A-LEVEL PAPER 1 PP1 MS

**1.**

 ****

 ****

 ** [9]**

**2.**

 **** **[6]**

**3.**

 ****

 ** [6]**

 **4.** (a)     ∆*H* = *Σ*(∆*H*f products) - Σ(∆*H*f reactants)

*Allow correct cycle*

**1**

/= +34 - +90
= -56 kJ mol–1

*Ignore no units, penalise incorrect units*

**1**

(b)     ∆*S* = *Σ*(*S* products) - Σ(*S* reactants)

**1**

/= 240 - (205 +211/2)
= -70.5 J K–1 mol–1 / -0.0705 kJ K–1 mol–1

*Ignore no units, penalise incorrect units*

*Allow -70 to -71/-.070 to -.071*

**1**

(c)     *T* = ∆*H*/∆*S*         / *T* = (Ans to part(a) ×1000)/ans to part(b)

*Mark consequentially on answers to parts (a) and (b)*

**1**

/= -56/(-70.5 ÷ 1000)
= 794 K (789 to 800 K)

*Must have correct units*

*Ignore signs; allow + or – and –ve temps*

**1**

(d)     Temperatures exceed this value

**1**

(e)     N2 + O2 → 2NO

*Allow multiples*

**1**

(f)     there is no change in the number of moles (of gases)

*Can only score these marks if the equation in (e) has equal number of moles on each side*

*Numbers, if stated must match equation*

**1**

So entropy/disorder stays (approximately) constant / entropy/disorder change is
very small / *∆S*=0 / *T∆S*=0

**1**

**[10]**

**5.**      (a)     Hydrogen bonding **(1)**between H2O and NH3 **(1)**

(b)     (i)      NH3 + H2O  NH4+ + OH– **(1)**

(ii)     Ammonia is weak base **(1)**

*NOT partially ionised*

         Equilibrium to left or incomplete reaction **(1)**

**3**

(c)     A proton donor **(1)**

**1**

(d)     *Buffer solution*: A solution which resists change in pH **(1)**when small amounts of acid or base added or on dilution **(1)**

*Reagent*: NH4Cl **(1)**

*Allow a correct strong acid*

**3**

(e)     (i)      Ka = [H+] [A–] / [HA] **(1)**     = [H+] [0.125 × 4] **(1)** / 1.00
[H+] = 1.70 × 10–5 / 0.125 × 4 = 3.40 × 10–5 **(1)**

pH = –log10 [H+] = 4.47 **(1)**

*Allow pH conseq to [H+] if 2 place decimals given*

(ii)     H+ + CH3COO– → CH3COOH **(1)**

**5**

**[14]**

**6.** (a)     Over time / after storage meter does not give accurate readings

*Do not allow ‘to get an accurate reading’ or ‘reading drifts’ on its own.*

*Allow ‘temperature variations affect readings’.*

**1**

(b)     Any **five** from:

*Ignore references to the use of the pipette, the filling of the burette and the calibration of the pH meter.*

•        Measure pH (of the acid)

•        Add alkali in known small portions

*Allow 1 – 2cm3.*

•        Stir mixture

•        Measure pH (after each addition)

•        Repeat until alkali in excess

*Allow 27 – 50cm3.*

•        Add in smaller increments near endpoint

*Allow 0.1 – 0.5cm3.*

*To score full marks, the sequence must follow a logical order.*

**5 max**

**[6]**

**7.** (a)     Zn(s)  →  Zn2+(aq)  +  2e−

*If equations reversed, allow* ***M1*** *only.*

**1**

Cu2+(aq)  +  2e−  →  Cu(s)

