WINTER– 15EXAMINATION

Subject Code:17203 Model Answer **Page No: 1/10**

Applied Chemistry

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 themodel answer scheme. 2) The model answer and the answer written by candidate may vary but the examiner may tryto 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 thefigure. 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 constantvalues 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.		

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1.		**Attempt any NINE of the following:**		18
	a)	**Define 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 ½ mark each	2
	b)	**What are the products of Blast furnace?** i) Pig Iron ii) Slag iii) Flue Gases (any two products)	2	2
	c)	**State types of lubricants with examples.** **i) Solid lubricants:** Examples: graphite, molybdenum disulphide, soap, soap stone, wax, talc, chalk, mica, teflon etc. **ii) Semi-solid lubricants:** Examples: greases and vaseline. **iii) Liquid lubricants:** Examples: vegetable and animal oils such as castor, olive, coconut, palm, neem, linseed, hazel nut, tallow, lard, whale, codliver oil etc. and fatty acids like oleic acid, stearic acid etc., silicones, blended oils, and mineral oils. **(Any two types with one example)**	2	2
	d)	**Why gold does not get corroded in air?** In case of gold metal, the oxide film formed is **Unstable oxide film.** So as soon as the film is formed it decomposes back into original metal& oxygen. Therefore corrosion is not possible here. **2 M + O_2** ⟶ **2MO** ⟶ **2 M + O_2** ↑ Metal Metal oxide **(consider either statement or reaction)**	2	2
	e)	**Explain the function of coke in extraction of iron from its ore?** **Function of coke**-In the extraction of iron metal from haematite ore coke is used as a reducing agent. It reduces iron oxide to iron metal. $Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$ ↑	2	2
	f)	**Define heat treatment.** Heat treatment of steel may be defined as the process of heating steel to a certain high temperature and then cooling it at a controlled rate, in order to develop certain desirable physical properties in it without changing its chemical composition.	2	2

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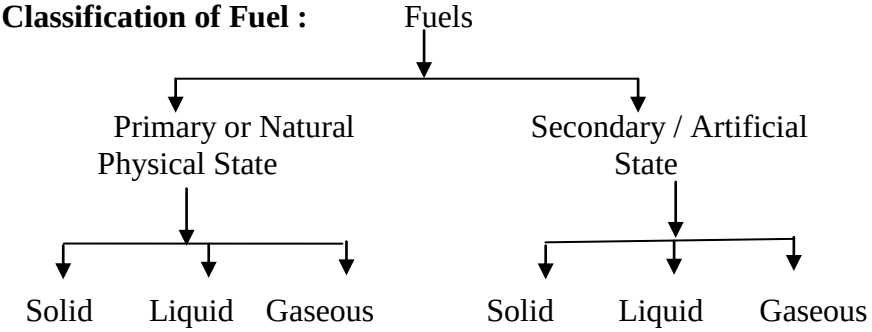
1.	**g)**	**State different types of film formed during corrosion and which type of oxide film is more protective against corrosion?** **Types of film formed during corrosion: (any two)** 1) Stable film :- a) Porous film b) Non – Porous film 2) Unstable film 3) Volatile film **Stable non-porous or Unstable film** is more protective against corrosion. (any one)	1 1	2
	h)	**Name two ores of iron with its molecular formulae.** **Sr.No. / Name of Ore / Molecular formulae** 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) **(Any two:1 mark each with formula)**	1 1 mark each	2
	i)	**Why galvanised containers are not used for food stuffs?** Galvanized container contains zinc coating. Since zinc is more active metal, zinc gets dissolved in dilute acids present in food stuffs forming poisonous (toxic) zinc compounds which will poison the content. Therefore galvanized containers cannot be used for storing food stuff.	2	2
	j)	**Define the term fire point and flash point.** **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." **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 1	2
	k)	**Define fuels. How are they classified?** **Fuel:** A fuel can be defined as any combustible substance which during combustion gives large amount of heat energy. **Classification of Fuel :**  	1 1	2

