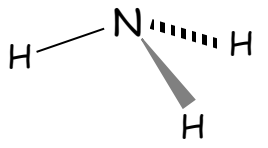
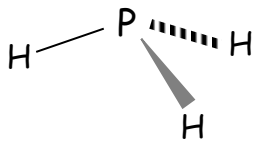
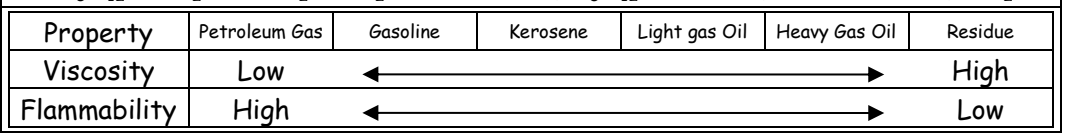
Past Papers Int 2 Chemistry

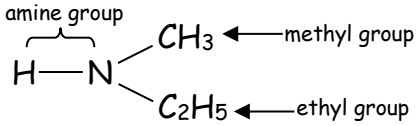
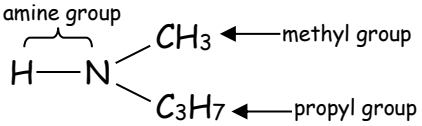
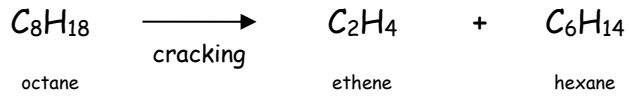
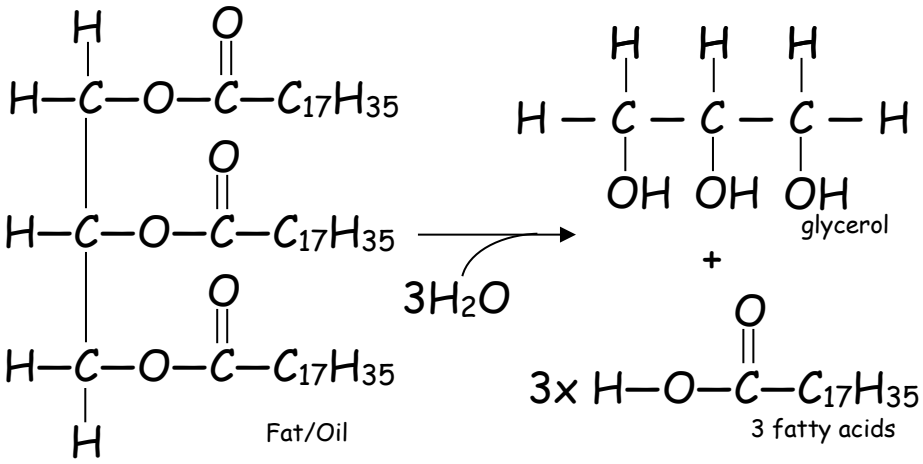
2012 Marking Scheme

Grade Awarded	Mark Required (/80)	%	% candidates achieving grade
A	55+	69%+	35.9%
B	46+	57%+	21.9%
C	38+	47%+	19.3%
D	34+	42%+	6.8%
No award	<34	<42%	16.1%

