Past Papers

Standard Grade

General

Chemistry

2009

Marking Scheme

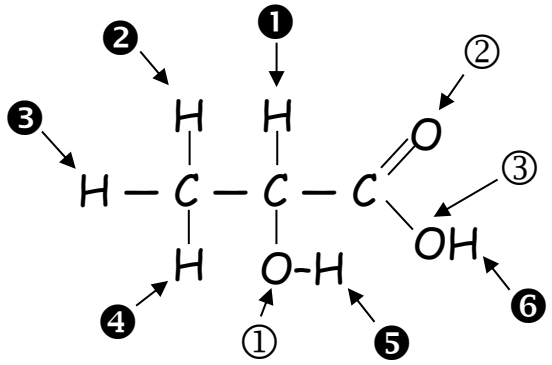
2009 General	KU		PS	
	/30	%	/30	%
3	19+	63%	20+	67%
4	14+	47%	14+	47%
5	11+	37%	12+	40%
7	<11	<37%	<12	<40%

2009 Standard Grade Chemistry General Marking Scheme

Question	Answer	Chemistry Covered
1a	B	Fluorine has the electron arrangement of 2,7 (p6 data booklet)
1b	E	Noble Gases are unreactive elements, found in Group 0
1c	C+D Both for 1 mark	Groups are vertical columns on the periodic table
2a	D	Iron is the catalyst in the Haber Process: $N_2 + 3H_2 \rightarrow 2NH_3$
2b	A	<table><tr><td>Metal</td><td>Mercury</td><td>Magnesium</td><td>Copper</td><td>iron</td><td>silver</td><td>sodium</td></tr><tr><td>Density</td><td>13.5</td><td>1.74</td><td>8.96</td><td>7.87</td><td>10.5</td><td>0.97</td></tr></table>
2c	F	<table><tr><td>Metal</td><td>Mercury</td><td>Magnesium</td><td>Copper</td><td>iron</td><td>silver</td><td>sodium</td></tr><tr><td>Discovery</td><td>ancient</td><td>1774 (old data booklet)</td><td>ancient</td><td>ancient</td><td>ancient</td><td>1807</td></tr></table>
3a	B+F Both for 1 mark	Variable which is changing: concentration (B is 1 mol/l and F is 2mol/l) Variables remaining the same: particle size (ribbon) and temperature (20°C)
3b	E	Box E is the fastest reaction: lowest particle size (powder), highest concentration (2mol/l) highest temperature (40°C)
4a	C	Air contains approx 80% nitrogen and approx 20% oxygen
4b	B	<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>
4c	E	glucose + oxygen ⟶ carbon dioxide + water $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$
4d	B	ACID + METAL ⟶ SALT + HYDROGEN
5a	F	Blast Furnace: iron oxide + carbon ⟶ iron + carbon dioxide
5b	D	Galvanising: Zinc coating sacrificially protects iron (or steel) underneath
6a	B	<table><tr><td>Compound</td><td>lead sulphate</td><td>sodium chloride</td><td>calcium hydroxide</td><td>potassium phosphate</td></tr><tr><td>Elements</td><td>lead + sulphur + oxygen</td><td>sodium + chlorine</td><td>calcium + hydrogen + oxygen</td><td>potassium + phosphorus + oxygen</td></tr></table>
6b	C	ACID + METAL HYDROXIDE → SALT + WATER (alkali) Hydrochloric acid + calcium hydroxide ⟶ calcium chloride + water
7	A,C 1 mark each	☑A Glucose has the formula $C_6H_{12}O_6$ and is classified as a carbohydrate ☒B Small carbohydrates like sugars are soluble in water ☑C Photosynthesis: carbon dioxide + water ⟶ glucose + oxygen ☒D Test for starch: Iodine solution turning blue/black ☒E Small molecules like glucose are small enough to pass through the gut wall into the blood
8	A,E 1 mark each	☑A Silver and gold are both transition metals as they are found in the block between groups 2+3 ☒B Silver and gold are metals ∴ both conduct electricity ☒C Lead is above both silver and gold in the Reactivity Series ☒D Silver and gold are unreactive metals and do not react with hydrochloric acid ☑E Silver and gold are unreactive metals and are both found uncombined in the Earth's crust

