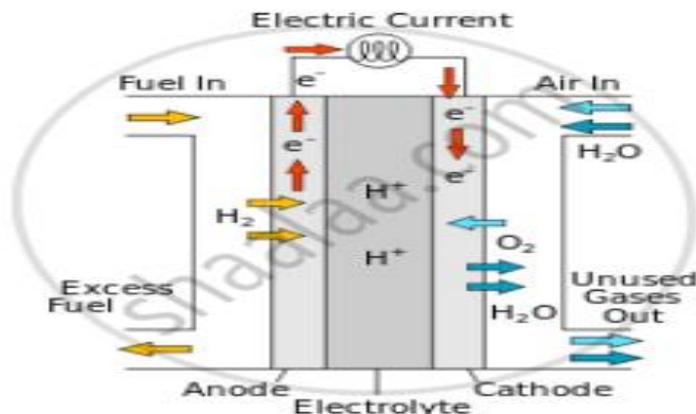


**ENGINEERING CHEMISTRY [0BSBS111]**

**MODEL ANSWER**

<b>Q.No</b>	<b>PERTICULAR</b>
<b>Q1a</b>	Defination 1 mark Types of Hardness 3 marks a)Temporary hardness b)Permanent hardness
<b>Q1b</b>	Defination 1 Mark Explanation with reaction 4 Marks Formula 1 Marks 1)Defination 2)Reaction $MnSO_4 + 2 KOH \rightarrow Mn(OH)_2 + K_2SO_4$ $2Mn(OH)_2 + O_2 \rightarrow 2MnO(OH)_2$ $MnO(OH)_2 + H_2SO_4 \rightarrow MnSO_4 + 2H_2O + [O]$ <p align="right">Nascent Oxygen</p> $2KI + H_2SO_4 + [O] \rightarrow K_2SO_4 + H_2O + I_2 \uparrow$ $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2 NaI$ 3) Formula Dissolved Oxygen = $\frac{Va \times N \times 8 \times 1000}{Vb}$ Where, Va= Volume of $Na_2S_2O_3$ N= Normality of $Na_2S_2O_3$ Vb= Volume of water sample used
<b>Q1C</b>	Explanation 6 Marks 1) <b>Avoid water traps:</b> Design surfaces so that <b>water and moisture drain easily.</b> (e.g., avoid sharp corners, crevices, or pockets.) 2) <b>Provide drainage holes:</b> So that rainwater or condensed water can flow out. 3) <b>Avoid contact of dissimilar metals:</b> Prevent <b>galvanic corrosion</b> by insulating metals of different types. 4) <b>Allow ventilation:</b> Ensure <b>free air circulation</b> to keep the surface dry. 5) <b>Easy maintenance:</b> Design should allow <b>easy cleaning and inspection.</b> <b>Use protective coatings:</b> Provide <b>paint, galvanising, or plating</b> where exposure is unavoidable.
<b>Q2a i</b>	Defination 1 Marks Explanation 3 Marks Defination Types of atmospheric corrosion:-1)Corrosion due to Oxygen 2) Corrosion due to other gases Reactions: $M \rightarrow M^{2+} + 2e^-$ $O_2 + 2e^- \rightarrow O^{2-}$ Overall reaction $M + O_2 \rightarrow M^{2+} + O^{2-} \rightarrow MO$

