SUMMER– 2018 EXAMINATION

Subject Name: Applied Chemistry **Model Answer** Subject Code: 17203

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.	Answers	Marking Scheme
1		**Attempt any NINE of the following:**	**18**
	(a)	**Name the products of blast furnace obtained during smelting of iron ore.**	**2**
		i) Pig Iron ii) Slag iii) Flue Gases	2
	(b)	**Define heat treatment of steel**.	
		Heat treatment:- The process of heating steel to a certain high temperature and then cooling it at a controlled rate in order to develop certain physical properties without changing its chemical composition is known as heat treatment of steel.	**2** 2
	(c)	**Give any two applications of wrought iron**. 1) It is used in manufacture of chains, hooks, spanners etc. 2) It is used in making bolts, nails, railway coupling, railway carriages etc.	**2** 1 mark each

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1.	**(d)**	**Write the composition of magnetic steel.**	**2**
		e.g Alnico Al - 20% Ni - 20% Co - 10% and Steel - 50%	2
	e)	**State and explain any two factors affecting immersed 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. **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. **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. **5) Effect of PH:-**Acidic media are more corrosive than alkaline and neutral media. **6) Differential aeration**: Corrosion occurs where oxygen access is least. **7) 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. **(Note: Consider any two factor)**	**2** 1 mark each
	(f)	**"Tinned containers are preferred over galvanized containers for storing food stuff''. Give reason.** Since tin is less active metal, It does not react with the food stuffs to form poisonous compounds whereas zinc is more active metal and reacts with dilute acids also which forms poisonous compound in case of galvanized containers. So tinned containers are used to store food stuff.	**2** 2

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Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	**g)**	**Define atmospheric corrosion.** The corrosion which is brought about by the atmospheric conditions is called atmospheric corrosion. **OR** This type of corrosion occurs when metals come in contact directly with atmospheric gases like O_2, Cl_2, Br_2, I_2, H_2S, CO_2, SO_2, NO_2 etc and moisture.	**2** 2
	(h)	**Name the different types of oxide film formed during atmospheric corrosion.** 1. Stable Film- a) Porous film b) Non-Porous film 2. Unstable film 3. Volatile film	**2** 2
	(i)	**Define the term fuel and Give its classification.** **Fuel:** A fuel can be defined as any combustible substance which during combustion gives large amount of heat energy. **Classification of Fuel :** **Primary or Natural** : - a) Solid b) Liquid c) Gaseous **Secondary or Artificial** :- a) Solid b) Liquid c) Gaseous	**2** 1 1
	(j)	**State any two properties of bio diesel.** 1) It is an alternative fuel formulated exclusively for diesel engines with 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)**	**2** 2
	(k)	**Define calorific value and Ignition temperature.** **Calorific value :** It is defined as "the total amount of heat produced by the complete combustion of unit mass or unit volume of the fuel." **Ignition temperature:** "It is the minimum temperature at which combustion of a fuel takes place when the firing is once started."	**2** 1 1

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Q. No.	Sub Q. N.	Answers	Marking Scheme
1.	**(l)**	**Define the term flash and fire point.**	**2**
		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
2.		**Attempt any FOUR of the following:**	**16**
	(a)	**Write chemical reactions taking place in zone of reduction of blast furnace.**	**4**
		i) $3Fe_2O_3 + CO \longrightarrow 2\ Fe_3O_4 + CO_2$	1 mark each
		ii) $Fe_3O_4 + CO \longrightarrow 3FeO + CO_2$	
		iii) $FeO + CO \longrightarrow Fe + CO_2$	
		iv) $CaCO_3 \longrightarrow CaO + CO_2$	
		v) $2Fe + 3CO \longrightarrow Fe_2O_3 + 3C$	
		vi) $3Fe + 4CO \longrightarrow Fe_3O_4 + 4C$	
		(Note: consider any four reactions)	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	**b)**	**Differentiate between annealing and normalizing.**	**4**

Annealing	Normalizing
1.It is the process of heating the steel at a temperature (760-925^{0}C) and cooling it slowly in the furnace along with the furnace	1.It is the process of heating the steel at a temperature of 50 ^{0}C above the critical temperature (725^{0}C) and cooling it freely in air at a rate of 5^{0}C/Sec.
2.Due to annealing steel becomes more soft, pliable, malleable & ductile	2. Due to normalizing steel becomes homogeneous & more soft. The mechanical properties of steel are more improved than annealing.
3.Time required for annealing is more than normalizing	3.Time required for normalizing is less than annealing
4. Consumption of fuel or electric power is more.	4. Consumption of fuel or electric power is less.

1 mark each

c) **State composition, properties and uses of heat resisting steels.** **4**

Composition	**Properties**	**Uses**
Nichrome: Cr = 23-30% C=0.35% & Remaining steel	1. resists temperature between 815 –1150^{0}C 2. It has low coefficient of expansion. 3. retains its mechanical properties even at high temperature 4. does not soften at high working temperature 5. Resistance to oxidation.	1) for making heating coils for furnaces & stoves 2) In making parts of boilers, steam lines, gas turbines, annealing boxes etc. 3) Used in other equipment's exposed to high temperature.

