Gateways School

**Period 3 & Reactions of aqueous ions**

**Revision PPQ Answers**

39 marks

**Q1.**

(a)     (i)      Deductions:

         Ionic **(1)**Ions not free to move in the solid state **(1)**Ions free to move when molten or in aqueous solution **(1)**Identity of **P**: Na2O or sodium oxide **(1)**

*N.B. If a formula given this must be correct*

         Equation: Na2O + H2O → 2 NaOH **(1)**

**5**

(ii)     Deductions:

         Covalent  
Intermolecular forces are weak or van der Waals forces,  
or dipole-dipole

*N.B. Any answer including a reference to hydrogen bonding is incorrect*

         Identity of **Q**: SO2 or sulphur dioxide **(1)**

         Equation: SO2 + H2O → H2 SO3**(1)**

*NB Allow max one for SO3*

**4**

(b)     (i)      Amphoteric **(1)**

(ii)     Equation with NaOH

         Al(OH)3 + NaOH → NaAl(OH)4

*OR Al(OH)3(H2O)3 + OH– → [Al(OH)4(H2O)2]– + H2O  
OR Al(OH)3 + OH– → [Al(OH)4]–*

**R** identified as Al(OH)3 or Al(OH)3(H2O)3 **(1)**A balanced equation **(1)**

*N.B. Allow equation with six co-ordinate Aluminium and up to six OH– ligands  
N.B. Allow equation mark if M(OH)3 given in a balanced equation*

         Equation with H2SO4

2Al(OH)3 + 3H2SO4 → Al2(SO4)3 + 6H2O

OR Al(OH)3(H2O)3 + H+ → [Al(OH)2(H2O)4+ + H2O

*NB Allow equations with six co-ordinate Aluminium and up to six H2O ligands NB Allow equation mark if M(OH)3 given in a balanced equation*

Correct Al species as product **(1)**A balanced equation **(1)**

(iii)     Large lattice energy  
or strong covalent bonds  
or ΔHsoln is very positive  
or ΔG is positive  
or sum of hydration energies less than covalent bond energies **(1)**

**6**

**[15]**

**Q2.**

(a)     Idea that over time / after storage meter does not give accurate readings

*Do not accept ‘to get an accurate reading’ without further qualification.*

*Allow ‘temperature variations affect reading’.*

**1**

(b)       


*Allow without (aq) symbols.*

*Need at least one set of square brackets around complex ions*

**1**

(c)     pH = –log [H+]

**1**

[H+] = 0.0240

*Do not penalise precision of [H+]*

*Correct answer scores M1 and M2.*

**1**

*Ka* = (0.0240)2 / 0.1 = 5.75 ×10-3 or 5.76 ×10-3

*Correct answer without working loses M1 and M2.*

*Allow 7.58 ×10-3*

**1**

Answer, even if incorrect, given to 3 sig figs

**1**

(d)     Oxygen (in the air) / O2

*Ignore ‘air’ or ‘the atmosphere’ or ‘chemicals in soil’.*

*List principle.*

**1**

(e)     4.0 – 6.9

*Do not penalise precision.*

**[7]**

**Q3.**

(a)     Brown ppt/solid

**1**

Gas evolved/effervescence

**1**

2[Fe(H2O)6]3+ + 3CO32– → 2Fe(H2O)3(OH)3 + 3CO2 + 3H2O

*Must be stated, Allow CO2 evolved. Do not allow CO2 alone*

*Correct iron product (1) allow Fe(OH)3 and in equation*

*Balanced equation (1)*

**2**

(b)     White ppt/solid

**1**

Colourless Solution

*Only award M2 if M1 given or initial ppt mentioned*

**1**

[Al(H2O)6]3+ + 3OH– → Al(H2O)3(OH)3 + 3H2O

*Allow [Al(H2O)6]3+ + 3OH– → Al(OH)3 + 6H2O*

**1**

Al(H2O)3(OH)3 + 3OH– → [Al(OH)6]3– + 3H2O

*Allow formation of [Al(H2O)6–x(OH)x](x–3)– where x = 4,5,6*

*Allow product without water ligands*

*Allow formation of correct product from [Al(H2O)6]3+*

**1**

(c)     Blue ppt/solid

**1**

(Dissolves to give a) deep blue solution

*Only award M2 if M1 given or initial ppt mentioned*

**1**

[Cu(H2O)6]2+ + 2NH3 → Cu(H2O)4(OH)2 + 2NH4+

*Allow [Cu(H2O)6]2+ + 2NH3 → Cu(OH)2 + 2NH4+ + 4H2O*

*Allow two equations: NH3 + H2O → NH4+ + OH–*

*then [Cu(H2O)6]2+ + 2OH– → Cu(OH)2 + 4H2O etc*

**1**

Cu(H2O)4(OH)2 + 4NH3 → [Cu(H2O)2(NH3)4]2+ + 2OH– + 2H2O

*Allow [Cu(H2O)6]2+ + 4NH3 → [Cu(H2O)2(NH3)4]2+ + 4H2O*

**1**

(d)     Green/yellow solution

**1**

[Cu(H2O)6]2+ + 4Cl– → [CuCl4]2– + 6H2O

**1**

**[14]**

**Q4.**

B

**[1]**

**Q5.**

A

**[1]**