Past Papers

Standard Grade

General

Chemistry

2013

Marking Scheme

2013 General	KU		PS	
	/30	%	/30	%
3	20+	67%	21+	70%
4	15+	50%	15+	50%
5	13+	43%	12+	40%
7	<13	<43%	<12	<40%

2013 Standard Grade Chemistry General Marking Scheme

<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>1a</td><td>C</td><td>
<table>
<tr><td>Element</td><td>Sodium</td><td>Beryllium</td><td>Calcium</td><td>Magnesium</td><td>Potassium</td><td>Lithium</td></tr>
<tr><td>Discovery</td><td>1807</td><td>1798</td><td>1808</td><td>1775</td><td>1807</td><td>1817</td></tr>
</table>
</td></tr>
<tr><td>1b</td><td>E</td><td>Potassium, phosphorus and nitrogen are the three essential elements for healthy plant growth and soluble compounds containing these elements are used in fertilisers.</td></tr>
<tr><td>1c</td><td>F</td><td>
<table>
<tr><td>Element</td><td>Sodium</td><td>Beryllium</td><td>Calcium</td><td>Magnesium</td><td>Potassium</td><td>Lithium</td></tr>
<tr><td>Flame Colour</td><td>Yellow</td><td>Not listed in data booklet</td><td>Orange-Red</td><td>Not listed in data booklet</td><td>Lilac</td><td>Red</td></tr>
</table>
</td></tr>
<tr><td>2a</td><td>B+F
Both for 1 mark</td><td>
<table>
<tr><td>Fair Test</td><td>Factor</td><td>B</td><td>F</td></tr>
<tr><td>Factor which is changing:</td><td>Concentration</td><td>1mol/l</td><td>0.5mol/l</td></tr>
<tr><td rowspan="2">Factors kept constant:</td><td>Particle Size</td><td>Lump</td><td>Lump</td></tr>
<tr><td>Temperature</td><td>25°C</td><td>25°C</td></tr>
</table>
</td></tr>
<tr><td>2b</td><td>D</td><td>
<table>
<tr><td>Factor</td><td>Particle Size</td><td>Concentration</td><td>Temperature</td></tr>
<tr><td>Conditions for Faster Reaction</td><td>Smallest Particle Size
∴ Powder</td><td>Highest Concentration
∴ 1 mol/l</td><td>Highest Particle Size
∴ 30°C</td></tr>
</table>
</td></tr>
<tr><td>3a</td><td>C+E
Both for 1 mark</td><td>
<table>
<tr><td>Element</td><td>Hydrogen</td><td>Nitrogen</td><td>Oxygen</td><td>Fluorine</td><td>Chlorine</td><td>Bromine</td><td>Iodine</td></tr>
<tr><td>Formula</td><td>H_2</td><td>N_2</td><td>O_2</td><td>F_2</td><td>Cl_2</td><td>Br_2</td><td>I_2</td></tr>
</table>
</td></tr>
<tr><td>3b</td><td>D</td><td>
<table>
<tr><td>Element</td><td>Carbon</td><td>Sulphur</td><td>Nitrogen</td><td>Neon</td><td>Oxygen</td><td>Phosphorus</td></tr>
<tr><td>Group on Periodic Table</td><td>Group 4</td><td>Group 6</td><td>Group 5</td><td>Group 0
(Noble Gas)</td><td>Group 6</td><td>Group 5</td></tr>
</table>
</td></tr>
<tr><td>3c</td><td>E</td><td>Air is made up of approximately 80% nitrogen and 20% oxygen</td></tr>
<tr><td>4a</td><td>B+C
Both for 1 mark</td><td>
<table>
<tr><td>-ide</td><td>Compound contains the two named elements</td></tr>
<tr><td>-ate</td><td>Compound contains 3 elements (two named elements + oxygen)</td></tr>
<tr><td>-ite</td><td>Compound contains 3 elements (two named elements + oxygen)</td></tr>
</table>
</td></tr>
<tr><td>4b</td><td>F</td><td>Metal oxides (which are soluble) form alkalis when dissolved in water</td></tr>
<tr><td>4c</td><td>D</td><td>Non-metal oxides (which are soluble) form acids when dissolved in water</td></tr>
<tr><td>5a</td><td>A</td><td>☑A scratched tin layer would cause the iron to rust faster as the iron is more reactive and would protect the tin by sacrificial protection
☒B scratched paint layer would allow iron to rust at normal rate
☒C scratched plastic layer would allow iron to rust at normal rate
☒D scratched zinc layer would protect the iron by sacrificial protection
☒E scratched magnesium layer would protect the iron by sacrificial protection</td></tr>
<tr><td>5b</td><td>D</td><td>Galvanising: Covering iron in the more reactive zinc for sacrificial protection</td></tr>
<tr><td>6</td><td>B</td><td>
<table>
<tr><td>Ion</td><td>Information</td><td>Conclusion</td></tr>
<tr><td>Sodium</td><td>sodium chloride is colourless</td><td>sodium ions are colourless</td></tr>
<tr><td rowspan="2">Chromate</td><td>potassium chloride is colourless</td><td>potassium ions are colourless</td></tr>
<tr><td>potassium chromate is yellow</td><td>If potassium ions are colourless then yellow colour must come from chromate ions</td></tr>
</table>
Sodium chromate will have yellow colour as sodium ions are colourless and chromate ions are yellow.
</td></tr>
<tr><td>7</td><td>A,C
1 mark each</td><td>☑A Glucose joins together to form starch in plants
☒B Starch is a large polymer which is insoluble (sugars are soluble)
☑C Iodine turns blue/black in the presence of starch
☒D Starch is a large polymer which is not sweet (sugars are sweet)
☒E Starch is a carbohydrate with formula $(C_6H_{10}O_5)_n$</td></tr>
</table>

