



Winter- 2018 EXAMINATION  
Model Answer

Subject Name: Applied Chemistry

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.	Answer	Marking Scheme																		
<b>1</b>	(a)	<p><b>Attempt any nine:</b> <b>Name two important ores of iron? Mention its formula.</b></p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 15%;">Sr. No.</th> <th style="width: 40%;">Name of Ore</th> <th style="width: 45%;">Chemical formula</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Magnetite</td> <td><math>Fe_3O_4</math></td> </tr> <tr> <td style="text-align: center;">2</td> <td>Haematite</td> <td><math>Fe_2O_3</math></td> </tr> <tr> <td style="text-align: center;">3</td> <td>Limonite</td> <td><math>2Fe_2O_3 \cdot 3H_2O</math></td> </tr> <tr> <td style="text-align: center;">4</td> <td>Siderite</td> <td><math>FeCO_3</math></td> </tr> <tr> <td style="text-align: center;">5</td> <td>Iron Pyrites</td> <td><math>FeS_2</math></td> </tr> </tbody> </table>	Sr. No.	Name of Ore	Chemical formula	1	Magnetite	$Fe_3O_4$	2	Haematite	$Fe_2O_3$	3	Limonite	$2Fe_2O_3 \cdot 3H_2O$	4	Siderite	$FeCO_3$	5	Iron Pyrites	$FeS_2$	<p><b>18</b> <b>2</b></p> <p>1 mark each</p>
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	(b)	<p><b>State any two functions of Blast furnace.</b> 1. To reduce the ore to metallic. 2. To remove the impurities in the form of slag.</p>	<p><b>2</b> 1 mark each</p>																		
	(c)	<p><b>Define heat treatment. Give any two purposes of heat treatment.</b> <b>Heat treatment:-</b> 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. <b>Purpose of heat treatment:-</b> 1) To change the structure of steel. 2) To increase surface hardness. 3) To increase resistance to heat &amp; corrosion. 4) To alter the magnetic properties of steel. 5) To vary strength and hardness.</p>	<p><b>2</b> <b>1</b></p> <p>½ mark each</p>																		



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1		6) To make steel easily workable. 7) To remove trapped gases. 8) To improve machinability and mechanical properties.	
	(d)	<b>What is the effect of alloying element Cr &amp; V on the properties of steel?</b> <b>Effect of alloying element Cr:- (Any One)</b> i) It increases hardness, toughness and tensile strength. ii) It increases wear resistance and resistance to corrosion. <b>Effect of alloying element V: (Any One)</b> i) It improves tensile strength, ductility and shock resistance. ii) It increases air hardening and cutting quality.	2 1  1
	(e)	<b>Define corrosion. Mention its types.</b> <b>Corrosion:</b> Any process of chemical or electrochemical decay or destruction of a metal due to the action of surrounding medium is called as corrosion. <b>Types of corrosion:</b> i) Atmospheric corrosion / direct chemical corrosion / Dry corrosion ii) Immersed corrosion / electro chemical corrosion / Wet corrosion	2 1  1
	(f)	<b>Name any four factors affecting electrochemical corrosion.</b> 1) Position of metal in a galvanic series      2) Purity of the Metal 3) Physical state of the metal                      4) Solubility of the corrosion products 5) Effect of PH    6) Nature of the oxide film. 7) Relative area of anode and cathode              8) Conductance of medium. 9) Differential aeration.                                  10) Temperature 11) Humidity    12) Presence of impurities in the atmosphere	2   ½ mark each
	(g)	<b>Define Cementation. Name its types.</b> <b>Cementation:</b> It is the process of heating the base metal in a revolving drum containing a powder of coating metal. <b>Types:</b> i) Sherardizing ii) Chromizing iii) Colorizing	2  1  1