Section:	Multiple Choice	Extended Answer
Average Mark:	19.5 /30	29.2 /50

2012 Int2 Chemistry Marking Scheme

MC Qu	Answer	% Pupils Correct	Reasoning
1	A	84	☑A Group 0 elements are all monatomic, unreactive and gases. ☒B Group 1 metals are solids and metallic bonding does not involve molecules ☒C Group 2 metals are solids and metallic bonding does not involve molecules ☒D Not all group 7 elements are gases and they are quite reactive elements
2	B	95	☒A magnesium powder reacts faster than magnesium ribbon ☑B magnesium reacts faster than zinc and powder reacts faster than ribbon ☒C magnesium reacts faster than zinc ☒D magnesium reacts faster than zinc
3	A	45	☑A Endothermic reactions have products higher than reactants on the energy axis ☒B this reaction is endothermic and energy is absorbed from the surroundings ☒C Exothermic reactions have products lower than reactants on the energy axis ☒D Products have more energy than reactants as they are higher on the energy axis
4	D	81	☒A lithium has a mass number of 7 and oxygen has a mass number of 16 ☒B lithium has an atomic number of 3 and oxygen has a atomic number of 8 ☒C lithium has 1 outer electron (group 1) and oxygen has 6 outer electrons (group 6) ☑D Lithium (2,1) and oxygen (2,6) both have 2 occupied energy levels (electron shells)
5	C	40	☒A Fluorine forms negative ions as it is a non-metal. ☒B lithium atoms (2,1) forms lithium Li^+ ions with electron arrangement of 2 ☑C sodium atoms (2,8,1) forms sodium Na^+ ions with electron arrangement of 2,8 ☒D Neon is a Noble Gas (group 0) and already has an electron arrangement of 2,8
6	D	61	☒A Calcium oxide is ionic as it is made from a metal and a non-metal ☒B Chlorine has non-polar covalent bonds as it is an element ☒C Sodium bromide is ionic as it is made from a metal and a non-metal ☑D Water contains polar covalent bonds between the H and O atoms
7	A	78	☑A Lead (metal) and fluorine (non-metal) forms an ionic compound ☒B Sulphur (non-metal) and oxygen (non-metal) forms a covalent compound ☒C Carbon (non-metal) and nitrogen (non-metal) forms a covalent compound ☒D Phosphorus (non-metal) and chlorine (non-metal) forms a covalent compound
8	A	49	☑A Carbon monoxide CO is a diatomic molecule (molecule contains 2 atoms) ☒B Sulphur dioxide SO_2 is a triatomic molecule (molecule contains 3 atoms) ☒C Nitrogen trihydride NH_3 is a tetratomic molecule (molecule contains 4 atoms) ☒D Carbon tetrachloride CCl_4 is a pentatomic molecule (molecule contains 5 atoms)
9	B	63	Phosphorus and nitrogen are both in group 5 and NH_3 and PH_3 both have a trigonal pyramidal shape (Trigonal pyramidal was previous called pyramidal)  
10	A	55	☑A ions are locked together in a solid lattice so no conduction of electricity ☒B ions move through ionic compounds as it conducts, not electrons ☒C solid metals conduct electricity ☒D ionic compounds always have positive and negative ions inside them
11	B	68	☒A $C_2H_6 + 3\frac{1}{2}O_2 \rightarrow \mathbf{2}CO_2 + 3H_2O$ ∴1 mole of C_2H_6 burns to form **2** moles of CO_2 ☑B $C_3H_8 + 5O_2 \rightarrow \mathbf{3}CO_2 + 4H_2O$ ∴1 mole of C_3H_8 burns to form **3** moles of CO_2 ☒C $C_4H_{10} + 6\frac{1}{2}O_2 \rightarrow \mathbf{4}CO_2 + 5H_2O$ ∴1 mole of C_4H_{10} burns to form **4** moles of CO_2 ☒D $C_5H_{12} + 8O_2 \rightarrow \mathbf{5}CO_2 + 6H_2O$ ∴1 mole of C_5H_{12} burns to form **5** moles of CO_2
12	A	76	

