

Strand I: Mixtures, elements and compounds

I.1: Structure of the atom

Section A

1. C
2. A
3. C
4. C
5. C
6. B
7. D

Section B

1.
 - (a) An atom is the smallest particle of an element that can take part in a chemical change.
 - (b) Protons: 11; Neutrons: 12; Electrons: 11
2.
 - (a) 13
 - (b) Metal
 - (c) It has 3 electrons in its outermost shell and tends to lose these electrons to form a positive ion.
- 3.

Sub-atomic particles	Charge	Location
Proton	Positive	Nucleus
Neutron	No charge	Nucleus
Electron	Negative	Energy level

4.
 - (a) 20
 - (b) 40
5. O- 2.6; Na – 2.8.1
6.
 - (a) Potassium, Magnesium
 - (b) Neon, Chlorine
 - (c) Metals are good conductors of heat and electricity, while non-metals are generally poor conductors.

I.2: Metals and alloys

Section A

1. C
2. D
3. C
4. A
5. C
6. D
7. A

Section B

1.
 - (a) An alloy is a material made by mixing a metal and another substance or substances. Common alloys include brass, steel, bronze, duralumin and stainless steel.
 - (b) During rusting, iron reacts with oxygen in the presence of water to form hydrated iron (III) oxide, which is rust. Conditions necessary for rust are oxygen and moisture.
2. Colour, state of metal, ductility, malleability, thermal and electrical conductivity.

3.

- (a) Painting forms a protective layer over the iron, preventing water and oxygen from coming into contact with the iron, thus preventing rusting.
- (b) Galvanising, Oiling or greasing

4.

Alloy	Composition
Steel	Iron and carbon
Stainless steel	Iron, chromium and nickel
Brass	Copper and zinc
Bronze	Copper and tin
Duralumin	Aluminium, copper and magnesium

5.

- (a) Good conductor of heat; High melting point
- (b) Good conductor of heat: Allows heat to pass quickly from the heat source to the food. High melting point: Prevents the pot from melting or deforming when exposed to high temperatures.

6.

- (a) Rusting did not occur in test tube **X** because boiled water removed all the oxygen in the water and the layer of oil prevented oxygen from dissolving in the water. Rusting did not occur in test tube **Y** because anhydrous calcium chloride absorbed moisture making it unavailable in the test tube. Rusting occurred in test tube **Z** because of the presence of water and oxygen in the test tube.
- (b) Rusting occurred in test tube **Z** because of the presence of water and oxygen in the test tube.

- (c) Anhydrous calcium chloride was used to absorb moisture from the air, keeping test tube Y dry.
- (d) Salt accelerates rusting. Therefore, the nail in test tube Y would rust faster.

I.3: Water hardness

Section A

1. A
2. A
3. A
4. A
5. A
6. C
7. B
8. A

Section B

1.

(a)

Water sample	Conclusion
Well water	Hard water
Rainwater	Soft water
Sample R	Soft water
Sample S	Hard water
Sample T	Soft water
Sample Q	Hard water

(b) Hard water contains dissolved calcium and magnesium salts and soft water does not. Soft water forms lather easily and quickly with soap, while hard water forms lather slowly/ does not lather and produces scum.

(c) Observation, classification, conclusion.

(d) To ensure a fair and valid comparison between the water samples, so that any difference in lather formed was due to the hardness of the water and not the amount of water or soap used.

(e) Rainwater.

2.

(a) The observation suggests that the water is hard water because it reacts with soap to form scum and therefore requires more soap before lather forms.

(b) Boiling the water. Adding sodium carbonate to the water. Distillation.

(c) Boiling removes temporary hardness.

3.

(a) Advantages of hard water

It contains calcium ions that are essential for strong bones and teeth.

When it is transported in led pipes, it does not dissolve the lead metal ions due to deposition of magnesium or calcium carbonate that prevents lead poisoning

(b) Disadvantages of hard water

It wastes soap when used for washing because more soap is required to form lather.

It forms scum that stains garments during washing.

It clogs hot water pipes and can make them burst.

It reduces the efficiency of kettles and boilers by forming scales on their heating elements.

(c) It contains calcium and magnesium ions, which are important minerals for strong bones and teeth.

4.

(a) Scale.

(b) The scale forms a layer on the heating element. This reduces the transfer of heat from the element to the water, so the appliances take longer to heat the water.

(c) Descale the appliances using a suitable acid such as vinegar.