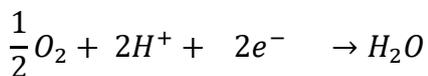
<b>Q2a ii</b>	<b>Primary Battery</b>	<b>Secondary Battery</b>	
	A primary battery is a battery that can be used only once and cannot be recharged.	A secondary battery is a rechargeable battery that can be used multiple times.	
	The chemical reaction is irreversible.	The chemical reaction is reversible.	
	Cannot be recharged once discharged.	Can be recharged by passing electric current in reverse direction.	
	Short life span – used until chemicals are exhausted.	Long life span – can be reused many times.	
	Cheaper initially.	Costly initially, but economical in long run.	
	Requires no maintenance.	Requires regular charging and maintenance.	
	Dry cell (Leclanché cell), Mercury cell, Alkaline cell.	Lead-acid battery, Nickel-cadmium (Ni-Cd) battery, Lithium-ion battery.	
	Used in clocks, remote controls, toys, flashlights.	Used in cars, inverters, mobile phones, laptops.	
<b>Q2b i</b>	Defination 1 Marks Types 3 Marks Defination Types of fuel cell 1) Alkaline Fuel Cell (AFC) 2) Solid Oxide Fuel Cell (SOFC) 3) Molten Carbonate Fuel Cell (MCFC) 4) hosphoric Acid Fuel Cell (PAFC) 5) Hydrogen–Oxygen Fuel Cell (H <sub>2</sub> –O <sub>2</sub> )		
<b>Q2b ii</b>	Defination 1 Mark Explanation 3 Marks 1) Anode 2) Cathode 3) Electrolyte		
<b>Q2c</b>	Diagram 2 Marks Explanation 3 Marks Reaction 3 Marks		



At anode



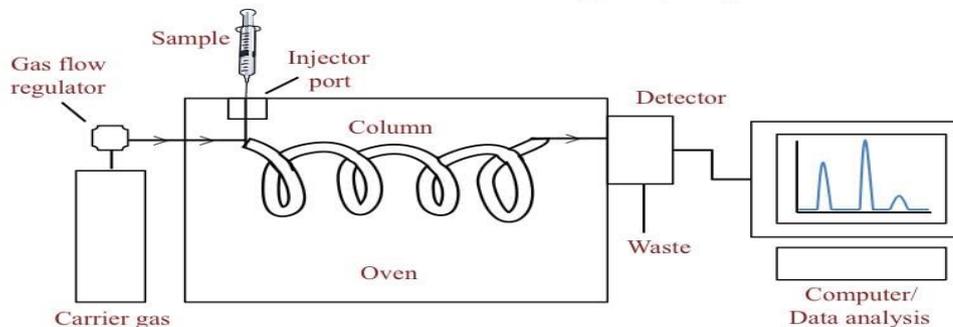
At Cathode



<p><b>Q3A</b></p>	<p><b>Any 4 Advantages (0.5Marks each) (1Marks each)</b></p> <p><b>Advantages</b></p> <ol style="list-style-type: none"> <li>1. High Resolution</li> <li>2. High Depth of Field</li> <li>3. Wide Magnification Range</li> <li>4. Minimal Sample Preparation</li> <li>5. Elemental analysis possible</li> </ol> <p><b>Applications</b></p> <ol style="list-style-type: none"> <li>1. Surface morphology</li> <li>2. Biological and medical research</li> <li>3. Electronics and semiconductor industry</li> <li>4. Quality control industries</li> <li>5. Forensic Science</li> </ol>	<p><b>Any Four Applications</b></p>
<p><b>Q3B</b></p>	<p>Instrumentation &amp; Working of IR Spectrophotometer.</p> <p><b>Instrumentation: Diagram 2 Marks and Explanation 2 Marks ,Working 2 Marks</b></p> <ol style="list-style-type: none"> <li>1) Source</li> <li>2) Monochromator</li> <li>3) Beam splitter</li> <li>4) Sample cell and reference cell</li> <li>5) Detector</li> <li>6) Amplifier and Recorder</li> </ol>	
<p><b>Q3C</b></p>	<p><b>Components:- Diagram 2 Marks Explanation 2 Marks</b></p> <ol style="list-style-type: none"> <li>1. Sample injection system</li> <li>2. Column</li> <li>3. Oven</li> <li>4. Detector</li> </ol>	

