Past Papers Int 2 Chemistry

2004 Marking Scheme

Grade Awarded	Mark Required (/80)		% candidates achieving grade
A	56+	70%	27.7%
B	47+	59%	18.2%
C	39+	49%	20.8%
D	33+	41%	11.1%
No award	<33	<41%	22.1%

2004 Int2 Chemistry Marking Scheme

MC Qu	Answer	% Pupils Correct	Reasoning
1	D	92	☒A Nitrogen is in group 5 so is not a Noble Gas (group 0) ☒B Fluorine is in group 7 so is not a Noble Gas (group 0) ☒C Oxygen is in group 6 so is not a Noble Gas (group 0) ☑D Neon is in group 0 so is a Noble Gas
2	A	78	☑A $HCl(g) + H_2O(l) \rightarrow H^+(aq) + OH^-(aq)$ is the correct equation ☒B Solution of H^+ and OH^- ions are written as $H^+(aq) + OH^-(aq)$ not $H^+(l) + OH^-(l)$ ☒C Hydrogen chloride gas is written as $HCl(g)$ not $HCl(aq)$ ☒D Solution of H^+ and OH^- are written as $H^+(aq) + OH^-(aq)$ not $H^+(l) + OH^-(l)$
3	B	51	$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{1.00 - 0.25}{25 - 0} = \frac{0.75}{25} = 0.3 \text{ mol } l^{-1}$
4	C	73	<table><tr><th>Experiment</th><th>Mass of Mg</th><th>Concentration</th><th>Temp</th><th>Time</th><th>Reasoning</th></tr><tr><td>3</td><td>0.5g</td><td>0.2 mol l^{-1}</td><td>30°C</td><td>20s</td><td>Last experiment has a lower temperature</td></tr><tr><td>5</td><td>0.5g</td><td>0.2 mol l^{-1}</td><td>25°C</td><td>Above 20s</td><td>so reaction time is greater than 20s</td></tr></table>Reaction Time is higher than experiment 3 ∴ time is greater than 20s <table><tr><th>Experiment</th><th>Mass of Mg</th><th>Concentration</th><th>Temp</th><th>Time</th><th>Reasoning</th></tr><tr><td>2</td><td>0.5g</td><td>0.1 mol l^{-1}</td><td>25°C</td><td>60s</td><td>Last experiment has lower concentration</td></tr><tr><td>5</td><td>0.5g</td><td>0.2 mol l^{-1}</td><td>25°C</td><td>Below 20s</td><td>so reaction time is less than 20s</td></tr></table>Reaction time is lower then experiment 2 ∴ time is less than 60s
5	A	66	In neutral atoms: number of protons = number of electrons Number of protons = atomic number = 26 = number of electrons
6	D	52	☒A Non-polar covalent: pairs of electrons being shared equally between bonds ☒B Polar covalent: pairs of electrons being shared unequally between bonds ☒C Ionic: the attraction of oppositely charge ions for each other ☑D Metallic: the attraction of positively charged ions for delocalised electrons
7	A	48	☑A Reaction at negative electrode: $Ag^+ + e^- \rightarrow Ag$ ☒B Positive ions gain electrons to become neutral atoms not lose electrons ☒C Positive ions travel to the negative electrode not the positive electrode ☒D Positive ions travel to the negative electrode not the positive electrode
8	B	85	☒A C_7H_{16} is a alkane due to general formula C_nH_{2n+2} ☑B C_7H_{14} is a cycloalkane with general formula C_nH_{2n} ☒C C_7H_{12} is not a cycloalkane as it does not fit general formula C_nH_{2n} ☒D C_7H_{10} is not a cycloalkane as it does not fit general formula C_nH_{2n}
9	C	81	☒A All carbon-based plastics will release carbon monoxide (CO) when burned ☒B All carbon-based plastics will release carbon dioxide (CO_2) when burned ☑C Polymer does not have chlorine in structure so cannot release HCl when burned ☒D This polymer releases hydrogen cyanide (HCN) when burned due to –CN groups
10	C	43	Oils contain C=C double bonds which keeps molecules far enough apart to be a liquid. Addition of hydrogen across C=C double bonds changes the shape of the molecule and hardens the liquid oil into a solid fat as the carbon chains straighten and fat molecules fit together closely.
11	A	86	☑A 5 carbon main chain with $-CH_3$ methyl groups on carbons 2 and 3. ☒B molecule is numbered incorrectly and does not give lowest numbering system ☒C main chain has 5 carbons so is pentane not 3 carbon propane ☒D main chain has 5 carbons so is pentane not 3 carbon propane