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1	(h)	<b>List any four constituents of paint.</b> 1) Pigments 2) Drying Oil / Medium 3) Thinners 4) Driers 5) Extenders 6) Plasticizers	2 ½ mark each																		
	(i)	<b>Define calorific value &amp; ignition temperature</b> <b>Calorific value:</b> - It is defined as “the total amount of heat produced by the complete combustion of unit mass or unit volume of the fuel.” <b>Ignition temperature:</b> -It is the minimum temperature at which combustion of a fuel takes place when the firing is once started.	2 1 mark each																		
	(j)	<b>Give two applications of biodiesel.</b> 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.	2 1 Mark each																		
	(k)	<b>Distinguish between solid fuel and liquid fuel. (any two)</b>	2																		
		<table border="1"> <thead> <tr> <th>Property</th> <th>Solid</th> <th>Liquid</th> </tr> </thead> <tbody> <tr> <td>1. Calorific Value</td> <td>Low</td> <td>Higher</td> </tr> <tr> <td>2. Ignition Temperature</td> <td>Very high</td> <td>Moderate</td> </tr> <tr> <td>3. Cost</td> <td>Cheap</td> <td>Costly</td> </tr> <tr> <td>4. Ash content</td> <td>High</td> <td>Negligible</td> </tr> <tr> <td>5. Velocity of combustion</td> <td>Non controllable</td> <td>Easily Controllable</td> </tr> </tbody> </table>	Property	Solid	Liquid	1. Calorific Value	Low	Higher	2. Ignition Temperature	Very high	Moderate	3. Cost	Cheap	Costly	4. Ash content	High	Negligible	5. Velocity of combustion	Non controllable	Easily Controllable	1 mark each
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(l)	<b>Define cloud point and viscosity index of a lubricant</b> <b>Cloud point:</b> Cloud point indicates the temperature at which the oil becomes cloudy in appearance, due to separation of wax. <b>Viscosity Index:</b> The rate of change of viscosity of a liquid (Oil) with the change of temperature is known as viscosity index.	2 1 1																			



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2	(a)	<p><b>Attempt any four:</b>  <b>Write chemical reactions taking place in zone of reduction of blast furnace.</b></p> <p>i) <math>3\text{Fe}_2\text{O}_3 + \text{CO} \longrightarrow 2\text{Fe}_3\text{O}_4 + \text{CO}_2</math>            ii) <math>\text{Fe}_3\text{O}_4 + \text{CO} \longrightarrow 3\text{FeO} + \text{CO}_2</math>            iii) <math>\text{FeO} + \text{CO} \longrightarrow \text{Fe} + \text{CO}_2</math>            iv) <math>\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2</math>            v) <math>2\text{Fe} + 3\text{CO} \longrightarrow \text{Fe}_2\text{O}_3 + 3\text{C}</math>            vi) <math>3\text{Fe} + 4\text{CO} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{C}</math>  <b>(Note: consider any four reactions)</b></p>	<p><b>16</b> <b>4</b></p> <p>1 mark each</p>																								
	(b)	<p><b>Give the classification of plain carbon steel. Write composition, one property and one use of different plain carbon steel.</b>  <b>Classification:</b>            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</p> <table border="1"> <thead> <tr> <th>Properties</th> <th>Low or Mild Carbon Steel</th> <th>Medium Carbon Steel</th> <th>High Carbon Steel</th> </tr> </thead> <tbody> <tr> <td>i)Hardness</td> <td>Soft, tough, malleable, ductile</td> <td>Harder &amp; 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 hardened 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> </tbody> </table> <p><b>(Any one property and one application of different plain carbon steel)</b></p>	Properties	Low or Mild Carbon Steel	Medium Carbon Steel	High Carbon Steel	i)Hardness	Soft, tough, malleable, ductile	Harder & tougher than steel	Quite hard.	ii)Weldability	Suitable for welding	Fairly good for welding (not easily)	Unweldable	iii)Heat treatment	Responds to heat treatment	can be hardened by heat treatment.	can be imparted desired hardness by heat treatment highest	iv)Tensile Strength	low	high	Highest	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.	<p><b>4</b></p> <p>2</p> <p>1</p> <p>1</p>
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	(d)	<p><b>Define fuel. Give the classification of fuel based on their occurrence with two examples of each type.</b></p> <p><b>Fuel:</b> A fuel can be defined as any combustible substance which during combustion gives large amount of heat energy.</p> <p><b>Classification of Fuel :</b></p> <p><b>I) Primary or Natural Physical State</b></p> <p>i) <b>Solid</b> – e.g wood ,coal</p> <p>ii) <b>Liquid-</b> e.g Crude oil</p> <p>iii)<b>Gaseous-</b> e.g Natural gas (marsh gas)</p> <p><b>II) Secondary or Artificial Physical State</b></p> <p>i) <b>Solid</b> – e.g coke, charcoal</p> <p>ii) <b>Liquid-</b> e.g Petrol, kerosene, diesel oil, lubricating oil</p> <p>iii)<b>Gaseous-</b> e.g LPG, water gas ,producer gas ,coal gas, biogas</p>	4  1  1 ½  1 ½														



