1. State differences between acids and bases.

**Solution:**

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Acids are sour to taste.</td>
<td>Bases are bitter to taste.</td>
</tr>
<tr>
<td>(ii) Acids turn blue litmus red.</td>
<td>Bases do not change the colour of blue litmus.</td>
</tr>
<tr>
<td>(iii) Acids do not change the colour of red litmus.</td>
<td>Bases turn red litmus blue.</td>
</tr>
<tr>
<td>(iv) With china rose indicator, acds give dark pink colour.</td>
<td>Bases give green colour with china rose indicator.</td>
</tr>
<tr>
<td>(v) Acids do not change the colour of turmeric indicator.</td>
<td>Bases turn the colour of turmeric indicator to red.</td>
</tr>
</tbody>
</table>

2. Ammonia is found in many household products, such as window cleaners. It turns red litmus blue. What is its nature?

**Solution:**

Ammonia is basic in nature as it turns the colour of red litmus paper blue.

**Concept insight:**

Bases turn red litmus to blue.

3. Name the source from which litmus solution is obtained. What is the use of this solution?

**Solution:**

Litmus solution is obtained from lichens. A natural dye extracted from lichens is dissolved in distilled water to obtain litmus solution.

It is used as an indicator to distinguish between acids and bases.

<table>
<thead>
<tr>
<th>Solution</th>
<th>Colour of litmus solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidic</td>
<td>Red</td>
</tr>
<tr>
<td>Basic</td>
<td>Blue</td>
</tr>
<tr>
<td>Neutral</td>
<td>No change</td>
</tr>
</tbody>
</table>

**Concept insight:**

Indicator is a substance which is used to distinguish between acids and bases.

4. Is the distilled water acidic/basic/neutral? How would you verify it?
Solution:

Distilled water is neutral in nature. The same can be verified by using red and blue litmus papers. Neither will show a colour change with distilled water. This proves that distilled water is neutral.

Concept insight:
As distilled water consists of no dissolved ions and salts, it is neutral in nature.

5. Describe the process of neutralization with the help of an example.

Solution:

The reaction between an acid and a base is known as neutralization reaction. In this reaction, both acid and base cancel each other’s effect. Neutralization reaction results in the formation of salt and water. During this reaction, energy in the form of heat is evolved.

Acid + Base $\rightarrow$ Salt + Water + Heat

For example, when sodium hydroxide (NaOH) is added to hydrochloric acid (HCl), sodium chloride (NaCl) and water (H$_2$O) are obtained.

NaOH + HCl $\rightarrow$ NaCl + H$_2$O + Heat

Concept insight:
In neutralization reaction, acid and base nullify each other’s effect and produce salt and water.

6. Mark 'T' if the statement is true and 'F' if it is false:

(i) Nitric acid turns red litmus blue. (T/F)
(ii) Sodium hydroxide turns blue litmus red. (T/F)
(iii) Sodium hydroxide and hydrochloric acid neutralize each other and form salt and water. (T/F)
(iv) Indicator is a substance which shows different colors in acidic and basic solutions. (T/F)
(v) Tooth decay is caused by the presence of a base. (T/F)

Solution:

(i) False
(ii) True
(iii) True
(iv) True
(v) False
(i) Nitric acid is an acid in nature. Acids turn blue litmus red.

**Concept insight:**
Acids turn blue litmus red.

(ii) Sodium hydroxide is a base and will turn red litmus blue.

**Concept insight:**
Bases turn red litmus blue.

(iii) Acid and base react with each other to form salt and water. Sodium hydroxide and hydrochloric acid neutralize each other and form salt and water.

**Concept insight:**
Reaction between an acid and a base is called neutralization.

(iv) Indicator is a substance which shows different colour in acidic and basic solutions to distinguish between them.

(v) Tooth decay is caused by the acid released by bacteria by decomposing left over food particles in our mouth.

7. Dorji has a few bottles of soft drink in his restaurant. But, unfortunately, these are not labeled. He has to serve the drinks on the demand of customers. One customer wants acidic drink, another wants basic and third one wants neutral drink. How will Dorji decide which drink is to be served to whom?

