

MT

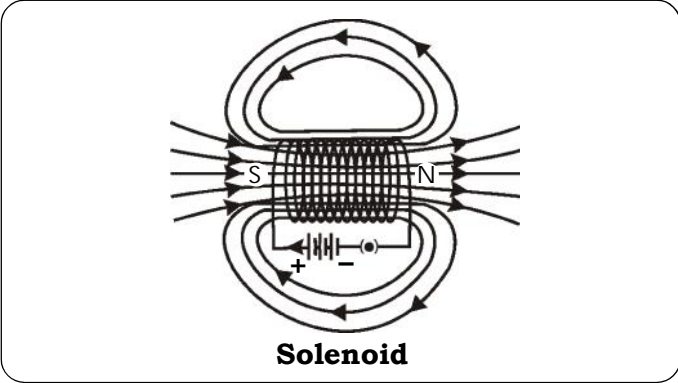
2017 ____ 1100

MT - SCIENCE & TECHNOLOGY - I (72) - SEMI PRELIM - I : PAPER - 4

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

SECTION - A												
A.1. (A) Fill in the blanks :												
(1) The phenomenon of splitting of light into its component colours is hydroxyl ions (OH⁻) .		1										
(2) Red coloured light is scattered the least by fog or smoke.		1										
(3) Alnico is an alloy of aluminium, nickel, cobalt.		1										
A.1. (B) True or False :												
(1) True		1										
(2) False : Magnetic lines of force never cross each other.		1										
A.2. Rewrite the following statements by selecting the correct alternative:												
(1) (a) Universal indicator		1										
(2) (a) colourless and odourless H ₂		1										
(3) (c) 40°		1										
(4) (a) $\hat{e}_i > \hat{e}_r$ but $\hat{e}_i = \hat{e}_e$		1										
(5) (a) current and number of turns per unit length		1										
A.3. Answer the following in short : (Any 5)												
(1)	<table border="1" style="width: 100%;"><thead><tr><th style="width: 50%; text-align: center;">Acid</th><th style="width: 50%; text-align: center;">Base</th></tr></thead><tbody><tr><td>(i) A substance which liberates H⁺ ions when dissolved in water is an acid.</td><td>(i) A substance which liberates OH⁻ ions in water is called a base.</td></tr><tr><td>(ii) Blue litmus turns red in an acid.</td><td>(ii) Red litmus turns blue in a base.</td></tr><tr><td>(iii) The pH of an acid ranges from 0 to 7.</td><td>(iii) The pH of a base range from 7 to 14.</td></tr><tr><td>(iv) Acids are sour to taste.</td><td>(iv) Bases are bitter to taste.</td></tr></tbody></table>	Acid	Base	(i) A substance which liberates H ⁺ ions when dissolved in water is an acid.	(i) A substance which liberates OH ⁻ ions in water is called a base.	(ii) Blue litmus turns red in an acid.	(ii) Red litmus turns blue in a base.	(iii) The pH of an acid ranges from 0 to 7.	(iii) The pH of a base range from 7 to 14.	(iv) Acids are sour to taste.	(iv) Bases are bitter to taste.	2
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(2)	(i) Each copper sulphate crystal contains five molecules of water of crystallization due to which it is blue in colour. (ii) On heating, the copper sulphate crystals lose the water of crystallization and become colourless.	2
(3)	When carbon dioxide is passed through lime water, it turns milky due to the formation of white precipitate of calcium carbonate. $\begin{array}{ccccccc} \text{Ca(OH)}_{2(\text{aq})} & + & \text{CO}_{2(\text{g})} & \rightarrow & \text{CaCO}_3\downarrow & + & \text{H}_2\text{O}_{(\text{l})} \\ \text{Calcium} & & \text{Carbon} & & \text{Calcium} & & \text{Water} \\ \text{hydroxide} & & \text{dioxide} & & \text{carbonate} & & \end{array}$	2
(4)	(i) Stars are point sources of light as they are very far away. (ii) The refractive index of air in the given region in atmosphere goes on changing continuously and randomly. (iii) When the atmosphere refracts more light towards us, a star is seen bright. (iv) When the atmosphere refracts less light towards us, a star is seen dim. (v) Thus, due to change in refractive index of atmosphere, stars appear twinkling at night	2
(5)	(i) If many electrical appliances of high power rating such as geyser, heater, motor, oven are switched on simultaneously, overloading occurs. (ii) This may result in switching off of the fuse resulting in disruption in power supply. (iii) It may also cause fire. Hence we should not use many electrical appliances simultaneously.	2
(6)	<p>Given : Velocity in first medium (V_1) $= 2 \times 10^8 \text{ m/s}$ Velocity in second medium (V_2) = $1.25 \times 10^8 \text{ m/s}$ To find : Refractive index of second medium w.r.t. the first medium (${}_1\eta_2$)</p> <p>Formula : ${}_1\eta_2 = \frac{V_1}{V_2}$</p> <p>Solution : ${}_1\eta_2 = \frac{V_1}{V_2}$</p> <p>$\therefore {}_1\eta_2 = \frac{2 \times 10^8}{1.25 \times 10^8}$</p> <p>$\therefore {}_1\eta_2 = 1.6$</p> <p>The refractive index of the second medium w.r.t. the first medium is 1.6.</p>	2