*Ignore state symbols.*

**1**

(b)     Moles of copper(II) reacted = (100 / 1000) × 0.5 = 0.05

**1**

Moles of zinc reacted = 0.05

**1**

Mass of zinc lost = 0.05 × 65.4 = 3.27 g

*Correct final answer without working scores* ***M3*** *only.*

**1**

(c)     Allow cell to discharge until [Cu2+] is 0.5

*Alternative: Allow cell to discharge completely.*

**1**

Confirmed by colorimetric measurement or other suitable method

*Solution colourless or use of chemical test to determine absence of copper(II)*

**1**

Weigh the Zn electrode before and after the experiment

*Weigh Zn electrodes before and after and halve the mass change.*

**1**

**[8]**

**8.** (a)      (i)     Ionic lattice / solid / giant ionic

*CE = 0/2 if molecules / IMFs / atoms / metallic*

**1**

Strong (electrostatic) forces/attraction between ions

*Allow strong ionic bonds for M2 only*

*Allow lot of energy to break ionic bonds*

**1**

(ii)     Molecular/molecules

**1**

Weak dipole-dipole and/or van der Waals forces between molecules

*QoL*

*Type of force must be mentioned*

**1**

(b)     P4O10 bigger molecule/has larger surface area than SO2

*Allow Mr of P4O10 greater than for SO2*

*If P4O10 macromolecule/ionic, CE = 0/2*

**1**

van der Waals forces between molecules stronger

*Allow stronger IMF*

**1**

(c)     Na2O   +   H2O      2Na+   +   2OH–

*Allow 2NaOH*

**1**

14

*Allow 12–14*

**1**

P4O10   +   6H2O      4H3PO4

*Allow ions*

**1**

0

*Allow –1 to +2*

**1**

(d)     6Na2O   +   P4O10      4Na3PO4

*Allow ionic*

*Allow correct formula of product with atoms in any order*

**1**

**[11]**

**9.**     (a)     1s2 2s2 2p6 3s2 3p6 3d10

*allow [He] 2s2 . or [Ne] 3s2.or [Ar]3d10*

**1**

d sub-shell / shell / orbitals / sub-level full (or not partially full)

*can only score M2 if d10 in M1 correct*

*allow ‘full d orbital’ if d10 in M1*

*do not allow d block*

**1**

(b)     atom or ion or transition metal bonded to / surrounded by
one or more ligands

*Allow Lewis base instead of ligand*

**1**

by co–ordinate / dative (covalent) bonds / donation of
an electron pair

*can only score M2 if M1 correct*

**1**

(c)     H2 / hydrogen

*do not allow H*

**1**

no lone / spare / non-bonded pair of electrons

*only score M2 if M1 correct or give ‘H’ in M1*

**1**

(d)     (i)      +2 or 2+ or Pd2+ or II or +II or II+ or two or two plus

**1**

(ii)     tetrahedral

*these shapes can be in any order*

**1**

square planar

*allow phonetic spelling e.g. tetrahydral*

**1**

**[9]**

**10.** (a)    **Reaction 1**

***General principles in marking this question***

*Square brackets are not essential*

*Penalise charges on individual ligands rather than on the whole complex*

*Reagent and species can be extracted from the equation*

*Ignore conditions such as dilute, concentrated, excess*

*Reagent must be a compound NOT just an ion*

*Equations must start from [Cu(H2O)6 ]2+ except in part (b)*

*Mark reagent, species and equation independently*

ammonia (NH3) (solution) / NaOH

**1**

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

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

*Do not allow OH– for reagent*

*Product 1, balanced equation 1*

*Allow either equation for ammonia*

**2**

(b)    **Reaction 2**

Ammonia (conc / xs)

**1**

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

*Product 1, balanced equation 1*

*Note that the equation must start from the hydroxide [Cu(H2O)4(OH)2]*

**2**

(c)    **Reaction 3**

Na2CO3 / any identified soluble carbonate / NaHCO3

*Do not allow NaCO3 or any insoluble carbonate but mark on*

**1**

[Cu(H2O)6]2+ + CO32- → CuCO3 + 6H2O

OR [Cu(H2O)6]2+ + Na2CO3 → CuCO3 + 6H2O + 2Na+

OR 2[Cu(H2O)6]2+ + 2CO32- → Cu(OH)2.CuCO3 + 11H2O + CO2

OR with NaHCO3

[Cu(H2O)6]2+ + HCO3− → CuCO3 + 6H2O + H+

*Product 1, balanced equation 1*

**2**

(d)    **Reaction 4**

HCl (conc / xs) / NaCl

*Allow any identified soluble chloride*

**1**

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

*Product 1, balanced equation 1*

**2**

**[12]**

|  |  |  |
| --- | --- | --- |
| **11.** | (a) |  |
|  | (b) |  |
|  | (c) |  |
|  | (d) | (i)  |  |
|  |  | (ii)  | Both = 1 mark |
|  | (e) |  |
|  | (f) |  |
|  |  |
|  | (g) |  |
|  | (h) |  |
|  | (i) |  |
|  | (j) | **[14]** |