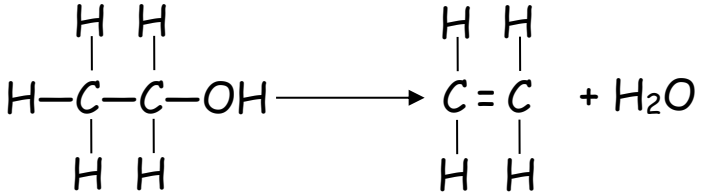
Past Papers Int 2 Chemistry

2003 Marking Scheme

Grade Awarded	Mark Required (/80)	
A	56+	70%
B	48+	60%
C	40+	50%
D	-	-
No award	-	-

2003 Int2 Chemistry Marking Scheme

MC Qu	Answer	% Pupils Correct	Reasoning
1	B	62	☒A Aluminium is in group 3 and is not a transition metal. ☑B Cobalt is a transition metal and Chlorine is a halogen (group 7) element. ☒C Oxygen is in group 6 and halide ions are formed from halogens (group 7) ☒D Sodium is in group 1 and is not a transition metal.
2	C	26	Change: Decrease in Concentration Effect on Reaction Rate: Slower (less successful collisions) Effect on Volume of Gas Produced: Same (still same quantity of reactants)
3	B	71	Atoms are neutral when: total positive charge = total negative charge ∴ In neutral atoms: number of protons = number of electrons
4	A	84	☑A 2,8,1 is the electron arrangement of sodium (group 1) ☒B 2,8,2 is the electron arrangement of magnesium (group 2) ☒C 2,8,3 is the electron arrangement of aluminium (group 3) ☒D 2,8,4 is the electron arrangement of silicon (group 4)
5	C	75	Isotopes: Same atomic number but different mass number Same number of protons but different number of neutrons
6	D	33	Compound formula: X_2O_3 ∴ Valency of X must be 3 forming X^{3+} ion Equation: $X \longrightarrow X^{3+} + 3e^-$ (X loses 3 electrons)
7	B	81	☒A Bromine is a non metal and is a non-conductor ☑B Mercury is a metal and is a conductor of electricity ☒C Oxygen is a non metal and is a non-conductor ☒D Sulphur is a non metal and is a non-conductor
8	B	89	Write down Formulae of ions: $Al\ SO_4^{2-}$ Write down Valency below each ion: Al 3, SO_4 2 Put in Cross-over Arrows: Al 3, SO_4 2 Follow arrows to get formula: $Al_2(SO_4)_3$
9	D	67	☒A ethane has only the one structure and has no isomers ☒B ethene has only the one structure and has no isomers ☒C propane has only the one structure and has no isomers ☑D There are two structures for C_3H_6: propene (in question) and cyclopropane
10	A	46	☑A Molecule drawn is methyl ethanoate ☒B Molecule drawn is ethyl ethanoate ☒C Molecule drawn is methyl propanoate ☒D Molecule drawn is ethyl methanoate
11	D	67	X: Distillation — Distillation separates compounds with different boiling points Y: Cracking — Cracking breaks large molecules into smaller unsaturated molecules Z: Polymerisation — Polymerisation joins up small molecules in to larger polymers
12	B	49	

