

# MT

2017 \_\_\_\_ 1100

MT - SCIENCE & TECHNOLOGY - I (72) - SEMI PRELIM - I : PAPER - 5

Time : 2 Hours      Semi Prelim - I : Model Answer Paper      Max. Marks : 40

<b>SECTION - A</b>												
<b>A.1. (A) Fill in the blanks :</b>												
(1) Reaction of acids and metals results in evolution of <b>hydrogen</b> gas.		<b>1</b>										
(2) The phenomenon of change in the <b>direction</b> of light when it passes from one transparent medium to another is called refraction.		<b>1</b>										
(3) <b>Red</b> coloured light is scattered the least by fog or smoke.		<b>1</b>										
<b>A.1. (B) True or False :</b>												
(1) True		<b>1</b>										
(2) False : Magnetic field decreases as we go away from a magnet.		<b>1</b>										
<b>A.2. Rewrite the following statements by selecting the correct alternative:</b>												
(1) (d) all of these		<b>1</b>										
(2) (d) All the three (a), (b) and (c)		<b>1</b>										
(3) (c) passes without bending		<b>1</b>										
(4) (a) 50°		<b>1</b>										
(5) (a) increases		<b>1</b>										
<b>A.3. Answer the following in short : (Any 5)</b>		<b>2</b>										
(1)	<table border="1" style="width: 100%;"><thead><tr><th style="text-align: center;">Washing soda</th><th style="text-align: center;">Baking soda</th></tr></thead><tbody><tr><td>(i) It is sodium carbonate.</td><td>(i) It is sodium bicarbonate or sodium hydrogen carbonate.</td></tr><tr><td>(ii) It's molecular formula is <math>\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}</math></td><td>(ii) It's molecular formula is <math>\text{NaHCO}_3</math>.</td></tr><tr><td>(iii) It is a crystalline substance.</td><td>(iii) It is an amorphous powder.</td></tr><tr><td>(iv) It is used in manufacturing soaps and detergent.</td><td>(iv) It is used in bakery for making cakes and bread lighter and spongy.</td></tr></tbody></table>	Washing soda	Baking soda	(i) It is sodium carbonate.	(i) It is sodium bicarbonate or sodium hydrogen carbonate.	(ii) It's molecular formula is $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	(ii) It's molecular formula is $\text{NaHCO}_3$ .	(iii) It is a crystalline substance.	(iii) It is an amorphous powder.	(iv) It is used in manufacturing soaps and detergent.	(iv) It is used in bakery for making cakes and bread lighter and spongy.	
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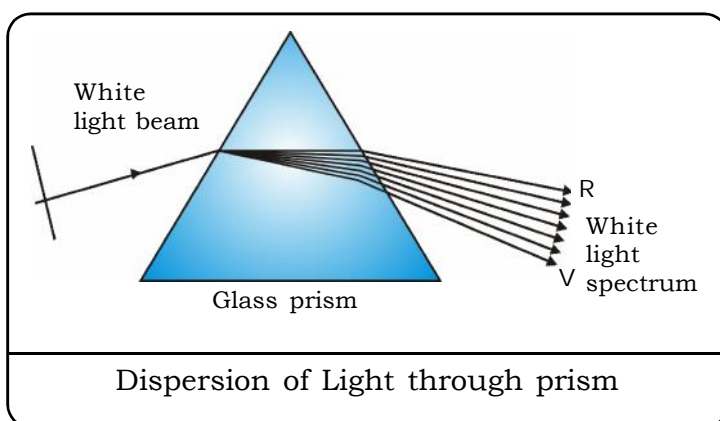
(2)	<p>(i) When bleaching powder comes in contact with air it reacts with carbon dioxide to form calcium carbonate and releases chlorine gas.</p> $\text{CaOCl}_2 + \underset{\text{(air)}}{\text{CO}_2} \rightarrow \text{CaCO}_3 + \text{Cl}_2 \uparrow$ <p>(ii) This generated chlorine is known as “available chlorine.”</p> <p>(iii) On the basis of percentage of “available chlorine” various brands of bleaching powder are available in the market.</p>	2
(3)	<p>When sodium bicarbonate (sodium hydrogen carbonate) reacts with dilute hydrochloric acid, it gives sodium chloride, water and carbon dioxide gas is liberated.</p> $\text{NaHCO}_{3(s)} + \text{HCl}_{(aq)} \rightarrow \text{NaCl}_{(aq)} + \text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)}$ <p>Sodium bicarbonate      Hydrochloric acid      Sodium chloride      Water      Carbon dioxide</p>	2
(4)	<p>(i) The rainbow appears in the sky after a rain shower.</p> <p>(ii) The water droplets act as small prisms.</p> <p>(iii) When sunlight enters the water droplets present in the atmosphere, they refract and disperse the incident sunlight, then they reflect it internally and finally again refract resulting in a rainbow.</p> <p>(iv) The water droplets of a fountain can do the same thing if sunlight passes through them. Hence, it is possible to enjoy a rainbow at fountains in any season.</p>	2
(5)	<p>(i) If we touch the wire bare footed, a large current may pass through our body.</p> <p>(ii) As a result, we may receive a severe shock. This shock may sometimes cause death.</p> <p>(iii) Therefore, while working with electricity we must wear gloves made of insulated material and rubber soled shoes.</p> <p>(iv) Hence wires carrying electricity should not be touched bare footed.</p>	2
(6)	<p><b>Given :</b> Velocity of light in air (<math>V_a</math>) = <math>3 \times 10^8</math> m/s  Velocity of light in medium (<math>V_m</math>) = <math>1.5 \times 10^8</math> m/s</p> <p><b>To find :</b> Refractive index of medium w.r.t. air (<math>{}_a\eta_m</math>) = ?</p> <p><b>Formula :</b> <math>\frac{V_a}{V_m} = {}_a\eta_m</math></p> <p><b>Solution :</b> <math>\frac{V_a}{V_m} = {}_a\eta_m</math></p>	2