5. Recorder

### Gas Chromatography



Working :- 2 Marks

<p><b>Q3D</b></p>	<p><b>Fundamental Modes of Vibrations explanation with diagram 6 Marks</b></p> <p><b>A) Stretching Vibrations                      2 Marks</b></p> <ol style="list-style-type: none"> <li>1. Symmetric Stretching: Both bonds lengthen or shorten simultaneously.</li> <li>2. Asymmetric Stretching: One bond lengthens while the other shortens.</li> </ol> <p><b>B) Bending Vibrations                              4 Marks</b></p> <ol style="list-style-type: none"> <li>1. Scissoring: Atoms move towards or away from each other.</li> <li>2. Rocking: Atoms move in the same direction.</li> <li>3. Wagging: Atoms move up and down out of plane.</li> <li>4. Twisting: One atom moves up while the other moves down.</li> </ol>
<p><b>Q4A</b></p>	<p>Defination of Calorific Value 1 Marks Types of calorific values                      3 Marks</p> <ol style="list-style-type: none"> <li>1) Higher calorific value (HCV) or Gross calorific value (GCV)</li> <li>2) Lower calorific value (LCV) or Net calorific value (NCV)</li> </ol>
<p><b>Q4B</b></p>	<ol style="list-style-type: none"> <li>1. Weight of coal sample=<math>X=1.2</math> g</li> <li>2. Mass of water in calorimeter=<math>W=2000</math> gm</li> <li>3. Water equivalent of calorimeter=<math>w=120</math> gm</li> <li>4. Rise in temperature=<math>(t_2-t_1)=8.8^\circ\text{C}</math></li> <li>5. Latent heat of condensation of steam=<math>587</math> cal/g</li> <li>6. Hydrogen content in the fuel=<math>5\%</math></li> </ol> <p><b>GCV=15546.66 cal/g</b> <b>NCV= 15282.51 cal/g</b></p>
<p><b>Q4B</b></p>	<ol style="list-style-type: none"> <li>1. Volume of gas burnt =<math>V=0.09</math> m<sup>3</sup></li> <li>2. Weight of water used for cooling the combustion products=<math>W=30.5</math> Kg</li> <li>3. Rise in temperature =<math>(t_2-t_1)=10^\circ\text{C}</math></li> </ol>

	<p>4. Weight of steam condensed=<math>m=0.035</math> Kg  5. Heat liberated in condensing water vapour and cooling the condensate is 587 Kcal/Kg)</p> <p><b>GCV=3388.88 Kcal/m<sup>3</sup></b>  <b>NCV=3160.61 Kcal/m<sup>3</sup></b></p>
<b>Q4C</b>	<p>X=0.6 gm  W+w=2200 gm  (t<sub>2</sub>-t<sub>1</sub>)= 6.52°C  % of Hydrogen= 5%  Latent heat of steam=587 cal/g  <b>GCV=23906.66 cal/g</b>  <b>NCV=23642.51 cal/g</b></p>
<b>Q5A</b>	<p>Reaction-2 Marks  Properties (any 4) -1 Marks  Applications (any 4) - 1 Marks</p>
<b>Q5B</b>	<p><b>Composition – 2Marks Properties -1Mark Uses of Brass 1 Mark</b></p> <p><b>Composition</b>  Copper -90%  Zinc-10%</p> <p><b>Properties</b></p> <ol style="list-style-type: none"> <li>1. Harder than copper</li> <li>2. Good ductility and malleability</li> <li>3. Corrosion-resistant</li> <li>4. Good electrical and thermal conductivity</li> <li>5. Attractive golden colour</li> </ol> <p><b>Uses</b></p> <ol style="list-style-type: none"> <li>1. Electrical components</li> <li>2. Musical instruments</li> <li>3. Decorative items</li> <li>4. Valves, taps, screws</li> </ol>
<b>Q5C</b>	<p><b>synthesis of Nanomaterial 2 Marks for each method</b></p> <p><b>A) Top-Down Approach</b>  Breaking bulk material into nanosized particles.  <b>Methods:</b></p> <ol style="list-style-type: none"> <li>1. Mechanical milling</li> <li>2. Lithography</li> <li>3. Laser ablation</li> <li>4. Etching</li> </ol> <p><b>B) Bottom-Up Approach</b>  Building nanoparticles atom-by-atom or molecule-by-molecule.  <b>Methods:</b></p> <ol style="list-style-type: none"> <li>1. Sol-gel method</li> <li>2. Chemical vapour deposition (CVD)</li> </ol>