13	C	60	☒A poly(ethane) is used to make shopping bags (and many other things too) ☒B Perspex is a transparent plastic used in spectacles ☑C Poly(ethenol) is a plastic which is soluble in water ☒D Kevlar is a strong plastic used in bullet-proof vests
14	A	44	There are two monomers used to create this polymer. The 1st 2 carbons (from either end) are from an ethane monomer. The 3rd and 4th carbons have a $-CH_3$ side group making the monomer for this group propene
15	D	75	<table><tr><th>Food Type</th><th>Carbon</th><th>Hydrogen</th><th>Oxygen</th><th>Nitrogen</th></tr><tr><td>Carbohydrates</td><td>✓</td><td>✓</td><td>✓</td><td>✖</td></tr><tr><td>Fats</td><td>✓</td><td>✓</td><td>✓</td><td>✖</td></tr><tr><td>Proteins</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table>
16	A	79	☑A ammonia dissolves in water to form the weak alkali ammonium hydroxide (pH>7) ☒B non-metal oxides e.g. carbon dioxide dissolve in water to form an acid (pH<7) ☒C non-metal oxides e.g. sulphur dioxide dissolve in water to form an acid (pH<7) ☒D sodium chloride dissolves in water to give a neutral solution (pH=7)
17	C	55	$\textbf{c}\text{oncentration} = \frac{\textbf{n}\text{o. of mol}}{\textbf{v}\text{olume}} = \frac{0.25 \text{ mol}}{0.5 \text{ litres}} = 0.5 \text{ mol } l^{-1}$
18	C	44	☒A Lithium hydroxide is an metal hydroxide/alkali and forms a solution with pH >7 ☒B Alkalis contain a few H^+ ions (all water-based solutions contain some H^+ ions) ☑C Lithium hydroxide is a strong base as there is full dissociation of OH^- ions ☒D No hydrogen gas produced in reaction: Acid + Metal Hydroxide ⟶ Salt + Water
19	C	86	☒A copper is too unreactive to react with dilute acid to give hydrogen gas ☒B gold is too unreactive to react with dilute acid to give hydrogen gas ☑C magnesium + hydrochloric acid ⟶ magnesium chloride + hydrogen ☒D mercury is too unreactive to react with dilute acid to give hydrogen gas
20	D	73	☒A Condensation: small molecules join together with water removed at join ☒B Distillation: separation of substances with different boiling points ☒C Evaporation: physical change when liquid turns into a gas ☑D Filtration: Separation of a insoluble solid from a liquid
21	A	76	$Pb^{2+} + 2NO_3^- + 2Na^+ + 2I^- \longrightarrow Pb^{2+}(I^-)_2 + 2Na^+ + 2NO_3^-$ Cancel out any spectator ions which appear on both sides $Pb^{2+} + \cancel{2NO_3^-} + \cancel{2Na^+} + 2I^- \longrightarrow Pb^{2+}(I^-)_2 + \cancel{2Na^+} + \cancel{2NO_3^-}$ Re-write equation omitting spectator ions $Pb^{2+} + 2I^- \longrightarrow Pb^{2+}(I^-)_2$
22	D	85	☒A copper is below zinc in the electrochemical series ∴ no displacement reaction ☒B gold is below zinc in the electrochemical series ∴ no displacement reaction ☒C iron is below zinc in the electrochemical series ∴ no displacement reaction ☑D magnesium displaces zinc from solution as it is higher in the electrochem series
23	B	58	Ferroxyl indicator turns blue in the presence of Fe^{2+} ions Ferroxyl indicator turns pink in the presence of OH^- ions
24	A	81	Atomic number = number of protons = 26 Mass number = number of protons + number of neutrons = 26+30 = 56
25	D	36	☒A Bromine has formula Br_2 ∴ bromine is a diatomic molecule ☒B Carbon monoxide has formula CO ∴ carbon monoxide is a diatomic molecule ☒C Oxygen has formula O_2 ∴ oxygen is a diatomic molecule ☑D Water has formula H_2O ∴ water is a triatomic molecule

26 A 74

Property	Petroleum Gas	Gasoline	Kerosene	Light gas Oil	Heavy Gas Oil	Residue
Viscosity	Low	←	—	—	→	High
Evaporation	Quickly	←	—	—	→	Slowly
Flammability	High	←	—	—	→	Low
Boiling Point	Low	←	—	—	→	High

27 D 64

☒A Combustion: chemical reaction where oxygen is joined up as substance burns
☒B Condensation: small join together and water is removed at the join
☒C Fermentation: glucose ⟶ ethanol + carbon dioxide
☑D Hydrolysis: starch breaks down into glucose with water added at the split

28 B 58

☒A calcium hydroxide + hydrochloric acid ⟶ calcium chloride + water
☑B calcium carbonate + hydrochloric acid ⟶ calcium chloride + water + carbon dioxide
☒C calcium oxide + hydrochloric acid ⟶ calcium chloride + water
☒D calcium + hydrochloric acid ⟶ calcium chloride + hydrogen (flammable!)

