallurgy:** It is the process of extraction of a metal from its ore economically & profitably. **ii) Flux** :-The substance which is used to remove the gangue during the smelting process is known as flux. ----------	**2** 1 1

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1	d	**Why galvanized containers are not used for storing food stuffs**. Galvanized container contains zinc coating. Since zinc is more active metal it readily reacts with the acids present in the food stuffs forming zinc compounds which are highly poisonous & it may poison the food stuffs. Therefore galvanized containers can not be used for storing food stuff.	**2** 2
	e	**Identify the type of corrosion in following examples:** **(i) Submarines dipped in sea water** **(ii) Rusting of Iron articles**	**2**
		Sr. No. / **Example** / **Type of corrosion** 1 / Submarines dipped in sea water / Immersed Corrosion 2 / Rusting of Iron articles / Atmospheric Corrosion	1 1
	f	**Define i) Sherardizing ii) Chromizing**	**2**
		i) Sherardizing : It is the process coating small iron or steel article by diffusion of zinc at the surface of base metal.	1
		ii) Chromizing : It is the process of coating small iron or steel article by diffusion of chromium at the surface of base metal.	1
	g	**Define Paint. Write its two characteristics.**	**2**
		Paint: Paint is a mechanical dispersion mixture of one or more pigments in a vehicle.	1
		Characteristic: 1) It should have high covering power. 2) It should form tough, uniform and adherent film. 3) It should have brushing characteristics. 4) It produces glossy film. 5) It should have high hiding power. 6) Its film should be fluid enough to be spread easily over the surface to be protected.	½ mark each

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	h	**Distinguish between temporary hardness and permanent hardness in water (Two points)**	**2**

Temporary hardness	**Permanent hardness**
1. Water containing bicarbonates of calcium and magnesium and can be made free from these salts by boiling is known as temporary hard water.	**1.** Water containing chlorides and sulphates of calcium and magnesium and can not be made free from these salts by boiling is known as permanent hard water.
2 Temporary hardness is due to $Ca(HCO_3)_2$ & $Mg(HCO_3)_2$.	**2.** Permanent hardness is due to $CaCl_2$, $MgCl_2$, $CaSO_4$, and $MgSO_4$.
3. This hardness can be removed by boiling water.	**3.** This hardness cannot be removed by boiling water.
4. It is due to carbonates hence it is known as carbonate hardness.	4. It is due to other salts hence it is known as non-carbonate hardness.

1 mark each

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	l	**Why soft water is preferred in sugar industry other than hard water?** To avoid following adverse effects of hard water in sugar industry soft water is preferred other than hard water. 1) If hard water used in sugar industry then sugar may not crystallize well. 2) Sugar may be deliquescent. 3) Sugar may gets decomposed during storage. **(Any Two Effects)**	**2** 1 mark each
	j	**Write four characteristics of potable water** i)Water should be clear, colorless & odourless. ii) It should be pleasant in taste. iii) It should be free from disease causing micro-organisms. iv) It should be soft. v) Its turbidity should not be more than 10 ppm. vi) Its colour should not exceed 20 ppm. vii) Its dissolved solids should not be more than 500 ppm	**2** ½ mark each

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Q. No.	Sub Q. N.	Answer	Marking Scheme
1	k	**Name two constituents of cement with its formulae.**	**2**

Name of constituent	Chemical formula
Lime	CaO
Silica	SiO_2
Alumina	Al_2O_3
Iron oxide	Fe_2O_3
Magnesia	MgO
Sulphur trioxide	SO_3
Soda and Potash	Na_2O+K_2O
Gypsum	$CaSO_4.2H_2O$