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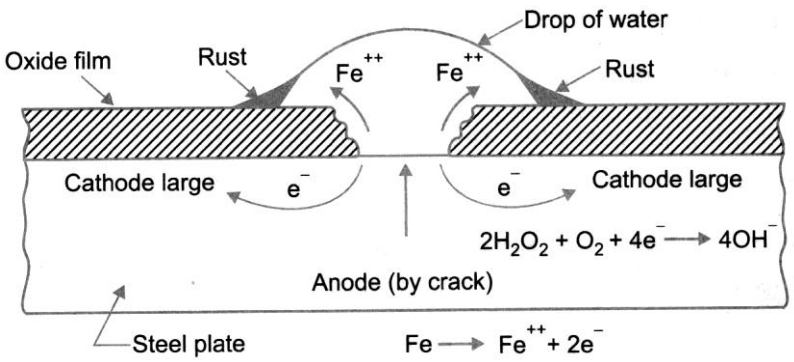
1.	**l)**	**Give composition of L.P.G.** **Composition:-** The average composition of LPG is 1) Ethane = 0.20% 2) Propane = 57.30% 3) Butane = 41.10% 4) Pentane = 1.40%	½ mark each	2
2.		**Attempt any FOUR of the following:**		16
	a)	**State composition, properties and applications of C.N.G.**		4
		Composition:- CH_4 (methane) = 88.5% C_2H_6 (ethane) = 5.5% C_3H_8 (Propane) = 3.7% C_4H_{10} (butane) = 1.8% Rest is H_2, CO_2, H_2S etc.	2	
		Properties:- (Any one) 1. It is cheaper than petrol or diesel. 2. Its ignition temp is high (540^0C). 3. It is odourless& non corrosive. 4. It is light weight gas. 5. Its calorific value is high. 6. Being free from lead &sulphur, its use substantially reduces harmful engine emissions.	1	
		Applications: (Any one) 1. It is used in traditional petrol I.C. engine cars (petrol / CNG) 2. It is also used in locomotive generators to generate electricity that drives the motors of the train.	1	
	b)	**Explain mechanism of electrochemical corrosion due to absorption of O_2 gas.** **Anode:** - By crack **Cathode :-** Coated metal part  	1	4

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2.	**b)**	**Process:** 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. **At Anode:-** $\mathbf{Fe \longrightarrow Fe^{++} + 2e^-}$ The liberated electrons flow from anode to cathode areas. The electrons are reacting with water and dissolved O_2. **At Cathode:-** $\mathbf{2H_2O + O_2 + 4e^- \longrightarrow 4OH^-}$ The $\mathbf{Fe^{2+}}$ ions at anode and $\mathbf{OH^-}$ ions at cathode diffuse and when they meet $Fe(OH)_2$ is precipitated. $\mathbf{Fe^{2+} + 2(OH)^- \longrightarrow Fe(OH)_2 \downarrow}$ If enough oxygen is present, $Fe(OH)_2$ gets converetd into $Fe(OH)_3$ i.e. yellow rust. $\mathbf{4\,Fe(OH)_2 + O_2 + 2H_2O \longrightarrow 4\,Fe(OH)_3 \downarrow}$	1 1 1	
	c)	**Define neutralization number, saponification value, viscosity and viscosity index.** **Neutralization point:** It is the number of milligrams of KOH required to neutralize free acids present in one gram of oil. **Saponification value:**It is the number of milligrams of KOH required to saponify 1 gm. of oil. **Viscosity:** It is defined, as the force in dynes required for moving 1 cm^2 of the liquid over another surface with a velocity of 1cm per second. **Viscosity index:**"The rate of change of viscosity of a liquid (Oil) with the change of temperature is known as viscosity index."	1 1 1 1	4
	d)	**Give chemical reactions taking place in zone of reduction of blast furnace.** The reduction of iron oxide is done in the following stages:- $Fe_2O_3 \longrightarrow Fe_3O_4 \longrightarrow FeO \longrightarrow Fe$ i) In between 300 – 500^0C, when charge is heated, Fe_2O_3 (Ferric oxide) is reduced to Fe_3O_4 (Ferroso ferric oxide). $3Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2 \uparrow$ 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 $Fe_3O_4 + CO \longrightarrow 3FeO + CO_2 \uparrow$ iii) At temperature between 700 – 800^0C, FeO is reduced to metallic iron. $FeO + CO \longrightarrow Fe + CO_2 \uparrow$	1 Mark each	4