<table>
<tr><td>13</td><td>D</td><td>78</td><td>
<table>
<tr><th>ethylmethylamine</th><th>propylmethylamine</th></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>ethyl comes before methyl as it has more carbons</td><td>propyl comes before methyl as it has more carbons</td></tr>
</table>
</td></tr>
<tr><td>14</td><td>C</td><td>48</td><td>All three carboxyl COOH groups will be neutralised by the alkali sodium hydroxide.
The hydroxyl –OH group does not react with the alkali sodium hydroxide.</td></tr>
<tr><td>15</td><td>A</td><td>70</td><td> 
</td></tr>
<tr><td>16</td><td>D</td><td>47</td><td>
<table>
<tr><th>Area of Chemistry</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>Type of Polymer</td><td>condensation</td><td>Water removed between –OH group and –COOH group</td></tr>
<tr><td>Property</td><td>thermoplastic</td><td>Linear fibres with no cross links between fibres</td></tr>
</table>
</td></tr>
<tr><td>17</td><td>C</td><td>84</td><td>☒A some carbon in polymer would burn incompletely to form carbon monoxide
☒B carbon in polymer would burn completely to form carbon dioxide
☑C there is no chlorine ion polymer to form HCl
☒D Cyanide –CN groups in polymer would form HCN gas during burning of polymer</td></tr>
<tr><td>18</td><td>D</td><td>68</td><td>☒A PVC is an insoluble polymer
☒B Biopol is an insoluble polymer
☒C Polystyrene is an insoluble polymer
☑D Poly(ethenol) is an soluble polymer and suitable for use in a dishwasher tablet</td></tr>
<tr><td>19</td><td>C</td><td>85</td><td> 
</td></tr>
<tr><td>20</td><td>C</td><td>71</td><td>Insulin is a protein made of amino acid monomers joined together</td></tr>
<tr><td>21</td><td>B</td><td>66</td><td>Soluble metal oxides dissolve in water to form alkalis but zinc oxide is insoluble.
When added to water, zinc oxide would not change the pH of water (pH=7).</td></tr>
<tr><td>22</td><td>B</td><td>61</td><td>Neutralisation reactions involve the reaction of H^+ ions and OH^- ions to form water.</td></tr>
<tr><td>23</td><td>A</td><td>87</td><td>Electrochemical Series Order: Magnesium, zinc, iron, copper and silver (p7 data booklet)
<table>
<tr><td>Cell</td><td>Mg-Ag</td><td>Zn-Ag</td><td>Fe-Ag</td><td>Cu-Ag</td></tr>
<tr><td>Voltage</td><td>2.7V</td><td>1.1V</td><td>0.9V</td><td>0.5V</td></tr>
</table>
</td></tr>
<tr><td>24</td><td>C</td><td>58</td><td>☒A air has no carbon in it so carbon dioxide could not be formed by sparking air
☒B air has no sulphur in it so sulphur dioxide could not be formed by sparking air
☑C air contains both nitrogen and oxygen. Sparking air forms nitrogen dioxide
☒D air has no chlorine in it so hydrogen chloride couldn't be formed by sparking air</td></tr>
</table>

25	D	44	☒A carbon does not react with hydrochloric acid to form an acid ☒B calcium oxide neutralises acid form salt and water but no gases are formed ☒C carbon dioxide gas is formed but CO_2 does not burn with a pop ☑D zinc reacts with acid to form hydrogen, which burns with a pop
26	B	64	☒A Copper Sulphate salt is formed by neutralising sulphuric acid with bases containing copper ☑B Sodium oxide cannot be formed by the neutralisation of an acid (no acid contains the oxide ion) ☒C Magnesium Chloride salt is formed by neutralising hydrochloric acid with bases containing magnesium ☒D Calcium nitrate salt is formed by neutralising nitric acid with bases containing calcium
27	C	38	☒A iron is lower than magnesium in ECS ∴ no displacement reaction occurs ☒B iron is lower than sodium in ECS ∴ no displacement reaction occurs ☑C iron is above than silver in ECS ∴ displacement reaction occurs ☒D iron cannot displace itself from solutions
28	D	66	☒A At zinc electrode: $Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$ ∴ zinc electrode decreases in mass ☒B At zinc electrode: $Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$ ∴ zinc electrode decreases in mass ☒C At copper electrode: $Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$ ∴ copper electrode increases in mass ☑D copper electrode gets heavier as copper deposits on electrode, zinc electrode gets lighter as zinc atoms break off as Zn^{2+} ions into the solution
29	C	65	☒A metal is below Zn and Mg in reactivity (metal between would need electrolysis) ☒B metal is below Mg and K in reactivity (metal between would need electrolysis) ☑C zinc is made by heating with carbon and copper can be made by heat alone ☒D metal is above copper and gold in reactivity (they can be made by heat alone)
30	D	61	☒A iron nail would rust to protect copper as it is higher in electrochemical series ☒B iron nail would rust to protect tin as it is higher in electrochemical series ☒C iron nail would rust as cathodic protection is attaching to negative electrode ☑D iron nail would not rust: cathodic protection by attaching to negative electrode

