Spec ref.		**Learning outcomes** *What most candidates should be able to do*	**Suggested timing (hours)**	**Opportunities to develop Scientific Communication skills**	**Opportunities to develop and apply practical and enquiry skills**	**Self/peer assessment opportunities and resources** *Reference to past questions that indicate success*	Key pieces of assessed work	
4.8.1.1	In chemistry, a pure substance is a single element or compound, not mixed with any other substance. Pure elements and compounds melt and boil at specific temperatures. Melting point and boiling point data can be used to distinguish pure substances from mixtures. In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state, eg pure milk.	Be able to use melting point data to distinguish pure from impure substances. WS 2.2, 4.1	1	Define the terms: • pure substance • compound. Explain, in terms of intermolecular forces, the terms: • melting point • boiling point. Use data to identify pure and impure substances. Identify the contents of mineral waters sold as 'pure'. Discuss the meaning of 'pure'.	Research the melting and boiling points of common pure substances and compounds. Suggest reasons for differences in data available on the internet.		Past paper question 4 specimen paper 1 set 1	
4.8.1.2	A formulation is a mixture that has been designed as a useful product. Many products are complex mixtures in which each chemical has a particular purpose. Formulations are made by mixing the components in	Identify formulations given appropriate information. Students do **not** need to know the	0.5	Define the terms: • mixture • formulation.	Research the composition of the following formulations: • fuel • cleaning agents • paints			

	carefully measured quantities to ensure that the product has the required properties. Formulations include fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods.	names of components in proprietary products. WS 1.4, 2.2			• medicines • alloys • fertilisers • foods. Identify the purpose of each chemical in the formulation.		
4.8.1.3	Chromatography can be used to separate mixtures and can give information to help identify substances. Chromatography involves a stationary phase and a mobile phase. Separation depends on the distribution of substances between the phases. The ratio of the distance moved by a compound (centre of spot from origin) to the distance moved by the solvent can be expressed as its R_f value: $$R_f = \frac{distance\ moved\ by\ substance}{distance\ moved\ by\ solvent}$$ Different compounds have different R_f values in different solvents, which can be used to help identify the compounds. The compounds in a mixture may separate into different spots depending on the solvent but a pure compound will produce a single spot in all solvents.	Explain how paper chromatography separates mixtures. Suggest how chromatographic methods can be used for distinguishing pure substances from impure substances. Interpret chromatograms and determine R_f values from chromatograms. Provide answers to an appropriate number of significant figures. WS 2.4, 2.6 MS 1a, 1c, 1d, 2a	2	Describe a method for paper chromatography. Explain what happens to substances during the process of chromatography. Describe to another student what the R_f value is and instructions on how to calculate the R_f value. Devise a method for distinguishing between pure and impure substances using chromatography.	**Required practical 6:** Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values. AT skills covered by this practical activity: 1 and 4.	Video clips YouTube: Basics of chromatography YouTube: Paper and thin layer chromatography Exampro user guide PowerPoint	Past paper question 7 specimen paper 2 set 1

4.8.2.1	The test for hydrogen uses a burning splint held at the open end of a test tube of the gas. Hydrogen burns rapidly with a pop sound.		0.5	Describe the test for hydrogen to another student.	Carry out a simple test for hydrogen.	Video clip YouTube: Testing for hydrogen, oxygen, carbon dioxide, (ammonia) and chlorine	
4.8.2.2	The test for oxygen uses a glowing splint inserted into a test tube of the gas. The splint relights in oxygen.		0.5	Describe the test for oxygen to another student.	Carry out a simple test for oxygen.		
4.8.2.3	The test for carbon dioxide uses an aqueous solution of calcium hydroxide (lime water). When carbon dioxide is shaken with or bubbled through limewater the limewater turns milky (cloudy).		0.5	Describe the test for carbon dioxide to another student.	Carry out a simple test for carbon dioxide.		
4.8.2.4	The test for chlorine uses litmus paper. When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white.		0.5	Describe the test for chlorine to another student.	Small amounts of chlorine can be generated from the electrolysis of brine (either as a demonstration or during a class practical).		exam