JABchem

Past Papers Int 2 Chemistry

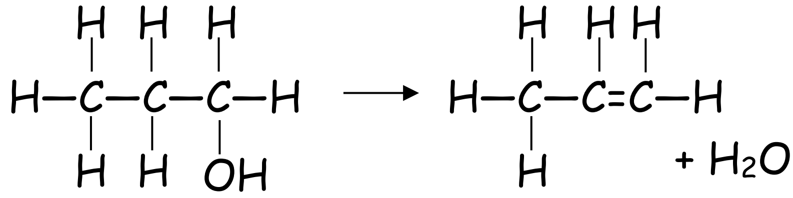
2013

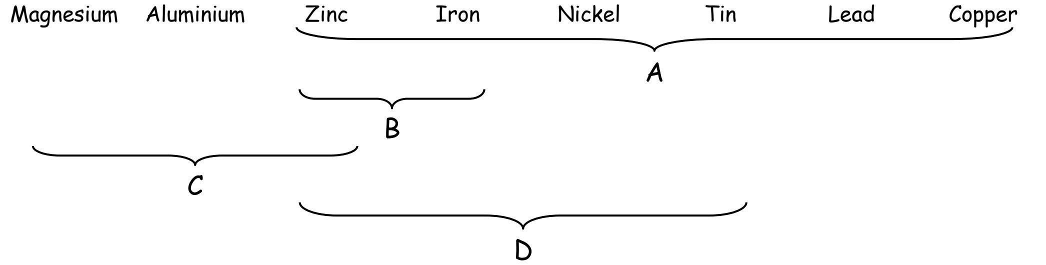
Marking Scheme

Grade Awarded	Mark Required (/80)	%	% candidates achieving grade
A	58+	72.5%+	41.0%
B	49+	61%+	21.4%
C	41+	51%+	17.9%
D	37+	46%+	6.5%
No award	<37	<46%	13.2%

Section:	Multiple Choice	Extended Answer
Average Mark:	20.5 /30	32.9 /50

<table>
<tr><th colspan="4">2013 Int2 Chemistry Marking Scheme</th></tr>
<tr><th>MC Qu</th><th>Answer</th><th>% Pupils Correct</th><th>Reasoning</th></tr>
<tr><td>1</td><td>B</td><td>93</td><td>☒A energy is released in any exothermic reaction to the surroundings
☑B energy is released in any exothermic reaction to the surroundings
☒C energy absorbed from the surroundings is an endothermic reaction
☒D when the products have more energy than the reactants then energy has been absorbed from the surroundings during the reaction ∴ endothermic reaction</td></tr>
<tr><td>2</td><td>A</td><td>83</td><td>☑A $HCl_{(g)} + H_2O_{(l)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$ is the correct equation including state symbols
☒B hydrogen chloride HCl is a gas in the question but a liquid in the equation
☒C hydrogen chloride HCl is a gas in the question but an aqueous in the equation
☒D H^+ and Cl^- ion are aqueous (aq) when in solution not liquids</td></tr>
<tr><td>3</td><td>B</td><td>69</td><td><table>
<tr><td>Solute</td><td>Substance which is dissolved (ethanol)</td></tr>
<tr><td>Solvent</td><td>Liquid which does the dissolving (water)</td></tr>
<tr><td>Solution</td><td>Mixture of solute dissolved in the solvent (whisky)</td></tr>
</table></td></tr>
<tr><td></td><td>B</td><td>79</td><td>☒A hydration of ethene is a chemical process not an enzyme-catalysed reaction
☑B hydrolysis of starch into glucose is catalysed by the enzyme amylase
☒C hydrocarbon cracking is a chemical process not an enzyme-catalysed reaction
☒D alkanes → alkenes is a chemical process not an enzyme-catalysed reaction</td></tr>
<tr><td>5</td><td>C</td><td>92</td><td><table>
<tr><th>Particle</th><th>Location</th><th>Charge</th><th>Mass</th></tr>