2012 Int2 Chemistry Marking Scheme

Long Qu	Answer	Reasoning
1a	Covalent Network	SiO_2 contains two non-metals ∴ Covalent bonding in compound • Covalent network substances have high melting points • Covalent molecular substances have low melting & boiling points
1b	Sb_2O_3	Write down Valency below each element's symbol: Sb (3) O (2) → Put in Cross-over Arrows → Follow arrows to get formula: Sb_2O_3
1c(i)	$^{11}_{5}B$	Mass N° ⟶ $^{11}_{5}B$ Mass number = protons + neutrons = 5+6 Atomic N° ⟶ Atomic number = no of protons =5
1c(ii)	Isotopes	Isotopes have same atomic number different mass number same no of protons different no of neutrons
2a(i)	2.75	Rate = $\frac{\Delta quantity}{\Delta time} = \frac{32 - 10}{10 - 2} = 2.75$ l ms^{-1}
2a(ii)	4.5	Problem Solving: Reading values from a line graph
2b	$NaN_3 \rightarrow Na + N_2$	NaN_3 sodium azide (Formula given in question) → Na sodium metal (Metal elements come as single atoms) + N_2 nitrogen gas (Nitrogen is a diatomic element)
2c	very reactive or explosive or flammable	The sodium metal produces is very reactive and could catch fire or even explode.
3a	2 4 6	PPA 1.1 Question: Total volume should be the same in experiment
3b	Answer should include:	Time measure until Blue/Black colour appears Rate = $^{1}/_{TIME}$
3c	White tile under beaker or sharp colour change	PPA 1.1 Question: White tile makes colour change easier to observe Sudden colour change and end point of reaction can be easily judged
4a	Homogeneous	**Type of Catalyst** / **Definition** Homogeneous: Catalyst in same state as reactants Heterogeneous: Catalyst in different state from reactants
4b	Increased surface area allows more collisions	The greater the surface of a substance, the greater the surface on which the reaction can take place. ∴ greater the number of collisions ∴ greater reaction rate
4c	0.02	no. of mol = $\frac{\textbf{mass}}{\textbf{gfm}} = \frac{1.8}{90} = 0.02$ mol
5a	Answer to include:	Family with similar chemical properties and same general formula
5b(i)	Greater the carbon number, greater the energy released	Alkanal / Methanal / Ethanal / Propanal / Butanal Chemical Formula / CH_2O / C_2H_4O / C_3H_6O / C_4H_8O Energy Released (kJ mol^{-1}) / 510 / 1056 / 1624 / 2304

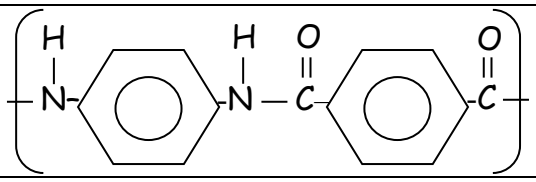
5b(ii) — 2800 - 3200

Alkanal	Methanal	Ethanal	Propanal	Butanal	Pentanal
Energy Released	510	1056	1624	2304	-
Difference		546	568	680	(486 - 896)
Prediction	-	-	-	-	2800 - 3200