$$\therefore {}_a\eta_m = \frac{3 \times 10^8}{1.5 \times 10^8}$$

$$\therefore {}_a\eta_m = 2$$

**The refractive index of medium w.r.t. air is 2.**

(7)



2

**A.4. Answer the following in brief : (Any 5)**

- (1) (i) It is defined as fixed number of water molecules present in crystal structure. It is responsible for crystalline structure (shape) and colour in certain compounds. **3**
- (ii) The salts that contain water of crystallization is called as hydrated salt.  
**Eg. :**  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  : Copper sulphate pentahydrate, it contains 5 molecules of water of crystallization.  
 $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  : Sodium carbonate decahydrate, it contains 10 molecules of water of crystallization.  
 $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  : Ferrous sulphate heptahydrate, it contains 7 molecules of water of crystallization.  
 $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  : Zinc sulphate heptahydrate, it contains 7 molecules of water of crystallization.

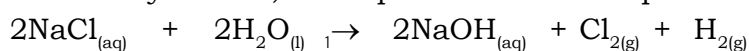
- (2) (i) **pH in our digestive system :** Our stomach produces hydrochloric acid (pH about 1.4) which helps in digesting our food without harming our stomach. Sometimes excess of acid is produced for various reasons that causes pain due to indigestion. In order to cure indigestion, bases are taken as antacid. Antacids are mild bases having no toxic effect on our body. Antacids being basic in nature, antacids react with excess acid in the stomach and neutralize it. Eg: Magnesium Hydroxide (Milk of magnesia) and sodium bicarbonate (baking soda). **3**
- (ii) **pH change as the cause of tooth decay :** When we eat food containing sugar, then bacteria present in mouth break down

sugar and produce lactic acid. This acid lowers the pH in the mouth making it acidic. Tooth decay starts when pH of acid formed in mouth falls below 5.5. This is because the acid becomes strong enough to attack the enamel of our teeth and corrode it that sets in tooth decay. Though tooth enamel is made of calcium phosphate that is the hardest material in our body, it starts corroding when the pH of the mouth is lower than 5.5.

- (iii) Many tooth pastes contain bases to neutralize the mouth acid and prevent tooth decay.
- (iv) Most of the plants grow best when pH of soil is close to 7. If the soil is too acidic or too basic, plants grow badly or don't grow at all. If the soil is too acidic then it is treated with materials like quick lime (calcium oxide) or slaked lime (calcium hydroxide) to reduce the acidity. If the soil is too alkaline, it can be reduced by adding decaying organic matter.