1 mark each

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	l	**Give any two uses of plaster of paris.** It is used in- 1. In surgery for plastering fractured parts of body. 2. In making statues, moulds, black board chalks 3. In laboratory for making apparatus air tight. 4. In plastering the interior ceilings, walls & decoratives. 5. For making impressions for dentures, inlays, casting of metal fillings etc.	**2** 1 mark each
2		**Attempt any FOUR of the following:**	**16**
	a	**Write the chemical reaction taking place in zone of reduction in blast furnace.** The reduction is done in stages as given below:- $Fe_2O_3 \rightarrow Fe_3O_4 \rightarrow FeO \rightarrow Fe$ i) In between 300 – 500^0C, when charge is heated, Fe_2O_3 (Ferric oxide) is reduced to Fe_3O_4 (Ferroso ferric oxide). $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$. This Fe_3O_4 is stable upto 650^0C in presence of CO, CO_2 & free coke. ii) In between 650 – 700^0C, Fe_3O_4 is reduced to FeO $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$. iii) At temperature between 700 – 800^0C, FeO is reduced to metallic iron. $FeO + CO \rightarrow Fe + CO_2$.	**4** 1 1 1

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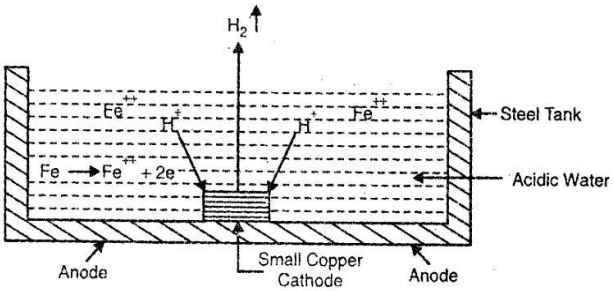
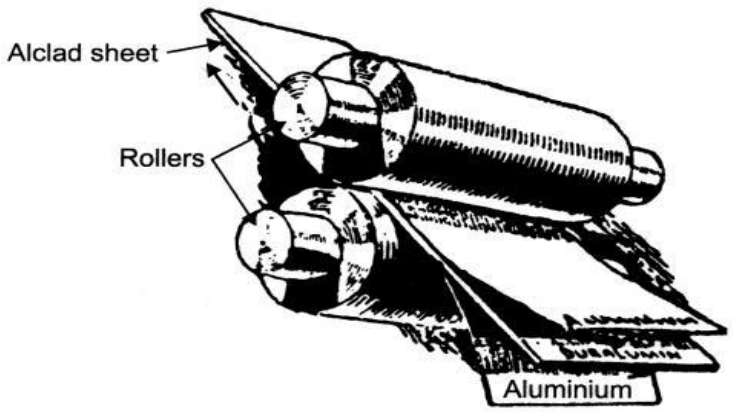
2	a	iv) Simultaneously, the limestone present in the charge is also decomposed to produce lime. $CaCO_3 \rightarrow CaO + CO_2$. v) The metal produced is spongy; simultaneously a part of metallic iron reacts with CO to form Fe_2O_3 or Fe_3O_4. $2Fe + 3CO \rightarrow Fe_2O_3 + 3C$. $3Fe + 4CO \rightarrow Fe_3O_4 + 4C$. **(Note: Write any four reactions)**	1
	b	**Explain the process of Annealing of steel.** **Annealing:** 1. It is defined as heating the steel to certain high temperature & then cooling at a controlled and slow rate in furnace is called annealing. 2. Due to annealing steel becomes more soft, malleable, ductile and pliable and acquires many new properties which are magnetic and electrical in nature. 3. The temperature in annealing depends upon the percentage of carbon in steel. 4. The purposes of annealing are as follows. i) It improve machinability. ii) It soften the steel. iii) It increase ductility & toughness. iv) It remove internal stress caused due to uneven contraction during casting.	**4** 1 1 2
	c	**Give any four differences between : Low carbon, Medium carbon and High carbon steel.**	**4**