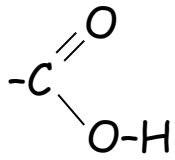
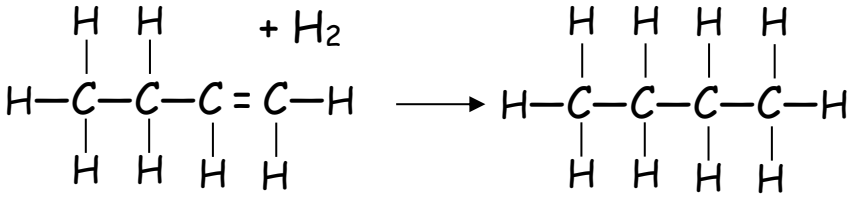
29 C 93

1 mol of $(NH_4)_2CO_3$ = (2x14)+(8x1)+(1x12)+(3x16) = 28+8+12+48 = 96g

30 D 69

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

2003 Int2 Chemistry Marking Scheme

Long Qu	Answer	Reasoning
1a	Biological catalyst	Enzymes are proteins which are biological catalysts which catalyse chemical reactions in living organisms at body temperatures
1b		The carboxyl group (-COOH) is found in carboxylic acids.
1c	Sugar might ferment into alcohol	Yeast will undergo the process of fermentation in anaerobic conditions: glucose $\xrightarrow[\text{(no air)}]{\text{yeast}}$ ethanol + carbon dioxide $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$
2a	Reaction which releases heat/energy	Exothermic: reactions which give out energy or heat Endothermic: reactions which absorb energy/heat from the surroundings
2b	2 mol	$2N_2O \longrightarrow 2N_2 + O_2$ 2mol 1mol 4mol 2mol
2c	Jar A has more oxygen (33%) than air	When dinitrogen monoxide breaks down, it contains 67% nitrogen and 33% oxygen. As air has 21% oxygen, candle will burn longer in 33% oxygen.
3a	← From right (B) to left (A)	Electrons are released by the reaction at electrode B (right) Electrons move from electrode B to electrode A Electrons are picked up by the reaction at electrode A (left)
3b	$2Ag^+ + 2I^- \rightarrow 2Ag + I_2$	$2Ag^+ + 2e^- \rightarrow 2Ag$ $2I^- \rightarrow I_2 + 2e^-$ Add together equations cancelling out electrons $2Ag^+ + 2I^- \rightarrow 2Ag + I_2$
3c	To complete circuit	The ion bridge completes the circuit as it allows ions to travel from side to side to balance the movement of charge moving within the circuit.
3d	Starch turning blue/black	The test for iodine is starch turning blue/black
4a	Provide body with energy	Carbohydrates, Fats: Provide body with energy Proteins: Needed for body growth and tissue repair
4b	Plants	Plants produce oils e.g. olive oil, sunflower oil, primrose oil, etc
4c	Oils are more unsaturated than fats	Fats are solid because the carbon chains within the molecule are straight and the molecules fit closely together. This leads to the molecule having a higher melting point and therefore is a solid at room temperature. Oils are unsaturated and the C=C double bonds in the chain stop the molecules getting as close together and there fore lowering the melting point to make the oil a liquid at room temperature.
4d	Addition of hydrogen across C=C double bonds	

5a Energy required decreases

Group 0 Element	Helium (He)	Neon (Ne)	Argon (Ar)
Energy Required	2400 kJ mol^{-1}	2100 kJ mol^{-1}	1650 kJ mol^{-1}

Going down a group the energy required decreases.

