Blast-off : Acid and Alkali Mark Scheme

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1. **Complete the paragraph by filling in the missing words from the box:**
    - Litmus is an indicator because it has different *colours* in an acid and in a base.
    - The pH scale runs from 0 to 14 and it measures the *strength* of an acidic or basic solution.
    - A neutral substance has a *pH* of 7.
    - Acids have a pH of *less* than 7 and the lower the pH value, the stronger the acid.
    - Bases have a pH *greater* than 7 and the higher the pH value, the stronger the base.
    - *Universal* indicator is also used to measure the pH of a solution because it has a different colour at each pH value.
2. **What is an indicator?**
    - An indicator is a substance that changes colour in the presence of an acid or an alkali.
3. **Which of these statements are true or false?**
    - All acids are dangerous: False
    - Acids are sweet tasting: False
    - Acids have a pH below 7: True
    - Alkalis turn universal indicator red: False
    - Alkalis feel soapy: True

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1. **Complete these reactions:**
    - Sodium hydroxide + Hydrochloric acid → Sodium chloride + Water
    - Magnesium oxide + Sulphuric acid → Magnesium sulphate + Water

- Calcium hydroxide + Nitric acid → Calcium nitrate + Water

2. **Fill in the gaps using the words in the box:**
    - *Dilute* acids are used in schools. If any of them make contact with *skin*, it becomes *red* or blistered, and feels burnt.
    - Concentrated *acids* (like hydrochloric acid and *sulfuric* acid) can attack *metals* and destroy skin if spilled.
    - Dilute acids like *vinegar* (ethanoic acid), and lemons (*citric* acid) taste very *sour*. These are safe to use in food, but they can still hurt you if they get into a cut or into your *eyes*.

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1. A wasp's sting is alkaline. What household substance can be used to cure it?
    - Vinegar, as it is acidic and will neutralise the alkali.
2. Explain why farmers use lime if the soil is too acidic to grow crops.
    - Lime (calcium carbonate) neutralises the acidic soil, improving pH for nutrient absorption and crop growth.
3. What is the name of the acid in our stomach?
    - Hydrochloric acid.
4. Name one chemical substance that could be safely used to reduce the acid in your stomach.
    - Magnesium hydroxide (Milk of Magnesia).
5. What are the two products of a neutralisation reaction?
    - Salt and water.
6. Antacids are the name given to the group of substances that help to treat indigestion. Why do you think they are called antacids?
    - They neutralise excess stomach acid, reducing discomfort and symptoms.
7. What is the full chemical name of lime?
    - Calcium carbonate.

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1. **Complete the following reactions:**
    - Magnesium + Nitric acid → Magnesium nitrate + Hydrogen
    - Silver + Hydrochloric acid → No reaction
    - Lead + Sulphuric acid → Lead sulphate + Hydrogen
    - Copper + Nitric acid → Copper nitrate + Hydrogen
2. **Complete the paragraph below by filling in the gaps using the words in the box:**
    - *Strong* alkalis (sodium hydroxide) are used in schools. Like acids, if any of them make contact with skin, it becomes red or *blistered*. *Concentrated* alkalis are corrosive, like *ammonia*. They can attack metals and destroy skin if spilled.
    - Dilute *alkalis* are found in *toothpaste* and baking powder. These are safe to use in food. Strong alkalis are often used in *household* cleaners. Examples include drain cleaner, *bleach* and oven cleaners.

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Question 1

Table: A variety of solutions were tested. Put a ✓ in the correct box.

Solution	pH Reading	Acidic	Alkaline	Neutral
Lemon juice	2.2	✓		
Toothpaste	9.9		✓	
Blood	7.4		✓	
Pure water	7.0			✓
Tomato juice	4.4	✓		

Reason for using a pH probe over universal indicator:

- A pH probe provides a precise, numerical value for the pH, while a universal indicator only gives a rough estimation based on color.

Why dip the probe in pure water between tests?

- To avoid contamination between solutions and ensure accurate readings.

What is an indicator?

