

# CBSE

# SAMPLE PAPER

## SOLVED

# SCIENCE

Time allowed: 90 Minutes

Maximum Marks: 40

### General Instructions:

- The Question Paper contains three sections.
- Section A has 24 questions. Attempt any 20 questions.
- Section B has 24 questions. Attempt any 20 questions.
- Section C has 12 questions. Attempt any 10 questions.
- All questions carry equal marks.
- There is no negative marking.

### SECTION - A

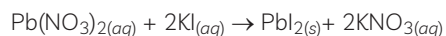
(Section-A consists of 24 questions. Attempt any 20 questions from this section.)  
(The first attempted 20 questions would be evaluated)

**1. Reema took 5 ml of Lead Nitrate solution in a beaker and added approximately 4 ml of Potassium Iodide solution to it. What would she observe?**

- The solution turned red.
- Yellow precipitate was formed.
- White precipitate was formed.
- The reaction mixture became hot.

**Ans.** (b) Yellow precipitate was formed.

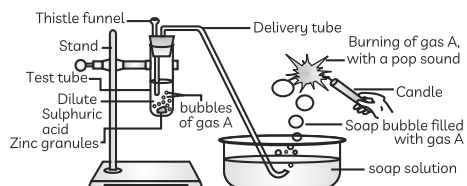
**Explanation:** When potassium iodide solution is added to lead nitrate solution, a yellow coloured precipitate of lead iodide is formed.



#### Related Theory

The type of reaction taking place is double displacement reaction, as an exchange of ions takes place between the reactants.

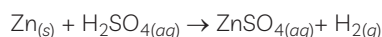
**2. Identify gas A in the following experiment.**

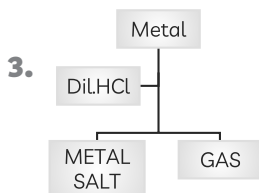


- Nitrogen
- Hydrogen
- Oxygen
- Carbon dioxide

**Ans.** (b) Hydrogen

**Explanation:** Hydrogen gas is evolved when dilute sulphuric acid is added to zinc granules. The type of reaction taking place is single displacement reaction.





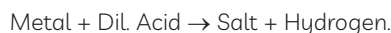
Which of the following two combinations are correct?

	Metal	Gas Evolved
(I)	Copper	Yes
(II)	Iron	Yes
(III)	Magnesium	No
(IV)	Zinc	Yes

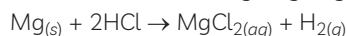
- (a) (I) and (III)                      (b) (I) and (IV)  
 (c) (II) and (III)                     (d) (II) and (IV)

Ans. (d) (II) and (IV)

**Explanation:** Most metals react with the dilute hydrochloric acid to produce metal salt and hydrogen gas. However, hydrogen gas is not evolved when less reactive metals such as copper, mercury, silver or gold react with dilute acid.



So, iron, magnesium and zinc react with dil. HCl to form salt and hydrogen gas.



**Caution**

→ All metals do not react with dilute acids to evolve hydrogen gas. Only those elements which lie above hydrogen in the reactivity series displace hydrogen from dilute acid. Also, except Mg and Mn, no other metal forms hydrogen gas with dil. nitric acid.

4. Which of the following correctly represents a balanced chemical equation?

- (a)  $\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(s)} \rightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$   
 (b)  $3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(g)} \rightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$   
 (c)  $3\text{Fe}_{(s)} + \text{H}_2\text{O}_{(g)} \rightarrow \text{Fe}_3\text{O}_4(s) + \text{H}_2(g)$   
 (d)  $3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(g)} \rightarrow \text{Fe}_3\text{O}_4(s) + \text{H}_2(g)$

Ans. (b)  $3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(g)} \rightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$

**Explanation:** A balanced chemical equation has an equal number of atoms of different elements in the reactants and products in accordance with the law of conservation of mass.

Number of atoms of each element in reactant side should be equal to the number of atoms of the elements in product side.

The number of atoms of elements in reactant side and product side in the equation:

$3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(g)} \rightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$ , is given below:

Element	No. of atoms in reactant side	No. of atoms in product side
Fe	3	3
H	8	4
O	4	8

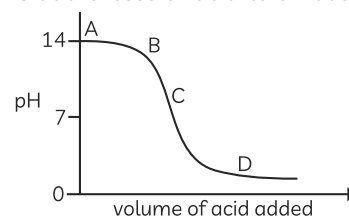
Therefore, it is a balanced equation.



**Caution**

→ While balancing equation, place a number in front of the chemical formula of reactants and products without changing the formula of the substances.

5. The graph given below depicts a neutralization reaction (acid + alkali → salt + water). The pH of a solution changes as we add excess of acid to an alkali.



Which letter denotes the area of the graph where both acid and salt are present?

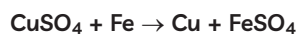
- (a) A                                      (b) B  
 (c) C                                      (d) D

Ans. (d) D

**Explanation:** Neutralization reaction is the reaction between an acid (pH < 7) and a base (pH > 7) to form a salt and water.

When excess of acid is added to an alkali, the solution changes from basic to acidic. In the graph, the areas marked A, B and C have pH > 7 and therefore depict basic medium. Whereas, the region marked D has pH < 7 and therefore shows acidic medium and is the correct answer.

6. In the reaction of iron with copper sulphate solution:



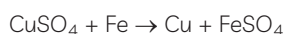
Which option in the given table correctly represents the substance oxidised and the reducing agent?

	Substance Oxidized	Reducing Agent
(a)	Fe	Fe
(b)	Fe	FeSO <sub>4</sub>
(c)	Cu	Fe
(d)	CuSO <sub>4</sub>	Fe

**Ans.** (a) Substance Oxidized : Fe  
Reducing agent : Fe

**Explanation:** In a chemical reaction, the substance to which oxygen is added or hydrogen is removed is said to be oxidized and the substance oxidized is the reducing agent as it either removes oxygen atom from the other substance or provides hydrogen to it.

In the reaction of iron with copper sulphate solution:



we observe that oxygen is added to Fe and it becomes FeSO<sub>4</sub> whereas oxygen is removed from CuSO<sub>4</sub> and it becomes Cu.

Therefore, Fe is getting oxidized and as it is removing oxygen from CuSO<sub>4</sub>, it is also the reducing agent.



**Caution**

→ Only reactant substances are either oxidized or reduced, not the products.

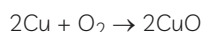
**7. The chemical reaction between copper and oxygen can be categorized as :**

- (a) Displacement reaction
- (b) Decomposition reaction
- (c) Combination reaction
- (d) Double displacement reaction

**Ans.** (c) Combination reaction

**Explanation:** When copper is heated, a black coloured coating is formed on its surface as copper reacts with oxygen to form copper (II) oxide.

The chemical reaction taking place between copper and oxygen :



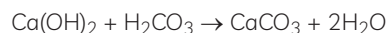
As copper and oxygen combine to form a single product, it is a combination reaction.

