**AS Amount of Substance (Ans)**

**1.** (a)  × 12 **(1)** 2

(b) Multiply by Avogadro’s number 1

(c) (i) Moles NaH =  **(1)**  
moles NaOH = Moles NaH = 0.0417 **(1)**  
= 0.167 mol2 dm–3 **(1)**  
(allow 0.166 – 0.168)

(ii) pV = nRT **(1)**  
= **(1)** allow consequential  
= 0.00102 m3 **(1)**  
(allow 0.00101 – 0.00103) (allow in dm3 or cm3)

(iii) vol HCl =  × 1000 =  × 1000 **(1)**

= 37.3 cm3 **(1)**

(allow 37.1 to 38.0 and conseq.) 8

[11]

**2.** (a) simplest ratio of atoms of each element in a compound **(1)** 1

(b) mass of O = 1.842 g **(1)**  
Ca : N : O = :: **(1)**

= 1:2:6

CaN2O6 **(1)** 3

(c) Mr **(1)** 1

(d) (i) n =  **(1)** (allow PV = nRT)

=  **(1)**

= 0.0597 **(1)** (allow 0.059 to 0.06)

(ii) 0.0597 ×4 = 0.239 **(1)** (allow 0.24)  
 (allow conseq on (i))

(iii) moles NH3 = 0.293 ×  = 0.00597 **(1)**

volume = 1000 ×  = 39.8 (cm3) **(1)**

(allow conseq  
 allow 0.0398 dm3) 6

[11]

**3.** (a) Moles HCl =  =  **(1)** (= 0.537)  
Concentration =  **(1)**  
 = 2.15 (mol dm–3) **(1)**

Conseq on  correct  
min 2 d.p. 2.14 to 2.15  
Ignore units  
A.E. lose one mark

3

(b) (i)  = 5.7**(1)** × 10–3 (mol) **(1)**

5.7 to 5.71 × 10–3

(ii)  = 2.85 × 10–3 (mol) **(1)**

Conseq

(iii)  = 138 **(1)**

Conseq

(iv) *Relative atomic mass of* ***M***: 138 - 60 = 78 **(1)  
  =** 39 **(1)***Identify of* ***M***: Potassium or K or K+ **(1)**

Conseq  
If 78 = Mr then M = selenium

6

[9]

**4.** (a) (i)Avogadro’s number/constant of molecules/particles/species / 6  1023 1

[Not ‘atoms’]

**Or** same number of particles as (there are atoms)

[Not molecules]

in 12.(00)g of 12C 1

(ii) Moles O2 = (= 1.09  10–2 mol) 1

= 29 ( 1.09  10–2) 1

[Accept answers via 4 separate mole calculations]

= 0.316 – 0.317 mol [answer to 3+ sf] 1

[Mark conseq on errors in M1/M2] (1)

(iii) Moles of nitroglycerine = 4  1.09  10–2 (= 0.0438 mol) 1

[Mark conseq on their moles of O2]

*M*r of nitroglycerine = 227 or number string 1

Moles of nitroglycerine = 227  0.0438 = 9.90 – 9.93(g)

[answer to 3+ sf]

[If string OK but final answer wrong then allow M6 but AE for M7]

[Mark conseq on error in Mr] [Penalise wrong units]

[Penalise sig. fig. errors once only in whole question]

(b) pV = nRT **or** pV =  **or** p =  1  
 p =  =  1

= 7980093 **or** 7980 **or** 7.98 1

[ignore s.f.]

units = Pa **or** kPa **or** MPa (as appropriate) 1

[If error in conversion from Pa, treat as a contradiction of the units mark]

[If transfer error, mark conseq but penalise M2]

[If data from outside of above used, penalise M2 and M3]

[If pV expression incorrectly rearranged, penalise M2 and M3]

[if T = 1373 K used, penalise M2]

[11]

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

(a) (i) moles KNO3 = 1.00/101.1 = 9.89 × 10-3 (mol) 1

(ii)

moles O2 = n =  = **(1)**  **(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)

*K* *N* *O*

  (1)

1.17 1.18 2.35

1 1 2 KNO2 (1) 3

*(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)*

(c) 2KNO3 → 2KNO2 + O2 or fractions/multiples 1

*(accept* 2*KNO*3 *→ K*2*N*2*O*4 *+ O*2*)*

*(do NOT accept ‘Y’ in equation)*

[10]

A = 42

B = 36

C = 31

D = 26

E = 21