6a — very strong

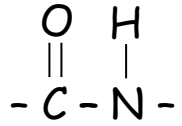
Kevlar is very strong polymer used in bullet-proof vests

6b(i) — Answer to include:



6b(ii) — Amide link

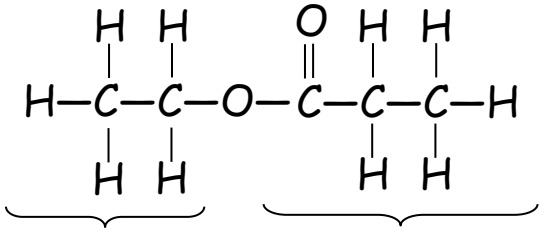
The structure of the amide link is



7a — Hydration

Addition reactions involve the addition of a compound across a C=C double bond. Water can be added across a C=C double bond with –H added on one side and –OH added to the other side carbon.

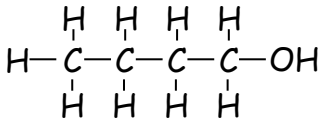
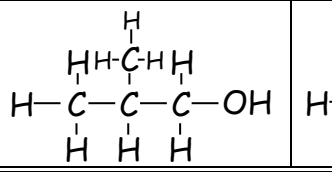
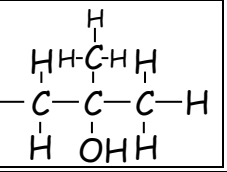
7b — ethylpropanoate



2C alcohol side
Ester begins with ETHYL

3C carboxylic acid side
Ester ends in PROPANOATE

7c — One from:

Butan-1-ol C_4H_9OH	2-methylpropan-1-ol C_4H_9OH	2-methylpropan-2-ol C_4H_9OH
		

8a

	Saturated
Bromine decolourises	
No change	
	Unsaturated

Hydrocarbon	Answer	Reasoning
A	Saturated	Hydrocarbons which do not change bromine are saturated
B	Bromine decolourises	Unsaturated C_6H_{12} is hexane and decolourises bromine solution
C	No change	Saturated C_6H_{12} is cyclohexane and does not decolourise bromine
D	Unsaturated	Hydrocarbons which decolourises bromine quickly are unsaturated

8b — One from:

PPA 2.1 Question:

Be careful not to inhale fumes | Use a fume cupboard or well ventilated area | Don't breathe in (bromine) fumes | Wear gloves | Thiosulphate present

8c — Cyclohexane

C_6H_{12} is either hexene or cyclohexane. As hydrocarbon C is saturated, C must be cyclohexane and not hexene as hexene has a C=C double bond and is unsaturated.

9a — Answer to include:

Test water in beaker with iodine solution (but not contents of visking tubing)
Presence of starch shown by iodine turning blue/black

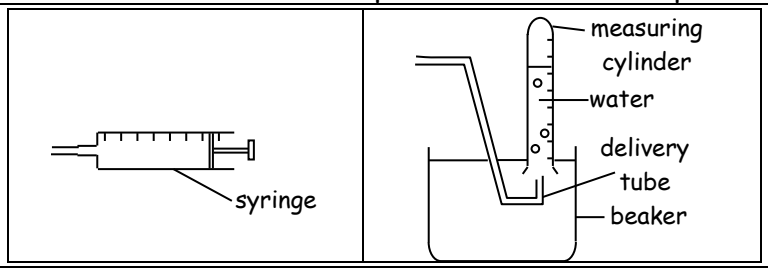
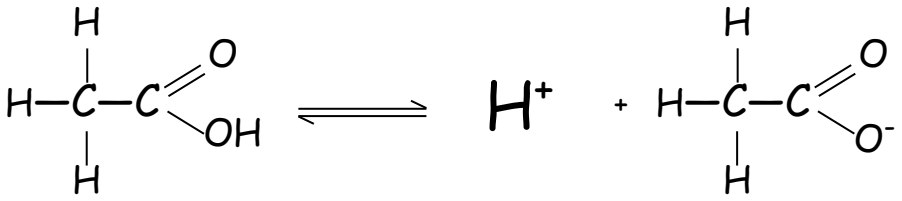
9b(i) — Glucose

