Year 10 Advanced Science - Chemistry Test 2016 (Max = 100 marks)
Part A Multiple Choice Questions (20 marks)

1. Which of the following involves a chemical change?
   A A piece of chocolate becomes soft when warmed.
   B Dry ice (solid CO₂) is warmed to form gaseous CO₂.
   C Fireflies glow in the dark.
   D Water boils to become steam.

2. Which of the following particles can be found inside the nucleus of an atom?
   A Electrons and protons
   B Neutrons and protons
   C Electrons and neutrons
   D Neutrons only

3. Which of the following is not an example of a metal?
   A Copper
   B Chromium
   C Argon
   D Tungsten

4. Which of the following substances is a covalent compound?
   A Na₂O
   B Fe₂O₃
   C SO₂
   D PbO₂

5. In the compound copper sulphate (CuSO₄), the copper ion would have a charge of:
   A +2
   B -2
   C +1
   D -1.

6. Which element needs to exist as molecules?
   A Neon
   B Carbon
   C Calcium
   D Nitrogen

7. Magnesium is dissolved in acid. Its equation is Mg + 2HCl →  _____ + H₂. The missing chemical in the reaction is:
   A MgCl₂
   B Mg₂Cl
   C MgCl₂
   D 2MgCl₂

8. Magnesium is a more reactive metal than Lead. This means that:
   A electrons are easily transferred from Magnesium atoms to Lead atoms
   B Magnesium will deposit if Lead is placed in a solution containing Magnesium ions
   C Lead atoms give up electrons more easily than Magnesium atoms
   D Lead will be produced if Magnesium is placed in a solution containing Lead ions.

9. When solutions of sodium chloride (NaCl) and silver nitrate (AgNO₃) are mixed, solid silver chloride (AgCl) forms. Which ions remain dissolved in the solution?
   A Na⁺ and Cl⁻
   B Ag⁺ and Cl⁻
   C Na⁺ and NO₃⁻
   D Ag⁺ and NO₃⁻

10. How many electrons are shared when two atoms have a double bond between them?
    A 2
    B 4
    C 6
    D 8

11. A precipitate:
    A may form when two clear solutions are mixed
    B is a soluble salt
    C forms because the ions in a solution repel each other
    D collects at the surface when two solutions are mixed.
12. A chemical reaction is represented by the equation shown below.
   \[ \text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{CO}_2(g) \]  
   This is an example of:
   A. a neutralisation reaction  
   B. a displacement reaction  
   C. a precipitation reaction  
   D. a decomposition reaction.

13. In the chemical reaction iron + sulphur \( \rightarrow \) iron sulphide:
   A. iron and sulphur are products  
   B. iron sulphide is the product  
   C. iron, sulfur and iron sulphide are products  
   D. sulphide is the product.

14. The structure of a metal is best described as a lattice of:
   A. alternating positive and negative ions  
   B. positive ions surrounded by freely moving electrons  
   C. molecules held together by covalent bonds  
   D. atoms held together by covalent bonds.

15. Which of the following is not a property of most metals?
   A. poor thermal conductors  
   B. good electrical conductors  
   C. malleable  
   D. shiny appearance

16. Moving through the activity series for metals from potassium (K) to gold (Au) the metals become more:
   A. likely to be found as native metals  
   B. reactive  
   C. expensive to extract from their ores  
   D. likely to donate electrons.

17. Elements in Group 3 of the periodic table are most likely to:
   A. lose three electrons when they react.  
   B. gain three protons when they react.  
   C. lose three neutrons when they react.  
   D. gain three electrons when they react.

18. Ionic compounds such as KCl (s) are hard like metals, but unlike metals they are:
   A. brittle.  
   B. gases at room temperature.  
   C. malleable and ductile.  
   D. conduct electricity.

19. Which of the following is the balanced chemical equation that describes the reaction of hydrogen with oxygen to produce water?
   A. \( 2\text{H}(g) + 0(g) \rightarrow \text{H}_2\text{O}(g) \) \( \times \)  
   B. \( \text{H}_2(g) + \text{O}_2(g) \rightarrow \text{H}_2\text{O}(g) \)  
   C. \( 2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(g) \)  
   D. \( \text{H}_2(g) + \text{O}_2(g) \rightarrow \text{H}_2\text{O}_2(g) \) \( \times \)

20. Which of the following processes could prevent iron from rusting?
   A. Reacting with sodium chloride  
   B. Alloying with chrome and nickel  
   C. Melting and solidification  
   D. Cleaning with an acid
Part B: Short Answered Questions

