May 2010
SEC Chemistry Paper 1
Marking Scheme

Section A

1 (a) Electron -1
Neutron 0

(b) 

<table>
<thead>
<tr>
<th></th>
<th>Electrons</th>
<th>Neutrons</th>
<th>Protons</th>
<th>Mass number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atom R</td>
<td>17</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ion Q(^2-)</td>
<td></td>
<td></td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Ion T(^+)</td>
<td>2</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Atom W</td>
<td>17</td>
<td></td>
<td></td>
<td>37</td>
</tr>
</tbody>
</table>

½ x 8

(ii) R and W
Award 1 if both correct
Award 0 if one correct

2 (a) (i) Moles carbon = 85.71 / 12 = 7.142
Moles hydrogen = 14.29 / 1 = 14.29
Ratio 1C : 2H  E.F. = CH\(_2\)
If E.F is given as (CH\(_2\))\(_n\) deduct ½ mark

(ii) M.F. = 3 x EF
E.F. = C\(_3\)H\(_6\)
½

(b) (i) C\(_3\)H\(_6\) + Br\(_2\) → CH\(_3\)CHBrCH\(_2\)Br
accept C\(_3\)H\(_6\)Br\(_2\)
All correct formulae award 2
If not all correct award 1

(ii) Red-orange bromine is decolorized / to colorless
Accept orange-brown
Do not accept brown
Award ½ if the colour is indicated and the answer is ‘decolorised’.

(iii) Any valid structure for an alkyne, showing triple bond
Award 0 if triple bond not shown
Award ½ if triple bond carbon is shown with five bonds
Accept bromoalkene.

Total 8 marks
3
Energy vibrate
(a) ________________________    (b) ________________________
liquid low
(c) ________________________    (d) ________________________
forces (accept bonds) accept gas or vapour
(e) ________________________    (f) ________________________
evaporation boiling
(g) ________________________    (h) ________________________
solid gas
(i) ________________________      (j) ________________________ ½ x 10

Total 5 marks

4 (a) \[4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-\] OR \[4\text{OH}^- - 4\text{e}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2\]
correct substances award 1 correct balancing award 1 2
If equation is incorrect but OH- is selected award ½

(b) (i) \[2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-\]
correct substances award 1 correct balancing award 1 2
If equation is incorrect but Cl- is selected award ½
(ii) Greenish-yellow gas/ gas / effervescence/ slightly yellowish solution 1

(c)
\[
\begin{array}{|c|c|}
\hline
\text{Mole of product} & \text{4F} \rightarrow 1\text{mole O}_2 \quad ½ \text{Hence 2F} \rightarrow 0.5\text{mole} \quad ½ \\
\text{in Experiment (a)} & \\
\hline
\text{Mole of product} & 2\text{F} \rightarrow 1\text{mole Cl}_2 \\
\text{in Experiment (b)} & \\
\hline
\end{array}
\]
Total 7 marks
5. (a) Dot-cross showing
Hydrogen with 1 electron being shared ½
Bromine with 7 electrons with one electron being shared ½
Both atoms completing the octet in an acceptable manner 1 2

Do not accept sharing shown as loops joining separated atoms: 
H ─► Br

(b) Carbon atom with 4 electrons ½
Three hydrogen atoms shown sharing an electron with carbon ½
One chlorine atom sharing an electron with carbon ½
Carbon and chlorine have an octet ½

Do not accept sharing shown as loops joining separated atoms 2

Total 4 marks

6. (a) True 1
(b) False 1
(c) False 1
(d) False 1
(e) True 1
(f) False 1

Total 6 marks

7. (a) Heat is given out / the reaction is exothermic 1
(b) J / kJ or kJmol⁻¹. 1
(c) Usual energy profile showing
horizontal axis labeled Reaction Path / extent of reaction ½
vertical axis labeled Energy ½
energy level labeled ‘reactants’/ HCl + KOH ½
lower energy level labeled ‘products’/ KCl + H₂O ½
Difference in energy level labeled ΔH 1

Disregard any reference to activation energy 3
(d) -38 1

Total 6 marks
8 (a) Moles hydrochloric acid = \( \frac{32.5 \times 0.12}{1000} \) moles ½
\[
= 0.0039 \text{ moles}
\]
½ 1

(b) Moles sodium carbonate neutralized = \( \frac{0.0039}{2} \) moles ½
\[
= 0.00195 \text{ moles}
\]
½ 1

(c) Mass sodium carbonate = 0.00195 \times 106 ½
\[
= 0.2067 \text{ g}
\]
½ 1

(d) Mass sodium chloride = 0.25 – 0.2067 = 0.0433g 1

Percentage impurity = \( \frac{0.0433 \times 100}{0.25} \) 1 3
\[
= 17.32 \%
\]
1

Total 6 marks

9 (a) (i) \( \text{Mg} + 2\text{Ag}^+ \rightarrow \text{Mg}^{2+} + 2\text{Ag} \)
Correct substances award 1
Correct balancing award 1
Disregard state symbols 2

(ii) Potassium reacts vigorously with the water of the solution / potassium gives an exothermic reaction with water/ effervescence/ hydrogen is given off/explosion/burns with a lilac flame any two 2

(b) Distilled water added to potassium carbonate and magnesium chloride in a small beaker. Stirred.
Filter magnesium carbonate precipitate formed.

