



SUMMER – 14 EXAMINATION

Subject Code: 17203

Subject: Applied Chemistry

Model Answer

Page No: 1/12

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
		<p><u>Important Instructions to examiners:</u></p> <ol style="list-style-type: none">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 <u>(Not applicable for subject English and Communication Skills).</u>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)	Name four ores of iron. Oxides :- a) Magnetite b) Haematite c) Limonite Carbonate: - Siderite Sulphide: - Iron Pyrites (Any four ½ mark each)	½ mark each	2				
	b)	Give composition and properties of wrought iron. Composition: C = 0.25 – 0.5% Traces = S,P,Si & Mn = 0.3% Properties: 1) Soft , fibrous, grey,tough ,medium tensile strength. 2) Highest M.P.1500 ⁰ C. 3) Magnetised but not permanently. 4) Malleable & ductile, also be forged , extruded and welded. 5)Resistant towards rusting and corrosion. 6)Presence of slag gives strength and toughness. (Any two properties)	1 ½ mark each	2				
	c)	State any two applications of heat resisting steel Nichrome. 1) For making heating coils for furnaces & stoves. 2) In making parts of boilers, steam lines, gas turbines, annealing boxes, aero- engine valves etc. 3) Used in other equipments exposed to high temperature. (Any two applications)	1 mark each	2				
	d)	What is the effect of Cr and CO on properties of steel? <table border="1" style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 20%;">Cr (Chromium)</td> <td>It increases tensile strength, hardness, toughness, wear resistance & corrosion resistance.</td> </tr> <tr> <td>CO (Cobalt)</td> <td>It gives strength, hardness, imparts permanent magnetism</td> </tr> </table>	Cr (Chromium)	It increases tensile strength, hardness, toughness, wear resistance & corrosion resistance.	CO (Cobalt)	It gives strength, hardness, imparts permanent magnetism	1 mark each	2
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CO (Cobalt)	It gives strength, hardness, imparts permanent magnetism							
	e)	What is corrosion? Give 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 / Direct chemical/ Dry corrosion 2) Immersed corrosion / Electro chemical corrosion / Wet corrosion.	1 1	2				



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1.	f)	State and explain factors affecting on atmospheric corrosion. Factors affecting atmospheric corrosion:- 1) Impurities in the atmosphere:- Corrosion rate is fast in the presence of all impurities such as H ₂ S, SO ₂ , CO ₂ , Cl ₂ , gases along with vapors of HCl & H ₂ SO ₄ etc. Atmospheric air in industries areas contains these impurities. 2) Moisture in the atmosphere:- Atmospheric gases & chemical vapours dissolve in moisture and reaction between such dissolved gases and metal becomes faster. Therefore moisture acts as conducting medium and enhances the corrosion.	1 1	2
	g)	How the protection of metal done by the modification of environment? a) Removal of corrosion stimulants b) Use of corrosion inhibitors 1) Anodic inhibitors 2) Cathodic inhibitors 3) Vapour phase inhibitors	1 mark each	2
	h)	Why the galvanized containers are not used for storing food stuff? Galvanised utensils (zinc coated) cannot be used for preparing and storing food stuff, which are acidic in nature because zinc gets dissolved in dilute acids forming poisonous zinc compounds which will poison the content.	2	2
	i)	Write any four characteristics of good/ideal fuel. Characteristics of a good fuel: 1) A good fuel should have a high calorific value. 2) A good fuel should have a moderate ignition point. 3) A good fuel should not liberate any polluting or poisonous product gases. 4) The velocity of combustion should be moderate. 5) The combustion should be easily controllable. 6) It should contain low percentage of non-combustible matter. 7) It should be cheap, easily available & convenient for transportation. 8) A good fuel requires smaller space to store. 9) A good fuel does not contain any volatile matter causes air pollution. (Any four characteristics)	1/2 mark each	2