**8. Which of the given options correctly represents the Parent acid and base of Calcium Carbonate?**

	Parent Acid	Parent Base
(a)	HCl	NaOH
(b)	H <sub>2</sub> CO <sub>3</sub>	Ca(OH) <sub>2</sub>
(c)	H <sub>3</sub> PO <sub>3</sub>	CaSO <sub>4</sub>
(d)	H <sub>2</sub> SO <sub>4</sub>	CaSO <sub>4</sub>

**Ans.** (b) Parent Acid : H<sub>2</sub>CO<sub>3</sub>  
Parent Acid : Ca(OH)<sub>2</sub>

**Explanation:** Calcium carbonate, chemical formula CaCO<sub>3</sub>, is formed from carbonic acid, H<sub>2</sub>CO<sub>3</sub> and the base calcium hydroxide, Ca(OH)<sub>2</sub>.



**Related Theory**

- Salts may be neutral, acidic or basic depending upon the strength of the acid and base from which it has been derived or formed.
- Salts of a strong acid and a strong base are neutral with pH value of 7.
- Salts of a strong acid and weak base are acidic with pH value less than 7.
- Salts of a strong base and weak acid are basic in nature, with pH value more than 7.
- Calcium carbonate is a basic salt as it is formed by a weak acid and a strong base.

**9. How will you protect yourself from the heat generated while diluting a concentrated acid?**

- (a) By adding acid to water with constant stirring.
- (b) By adding water to acid with constant stirring.
- (c) By adding water to acid followed by base.
- (d) By adding base to acid with constant stirring.

**Ans.** (a) By adding acid to water with constant stirring.

**Explanation:** Dilution of a concentrated acid is a highly exothermic process. If we add water to the concentrated acid, the mixture may splash and cause severe burn injuries due to the large amount of heat produced. Therefore, acid should be added to the water drop by drop with constant stirring so that the heat evolved may be absorbed by the water.

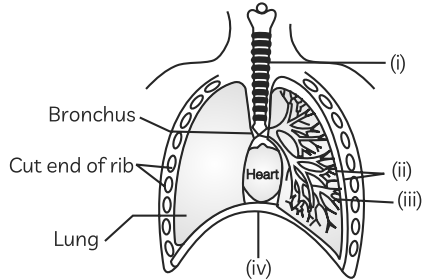
**10. Why is it important to balance a skeletal chemical equation?**

- (a) To verify law of conservation of energy.
- (b) To verify the law of constant proportion.
- (c) To verify the law of conservation of mass.
- (d) To verify the law of conservation of momentum.

**Ans.** (c) To verify the law of conservation of mass.

**Explanation:** We need to balance chemical equations to satisfy the law of conservation of mass in chemical reactions. This is done by making the number of different types of atoms equal on both the sides of an equation.

11. Carefully study the diagram of the human respiratory system with labels (i), (ii), (iii) and (iv). Select the option which gives correct identification and main function and /or characteristic.



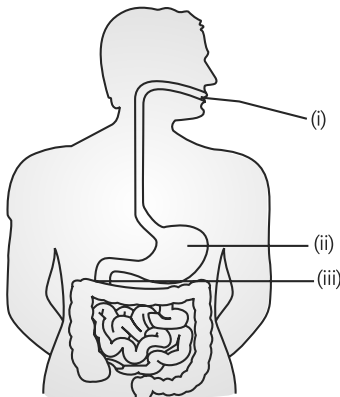
- (a) (i) Trachea: It is supported by bony rings for conducting inspired air.  
 (b) (ii) Ribs: When we breathe out, ribs are lifted.  
 (c) (iii) Alveoli: Thin-walled sac like structures for exchange of gases.  
 (d) (iv) Diaphragm: It is pulled up when we breathe in.

**Ans.** (c) (iii) Alveoli: Thin-walled sac like structures for exchange of gases.

**Explanation:** Trachea is supported by rings of cartilages to prevent it from collapsing when there is not air present in it.

When we breathe out, the muscles of diaphragm and ribs relax and the diaphragm and muscles attached to ribs contract when we breathe in.

12. Identify the option that indicates the correct enzyme that is secreted in location (i), (ii) and (iii).



- (a) (i)-lipase, (ii)-trypsin, (iii)-pepsin  
 (b) (i)-amylase, (ii)-pepsin, (iii)-trypsin  
 (c) (i)-trypsin, (ii)-amylase, (iii)-carboxylase  
 (d) (i)-permease, (ii)-carboxylase, (iii)-oxidase

**Ans.** (b) (i)-amylase, (ii)-pepsin, (iii)-trypsin

**Explanation:** The digestion of food begins in the mouth, marked as (i), as saliva contains an enzyme called salivary amylase that breaks down starch which is a complex molecule to give sugar.

In the stomach marked as (ii), the gastric glands present in its wall release hydrochloric acid, a protein digesting enzyme called pepsin, and mucus.

The enzyme trypsin secreted by pancreas digests proteins.

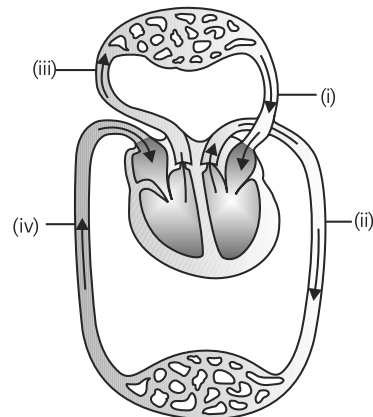
13. Opening and closing of stomatal pore depends on:

- (a) Atmospheric temperature  
 (b) oxygen concentration around stomata  
 (c) carbon dioxide concentration around stomata  
 (d) water content in the guard cells

**Ans.** (d) water content in the guard cells

**Explanation:** The opening and closing of the stomatal pore is a function of the guard cells. The stomatal pore opens when the guard cells swell when water flows into them and closes if the guard cells shrink when water flows out of them.

14. The figure given below shows a schematic plan of blood circulation in humans with labels (i) to (iv). Identify the correct label with its functions?



- (a) (i) Pulmonary vein - takes impure blood from body part.  
 (b) (ii) Pulmonary artery - takes blood from lung to heart.  
 (c) (iii) Aorta - takes blood from heart to body parts.  
 (d) (iv) Vena cava takes - blood from body parts to right auricle.

**Ans.** (d) (iv) Vena cava takes - blood from body parts to right auricle.

**Explanation:**

- (i) It is pulmonary vein which carries oxygenated blood from lungs and pours into left atrium.
- (ii) It is aorta which carries oxygenated blood from the left ventricle of the heart to various parts of the body.
- (iii) It is pulmonary artery carries deoxygenated blood from the right ventricle to the lungs.
- (iv) It is vena cava which carries deoxygenated blood from various parts of the body and pours it into right atrium.

Therefore, the correct option is (d), as the parts (ii) and (iii) have been marked wrong, whereas the function of part (i) is wrongly mentioned.

- 15. Identify the phase of circulation which is represented in the diagram of heart given below. Arrows indicate contraction of the chambers shown.**

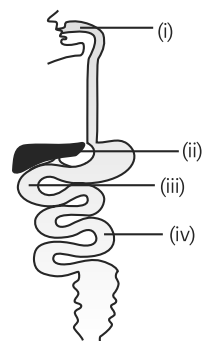


- (a) Blood transferred to the right ventricle and left ventricle simultaneously.
- (b) Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously.
- (c) Blood transferred to the right auricle and left auricle simultaneously.
- (d) Blood is received from lungs after oxygenation and is received from various organs of the body.