1 mark for choice of chemicals (½ mark each)
1 mark for method (½ for solution; ½ for filtration)
Accept equation if given showing aqueous solutions followed by filtering 2

Total 6 marks
<table>
<thead>
<tr>
<th>Element</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) magnesium</td>
<td>White ash formed / intense white light / magnesium ribbon burns</td>
</tr>
<tr>
<td>(ii) sulfur</td>
<td>Yellow solid used up / pungent smelling gas / gas produced / burns with a blue flame (if the observation is ‘it darkens’ award ½)</td>
</tr>
<tr>
<td>(iii) copper</td>
<td>Pink powder ‘disappears’ / black solid formed</td>
</tr>
</tbody>
</table>

Award 1 mark for any one of the observations listed.

(b) Sulfur dioxide  
do not accept sulfur trioxide  
do not accept sulfur oxide  

(c) \(2Cu + O_2 \rightarrow 2CuO\)  
Correct substances award 1  
Correct balancing award 1  
Disregard state symbols  

Total 6 marks

Section B

11 (a) (i) Sulfur dioxide (if correct formula is given instead of name award ½)  
(ii) from orange to green (if answer is ‘turns green’ award only ½)  
(iii) Potassium sulfite  
Accept the formula. Award ½ mark for each ion.  
If \(H_2SO_3\) is given award ½ mark.  
(iv) \(2HCl + K_2SO_3 \rightarrow 2KCl + H_2O + SO_2\)  
Correct substances award 1  
Correct balancing award 1  
Partially correct substances / balancing award ½  
Disregard state symbols  
If (iii) is incorrect, do not award marks for the corresponding equation.  
(v) \(Ba^{2+}_{(aq)} + SO_3^{2-}_{(aq)} \rightarrow BaSO_3(s)\)  
Correct substances award 1  
Correct state symbols award 1  

(b) (i) Ammonia  
(If answer given is ammonium, award only ½)  
(ii) Dense white fumes with HCl  
Do not accept ‘is soluble’
Do not accept ‘reacts with chlorine to give white fumes’.

(iii) Ammonium bromide

(iv) \( \text{NH}_4^+ (aq) + \text{OH}^- (aq) \xrightarrow{} \text{NH}_3 (g) + \text{H}_2\text{O}(l) \)

Correct substances award 1
Correct state symbols award 1

Do not accept \( \text{NH}_4\text{OH} \) as product.

(v) \( \text{Ag}^+ (aq) + \text{Br}^- (aq) \xrightarrow{} \text{AgBr}(s) \)

Correct substances award 1
Correct state symbols award 1

If (iii) is incorrect do not award marks for the corresponding equation.

(c) (i) Lead(II) nitrate

Accept also lead(II) ethanoate
Accept the formula

(ii) Lead(II) hydroxide

(iii) Lead(II) bromide

(iv) \( \text{Pb}^{2+} (aq) + 2\text{Br}^- (aq) \xrightarrow{} \text{PbBr}_2(s) \)

Correct substances award 1
Correct state symbols award \( \frac{1}{2} \)
Correct balancing award \( \frac{1}{2} \)

Total  20 marks

12  (a) (i) Sodium hydrogen sulphate / \( \text{NaHSO}_4 \)

Sodium sulphate / \( \text{Na}_2\text{SO}_4 \)

(ii) \( \text{H}_2\text{SO}_4 + \text{NaOH} \xrightarrow{} \text{NaHSO}_4 + \text{H}_2\text{O} \)

OR

\( \text{H}_2\text{SO}_4 + 2\text{NaOH} \xrightarrow{} \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O} \)

Correct substances award 1
Correct balancing award 1

Partially correct substances / partially correct balancing award \( \frac{1}{2} \)
Disregard state symbols

(b) (i) \( \text{CH}_3\text{COOH} + \text{NaHCO}_3 \xrightarrow{} \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2 \)

Correct substances award 1
Correct balancing award 1

Partially correct substances / partially correct balancing award \( \frac{1}{2} \)
Disregard state symbols

(ii) sodium ethanoate
Water
Carbon dioxide

(c) (i) \( U < W < V < T \)
Award 2 marks for all correct
Award 1 mark for two in their proper place
Award ½ if one is in the proper place

(ii) Same volumes

<table>
<thead>
<tr>
<th>Solution T</th>
<th>Solution U</th>
<th>Solution V</th>
<th>Solution W</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 cm³</td>
<td>25 cm³</td>
<td>10 cm³</td>
<td>15 cm³</td>
</tr>
</tbody>
</table>

½ x 4  
Award marks if answer given is simply ‘same volumes’.

(d) (i) Magnesium carbonate  
No credit for sodium hydroxide

(ii) Is basic  
Is not corrosive/is non toxic

If NaOH is chosen in (i) award 1 here for saying that it is basic

(e) Lead(II) sulfate forms a protective layer/ stops the reaction from continuing/ is insoluble  
Lead(II) nitrate is sol and reaction can proceed

\[
PbCO_3 + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O + CO_2
\]

Correct substances award 1  
Correct balancing award 1

State symbols can substitute second mark

Total 20 marks