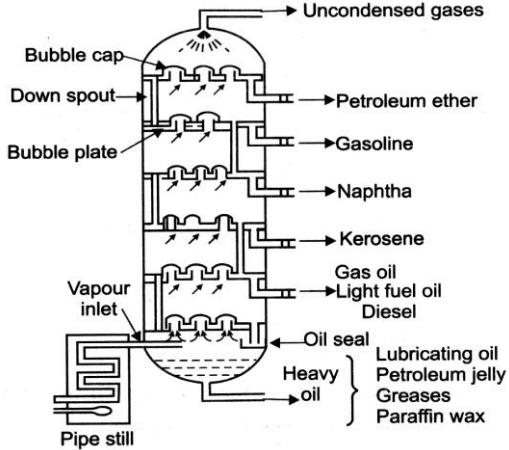
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
1.	j)	What are significance of proximate analysis? Proximate analysis provides following valuable information in assessing the quality of fuel i) Moisture ii) Volatile Matter iii) Ash iv) Fixed Carbon	$\frac{1}{2}$ mark each	2
	k)	Write composition, properties of Biogas. The average composition of biogas is: CH_4 (methane) = 50 – 60% (Combustible gas) CO_2 (carbon dioxide) = 30 – 40% (non – combustible gas) H_2 (hydrogen) = 5 – 10% (Combustible gas) N_2 (nitrogen) = 2-6% (non – combustible gas) H_2S (Hydrogen sulphide) = traces (Combustible gas) Properties:- a) Biogas on burning liberates a larger amount of heat than that obtained by burning animal dung or fire wood directly. b) It burns without producing residue, smoke etc. c) It is cheap, clean in use, has good calorific value & convenient fuel. d) It does not pollute the atmosphere. e) It involves no storage problem. f) Biogas production is very economical. g) It provides excellent yield of good manure. (Any two properties)	1 $\frac{1}{2}$ mark each	2
	l)	Define lubricant. Name any two examples of liquid lubricants. Lubricant: Any substance introduced between two moving or sliding surface to reduce the frictional resistance between them is known as lubricant. Examples of liquid lubricants. e. g Palm oil, Coconut oil, Castor oil, Neem oil, Hazel nut oil, Tallow oil, Lard oil etc. (Any relevant examples of Liquid lubricants can be considered)	1 1	2
	2.	a)	Attempt any four of the following: Write the chemical reactions taking place in zone of heat absorption.	



Que. No.	Sub. Que.	Model Answer	Marks	Total Marks									
2.		<p>zone of heat absorption:</p> <p>i) $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$ ii) $CO_2 + C \rightarrow 2CO - 39 \text{ Kcal}$ iii) $2CO \rightarrow CO_2 \uparrow + C$ iv) $CaO + SiO_2 \rightarrow CaSiO_3 \text{ (Slag)}$ v) $SO_2 + 2C \rightarrow S + 2CO \uparrow$ vi) $P_2O_5 + 5C \rightarrow 2P + 5CO \uparrow$ vii) $MnO_2 + 2C \rightarrow Mn + 2CO \uparrow$ viii) $SiO_2 + 2C \rightarrow Si + 2CO \uparrow$ (Note: Any four reactions: 4 mark)</p>	1 mark each										
	b)	<p>Write composition, properties and applications of 18-8 stainless steel, 18-4-1 high speed steel.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 33%;">Composition</th> <th style="width: 33%;">Properties</th> <th style="width: 33%;">Applications</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <p>18-8 Stainless Steel Chromium = 18% Nickel = 8% Remaining mild steel (74%) (1 Mark)</p> </td> <td style="vertical-align: top;"> <p>1. Strong & tough 2. Non – magnetic 3. Good resistant to heat 4. Difficult to weld 5. High hardness & tensile strength. 6. Resistant to atmospheric and chemical corrosion (Any one :1/2 Mark)</p> </td> <td style="vertical-align: top;"> <p>1. Household utensils. 2. hydraulic machinery 3. In dairy & food industry 4. Dental & surgical instruments. 5. In chemical industries (Any one :1/2 Mark)</p> </td> </tr> <tr> <td style="vertical-align: top;"> <p>18-4-1 High Speed Steel Tungsten (W) = 18% Chromium (Cr) = 4% Vanadium (V) = 1% Remaining steel (1 Mark)</p> </td> <td style="vertical-align: top;"> <p>1. These steels are very hard even at high temp. 2. resistant to wear. 3. tough enough to withstand chipping 4. Hardness can be increased by heat treatment. (Any one :1/2 Mark)</p> </td> <td style="vertical-align: top;"> <p>1. For making tools for lathes, drills, planners, shapers milling cutter etc. (Any one :1/2 Mark)</p> </td> </tr> </tbody> </table>	Composition	Properties	Applications	<p>18-8 Stainless Steel Chromium = 18% Nickel = 8% Remaining mild steel (74%) (1 Mark)</p>	<p>1. Strong & tough 2. Non – magnetic 3. Good resistant to heat 4. Difficult to weld 5. High hardness & tensile strength. 6. Resistant to atmospheric and chemical corrosion (Any one :1/2 Mark)</p>	<p>1. Household utensils. 2. hydraulic machinery 3. In dairy & food industry 4. Dental & surgical instruments. 5. In chemical industries (Any one :1/2 Mark)</p>	<p>18-4-1 High Speed Steel Tungsten (W) = 18% Chromium (Cr) = 4% Vanadium (V) = 1% Remaining steel (1 Mark)</p>	<p>1. These steels are very hard even at high temp. 2. resistant to wear. 3. tough enough to withstand chipping 4. Hardness can be increased by heat treatment. (Any one :1/2 Mark)</p>	<p>1. For making tools for lathes, drills, planners, shapers milling cutter etc. (Any one :1/2 Mark)</p>	2	4
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	c)	<p>Distinguish between cast iron, pig iron and steel.</p>		4									