**Ans.** (b) Blood is transferred to lungs for oxygenation and is pumped into various organs simultaneously.

**Explanation:** When the left and right ventricles of the heart contract, the oxygenated blood from Left Ventricle is distributed to all parts of the body through aorta and the deoxygenated blood flows to the lungs from Right Ventricle through pulmonary artery.

- 16. Observe the diagram of Human digestive system.**



Match the labeling referred in column I and correlate with the function in column II.

Column I	Column II
(A)	(i) The length of this depends on food the organism eats.
(B)	(ii) Initial phase of starch digestion
(C)	(iii) Increases the efficiency of lipase enzyme action
(D)	(iv) This is the site of the complete digestion of carbohydrates, proteins and fats.

- (a) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)
- (b) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)
- (c) (A)-(ii), (B)-(iv), (C)-(iii), (D)-(i)
- (d) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

**Ans.** (b) (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

**Explanation:** In the human digestive system, the digestion of food begins in the mouth, labelled (i), where the salivary glands secrete an enzyme salivary amylase that breaks down starch into simple sugar. The part labelled (ii) is the liver which secretes bile juice that increases the efficiency of the enzyme lipase by breaking large globules of fat into smaller globules.

Part labelled (iii) and (iv) is small intestine which is a highly coiled organ and is the site of complete digestion of carbohydrates into glucose, fat into fatty acid and glycerol and protein into amino acids. Moreover, the length of the small intestine differs in various organisms as it depends on the food eaten by the organisms.

- 17. Which of the following mirror is used by a dentist to examine a small cavity in a patient's teeth?**

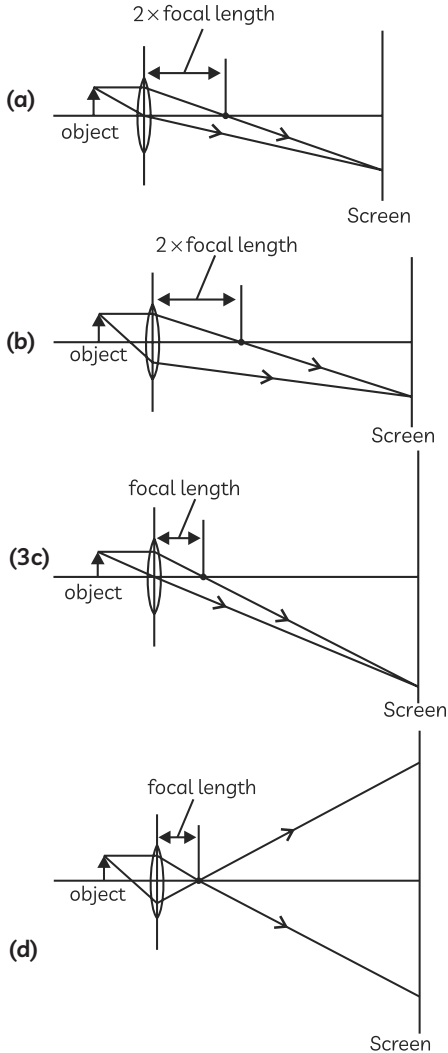
(a) Convex mirror

- (b) Plane mirror
- (c) Concave mirror
- (d) Any spherical mirror

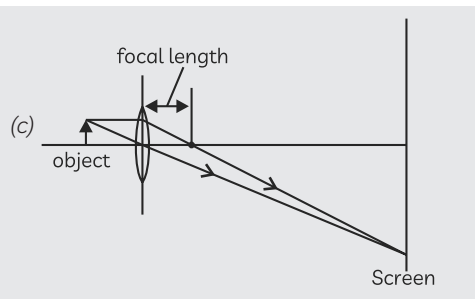
**Ans.** (c) Concave mirror

**Explanation:** Concave mirrors concentrates parallel rays of light on its focus and are therefore used by dentists to examine small cavities in patient's teeth.

**18. Which diagram shows image formation of an object on a screen by a converging lens?**



**Ans.**



**Explanation:** In the image formation by a converging or convex lens, a ray parallel to the principal axis passes through the focus after refraction and a ray passing through the optical centre does not suffer any deviation, as it is incident normally.

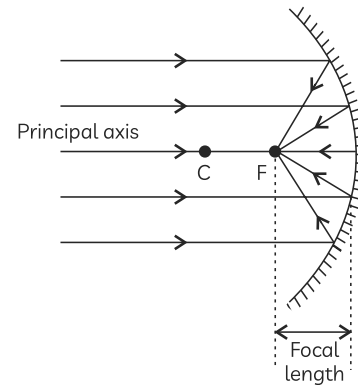
Therefore, (c) is the correct diagram showing image formation of the given object by the convex lens.

**19. Which of the following can make a parallel beam of light when light from a point source is incident on it?**

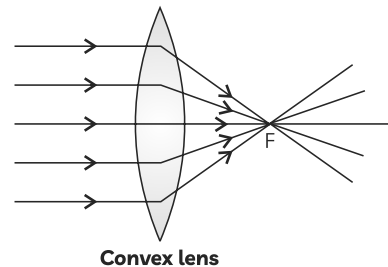
- (a) Concave mirror as well as convex lens.
- (b) Convex mirror as well as concave lens.
- (c) Two plane mirrors placed at  $90^\circ$  to each others.
- (d) Concave mirror as well as concave lens.

**Ans.** (a) Concave mirror as well as convex lens.

**Explanation:** When a parallel beam of light from a point source is incident on a concave mirror, the rays converge at the focus after reflection from the mirror.



When a parallel beam of light passes through a convex lens, the rays also converge at the principal focus after refraction from the lens.



**20. Consider these indices of refraction: glass: 1.52; air: 1.0003; water: 1.333. Based on the refractive indices of three materials, arrange the speed of light through them in decreasing order.**

- (a) The speed of light in water > the speed of light in air > the speed of light in glass.

- (b) The speed of light in glass > the speed of light in water > the speed of light in air.  
 (c) The speed of light in air > the speed of light in water > the speed of light in glass.  
 (d) The speed of light in glass > the speed of light in air > the speed of light in water.

**Ans.** (c) The speed of light in air > the speed of light in water > the speed of light in glass.

**Explanation:** The speed of light in a medium is inversely proportional to the refractive index of the medium as refractive index  $n = \frac{c}{v}$ , where  $c$  is the speed of light in vacuum and  $v$  is the speed of light in the given medium.

Out of the three media given, glass has the highest refractive index (1.52) whereas air has the least refractive index (1.003). Therefore, speed of light in air is the greatest followed by that in water and then in glass.



**Caution**

→ A medium with higher refractive index will be denser in which speed of light will be less as compared to a rarer medium having lower refractive index.