**Solution:**
Since the drinks are edible, Dorji can take the decision by tasting the drinks. Acidic drinks will be sour to taste whereas basic drinks will be bitter to taste and neutral drinks will have no taste. He can also use litmus paper to identify the acid, base and neutral drink.

1. If Dorji has litmus indicator (solution or paper), then he can take its help. He should put one drop of each drink on blue litmus paper. If the colour of the litmus paper changes to red, then it is an acidic drink.

2. Out of the remaining drinks, some are basic and some are neutral. Again, he should put one drop of the remaining drinks on red litmus paper. If the colour changes to blue, then it is basic and the others are neutral. In this way, he can serve all the three customers their respective drinks.

**Concept insight:**
Litmus paper is an indicator. An acid turns blue litmus red and a base turns blue litmus red.

8. Explain why:

(A) An antacid tablet is taken when you suffer from acidity.

(B) Calamine solution is applied on the skin when an ant bites.
(C) Factory waste is neutralized before disposing it into the water bodies.

**Solution:**

(A) This is because during acidity, an excess of acid is produced in the stomach. An antacid contains base, such as milk of magnesia. These bases react with excess of acids and neutralize their effect, thus giving us relief.

**Concept insight:**

Antacid contains base (magnesium hydroxide) which neutralizes excess of acid produced in the stomach.

(B) When an ant bites, it injects formic acid into the skin. Calamine solution contains zinc carbonate which is basic in nature. Therefore, it is applied on the skin to neutralize the effect of formic acid.

**Concept insight:**

Calamine neutralizes the effect of formic acid and thus relieves pain.

(C) Factory wastes contain acids. Therefore, these wastes, when thrown directly to water bodies, harm aquatic lives. Hence, these wastes are neutralized with basic chemicals before disposing to water bodies.

**Concept insight:**

Industrial wastes are acidic and are very harmful to aquatic organisms hence; bases are added to these so that it may not harm aquatic organisms.

9. Three liquids are given to you. One is hydrochloric acid, another is sodium hydroxide and the third is a sugar solution. How will you identify them? You have only turmeric indicator.

**Solution:**

1. We will put a drop each of hydrochloric acid, sodium hydroxide, and sugar solution on the turmeric indicator. The liquid which changes the colour of turmeric indicator to red is basic in nature, that is, sodium hydroxide.

2. Now, we will put a drop of sodium hydroxide on a drop of each of the other two liquids separately. After that, we will put the drops of these mixtures on turmeric indicator. The drop which will change the colour of the turmeric indicator to red contains sugar solution. This is because the mixture of basic and neutral solutions is basic in nature.

3. On the other hand, the drop which will not change the colour of turmeric indicator contains hydrochloric acid. This is because hydrochloric acid reacts with sodium hydroxide to form a neutral solution.

**Concept insight:**

Turmeric is also an acid-base indicator. It turns red with base and remains colorless with acid.
10. Blue litmus paper is dipped in a solution. It remains blue. What is the nature of the solution? Explain.

**Solution:**

The above solution could be a base or a neutral solution because:

1. Bases turn red litmus to blue but do not react with blue litmus.
2. Neutral substance also does not react with litmus solution.

**Concept insight:**

Bases do not react with blue litmus. Neutral substances also do not react with litmus solution.

11. Consider the following statements:

(A) Both acids and bases change colour of all indicators.
(B) If an indicator gives a colour change with an acid, it does not give a change with a base.
(C) If an indicator changes colour with a base, it does not change colour with an acid.
(D) Change of colour in an acid and a base depends on the type of the indicator.

Which of these statements are correct?

(i) All four  
(ii) A and D  
(iii) B and C  
(iv) only D

**Solution:**

(iv) only D

All indicators do not change with bases and acids, e.g. turmeric changes its colour to pink with base but it remains yellow with acid. (option (i) is incorrect). Some indicators change colour with both acid and base, e.g. litmus, methyl orange (option (ii) is not correct). Change of colour in an acid and a base depends on the type of the indicator (option (iv) is correct).