Year 11 Chemistry Test ***SOLUTIONS***

Equations, Energy and Water

1.

(a) $K_3N_{(aq)}$

(b) $NH_4OH_{(aq)}$

(c) $Cr_2(CO_3)_{3\,(s)}$

2. The strong hydrogen bonding in the water causes surface tension, holding the water strider up.

3.

(a) Mg^{2+} and Ca^{2+}

(b) When soap is used it does not froth properly, so its cleaning effectiveness is reduced.

(c) When heated the termporary hard water is softened and the permanent hard water is still hard.

4.

(a) (answer may differ slightly)

Drinking water: Flocculation, sedimentation, filtration, disinfection.

Desalination: Seawater supply, pre-treatment, reverse osmosis, post-treatment.

Wastewater: Removing solids, extracting sludge, aeration, separating biomass.

(b) Drinking water:

Flocculation: it would be murky because the suspended clay particles would be present
Sedimentation: might not work at all, since the clay particles would clog up the filter later on
Filtration: it would be a funny colour because tiny particles would still be present
Disinfection: the water would not be safe to drink as it would contain harmful bacteria

Desalination:

Seawater supply: it would be air
Pre-treatment: might not work at all, since particles might clog up the reverse osmosis
Reverse osmosis: it would be salty
Post-treatment: it would be too pure (no minerals dissolved in it)

Wastewater:

Removing solids: it would contain rubbish and grit
Extracting sludge: it might be murky or worse
Aeration: it would contain organic pollutants
Separating biomass: it would be dirty and probably unhealthy

5.

(a) $MgBr_{2\,(aq)} + Ag_2SO_{4\,(aq)} \rightarrow MgSO_{4\,(aq)} + AgBr\,(s)$
$Br^-_{(aq)} + Ag^+_{(aq)} \rightarrow AgBr\,(s)$

(b) $HNO_{3\,(aq)} + Na_2CO_{3\,(aq)} \rightarrow NaNO_{3\,(aq)} + H_2O_{(l)} + CO_{2\,(g)}$
$2H^+_{(aq)} + CO_{3\,(aq)} \rightarrow H_2O_{(l)} + CO_{2\,(g)}$

(c) $HCl_{(aq)} + Fe_{(s)} \rightarrow H_{2\,(g)} + FeCl_{2\,(aq)}$
$2H^+_{(aq)} + Fe_{(s)} \rightarrow H_{2\,(g)} + Fe^{2+}_{(aq)}$

6.

(a) Increases their movement speed

(b) Sometimes the energy is used to break bonds to change the state of the substance (latent heat).

(c) $E = mL = 200 \times 334 = 66800$ J (3 s.f.)

(d) Into.

(e) $E = mc\Delta T$

$$\therefore \Delta T = \frac{E}{mc} = \frac{66800}{1000 \times 4.18} = 16°$$

$$\text{Final temperature} = 25 - 16 = 9°$$

BONUS QUESTION

A) (diagram would show the molecule v-shapes lining up)
As the water cools, its v-shaped molecules line up to form a regular hexagonal lattice.

or

B) (diagram would show the hydrogen bonding between separate molecules)
The strong hydrogen bonding between molecules attracts them together closely into a blob.