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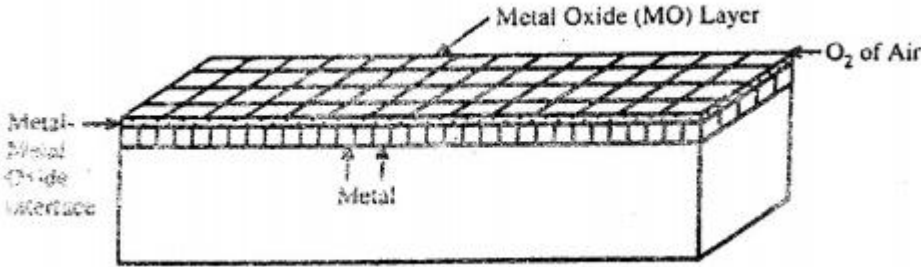
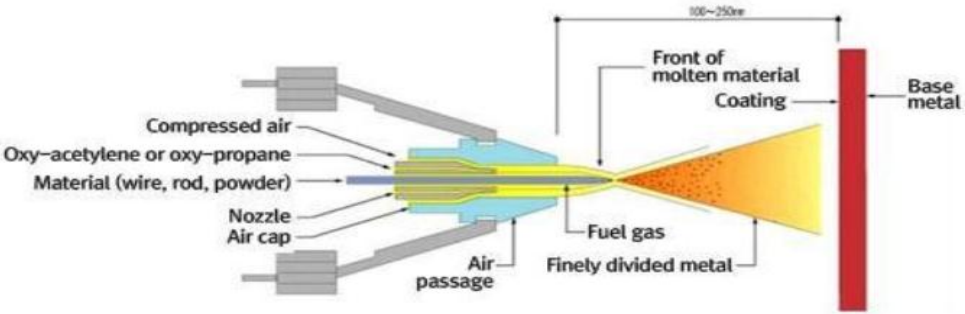
Q. No.	Sub Q.N.	Answer	Marking Scheme
2	(e)	<p><b>Explain the significance of proximate analysis.</b> <b>Significance:</b> Proximate analysis provides following valuable information in assessing the quality of fuel</p> <p><b>i) Moisture:</b> - Lesser the moisture better is the quality of coal. <b>ii) Volatile Matter:</b> - Lower / lesser the volatile matter, better the rank of the coal. <b>iii) Ash:</b> - For a good quality of coal, percentage of ash should be minimum. <b>iv) Fixed Carbon:</b> - Higher the percentage of fixed carbon, greater is the calorific value.</p>	4 1 mark each
	(f)	<p><b>Write composition, 2 properties and two uses of CNG.</b></p> <p><b>Composition: -</b> 1) CH<sub>4</sub> (methane) = 88.5% 2) C<sub>2</sub>H<sub>6</sub> (ethane) = 5.5% 3) C<sub>3</sub>H<sub>8</sub> (Propane) = 3.7% 4) C<sub>4</sub>H<sub>10</sub> (butane) = 1.8% Rest is H<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>S etc.</p> <p><b>Properties: -</b> 1) It is cheaper than petrol or diesel. 2) Its ignition temp is high (540<sup>0</sup>C). 3) It is odorless &amp; non corrosive. 4) It is light weight gas. 5) Its calorific value is high. 6) Being free from lead &amp; sulphur, its use substantially reduces harmful engine emissions.</p> <p><b>Applications:</b> 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.</p>	4 2 1 1

