

الاسم:
الرقم:مسابقة في مادة الكيمياء
المدة : ساعة واحدة

This Exam Is Composed of Three Exercises. It Is Inscribed on 2 Pages.

The Use of Non-programmable Calculator Is Allowed.

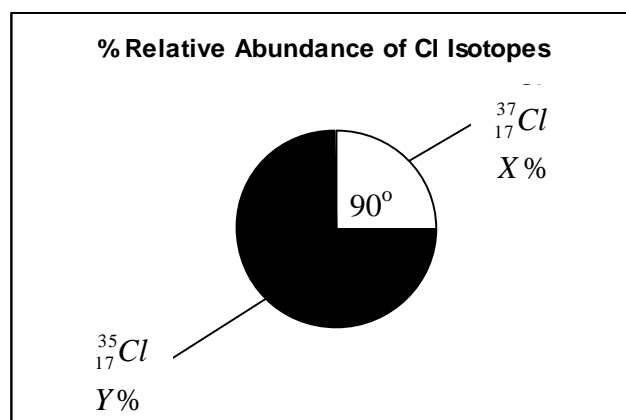
Answer the Following Three Questions.

First Exercise (7points) Common Table Salt Sodium Chloride

Several chemicals can be obtained from sodium chloride such as chlorine, sodium hydroxide, sodium and other chemicals. The obtained chemicals have various uses. For example, sodium hydroxide is used in soap making and manufacturing paper, sodium is used in street lighting lamps and chlorine gas is used to treat drinking water, swimming pools and to produce household bleach.

Chlorine exists in nature as an isotopic mixture.

The **figure** shows the representation of the isotopes of chlorine and the percentage (%) relative abundance of each isotope expressed as X % and Y %.



Figure

1- Using the information given in the **figure**:

a) Calculate the % relative abundance of the isotope $^{37}_{17}\text{Cl}$.

b) Calculate the charge of the nucleus of the isotope $^{35}_{17}\text{Cl}$.

Given: The relative charge of a proton = 1+ , the charge of a neutron = 0

2- Copy the following table on your answer sheet and complete it.

Isotope	% relative abundance	Number of neutrons	Number of electrons
$^{35}_{17}\text{Cl}$			
$^{37}_{17}\text{Cl}$			

3- Although chlorine gas is poisonous, yet it reacts with sodium metal to produce a very important salt, sodium chloride, commonly called table salt which is an essential component of our diet.

The equation of the reaction is: $2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$

a) Indicate the oxidation number of the atoms of the elements before and after the reaction.

b) Write the oxidation half-reaction.