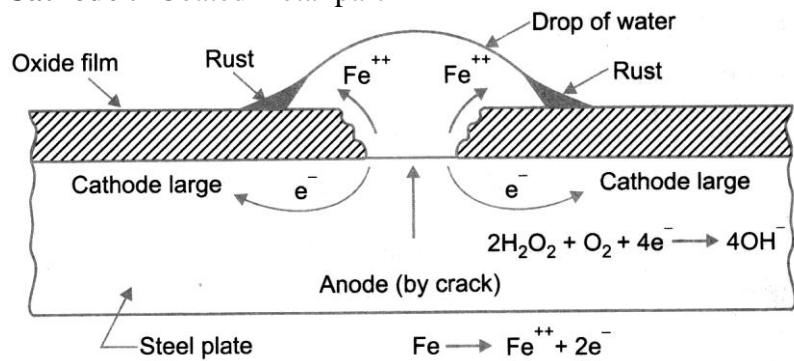


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2		<table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 50%; text-align: center;">Cast iron/Pig iron</th> <th style="width: 50%; text-align: center;">Steel</th> </tr> </thead> <tbody> <tr> <td>1) It is the impure form of Iron</td> <td>1) It is an alloy of Iron and carbon.</td> </tr> <tr> <td>2) Carbon content 2.5-4.5%</td> <td>2) Carbon content 0.05-1.5%</td> </tr> <tr> <td>3) Structure is crystalline</td> <td>3) Structure varies according to impurities</td> </tr> <tr> <td>4) Melting point is lowest i.e. 1100-1200⁰ c</td> <td>4) Melting point is between 1200-1500⁰ c</td> </tr> <tr> <td>5) Very hard and brittle</td> <td>5) soft than cast iron</td> </tr> <tr> <td>6) High Tensile strength</td> <td>6) Highest Tensile strength</td> </tr> <tr> <td>7) It is neither malleable nor ductile</td> <td>7) Malleable and ductile if % of C is low.</td> </tr> <tr> <td>8) It can not be magnetised permanently</td> <td>8) It can be magnetised permanently</td> </tr> <tr> <td>9) It can not be forged</td> <td>9) It can be forged but not easily</td> </tr> </tbody> </table> <p>(Any four points & any relevant difference can be considered.)</p> <p>d) Define fuels. Give its details classification. Fuel: A fuel can be defined as any combustible substance which during combustion gives large amount of heat energy called as fuel.</p> <p>Classification of Fuel</p> <div style="text-align: center;"> <pre> graph TD Fuels --> Primary[Primary or Natural] Fuels --> Secondary[Secondary / Artificial] Primary --> P_Physical[Physical State] P_Physical --> P_Solid[Solid] P_Physical --> P_Liquid[Liquid] P_Physical --> P_Gaseous[Gaseous] P_Solid --> P_Solid_Ex[e.g. Wood] P_Liquid --> P_Liquid_Ex[Crudeoil] P_Gaseous --> P_Gaseous_Ex[Natural] Secondary --> S_Physical[Physical State] S_Physical --> S_Solid[Solid] S_Physical --> S_Liquid[Liquid] S_Physical --> S_Gaseous[Gaseous] S_Solid --> S_Solid_Ex[e.g. Coke] S_Liquid --> S_Liquid_Ex[Petrol] S_Gaseous --> S_Gaseous_Ex[LPG] </pre> </div> <p>e.g. Wood Crudeoil Natural e.g. Coke Petrol LPG</p>	Cast iron/Pig iron	Steel	1) It is the impure form of Iron	1) It is an alloy of Iron and carbon.	