5b Energy required increases

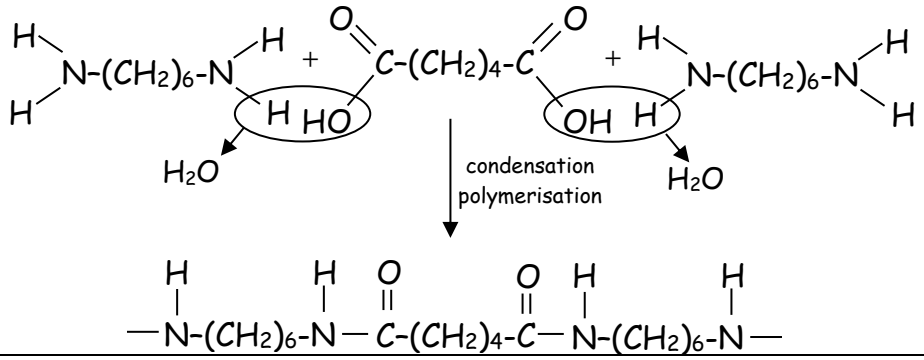
Element	Sodium ⟷	Argon
Atomic Number	11 ⟷	18
Energy Required	500 kJ mol^{-1} ⟷	1650 kJ mol^{-1}

Energy increases across a period from sodium to argon

5c Bar between 400 and 750

Bar must be higher than 400 (bar 19) to continue trend across a period.
Bar must not be above 750 (bar 12) to continue trend down a group.

6a Diagram showing:



6b 2 functional groups on each monomer

To make a large polymer, the monomers must have 2 functional groups to keep the polymer being formed. One functional group per monomer will end the formation of the polymer.

7a Methanol

Ester bonds break releasing a one carbon alkanol ∴ methanol is released

7b(i) 0.006

Time	Concentration	Change in concentration
0s	0.010 mol l^{-1}	0.010 – 0.004
400s	0.004 mol l^{-1}	= 0.006 mol l^{-1}

7b(ii) 0.000015 or 1.5 x10^{-5}

$$\text{Rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{0.010 - 0.004}{400 - 0} = \frac{0.006}{400} = 0.000015 \text{ cm}^3 \text{ s}^{-1}$$

8a Ethanoic acid is a weak acid

Strong Acid: full dissociation of molecules to form H^+ ions
Weak Acid: partial dissociation of molecules to form H^+ ions

8b

Lower
Faster

Acid Type	Dissociation	pH	Rate of Reaction	Conductivity
Strong Acid	Full	Low e.g. pH=1	Fast	High
Weak Acid	Partial	Higher e.g. pH=4	Slow	Low

8c 0.835

NaOH **n**o. of mol = **v**olume x **c**oncentration = 0.0334_{litres} x $0.5_{mol\ l^{-1}}$ = 0.0167_{mol}

$$CH_3COOH + NaOH \longrightarrow 2NaCl + CO_2 + H_2O$$

1mol 1mol
0.0167mol 0.0167mol

$$\text{concentration} = \frac{\text{no. of mol}}{\text{volume}} = \frac{0.0167\text{mol}}{0.02 \text{ litres}} = 0.835 \text{ mol } l^{-1}$$

9a Add solid until no more bubbles form

sulphuric acid + magnesium carbonate ⟶ magnesium sulphate + water + carbon dioxide

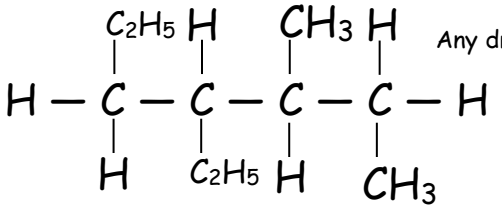
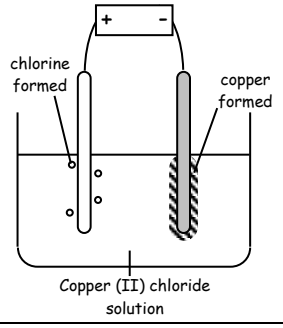
9b To ensure all acid is neutralised

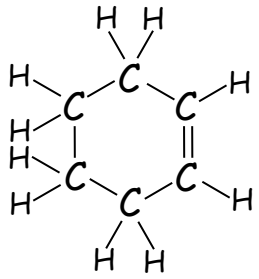
sulphuric acid + magnesium ⟶ magnesium sulphate + hydrogen

Solid is added and acid stirred until acid stops bubbling. Once enough solid has been added and the mixture doesn't start to bubble again, all the acid has been neutralised. The excess solid is removed by filtration and the salt solution is evaporated to make the new substance.