12 — C — 75

C_3H_8 is called propane ∴ alkane with general formula C_nH_{2n+2}

☒A Molecule is cyclobutane C_4H_8 so is not an alkane with general formula C_nH_{2n+2}
☒B Molecule is but-2-ene C_4H_8 so is not an alkane with general formula C_nH_{2n+2}
☑C Molecule is 2-methylbutane C_5H_{12} is an alkane with general formula C_nH_{2n+2}
☒D Molecule is 2-methylbutene C_5H_{10} is not an alkane with general formula C_nH_{2n+2}

13 — B — 86

Molecule 1	Molecule 2	Molecule 3	Molecule 4
CH_2O	C_2H_4O	C_3H_6O	C_4H_8O
general formula = $C_nH_{2n}O$			

14 — C — 41

☒A Condensation: small molecules join together with water removed at join
☒B Dehydration: water is removed and a C=C double bond is left behind
☑C Hydration: water is added across a C=C double bond in ethane to make ethanol
☒D Hydrolysis large molecule breaks down with water inserted at the break

15 — B — 85

☒A $-CH_3$ and $-COOCH_3$ groups must be on the same carbon
☑B monomer has $-CH_3$ and $-COOCH_3$ on the same carbon & has a C=C double bond
☒C $-CH_3$ and $-COOCH_3$ groups must be on the same carbon
☒D molecule lacks C=C double bond to be the monomer which joins together

16 — B — 58

☒A molecule has same structure as molecule 1 so it not an isomer
☑B molecule has same formula C_4H_8 and is an isomer as it has different structure
☒C molecule has formula C_4H_6 so has different formula and is not a formula
☒D molecule has formula C_4H_6 so has different formula and is not a formula

17 — B — 46

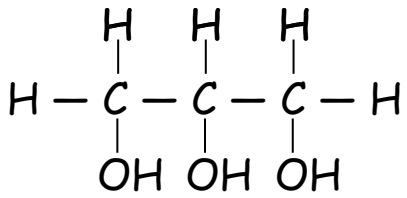
Reaction	Reaction Type	Equation
X	condensation	$nC_6H_{12}O_6 \longrightarrow (C_6H_{10}O_5)_n + nH_2O$
Y	hydrolysis	$(C_6H_{10}O_5)_n + nH_2O \longrightarrow nC_6H_{12}O_6$

18 — D — 60

Carbohydrate	Glucose	Fructose	Maltose	Sucrose	Starch
Formula	$C_6H_{12}O_6$	$C_6H_{12}O_6$	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$	$(C_6H_{10}O_5)_n$
Reaction with Benedict's Solution	blue → brick red	blue → brick red	blue → brick red	no change	no change

19 — C — 47

Glycerol is also called propane-1,2,3-triol



20 — A — 48

☑A Amine groups have the functional group $-NH_2$
☒B Proteins are polymers of joined up amino acids with peptide links (NH-CO)
☒C Amino Acids have 2 functional groups: Amine $-NH_2$ and carboxyl -COOH
☒D Carboxylic acids contain the carboxyl functional group –COOH

21 — D — 70

$$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.5 \text{ mol}}{0.250 \text{ litres}} = 2 \text{ mol } l^{-1}$$