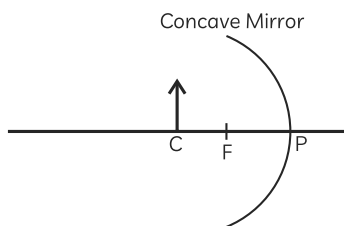
- 21.** If a beam of red light and a beam of violet light are incident at the same angle on the inclined surface of a prism from air medium and produce angles of refraction  $r$  and  $v$  respectively, which of the following is correct?

- (a)  $r = v$                                       (b)  $r > v$   
 (c)  $r = \frac{1}{v}$                                       (d)  $r < v$

**Ans.** (d)  $r < v$

**Explanation:** The amount of deviation of light depends on its colour as the refractive index of glass is different for different colours. Since, violet colour deviates the most and red deviates the least, the angle of refraction  $r < v$ .

**22.**



- Examine the above figure and state which of the following option is correct? [one small box in the figure is equal to 1 cm]  
 (a) The mirror has a focal length of -6 cm and will produce an image of magnification +1.

- (b) The mirror has a focal length of -3 cm and will produce an image of magnification -1.  
 (c) The mirror has a focal length of -3 cm and will produce an image of magnification +1.  
 (d) The mirror has a focal length of -6 cm and will produce an image of magnification -1.

**Ans.** (b) The mirror has a focal length of -3 cm and will produce an image of magnification -1.

**Explanation:** The distance between the pole P and focus F is 3 cm (3 boxes) and the object is placed at the centre of curvature C. Image formed by a concave mirror when object is kept at C is formed at C, is real and inverted and of the same size as the object. Therefore, magnification  $m = -1$ .



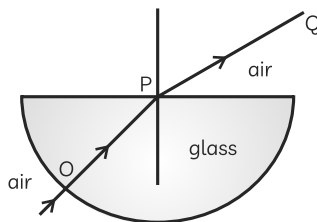
**Related Theory**

→ Magnification ( $m$ ) by a spherical mirror is defined as the ratio of the size of the image to the size of the object. Thus, magnification,

$$m = \frac{\text{size of image (h')}}{\text{size of object (h)}} = \frac{h'}{h} = -\frac{v}{u}$$

→ Magnification has two components: The sign denotes whether image is real (minus sign) or virtual (plus sign) and magnitude denotes the relative size of image as compared to the object.

**23.**



The angle of incidence from air to glass at the point O on the hemispherical glass slab is.

- (a)  $45^\circ$                                       (b)  $0^\circ$   
 (c)  $90^\circ$                                       (d)  $180^\circ$

**Ans.** (b)  $0^\circ$

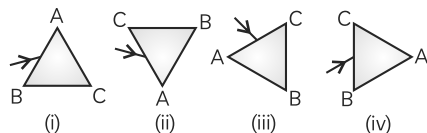
**Explanation:** At the point O, the incident light does not suffer any refraction. That is, the incident ray is incident normally on the glass. As angle of incidence is the angle between the incident ray and normal at the point of incidence, the angle of incidence =  $0^\circ$ .



**Caution**

→ In normal incidence of light, angle of incidence =  $0^\circ$  and not  $90^\circ$ .

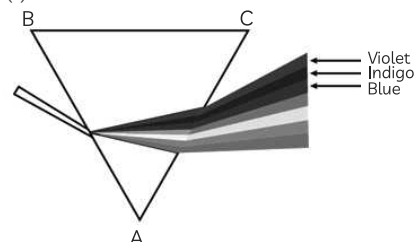
24. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in below Figure. In which of the following diagrams, after dispersion, the third colour from the top of the spectrum corresponds to the colour of the sky?



- (a) (i)                      (b) (ii)  
(c) (iii)                  (d) (iv)

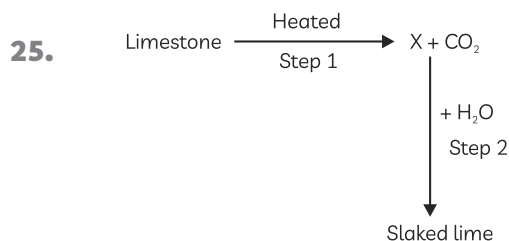
Ans. (b) (ii)

**Explanation:** When white light is incident on a prism, it splits into its component colours VIBGYOR. The colour of sky, namely blue, will be seen as third colour from the top of the spectrum if the prism is inverted as shown in figure (ii).



## SECTION - B

(Section B consists of 24 questions. (Q. No. 25 to 48) Attempt any 20 questions from this section.) (The first attempted 20 questions would be evaluated)

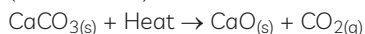


Identify the correct option from the given table which represents the type of reactions occurring in step 1 and step 2.

	Endothermic	Exothermic
(a)	x	✓
(b)	✓	x
(c)	✓	✓
(d)	x	x

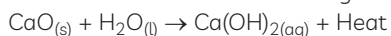
Ans. (c) Setp 1 : Endothermic  
Setp 2 : Exothermic

**Explanation:** When limestone ( $\text{CaCO}_3$ ) is heated, it decomposes to form calcium oxide (marked as X) and carbon dioxide:

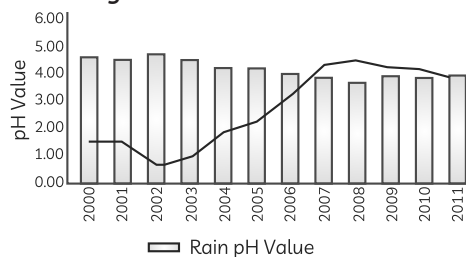


This is an endothermic reaction as heat is absorbed in this case.

When calcium oxide is dissolved in water, it forms slaked lime, which is an exothermic reaction as heat is evolved during this process.



26. In which year is concentration of hydrogen ion the highest?



- (a) 2002                      (b) 2008  
(c) 2011                      (d) 2005

Ans. (a) 2002

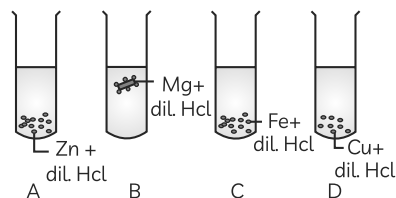
**Explanation:** The concentration of hydrogen ion is inversely proportional to the pH of the solution. As the pH value of rain water was minimum in the year 2002, we can say that concentration of hydrogen ions was maximum during this year.



### Caution

Remember that higher the pH value, more basic the solution and lower the pH, more acidic will be the solution.

27. The diagram shows the reaction between metal and dil. acid.



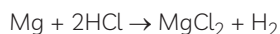


What is the reason for different behaviour of Mg in test tube B?

- (a) Mg is lighter element than dil. HCl.
- (b) Mg reacts with dil. HCl to produce H<sub>2</sub> gas which helps in floating.
- (c) Mg reacts with dil. HCl to produce N<sub>2</sub> gas which helps in floating.
- (d) Mg reacts with dil. HCl to produce CO<sub>2</sub> gas which helps in floating.

**Ans.** (b) Mg reacts with dil. HCl to produce H<sub>2</sub> gas which helps in floating

**Explanation:** When Mg reacts with dil HCl, it forms MgCl<sub>2</sub> and H<sub>2</sub> gas. The bubbles of hydrogen gas formed stick to the surface of Mg due to which Mg floats.