1. Periodic Table and Atomic Structure [12 marks] [¼ mark @ ]

<table>
<thead>
<tr>
<th>Element/Ion</th>
<th>Symbol</th>
<th>Atomic no</th>
<th>Mass no</th>
<th>Proton no</th>
<th>Neutron no</th>
<th>Electronic configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>eg. Lithium</td>
<td>Li</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>(2,1)</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg</td>
<td>12</td>
<td>24</td>
<td>12</td>
<td>12</td>
<td>(2,8,2) (15)</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>P</td>
<td>15</td>
<td>31</td>
<td>15</td>
<td>16</td>
<td>(2,8,5) (15)</td>
</tr>
<tr>
<td>Argon</td>
<td>Ar</td>
<td>18</td>
<td>40</td>
<td>18</td>
<td>22</td>
<td>(2,8,8) (15)</td>
</tr>
<tr>
<td>Potassium ion</td>
<td>K⁺</td>
<td>19</td>
<td>39</td>
<td>19</td>
<td>20</td>
<td>(2,8,8) (15)</td>
</tr>
<tr>
<td>Bromine ion</td>
<td>Br⁺</td>
<td>35</td>
<td>80</td>
<td>35</td>
<td>45</td>
<td>35 electrons</td>
</tr>
<tr>
<td>Oxide ion</td>
<td>O²⁻</td>
<td>8</td>
<td>16</td>
<td>8</td>
<td>8</td>
<td>(2,8)</td>
</tr>
</tbody>
</table>

2. Write down the name of each of the following compounds and state whether each is ionic or covalent compound. [10 marks]

<table>
<thead>
<tr>
<th>Chemical Formula</th>
<th>Name of the chemical [1 mark @]</th>
<th>Ionic or covalent compound [½ mark @]</th>
<th>How many atoms in one molecule? [½ mark @]</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂S</td>
<td>Hydrogen Sulphide</td>
<td>Covalent</td>
<td>3</td>
</tr>
<tr>
<td>AlBr₃</td>
<td>aluminium bromide</td>
<td>Ionic</td>
<td>4</td>
</tr>
<tr>
<td>Fe₃(PO₄)₂</td>
<td>Iron Phosphate</td>
<td>Covalent</td>
<td>13</td>
</tr>
<tr>
<td>Mg(OH)₂</td>
<td>Magnesium Hydroxide</td>
<td>Ionic</td>
<td>5</td>
</tr>
<tr>
<td>(NH₄)₂CO₃</td>
<td>Ammonium Carbonate</td>
<td>Ionic</td>
<td>14</td>
</tr>
</tbody>
</table>

3. Write down the chemical formula for each compound [8 marks]

<table>
<thead>
<tr>
<th>Name</th>
<th>Chemical formula</th>
<th>Name</th>
<th>Chemical formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc Sulphate</td>
<td>ZnSO₄</td>
<td>Ammonium Sulphide</td>
<td>(NH₄)₂S</td>
</tr>
<tr>
<td>Barium Chloride</td>
<td>BrCl₂</td>
<td>Potassium bicarbonate</td>
<td>K₂CO₃</td>
</tr>
<tr>
<td>Sodium Phosphate</td>
<td>Na₃PO₄</td>
<td>Copper(1) Oxide</td>
<td>Cu₂O</td>
</tr>
<tr>
<td>Beryllium Iodide</td>
<td>BeI₂</td>
<td>Aluminium Carbonate</td>
<td>Al₂(CO₃)₃</td>
</tr>
</tbody>
</table>

4. Balance the following chemical equations. [5 marks]

- H₂SO₄ + 2NH₄OH → (NH₄)₂SO₄ + 2H₂O
- Zn + CuSO₄ → ZnSO₄ + Cu
- Fe(OH)₃ + 3HCl → FeCl₃ + 3H₂O
- 4Al + 3O₂ → 2Al₂O₃
- C₃H₈ + 5O₂ → 3CO₂ + 4H₂O
5. Explain why ionic compounds such as magnesium fluoride do not conduct electricity when it is solid but do conduct when dissolved in pure distilled water. [3 marks]

\[
\begin{align*}
\text{Mg}^{2+} & \text{ and } F^- \text{ interlock to form a giant ionic} \\
\text{lattice, no free ions are moving, therefore it} \quad \text{can't conduct electricity. If dissolved in water,} \\
\text{releasing free Mg}^{2+} \text{ and F}^- \text{ ions to conduct electricity.}
\end{align*}
\]