22 — C — 69

☒A oxidation is loss of electrons ∴ electrons appear after arrow
☒B oxidation is loss of electrons ∴ electrons appear after arrow
☑C reduction is gain of electrons: Fe^{3+} gains electron to become Fe^{2+}
☒D reduction is gain of electrons but Fe^{3+} is on wrong side of equation

23 — B — 74

☒A non-metal oxides e.g. carbon dioxide dissolve in water in form acids
☑B copper oxide is insoluble in water (p8 of data book) so pH is unchanged
☒C metal oxides e.g. sodium oxide dissolve in water in form alkali
☒D non-metal oxides e.g. sulphur dioxide dissolve in water in form acids

<table>
<tr><td>24</td><td>A</td><td>59</td><td>Bases neutralise acids:
acid + metal hydroxide (alkali) → salt + water
acid + metal oxide → salt + water
acid + metal carbonate → salt + water + carbon dioxide</td></tr>
<tr><td>25</td><td>D</td><td>61</td><td>☒A calcium chloride and copper bromide are both soluble ∴ no precipitate
☒B lithium chloride and copper sulphate are both soluble ∴ no precipitate
☒C magnesium chloride and copper nitrate are both soluble ∴ no precipitate
☑D copper hydroxide is insoluble so forms as a precipitate</td></tr>
<tr><td>26</td><td>A</td><td>38</td><td>☑A Nitrogen dioxide is an acidic oxide so reacts with an alkaline solution
☒B Ammonia forms an alkali in water so does not react with an alkaline solution
☒C Oxygen is neutral so does not react with and alkaline solution
☒D Argon is neutral in water so does not react with an alkaline solution</td></tr>
<tr><td>27</td><td>D</td><td>60</td><td>☒A Electrons travel through wires, ions travel through the solution
☒B Electrons travel through wires, ions travel through the solution
☒C Electrons travel from zinc (higher metal) to tin (lower metal)
☑D Electrons travel through wires from zinc (higher metal) to tin (lower metal)</td></tr>
<tr><td>28</td><td>B</td><td>65</td><td>☒A iron is less reactive than magnesium ∴ no displacement reaction
☑B iron is more reactive than tin ∴ displacement reaction takes place
☒C iron is less reactive than sodium ∴ no displacement reaction
☒D iron is less reactive than zinc ∴ no displacement reaction</td></tr>
<tr><td>29</td><td>D</td><td>60</td><td><table>
<tr><th>Cell</th><th>Voltage</th><th>Metal 1</th><th>Metal 2</th><th>Reasoning</th></tr>
<tr><td>A</td><td>1.5V</td><td>Silver</td><td>zinc</td><td>biggest difference in metals ∴ highest voltage</td></tr>
<tr><td>B</td><td>1.1V</td><td>copper</td><td>zinc</td><td>2nd biggest difference in metals ∴ 2nd highest voltage</td></tr>
<tr><td>C</td><td>0.6V</td><td>Tin</td><td>zinc</td><td>2nd smallest difference in metals ∴ 2nd lowest voltage</td></tr>
<tr><td>D</td><td>0.3V</td><td>Iron</td><td>zinc</td><td>smallest difference in metals ∴ lowest voltage</td></tr>
</table></td></tr>
<tr><td>30</td><td>A</td><td>58</td><td>☑A Aluminium is so reactive that it must be made by molten electrolysis
☒B Copper is made by heating copper ore with carbon
☒C Iron is made by heating iron ore with carbon in a blast furnace
☒D Gold ore releases gold metal by heating the ore alone</td></tr>
</table>