	<ol style="list-style-type: none"> <li>3. Self-assembly</li> <li>4. Precipitation and chemical reduction</li> </ol>
<b>Q5D</b>	<p><b>Properties of Carbon Nanotubes (Any 8 properties) 0.5 Mark each</b></p> <ol style="list-style-type: none"> <li>a) Mechanical:Very high tensile strength</li> <li>b) High elasticity:Stronger than steel by weight</li> <li>c) Electrical:Can be metallic or semiconducting</li> <li>d) High electrical conductivity</li> <li>e) Excellent thermal conductivity</li> <li>f) Heat resistance</li> <li>g) Chemical:High stability</li> <li>h) Resistant to corrosion</li> <li>i) Large surface area</li> <li>j) Optical:Unique absorption and emission properties</li> </ol>
<b>Q5E</b>	<p><b>Defination of Alloys 1 Marks</b></p> <p><b>Purpose of Making Alloys –(Any 6) 0.5 Marks each</b></p> <ol style="list-style-type: none"> <li>1. Increase strength and hardness</li> <li>2. Improve corrosion resistance</li> <li>3. Lower melting point</li> <li>4. Increase electrical or thermal resistance</li> <li>5. Reduce cost</li> <li>6. Improve appearance</li> <li>7. Enhance durability and machinability</li> </ol>
<b>Q6A</b>	<p>Statement of Beer–Lambert’s Law - 2 Marks</p> <p>Derivation - 4 Marks</p>
<b>Q6B</b>	<p>X=0.83 g</p> <p>W=3500 g</p> <p>T1=26.5°C</p> <p>T2= 29.2°C.</p> <p>W=385 g</p> <p>latent heat of steam is587 cal/g</p> <p>% of hydrogen=7 %</p> <p><b>GCV=12637.95 cal/g</b></p> <p><b>NCV=12268.14 cal/g</b></p>
<b>Q6C</b>	<p><b>Composition – 2Marks Properties -1Mark Uses of Brass 1 Mark</b></p> <p><b>Composition</b></p> <p>Copper -90%</p> <p>Zinc-10%</p> <p><b>Properties</b></p> <ol style="list-style-type: none"> <li>6. Harder than copper</li> <li>7. Good ductility and malleability</li> <li>8. Corrosion-resistant</li> <li>9. Good electrical and thermal conductivity</li> <li>10. Attractive golden colour</li> </ol>

	<p><b>Uses</b></p> <ol style="list-style-type: none"> <li>5. Electrical components</li> <li>6. Musical instruments</li> <li>7. Decorative items</li> <li>8. Valves, taps, screws</li> </ol>
<p><b>Q6D</b></p>	<ol style="list-style-type: none"> <li>1. Volume of gas used = <math>V=0.1 \text{ m}^3</math></li> <li>2. Weight of water heated = <math>W=25 \text{ Kg}</math></li> <li>3. Temperature of Inlet water = <math>t_1=22^\circ\text{C}</math></li> <li>4. Temperature of Outlet water = <math>t_2=34^\circ\text{C}</math></li> <li>5. Weight of steam condensed = <math>m=0.024 \text{ Kg}</math></li> <li>6. Heat liberated in condensing water vapour and cooling the condensate is <math>580 \text{ Kcal/Kg}</math></li> </ol> <p><b>HCV=3000 Kcal/m<sup>3</sup></b></p> <p><b>LCV=2860.8 Kcal/m<sup>3</sup></b></p>