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 any two ores of iron chemical formula.**		
		Sr.No. / Name of Ore / Chemical formula. 1 / Magnetite / (Fe_3O_4) 2 / Haematite / (Fe_2O_3) 3 / Limonite / ($2Fe_2O_3.3H_2O$) 4 / Siderite / ($FeCO_3$) 5 / Iron Pyrites / (FeS_2)	**1 Mark each**	**2**
	b)	**What are the products of Blast furnace?** i) Pig Iron ii) Slag iii) Flue Gases **(Any two products)**	**1 Mark each**	**2**
	c)	**State any two purposes of hardening.** **Purpose :-** i) To improve strength, elasticity, ductility, toughness. ii) To increase its resistance to wear. iii) To increase machinability (ability to cut other metals).	**1 Mark each**	**2**
	d)	**Why is an alloying element nickel added to steel?** **Addition of alloying element nickel improves following properties of steel:** i) Corrosion resistance. ii)Heat resistance iii)Elasticity iv) Toughness v)Ductility vi) Tensile strength. **(Any two properties 1 mark each)**	**2**	**2**
	e)	**Define corrosion and state it's 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** i)Atmospheric corrosion / direct chemical corrosion / Dry corrosion ii)Immersed corrosion / electro chemical corrosion / Wet corrosion.	**1** **1**	**2**
	f)	**State and explain the factors affecting rate of atmospheric corrosion.** **<u>1) Impurities in the atmosphere</u>:-** Atmospheric corrosion rate is fast in the presence of impurities such as H_2S, SO_2, CO_2, Cl_2, gases along with vapours of HCl & H_2SO_4 etc. Atmospheric air in industrial areas contains these impurities.	**1**	**2**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
1		**2) Moisture in the atmosphere:-** Atmospheric gases & chemical vapors dissolve in moisture and reaction between such dissolved gases and metal becomes faster.Therefore moisture acts as conducting medium and enhances the corrosion.	**1**	
	g)	**List any four constituents of paint.** **The constituents of the paint are:-** 1) Pigments 2) Drying Oil / Medium 3) Thinners 4) Driers 5) Extenders 6) Plasticizers	**½ Mark each**	**2**
	h)	**Give reason why galvanized containers are not used for storing food stuffs.** Galvanized container contains zinc coating. Since zinc is more active metal, zinc gets dissolved in dilute acids forming poisonous (toxic) zinc compounds which will poison the content. Therefore galvanized containers can not be used for storing food stuff.	**2**	**2**
	i)	**Classify fuel with suitable examples of each.** **I) Primary or Natural Physical State** i) Solid – e.g wood ,coal ii) Liquid- e.g Crude oil iii)Gaseous- e.g Natural gas (marsh gas) **II)Secondary or Artificial Physical State** i) Solid – e.g coke, charcoal ii) Liquid- e.g Petrol,kerosene,diesel oil, lubricating oil iii)Gaseous- e.g LPG,water gas ,producer gas ,coal gas,biogas **(Any one type of classification with two types along with one example of each 1 mark)**	**2**	**2**
	j)	**Write any two disadvantages of solid fuels.** 1) They have high ash content value. 2) A large proportion of heat is wasted during their combustion. 3) Combustion operations cannot be controlled easily. 4) Cost of handling is high. 5) Calorific value is lower than liquid or gaseous fuels. 6) They require excess of air for complete combustion. 7) They cannot be used in I.C. engines as a fuel.	**1 Mark each**	**2**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
1.	**k)**	**Write ant two applications of Bio-diesel.** **Applications of Biodiesel:-** 1) It is an alternative fuel formulated exclusively for diesel engines little or no modification in engines. 2) It is also used as a heating fuel in domestic & commercial boilers. 3) It is used in rockets. **(Any two applications)**	**1** **Mark each**	**2**
	l)	**Define Lubrication.Name the types of lubrication.** **Lubrication:** The process of reducing frictional resistance between moving or sliding surfaces, by the introduction of lubricants in between them is called **lubrication.** **Types of Lubrication (Any two)** 1. Fluid – Film Lubrication 2. Boundary Lubrication 3. Extreme Pressure Lubrication	**2** **1** **½ Mark each**	**2**
2.	**a)**	**Attempt any FOUR** **Write the chemical reaction taking place in zone of reduction of blast furnace.** i) $3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2\uparrow$ ii) $Fe_3O_4 + CO \longrightarrow 3FeO + CO_2\uparrow$ iii) $FeO + CO \longrightarrow Fe + CO_2\uparrow$ iv) $CaCO_3 \longrightarrow CaO + CO_2\uparrow$ v) $2Fe + 3CO \longrightarrow Fe_2O_3 + 3C$ vi) $3Fe + 4CO \longrightarrow Fe_3O_4 + 4C$ **(Note: consider any four reactions)**	**16** **4** **1** **Mark each**	**16**
	b)	**Write two properties and two uses of magnetic steel.** **Steel** | **Properties** | **Uses** **Magnetic steel** | 1. This steel has very high ferromagnetic character 2. Magnetic property of alloy is not lost with time & at higher temperature also. | i)It is used for making permanent & powerful magnets for ransformer cores. ii)Dynamos iii)Motors iv)Loudspeakers, v) Speakers for audio &video sets in electromagnets.	**4**	**4**