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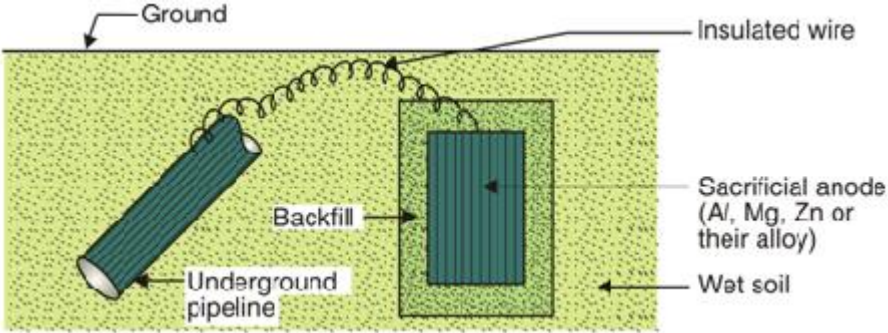
Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	(a)	<p><b>Attempt any four:</b>  <b>Explain the mechanism of oxidation corrosion</b></p> $M \longrightarrow M^{2+} + 2e^{-} \quad (\text{loss of electrons})$ <p style="text-align: center;">(Metal ion)</p> $O + 2e^{-} \longrightarrow O^{2-} \quad (\text{gain of electrons})$ <hr/> $M + O \longrightarrow M^{2+} + O^{2-} \longrightarrow MO \quad (\text{Metal oxide})$ <p>The electrons are transferred from metal atom to oxygen. Metal loses electron while oxygen accepts electron forms their respective ions these two types of ion combine together to form metal oxide.</p>  <p>(b) <b>Name and describe the method used for coating large and irregularly shaped articles for prevention of corrosion.</b>  <b>“Metal spraying”</b> is the method used for coating large and irregularly shaped articles for prevention of corrosion.</p> <p><b>Diagram:</b></p> 	<p><b>16</b> <b>4</b></p> <p>2</p> <p>1</p> <p>1</p> <p><b>4</b></p> <p>1</p> <p>1</p>

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Q. 3		<p><b>Process:-</b> In this method ,coating metal sprayed on the surface of base metal with the help of spraying gun or pistol. The spraying gun consist of a duct for compressed air and is fitted with the oxy- hydrogen flame. The coating metal in the form of wire is fed into the gun which is then melted inside the gun with the help of oxy hydrogen flame. The molten metal then sprayed on the surface of base metal with the help of compressed air.</p> <p>(c) <b>Describe sacrificial anodic protection with neat diagram.</b></p> <p><b>Method:</b></p> <p>The metallic structure to be protected from corrosion is connected to anodic metal (upper placed in galvanic series) by an insulated wire. Thus externally added metal like Zn, Al, Mg, etc will be more active, acts as anode and gets corroded. And the main metal is protected; hence it is called as sacrificial anode. For better electrical contact, the active metal is placed in back fill (coal and NaCl). After consumption of active metal completely, it is replaced by fresh piece.</p> <p>Magnesium or zinc rods are bolted along the sides of ship. Zinc rods are inserted into boiler or hot water tanks to prevent corrosion. The protection of underground pipelines is shown in Fig.</p> 	<p>2</p> <p>4</p> <p>2</p> <p>2</p>