<table>
<tr><th>Question</th><th>Answer</th><th>Chemistry Covered</th></tr>
<tr><td>9a</td><td>exothermic</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>9b</td><td>Will run out eventually</td><td>Finite resources are resources which will not go on for ever and will run out with overuse.</td></tr>
<tr><td>9c</td><td>Crude oil or natural gas</td><td>Fossil Fuels: coal, oil, (natural) gas and peat.</td></tr>
<tr><td>10a</td><td><table><tr><td>12</td><td>Metal</td></tr><tr><td>17</td><td>Non-metal</td></tr></table></td><td>Atomic Number: number of protons in an atom
Metals are found on the left hand side of STEPS on Periodic Table</td></tr>
<tr><td>10b(i)</td><td>$MgCl_2$</td><td><table><tr><td>Write down Valency below each element's symbol
Mg Cl
2 1</td><td>Put in Cross-over Arrows
Mg Cl
2 1</td><td>Follow arrows to get formula
$MgCl_2$</td></tr></table></td></tr>
<tr><td>10b(ii)</td><td>1412
714</td><td>Melting and Boiling points of selected compounds are found on p5 of data booklet.</td></tr>
<tr><td>10b(iii)</td><td>Liquid</td><td>At 1000°C: magnesium chloride has melted (mpt=714°C)
At 1000°C: magnesium chloride has yet to boil (bpt=1412°C)</td></tr>
<tr><td>11a</td><td><table><tr><th>Plastic</th><th>Use</th></tr><tr><td>Perspex</td><td>Advertising signs</td></tr><tr><td>PVC</td><td>Artificial limbs</td></tr><tr><td>Polythene</td><td>Carrier bags</td></tr><tr><td>Polystyrene</td><td>Egg cartons</td></tr></table></td><td>Problem Solving: Paragraph of information → table</td></tr>
<tr><td>11b</td><td>Gets broken down by bacteria</td><td><table><tr><td>Biodegradable</td><td>get broken down by living organisms like bacteria and eventually disappear.</td></tr><tr><td>Non-Biodegradable</td><td>Do not get broken down by living organisms like bacteria and last a long time.</td></tr></table></td></tr>
<tr><td>11c</td><td>Thermoplastic</td><td><table><tr><td>Thermoplastic</td><td>Will reshape/melt on heating</td></tr><tr><td>Thermosetting</td><td>Do not reshape/melt on heating</td></tr></table></td></tr>
<tr><td>11d</td><td>Styrene</td><td><table><tr><td>Polymer</td><td>poly(ethene)</td><td>poly(propene)</td><td>poly(chloroethene)</td><td>poly(styrene)</td></tr><tr><td>Monomer</td><td>ethene</td><td>propene</td><td>chloroethene</td><td>styrene</td></tr></table></td></tr>
<tr><td>11e</td><td>Polymerisation
Or Addition Polymerisation</td><td>Polymerisation: process where monomers join together to make a bigger molecule (polymer)</td></tr>
<tr><td>12a</td><td>chlorine</td><td>Positive electrode: $2Cl^- \longrightarrow Cl_2 + 2e^-$
Negative Electrode: $Cu^{2+} + 2e^- \longrightarrow Cu$</td></tr>
<tr><td>12b</td><td>electrons</td><td>Electrons travel through the wires
Ions travel through the solution</td></tr>
<tr><td>12c</td><td>carbon or graphite</td><td>Graphite, a form of carbon, is the only non-metal conductor of electricity and is suitable for use as an electrode</td></tr>
<tr><td>13a</td><td>0.8g or
the same</td><td>Catalysts are chemically unchanged during reactions
∴ same mass of catalysts at start and end of reaction</td></tr>
<tr><td>13b(i)</td><td>Cracking</td><td><table><tr><td>Starting Chemicals</td><td>large, saturated and less useful</td></tr><tr><td>Products</td><td>smaller, more useful and some unsaturated</td></tr></table></td></tr>
</table>

