



Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. acid
2. alkali
3. indicator
4. neutralization
5. acid rain
6. hard water
7. bicarbonates
8. alloy

K • 4

Each carries 0.5 mark.

2 Label the diagram

1. cork
2. dilute hydrochloric acid
3. carbon dioxide

4. delivery tube
5. marble chips (calcium carbonate)
6. lime water turns milky

K • 3

Each carries 0.5 mark.

3 Multiple choice

- i. d. soap solution

K • 1

Only a **base** turns red litmus blue, and soap solution is basic. Curd (lactic acid), tomato (citric and oxalic acids) and cola (carbonic and phosphoric acids) are all acidic. Some books give **shampoo** as the fourth option instead: choose it, as the only one that isn't clearly acidic, but know that most shampoos today are made mild, close to neutral; soap is the reliable base.

- ii. c. ash is alkaline

U • 1

Ash is **alkaline** (basic), so it neutralizes the acid in the soil. Being cheap and easy to find makes it convenient, but that is not why it works.

- iii. c. the permutit method

K • 1

Boiling, Clark's method and adding calcium hydroxide (which is Clark's method) remove only temporary hardness. The **permutit method** (or washing soda) removes permanent hardness.

- iv. c. rusting

U • 1

Stainless steel **doesn't** rust easily, because chromium forms a thin protective layer on its surface. It is still heavy and still shiny. Some books ask this about mixing **carbon** with iron. Carbon alone makes ordinary steel, which is much harder than iron but still rusts; it is chromium and nickel that stop the rusting.

- v. b. copper is more reactive than silver

A • 1

Copper has pushed silver out of its salt, so copper is the **more reactive** metal. The blue color is copper nitrate, the new salt.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Lactic acid.

- b. MARKING SCHEME

K • 1

✓ Pink.



- c. MARKING SCHEME A • 1
✓ Temporary hardness.

5 Short answers

- a. MARKING SCHEME U • 2
✓ Any one difference, e.g. a strong acid gives many hydrogen ions in water (almost all its molecules split up); a weak acid gives few.
✓ Any second difference, e.g. a strong acid corrodes skin, cloth and metals, a weak acid is usually harmless in small amounts; or examples: hydrochloric, sulphuric acid; acetic, citric acid.
- b. MARKING SCHEME A • 2
✓ Magnesium hydroxide (milk of magnesia) is a mild base, an antacid.
✓ It neutralizes the extra hydrochloric acid in the stomach: $\text{Mg(OH)}_2 + 2\text{HCl} \rightarrow \text{MgCl}_2 + 2\text{H}_2\text{O}$.
- c. MARKING SCHEME U • 2
✓ Any one difference, e.g. temporary hardness is caused by the bicarbonates of calcium and magnesium; permanent hardness by their sulphates and chlorides.
✓ Any second difference, e.g. temporary hardness is removed by boiling or Clark's method; permanent hardness is not removed by boiling, but by washing soda or the permutit method.
- d. MARKING SCHEME A • 2
✓ Tube-well water is hard: its calcium and magnesium salts turn soap into a grayish scum that sticks in the cloth.
✓ Any one suggestion, e.g. soften the water with washing soda (or by boiling), use detergent instead of soap, or wash in rainwater.

6 Long answers

- a. ANSWER U • 4
Draw a tank with layers of gravel at the bottom, then coarse sand, then sodium zeolite (sodium aluminium silicate), with hard water poured in at the top and soft water coming out at the bottom. As the hard water trickles down through the zeolite, the calcium and magnesium ions in the water change places with the sodium ions in the zeolite: the calcium and magnesium stay on the zeolite and the sodium goes into the water, where it causes no hardness. Soft water flows out. When the zeolite is used up, a strong solution of sodium chloride is run through it to put the sodium back, and it is used again.
- MARKING SCHEME
- ✓ A labeled diagram: a tank of gravel, coarse sand and sodium zeolite, hard water in at the top, soft water out at the bottom.
 - ✓ The calcium and magnesium ions in the water are swapped for the sodium ions of the zeolite.
 - ✓ The calcium and magnesium stay on the zeolite, so the water that flows out is soft.
 - ✓ The used zeolite is recharged with strong sodium chloride (salt) solution and used again.



b. ANSWER

A · 4

- i. A turns methyl orange and litmus red, so A is an acid; phenolphthalein stays colorless in an acid, so X = colorless. B turns litmus blue and phenolphthalein pink, so B is a base; methyl orange turns yellow in a base, so Y = yellow.
- ii. A, the acid. Acids react with carbonates to give a salt, water and carbon dioxide:
 $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$.

MARKING SCHEME

- ✓ i. X = colorless (A is an acid).
- ✓ i. Y = yellow (B is a base).
- ✓ ii. A, the acid.
- ✓ ii. Because an acid reacts with a carbonate to give carbon dioxide (with a salt and water), e.g. $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$.

7 Numerical problem**ANSWER**

A · 2

Percentage of gold = $22 \div 24 \times 100 \approx 91.7\%$. Mass of the bangle = $2 \times 11.66 = 23.32$ g;
gold in it = $23.32 \times 22 \div 24 \approx 21.4$ g.

MARKING SCHEME

- ✓ $22 \div 24 \times 100 \approx 91.7\%$ gold.
- ✓ $2 \times 11.66 = 23.32$ g, and $23.32 \times 22 \div 24 \approx 21.4$ g of gold.

8 Think**ANSWER**

HA · 2

Acid rain makes the soil too acidic. I would suggest: (1) test the soil's pH; (2) spread lime (calcium hydroxide or powdered limestone) or wood ash, which are bases, to neutralize the acid; (3) add plenty of compost and manure to put back nutrients and make the soil healthier; and (4) in the long run, reduce the air pollution that causes the acid rain.

MARKING SCHEME

- ✓ Acid rain makes the soil too acidic, so spread a base such as lime (calcium hydroxide) or wood ash to neutralize the acid (after testing the soil's pH).
- ✓ Any one more, e.g. add compost and manure to put back the nutrients washed away; reduce the air pollution that causes the acid rain.

9 Activity: Acid, base or neutral?

(not marked)

WHAT STUDENTS SHOULD FIND

Lemon juice and vinegar: blue litmus turns red, red stays red, phenolphthalein stays colorless: acids.
Soap solution and ash water: red litmus turns blue, blue stays blue, phenolphthalein turns pink: bases.
Salt water: no change in any indicator: neutral.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Lapsi (garden):** Lapsi tastes sour because of the acids in its fruit; find it in the garden.
- **Himalayan Pink Salt (exhibit):** Pink rock salt is mostly sodium chloride, common salt; a trace of iron oxide colors it.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	11	10	12	2	35