4

(Comp.- 2 marks, any two Properties and any 2 Uses 1 marks each)

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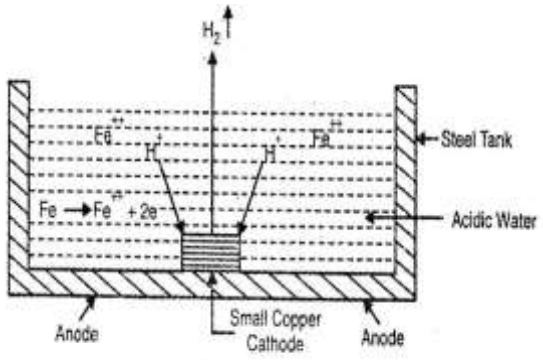
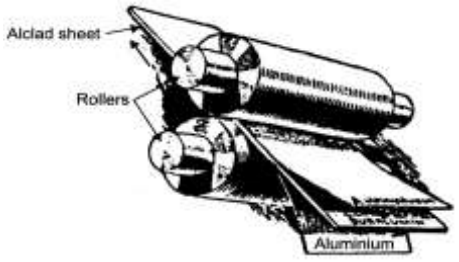
Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	**d)**	**Sate four characteristics of good fuels.** **Characteristics of good fuel.** 1) It should have moderate ignition temperature. 2) It should have high calorific value. 3) It should possess moderate velocity of combustion. 4) It should have low contents of non-combustible matter. 5) It should have low moisture content. 6) Its products of combustion should not be harmful. 7) It should be available in bulk at low cost. 8) It should be easy to store and transport. 9) It combustion should be easily controllable. 10) It should not undergo spontaneous combustion. 11) It should burn in air with efficiency. **(Any four: 1 mark each)**	**4** 1 mark each
	e)	**State composition and properties of CNG.** **Composition: -** 1) CH_4 (methane) = 88.5% 2) C_2H_6 (ethane) = 5.5% 3) C_3H_8 (Propane) = 3.7% 4) C_4H_{10} (butane) = 1.8% Rest is H_2, CO_2, H_2S etc. **Properties: -** 1) It is cheaper than petrol or diesel. 2) Its ignition temp is high (540^0C). 3) It is odorless & 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.	**4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	**f)**	**Explain the process of determining percentage of moisture and volatile matter in coal sample by proximate analysis.** **1) Percentage of Moisture:-** i) About 1 gm of finely powdered air- dried coal sample is weighed (W g) in a crucible. ii) The crucible is placed in an electric hot oven for 1 hour at 105^0C. iii) Cool it to room temp in a desiccator & weighed it again (W1 g). iv) Loss in weight (W – W1 g) is due to loss of moisture from the coal. % of moisture = $\frac{\text{Loss in weight x 100}}{\text{Weight of coal sample}}$ = (W-W1) / W x 100 **2) Percentage of Volatile Matter (V.M.):-** i) The above sample of moisture free coal left in crucible (W1g) is covered with a lid. ii) Then the crucible is placed in a muffle furnace at 925^0C for 7 min. iii) Cool it in desiccator to room temp & weigh it again. (W2g) (Without lid) % of Volatile matter = $\frac{\text{Loss in weight x 100}}{\text{Weight of coal sample}}$ = (W1-W2) / W x 100	**4** 2 2

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.		**Attempt any four of the following:**	**16**
	a)	**Explain the mechanism of immersed corrosion by Hydrogen evolution**	**4**
			1
		Steel tank: - Anode **Copper 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)** 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

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	b)	**Distinguish between Galvanizing and Tinning.**	**4**

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.	1
ii)	In galvanizing, 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.	1
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.	1
iv)	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.	Tin coated containers and utensils can be used for storing any food stuff since Tin is nontoxic and protects the metal from corrosion and does not causes food poisoning.	1

	c)	**Name and explain the method used for making Alclad sheets.**	**4**
		Method : Metal cladding	1
		Process: i) 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 temp & pressure. iii) Cladded metal is cathodic with respect to the base metal so that electrolytic protection is provided metals like Cu, Ni, Ag ,Pb, Pt & alloys like stainless steel, Ni alloys, Cu & pb alloys & Pb alloys are used as cladding materials.	2
			1

Q. No.	Sub Q. N.	Answers	Marking Scheme
3.	d)	**Give any one application of the following lubricants.** **i) Graphite** **ii) Silicone oil:** **iii) Water** iv) **Greases.** i) **Graphite:** It is used as lubricant in lathes, railway track joints, tractors, rollers, open gears, air compressors, cast iron, graphite suspension of water 'aqua dag 'used food processing industry and suspension of oil 'oil dag' used in IC engines, etc. ii) **Silicone oil:** It is used as working fluid in transformer, oil filled heater, in sewing machine, as moisture repellent, bushings, bearings, dielectric lubricant for clocks, etc. iii) **Water:** It is used as lubricant in pressurized equipment, coolant in nuclear reactor and high speed cutting machine, etc. iv) **Greases:** It is used as lubricant in wire ropes, rail axel boxes, automobiles, farm equipments, tractors, gears, water pumps, aircraft, rocket motors, etc. **(Note: Consider any one application of each)**	**4** 1 1 **1** **1**
	e)	**Explain mechanism of fluid film lubrication in process with labeled 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. **Diagram**	**4** **3**

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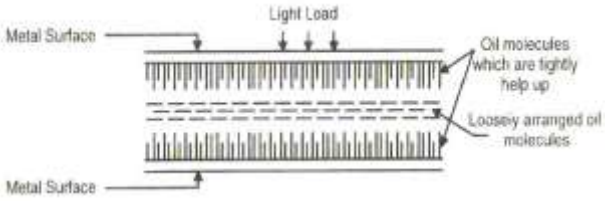
3.	**e)**		**1**
	f)	**State any four functions of lubricants.** 1. It avoids direct contact between the rubbing surfaces and hence reduces the surface wear & tear & deformation. 2. It reduces the loss of heat, so it acts as a coolant. 3. It reduces expansion of metal by local frictional heat. 4. It 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.	**4** 1 mark Each