<tr><td>Proton</td><td>in nucleus</td><td>+1</td><td>1 amu</td></tr>
<tr><td>Neutron</td><td>in nucleus</td><td>0</td><td>1 amu</td></tr>
<tr><td>Electron</td><td>outside nucleus</td><td>–1</td><td>approx zero</td></tr>
</table></td></tr>
<tr><td>6</td><td>A</td><td>77</td><td>Group 0 elements have a full outer shell and are stable. Elements in other groups can share electrons in covalent bonds to achieve a full outer shell.</td></tr>
<tr><td>7</td><td>B</td><td>39</td><td>☒A vanadium (V) oxide has the formula V_2O_5
☑B vanadium (IV) oxide has the formula VO_2
☒C vanadium (III) oxide has the formula V_2O_3
☒D vanadium (II) oxide has the formula VO</td></tr>
<tr><td>8</td><td>A</td><td>64</td><td><table>
<tr><td>Equation in question</td><td>$4NH_3 + xO_2 \rightarrow 4NO + yH_2O$</td></tr>
<tr><td>12H before arrow
∴ $6H_2O$ required to balance 12H</td><td>$4NH_3 + xO_2 \rightarrow 4NO + 6H_2O$</td></tr>
<tr><td>$4NO + 6H_2O$ before arrow = 10xO
∴ $5O_2$ required to balance 10xO</td><td>$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$</td></tr>
</table></td></tr>
<tr><td>9</td><td>D</td><td>82</td><td>☒A gfm of CO = (1x12) + (1x16) = 12 + 16 = 28g
☒B gfm of CO_2 = (1x12) + (2x16) = 12+32 = 44g
☒C gfm of N_2 = (2x14) = 28g
☑D gfm of CH_4 = (1x12) + (4x1) = 12+4 = 16g</td></tr>
<tr><td>10</td><td>C</td><td>90</td><td>Isomers have same molecular formula but different structural formula.
Chemical in question has a formula of C_5H_{12}
☒A chemical has a formula of C_5H_{10} ∴ not an isomer because of different formula
☒B chemical has a formula of C_5H_{10} ∴ not an isomer because of different formula
☑C chemical has a formula of C_5H_{12} ∴ same formula but different structure
☒D chemical has a formula of C_6H_{14} ∴ not an isomer because of different formula</td></tr>
<tr><td>11</td><td>C</td><td>46</td><td>☒A if compound burned produces H_2O then hydrogen must be found in the fuel
☒B if compound burned produces CO_2 then carbon must be found in the fuel
☑C If CO_2 and H_2O are found in the products then fuel contains both C and H
☒D oxygen could either be found in the fuel or the air the fuel burned in</td></tr>
</table>

