Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) (i) $75.0 \times 10^{-3} \times 0.500 = 0.0375$ (mol)	1	
(ii) $21.6 \times 10^{-3} \times 0.500 = 0.0108$ (mol)	1	
(iii) $0.0375 - 0.0108 = 0.0267$ (mol)	1	
(iv) *moles of* $MgCO_3 = 0.0267/2 = 0.01335$ (mol)	1	0.0133 to 0.0134 would be allowed.
mass of $MgCO_3 = 0.01335 \times 84.3$	1	
$= 1.125$ g	1	
percentage $MgCO_3 = 1.125/1.25 \times 100$	1	Keep going through the calculation. You can score consequential marks even if you have made an arithmetic error.
$= 90\%$	1	
(b) (i) % oxygen = 38.0	1	If no % of oxygen, maximum 1 mark.
Na = 36.5/23 S = 25.5/32.1 O = 38.0/16 = 1.587 = 0.794 = 2.375	1	
= 2 : 1 : 3	1	
(ii) $Na_2SO_3 + 2HCl - 2NaCl + H_2O + SO_2$	1	You can also have multiples when balancing your equation.
2 (a) (i) $100 \times 10^{-3} \times 0.500 = 5.00 \times 10^{-2}$ (mol)	1	accept 5×10^{-2} / 0.05
(ii) $27.3 \times 10^{-3} \times 0.600 = 1.64 \times 10^{-2}$ *or* 1.638×10^{-2} (mol) only	1	
(iii) 1.64×10^{-2} (mol)	1	
(iv) $5.00 \times 10^{-2} - 1.64 \times 10^{-2} = 3.36 \times 10^{-2}$ (mol)	1	
(v) $3.36 \times 10^{-2} \times ½ = 1.68 \times 10^{-2}$ (mol)	1	if 2.78×10^{-2} used 1.39×10^{-2}
$1.68 \times 10^{-2} \times 132.1$ *or* $1.39 \times 10^{-2} \times 132.1$	1	
= 2.22 g *or* 1.83 g	1	
(b) $pV = nRT$	1	If you get the moles wrong you will get consequential marks if you use your mole value correctly.
$n = \frac{0.143}{17} = 8.41 \times 10^{-3}$ (mol)	1	
$T = \frac{pV}{nR} = \frac{100\,000 \times 2.86 \times 10^{-4}}{8.31 \times 8.4 \times 10^{-3}}$	1	
$= 408.5 - 410.5$ (K)	1	

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3 (a) moles $HNO_3 = 175 \times 10^{-3} \times 1.5 = 0.2625$ mol	1	
moles $Pb(NO_3)_2 = ½ \times 0.2625 = 0.131$ mol	1	You must use the ratio from the equation, i.e. 2 : 1
M_r $Pb(NO_3)_2 =$ 331.2	1	
mass $Pb(NO_3)_2 = 331.2 \times 0.131 = 43.3$ g	1	
(b) (i) $pV = nRT$	1	Don't forget p in Pa, V in m^3 and T in K.
$n = \frac{pV}{RT} = \frac{100\,000 \times 1.5 \times 10^{-4}}{8.31 \times 500}$	1	
$= 3.61 \times 10^{-3}$	1	
(ii) moles $NO_2 = 4/5 \times 3.61 \times 10^{-3}$	1	Ratio of gas molecules: there are 4 NO_2 and 1 O_2, so the fraction of NO_2 in the mixture of gases is 4/5.
$= 2.89 \times 10^{-3}$ *or* 1.78×10^{-3}	1	
M_r $NO_2 = 46$	1	
mass $NO_2 = 46 \times 2.89 \times 10^{-3} = 0.1.33$ (g) *or* 0.0821 (g)	1	
4 (a) (i) Avogadro's number of molecules / particles / species / 6×10^{23}	1	
or same number of atoms as in 12.(00) g of ^{12}C	1	
(ii) moles $O_2 = \frac{0.350}{32}$ $(= 1.09 \times 10^{-2}$ mol)	1	Give answer to 3 significant figures.
$= 29\ (\times 1.09 \times 10^{-2})$	1	
$= 0.316 – 0.317$ mol	1	
(iii) moles of nitroglycerine $= 4 \times 1.09 \times 10^{-2}$ (= 0.0438 mol)	1	Give answer to 3 significant figures.
M_r of nitroglycerine = 227	1	
moles of nitroglycerine $= 227 \times 0.0438 = 9.94–9.95$	1	
(b) $pV = nRT$	1	
$p = \frac{nRT}{V} = \frac{0.873 \times 8031 \times 1100}{1.00 \times 10^{-3}}$	1	
$= 7\,980\,093$ *or* 7980 *or* 7.98	1	
units = Pa *or* kPa *or* MPa (as appropriate)	1	

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5 **(a)** **(i)** moles $KNO_3 = 1.00/101.1 = 9.89 \times 10^{-3}$ (mol)	1	
(ii) $pV = nRT$ *or* $n = pV/RT$	1	
moles $O_2 = n = \frac{pV}{RT}$	1	
$= \frac{100\,000 \times 1.22 \times 10^{-4}}{8.31 \times 298}$	1	
$= 4.93 \times 10^{-3}$ (mol)	1	
(b) **(i)** simplest ratio of atoms of each element in a compound	1	You must learn this definition exactly.
(ii) K N O $\frac{45.9}{39.1}$ $\frac{16.5}{14}$ $\frac{37.6}{16}$ 1.17 1.18 2.35 1 1 2 KNO_2	3	If % of O is missing then you can only get one mark.
(c) $2KNO_3 \rightarrow 2KNO_2 + O_2$	1	You can put multiples of an equation.

Nelson Thornes is responsible for the solution(s) given and they may not constitute the only possible solution(s).