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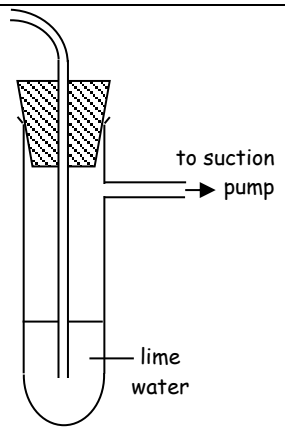
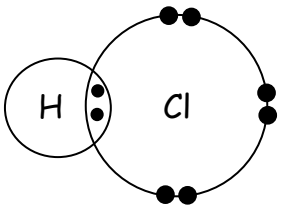
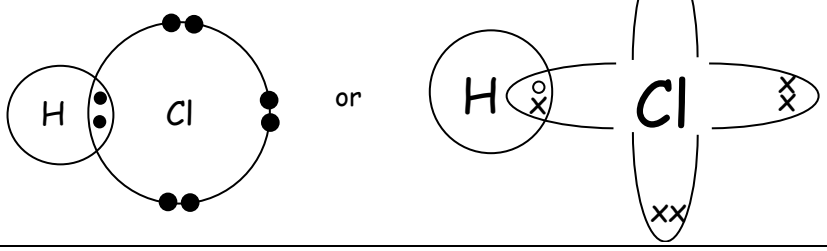
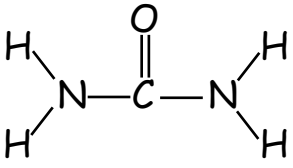
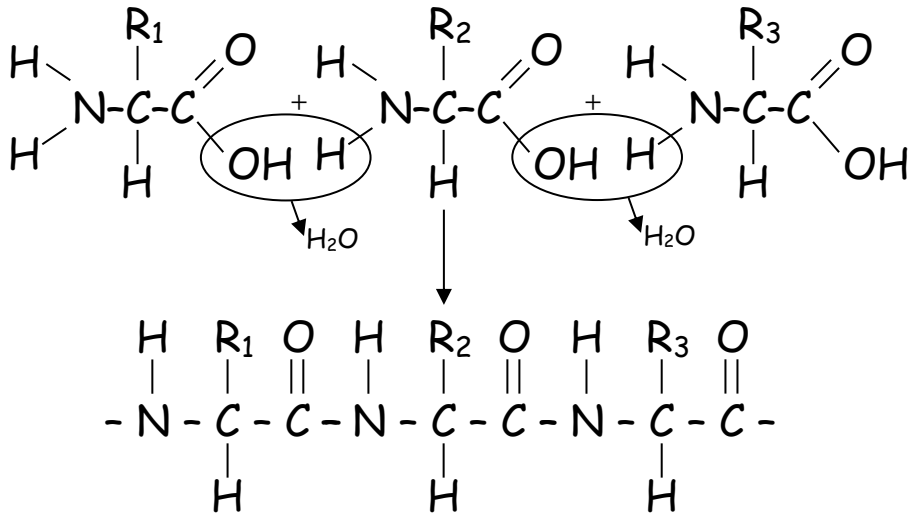
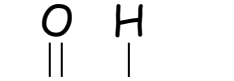
Long Qu	Answer	Reasoning
1a(i)	$^{81}_{35}Br$	Mass number ⟶ ^{81} Atomic number ⟶ $_{35}$ $^{81}_{35}Br$
1a(ii)	46	No. of protons = atomic number = 35 No. of neutrons = mass number – atomic number = 81 – 35 = 46 No. of electrons = atomic number - charge = 35 – 0 = 35
1b	Equal percentage of 79 and 81 present	If relative atomic mass closer to 79 than 81 — More 79 present than 81 If relative atomic mass half way between to 79 and 81 — Equal amounts of 79 and 81 If relative atomic mass closer to 81 than 79 — More 81 present than 79
2a	$2CO + 2NO \downarrow 2CO_2 + N_2$	$2CO + 2NO \longrightarrow 2CO_2 + N_2$
2b	Catalyst in different state from reactants	**Type of Catalyst** — **Definition** Homogeneous — Catalyst in same state as reactants Heterogeneous — Catalyst in different state from reactants
3a		Carbon dioxide and water are formed from burning hydrocarbons like candle wax. • Hydrogen in a hydrocarbon burns to form water • Carbon is a hydrocarbon burns completely to form carbon dioxide
3b	Water	Cobalt chloride paper can be used to detect the presence of water
3c	Incomplete combustion	Soot (carbon) is formed during incomplete combustion. Carbon monoxide and soot are formed when there is a limited air supply and not enough oxygen available for complete combustion.
4a		
4b	Polar (covalent)	A covalent bond is a shared pair of electrons between 2 non-metal atoms. When the electrons are shared unequally within the bond, the bond is polar and has a slightly positive end and a slightly negative end.
5a		Element — Carbon — Hydrogen — Oxygen — Nitrogen No. of bonds — 4 — 1 — 2 — 3