(7)	 <p style="text-align: center;">Solenoid</p>	2
<p>A.4. Answer the following in brief : (Any 5)</p>	<p>(1) (i) When a base reacts with acid, then a salt and water is formed. This is called as neutralization reaction.</p> <p>(ii) E.g. :</p> <p>(a) When hydrochloric acid reacts with sodium hydroxide, sodium chloride and water are formed.</p> $\begin{array}{ccccccc} \text{HCl} & + & \text{NaOH} & \xrightarrow{\quad} & \text{NaCl} & + & \text{H}_2\text{O} \\ \text{(Acid)} & & \text{(Base)} & & \text{(Salt)} & & \text{(Water)} \\ \text{Hydrochloric} & & \text{Sodium} & & \text{Sodium} & & \text{Water} \\ \text{acid} & & \text{hydroxide} & & \text{chloride} & & \end{array}$ <p>(b) When carbon dioxide is passed through lime water, it turns milky due to the formation of white precipitate of calcium carbonate.</p> $\begin{array}{ccccccc} \text{Ca(OH)}_2 & + & \text{CO}_2 & \xrightarrow{\quad} & \text{CaCO}_3 & + & \text{H}_2\text{O} \\ \text{(Base)}_{2(\text{aq})} & & \text{(Acid)}_{(\text{g})} & & \text{(Salt)}_{3(\text{s})} \downarrow & & \text{(Water)}_{(\text{l})} \\ \text{Calcium} & & \text{Carbon} & & \text{Calcium} & & \text{Water} \\ \text{hydroxide} & & \text{dioxide} & & \text{carbonate} & & \end{array}$ <p>(c) Thus this is a neutralization reaction where base reacts with acidic non-metallic oxide (CO_2) to form salt and water.</p>	3
(2)	<p>Metal carbonates react with dilute acid to give carbon dioxide gas. The example is given below: Sodium carbonate reacts with dilute hydrochloric acid. When sodium carbonate reacts with dilute hydrochloric acid it gives sodium chloride, water and carbon dioxide gas is liberated.</p> $\begin{array}{ccccccc} \text{Na}_2\text{CO}_3 & + & 2\text{HCl} & \rightarrow & 2\text{NaCl} & + & \text{H}_2\text{O} & + & \text{CO}_2 \\ \text{Sodium} & & \text{Hydrochloric} & & \text{Sodium} & & \text{Water} & & \text{Carbon} \\ \text{carbonate} & & \text{acid} & & \text{chloride} & & & & \text{dioxide} \end{array}$	3
(3)	<p>(i) It is used as a medicine(antacid). When it is taken, it undergoes hydrolysis to give sodium hydroxide in the stomach. Thus sodium hydroxide neutralizes the hydrochloric acid produced by gastric juice and gives relief to the patient from acidity.</p>	3

	$\text{NaHCO}_3 + \text{H}_2\text{O} \rightarrow \text{NaOH} + \text{H}_2\text{O} + \text{CO}_2\uparrow$ $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$	
	(ii) It is used as a constituent in baking powder, used to prepare bread and cakes to make them lighter and spongy. (iii) It is used in fire extinguishers. (iv) It is used to prepare CO_2 gas.	
(4)	(a) It works on the principle of electromagnetic induction. (b) X -Armature coil, Y- Split ring (c) It generates direct current.	3
(5)	(i) 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. (ii) The extent of change in the direction of the light ray is different for different media. It is related to refractive index of the medium. (iii) Greater the refractive index of a medium, greater is the bending of light.	3
(6)	(i) Magnetic lines of force are closed continuous curves, which start from north pole and end at the south pole. (ii) The tangent at any point in the magnetic lines of force gives the direction of the magnetic field at that point. (iii) Two magnetic lines of force can not intersect each other. (iv) Magnetic lines of force are crowded where the magnetic field is strong and far from each other where the field is weak.	3
(7)	(i) The phenomenon of splitting of light into its component colours is called as dispersion. (ii) The band of coloured components of light beam is called spectrum. The colours in the order from bottom to top are violet, indigo, blue, green, yellow, orange, red (VIBGYOR).	3
A.5.	Answer in detail: (Any 1)	
(1)	(a) A device which converts electrical energy into mechanical energy is called an electric motor. (b) Working of the electric motor : (i) When current is passed through the coil ABCD, arms AB and CD experience force.	5

	<p>(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.</p> <p>(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.</p> <p>(iv) But the coil does not stop due to inertia. It goes on rotating until the commutator again comes in contact with the brushes B₁ and B₂. Again the current starts passing through the coil and the arm AB rotates through 90°, 180°, 270° and 360 degrees.</p> <p>(v) Now the force acting on arm AB is upward and CD is downward. Again this force moves the coil in clockwise direction.</p> <p>(vi) Thus, the coil rotates with the help of electrical energy. The coil of DC motor continues to rotate in the same direction.</p>	
(2)	<p>(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 H₂O it turns milky due to formation of calcium carbonate.</p> <p>(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. $\text{CuO} + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{H}_2\text{O}$</p> <p>(c) The fixed number of water molecules present in the crystal structure of a compound is known as water of crystallization.</p>	<p>2</p> <p>2</p> <p>1</p>