<table>
<tr>
<td>8</td>
<td>A,D
1 mark each</td>
<td>☑A ionic solutions conduct
☒B Covalent solids do not conduct
☒C Covalent liquids do not conduct
☑D Metallic solids conduct
☒E Ionic solids do not conduct (ions cannot move)
<table>
<tr><th>Bonding</th><th>Solid</th><th>Liquid</th><th>Solution</th></tr>
<tr><td>Metallic
(metals only)</td><td>✓</td><td>✓</td><td>-</td></tr>
<tr><td>Covalent
(non-metals only)</td><td>×</td><td>×</td><td>×</td></tr>
<tr><td>Ionic
(metals + non-metals)</td><td>×</td><td>✓</td><td>✓</td></tr>
</table>
</td>
</tr>
<tr>
<td>9</td>
<td>B,E
1 mark each</td>
<td>☒A potassium atoms have 19 electrons, argon has 18 electrons
☑B Potassium and lithium are in same group so have similar chemical properties
☒C potassium has atomic number of 19, sodium has atomic number of 11
☒D potassium has more electron shells than fluorine so potassium is larger
☑E potassium atoms (2,8,8,1) lose one electron to become potassium K^+ ions (2,8,8)</td>
</tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>10a</td><td>Table showing:</td><td>
<table>
<tr><th>Plastic</th><th>Property</th></tr>
<tr><td>Poly(ethenol)</td><td>Soluble (in water)</td></tr>
<tr><td>Poly(ethyne)</td><td>Conducts electricity</td></tr>
<tr><td>Biopol</td><td>Biodegradable</td></tr>
<tr><td>PVK</td><td>photoconductive</td></tr>
</table>
</td></tr>
<tr><td>10b</td><td>Broken down by bacteria</td><td>Biodegradable polymers like biopol have bonds in the structure which can be broken down. The long chain polymer can then be broken into much smaller chunks by bacteria and the polymer disappears over time.</td></tr>
<tr><td>10c(i)</td><td>solute</td><td>
<table>
<tr><td>solute</td><td>the substance that is dissolved</td></tr>
<tr><td>solvent</td><td>the liquid that does the dissolving</td></tr>
<tr><td>solution</td><td>A mixture formed when a solute dissolves in a solvent</td></tr>
</table>
</td></tr>
<tr><td>10c(ii)</td><td>Higher the % of hydroxyl groups, the lower the solubility</td><td>Problem Solving: Building a conclusion from data in a table.</td></tr>
<tr><td>11a</td><td>Bar chart showing:</td><td>½mark – vertical scale
½mark – correct labelling of bars & mass/mg on y-axis
1mark – bars drawn correctly (±½box)</td></tr>
<tr><td>11b</td><td>Thousands

Animals</td><td>Coal takes millions of years to form

Coal is made from the remains of plant materials like trees.</td></tr>
<tr><td>11c</td><td>Will run out eventually</td><td>Finite resources cannot be replaced quickly and they will run out if they are overused e.g. fossil fuels.</td></tr>
<tr><td>11d</td><td>Carbon dioxide and water</td><td>Methane is a hydrocarbon with the formula CH_4.
• the carbon in methane burns in a plentiful supply of air to form carbon dioxide.
• the hydrogen in methane burns to form water.</td></tr>
<tr><td>12a</td><td>B A C</td><td>The most reactive (B) reacts to give off the most bubbles
The least reactive (C) reacts to give off the least bubbles</td></tr>
<tr><td>12b</td><td>Hydrogen</td><td>ACID + METAL ⟶ SALT + HYDROGEN</td></tr>
<tr><td>12c(i)</td><td>Copper, mercury, silver, gold or platinum</td><td>The least reactive metals do not react with dilute acids like hydrochloric acid. Copper and the metals below it in the reactivity series (mercury, solver gold and platinum) are not reactive enough to react with dilute acids</td></tr>
<tr><td>12c(ii)</td><td>One answer from:</td><td>
<table>
<tr><td>Temperature</td><td>Concentration of acid</td><td>Mass of metal</td><td>Particle Size of metal</td></tr>
</table>
</td></tr>
<tr><td>13a</td><td>Chlorophyll</td><td>Chlorophyll is the chemical inside plant cells which absorbs the light energy needed to make glucose by photosynthesis in plants.</td></tr>
</table>