**28. The table shown below gives information about four substances : A, B, C and D.**

Substance	Melting Point (K)	Electrical Conductivity	
		Solid	Liquid/Aqueous
A	295	Good	Good
B	1210	Poor	Good
C	1890	Poor	Good
D	1160	Poor	Poor

Identify ionic compounds from the above given substances.

- (a) A, B
- (b) B, C
- (c) A, B, D
- (d) A, C, D

**Ans.** (b) B, C

**Explanation:** Ionic compounds have high melting and boiling points. They do not conduct electricity in solid state but conduct electricity in molten state or when dissolved in water as they contain ions.

As melting point of B and C is high and they do not conduct electricity in solid state but conduct electricity in liquid or aqueous medium, they both are ionic compounds.

**29. Vinay observed that the stain of curry on a white shirt becomes reddish-brown when soap is scrubbed on it, but it turns yellow again when the shirt is washed with plenty of water. What might be the reason for his observation?**

- (I) Soap is acidic in nature
- (II) Soap is basic in nature
- (III) Turmeric is a natural indicator which gives reddish tinge in bases

(IV) Turmeric is a natural indicator which gives reddish tinge in acids

- (a) (I) and (II)
- (b) (II) and (III)
- (c) (I) and (IV)
- (d) (II) and (IV)

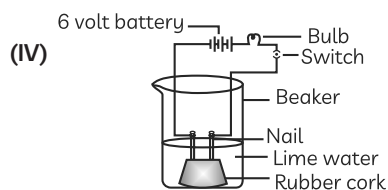
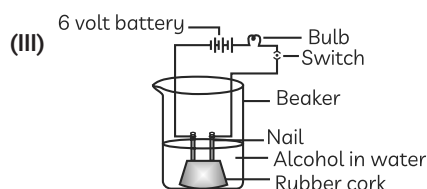
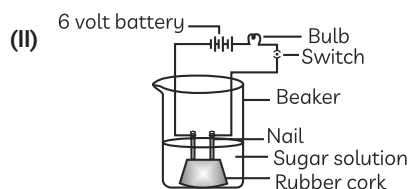
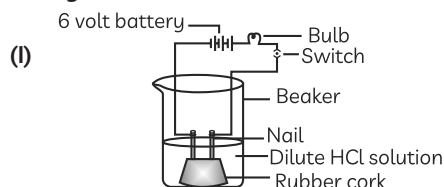
**Ans.** (b) (II) and (III)



### Related Theory

- Indicators are classified as natural indicators, synthetic indicators or olfactory indicators.
- Natural indicators are the substances obtained from natural sources such as a dye, flower, leaf etc in plants. For example, Litmus (purple coloured dye extracted from the lichen plant), red cabbage leaf extract etc.
- Synthetic indicators are the compounds synthesized in a chemistry lab or industrially rather than compounds found in nature. For example, Phenolphthalein, Methyl orange.
- Olfactory indicators are the substances whose odour or smell changes in acidic or basic medium. For example, Onion extract, vanilla extract.

**30. In which of the following setups would the bulb glow?**



- (a) (I) and (II)
- (b) (I) and (IV)
- (c) (II), (III) and (IV)
- (d) (I), (ii) and (IV)

**Ans.** (b) (I) and (IV)

**Explanation:** In the setup shown, the bulb will glow only when there is a flow of current through the solution. As dil. HCl and lime water contain ions, they will conduct electricity whereas sugar and alcohol do not contain ions and hence will not conduct electricity.



**Caution**

→ Both sugar and alcohol have H in their molecular formula but that does not mean that they can form hydrogen ions.

**Question No. 31 to 34 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below :**

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true and R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is False but R is true

**31. Assertion:** Fresh milk in which baking soda is added, takes a longer time to set as curd.

**Reason:** Baking soda decreases the pH value of fresh milk to below 6.

**Ans.** (c) A is true but R is false

**Explanation :** Baking soda or  $\text{NaHCO}_3$  is a mild base which is added to milk so as to shift the pH of milk from slightly acidic ( $\text{pH} < 7$ ) to slightly basic ( $\text{pH} > 7$ ) so that this milk will take longer time to set as curd.

**32. Assertion:** Decomposition of vegetable matter into compost is an endothermic reaction.

**Reason:** Decomposition reaction involves breakdown of a single reactant into simpler products.

**Ans.** (d) A is False but R is true

**Explanation:** Decomposition of vegetable matter into compost is an exothermic reaction as heat is produced during this process. Burning of natural gas in air respiration, reaction between calcium oxide and water to form slaked lime and all combustion reactions are exothermic.

**33. Assertion:** Resins and gums are stored in old xylem tissue in plants.

**Reason:** Resins and gums facilitate transport of water molecules.

**Ans.** (c) A is true but R is false

**Explanation:** Resins and gums are stored in old xylem tissues as these are waste products that are excreted by the plants.



**Related Theory**

- Excretion in Plants :
- Plants get rid of oxygen and carbon dioxide through stomata in leaves and lenticels in stems.
- Excess water is got rid off by transpiration.
- Cellular vacuoles store many plant waste products.
- Plants get rid of stored solid and liquid wastes by shedding of leaves, peeling of bark and feeling of fruits.
- Plants also excrete some waste substances into the soil around them.

**34. Assertion:** Sky appears blue in the day time.

**Reason:** White light is composed of seven colours.

**Ans.** (b) Both A and R are true and R is not the correct explanation of A

**Explanation:** Sky appears blue during day time due to the scattering of light by the large number of gas, smoke and water vapour molecules present in the earth's atmosphere. As the size of the scatterer is much smaller than the wavelength of light, light of smaller wavelength is scattered the most.



**Related Theory**

→ The sky would appear black in the day time if the earth had no atmosphere, as no colour of sunlight would be scattered then.

**35. The table given below shows the reaction of a few elements with acids and bases to evolve Hydrogen gas.**

Element	Acid	Base
A	x	x
B	✓	✓
C	✓	x
D	✓	✓

**Which of these elements form amphoteric oxides ?**

- (a) A and D
- (b) B and D
- (c) A and C
- (d) B and D

**Ans.** (b) B and D

**Explanation:** Amphoteric oxides are the metal oxides that show both acidic and basic nature.

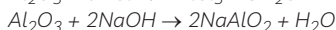
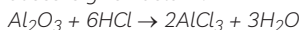
For example, aluminium oxide and zinc oxide are amphoteric oxides.

In the given table, B and D react with both acids and bases to evolve hydrogen gas and are therefore amphoteric oxides.



### Related Theory

The reaction of aluminium oxide with acids and bases is given below :



**36. In which of the following groups of organisms, blood flows through the heart only once during one cycle of passage through the body?**

- (a) Rabbit, Parrot, Turtle
- (b) Frog, crocodile, Pigeon
- (c) Whale, Labeo, Penguin
- (d) Shark, dog fish, sting ray

**Ans.** (d) Shark, dog fish, sting ray

**Explanation:** The blood goes through the heart of fishes only once during one cycle of passage through the body, whereas in other vertebrates it goes twice through the heart during each cycle.