<table>
<tr><td>13b(ii)</td><td>C_7H_{14}</td><td>C_7H_{14}: heptene – alkene with general formula C_nH_{2n}
C_9H_{20}: nonane – alkane with general formula C_nH_{2n+2}</td></tr>
<tr><td>14a</td><td>bar chart containing:</td><td>½mark – vertical scale
½mark – correct labelling of bars
1mark – bars drawn correctly (½ box error allowed)</td></tr>
<tr><td>14b</td><td>2 atoms joined together</td><td>Diatomic molecules have 2 atoms joined together by covalent bonds:
<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>14c</td><td>Alloys</td><td>Alloys are mixture of metals (or mixture of metals with non-metals)
e.g. Steel, stainless steel, brass, bronze, solder, amalgam, cupro-nickel</td></tr>
<tr><td>14d(i)</td><td>Intact tin-layer is barrier to water/air</td><td>Tin-layers outside steel will prevent air/water getting to steel underneath and thus prevent corrosion. If the tin layer gets scratched and the steel is exposed to air/water, the iron underneath sacrificially corrodes to protect the tin layer instead.</td></tr>
<tr><td>14d(ii)</td><td>Mg or Zn or Al</td><td>zinc, aluminium, magnesium would provide sacrificial protection. Calcium, lithium, sodium, potassium would also provide sacrificial protection to steel but are too reactive to work in practice.</td></tr>
<tr><td>15a</td><td>will run out/need replaced or more expensive than mains</td><td>
<table>
<tr><th>Advantages of Batteries</th><th>Advantages of Mains</th></tr>
<tr><td>portable</td><td>will run out/need replaced</td></tr>
<tr><td>low voltage</td><td>high voltages available</td></tr>
<tr><td>safer</td><td></td></tr>
</table></td></tr>
<tr><td>15b(i)</td><td>Value between 0.5V – 2.7V</td><td>Magnesium is higher up electrochemical series than iron
∴voltage will be less than 2.7V
Tin is lower down electrochemical series than iron
∴voltage will be more than 0.5V</td></tr>
<tr><td>15b(ii)</td><td>Any one from:</td><td>
<table>
<tr><td>Any one from:</td><td>volume + concentration of electrolyte</td></tr>
<tr><td>temperature</td><td>distance between electrodes</td></tr>
<tr><td>size of rods</td><td>depth of rod immersion</td></tr>
</table></td></tr>
<tr><td>16a(i)</td><td>man-made or not natural</td><td>Synthetic materials are made by the chemical industry and do not occur naturally on Earth</td></tr>
<tr><td>16a(ii)</td><td>Potassium K or phosphorus P</td><td>3 essential elements for plant growth are:
Potassium, Phosphorus and Nitrogen</td></tr>
<tr><td>16b</td><td>Ammonia or NH_3</td><td>ammonium nitrate + calcium hydroxide → calcium nitrate + water + ammonia
$2NH_4NO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + 2H_2O + 2NH_3$</td></tr>
<tr><td>17a</td><td>Biological catalyst</td><td>Enzymes are biological catalysts which are designed to work best at 37°C</td></tr>
<tr><td>17b</td><td>$C_3H_6O_3$

any order of elements is acceptable</td><td>  </td></tr>
</table>

<table>
<tr><td>17c</td><td>Sugar/Glucose is used up by fermentation
or
So alcohol is not produced
or
So sugar would not ferment</td><td>glucose $\xrightarrow[\text{enzymes}]{\text{no air}}$ ethanol + carbon dioxide
$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td>18a</td><td>check colour chart against colour to get pH number</td><td>The colour obtained in the gas jar is matched against the colours on the pH colour chart.
The corresponding number is the pH of the solution.</td></tr>
<tr><td>18b</td><td>any pH less than 7</td><td>Phosphorus oxide is a non-metal oxide. Non-metals oxides dissolve in water to form acids e.g. CO_2, NO_2 and SO_2 (but not CO)</td></tr>
<tr><td>18c</td><td>it is insoluble</td><td>Aluminium oxide is insoluble (p8 of data booklet)</td></tr>
<tr><td>19a</td><td>higher the number of carbons, the lower the octane number</td><td>For both alkanes and alkenes, every time a carbon is added to the chain length, the octane number falls each time.</td></tr>
<tr><td>19b</td><td>99-108</td><td>Answer must be higher than 98</td></tr>
<tr><td>19b</td><td>99-108</td><td>
<table>
<tr><td>Alkene</td><td>Propene</td><td>Butene</td><td>Pentene</td><td>Hexene</td><td>Heptene</td></tr>
<tr><td>No. of Carbons</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Octane Number</td><td>-</td><td>98</td><td>93</td><td>85</td><td>75</td></tr>
<tr><td>Difference:</td><td></td><td>average (7)</td><td>5</td><td>8</td><td>10</td></tr>
<tr><td>Prediction:</td><td>105</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>19c</td><td>octane number of alkanes lower than
octane number of alkene</td><td>The octane number of an alkane is always lower than octane number of corresponding alkene</td></tr>
</table>