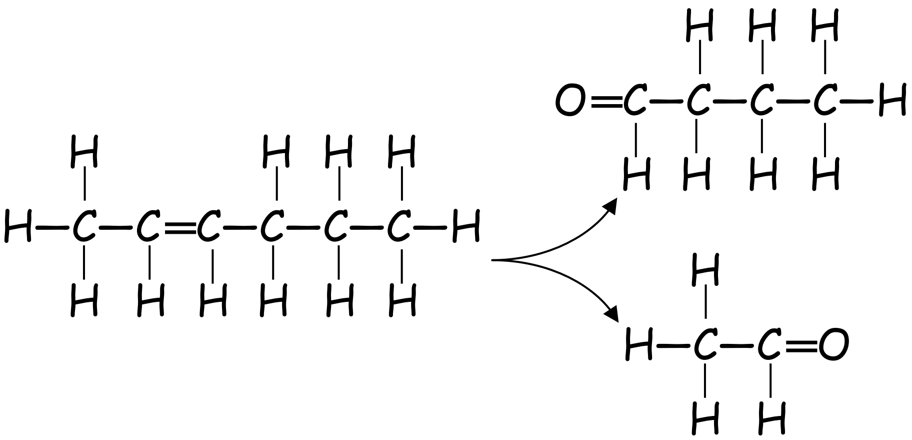
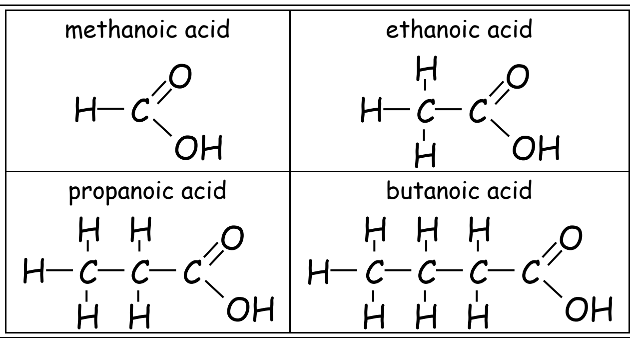
12	C	68	☒A cyclohexane has the formula C_6H_{12} ☒B cyclohexane does not rapidly decolourise bromine solution (no C=C double bond) ☑C cyclohexane has the formula C_6H_{12} and does not react with bromine solution ☒D cyclohexane has the formula C_6H_{12}
13	B	84	glucose $\xrightarrow[\text{(no air)}]{\text{enzymes}}$ ethanol + carbon dioxide $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$
14	C	61	
15	B	78	☒A if n=2, $C_nH_{n+4}N$ would give a formula of C_2H_6N (compound 2 had formula C_2H_7N) ☑B if n=2, $C_nH_{2n+3}N$ would give a formula of C_2H_7N (compound 2 had formula C_2H_7N) ☒C if n=2, $C_nH_{3n+2}N$ would give a formula of C_2H_8N (compound 2 had formula C_2H_7N) ☒D if n=2, $C_nH_{4n+1}N$ would give a formula of C_2H_9N (compound 2 had formula C_2H_7N)
16	B	68	☒A biopol is a synthetic compound and not found in nature ☑B biopol is synthetic and is biodegradable (broken down by bacteria) ☒C biopol is a synthetic compound and not found in nature ☒D biopol is a biodegradable polymer and is able to be broken down by bacteria
17	D	68	☒A $-C_{17}H_{35}$ is saturated and contains no C=C double bonds ☒B $-C_{17}H_{33}$ is unsaturated and contains one C=C double bond ☒C $-C_{17}H_{31}$ is unsaturated and contains two C=C double bonds ☑D $-C_{17}H_{29}$ is unsaturated and contains three C=C double bonds
18	C	83	☒A all solutions contain hydrogen ions and hydroxide ions at all times ☒B neutral solutions contain equal numbers of hydrogen and hydroxide ions ☑C alkaline solutions contain more hydroxide ions than hydrogen ions ☒D acidic solutions contain more hydrogen ions than hydroxide ions
19	D	65	☒A sucrose does not react with Benedict's solution ☒B sucrose does not react with Benedict's solution ☒C starch does not react with Benedict's solution ☑D both maltose and glucose turn Benedict's solution blue → brick red
20	A	78	☑A as pH rises from 3 to 6, concentration of H^+ ions decreases ☒B OH^- ions increase in number as pH rises from 3 to 6 ☒C at pH=6, concentration of H^+ ions is greater than concentration of OH^- ions ☒D as pH rises from 3 to 6, concentration of H^+ ions decreases
21	C	60	concentration = $\frac{\text{no. of moles}}{\text{volume}} = \frac{0.25\ \text{mol}}{0.5\ \text{litres}} = 0.5\ \text{mol l}^{-1}$
22	A	59	Bases are compounds which neutralise acids and form water e.g. metal hydroxides (alkalis), metal oxides and metal carbonates
23	D	40	☒A Argon is an insoluble noble gas and does not react with acidic solutions ☒B Oxygen is an insoluble gas and does not react with acidic solutions ☒C Ammonia dissolves in water to form an alkali ∴ would not react with an alkali ☑D Nitrogen dioxide forms an acidic solution and would react with alkali
24	A	42	☑A Ammonium chloride is made during the neutralisation of ammonium hydroxide with hydrochloric acid ☒B Calcium oxide cannot be made by the neutralisation of an acid ☒C Hydrogen chloride cannot be made by the neutralisation of an acid ☒D sodium hydroxide cannot be made by the neutralisation of an acid
25	D	82	☒A Condensation: change of state from gas to liquid ☒B Distillation: separation of chemicals with different boiling points ☒C Evaporation: change of state from liquid to gas ☑D Filtration: separation of insoluble solid from a liquid/solution