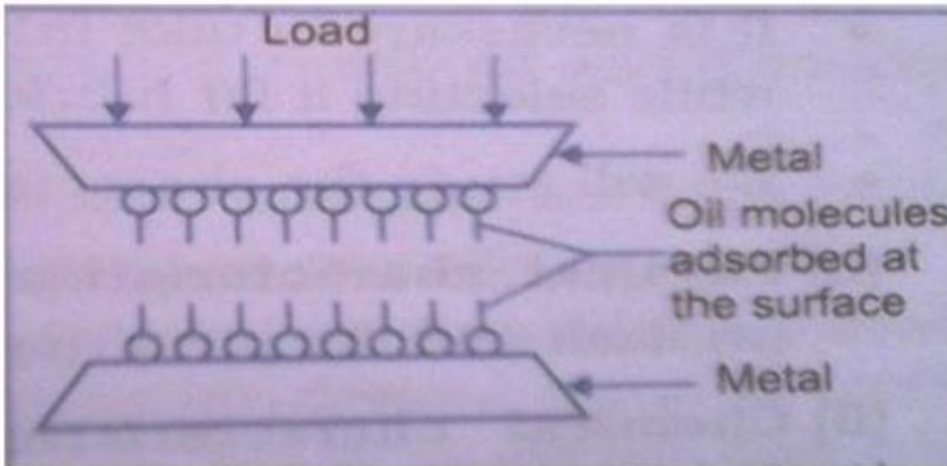
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3.	(d)	<p><b>Define lubricant. Give the classification of lubricants with at least one example of each type.</b></p> <p><b>Lubricant:</b> Any substance introduced between two moving or sliding surface to reduce the frictional resistance between them is known as lubricant.</p> <p><b>Classification:</b></p> <p><b>i) Solid lubricants:</b> Examples: graphite, molybdenum disulphide, soap, soapstone, wax, talc, chalk, mica etc</p> <p><b>ii) Semi-solid lubricants:</b> Examples: greases and Vaseline.</p> <p><b>iii) Liquid lubricants:</b> Examples: vegetable and animal oils such as castor, olive, coconut, palm, neem, linseed, hazel nut, tallow, lard, whale, cod-liver oil etc. and fatty acids like oleic acid, Stearic acid etc., silicones, blended oils, and mineral oils. (Any one example of each)</p>	4 1 1 1
	(e)	<p><b>Explain boundary lubrication with diagram.</b></p> <p><b>Boundary lubrication:</b> This type of lubrication is done when a continuous fluid film of lubricant cannot persist &amp; direct metal to metal contact is possible due to certain reasons. 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.</p> <p>iii) The adsorbed layers cannot get removed easily &amp; 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><b>Diagram</b></p>  <p>The diagram illustrates boundary lubrication between two metal surfaces. Two trapezoidal shapes represent the metal surfaces, with arrows pointing downwards from the top one labeled 'Load'. Between the two metal surfaces, a layer of oil molecules is shown. Each oil molecule is represented by a small circle with a tail pointing towards the metal surface. Labels with arrows point to the top metal surface ('Metal'), the oil molecules ('Oil molecules adsorbed at the surface'), and the bottom metal surface ('Metal').</p>	4 3 1



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3.	(f)	<p><b>Suggest the type of lubricant used for the following jobs:</b></p> <p><b>i) Clock</b> <b>ii) I.C. Engines</b> <b>iii) Gears</b> <b>iv) Sewing machine</b></p> <p><b>i) Clock :</b> Vegetable and animal oils like palm oil, hazel nut oil, neat foot oil, etc</p> <p><b>ii) I.C. Engines: Mineral</b> oils containing additives are used.</p> <p><b>iii) Gears:</b> Thick mineral oils containing extreme pressure additives (like metallic soaps).State any four functions of lubricants.</p> <p><b>iv) Sewing machine :</b> Mineral oil, silicones, thin vegetable and animal oils like palm oil, hazel nut oil, neat foot oil.</p>	<p>4</p> <p>1 mark Each</p>