- An indicator is a substance that changes color in the presence of an acid or an alkali to show the pH of a solution.

Name 2 other indicators that could have been used:

- Phenolphthalein
- Methyl orange

Question 2

Which test tube is showing the greatest reaction?

- Test tube B is showing the greatest reaction because it has the most bubbles, indicating rapid hydrogen gas production.

Which gas is released when metals react with acids?

- Hydrogen gas.

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3. (a) Use the graph to give the pH of the liquid in Barry's mouth before he started to eat.
    - pH: 7.

    (b) What does this pH tell you about the liquid in Barry's mouth before he started to eat?
    - It was neutral.

(b) What happened to the pH of the liquid in Barry's mouth as he ate the meal?

- The pH decreased, becoming more acidic.

c. Barry chews special chewing gum after each meal. The chewing gum neutralises the liquid in his mouth. What type of substance neutralises an acid?

- An alkali.

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1. (a) Which gas dissolved to form the most acidic solution? Explain your choice.
    - Carbon dioxide. It required the highest number of alkali drops (160) to return the indicator to green, showing the most acidity.
2. (b) Which gas formed a neutral solution? Explain your choice.
    - Air. The indicator did not change colour, indicating it was neutral.
3. (c) What effect does an alkali have on an acid?
    - An alkali neutralises an acid, forming a salt and water.
4. (d) Complete the word equation for the reaction between zinc and hydrochloric acid:
    - Zinc + Hydrochloric acid → Zinc chloride + Hydrogen.

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1. (a) Sharna boiled some red cabbage in water. What method did she use to separate pieces of cabbage from the cabbage-water?
    - Filtration.
2. (b) Sharna wanted to find out if the purple cabbage-water contained more than one coloured substance. What method did she use?
    - Chromatography.
3. (c) Sharna mixed cabbage-water with washing-up liquid. The mixture turned blue. What does this tell you about the washing-up liquid?
    - Washing-up liquid is alkaline.
4. (d) Sharna mixed cabbage-water with lemon juice. What colour was the mixture?
    - Red.
5. (e) What is the name of a chemical that changes colour when mixed with acids or alkalis?
    - Indicator.

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1. (a) Winston used universal indicator to test hydrochloric acid. What colour did the indicator turn?
    - Red.
2. (b) What pH value would the hydrochloric acid likely have?
    - Around 1-2.
3. (c) Why did the mixture fizz when Winston added magnesium carbonate to hydrochloric acid?
    - Carbon dioxide gas was produced.
4. (d) Why did the fizzing stop when more magnesium carbonate was added?
    - All the acid had been neutralised.
5. (e) When magnesium carbonate reacts with hydrochloric acid, what are the two products?
    - Magnesium chloride and carbon dioxide.
6. (f) Why is hydrochloric acid needed in the stomach?
    - It helps digest food and kills bacteria.

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1. (a) What are the names of two fossil fuels?
    - Coal and oil.
2. (b) Complete the word equation for the reaction between sulphur and oxygen:
    - Sulphur + Oxygen → Sulphur dioxide.
3. (c) What effect does an alkali have on the pH of an acidic lake?
    - It increases the pH, making the lake less acidic.
4. (d) When calcium hydroxide reacts with sulphuric acid, what is the name of the salt formed?
    - Calcium sulphate.
5. (e) Why are leaves important for tree growth?
    - Leaves are needed for photosynthesis to produce food for the tree.

6. (f) What effect does acid rain have on buildings made of limestone?
    - It reacts with the limestone, causing erosion and damage.

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1. (a) Give the name of one acidic liquid tested by Ramy.
    - Lemonade.
2. (b) Give the name of one neutral liquid tested by Ramy.
    - Water.
3. (c) Ramy dissolved some bicarbonate of soda in distilled water, producing an alkaline solution. What colour would the indicator turn?
    - Blue.
4. (d) Ramy added lemon juice to the bicarbonate of soda solution. How could he tell that a gas was produced?
    - Bubbles formed in the solution.
5. (e) What is the name of the reaction between an acid and an alkali?
    - Neutralisation.