Skies on Fire: Acid Rain & Acid-Base Reactions

https://www.youtube.com/watch?v=Ms4v0Ekvyuw

1. In the video a researcher measures tap water and acidic river water using a digital pH gauge. Students from John Abbot recently did a similar study on ground water from Ile Perrot. The tap water had a pH of 7 and the ground water had a pH of 4.
   a) Which water source was more acidic? **The Ground water**
   b) How much more acidic was it compared to the other water source?

1 – 2 – 3 **– 4 > 5 > 6> 7** – 8 – 9 – 10 – 11 – 12 – 13 – 14 10 x10 x10 = 1000 3 steps = 10^3 or 10x10x10	The pH scale is logarithmic So each step is ten times more or less acidic

   c) Other than a digital pH gauge, what kind of tool could be used to find the pH of a solution?

An **indicator** such as phenolphthalein or litmus paper could be used.
Indicators can be mixed together to create universal indicators that give more specific pH values.

2. a) The chemical formula for most acids is fairly similar, what do most acids have in common when it comes to their chemical formula?

Most acids start with an H, this shows that they tend to contain the element "Hydrogen"
ex. HCl : Hydrochloric acid
HNO_3: Nitric Acid

   b) We learned about a special exception, what is the name and formula of this acid?

Acetic acid (or Ethanoic Acid), the kind of acid found in vinegar is a different type of acid and it doesn't have the same formula (but it still contains hydrogen).
Acetic Acid: CH_3COOH

3. Acid rain is typically acidic because of nitrogen compounds released by industrial buildings. Most of the acid in acid rain is nitric acid (HNO_3). When it hits the ground the acid rain reacts with chemicals such as calcium hydroxide ($Ca(OH)_2$) to form water and calcium nitrate, a salt ($Ca(NO_3)_2$).

a) What are chemicals belonging to the group including calcium hydroxide called?

These chemicals are bases, they react with acids to neutralize them and produce water and a salt as a reaction product. This process brings the pH of a solution closer to 7 (neutral).

b) What type of reaction is this? Justify your answer.

This is an acid-base neutralization reaction.
The acid and base in a neutralization reaction react chemically in solution to produce a salt (calcium nitrate in this case) and water.

c) What would the chemical formula for the reaction between nitric acid and calcium hydroxide look like?

$$2\,HNO_3 + Ca(OH)_2 \rightarrow 2\,H_2O + Ca(NO_3)_2$$

Acid Base Water Salt

d) What is the law of conservation of mass?

It is a law of physical science that states that matter (anything that has mass) cannot be created or destroyed by any known means. This means that the amount of matter (mass) that goes into a system will be the same as the matter (mass) that comes out.

For example if 20 grams of reactants are completely reacted with each other, the total mass of the products should also be 20 grams.

e) How much calcium hydroxide would react with 126g of nitric acid to produce 36g of water and 164g of calcium nitrate ($Ca(NO_3)_2$)?

$$2\,HNO_3 + Ca(OH)_2 \rightarrow 2\,H_2O + Ca(NO_3)_2$$

126g ??? 36g 164g

200g-126g=??? 200g total

74 grams of calcium hydroxide