NATIONAL SPORT SCHOOL

HALF-YEARLY EXAMINATION 2016

Track 3

FORM 3 CHEMISTRY TIME: 1h 30 mins

<table>
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<tr>
<th>Question</th>
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DO NOT WRITE ABOVE THIS LINE

Name: ___________________________________  Class: __________

<table>
<thead>
<tr>
<th>85% of Theory Paper</th>
<th>15% Practical</th>
<th>100% Final Score</th>
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Useful data: A copy of the Periodic Table is printed below.

**PERIODIC TABLE**

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</table>

Key

<table>
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<tr>
<th>a</th>
<th>b</th>
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</thead>
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<tr>
<td>relative atomic mass</td>
<td>symbol</td>
</tr>
<tr>
<td>atomic number</td>
<td></td>
</tr>
</tbody>
</table>
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National Sport School  Page 1 of 12
SECTION A:

Answer ALL questions in this section, using the spaces provided. This section carries 60 marks.

1a. Materials are classified as solid, liquid or gas according to their properties. Draw the arrangements of the particles in solids, liquids and gases in the appropriate box provided underneath.

- Solid
- Liquid
- Gas

(3 marks)

b. The melting and boiling points of 6 substances are given below.

i. Fill in the table by predicting the state of each substance at room temperature. (Room temperature taken at 20°C).

<table>
<thead>
<tr>
<th>Substance</th>
<th>Melting point/°C</th>
<th>Boiling point/°C</th>
<th>Solid/Liquid or Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>-182</td>
<td>-164</td>
<td></td>
</tr>
<tr>
<td>Sulfur</td>
<td>113</td>
<td>445</td>
<td></td>
</tr>
<tr>
<td>Mercury(II)</td>
<td>-30</td>
<td>357</td>
<td></td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>-112</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Mercury(II)chloride</td>
<td>276</td>
<td>302</td>
<td></td>
</tr>
<tr>
<td>Bromine</td>
<td>-7</td>
<td>59</td>
<td></td>
</tr>
</tbody>
</table>

(6 marks)

ii. Which substance will freeze first on cooling from room temperature to a low temperature? ________________________.

(1 mark)

(Total: 10 marks)
2. Name
a. a metal _________________________________________________.

b. a substance that sublimes on heating _________________________.

c. a non-metal _________________________________________________.

d. the positively charged particle inside an atom _____________________.

e. the apparatus used to separate two immiscible liquids _________________________________________________.

f. the process which describes the change from a liquid to a gas _________________________________________________.

g. an example of a diatomic molecule. _____________________________.

h. an element which is in the same group as sodium _____________________.

i. a noble gas _________________________________________________.

j. a compound _________________________________________________.

(Total: 10 marks)

3. Calcium chloride is a compound which forms by ionic bonding.

a. Fill in the table below (use the periodic table provided).

<table>
<thead>
<tr>
<th>Element</th>
<th>Number of protons</th>
<th>Number of electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2 marks)

b. Write down the electronic configuration of:

Ca _______________________

Cl _______________________

(2 marks)
c. Draw a dot and cross diagram in the space below, to show the ionic bonding in calcium chloride.

(5 marks)

d. What are the charges on the:

Ca ion _______________
Cl ion _______________

(2 marks)

e. Write the formula of Calcium chloride: ________________

(1 mark)

f. Explain why ionic compounds conduct electricity when molten or in solution?

__________________________________________________________________________________

(1 mark)

(Total: 13 marks)
4a. Balance the following equations:

i. \( \_\_\_\_\_\_ Fe + \_\_\_\_ H_2SO_4 \rightarrow \_\_\_\_\_\_ Fe_2(SO_4)_3 + \_\_\_\_ H_2 \)

ii. \( \_\_\_\_\_\_ CH_4 + \_\_\_\_\_\_ O_2 \rightarrow \_\_\_\_\_\_ H_2O + \_\_\_\_\_\_ CO_2 \)

iii. \( \_\_\_\_\_\_ KOH + \_\_\_\_\_\_ H_3PO_4 \rightarrow \_\_\_\_\_\_ K_3PO_4 + \_\_\_\_\_\_ H_2O \)

iv. \( \_\_\_\_\_\_ NH_3 + \_\_\_\_\_\_ O_2 \rightarrow \_\_\_\_\_\_ NO + \_\_\_\_\_\_ H_2O \)

(4 marks)

4b. Write down the correct formulae for the following compounds:

i. Magnesium sulfate  ________________.

ii. Beryllium oxide  ________________.

iii. Copper(II) chloride  ________________.

iv. Ammonium nitrate  ________________.