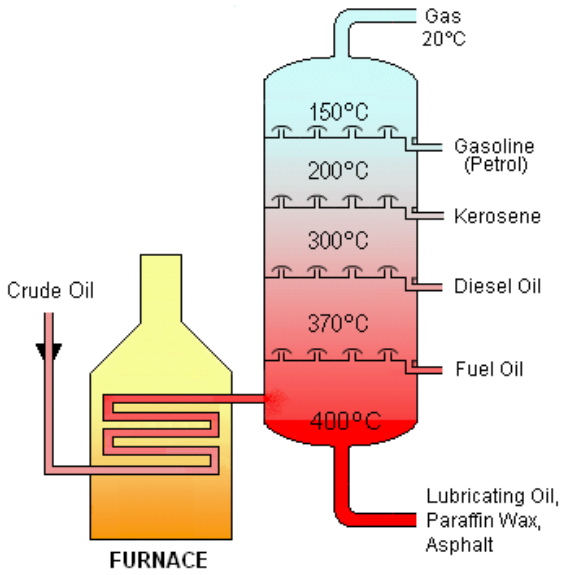
<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>2.</td><td>c)</td><td>How steel is classifed on the basis of carbon content? Give composition, properties and uses of different carbon steels.

It is classified on the percentage of carbon present in it.
a) Mild or low carbon steel – 0.05 to 0.3% carbon.
b) Medium carbon steel – 0.3 to 0.6% carbon.
c) High carbon steel – 0.6 to 1.5% carbon.

<table>
<tr><th>Properties</th><th>Low or Mild Carbon Steel</th><th>Medium Carbon Steel</th><th>High Carbon Steel</th></tr>
<tr><td>i)Hardness</td><td>Soft, tough, malleable, ductile</td><td>Harder & tougher than steel</td><td>Quite hard.</td></tr>
<tr><td>ii)Weldability</td><td>Suitable for welding</td><td>Fairly good for welding (not easily)</td><td>unweldable</td></tr>
<tr><td>iii)Heat treatment</td><td>Responds to heat treatment</td><td>can be hardned by heat treatment.</td><td>can be imparted desired hardness by heat treatment highest</td></tr>
<tr><td>iv)Tensile Strength</td><td>low</td><td>high</td><td>Highest</td></tr>
<tr><td>Uses :-</td><td>Soft wires, wires for rope, chains, rivets, bolts, nails, boiler tubes.</td><td>Rail roads, wheels, axles, fish – plates, turbine rotors, springs, gun parts, machine parts etc.</td><td>Wooden working tools, chisels, saws, drills, metal cutting tools for lathes, cutters, knives, blades, razors etc.</td></tr>
</table>
(Any two properties and uses of any one type of plain carbon steel)

