M1.D

[1]

M2.A

[1]

M3. *Ideal gas equation*: pV = nRT **(1)**

Calculation: n = pV/RT = $\frac{103000 \times 127 \times 10^{-6}}{(8.31 \times 415)}$ **(1)**

mark for volume conversion fully correct

= 3.79×10^{-3} (mol) **(1)**

range 3.79×10^{-3} to 3.8×10^{-3}

M_r = m/n = .304/3.79×10^{-3} = 80.1 **(1)**

range 80 – 80.3
min 2 s.f. conseq
If 'V' wrong lose M2; 'p' wrong lose M3; 'inverted' lose M3 and M4

[5]

M4. (penalty for sig fig error =1mark per question)

(a) (i) moles KNO_3 = 1.00/101.1 = 9.89×10^{-3} (mol)

1

(ii) pV = nRT or n = pV/RT

1

moles O2 = n = $\frac{pV}{RT}$ = **(1)** $\frac{100000 \times 1.22 \times 10^{-4}}{8.31 \times 298}$ **(1)**

2

= 4.93×10^{-3} (mol)

1

(mark answer first – check back if wrong)
(transcription error lose M3, mark M4 conseq on error)
(if 'untraceable' figures used M3=M4=0)
(if wrong temp conversion – lose M3 – conseq M4)
(if n = RT/pV CE, lose M3 and M4)

(b) (i) simplest/lowest ratio of atoms of each / element/s in a compound / substance / species / entity / molecule

1

(ii) *K* *N* *O*

$\frac{45.9}{39.1}$ $\frac{16.5}{14}$ $\frac{37.6}{16}$ (1)

(1)

1.17 1.18 2.35

1 1 2 KNO^2 (1)

(M3 tied to M2), (M3 can be transferred from equation if ratio correct but EF not given) (if calc inverted, lose M2 and M3), (if used At N^1 / wrong No for Ar then CE, lose M2 and M3) (if % of O missing, award M2 only)

3

(c) $2KNO_3 \rightarrow 2KNO_2 + O_2$ or fractions/multiples

(accept $2KNO_3 \rightarrow K_2N_2O_4 + O_2$)
(do NOT accept 'Y' in equation)

1

[10]

M5. B

[1]

M6. (a) (i) 4.86×10^{-3}

1

(ii) 2.43×10^{-3}

(mark conseq on (a)(i))

1

(iii) 2.43×10^{-2}

(mark conseq on (a)(ii))

1

(iv) $3.01/2.43 \times 10^{-2}$

(mark conseq on (a)(iii))

1

124

(Do not allow 124 without evidence of appropriate calculation in (a)(iii))

1

(b) $M_r(Na_2CO_3) = 106$
M_r (xH_2O) = 250 –106 = 144 *(mark conseq on M1)*
x = 8 *(mark conseq on M2)*

(Penalise sf errors once only)

3

(c) (i) PV = nRT

1

(ii) Moles A_r = 325/39.9 = 8.15

(accept M_r = 40)

1

P = nRT/V = (8.15 × 8.31 × 298)/5.00 × 10^{-3}
= 4.03 × 10^6 Pa or = 4.03 × 10^3 kPa

Range = 4.02 × 10^6 Pa to 4.04 × 10^6 Pa

(If equation incorrectly rearranged, M3 & M4 = 0 If n =325, lose M2)

(Allow M1 if gas law in (ii) if not given in (i))

2

[12]

M7. (a) moles HNO_3 = 175 × 10^{-3} × 1.5 = (0.2625 mol);

1

moles $Pb(NO_3)_2 = ½ \times 0.2625 = (0.131\ mol)$;

1

$M_r\ Pb(NO_3)_2 = 331(.2)$;

1

mass $Pb(NO_3)_2 = 331.2 \times 0.131 = 43.5$ g;

(accept 43.2 - 43.8)

(M1 & M2 are process marks. If error in M1, or in M2, do not mark M4 consequentially, i.e. do not award M4)

(if atomic numbers used in M3, do not award M4)

1

(b) (i) $pV = nRT$;

1

$$n = \frac{pV}{RT} = \frac{100000 \times 1.5 \times 10^{-4}}{8.31 \times 500};$$

1

$= 3.61 \times 10^{-3}$;

(If pressure not converted to Pa, max 2)

(If $n = \frac{RT}{pV}$ *used = CE; M2 = M3 = 0)*

1

(ii) moles $NO_2 = 4/5 \times 3.61 \times 10^{-3}$;

[mark is for use of 4/5]

1

$= 2.89 \times 10^{-3}$ *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);

(if atomic numbers used, M3 = M4 = 0)

1

[11]

M8. (a) (i) $100 \times 10^{-3} \times 0.500 = 5.00 \times 10^{-2}$ (mol)

accept 5×10^{-2} / 0.05

1

(ii) $27.3 \times 10^{-3} \times 0.600 = 1.64 \times 10^{-2}$ / 1.638×10^{-2} (mol) only

1

(iii) 1.64×10^{-2} (mol)

Mark conseq on (ii)

1

(iv) $5.00 \times 10^{-2} - 1.64 \times 10^{-2} = 3.36 \times 10^{-2}$ (mol)

Mark conseq on (i) & (iii)

1

(v) $3.36 \times 10^{-2} \times ½ = 1.68 \times 10^{-2}$ (mol)

If 2.78×10^{-2} used 1.39×10^{-2}

Mark conseq on (iv)

1

$1.68 \times 10^{-2} \times 132(.1)$ **or** $1.39 \times 10^{-2} \times 132(.1)$

Mark for M_r

1

= 2.22 g **or** 1.83 g

1

(b) $pV = nRT$

1

$n = \frac{0.143}{17}$ = $8.4(1) \times 10^{-3}$ (mol)

1

$T = \frac{pV}{nR} = \frac{100000 \times 2.86 \times 10^{-4}}{8.31 \times 8.4 \times 10^{-3}}$ (1)

1

= 408.5 – 410.5 (K)

Mark conseq on moles

***Note** Sig. fig. penalty - apply once if single sf given, unless calc works exactly*

1

[11]