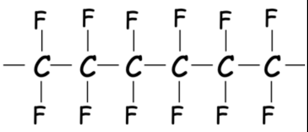
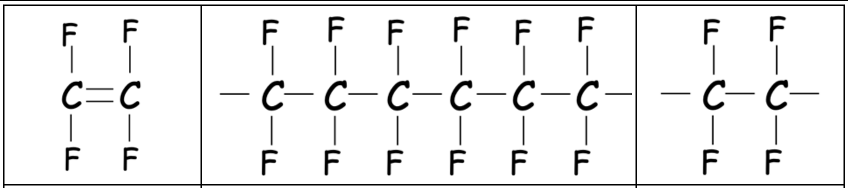
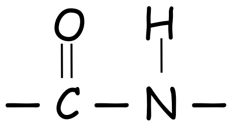
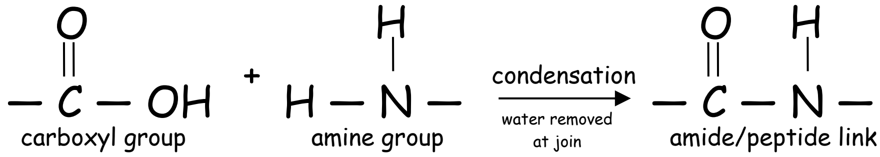
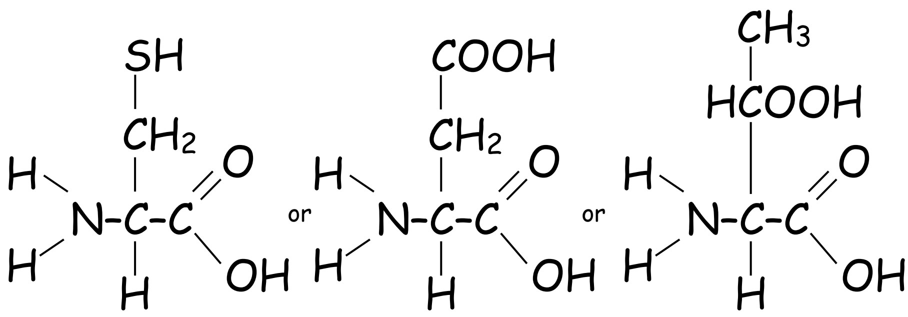
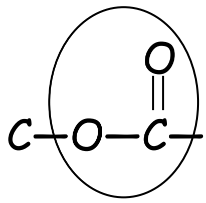
26	D	60	☒A electrons always flow through wires not solutions ☒B electrons always flow through wires not solutions ☒C copper is lower down than tin so electrons flow from tin to copper ☑D electrons flow through wires from higher up metals to lower down metals
27	A	68	
28	A	74	☑A iron nail corrodes to protect copper wire and salt water speeds up corrosion ☒B salt water is speeds up corrosion compared to tap water ☒C iron nail does not corrode as zinc protects iron nail by sacrificial protection ☒D iron nail does not corrode as zinc protects iron nail by sacrificial protection
29	B	45	☒A displacement: higher up metals displace lower down ions from compounds ☑B metal atoms lose electrons to become metal ions (oxidation is loss of electrons) ☒C precipitation: insoluble substance formed when two solutions are mixed ☒D metal atoms lose electrons to become metal ions (reduction is gain of electrons)
30	D	58	see table below