starch + water ⟶ glucose

$(C_6H_{10}O_5)_n + nH_2O \longrightarrow nC_6H_{12}O_6$

9b(ii) — Acid

Acid will catalyse the hydrolysis of starch to glucose

10a	To absorb light	Chlorophyll is the chemical inside plant cells which absorbs the light energy needed to make glucose in plants.
10b	To make energy	glucose + oxygen ⟶ carbon dioxide + water $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$
10c	Lowers the pH	Carbon dioxide dissolves in water to form an acidic solution which would react with the alkali in the pH=8.2 and lower the pH.
11a	Diagram showing:	
11b	calcium chloride	ACID + METAL CARBONATE ⟶ SALT + WATER + CARBON DIOXIDE hydrochloric acid + calcium carbonate ⟶ calcium chloride + water + carbon dioxide
11c	Line graph showing:	½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line
12a	Hydrogen	All acids contain H^+ ions which will be attracted to the negative electrode where they turn into hydrogen gas: $2H^+_{(aq)} + 2e^- \rightarrow H_{2(g)}$
12b	Weak acids do not fully dissociate	ethanoic acid ⇌ hydrogen ion + ethanoate ion 
12c	lower higher	Sulphuric acid H_2SO_4 has two H^+ ions on the formula but hydrochloric acid HCl has one H^+ ion in its formula. • Sulphuric acid gives a lower pH than the same volume and concentration of HCl as there more H^+ ions released into solution and this lowers the pH. • As sulphuric acid will have more ions in the solution than HCl, it will have a higher electrical conductivity.
13a	precipitation	barium chloride (soluble) + sodium sulphate (soluble) ⟶ barium sulphate (insoluble) + sodium chloride (soluble)
13b(i)	$Ba^{2+}+SO_4^{2-}\longrightarrow Ba^{2+}SO_4^{2-}$	$Ba^{2+} + 2Cl^- + 2Na^+ + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-}{}_{(s)} + 2Na^+ + 2Cl^-$ Cancel out any spectator ions which appear on both sides $Ba^{2+} + \cancel{2Cl^-} + \cancel{2Na^+} + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-}{}_{(s)} + \cancel{2Na^+} + \cancel{2Cl^-}$ Re-write equation omitting spectator ions $Ba^{2+} + SO_4^{2-} \longrightarrow Ba^{2+}SO_4^{2-}{}_{(s)}$
13b(ii)	Spectator	Spectator ions are present in a reaction mixture but do not take part in a chemical reaction.
14a	Oxidised or Loses electrons	Metals atoms lose electrons during corrosion and this process can be called oxidation.

14b(i)	$Ag \rightarrow Ag^+ + e^-$	At the positive electrode silver atoms lose an electron to form silver Ag^+ ions.
14b(ii)	To supply the electrons to coat the spoon in silver	The negative terminal of a battery has electrons to give to Ag^+ ions in the solution and turn the Ag^+ ions into silver atoms by the equation: $Ag^+(aq) + e^- \rightarrow Ag(s)$
15a(i)	0.5	**n**o. of mol = **v**olume x **c**oncentration = 0.25litres x 2mol l^{-1} = **0.5 mol**
15a(ii)	40g	$Fe_2O_3 + 2H_3PO_4 \longrightarrow 2FePO_4 + 3H_2O$ 1mol 2mol 0.25mol **0.5mol** gfm Fe_2O_3 = (2x56)+(3x16) = 112+48 = 160g **m**ass Fe_2O_3 = **n**o. of mol x **gfm** = 0.25 x 160 = 40g
15b	Prevents water and/or oxygen getting to iron underneath.	Both air/oxygen and water are required for corrosion to take place. A barrier to air and/or water getting to the metal underneath will prevent corrosion.