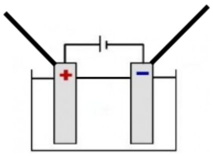
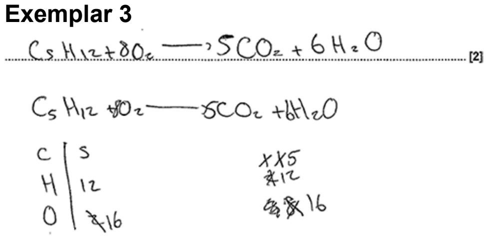
Mark scheme – Introducing Chemical Reactions (F)

Question			Answer/Indicative content	Marks	Guidance
1			C	1 (AO2.1)	
			Total	**1**	
2			D	1 (AO2.1)	
			Total	**1**	
3			B	1 (AO2.1)	
			Total	**1**	
4			A	1 (AO1.1)	
			Total	**1**	
5			C	1 (AO 2.1)	**<u>Examiner's Comments</u>** Candidates found this difficult, A and B were common incorrect responses.
			Total	**1**	
6			B	1 (AO 1.1)	
			Total	**1**	
7		i	Iodine + sodium bromide ✓	1 (AO2.1)	**Both required for the mark** **ALLOW** answers in either order
		ii	Bromine is more reactive than iodine / ORA ✓	1 (AO1.1)	**ALLOW i**odine cannot displace bromine
		iii	Cl_2 + 2Na*I* → 2NaC*l* + I_2 Formulae ✓ Balancing ✓	2 (AO1.1) (AO2.1)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg CL_2 + 2NA*I* → 2NaC*l* + I2
			Total	**4**	
8		i	Green ✓	1 (AO3.2b)	
		ii	Magnesium most reactive Zinc Iron	2 (AO3.2b)	

			Copper least reactive correct order – 2 marks magnesium as most reactive and copper as least – 1 mark		
		iii	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ ✓	1 (AO2.2)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of ‘+’ **ALLOW** a minor error in subscripts / formulae
			Total	**4**	
9	a	i	anode  cathode	2 (AO2 × 1.2)	All correct = 2 marks 1 or 2 correct = 1 mark
		ii	Positive electrode: bromine ✓ Negative electrode: lead ✓	2 (AO2 × 2.2)	**DO NOT ALLOW** bromide **ALLOW** reversed 1 mark
		iii	$PbBr_2$ ✓	1 (AO2.1)	
	b	i	All points plotted correctly scores 2 mark ✓✓ Straight line of best fit through the points ✓	3 (AO2 × 2.2 1.2)	**ALLOW** ± ½ square 3 or 4 points plotted correctly scores 1 mark **ALLOW** correctly drawn line of best fit through incorrectly drawn points; this may be a curve
		ii	0.72 (A) ✓	1 (AO3.1a)	**ALLOW** answer in the range 0.70 A – 0.74 A / ecf
		iii	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 47(g) award 2 marks** 5A = 15.5(g) = 15.5 × 3 = 46.5(g) ✓ = 47(g) (2 sig. figs) ✓	2 (AO2.1 1.2)	**ALLOW** 1.0 A = 3.1 (g) (from graph or table) 10(A) = 31(g) and 5 (A) = 1.55 (g) ✓ 15(A) = 31 + 1.55 = (46.5) 47 (g) ✓
			Total	**11**	
10			$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$ Formulae ✓ Balancing ✓	2 (AO2.2 ×2)	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **NOT** and / & instead of →

					balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae e.g. $CH_{4\,(\mathbf{g})}$ + **2**$O_{2\,(\mathbf{g})}$ → **2**$H_2O_{\,(\mathbf{g})}$ + $Co_{2\,(\mathbf{g})}$
			Total	**2**	
11		i	Hydrogen ion / H^+	1 (AO1.1)	
		ii	$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ Reactant ✓ Product ✓	2 (AO2.2 ×2)	
			Total	**3**	
12			$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ Formulae ✓ Balancing ✓	1(AO 1.1)	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** 'and'/'&' instead of '+' Balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg C_5H_{12} + 8O2 → 5Co_2 + 6h_2O __**Examiner's Comments**__ Many candidates wrote out the formulae correctly and so gained the first marking point, although some candidates used lower case letters. Many stopped at the formula stage without attempting the more difficult problem of balancing the equation. higher ability candidates went on to do the balancing, often with careful working showing lists of the different atoms on each side. See **exemplar 3**. **Exemplar 3** 
			Total	**2**	
13	a		large surface area to volume ratio (2)	2	**ALLOW** large surface area (1)
	b		Number of particles = 80.0 mg ÷ (5.0 × 10^{-3} mg) (1) = 16 000 particles (1)	2	
			Total	**5**	