Method	Electrolysis	Heat With Carbon	Heat Alone
Metals Made This Way	Potassium, Sodium, Lithium, Calcium, Magnesium, Aluminium	Zinc, Iron, Nickel, Tin, Lead, Copper	Mercury, Silver, Gold, Platinum
Reason	most reactive metals	medium reactive metals	least reactive metals

2013 Int2 Chemistry Marking Scheme

<table>
<tr><th>Long Qu</th><th>Answer</th><th>Reasoning</th></tr>
<tr><td>1a(i)</td><td>red</td><td><table><tr><td>Element</td><td>Barium</td><td>Calcium</td><td>Copper</td><td>Lithium</td><td>Potassium</td><td>Sodium</td><td>Strontium</td></tr><tr><td>Flame Colour</td><td>green</td><td>orange-red</td><td>blue-green</td><td>red</td><td>lilac</td><td>yellow</td><td>red</td></tr></table></td></tr>
<tr><td>1a(ii)</td><td>Same group in Periodic Table</td><td>Elements in the same group of the periodic table have similar chemical properties e.g. alkali metals in group 1, noble gases in group 0</td></tr>
<tr><td>1b</td><td><table><tr><td>Positive electrode</td><td>Negative electrode</td></tr></table></td><td>Chlorine gas is formed at the positive electrode:
$2Cl^-_{(l)} \longrightarrow Cl_{2(g)} + 2e^-$
Strontium metal is formed at the negative electrode:
$Sr^{2+}_{(l)} + 2e^- \longrightarrow Sr_{(l)}$</td></tr>
<tr><td>2a</td><td>Answer to include:</td><td>PPA 1.2 Question:
Measure time for the "x" to disappear, then calculate rate = $^1/_{time}$</td></tr>
<tr><td>2b</td><td>One from:</td><td><table><tr><td>Concentration of reactants</td><td>Volume of reactants</td><td>The "x"</td><td>Depth of reactants</td></tr></table></td></tr>
<tr><td>2c</td><td>Well ventilated room</td><td>The sulphur dioxide gas given off in this experiment should not be allowed to build up.</td></tr>
<tr><td>2d</td><td>$2Na^+$ and $2Cl^-$</td><td>Spectator ions appear chemically unchanged on both sides of a chemical equation:
$2Na^+$ appears on both sides of equation
$2Na^+ + S_2O_3^{2-} + 2H^+ + 2Cl^- \rightarrow 2Na^+ + 2Cl^- + SO_2 + S + H_2O$
$2Cl^-$ appears on both sides of equation</td></tr>
<tr><td>3a</td><td>Hydrogen</td><td>ACID + METAL ⟶ SALT + HYDROGEN
sulphuric acid + magnesium ⟶ magnesium sulphate + hydrogen</td></tr>
<tr><td>3b</td><td>18</td><td>$\text{rate} = \frac{\Delta\text{quantity}}{\Delta\text{time}} = \frac{72-0}{40-0} = 18\ cm^3\ s^{-1}$</td></tr>
<tr><td>3c</td><td>$0\ cm^3$</td><td>Copper, mercury, silver, gold and platinum are too unreactive to react with dilute sulphuric acid. No reaction ∴ no gas produced</td></tr>
<tr><td>3d</td><td>decreases rate</td><td><table><tr><th>Acid</th><th>Type</th><th>pH</th><th>Conductivity</th><th>Rate of Reaction</th></tr><tr><td>1 mol l^{-1} sulphuric acid</td><td>strong</td><td>lower</td><td>higher</td><td>faster</td></tr><tr><td>1 mol l^{-1} ethanoic acid</td><td>weak</td><td>higher</td><td>lower</td><td>slower</td></tr></table></td></tr>
<tr><td>4a</td><td><table><tr><td>1</td></tr><tr><td>2</td></tr><tr><td>1</td></tr></table></td><td>Number of protons = atomic number = 1
Number of neutrons = mass no – atomic no. = 3 - 1 = 2
Number of electrons = atomic number – charge = 1 – 0 = 1</td></tr>
<tr><td>4b</td><td>1</td><td>Relative atomic mass is the average mass of the isotopes in a sample.
If r.a.m. = 1 them the majority of the sample must also have a mass of 1</td></tr>
<tr><td>5a</td><td>Polar covalent</td><td>A covalent bond is a shared pair of electrons between two atoms.
If the electrons are not shared equally between the atoms then the bond becomes polar and has a positive end and a negative end of the bond.</td></tr>
<tr><td>5b(i)</td><td>increases</td><td><table><tr><td>Elements 3 to 9 is the period from lithium to fluorine</td><td rowspan="2">Bars increase from 3 → 9 and 11 → 17</td></tr><tr><td>Elements 11 to 17 are the period from sodium to chlorine.</td></tr><tr><td colspan="2">NB: Noble gases have zero electronegativity as they have no attraction from electrons</td></tr></table></td></tr>
<tr><td>5b(ii)</td><td>Bar drawn between 0.8 and 1.4</td><td>Bar must be higher in value than element 19 (0.7) as bars increase in size across a period
Bar must be lower than value than element 12 (1.5) as element 20 is in same group as element 12 but must be smaller in value than element 12</td></tr>
</table>