**37. What is common between extensive network of blood vessels around walls of alveoli and in glomerulus of nephron?**

- (a) Thick walled arteries richly supplied with blood
- (b) Thin walled veins poorly supplied with blood
- (c) Thick walled capillaries poorly supplied with blood
- (d) Thin walled capillaries richly supplied with blood

**Ans.** (d) Thin walled capillaries richly supplied with blood.



### Related Theory

Alveoli are balloon-like structures with thin walls and fine surface present in the lungs. The walls of the alveoli contain an extensive network of blood capillaries for exchange of gases.

Nephrons are cup-shaped structure having thin walls, attached to thin walled tubule present in the kidneys. Bowman's capsule is supplied with cluster of capillaries, called glomerulus for filtration.

**38. Plants use completely different process for excretion as compared to animals. Which one of the following processes is NOT followed by plants for excretion?**

- (a) They can get rid of excess water by transpiration.

(b) They selectively filter toxic substances through their leaves.

(c) Waste products are stored as resins and gums in old xylem.

(d) They excrete waste substances into the soil around them.

**Ans.** (b) They selectively filter toxic substances through their leaves.

**Explanation:** Plants get rid of oxygen and carbon dioxide through stomata in leaves and lenticels in stems. They get rid of excess water by transpiration. Cellular vacuoles store many plant waste products. Plants get rid of stored solid and liquid wastes by shedding of leaves, peeling of bark and peeling of fruits.

Other waste products are stored as resins and gums, especially in old xylem. Plants also excrete some waste substances into the soil around them.

**39. If the power of a lens is - 4.0D then it means that the lens is a**

- (a) concave lens of focal length -50 m
- (b) convex lens of focal length +50 cm
- (c) concave lens of focal length -25 cm
- (d) convex lens of focal length -25 m

**Ans.** (c) concave lens of focal length -25 cm

**Explanation:**

$$P = -4 \text{ D}$$

$$P = \frac{100}{f(\text{cm})}$$

$$f(\text{cm}) = \frac{100}{p}$$

$$= \frac{100}{-4} = -25 \text{ cm.}$$

Negative focal length means concave lens. Concave lens of focal length -25 cm.



### Related Theory

Power of a lens is the reciprocal of its focal length (in m). Power of a lens of focal length 1 m is 1 Dioptre.

Power of a concave lens is negative whereas power of a convex lens is positive.

**40. Rays from Sun converge at a point 15 cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object?**

- (a) 30 cm in front of the mirror
- (b) 15 cm in front of the mirror
- (c) Between 15 cm and 30 cm in front of the mirror
- (d) More than 30 cm in front of the mirror

**Ans.** (a) 30 cm in front of the mirror

**Explanation:** If rays converge at a point 15 cm from the mirror, then,

$$f = -15 \text{ cm}$$

then,  $C = -30 \text{ cm}$

An object kept at C makes an image of the same size as object.



### Related Theory

- Reflection by a concave mirror :
- As the position of object shifts from infinity to Focus F, the position of image shifts from Focus F to Infinity and Size of image increases from highly diminished to highly enlarged.
- When the object is that the focal point, the image is at infinity. As the object moves towards the mirror within the focal point the image becomes virtual and upright behind the mirror. Initially the virtual image is much larger than the object and really far away, but as the object approaches the mirror the virtual image also approaches the mirror and decreases in size.

**41.** In which of the following groups of organisms, food material is broken down outside the body and then absorbed in?

- (a) mushroom, green plants, amoeba
- (b) yeast, mushroom, bread mould
- (c) paramecium, amoeba, cuscuta
- (d) cuscuta, lice, tapeworm

**Ans.** (b) yeast, mushroom, bread mould



### Related Theory

- The mode of nutrition depends on the body design and functioning.
- It can be holozoic in which complex organic matter is fed by ingestion and this food is subsequently digested and absorbed. Examples are: Amoeba, frog, human beings.
- Mode of nutrition can be parasitic in which an organism (parasite) obtains the food synthesized by others (host). Examples are: Several fungi, bacteria, plants like Cuscuta, animals like plasmodium and roundworm.
- It can be saprophytic in which organisms obtain nutrients from the dead and decaying organic matter. Examples are: fungi and bacteria.

**42.** In a person the tubule part of the nephron is not functioning at all. What will its effect be on urine formation?

- (a) The urine will not be formed.
- (b) Quality and quantity of urine is unaffected.
- (c) Urine is more concentrated.
- (d) Urine is more diluted.

**Ans.** (d) Urine is more diluted.

**Explanation:** The function of tubule is to re-absorption of useful substances such as glucose and amino acids, salts and a major amount of water into the blood capillaries. Therefore, if the tubule part of the nephron is not functioning properly, urine will be more diluted.

**43.** If the real image of a candle flame formed by a lens is three times the size of the flame and the distance between lens and image is 80 cm, at what distance should the candle be placed from the lens?

- (a) -80 cm
- (b) -40 cm
- (c)  $-\frac{40}{3}$  cm
- (d)  $-\frac{80}{3}$  cm

**Ans.** (d)  $-\frac{80}{3}$  cm

**Explanation:**  $m = -3$   
 $V = 80 \text{ cm}$

$$m = \frac{v}{u}$$

$$-3 = \frac{80}{u}$$

$$u = \frac{80}{-3}$$

$$= -\frac{80}{3} \text{ cm}$$

Correct answer = (D)  $-\frac{80}{3}$  cm



### Related Theory

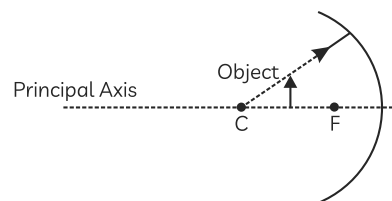
- Lens formula:  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , where  $u =$  object distance,  $v =$  image distance,  $f =$  Focal length.
- Magnification produced by a lens: It is defined as the ratio of the size of the image to the size of the object. Thus, magnification,  $m = \frac{\text{Size of image}}{\text{Size of object}} = \frac{h'}{h} = \frac{v}{u}$
- Magnification is always positive in case of a concave mirror as it always produces a virtual and erect image.
- In case of convex lens, Magnification is positive when the image formed is virtual and negative when image formed is real.



### Caution

- Always take  $u$  as negative, focal length of concave lens as negative and that of convex lens as positive.

**44.**



While looking at the above diagram, Nalini concluded the following:

- (I) the image of the object will be a virtual one.
- (II) the reflected ray will travel along the same path as the incident ray but in opposite direction.
- (III) the image of the object will be inverted.
- (IV) this is a concave mirror and hence the focal length will be negative. Which one of the above statements are correct?

- (a) (I) and (II)
- (b) (I) and (III)
- (c) (II), (III) and (IV)
- (d) (I), (II), (III) and (IV)

**Ans.** (c) (II), (III) and (IV)

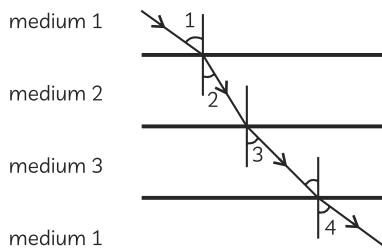


### Related Theory

A concave mirror forms a real and inverted image of an object for all positions of the object except when object lies between the pole and focus of the mirror, in which case a virtual and erect image is formed behind the mirror.

