**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* D

*Explanation:*

‘Salt’ is not limited to NaCl, it includes any ionic compound.

**Question 2**

*Answer:* A

*Explanation:*

Fertilizer is generally ionic with compounds like NH4NO3.Most pesticides are organic and toxic waste incinerators will release organics and gases.

**Question 3**

*Answer:* B

*Explanation:*

Ferrocene is an example of an organometallic compound. They feature a metal bonded to an organic molecule.

**Question 4**

*Answer:* C

*Explanation:*

Electrical conductivity is an accepted method to be used to test salinity levels.

**Question 5**

*Answer:* C

*Explanation:*

It is the ions that will flow through the solution, not the electrons.

**Question 6**

*Answer:* B

*Explanation:*

A relatively low temperature can be used to drive the water from the crystals leaving anhydrous sodium carbonate. The melting point of the pure solid is relatively high.

**Question 7**

*Answer:* D

*Explanation:*

Option D is the better answer, as only one of the ions present is precipitated.

**Question 8**

*Answer:* A

*Explanation:*

Option A presents the only two soluble solutions that will allow barium and sulfate ions to precipitate.

**Question 9**

*Answer:* B

*Explanation:*

An excess of silver nitrate must be added to ensure that all the iodide ions are precipitated.

**Question 10**

*Answer:* B

*Explanation:*

Green is the complementary colour of red. The green light will be absorbed by the solution.

**SECTION B: Short-answer questions**

**Question 1** (8 marks)

**a**. Example: fertilizer run-off, mining tailings, mineral deposits such as limestone caves.

 2 marks

**b**.  **i**. ‘hard’ water has higher than usual concentrations of metal ions such as Mg2+, Ca2+ and

 Fe2+. 1 mark

 **ii**. Use higher levels of soap or treat the water with ions to precipitate the metal ions out

 1 mark

 **c**. Tetraethyl lead, Pb(C2H5)4, is neither an ionic compound or an ionic compound – it has characteristics of both. It has a metal ion combined with an organic component, the ethyl group.

 2 marks

**d**. Metals such as cadmium, mercury and lead are examples of heavy metal salts. They are toxic if they accumulate in your body and it is difficult for the body to get rid of them. 2 marks

**Question 2** (15 marks)

**a.** Sampling protocols provide guidelines for taking more than one sample, for sampling a

 range of different points and water depths. Sampling vessels need to be cleaned regularly and

 samples analysed promptly. 2 marks

**b**. Pure water is a poor conductor of electricity as it has few ions. Salt adds ions to the water. When electrodes are placed in the water, the sodium ions and chloride ions move to opposite electrodes. 2 marks

**c**. **i**. Connect two graphite electrodes to a power supply. Include an ammeter in the circuit. When the circuit is switched on and the electrodes inserted, a current will flow. Record the current. It should increase as the salinity increases. 3 marks

 ii. Use the same volume of solution, electrode depth, temperature and electrode separation each time. . 2 marks

**d.** 2 marks for graph

**ii**. values will vary with graphs 2 marks

 Lake A: 34.2 0.016 M

 Lake B: 54.3 0.027 M

**iii**. concentration is 0.016 mole per litre = 0.00016 mole per 10 mL 2 marks

 mass = 0.00016 x 58.5 = 0.0094 g

**Question 3** (8 marks)

**a. i**. Radiation needs to be complementary of the colour of the solution. A blue solution might

 use red light for example. 1 mark

 **ii**. A uv-visible spectrophotometer uses a monochromators in place of filter. This

 gives a better control of wavelength and a wider range. 1 mark

 **iii**. The intensity will drop as the solution concentration increases. 1 mark

**b**. 2 marks

 concentration

**c**.  **i**. 34 mg L-1 1 mark

 **ii**. 10 mL sample so the mass of copper is 0.34 mg 1 mark

 **Question 4** (4 marks)

Mass of water = 32.3 – 19.34 = 12.96 g

n(Fe(NO3)3) = 19.34/241.8 = 0.08 n(H2O) = 12.96/18 = 0.72

ratio 1:9 Fe(NO3)3:9H2O

**Question 5** (5 marks)

A 50.0 mL sample of water is known to contain lead ions (Pb2+). An excess of sodium chloride solution is added to the sample to produce a precipitate.

Initial mass of the filter paper: 0.923 g

Mass of filter paper and dried precipitate: 1.556 g

**a**. Pb2+(aq) + 2NaCl(aq) 🡪 PbCl2(s) + 2Na+(aq) 1 mark

**b.** n(PbCl2) = 0.633/278.1 = 0.00228 mol 4 marks

 mass(Pb) = 0.00228 x 207.2 = 0.471 g per mL = 0.0094 g

 c = 0.0094 g mL-1