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2.	d)	iv) Simultaneously, the limestone present in the charge is also decomposed to produce lime. $CaCO_3 \longrightarrow CaO + CO_2 \uparrow$ v) The metal produced is spongy; simultaneously a part of metallic iron reacts with CO to form Fe_2O_3 or Fe_3O_4. $2Fe + 3CO \longrightarrow Fe_2O_3 + 3C$ $3Fe + 4CO \longrightarrow Fe_3O_4 + 4C$ **(Note: consider any four reactions)**		
	e)	**State advantages and disadvantages of solid fuels.** **Advantages: (any two)** 1) They are very cheap & easy to transport. 2) They are convenient to stored & safely as compared to liquid & gaseous fuels. 3) Their cost of production is low. 4) Moderate ignition point. **Disadvantages: (any two)** 1) They have high ash content value. 2) A large proportion of heat is wasted during 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. 8) Cannot be piped. 9) Require large space. 10) Burns with smoke.	2 2	4 4
	f)	**Explain fluid film lubrication with diagram.** **Fluid film lubrication :** i)It is carried out by introducing the liquid lubricants in between the moving or sliding surface. The lubricant film covers the irregularities of the sliding or moving surface & forms a thin layer in between them. This thin layer of lubricant avoids metal to metal contact & reduces wear & friction. ii) The resistance to movement of moving parts is only due to the internal resistance between the particles of the lubricant moving over each other. iii) In fluid film lubrication, the lubricant chosen should have the minimum viscosity under working condition & at the same time it should remain in place & separate the surfaces. **Examples:** This type of lubrication is provided in case of delicate instrument and light machines like watches, clocks, guns, sewing machines, scientific instrument etc.	2 1	

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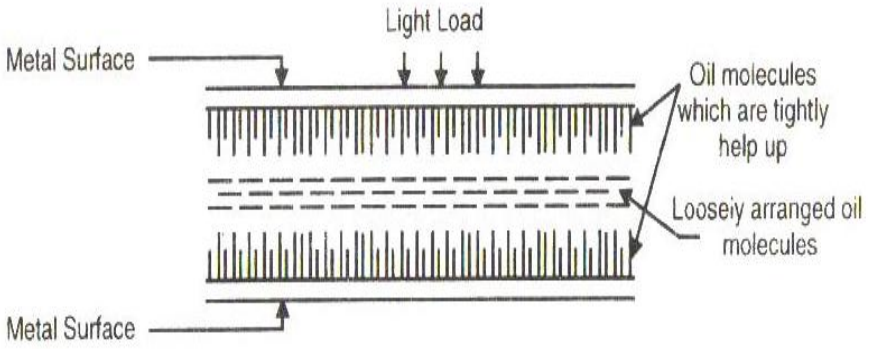
2.	**f)**		1	
3.		**Attempt any FOUR of the following:**		16
	a)	**Give composition, properties and applications of Biogas.**		4
		The average **composition** of biogas is: CH_4 (methane) = 50 – 60% (Combustible gas) CO_2 (carbon dioxide) = 30 – 40% (non – combustible gas) H_2 (hydrogen) = 5 – 10% (Combustible gas) N_2 (nitrogen) = 2-6% (non – combustible gas) H_2S (Hydrogen sulphide) = traces (Combustible gas)	2	
		Properties:- (any one) 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.	1	
		Applications:- (any one) a) It is used as an efficient fuel. b) It is used for cooking food. c) It is used as an illuminant in villages. d) To run engines (generators).	1	

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>3.</td><td>b)</td><td>Distinguish between Galvanizing and Tinning.

<table>
<tr><th>Sr.No.</th><th>Galvanizing</th><th>Tinning</th></tr>
<tr><td>i)</td><td>A process of covering iron or steel with a thin coat of Zinc to prevent it from rusting.</td><td>A process of covering iron or steel with a thin coat of Tin to prevent it from corrosion.</td></tr>
<tr><td>ii)</td><td>In galvanizing, zinc protects the iron as it is more electropositive than iron.It does not allow iron to pass into solution.</td><td>Tin protects base metal iron from corrosion, as it is less electropositive than iron and higher corrosion resistance.</td></tr>
<tr><td>iii)</td><td>In galvanizing Zn continues to protect the metal by galvanic cell action, even if coating of Zn is broken.</td><td>In tinning, tin protects the iron, till the coating is perfect.Any break in coating causes rapid corrosion.</td></tr>
<tr><td>iv)</td><td>Galvanized containers cannot be used for storing acidic food stuff, since Zn reacts with food acids forming Zn compounds which are highly toxic i.e. poisonous.</td><td>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.</td></tr>
</table></td><td>1 mark each</td><td>4</td></tr>
<tr><td></td><td>c)</td><td>How carbon steels classified? Give two properties and applications of each
Classification of Plain Carbon steel:
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.