The ray of light shown is incident normally on the mirror and hence will be reflected back along the same path.

45.



In the above diagram light is travelling through different media. It is noted by a scientist that  $\angle 1 = \angle 3 = \angle 4$  but  $\angle 2 < \angle 1$ . Which of the following statement would be correct?

- (a) Medium 1 is the denser than medium 3 but its density is equal to medium 2.
- (b) Medium 2 is the rarest medium.
- (c) Medium 3 is denser than medium 1.
- (d) Medium 1 and 3 are essentially the same medium, but medium 2 is denser than 1 and 3.

**Ans.** (d) Medium 1 and 3 are essentially the same medium, but medium 2 is denser than 1 and 3.

**Explanation:** It is given that  $\angle 1 = \angle 3 = \angle 4$  but  $\angle 2 < \angle 1$ . This means that medium 1 and 3 are the same medium as angle of emergence ( $\angle 3$ ) is equal to the angle of incidence ( $\angle 1$ )

only when both media are same. Medium 2 is denser than both medium 1 and 3 as angle of refraction ( $\angle 2$ ) is less than angle of incidence ( $\angle 1$ ).

46. The refractive index of flint glass is 1.65 and that for alcohol is 1.36 with respect to air. What is the refractive index of the flint glass with respect to alcohol?

- (a) 0.82
- (b) 1.21
- (c) 1.11
- (d) 1.01

**Ans.** (b) 1.21

**Explanation:** Refractive index of flint glass

$$\begin{aligned} \text{w.r.t alcohol} &= \frac{\text{R.I of flint glass}}{\text{R.I of alcohol}} \\ &= \frac{1.65}{1.36} = 1.21 \end{aligned}$$

hence correct answer –(b)1.21



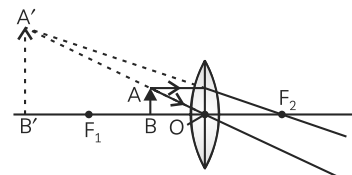
### Related Theory

The refractive index of two media with respect to each other can be found out in the following manner:

Consider three transparent media 1, 2 and 3 having refractive indices  $n_1$ ,  $n_2$  and  $n_3$  respectively. Then, the refractive index of medium 3 with respect to medium 2 is given as,

$$n_{32} = \frac{n_3}{n_2} = \frac{n_3/n_1}{n_2/n_1} = \frac{n_{31}}{n_{21}} = n_{31} \times n_{12}$$

47.



The above lens has a focal length of 10 cm. The object of height 2 mm is placed at a distance of 5 cm from the pole. Find the height of the image.

- (a) 4 cm
- (b) 6.67 mm
- (c) 4 mm
- (d) 3.33 mm

**Ans.** (c) 4 mm

**Explanation:** Given  $f = +10$ cm (Convex lens)

$$h_1 = 2 \text{ mm} = 0.2 \text{ cm.}$$

$$u = -5 \text{ cm.}$$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{5}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{5}$$

$$= \frac{1-2}{10} = \frac{-1}{10}$$

$$v = -10 \text{ cm}$$

$$m = \frac{v}{u} = \frac{h_2}{h_1}$$

$$m = \frac{-10}{-5} = \frac{h_2}{0.2}$$

$$\Rightarrow h_2 = 0.4 \text{ cm.}$$

$$h_2 = 4 \text{ mm}$$

48. A cable manufacturing unit tested few elements on the basis of their physical properties.

Properties	W	X	Y	Z
Malleable	Yes	No	No	Yes
Ductile	Yes	No	No	Yes
Electrical Conductivity	Yes	Yes	Yes	No
Melting Point	High	Low	Low	High

Which of the above elements were discarded for usage by the company?

- (a) W, X, Y  
 (b) X, Y, Z  
 (c) W, X, Z  
 (d) W, X, Z

Ans. (b) X, Y, Z

**Explanation:** Metals that are malleable, ductile, high electrical conductivity and high melting point will be selected by the cable manufacturing units whereas others will be discarded.

As only element W has all the desirable physical properties, it will be selected whereas X, Y and Z will be discarded.

## SECTION - C

(Section-C Consists of three Cases followed by questions. There are a total of 12 questions in this section.

Attempt any 10 questions from this section.

The first attempted 20 questions would be Evaluated)

### Case 1: The Salt Story

From: The New Indian Express 9 March, 2021

The salt pans in Marakkanam, a port town about 120 km from Chennai are the third largest producer of salt in Tamil Nadu. Separation of salt from water is a laborious process and the salt obtained is used as raw materials for manufacture of various sodium compounds.

One such compound is Sodium hydrogen carbonate, used in baking, as an antacid and in soda acid fire extinguishers.

The table shows the mass of various compounds obtained when 1litre of sea water is evaporated

Compound	Formula	Mass of Solid Present/g
Sodium Chloride	NaCl	28.0
Magnesium Chloride	MgCl <sub>2</sub>	8.0
Magnesium Sulphate	MgSO <sub>4</sub>	6.0
Calcium Sulphate	CaSO <sub>4</sub>	2.0
Calcium Carbonate	CaCO <sub>3</sub>	1.0
Total Amount of Salt Obtained		45.0

49. Which compound in the table reacts with acids to release carbon dioxide?

- (a) NaCl (b) CaSO<sub>4</sub>  
 (c) CaCO<sub>3</sub> (d) MgSO<sub>4</sub>

Ans. (c) CaCO<sub>3</sub>

**Explanation:** All metal carbonates and metal hydrogen carbonates react with dilute acid to release carbon dioxide gas.

Metal carbonate or hydrogen carbonate + Acid → Salt + carbon dioxide + water  
 $\text{CaCO}_{3(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{CaCl}_{2(aq)} + \text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)}$

50. How many grams of Magnesium Sulphate are present in 135 g of solid left by evaporation of sea water?

- (a) 6 g (b) 12 g  
 (c) 18 g (d) 24 g

Ans. (c) 18 g

**Explanation:** The amount of Magnesium Sulphate present in 45 g of solid left by evaporation of sea water is 6 g.

Therefore, amount of Magnesium Sulphate present in 135 g of solid left by evaporation of sea water will be  $\frac{6}{45} \times 135 = 18\text{g}$

51. What is the saturated solution of Sodium Chloride called?

- (a) Brine (b) Lime water  
 (c) Slaked lime (d) Soda water

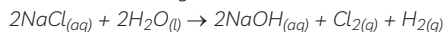
Ans. (a) Brine



### Related Theory

→ When electricity is passed through an aqueous solution of sodium chloride or brine, it decomposes to form sodium hydroxide.

→ This process is called the chlor-alkali process because of the products formed— chlor for chlorine and alkali for sodium hydroxide.