9c

Step 2	filtration
Step 3	evaporation

<table>
<tr><td>9d</td><td>24.1g</td><td>gfm Mg = 24.5g
$\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{4.9}{24.5} = 0.2\text{mol}$
$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$
1mol 1mol
0.2mol 0.2mol
gfm $MgSO_4$ = (1x24.5) + (1x32) + (4x16) = 24.5 + 32 + 64 = 120.5g
mass = no. of mol x gfm = 0.2 x 120.5 = 24.1g</td></tr>
<tr><td>10a</td><td>carbon dioxide and water</td><td>Methane is a hydrocarbon. Hydrocarbons burn to form carbon dioxide and water. The remaining 30% carbon dioxide does not burn.</td></tr>
<tr><td>10b(i)</td><td>Line graph showing:</td><td>½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line</td></tr>
<tr><td>10b(ii)</td><td>5.5</td><td>Correct answer must match the graph drawn.</td></tr>
<tr><td>11a</td><td>2,3-dimethylbutane</td><td><table><tr><td>Four carbons on main chain</td><td>= butane</td><td rowspan="3">Name:
2,3-dimethylbutane</td></tr><tr><td>Two $-CH_3$ sidegroups</td><td>= dimethyl</td></tr><tr><td>Sidegroups on carbons 2+3</td><td>= 2,3-</td></tr></table></td></tr>
<tr><td>11b</td><td>Correct drawing of:</td><td> 
Any drawing of 4-ethyl-3-methylheptane</td></tr>
<tr><td>12a</td><td>metallic bonding
(electrons free to move)</td><td>All metals have delocalised electrons which are able to jump from atom to atom. Electrons are free to move and this is conduction of electricity.</td></tr>
<tr><td>12b</td><td>Each chlorine atom gains one electron</td><td>Chlorine atoms gain one electron each to become chloride ions
$Cl + e^- \longrightarrow Cl^-$
2,8,7 2,8,8</td></tr>
<tr><td>12c</td><td> 
</td><td>At Positive electrode:
$2Cl^- \longrightarrow Cl_2 + 2e^-$
At Negative electrode:
$Cu^{2+} + 2e^- \longrightarrow Cu$</td></tr>
<tr><td>13a</td><td>$Zn \rightarrow Zn^{2+} + 2e^-$</td><td>Oxidation is the loss of electrons. Metals reacting to become compounds are oxidation reactions. See data booklet p7 for reduction version of this equation.</td></tr>
<tr><td>13b</td><td>Tin is less reactive than iron</td><td>Only metals higher in electrochemical/reactivity series than iron will sacrificially protect iron from rusting.</td></tr>
<tr><td>13c</td><td>Cr_2O_3</td><td><table><tr><th>Write down Formulae of ions</th><th>Write down Valency below each ion</th><th>Put in Cross-over Arrows</th><th>Follow arrows to get formula</th></tr><tr><td>Cr O</td><td>Cr O
3 2</td><td>Cr O
3 2</td><td>Cr_2O_3</td></tr></table></td></tr>
</table>

<table>
<tr><td>14a</td><td>  </td><td>Any correct structure of cyclohexene C_6H_{10}</td></tr>
<tr><td>14b</td><td>Bromine solution</td><td>PPA Safety Question</td></tr>
<tr><td>15a</td><td>Ethoxypropane</td><td>2 carbons on left of oxygen ∴ molecule starts with eth-
3 carbons on right of oxygen ∴ molecules ends with -propane</td></tr>
<tr><td>15b</td><td>Condensation</td><td>Condensation Reaction: Smaller molecules join together to form a bigger molecule with a small molecule like water removed at the join.</td></tr>
<tr><td>15c</td><td>36°C</td><td>
<table>
<tr><th>Compound</th><th>Formula</th><th>GFM</th><th>Boiling Point</th></tr>
<tr><td>pentane</td><td>C_5H_{12}</td><td>(5x12) + (12x1)
= 60 + 12
=72g</td><td>36°C</td></tr>
<tr><td>ethoxyethane</td><td>$CH_3CH_2OCH_2CH_3$
= $C_4H_{10}O$</td><td>(4x12)+(4x10)+(1x16)
= 48+10+16
= 74g</td><td>Similar to pentane</td></tr>
</table>
</td></tr>
</table>