Properties	**Low carbon steel**	**Medium carbon steel**	**High carbon steel**
Carbon content	0.05 to 0.3% carbon	0.3 to 0.6% carbon	0.6 to 1.5% carbon
Hardness	Soft, tough, malleable ductile	Harder &tougher than steel	Quite hard.
Weldability	Suitable for welding	Fairly good for welding (not easily)	unweldable
Heat treatment	Responds to heat treatment	can be hardened by heat treatment	can be imparted desired hardness by heat treatment
Tensile Strength	low	high	Highest

1 mark each

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	c	Uses :- Soft wires, wires for rope, chains, rivets, bolts, nails, boiler tubes. / Rail roads, wheels, axles, fish – plates, turbine rotors, springs, gun parts, machine parts etc. / Wooden working tools, chisels, saws, drills, metal cutting tools for lathes, cutters, knives, blades, razors etc.	
	d	**Explain the mechanism of immersed corrosion with evolution of hydrogen gas.**	**4**
			1
		Steel tank: - Anode **Cu – strip:- Cathode** These types of corrosion occur usually in acidic environments like 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 acts as anode & is corroded most with the evolution of hydrogen gas.	1
		Reactions: **At Anode:** **$Fe \longrightarrow Fe^{++} + 2e^-$ (Oxidation)**	1
		These electrons flow through the metal lattice from anode to the cathode that is piece of copper metal where they are accepted by H^+ ions to form H_2 gas **At cathode :** H^+ ions are eliminated as H_2 gas **$2H^+ + 2e^- \longrightarrow H_2\uparrow$ (Reduction)** Thus, over all reaction is **$Fe + 2H^+ \longrightarrow Fe^{++} + H_2\uparrow$**	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	e	**State and explain the factors affecting rate of electrochemical corrosion.** **A) Nature of metal**: **1) Position of metal in a galvanic series**: A metal having higher position in a galvanic series has more chemical reactivity and therefore, it gets attacked by gaseous and corroding medium faster. In the series the noble metals are at the bottom whereas the alkali metals are at the top. **2) Purity of the metal**: - Impurities present in a metal cause heterogeneity and forms a large no. of tiny galvanic cells when an aqueous medium comes in contact with such metal if the impurity metal is highly placed in a galvanic series then it acts as a anode and gets corroded to produce small depressions on the surface of the base metal. If the metal is pure it is corrosion resistant. **3) Physical state of the metal**:-The physical state of metal means orientation of crystals, grain size, stress The larger grain size of the metal the smaller will be its solubility and hence lesser will be its corrosion.eg :- mild steel grains are smaller than cast iron grains therefore mild steel gets corrodes faster. Areas under stress tend to be anodic and corrosion takes place at these stressed areas.The grain size in a metal can be increased by hardening operation or by alloying with a suitable element. 4) **Solubility of the corrosion products:-**Insoluble corrosion products function as a physical barrier thereby suppresses further corrosion. But if the corrosion product is soluble in the corroding medium the corrosion of the metal proceeds faster. **B) Nature of the Environment:-** 1) **Effect of PH**:-Acidic media are more corrosive than alkaline and neutral media.e.g. corrosion of Zn can be minimised by increasing the pH to 11 2)**Differential aeration**: Corrosion occures where oxygen access is least.eg :- When pipeline passes through moist soil as well as dry soil the part passing through moist soil having restricted oxygen access becomes anodic while the part passing through dry soil having more access of air becomes cathodic. This causes corrosion of pipe embedded in moist soil. 3) **Presence of impurities in the atmosphere**:- Corrosion of metals is more in industrial areas because corrosive gases like H_2S, SO_2, CO_2 and fumes of H_2SO_4 and HCl in industrial areas increases conductivity of the liquid layer in contact with the metal surface thereby increases the rate of corrosion.	**4** 1 mark each