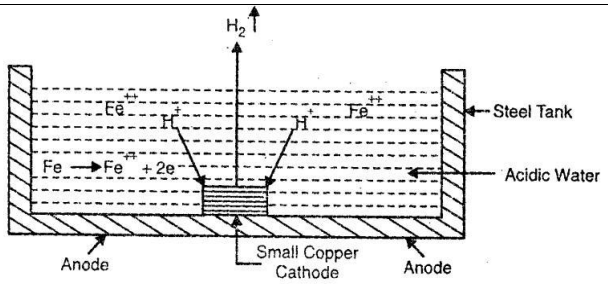
Write composition and properties of bio-gas.</td><td>2

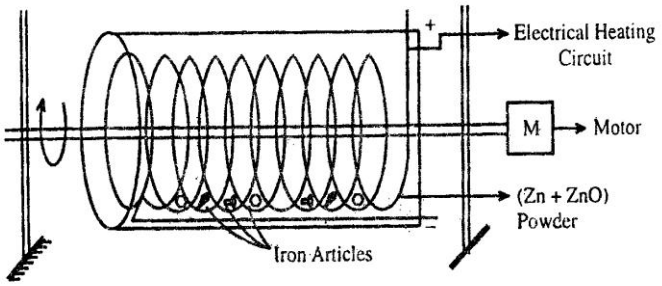
2</td><td>4</td></tr>
<tr><td></td><td>d)</td><td></td><td></td><td>4</td></tr>
</table>

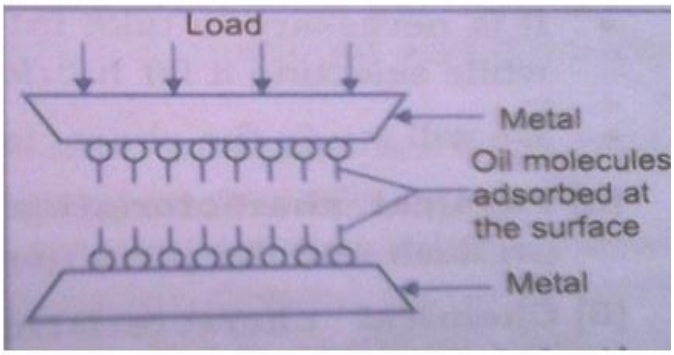
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2.		**Composition:-** **The average composition of biogas is;-** 1) CH_4 (methane) = 50 – 60% (Combustible gas) 2) CO_2 (carbon dioxide) = 30 – 40% (non – combustible gas) 3) H_2 (Hydrogen) = 5 – 10% (Combustible gas) 4) H_2S (Hydrogen sulphide) = traces (Combustible gas) 5) N_2 = 2-6% (Non carbon gas)	**2**	4
		Properties:- 1) Biogas on burning liberates a larger amount of heat than that obtained by burning animal dung or fire wood directly. 2) It burns without producing residue, smoke etc. 3) It is cheap, clean in use, has good calorific value & convenient fuel. 4) It does not pollute the atmosphere. 5) It involves no storage problem. 6) Biogas production is very economical. 7) It provides excellent yield of good manure. 8) Its flame temperature is about 540 ^{0}c. **(Composition 2 mark , any two properties 2 marks)**	**2**	
	e)	**With the help of labelled diagram, illustrate various fractions obtained during refining of crude petroleum.**  	**2**	4

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2.				
		(Any four fractions)	**½ Mark each**	
	f)	**State any four characteristics of a good fuel.** **Characteristics:** 1) A good fuel should have a high calorific value. 2) A good fuel should have a moderate ignition temperature.. 3) A good fuel should not liberate any polluting or poisonous 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 which causes air pollution. 10)Low moisture content ,clean in use and economic in labour.		**4**
3.		**Attempt any FOUR:**		**16**
	a)	**Explain the mechanism of immersed corrosion by evolution of hydrogen gas.**		**4**