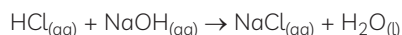


**52. What is the pH of the acid which is used in the formation of common salt?**

- (a) Between 1 to 3
- (b) Between 6 to 8
- (c) Between 8 to 10
- (d) Between 11 to 13

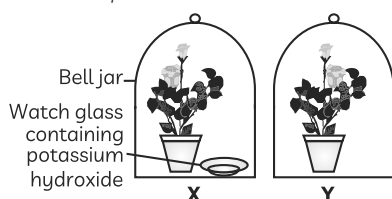
**Ans.** (a) Between 1 to 3

**Explanation :** Common salt or NaCl is formed from hydrochloric acid, HCl and sodium hydroxide, NaOH.



As HCl is a strong acid, its pH will be between 1 to 3.

**Case 2:** The Figure shown below represents an activity to prove the requirements for photosynthesis. During this activity, two healthy potted plants were kept in the dark for 72 hours. After 72 hours, KOH is kept in the watch glass in setup X and not in setup Y. Both these setups are air tight and have been kept in light for 6 hours. Then, Iodine Test is performed with one leaf from each of the two plants X and Y.



**53. This experimental set up is used to prove essentiality of which of the following requirements of photosynthesis?**

- (a) Chlorophyll
- (b) Oxygen
- (c) Carbon dioxide
- (d) Sunlight

**Ans.** (c) Carbon dioxide

**Explanation:** The experimental set up shown is used to prove that carbon dioxide is essential for photosynthesis as the set up has been made air tight and KOH has been placed to absorb all the carbon dioxide present in the bell jar, thereby creating absence of carbon dioxide gas.

**54. The function of KOH is to absorb :**

- (a) Oxygen
- (b) Carbon dioxide
- (c) Moisture
- (d) Sunlight

**Ans.** (b) Carbon dioxide

**Explanation:** KOH absorbs carbon dioxide present in the bell jar so that the plant can no longer perform photosynthesis.

**55. Which of the following statements shows the correct results of Iodine Test performed on the leaf from plant X and Y respectively?**

- (a) Blue - black colour would be obtained on the leaf of plant X and no change in colour on leaf of plant Y.
- (b) Blue - black colour would be obtained on the leaf of plant Y and no change in colour on leaf of plant X.
- (c) Red colour would be obtained on the leaf of plant X and brown colour on the leaf of plant Y.
- (d) Red colour would be obtained on the leaf of plant Y and brown colour on the leaf of plant X.

**Ans.** (b) Blue - black colour would be obtained on the leaf of plant Y and no change in colour on leaf of plant X.

**Explanation:** Plant X will not be able to perform photosynthesis as there is no carbon dioxide present in the jar. Hence it will not show positive starch test with iodine.

Plant Y will perform photosynthesis as all raw materials are present in the jar. Hence it will show positive starch test with iodine, that is, the leaf would turn blue black when drops of iodine are put on the leaf due to presence of starch in the leaf.

**56. Which of the following steps can be followed for making the apparatus air tight?**

- (I) placing the plants on glass plate
- (II) using a suction pump.
- (III) applying aaseline to seal the bottom of jar.
- (IV) creating vacuum
- (a) (I) and (II)
- (b) (II) and (III)
- (c) (I) and (III)
- (d) (II) and (IV)

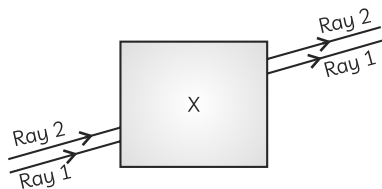
**Ans.** (c) (I) and (III)



### Related Theory

→ It is important to make the apparatus air tight so that air containing carbon dioxide may not enter the jar.

**Case 3 :** Noor, a young student, was trying to demonstrate some properties of light in her Science project work. She kept 'X' inside the box (as shown in the figure) and with the help of a laser pointer made light rays pass through the holes on one side of the box. She had a small butter-paper screen to see the spots of light being cast as they emerged.



- 57.** What could be the 'X' that she placed inside the box to make the rays behave as shown?
- a converging lens
  - a parallel-sided glass block
  - a plane mirror
  - a triangular prism

**Ans.** (b) a parallel-sided glass block

**Explanation:** As both the rays 1 and 2 are parallel to each other but laterally displaced, the material X is a glass slab. The emergent ray is always parallel to the incident ray in case of a glass slab, but is laterally displaced.

- 58.** She measured the angles of incidence for both the rays on the left side of the box to be  $48.6^\circ$ . She knew the refractive index of the material 'X' inside the box was 1.5. What will be the approximate value of angle of refraction?
- $45^\circ$
  - $40^\circ$
  - $30^\circ$
  - $60^\circ$

(use the value:  $\sin 48.6^\circ \approx 0.75$ )

**Ans.** (c)  $30^\circ$

**Explanation:** Refractive index of medium =  $\frac{\sin i}{\sin r}$

$$1.5 = \frac{\sin 48.6^\circ}{\sin r}$$

$$1.5 = \frac{0.75}{\sin r}$$

$$\sin r = \frac{0.75}{1.5}$$

$$\sin r = 0.5$$

$$r = \sin^{-1}(0.5)$$

$$r = 30^\circ$$



### Related Theory

The following are the laws of refraction :

(1) The incident ray, the refracted ray and the normal to the surface of separation of two media at the point of incidence, all lie in the same plane.

(2) Snell's law : The ratio of sine of angle of incidence  $i$  to the sine of angle of refraction  $r$  is constant. We

can write  $\sin i / \sin r = n_{21}$ , where  $n_{21}$  is a constant and is called the refractive index of medium 2 with respect to medium 1.

- 59.** Her friend noted the following observations from this demonstration :

- Glass is optically rarer than air.
- Air and glass allow light to pass through them with the same velocity.
- Air is optically rarer than glass.
- Speed of light through a denser medium is faster than that of a rarer medium.
- The ratio:  $\sin$  of angle of incidence in the first medium to the ratio of  $\sin$  of angle of refraction in the second medium, gives the refractive index of the second material with respect to the first one.

Which one of the combination of the above statements given below is correct.

- (I), (IV) and (V) are correct.
- (III) and (IV) are correct.
- (I), (IV) and (V) are correct.
- (III) and (V) are correct.

**Ans.** (d) (III) and (V) are correct.

**Explanation:** As light bends towards the normal when it travels from air to glass, air is rarer than glass, which means that the refractive index of air is less than that of glass. The refractive index of a medium 2 with respect to medium 1 or  $n_{21}$  is the ratio of sine of angle of incidence  $i$  to the sine of angle of refraction  $r$  which can be written as  $\frac{\sin i}{\sin r} = n_{21}$ .

- 60.** If the object inside the box was made of a material with a refractive index less than 1.5 then the :

- lateral shift of the rays would have been less.
- lateral shift of the rays would have been more.
- lateral shift of the rays would remain the same as before.
- there is not enough information to comment on any of the above statements

**Ans.** (a) lateral shift of the rays would have been less.

**Explanation:** The lateral shift depends on the refractive index of the medium and thickness of the slab. The greater the refractive index of the second medium, greater would light bend and hence greater would be the lateral shift.