6a	0.01	no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{1.57}{157}$ = 0.01 mol
6b	(Covalent) network	Silicon and oxygen are both non-metals ∴ covalent bonding in SiO_2 Silicon dioxide has a melting point of 1700°C ∴ SiO_2 can not be molecular as the melting point is too high and SiO_2 is a covalent network.
6c	$Ca_3(PO_4)_2$	Write down Valency below each ion's symbol: Ca PO_4^{3-} / 2 3 Put in Cross-over Arrows: Ca PO_4^{3-} ✕ 2 3 Follow arrows and cancel down to get formula: $Ca_3(PO_4)_2$
7a	Carbon dioxide	Catalytic convertor: carbon monoxide → carbon dioxide; nitrogen oxides → nitrogen; unburnt hydrocarbons → carbon dioxide + water
7b(i)	125.1	Mass of CO_2 = $\frac{100 \times \text{vol of } CO_2}{56.3} = \frac{100 \times 70.41}{56.3}$ = 125.1
7b(ii)	£130	Problem Solving: Information Selection from two graphs 146g CO_2 per km = Car Tax band F ∴ Car Tax Band F = £130.00
8a	Different boiling points	Distillation is used to separate hydrocarbons with different boiling points by progressive evaporation of hydrocarbons and collection of hydrocarbons by condensation.
8b	Increase in carbons increases the viscosity	The higher the number of carbons in a hydrocarbon, the higher the viscosity (thickness) of the hydrocarbon. The marble will take longer to fall through the more viscous liquids.
8c	2,3-dimethylbutane	1. Identify the longest chain: 4 carbons -butane 2. Identify the sidechains: 2 x $-CH_3$ -dimethylbutane 3. Lowest numbering system selected $-CH_3$ on C_2 and C_3 2,3-dimethylbutane
9a	Diagram of products shown:	
9b(i)	Butanoic acid	
9b(ii)	Turns lime water milky	Gas: Hydrogen / Oxygen / Carbon Dioxide Gas Test: Burns with a pop / Relights glowing splint / Turns lime water milky
10a	thermoplastic	Thermoplastic: Plastic which re-shaped on heating Thermosetting: Plastic which does not re-shape on heating

10b(i)		 Monomer | Polymer | Repeating Unit
10b(ii)	Addition	Addition polymerisation has monomers with C=C double bonds which open up and join up with each other to form a long chain of C-C single bonds in a polymer.
10c	Carbon monoxide	Carbon-based plastic will release carbon monoxide when burned
11a	2,8,8	$Ca \longrightarrow Ca^{2+} + 2e^-$ 2,8,8,2 (Calcium atom) → 2,8,8 (Calcium ion)
11b(i)		
11b(ii)	One amino acid from:	
12a		The ester link is formed during a condensation between a hydroxyl group and a carboxyl group. Water is removed as the groups join together.
12b	Hydrolysis	Hydrolysis: large molecules split into smaller molecules with water added across the split point in the molecule.
12c	8.52	gfm $C_{18}H_{36}O_2$ = 890g (in question) **no** of mol = $\frac{\textbf{mass}}{\textbf{gfm}} = \frac{8.9}{890}$ = 0.01 mol glyceryl tristearate + water ⟶ glycerol + stearic acid $C_{57}H_{110}O_6 + 3H_2O \longrightarrow C_3H_8O_3 + 3C_{18}H_{36}O_2$ 1mol ... 3mol 0.01mol ... 0.03mol gfm $C_{18}H_{36}O_2$ = (18x12)+(36x1)+(2x16) = 216+36+32 = 284g **mass** = **no**. of mol x **gfm** = 0.03 x 284 = 8.52g
13a(i)	Any pH below 7	pH | pH below 7 | pH = 7 | pH above 7 Description | Acidic | Neutral | Alkaline
13a(ii)	–OH group (bottom on the right)	Hydroxyl groups have the formula –OH Carboxyl -COOH groups contain an –OH group within the structure but the proximity of the C=O group to the –OH group changes the properties of the –OH group to the properties of the carboxyl –COOH group.

13b	Line graph showing:	½mark: labelling axes + units ½mark: correct scales ½mark: plotting points ½mark: drawing line
14a	To place metals in order of reactivity	PPA 3.3 Question Metals will react at different rates and can be placed in order of reactivity
14b	To provide oxygen	PPA 3.3 Question Potassium permanganate releases oxygen when heated.
14c	Fast reaction Slow reaction	Magnesium is more reactive than zinc so magnesium would be faster than zinc's moderately fast reaction. Copper is less reactive than zinc so copper would be slower than zinc's moderately fast reaction.
14d	Could explode	Potassium is more reactive than magnesium and the magnesium reaction is already a fast reaction.
15a	Titanium is less reactive than sodium	Higher metals will displace lower down metals in a displacement reaction. Sodium can displace titanium because it is higher up the electrochemical series than titanium
15b	$Na \rightarrow Na^{+} + e^{-}$	$Na \longrightarrow Na^{+} + e^{-}$ 2,8,1 (sodium atom) → 2,8 (sodium ion)
15c	No air must be present to prevent combustion	An argon gas environment in the reaction vessel would prevent oxygen/air getting to the hot metal and combusting.