5b	0.5	1 mol urea H_2NCONH_2 = (4x1) = (2x14) + (1x12) + (1x16) = 4 + 28 + 12 + 16 = 60g $\textbf{n}\text{o. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{30}{60} = 0.5$ mol
5c(i)	Line graph showing:	½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line
5c(ii)	0.22±0.01	Problem Solving: Reading information from a graph
6a	$2H^+ + 2OH^- \rightarrow 2H_2O$ or $H^+ + OH^- \rightarrow H_2O$	$2NH_4^+ + 2OH^- + 2H^+ + SO_4^{2-} \rightarrow 2NH_4^+ + SO_4^{2-} + 2H_2O$ Cancel out any spectator ions which appear on both sides ~~$2NH_4^+$~~ + $2OH^-$ + $2H^+$ + ~~SO_4^{2-}~~ → ~~$2NH_4^+$~~ + ~~SO_4^{2-}~~ + $2H_2O$ Re-write equation omitting spectator ions $2OH^- + 2H^+ \rightarrow 2H_2O$
6b	Turns blue	Ammonia gas dissolves in the water on damp pH paper and turns it blue. Ammonia dissolves in water to form ammonium hydroxide
6c	Fertiliser	Fertilisers are soluble compounds containing the elements: Nitrogen | Phosphorus | Potassium
7a	aluminium oxide catalyst liquid paraffin bromine solution	Problem Solving: Information transfer from written passage to diagram
7b	Remove bromine test tube from delivery tube	PPA Safety Question
8a	Neutralisation	acid + metal hydroxide (alkali) → salt + water acid + metal oxide → salt + water acid + metal carbonate → salt + water + carbon dioxide
8b	304	gfm FeO = (1x56) + (1x16) = 56 + 16 = 72g $\textbf{n}\text{o. of mol} = \frac{\textbf{mass}}{\textbf{gfm}} = \frac{144000}{72} = 2000$ mol $FeO + H_2SO_4 \rightarrow FeSO_4 + H_2O$ 1mol 1mol 2000mol 2000mol 1mol $FeSO_4$ = (1x56) + (1x32) + (4x16) = 56 + 32 + 64 = 152g **m**ass = **n**o. of mol x **gfm** = 2000 x 152 = 304000g = 304kg
9a	oxygen nitrogen monoxide oxygen sulphurous acid	Problem Solving: Transferring information from written passage to flow chart
9b	Line from: **Reaction 3 circle** Line to: **Nitrogen Monoxide box** between Reaction 1 and Reaction 2	In the chemical industry, chemicals are often recycled to save resources and costs.
9c	Full Dissociation of H^+ ions	Strong Acid: Full dissociation of molecules to release H^+ ions Weak Acid: Partial dissociation of molecules to release H^+ ions

10a — Amino acid



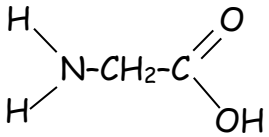
10b(i)



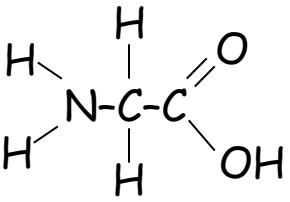
Peptide and amide links are chemically the same combination of bonds