Sr. No.	Fractions
1	Uncondensed gases
2	Gasoline (petrol)
3	Kerosene
4	Diesel Oil
5	Fuel oil
6	Lubricating oil, Paraffin wax, Asphalt

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
3.			**1**	
		Process: 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)** These electrons flow through the metal from anode to the cathode that is piece of copper metal where they are accepted by H^+ ions to form H_2 gas	**1**	
		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**	
	b)	**Name and explain the process of coating small and irregular shaped iron articles to protect from corrosion.**		**4**
		The method used to coat small and irregular shaped articles is **sherardizing.**	**1**	
		Process: i) The iron articles (bolts, screws, nails etc) to be coated are first cleaned and then packed with Zn dust and ZnO powder in a steel drum, which is provided with electrical heating circuit arrangement. ii) The drum is slowly rotated for 2-3 hours and its temp is kept between $350^0 – 400^0$C during this process Zn gets diffused slowly into iron forming Fe - Zn alloy at the surface which protects iron surface from corrosion.	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
3.			**1**	**4**
	c)	**Distinguish between galvanizing and tinning.** **Sr.No. | Galvanizing | Tinning** **i)** A process of covering iron or steel with a thin coat of **Zinc** to prevent it from rusting. | A process of covering iron or steel with a thin coat of **Tin** to prevent it from corrosion. **ii)** In galvanising, zinc protects the iron as it is more electropositive than iron.It does not allow iron to pass into solution. | Tin protects base metal iron from corrosion, as it is less electropositive than iron and higher corrosion resistance. **iii)** In galvanizing Zn continues to protect the metal by galvanic cell action, even if coating of Zn is broken. | In tinning, tin protects the iron, till the coating is perfect.Any break in coating causes rapid corrosion. **iv)** Galvanized containers can not be used for storing acidic food stuff, since Zn reacts with food acids forming Zn compounds which are highly toxic i.e. poisonous. | Tin coated containers and utensils can be used for storing any food stuff since Tin is non toxic and protects the metal from corrosion and does not causes food poisoning.	**1** **Mark each**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
3.	**d)**	**Suggest the type of lubricant used for following jobs:** i**)Clock** **ii) Cutting tools** **iv)Sewing machine** **iv) Gears** **i) Clock :** Vegetable and animal oils like palm oil, hazel nut oil, neat foot oil, etc **ii) Cutting tools:** Mineral oil containing additives like fatty oils,oil-emulsions. iii) **Sewing machine :** Mineral oil, silicones, thin vegetable and animal oils like palm oil, hazel nut oil, neat foot oil. **iv) Gears:** Thick mineral oils containing extreme pressure additives (like metallic soaps).	**1** **1** **1** **1**	**4**
	e)	**State and explain the types of lubrication done for machines working under heavy load and at slow speed.** A type of lubrication done for machines working under heavy load and at slow speed is **boundary lubrication.** **Process:** i) Under such conditions, the space between the moving parts is lubricated with a thin layer of oil lubricant. ii) 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. iv) The load is carried by the layers of the adsorbed lubricant on the metallic surfaces. v) The property which is responsible for this kind of adsorption is "Oiliness." **Diagram:**  	**1** **2** **1**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
3	**f)**	**Define the terms:**		**4**
		i) Flash Point	**1**	
		ii) Fire Point		
		iii) Acid value		
		iv) Emulsification		
		i) 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."	1	
		ii) Fire Point: "Fire point is the minimum temperature at which the oil gives enough vapours which catch fire & burn continuously at least for five seconds when flame is applied to it."	1	
		iii) Acid value: It is the number of milligrams of KOH required to neutralize free acid in one gram of oil.	1	
		iv) Emulsification: Certain oils have the tendancy to mix with water to form an intermate & stable mixture called emulsion & the process is known as 'emulsification.'	1	