2) Carbon content 2.5-4.5%	2) Carbon content 0.05-1.5%	3) Structure is crystalline	3) Structure varies according to impurities	4) Melting point is lowest i.e. 1100-1200 ⁰ c	4) Melting point is between 1200-1500 ⁰ c	5) Very hard and brittle	5) soft than cast iron	6) High Tensile strength	6) Highest Tensile strength	7) It is neither malleable nor ductile	7) Malleable and ductile if % of C is low.	8) It can not be magnetised permanently	8) It can be magnetised permanently	9) It can not be forged	9) It can be forged but not easily	1 mark each	
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	e)	<p>State and explain fractional distillation of crude petroleum. Write composition and uses of petrol and kerosene oil.</p>		4																				

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2.			1										
		<p>1) The crude oil is heated to about 400⁰C in an iron retort. The hot vapours are passed upto a tall vertical tower called ‘fractionating tower.’</p> <p>2) The tower is fitted with a large number of horizontal trays at short distance. Each tray is provided with small Chimneys which are covered with loose caps.</p> <p>3) As the vapour goes up, they become gradually cooler & fractional condensation takes place at different heights of column.</p> <p>4) High boiling point fractions condense first & comparatively low boiling point fractions condense turn by turn.</p> <p>5) The residue left in the retort above 400⁰C is a black & tarry mass called ‘asphalt or pitch’. It is used for making paints & as a preservative for wood & metals.</p>	1										
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 35%;">Composition</th> <th style="width: 35%;">Uses</th> </tr> </thead> <tbody> <tr> <td>Petrol</td> <td>C₅H₁₂ to C₉H₂₀</td> <td>Automobile fuel, solvent & in dry cleaning</td> </tr> <tr> <td>Kerosene oil</td> <td>C₁₀H₁₂ to C₁₆H₃₄</td> <td>As illuminant, jet engine fuel & in making oil gas</td> </tr> </tbody> </table>		Composition	Uses	Petrol	C ₅ H ₁₂ to C ₉ H ₂₀	Automobile fuel, solvent & in dry cleaning	Kerosene oil	C ₁₀ H ₁₂ to C ₁₆ H ₃₄	As illuminant, jet engine fuel & in making oil gas	1	
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		<p>(Note: Composition : ½ mark each ,any one use : ½ mark each of petrol and Kerosene oil.)</p>											
	f)	<p>What is LPG ? Give its composition ,properties and uses. LPG: LPG is a Liquefied petroleum gas.Itcan be readily liquefied under pressure but exist as gas under atmospheric pressure and also obtain as byproduct , during the distillation of petroleum or cracking of heavy oils.</p>	1	4									