a) Mild or low carbon steel – 0.05 to 0.3% carbon
Properties: (any two)
1. It is Soft, tough, malleable& ductile
2. It responds to heat treatment
3. It is suitable for welding
4. It has low tensile Strength
Applications: (any two)
1. It is used for soft wires, wires for rope
2. It is used for chains, rivets, bolts, nails, boiler tubes etc.</td><td>1

½

½</td><td>4</td></tr>
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3.	**c)**	**b) Medium carbon steel – 0.3 to 0.6% carbon.** **Properties: (any two)** 1. It is harder & tougher than steel 2. It can be hardened by heat treatment 3. It is fairly good for welding (not easily) 4. It has high tensile Strength than mild steel 5. It is shock resistant **Applications: (any two)** 1. It is used for rail roads, wheels, axles, fish – plates 2. It is used for armature and crank shafts, turbine rotors springs 3. It is used for gun parts, machine parts etc. **c) High carbon steel – 0.6 to 1.5% carbon.** **Properties: (any two)** 1. It is quite hard; resistant to wear hence it can produce a keen cutting edge. 2. It can be imparted desired hardness by heat treatment. 3. It is unweldable 4. It has highest tensile Strength **Applications: (any two)** 1. It is used for wooden working tools; making files, chisels, saws, drills etc. 2. It is used for metal cutting tools for lathes: cutters, knives, saws, blades, razors etc.	½ ½ ½ ½	
	d)	**State any four functions of lubricants.** 1. It avoids direct contact between the rubbing surfaces and hence reduces the surface wear & tear & deformation. 2. It reduces the loss of heat, so it acts as a coolant. 3. It reduces expansion of metal by local frictional heat. 4. It reduces unsmooth relative motion. 5. It reduces the maintenance & running cost of machine. 6. It reduces the power loss in I.C. engine. 7. In I.C. engine, the lubricant acts as a seal between the piston & cylinder wall, hence it prevents the leakage of gases at high pressure.	1 mark each	4
	e)	**Explain proximate analysis of coal and its significance.** **Proximate analysis of coal**: The analysis of a coal sample in which the moisture content, volatile matter content, ash content and fixed carbon content are found, is known as proximate analysis. This gives quick and valuable information regarding commercial classification and determination of suitability for particular industrial use.	2	4

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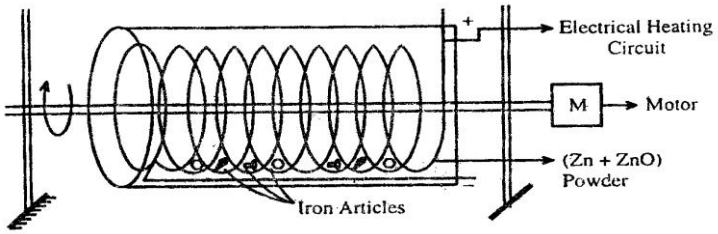
3.	**e)**	**Significance:** Proximate analysis provides following valuable information in assessing the quality of fuel **i) Moisture: -** Lesser the moisture better is the quality of coal. **ii) Volatile Matter: -** Lower / lesser the volatile matter, better the rank of the coal. **iii) Ash: -** For a good quality of coal, percentage of ash should be minimum. **iv) Fixed Carbon: -** Higher the percentage of fixed carbon, greater is the calorific value.	2	4
	f)	**Name and explain the method used to protect small and uneven articles from corrosion.** The method used to protect small and uneven articles from corrosion is **sherardizing.**	1	4
			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 – 400^0C during this process Zn gets diffused slowly into iron forming Fe - Zn alloy at the surface which protects iron surface from corrosion.	2	