(4 marks)

4c. Give the chemical name of the following compounds:

i. \( K\text{MnO}_4 \)  ________________________________.

ii. \( \text{Mg(OH)}_2 \)  ________________________________.

iii. \( \text{FeCl}_3 \)  ________________________________.

(3 marks)

(Total: 11 marks)

5. The following are oxides of some elements: ZnO, MgO, H_2O, K_2O, CO_2.

a. From the list choose:

i. a basic oxide which is soluble in water: ________________.

ii. a neutral oxide: ________________________________.

iii. an acidic oxide: ________________________________.

iv. an amphoteric oxide: ________________________________.

(4 marks)
5b. For the oxide in (a) (i) give a balanced equation to show how this oxide reacts with water.

__________________________________________________________

(2 marks)

(Total: 6 marks)

6a. A sample of water is heated from a liquid at 40 °C to a gas at 110 °C as shown in the graph below:

i. Which section of the graph represents the liquid phase only? __________.

ii. Which section of the graph represents the gas phase only? ____________.

iii. Which section of the graph represents the liquid and the gas phase together? ____________________________________________________.

iv. What is the temperature at section RS called? ______________________.

(4 marks)

v. Explain why at 100 °C, the temperature of water (section RS), does not change?

__________________________________________________________

__________________________________________________________.

(2 marks)
6b. In the space provided underneath, draw the cooling curve of water from a temperature of 100 °C to a temperature of -10 °C.

(4 marks)

(Total: 10 marks)

SECTION B:

Answer any TWO questions from this section. Each question carries 20 marks. Write your answers in the spaces provided.

7a. A student was asked to obtain copper sulfate crystals from a mixture of copper sulfate crystals and copper oxide powder. The student started separating the mixture by adding water to the mixture.

i. Explain why the student added water to the mixture of copper sulfate and copper oxide?

(2 marks)
ii. After adding the water to the mixture, the student stirred the mixture and then proceeded to the next stage of the separating technique. With the help of a labelled diagram, describe the second stage of this separation technique?


(4 marks)

iii. If the student wanted to obtain a dry sample from the solution obtained, what procedure would he have to follow? Describe the procedure with the help of a diagram.


(4 marks)
7b. Name the separation technique used to separate the following mixtures:

i. iron and sulfur: ___________________________________________

ii. obtaining water from a water/salt mixture: _____________________

iii. oxygen and liquid air: ______________________________________

iv. petrol and kerosene from crude oil: ___________________________

v. two different dyes: __________________________________________

(10 marks)

Total: 20 marks

8. This question is about air and its components.

a. The following setup can be used in a laboratory to remove the main gases, one by one, that make up the air around us.

\[ \text{U-tube 1 contains calcium hydroxide (limewater) solution, Ca(OH)\textsubscript{2}.} \]

\[ \text{U-tube 2 contains white anhydrous copper (II) sulfate, CuSO\textsubscript{4}.} \]

\[ \text{The furnace (3) contains heated copper metal (Cu).} \]

Which components of air are removed at each stage 1, 2, & 3? Include any observations and equations for the chemical reactions that take place at each stage.

U-tube 1: ____________________________________________________

______________________________________________________________

______________________________________________________________

U-tube 2: ________________________________
ii. What gas is collected in the evacuated globe?  
_______________________________________________________________

(1 mark) 

b. Three test-tubes were set-up as follows to prove that iron reacts with air (oxygen), in the presence of water to form rust.

i. Give the name and chemical formula for rust? 
Name: __________________      Formula: __________________________

(2 marks) 

ii. What is the function of the following materials used in the above experiment:  *anhydrous calcium chloride; oil; boiled water*

_______________________________________________________________

(3 marks)
iii. State whether you would expect the nails to rust in each of the test-tubes?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(3 marks)

iv. Give two methods which can be used to prevent rusting.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2 marks)

(Total: 20 marks)

9a. This question is about air pollution.

i. Mention three of the world’s major polluting gases:

________________________________________________________________________

(3 marks)

ii. For each gas mentioned in (i) state one likely source, and one harmful effect on the environment:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(6 marks)

iii. Explain briefly what is meant by the “greenhouse effect.”

________________________________________________________________________

________________________________________________________________________
9bi. Explain what is meant by acid rain and describe why it is harmful to the environment.

______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________

(4 marks)

ii. Explain what CFC’s are and describe why they are harmful to our atmosphere.

______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________

(4 marks)

(Total: 20 marks)

--- END OF PAPER --