6. Identify the following chemical equations as combination, decomposition, precipitation, combustion, displacement or neutralisation. [6 marks]

\[
\begin{align*}
a & \quad 2\text{Pb}_3\text{O}_4(s) \to 6\text{PbO}(s) + \text{O}_2(g) \quad \text{Decomposition} \\
b & \quad 2\text{HCl}_\text{(aq)} + \text{Ca(OH)}_2(s) \to \text{CaCl}_2_\text{(aq)} + 2\text{H}_2\text{O(l)} \quad \text{Neutralisation} \\
c & \quad 2\text{C}_3\text{H}_6(g) + 9\text{O}_2(g) \to 6\text{CO}_2(g) + 6\text{H}_2\text{O(l)} \quad \text{Combustion} \\
d & \quad (\text{NH}_4)_2\text{SO}_4_\text{(aq)} + \text{Ba(NO}_3)_2_\text{(aq)} \to \text{BaSO}_4(s) + 2\text{NH}_4\text{NO}_3_\text{(aq)} \quad \text{Precipitation} \\
e & \quad \text{Mg}(s) + 2\text{AgNO}_3_\text{(aq)} \to \text{Mg(NO}_3)_2_\text{(aq)} + 2\text{Ag(s)} \quad \text{Single displacement} \\
f & \quad \text{Fe}(s) + \text{S(s)} \to \text{FeS(s)} \quad \text{Combination}
\end{align*}
\]

7. Here is an activity series:

\[\text{K Na Ca Mg Al Zn Fe Pb Cu Ag Au}\]

a Which metal(s) would be most likely to: [7 marks]

i be found in its natural state \text{Au} 
ii be the most active of listed elements \text{K} 
iii be stored in oil \text{K Na} 
iv be used to make jewellery \text{Cu Ag Au} 
v in ribbon form and burn in air to give a bright light \text{Mg} 
vi displace Silver (Cu or Ag) \text{Cu} 
vii best conductors of electricity \text{Cu (Ag)}

b What is the meaning Galvanisation? Give an example. [2 marks]

Coating zinc around iron metal to prevent rusting of iron.

c Which of the following reaction takes place? Explain your answer. [2 marks]

\[
\begin{align*}
(A) & \quad \text{Zn(NO}_3)_2 + \text{Cu} \quad \rightarrow \quad \text{Cu(NO}_3)_2 + \text{Zn} \quad \text{or} \\
(B) & \quad \text{Cu(NO}_3)_2 + \text{Zn} \quad \rightarrow \quad \text{Zn(NO}_3)_2 + \text{Cu}
\end{align*}
\]

\[(B) \quad \text{only as Zn is more reactive than Cu}\]
8. A student wrote the equation below to represent the rusting of iron:

$$4 \text{Fe(s)} + 3 \text{O}_2(g) \rightarrow 2 \text{Fe}_2\text{O}_3(s)$$

a) Balance the above equation! [1 mark]

b) What substance required for rusting is *not* shown in this equation? [1 mark]

Water / $\text{H}_2\text{O}$

c) State 2 conditions that would speed up the rate of rusting of an iron garden chair other than the answer mentioned in b. [2 marks]

Salt, acid, moisture

d) Give 2 ways you can prevent rusting of the metal tools used in the garden. [2 marks]

Oil / grease, drying / cleaning

9. Describe TWO similarities and TWO differences between ionic bonds such as those found in calcium chloride and covalent bonds such as those found in molecules such as sulphur dioxide. [4 marks]

- The element atoms try to achieve octet - valence electrons are involved in formation of compound.

- Ionic bonds involve the transfer of an electron from metal to non-metal; Covalent bonds - sharing electrons between non-metallic ions.

10. Metals are able to conduct electricity. Explain this property using the metallic bonding model. (Illustrate with a simple diagram) [4 marks]

Metallic bond exists within a lattice surrounded by a sea of electrons allowing electricity to pass through


a) Draw a complete diagram showing the electronic configuration of Magnesium and Chlorine atoms.

b) Use Lewis diagrams or shell diagrams to show the formation of magnesium chloride. Write down the final formula of this compound. [5 marks]
12. Use a Lewis diagram to illustrate the structure of
   a) Nitrogen molecule
   \[
   N_2 \rightarrow \overset{\cdot}{N} \overset{\cdot}{N} \rightarrow N=\overset{\cdot}{N} \rightarrow N=\overset{\cdot}{N}
   \]
   [3 marks]

   b) Water molecule
   \[
   \overset{\cdot}{H} \overset{\cdot}{O} \overset{\cdot}{H} \rightarrow \overset{\cdot}{H} \overset{\cdot}{O} \overset{\cdot}{H} \rightarrow \overset{\cdot}{H} \overset{\cdot}{O} \overset{\cdot}{H}
   \]
   [3 marks]

   c) carbon dioxide.
   \[
   \overset{\cdot}{O} \overset{\cdot}{C} \overset{\cdot}{O} \rightarrow \overset{\cdot}{O} \overset{\cdot}{C} \overset{\cdot}{O} \rightarrow \overset{\cdot}{O} \overset{\cdot}{C} \overset{\cdot}{O}
   \]
   [4 marks]