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	e	4) **Humidity** :- The greater the humidity greater is the rate and extent of corrosion. Moisture dissolves the atmospheric gases or chemical vapours and the reaction between such dissolved gases with metallic surface becomes faster. Hence water can acts as a conducting medium and promotes corrosion. e.g:- Rusting of Fe is promoted in humid atmosphere. **(Note: write any four factors)**	
	f	**Explain metal cladding process with suitable diagram.** Metal cladding involves bonding firmly and permanently a dense , homogenous layer of a coating metal to the base metal on one or both sides. Process: i) The base metal is sandwiched or cladded between the two sheets of coating metal. ii) This sandwich is then passed through two heavy rollers maintained at high temperature & pressure. iii) Cladded metal is cathodic with respect to the base metal so that electrolytic protection is provided  	**4** 2 2

Q. No.	Sub Q. N.	Answer	Marking Scheme
3		**Attempt any FOUR of the following:**	**16**
	a	**Describe adverse effects of hard water on washing purposes and drinking purposes.**	**4**
		Adverse effect of hard water on washing purposes:	
		1. Hard water does not give lather freely with soap hence large quantity of soap is wasted. 2. Dissolved calcium and magnesium salt in hard water forms sticky precipitate of insoluble calcium and magnesium stearate and it may adhere on fabric. Therefore spots and streaks are produced on the cloths, which becomes prominent on ironing. 3. Iron salts present in hard water may redden the water and due to which yellow stains may be produce on the cloths. **(Any two points)**	2
		Adverse effect of hard water on drinking purposes:	
		1. Hard water is not suitable for drinking because presence of impurities may cause bad effect on digestion process. 2. Calcium oxalate crystals may be increased due to hard water. These crystals may enter in kidney or bladder to form kidney stone.	2
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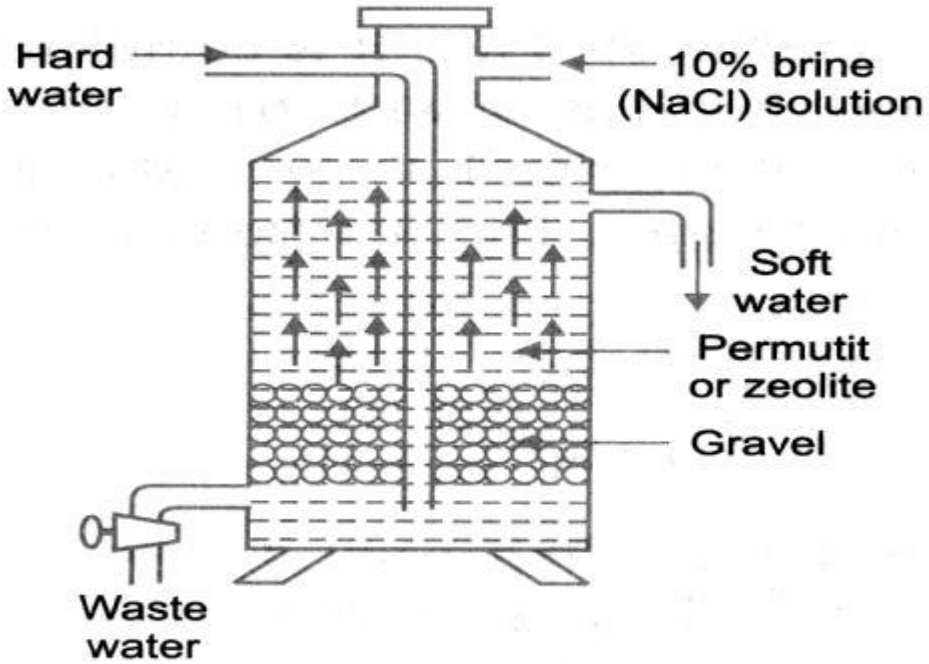
	b	**Explain the sterilization of water by using chlorine gas and bleaching powder.**	**4**
		By using chlorin gas- Cl_2 reacts with water to produce hypochlorous acid & nascent oxygen. Both are powerful germicides.Thus kills germs & microorganisms. 1) $Cl_2 + H_2O \rightarrow HOCl + HCl$ [Hypochlorous acid] 2) $HOCl \rightarrow HCl + [O]$ (Nascent oxygen) 3) Germs + [O] →Germs are killed	2
		By using bleaching powder: About 1 Kg. of bleaching powder per 1000 litres of water is mixed and resulting solution is allowed to stand for several hours. Following reactions takes place. 1) $CaOCl_2 + H_2O \rightarrow Ca(OH)_2 + Cl_2$ [Bleaching powder] 2) $Cl_2 + H_2O \rightarrow HOCl + HCl$ 3) $HOCl \rightarrow HCl + [O]$ [Hypochlorous acid] [Nascent oxygen] 4)Germs + [O] →Germs are killed Thus bleaching powder helps to kill microorganisms.	2