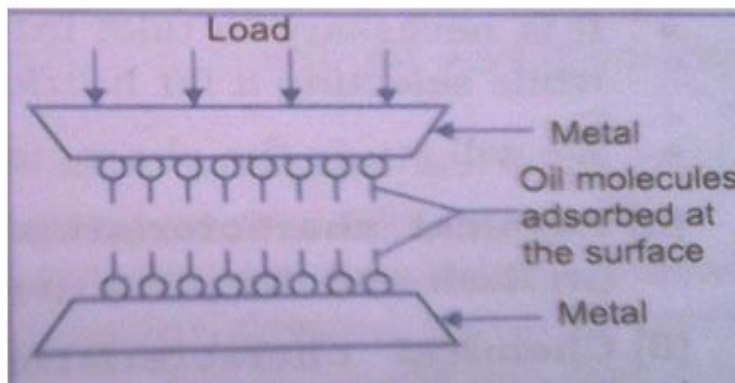
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
2.		<p>Composition:- The average composition of LPG is 1)Ethane = 0.20% 2)Propane = 57.30% 3) Butane = 41.10% 4)Pentane = 1.40%</p> <p>Properties:- 1) It is highly inflammable. 2) LPG is colorless, odourless gas. 3) Its calorific values it very high. 4) It is non corrosive to steel & copper alloys. 5) It does not produce any harmful product on combustion. 6) It is slightly toxic and slightly anesthetic if inhaled in large concentration.</p> <p>Uses:- 1) LPG is mainly used as a domestic fuel & industrial fuel. 2) It is also used as motor fuel. 3) It is also used in aerosol industries. 4) It is used in portable blow lamps, soldering, welding, brazing & steel cutting etc. (Note :Any two properties and two uses ½ mark each)</p>	1 1 1	
3.	a)	<p>Attempt any four of the following</p> <p>Write the factors affecting immersed corrosion.</p> <p>Factors affecting the rate of Electrochemical Corrosion:- 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 corroding medium faster. 2) Purity of the Metal: - Impurities present in a metal cause heterogeneity and forms a large no. of tiny galvanic cells when an aq. medium comes in contact with such metal.</p>	1 1 1 1 1	16 4

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3.		<p>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.</p> <p>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.</p> <p>5) Effect of PH:-Acidic media are more corrosive than alkaline and neutral media.</p> <p>6) Differeential aeration: Corrosion occures where oxygen access is least.</p> <p>7) Presence of impurities in the atmosphere:-Corrosion of metals is more in industrial areas.</p> <p>8) Humidity :- The greater the humidity greater is the rate and extent of corrosion .</p> <p>(Any Four factors : 1 mark each)</p> <p>Describe the mechanism of immersed corrosion by absorption of oxygen gas.</p> <p>b) Anode: - By crack Cathode :- Coated metal part</p> <div style="text-align: center;">  </div> <p>Process:</p> <p>i) The surface of iron is usually coated with a thin film of iron oxide. However if this iron oxide film develops some cracks, anodic areas are created on the surface while the coated metal part acts as cathode.</p> <p>At Anode:-</p> $\text{Fe} \longrightarrow \text{Fe}^{++} + 2\text{e}^{-}$ <p>The liberated electrons flow from anode to cathode areas. The electrons are reacting with water and dissolved O₂.</p>	<p style="margin-top: 500px;">1</p> <p style="margin-top: 100px;">1</p> <p style="margin-top: 100px;">1</p>	4



