

Water

1. (a) water came into contact with rocks / ground / soil 1
ignore mountains; erode gets first mark
- ions or compounds or chemicals **or** they dissolved / soluble / leached / reacts / forms a solution 1
*do **not** accept gets picked up*
*accept water dissolves them from the rocks for **2** marks*
- (b) (i) calcium **or** magnesium 1
*accept Ca²⁺ **or** Mg²⁺ **or** Ca **or** Mg*
*do **not** accept Ca⁺ alone*
- (ii) answers must involve both calcium and magnesium
totals required for 2 marks
- Ridgway: Ca + Mg = 53 1
 Homeland: Ca + Mg = 27 1
accept there is (almost) twice as much
*Magnesium and Calcium in Ridgway water for **1** mark*
- (iii) equal volumes / quantities / amounts of water 1
 add soap with / shaking / mixing / agitation 1
*same amounts of soap = max **2***
*do **not** accept just add*
*do **not** accept solid soap*
- the harder sample (Ridgway) needs 2 x more soap to give lather
or the less hard sample (Homeland) needs half as much soap to give lather can get twice as much scum with harder (Ridgway) sample 1
- [8]
2. (a) scale – (solid) formed when heat decomposes dissolved calcium / magnesium compounds owtte 1
allow: scale is formed when hard water is heated / boiled (to leave magnesium / calcium compounds)
- scale is calcium carbonate / CaCO₃ or magnesium carbonate / MgCO₃
ignore evaporate
- scum – (ppt) formed when soap reacts with calcium /magnesium (ions) owtte 1
allow scum is formed when hard water reacts with soap
- scum is calcium stearate / magnesium stearate
- (b) calcium (ions) / Ca²⁺ / magnesium (ions) / Mg²⁺ 1
 replaced by hydrogen ions / H⁺ / sodium ions / Na⁺ 1
- [4]

3. **two** methods and **1 linked** explanation **or** **1** method and **two** explanations, **1** linked = **3** marks
no linking of method and explanation then max **2** marks
ignore references to removal of hardness
- METHOD 1:** Filter *ignore screening / sedimentation*
- explanation 1:** remove insoluble substances / remove solids / small bits / dirt / mud/ soil / sand / silt
- METHOD 2:** precipitate / flocculate / add eg. alum
allow other named substances
- explanation 2:** removes (some) soluble material as solids / removes (some) metal ions
- METHOD 3:** add chlorine / chlorine dioxide / ozone
- explanation 3:** sterilise / kill bacteria / microorganisms / microbes 3
ignore 'remove bacteria'; ignore disinfect
- [3]**
4. (a) weak *not slightly* 2
alkaline / base
mark independently
- (b) contains Ca^{2+} / Mg^{2+} / named calcium compound / correct formula 1
do not accept reference to soap not calcium / magnesium
- (c) build up of fur / scale / forms CaCO_3 / precipitate formed 1
not 'scum'
wastes energy / less efficient / takes longer to boil 1
- (d) (i) sample B 1
contains (calcium) sulphate / SO_4^{2-} 1
not softened by boiling / does not contain 1
many HCO_3^- ions / cannot precipitate CaCO_3
- (ii) by use of ion-exchange / washing soda / distillation 1
not detergent / soap
- (e) strengthen bones, teeth / taste 1
not good for you / healthier

[10]