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	c	**Discuss the bad effect of using hard water in following industries.** **(i) Paper Industry** (ii) **Textile Industry**	**4**
		Paper industry 1) If hard water is used in paper manufacturing, then Ca^{++} and Mg^{++} ions react with the paper material. Hence, paper will not have desired smoothness and glossiness. 2) Iron & manganese impurities in hard water, affect whiteness or colors of paper.	2
		Textile industry (Note: Any two) 1) If hard water is used in textile industry, then large quantity of soap is wasted while washing the yarn. 2) At the same time, undesirable precipitate is formed which adheres to the fabrics and the exact shades of color are not obtained. 3) Fe and Mn salts may cause spots on fabrics.	2
	d	**Explain Zeolite process with suitable diagram**	**4**
			1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	d	**Explaination**:-In this process sodium permutit is placed in a suitable container and hard water is allowed to pass through it. The calcium & magnesium salts present in the hard water react with the sodium permutit to form water insoluble calcium & magnesium permutit which are retained by filter bed. Thus water obtained is free from calcium & magnesium salts.	1
		Reaction with temporary hardness causing salts:- $Ca(HCO_3)_2 + Na_2P \rightarrow Na_2(HCO_3)_2 + CaP$ $Mg(HCO_3)_2 + Na_2P \rightarrow Na_2(HCO_3)_2 + MgP$ **Reaction with permanent hardness causing salts:-** $CaCl_2 + Na_2P \rightarrow 2NaCl + CaP$ $MgCl_2 + Na_2P \rightarrow 2NaCl + MgP$ $CaSO_4 + Na_2P \rightarrow Na_2SO_4 + CaP$ $MgSO_4 + Na_2P \rightarrow Na_2SO_4 + MgP$ **(consider any Two reactions)**	2
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	e	**Calculate hardness of water sample if 50 ml water sample takes 8.5 ml 0.025 M disodium EDTA in titration at pH= 10 buffer.**	**4**
		We know that, 1000ml 1M EDTA = 1000ml 1M of $CaCO_3$.	1
		1000ml 1M EDTA = 100gm of $CaCO_3$. Therefore, to calculate, 1000ml 1M EDTA = 100gm of $CaCO_3$.	
		8.5ml 0.025M EDTA = (100 x 8.5 x 0.025) / 1000 x1 gm of $CaCO_3$. = 0.02125gm of CaCO3.	1
		50ml water sample contains = 0.02125gm of $CaCO_3$ 1000ml water sample contains = (0.02125x1000)/50 gm of $CaCO_3$ = 0.425 gm of $CaCO_3$	1
		To convert gm./lit into mg/lit, we have. 0. 425 x 1000 = 425 mg/lit of $CaCO_3$. = 425 ppm of CaCO3.	
		Therefore the total hardness of water sample = 425 ppm	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	f	**Explain four important properties of water proofing cement**. 1. **Pore Filling:** It accelerate setting time of concrete making it more impervious.Ingredients in it act as pore blocking agents. 2. **Inactive Pore Filling:** It improve density of concrete**.** 3. **Water repellents:** They act as pore blocking agents. 4. **Moisture resistant:** They increase the resistance to the penetration of moisture. ----------	**4** 1 mark each.