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3.		<p>At Cathode:-</p> $2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^- \longrightarrow 4\text{OH}^-$ <p>The Fe^{2+} ions at anode and OH^- ions at cathode diffuse and when they meet $\text{Fe}(\text{OH})_2$ is precipitated.</p> $\text{Fe}^{2+} + 2(\text{OH})^- \longrightarrow \text{Fe}(\text{OH})_2 \downarrow$ <p>If enough oxygen is present, $\text{Fe}(\text{OH})_2$ gets converted into $\text{Fe}(\text{OH})_3$ i.e. yellow rust.</p> $4\text{Fe}(\text{OH})_2 + \text{O}_2 + 2\text{H}_2\text{O} \longrightarrow 4\text{Fe}(\text{OH})_3 \downarrow$	1											
	c)	<p>Differentiate between Galvanising and Sherardizing. Write the similarities between Galvanising and Sherardizing.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Galvanizing</th> <th style="width: 50%;">sherardizing</th> </tr> </thead> <tbody> <tr> <td>1 It is process of coating iron or steel sheets with a thin coat of zinc by hot dipping method</td> <td>1 It is process of coating small iron or steel articles by alloying at surface with zinc metal</td> </tr> <tr> <td>2 In galvanizing surface of iron sheet is covered by a thin layer of zinc metal which protect the base metal from corrosion</td> <td>2 In sherardizing surface of iron or steel article is covered by a Zinc-iron alloy layer which protect the base metal from corrosion</td> </tr> <tr> <td>3 This process is carried out in a large tanks by dipping iron sheet in a bath of molten zinc at a temperature of about $425-460^{\circ}\text{C}$</td> <td>3 This process is carried out in a constantly rotating drum by packing the small iron or steel article in zinc powder at a temperature of about $350-400^{\circ}\text{C}$</td> </tr> <tr> <td>4 This process is widely used for protecting iron articles like fencing wires, roofing sheets etc.</td> <td>4. This process is used for protecting small & irregular iron articles like bolts, screws, nails, nuts etc.</td> </tr> </tbody> </table> <p>(Any Three points: 3 marks)</p> <p>Similarities between Galvanising and Sherardizing. In both the processes Zinc is used as a coating metal to protect Iron or Steel(Base Metal)</p>	Galvanizing	sherardizing	1 It is process of coating iron or steel sheets with a thin coat of zinc by hot dipping method	1 It is process of coating small iron or steel articles by alloying at surface with zinc metal	2 In galvanizing surface of iron sheet is covered by a thin layer of zinc metal which protect the base metal from corrosion	2 In sherardizing surface of iron or steel article is covered by a Zinc-iron alloy layer which protect the base metal from corrosion	3 This process is carried out in a large tanks by dipping iron sheet in a bath of molten zinc at a temperature of about $425-460^{\circ}\text{C}$	3 This process is carried out in a constantly rotating drum by packing the small iron or steel article in zinc powder at a temperature of about $350-400^{\circ}\text{C}$	4 This process is widely used for protecting iron articles like fencing wires, roofing sheets etc.	4. This process is used for protecting small & irregular iron articles like bolts, screws, nails, nuts etc.	1 1 mark each	4
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	d)	<p>Define the following properties of lubricant.</p> <ol style="list-style-type: none"> i. Viscosity ii. Oiliness iii. Flash point iv. Pour point 		4										

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3		<p>i) Viscosity: It is defined, as the force in dynes required for moving 1 cm² of the liquid over another surface with a velocity of 1cm per second</p> <p>ii) Oiliness: -It is defined as the power of oil to maintain a continuous film under pressure while used as a lubricant.</p> <p>iii) Flash Point: - Flash point of oil is the lowest temperature at which the oil begins to give enough vapours which give momentary flash of light when a flame is applied to it.</p> <p>iv) Pour point :It is the temperature at which the liquid ceases to flow or pour on cooling.”</p> <p>Define lubrication.Explain the boundry lubrication.</p> <p>e) Lubrication: - The process of reducing frictional resistance between moving or sliding surfaces, by the introduction of lubricants in between them is called lubrication.</p> <p>Boundry lubrication:</p> <p>This type of lubrication is done when a continuous fluid film of lubricant cannot persist & direct metal to metal contact is possible due to certain reasons.</p> <p>This happens when i) a shaft starts moving from rest or ii) the speed is very low or iii) the load is very high or iv) The viscosity of oil is too low.</p> <p>ii) Under such conditions, the space between the moving parts is lubricated with a thin layer of oil lubricant. The oil is adsorbed by physical or chemical forces or both on the metallic surfaces. iii) The adsorbed layers cannot get removed easily & thus avoids direct metal to metal contact. The load is carried by the layers of the adsorbed lubricant on the metallic surfaces.</p> <p>iv) The property which is responsible for this kind of adsorption is “Oiliness.”</p>	<p>1 mark each</p> <p>1</p> <p>2</p> <p>1</p>	<p>4</p>





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3	f.	<p>Write four functions of lubricant used in gears.</p> <p>Functions of lubricant:</p> <ul style="list-style-type: none">i. It acts as a coolant.ii. It bears extreme pressure.iii. It avoids unsmooth relative motion.iv. It prevents expansion by local frictional heat.v. Prevents surface wear & tear and deformation. <p>(Any four functions: 1 mark each)</p>	1 mark each	4