(3) Electrolysis of NaCl in solution and in fused state yield different products. 3

- (i) When electricity is passed through solution of sodium chloride, which is termed as brine (10% NaCl), it decomposes to form sodium hydroxide, an important basic compound.

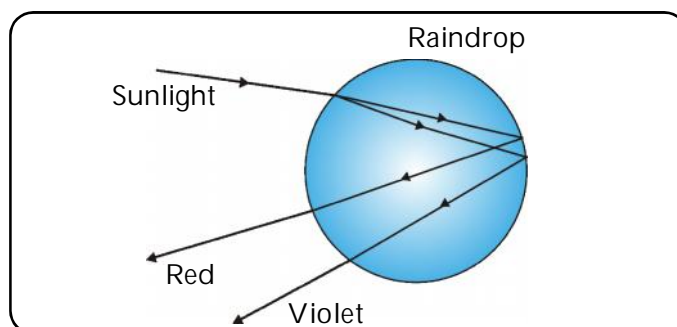


$\text{Cl}_2$  is liberated at anode and  $\text{H}_{2(\text{g})}$  at cathode respectively.

- (ii) Salt when heated at high temperature, the molten state is termed as fused state. NaCl is able to conduct electricity even in fused state. During electrolysis  $\text{Cl}_{2(\text{g})}$  is liberated at anode and sodium is deposited at cathode.

(4) (i) A rainbow appears in the sky during a rain shower. 3

- (ii) The water droplets act as small prisms. When sunlight enters the water droplets present in the atmosphere, they refract and disperse the incident sunlight.
- (iii) Then they reflect it internally inside the droplet and finally again refract it. As a collective effect of all these phenomenon, the seven coloured rainbow is observed.



(5)	(a) It works on the principle of electromagnetic induction. (b) X -Armature coil, Y- Slip ring (c) It generates alternating current.	<b>3</b>
(6)	(i) If the current in coil A is changed, then some current will be induced in coil B. (ii) As the current in coil A changes, the magnetic field related to it also change. (iii) Due to the changing magnetic field, current is induced in coil B.	<b>3</b>
(7)	(a) When light travels from one transparent medium to another transparent medium obliquely, the direction of propagation of light in the second medium changes. This phenomenon is called refraction of light.	<b>1½</b>
	(b) The light rays reflected from the coin, come obliquely. These rays bend away from the normal at the point of incidence (ie. the surface of water) and reach our eyes. These refracted rays appear to come from a point above the actual point and hence the coin appears to be raised up. Therefore the coin appears to float when the jar is tilted suitably and viewed at a suitable angle.	<b>1½</b>
<b>A.5.</b>	<b>Answer in detail: (Any 1)</b>	
(1)	(a) A device which converts electrical energy into mechanical energy is called an electric motor. (b) <b>Working of the electric motor :</b> (i) When current is passed through the coil ABCD, arms AB and CD experience force. (ii) According to Fleming's left hand rule the force experienced by arm AB is in the upward direction and arm CD in the downward direction. Both these forces are equal and opposite. (iii) This force rotates the coil in clockwise direction until the coil is vertical. At this position, the contact between commutator and brushes break. So the supply to the coil is cut off. Thus no force acts on the coil. (iv) But the coil does not stop due to inertia. It goes on rotating until the commutator again comes in contact with the brushes B <sub>1</sub> and B <sub>2</sub> . Again the current starts passing through the coil and the arm AB rotates through 90°, 180°, 270° and 360 degrees. (v) Now the force acting on arm AB is upward and CD is downward. Again this force moves the coil in clockwise direction.	<b>5</b>

	(vi) Thus, the coil rotates with the help of electrical energy. The coil of DC motor continues to rotate in the same direction.	
(2)	(a) $\text{Al}_2(\text{CO}_3)_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O} + 3\text{CO}_2 \uparrow$ During this reaction carbon dioxide gas is released, this gas when passed through decanted solution of chalk with $\text{H}_2\text{O}$ it turns milky due to formation of calcium carbonate.	<b>2</b>
	(b) When dil. HCl is added to red oxide i.e. (primer used before paint). We observe that the colour of the solution becomes blue. This is due to the formation of copper chloride. $\text{CuO} + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{H}_2\text{O}$	<b>2</b>
	(c) The bases which produce more number of $\text{OH}^-$ ions in aqueous solution are termed as strong bases.	<b>1</b>
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