- Peptide likes are found in proteins
- Amide links are found in polyamide polymers e.g. nylon

10b(ii)



Also can be drawn:



10c — Enzyme denatures or changes shape

Enzymes are specifically shaped proteins which catalyse chemical reactions at body temperatures. High temperatures can permanently change the shape of the enzyme and the enzyme no longer can catalyse the reaction

11a — Condensation

Condensation reactions join two smaller molecules together to make a larger molecule with a small molecule like water removed at the join.

11b(i) — Hydrogen H_2

$2C_2H_5OH \rightarrow CH_3COOC_2H_5$

C	H	O
4	12	2

C	H	O
4	8	2

$2X = 4H \therefore X = H_2$

11b(ii) — Fermentation of sugar

glucose $\xrightarrow[\text{(no air)}]{\text{yeast}}$ alcohol + carbon dioxide

$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

12a — $2H_2O+2Cl^- \rightarrow Cl_2+H_2$

$2Cl^- \rightarrow Cl_2 + 2e^-$

$2H_2O + 2e^- \rightarrow 2OH^- + H_2$

Add together equations cancelling out electrons

$2H_2O + 2Cl^- \rightarrow Cl_2 + H_2$

12b — Negative charges on membrane repel OH^- ions

The negative charges on the membrane will electrostatically repel negative ions like OH^- hydroxide ions. Positive ions, e.g. Na^+ ions have no problem approaching and passing through the membrane.

12c — thermoplastic

Thermoplastic	Plastic which re-shaped on heating
Thermosetting	Plastic which does not re-shape on heating

13a — Molecular covalent

Molecular Covalent	Low melting/boiling point
Covalent Network	High melting point

13b — Carbon, nitrogen and hydrogen

Product	Elements present that must be TNT
Carbon dioxide	Carbon (only)
Nitrogen	Nitrogen
water	Hydrogen (only)

14a

2	4	6

The concentration is being varied by decreasing the volume of sodium persulphate and increasing the volume of water added by the same volume. Overall, the total volume of liquid must remain the same in this fair test.

14b	Blue/black colour appears	PPA 1.1 Question Starch turns blue/black in response to the iodide ions turning into iodine
14c	Reaction rate is too slow	PPA 1.1 Question Colour change is too slow to distinguish the end point.
14d	$Na_2S_2O_8$	Write down Formulae of ions: Na $S_2O_8^{2-}$ → Write down Valency below each ion: Na $S_2O_8^{2-}$ (1 2) → Put in Cross-over Arrows: Na S_2O_8 (1 2) → Follow arrows to get formula: $Na_2S_2O_8$
15a(i)	Negative terminal provides electrons to iron to prevent rusting	Cathodic protection is the attaching of metal to the negative terminal of a DC power source. The electrons from the negative terminal turn metal ions created by corrosion back into metal ions. e.g. $Fe^{2+} + 2e^- \longrightarrow Fe$
15a(ii)	Sea water contains ions	Electrolyte is needed to complete a circuit. All electrolyte contains ions. Sea water contains sodium ions and chloride ions
15b	Any answer from:	Paint/grease/coat in plastic Galvanise/attach zinc Attach a more reactive metal
16a	Indicator	An indicator must be added to show the endpoint of the chemical reaction.
16b	0.123 mol l^{-1}	HNO_3 **n**o. of mol = **v**olume x **c**oncentration = 0.0246litres x 0.1mol l^{-1} = 0.00246mol $KOH + HNO_3 \longrightarrow KNO_3 + H_2O$ 1mol 1mol 0.00246mol 0.00246mol **c**oncentration = $\frac{\text{**n**o. of mol}}{\text{**v**olume}} = \frac{0.00246\text{mol}}{0.02\text{ litres}} = 0.123\text{ mol } l^{-1}$