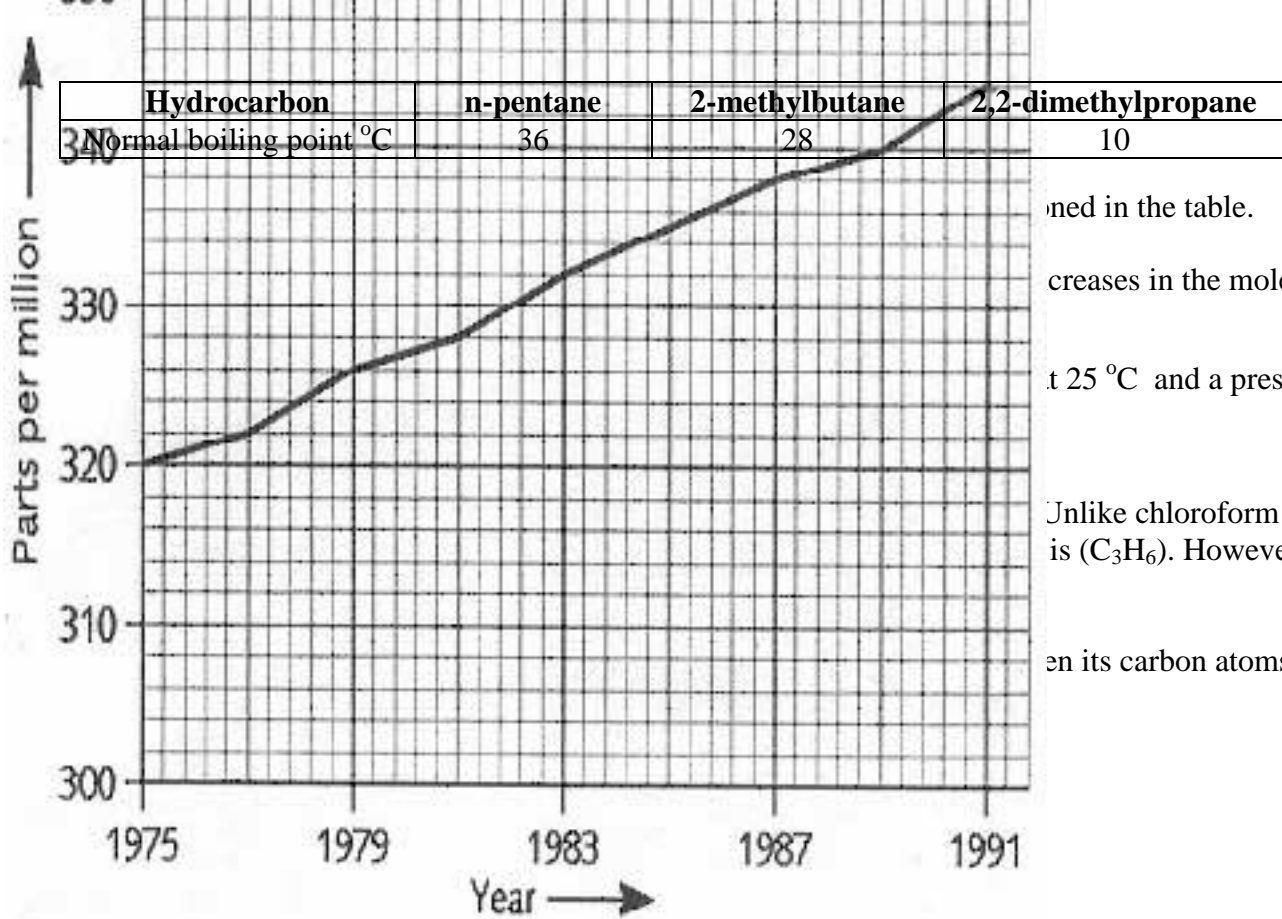
c) Identify the reducing agent.

4- Extract from what has preceded one use for: a) sodium chloride , b) chlorine gas.

Second Exercise (7 points) Hydrocarbons: Fuels and Anesthetics

Fuels are used in combustion reactions to produce energy. Anesthetics are used in surgery to reduce pain. The table given on the next page shows the IUPAC names (systematic names) of three hydrocarbons and their normal boiling point temperatures

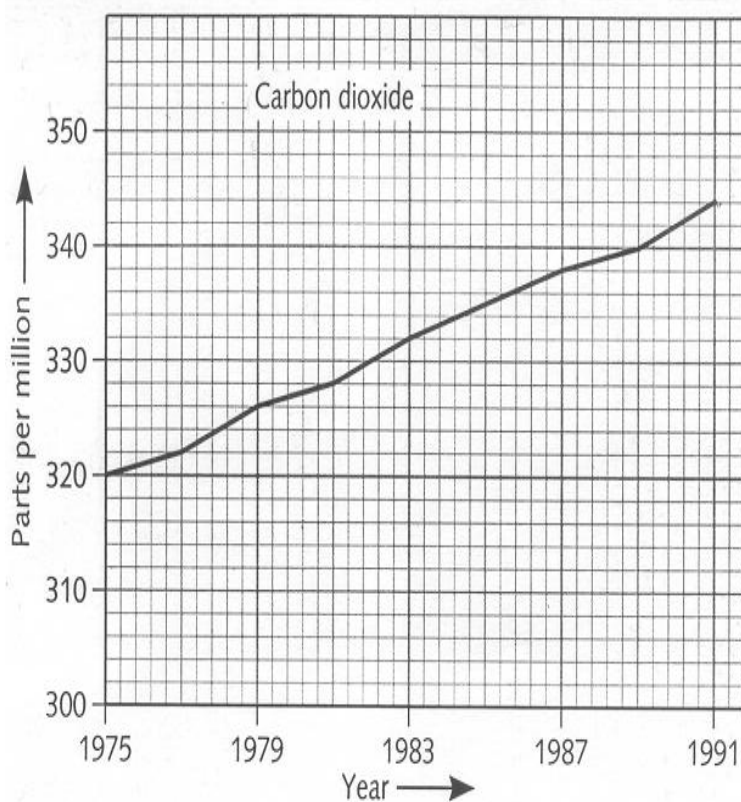
N.B: Normal boiling point is the temperature at which a liquid changes to gas under a pressure of 1 atmosphere.



