Mark scheme

Mole calculations

Chemistry 0620 · Paper 4 (Extended)

Total marks

46

MARKS FOR EACH QUESTION

1	2	3	4	5	6	Total
4	6	7	8	9	12	**46**

Question 1 [4]

1	**M1** 5 moles of calcium nitrate (1) **M2** 10 moles ammonium nitrate (1) or ecf **M1** × 2 **M 3** M_r of ammonium nitrate = 80 **M4** 800 g or ecf **M2** × **M3**	4

Question 2 [6]

2(a)	0.025 **M1** 50 / 1000 (=0.05) **M2** (0.05 × 0.5) = 0.025	 1 1
2(b)	0.0125	1
2(c)	0.55 **M1** 44 **M2** 0.55	 1 1
2(d)	0.3	1

Question 3 [7]

3(a)	(thermal) decomposition	1
3(b)	84 (1) 12.6 / 84 = 0.15(00) (1) 0.15(00) / 2 = 0.075(00) (1) 0.075(0) × 24.0 = 1.8 (1)	4
3(c)	$Ca(OH)_2$ (1) $CaCO_3$ (1)	2

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Question 4 **[8]**

4 **(a)** **(i)** (the number of particles which is equal to the number of atoms in) 12 g of carbon 12
or
the mass in grams which contains the Avogadro's constant number of particles
or
Avogadro's constant **or** 6 to 6.023 × 10^{23} of atoms / ions / molecules / electrons / particles
or
(the amount of substance which has a mass equal to) its relative formula mass / relative atomic mass / relative molecular mass in grams
or
(the amount of substance which has a volume equal to) 24 dm^3 of a gas at RTP
[1]

(ii) (Avogadro's constant is the) number of particles / atoms / ions / molecules in one mole of a substance
or
the number of carbon atoms in 12 g of C(12).
or
the number of particles / molecules in 24 dm^3 of a gas at RTP
or
6 to 6.023 × 10^{23} (particles / atoms / ions / molecules / electrons) [1]

(b) CH_4 **and** SO_2 [1]

2/16 = 1/8 or 0.125 moles of CH_4 **AND** 8/64 = 1/8 or 0.125 moles of SO_2 [1]

(c) **(i)** 4.8/40 = 0.12 moles of Ca
3.6/18 = 0.2 moles of H_2O **both** correct [1]

(ii) Ca is in excess (**no mark**) (because 0.12 moles of Ca need) 0.24 moles / 4.32 g of H_2O to react [1]
there is not enough / there are 0.2 moles / 3.6 g of H_2O [1]
or
Ca is in excess **(no mark)** (because 0.2 moles / 3.6 g of water will react with) 0.1moles/4.0 g of Ca [1]
there is more than that / there are 0.12 moles / 4.8 g of Ca [1]
or
Ca is in excess **(no mark)** because the mole ratio Ca:H_2O is 3:5 / mass ratio 4:3 [1]
which is bigger than the required mole ratio of 1:2 / mass ratio 10:9 [1]
or
Ca is in excess **(no mark)** because the mole ratio H_2O:Ca is 5:3 / mass ratio 3:4 [1]
which is smaller than the required mole ratio of 2:1 / mass ratio 9:10 [1]

(iii) 0.02 × 40 = 0.8 (g) [1]

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Question 5 [9]

5(a)	carbon dioxide / a gas is made;	1
5(b)(i)	red;	1
5(b)(ii)	0.001;	1
5(b)(iii)	0.0005;	1
5(b)(iv)	0.031 (2 marks) **M1 (iii)** / 0.0162;	2
5(c)	0.48 (dm^3) **M1** moles carbon dioxide = 0.02; **M2** volume carbon dioxide = 0.02 × 24; **M3** = 0.48 (dm^3);	3 1 1 1

Question 6 [12]

6(a)	relative atomic mass	1
6(b)	C_4H_{10} is covalent	1
	KF is ionic	1
6(c)	mol of Y = 0.060 / 24.0 = 2.5×10^{-3} or 0.0025	1
	M_r = 0.095 / 2.5×10^{-3} = 38(.0)	1
	fluorine	1
6(d)	mass of O = 3.87 g – 1.68 g = 2.19 (g)	1
	mol of P 1.68 / 31 OR 0.054.. and mol of O 2.19 / 16 **OR** 0.13…	1
	ratio of P to O P = 0.054… / 0.054 = 1 O = 0.13… / 0.054… = 2.5	1
	whole number ratio and P_2O_5 = 2 = 5	1
6(e)	the formula is P_4O_6 or (one mole of) P_2O_3 = 110 (g)	1
	mass = 220 (g)	1

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