2. Atoms, molecules and stoichiometry

2.3 Formulas

Paper 2

Marking Scheme

Q1.

(a)	**M1** % / A_r for C H O **M2** each % / A_r for C H O divided by the smallest value for % / Ar to give simplest whole number ratio / empirical formula **M3** compare M_r from **M2** ratio with 280 to deduce the actual molecular formula C H O 77.2 / 12 = 6.433 11.4 / 1 = 11.4 11.4 / 16 = 0.7125 9(.03) 16 1 $M_r(C_9H_{16}O)$ = 140 so molecular formula of **V** = $C_{18}H_{32}O_2$	**3**

Q2.

(b)	C : H : O 41.38 / 12 3.45 / 1 55.17 / 16 3.45 3.45 3.45 (so $C_{(1)}H_{(1)}O_{(1)}$)	**1**

Q3.

(d)(i)	phosphate(V)	**1**
(d)(ii)	*(molecular mass of NH_4MgPO_4)* = 137.3	**1**
	(245.3 – $M_r(NH_4MgPO_4)$ ÷ 18.0) = 6	**1**

Q4.

(a)(ii)	CO_2H	**1**

(b)(i)	$CaC_2O_4(s) \rightarrow CaO(s) + CO_2(g) + CO(g)$ **M1** correct formulae	**1**
	M2 balancing equation AND state symbols.	**1**

Q5.

(b)	(1)MBr_2 + 2$AgNO_3$ → 2AgBr + **M**$(NO_3)_2$	**1**

Q6.

(a)(i)	$2CuSO_4(aq) + 4KI(aq) \rightarrow 2CuI(s) + (1)I_2(aq) + 2K_2SO_4(aq)$ **M1** correct balancing **M2** correct state symbols	2

Q7.

(b)	Mass of 0.0982mol $CuSO_4$ in 17.43g $CuSO_4$.**y**H_2O	**M1** *calculate M_r $CuSO_4$ using Ar from data booklet* 63.5 + 32.1 + 64.0 = 159.6 **M2** *use Mr to calculate mass of $CuSO_4$* (0.0982 × M1) =15.67272g	4
	number of water in 17.43g of $CuSO_4$ **y**H_2O	**M3** *calculate the mass amount of water in sample AND use this value to calculate the amount of water present* (17.43-15.67)/18 = 0.097778 mol	
	value of **y**	**M4** *use the ratio of M2: 0.0982 to find y* (mol H_2O ÷ mol $CuSO_4$) = 1	

Q8.

(b)	$Mg_2Si(s) + 4H_2O(l) \rightarrow 2Mg(OH)_2(aq) + SiH_4(g)$ **M1** correct balancing and formulae	1
	M2 state symbols	1

Q9.

(b)(i)	**M1** *divide by A_r*	C 54.5 / 12	H 9.1 / 1	O 36.4 / 16	1
	M2 *divide by smallest number*	4.54 / 2.275 (= 2 OR 1.99)	9.1 / 2.275(=4)	2.275 / 2.275 (=1)	1
	M3 *empirical formula based on correctly rounded values of M2*		C_2H_4O		1