14	a	i	both points correctly plotted (1) reasonable line of best fit (1)	2	
		ii	−4 to −10 °C dependent on line of best fit (1)	1	
		iii	as the number of carbon atoms increases the boiling point increases (1) idea that larger molecules have greater intermolecular forces (1)	2	
	b		$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (2) correct formulae (1) balancing (1)	2	balancing mark is conditional on correct formulae **ALLOW** any correct multiple, e.g. $2C_3H_8 + 10O_2 \rightarrow 6CO_2 + 8H_2O$ (2) **ALLOW** = or Δ or ⇌ for arrow **DO NOT ALLOW** 'and' or & for + **ALLOW** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $C^3H^8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$ (2)
			Total	**6**	
15			**Correct – Any two from:** sulfuric acid reacts with zinc and / or zinc carbonate to make zinc sulfate (1) zinc reacts with acid to make hydrogen (1) zinc carbonate reacts with acid to make carbon dioxide (1) **Incorrect – Any two from:** Both reactions do not make hydrogen (1) zinc and / or zinc carbonate will not react with hydrochloric acid to make zinc sulfate (1) zinc carbonate does not make hydrogen when it reacts with acid (1)	4	
			Total	**3**	
16			** Please refer to the marking instruction point 10 for guidance on how to mark this question.* **Level 3 (5–6 marks)** **Suggestion would enable pure dry samples of all three components to be obtained in the correct sequence with clear explanations of why the methods work.** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)**	6	**AO3.3a: Analyse information in the table to develop experimental procedures** • Wash solid **C** with water and allow to dry. • Evaporate solution of **B** to obtain solid crystals. • Using a magnet will separate **A** from other two. • Add water to mixture of **B** and **C**. • Filter mixture of **B** and **C**. • Rinse and dry solid **C**. • Evaporate solution of **B**. **AO2.2: Apply knowledge of purification techniques**

18			**Suggestion would enable pure dry samples of two of the components of the mixture to be obtained with an attempt at an explanation.** *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** **Suggestion would enable a pure sample of one of the components to be obtained.** *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*		• **A** is magnetic or **B** and **C** are not magnetic. • **A** can be removed from the mixture as it will stick to the magnet. • **B** will dissolve but **C** will not. • Solid **C** will be left after filtering.
			Total	**3**	
17			B	1	
			Total	**1**	
18		i	Same number of electrons in outer shell / all have 7 electrons in outer shell (1)	1	**ALLOW** outer electrons or valence electrons rather than electrons in the outer shell **ALLOW** valence shell rather than outer shell **DO NOT ALLOW** the wrong number of electrons in the outer shell
		ii	$2Na + Br_2 \rightarrow 2NaBr$ Correct formulae of reactants and products (1) Balancing – depend on correct formulae (1)	2	**ALLOW** any correct multiple of the equation including fractions **ALLOW** = or ⇌ instead of → **DO NOT ALLOW** and or & instead of + **ALLOW** one mark for correct balanced equation with minor errors of case and subscript e.g. 2NA + Br2 → 2NaBr
		iii	KAt (1)	1	
			Total	**4**	
19	a		$S + O_2 \rightarrow SO_2$ (1) $2SO_2 + O_2 \leftrightharpoons$ (1) $2SO_3$ (1) $SO_3 + H_2O \rightarrow H_2SO_4$ (1)	4	One mark for each correct balanced equation One mark for reversible reaction sign
	b		17 (g) of ammonia makes 66 (g) of ammonium sulfate	1	

			So 51 g makes 198 g of ammonium sulfate (1)		
			Total	**5**	
20			$C_{15}H_{32} \rightarrow 2C_6H_{12} + C_3H_8$ (1)	1	**ALLOW** any correct multiple
			Total	**1**	