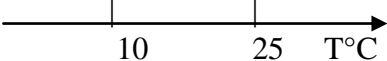
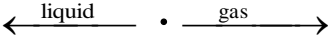
ned in the table.
 creases in the molecules
 t 25 °C and a pressure
 Unlike chloroform it has
 is (C₃H₆). However, the
 en its carbon atoms.

.C. and :O.

- 1- Explain the bond formation in a molecule of carbon dioxide and indicate the type of the bonds.
- 2-The increase in Earth's atmospheric temperature is a consequence of "green-house" effect. It is associated to the increased amount of carbon dioxide in the air. The graph given shows the changes in the amount of carbon dioxide (parts per million, ppm) between the years 1975 and 1991.
 - a) Give the value in ppm of the amount of carbon dioxide in the air for the year 1983.
 - b) Calculate the increase in the amount of carbon dioxide between the years 1983 and 1989.
 - c) Give a consequence of the increase in Earth's atmospheric temperature.
 - d) Justify why carbon dioxide is considered as pollutant and give one source of this pollutant.



Answers	Comments												
<p>First Exercise (7 pts)</p> <p>1- a) The % relative abundance of $^{37}_{17}\text{Cl}$ is:</p> $\% ^{37}_{17}\text{Cl} = X\% = \frac{90}{360} \times 100 = 25\% .$ <p>b) Because the charge of a neutron is zero(null) the charge of the nucleus of an isotope of $^{35}_{17}\text{Cl}$ is equal to the sum of the charges of protons. The number of protons = Z = 17, thus, the charge of nucleus = $17 \times (1+) = 17+$.</p>	<ul style="list-style-type: none"> • % of $^{37}_{17}\text{Cl} = \frac{1}{4} \times 100 = 25\%$ (Full mark) • The charge of the nucleus = $Z \times (1+) = 17 +$ (½ pt) • The charge of the nucleus = $Z \times (1+) + N \times (0) = 17 +$ (½ pt) 												
<p>2-</p> <table border="1" data-bbox="142 667 878 835"> <thead> <tr> <th>Isotope</th> <th>%relative abundance</th> <th>Number of neutrons</th> <th>Number of electrons</th> </tr> </thead> <tbody> <tr> <td>$^{35}_{17}\text{Cl}$</td> <td>75</td> <td>18</td> <td>17</td> </tr> <tr> <td>$^{37}_{17}\text{Cl}$</td> <td>25</td> <td>20</td> <td>17</td> </tr> </tbody> </table>	Isotope	%relative abundance	Number of neutrons	Number of electrons	$^{35}_{17}\text{Cl}$	75	18	17	$^{37}_{17}\text{Cl}$	25	20	17	<ul style="list-style-type: none"> • ½ Copy the table. • ¼ For each value.
Isotope	%relative abundance	Number of neutrons	Number of electrons										
$^{35}_{17}\text{Cl}$	75	18	17										
$^{37}_{17}\text{Cl}$	25	20	17										
<p>3- 0 0 +1 -1</p> <p>a) $2\text{Na} + \text{Cl}_2 \longrightarrow 2\text{NaCl}$</p> <p>b) $\text{Na} \longrightarrow \text{e}^- + \text{Na}^+$</p> <p>c) The reducing agent is Na because it lost an electron / atom. or, Na has been oxidized therefore it is the reducing agent.</p>	<ul style="list-style-type: none"> • ¼ For each value • ½ or Zero. • the oxidation number of Na increases from 0 to +1 Thus, Na is the reducing agent ½ or Zero. 												
<p>4- a) As a table salt</p> <p>b) Water treatment</p>	<ul style="list-style-type: none"> • Obtaining of chemical products. • To produce household bleaching agents. 												
<p>Second Exercise (7 pts)</p> <p>1- a) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$</p> $\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ \\ \text{CH}_3 \\ \\ \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$ <p>b) These three hydrocarbons have the same molecular formula C_5H_{12} and have different structural formulas.</p>	<ul style="list-style-type: none"> • According to their order. (Full mark). • If their order is not respected, each structure should be accompanied with its corresponding name. If not Zero. • Structural formulas (¼ for each) • They have the same number of carbon atoms and same number of hydrogen atoms: The molecular formula is $(\text{C}_5\text{H}_{12})$, and have different structural formulas. If C_5H_{12} is not mentioned (¼) 												