<table>
<tr><td>13b</td><td>Carbon dioxide</td><td>carbon dioxide + water ⟶ glucose + oxygen
$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$</td></tr>
<tr><td>13c</td><td>12
(accept 10-14)</td><td>
<table>
<tr><td>Temperature (°C)</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>Solubility (mg/l)</td><td>52</td><td>36</td><td>24</td><td>16</td><td>-</td></tr>
<tr><td>Difference:</td><td></td><td>16</td><td>12</td><td>8</td><td>Prediction: 4</td><td></td></tr>
<tr><td>Prediction:</td><td>-</td><td>-</td><td>-</td><td>-</td><td>12</td></tr>
</table>
</td></tr>
<tr><td>14a</td><td>Electrolysis</td><td rowspan="3">Electrolysis is the process where d.c. electricity is used to split ionic compounds in the liquid or solution state back to the elements.
• negative ions are attracted to the positive electrode:
$2Cl^- \rightarrow Cl_2 + 2e^-$
• positive ions are attracted to the negative electrode:
$Cu^{2+} + 2e^- \rightarrow Cu$</td></tr>
<tr><td>14b</td><td>Negative</td></tr>
<tr><td>14c</td><td>Gas (chlorine) is given off</td></tr>
<tr><td>14d</td><td>Carbon or graphite</td><td>Carbon, in the form of graphite, is the only non-metal element which conducts electricity</td></tr>
<tr><td>15a</td><td>C_4H_{10}</td><td>Cracking is the process where less useful saturated hydrocarbons are broken into smaller, unsaturated hydrocarbons.
• Total number of carbon and hydrogen atoms must balance on both sides of equation</td></tr>
<tr><td>15b</td><td>Bromine solution decolourises</td><td>Bromine solution will decolourise as the bromine Br_2 molecule adds across the C=C double bond in propene.</td></tr>
<tr><td>15c</td><td>0.7g</td><td>Catalyst is not used up in reaction so original mass will remain</td></tr>
<tr><td>16a</td><td>Increases</td><td>Acids have a pH below 7.
Indigestion tablets neutralise acid and will increase pH up to 7</td></tr>
<tr><td>16b(i)</td><td>Equation showing:</td><td>hydrochloric acid + calcium carbonate ⟶ calcium chloride + water + carbon dioxide</td></tr>
<tr><td>16b(ii)</td><td>Turns lime water milky</td><td>
<table>
<tr><td>Gas</td><td>Hydrogen</td><td>Oxygen</td><td>Carbon Dioxide</td></tr>
<tr><td>Gas Test</td><td>Burns with a pop</td><td>Relights glowing splint</td><td>Turns lime water milky</td></tr>
</table>
</td></tr>
<tr><td>16c</td><td>$C_5H_{12}O_5$</td><td>5 carbons, 12 hydrogens and 5 oxygens ∴ $C_5H_{12}O_5$</td></tr>
<tr><td>17a</td><td>Blue/purple</td><td>Ammonia gas is given off when ammonium salts are heated with strong alkalis e.g. calcium hydroxide.
Ammonia dissolves in water to form ammonium hydroxide which turns pH paper blue/purple.</td></tr>
<tr><td>17b</td><td>Ostwald Process</td><td>$NH_3 + O_2 \xrightarrow[\text{catalyst}]{Pt} NO_2 + H_2O$
NO_2 dissolves in water to form nitric acid</td></tr>
<tr><td>17c</td><td>Gives out heat</td><td>
<table>
<tr><td>Exothermic</td><td>Reaction which gives out heat</td></tr>
<tr><td>Endothermic</td><td>Reaction which takes in heat from the surroundings</td></tr>
</table>
</td></tr>
<tr><td>17d</td><td>Lightning/sparks</td><td>The direct combination of nitrogen and oxygen requires high voltage sparks to break the N≡N bond and allow the reaction.</td></tr>
</table>

18a(i)	Arrow on wires L ⟶ R	Electrons always travel through wires, not through the electrolyte solution. Electrons will travel from the metal higher up the electrochemical series (iron) to the metal lower down the electrochemical series (copper)
18a(ii)	Increase in voltage	iron/copper cell gives a voltage related to the positions on ECS Aluminium Zinc Iron Nickel Tin Lead Copper aluminium/copper cell gives a bigger voltage as there is a bigger separation on ECS
18b	Portable	Batteries produce d.c. current, are portable and do not produce mains hiss
18c(i)	Lead	Car batteries are also known as lead-acid batteries. The lead plates are dipped into sulphuric acid electrolyte.
18c(ii)	2	6 cells = 12V ∴ 1 cell = $\frac{12V}{6}$ = 2V
19a	AlI_3	Write down Valency below each element's symbol: Al I / 3 1 — Put in Cross-over Arrows: Al I / 3 1 — Follow arrows to get formula: AlI_3
19b(i)	aluminium nitrate	aluminium iodide + lead nitrate ⟶ aluminium nitrate (soluble, stays in solution) + lead iodide (insoluble, forms precipitate)
19b(ii)	filtration	Filtration separates insoluble solids from liquids.