Revision PPQu – Unit 3: Moles and Calculations MARK SCHEME

Q1.

M1 (M_r of sodium carbonate) = 106 **M2** (moles of sodium carbonate 2.12 ÷ 106 =) 0.02 **M3** (mass of carbon dioxide 0.02 × 44 =) 0.88 (g)	 **ALLOW** ecf from **M1** **M2** subsumes **M1** **ALLOW** answer from **M2** x 44 answer of 0.88 (g) with or without working scores 3	3

Q2.

(i)	**M1** $\frac{38.7}{12}$ $\frac{9.7}{1}$ $\frac{51.6}{16}$ **OR** 3.225 9.7 3.225 **M2** (divide by smallest) 1 3 1	0 marks if upside down calculation or use of atomic numbers	2
(ii)	**M1** Mr of CH_3O = 31 **M2** (62 ÷ 31 = 2 so molecular formula is) $C_2H_6O_2$	$C_2H_6O_2$ without working scores 2	2

Q3.

(a)

M1 calculation of actual mass of crystals obtained M2 division by expected mass of crystals (6.4) and multiplication by 100 to convert to percentage M3 correct to 1 dp Example calculation M1 (6.40 – 1.80 =) 4.6(0) M2 (% yield =) $\frac{4.6}{6.4}$ x100 OR 71.875 (%) M3 = 71.9 (%)	 M2 ECF M1 M3 DEP M2	3

(b)

M1 find percentage of water M2 divide each percentage by Mr to find number of moles M3 divide each answer by smallest to find ratio and value of x Expected calculation: M1 (79%) $CaSO_4$ 21% H_2O M2 $\frac{79}{136}$ (= 0.58) $\frac{21}{18}$ (= 1.17) M3 $\frac{0.58}{0.58}$ $\frac{1.17}{0.58}$ = 1 : 2 so x = 2	 correct answer without working scores 3	3

Q4.

Question number	Answer	Notes	Marks
(a) (i)	so that the (hot) lead does not react with oxygen/air (converting back into lead oxide)	**ACCEPT** so that lead is not oxidised (back to lead oxide)	1
(ii)	M1 repeat the heating M2 until the mass remains constant/ does not change	**ACCEPT** heat to constant mass for both marks	2
(b) (i)	4.66 (g)		1
(ii)	0.48 (g)		1
(iii)	• calculate the moles of lead and oxygen • divide by the smaller number • calculate the whole number ratio • give the empirical formula Example calculation **M1** $\frac{4.66}{207}$ and $\frac{0.48}{16}$ **OR** 0.0225 and 0.03(00) **M2** $\frac{0.0225}{0.0225}$ and $\frac{0.03(00)}{0.0225}$ **OR** 1:1.33 **M3** 1 x 3 and 1.33 x 3 **OR** 3:4 **M4** Pb_3O_4	Division by atomic numbers or upside down calculation scores 0 3:4 ratio without working scores 3 Pb_3O_4 without working scores 4 **ALLOW** ECF from incorrect masses.	4

Question number	Answer	Notes	Marks
(c) (i)	$Pb(NO_3)_2$ (aq) + 2HCl (aq) → $PbCl_2$ (s) + 2HNO_3 (aq)	**ALLOW** any combination of uppercase and lowercase letters	1
(ii)	• calculate the amount of $PbCl_2$ • multiply the moles by the M_r of $PbCl_2$ • evaluation to show that the value is about 5 g Example calculation **M1** $n(PbCl_2) = \frac{0.0370}{2}$ **OR** 0.0185 (mol) **M2** mass of $PbCl_2$ = 0.0185 x 278 (g) **M3** 5.143 (g)	**MAX 1** for 0.0370 x 278 if no division by 2 in **M1** **ALLOW** any number of sig figs 5.1, 5.14 and 5.143 g without working score 3 5 g without working scores 0 **ALLOW** alternative methods	3
			Total 13

Extensions

Q1

M1 moles of water = 0.02 x 5 **OR** 0.1 M2 molecules of water = 6×10^{22}	 ALLOW ecf from M1 Correct answer without working scores 2 1.2×10^{22} scores 1	2	

Q2.

M1 amount of water = 2.16 ÷ 18 = 0.12 mol 1

M2 number of hydrogen atoms = (0.12 ÷ 0.01) x 2 = 24 1

M3 formula of alkane = $C_{11}H_{24}$ 1

Correct answer of $C_{11}H_{24}$ scores 3 marks

Q3.

(c)	M1 8.46×10^{-3} mol of zinc M2 therefore 1.69×10^{-2} mol hydrochloric acid needed (which is less than 2.50×10^{-2} mol) **OR** M1 1.25×10^{-2} mol of zinc are needed M2 therefore 0.8(13) g of zinc is needed (and there is only 0.55g)	**ALLOW** any number of sig figs including one e.g. 0.008 moles of zinc, therefore 0.016 moles of acid needed scores M1 and M2	2