Answers	Comments
<p>c) As we go from n-pentane to 2,2- dimethylpropane, the normal boiling point decreases from 36°C to 10°C and the number of branching increases. Therefore, the normal boiling point of the molecules of isomers decreases as the number of branching increases.</p>	<ul style="list-style-type: none"> Any logical reasoning is accepted. The normal boiling point decreases when the number of branching increases. (½ pt). 
<p>2- a) 2, 2-dimethylpropane has a normal boiling point (10°C) which is less than the given temperature (25°C) Thus, it is a gas at this temperature and hence it can not be used as a liquid fuel at this temperature, 25°C.</p> <p>b) $C_5H_{12} + 8O_2 \longrightarrow 5CO_2 + 6H_2O$.</p>	 <p>Thus it can not be used as a liquid fuel at 25°C.</p> <ul style="list-style-type: none"> Condensed structural formula instead of C_5H_{12} is acceptable. Other isomer ½ pt.
<p>3- a) B : $\begin{array}{cccc} & & H & \\ & C & = & C & - & C & - & H \\ & H & & H & & H & & \end{array}$</p> <p>Chloroform $\begin{array}{c} Cl \\ \\ Cl - C - H \\ \\ Cl \end{array}$</p> <p>b) B : Propene $C = C$: double covalent bond. $C - C$: single covalent bond.</p> <p>c) Cyclopropane has low solubility in blood and the patient recovers quickly.</p>	<ul style="list-style-type: none"> Condensed structural formulas (¼ for each). <p>• ¼ x 2</p>
<p>Third Exercise (6 pts)</p> <p>1- Carbon atom needs four electrons to attain stable octet. On the other hand an oxygen atom needs two electrons to attain stable octet. Thus, carbon atom shares 2 pairs of electrons with each oxygen atom to become stable.</p> <p>Thus, the type of bonding between the carbon atom and each oxygen atom is double covalent bond.</p>	<ul style="list-style-type: none"> $O = C = O$ Sharing of two pairs of electrons, the bond is double covalent bond.(Full mark) $O = C = O$ Double covalent bond. (1pt)
<p>2- a) For 1983, the amount of CO_2 is equal to 332 p.p.m</p> <p>b) For 1983 \longrightarrow 332 p.p.m For 1991 \longrightarrow 340 p.p.m Thus, the increase: $340 - 332 = 8$ p.p.m.</p> <p>c) Floods .</p> <p>d) CO_2 is a pollutant because the increase in the amount of carbon dioxide increases the greenhouse effect. Source : Combustion of fuels containing carbon.</p>	<ul style="list-style-type: none"> 340 p.p.m (1 pt) 8 p.p.m (½ pt) Any logical consequence is accepted. Any logical example is accepted.