HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE

GRADE 10

PAPER 2 - Chemistry

JUNE 2016
TIME: 2 HRS

Total 140

Instructions

1. Answer ALL the questions.
2. This question paper consists of TWO sections:
3. SECTION A (12)
   SECTION B (128)

   Answer SECTIONS A and B in the ANSWER BOOK.
4. Non-programmable calculators may be used.
5. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Data sheets and a periodic table are attached for your use.
8. Give brief motivations, discussions, et cetera where required.
9. Numbers must be rounded off to **two decimal** places.

SECTION A

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.6) in the ANSWER BOOK.

1.1 Which ONE of the following pairs of elements contains the same number of neutrons?

A $^{4}_{2}He$ and $^{2}_{1}H$

B $^{14}_{6}C$ and $^{14}_{7}N$

C $^{1}_{1}H$ and $^{3}_{1}H$

D $^{4}_{2}He$ and $^{3}_{1}H$

1.2 Which ONE of the following has the same electron configuration as a potassium ion?

A Na^{+}

B Mg^{2+}

C $A\ell^{3+}$

D $C\ell^{-}$

1.3 Ionic bonds form because of very strong forces of attraction between oppositely charged ions. From this we conclude that ionic compounds ...

A are electrically neutral.

B have high melting points.

C conduct electricity.

D are gaseous compounds.

1.4 The process whereby solids change directly to gases ....

A Evaporation
B Condensation
C Sublimation
D Melting

1.5 Air cannot be called an element because:

A air can be separated into oxygen atoms
B air is a pure substance
C air contains more than one element
D air can be liquefied.

1.6 If 30 g of reactant A reacts completely with 25 g of reactant B, which ONE of the Following statements is CORRECT?

A The total mass of products plus any unreacted reactants will be less than 55 g.
B The total mass of products plus any unreacted reactants will be greater than 55 g.
C The total mass of the products plus any unreacted reactants will be 55 g
D The total mass of the products will be equal to 55 g

[2 x 7 = 14]

Question 3

Uranium is found in two *isotopic* forms: uranium-235 $\left({}^{235}_{92}\mathrm{U}\right)$ and uranium-238 $\left({}^{238}_{92}\mathrm{U}\right)$. Enriched uranium-235, which is highly reactive, is used in the generation of electricity and in nuclear weapons. When a country acquires enriched uranium-235, their neighbouring countries become nervous and suspicious.

Uranium-235 makes up approximately 0,7% of the total uranium content on earth. Stable uranium-238, which is not suitable for use in nuclear reactors, makes up 99,3%.

3.1 Define the term 'isotope'. (2)

3.2 Explain why ${}^{238}_{92}\mathrm{U}$, although more abundant, is not suitable for use as fuel in nuclear reactors. (2)

3.3 Calculate the relative atomic mass of uranium. (3)

[7]

Question 4

The following table shows the first ionisation energies for the elements of periods 1 and 2.

Period	Element	First ionisation energy ($kJ.mol^{-1}$)
1	H	1 312
	He	2 372
2	Li	520
	Be	899
	B	801
	C	1 086
	N	1 402
	O	1 314
	F	1 681
	Ne	2 081

4.1 What is the meaning of the term *first ionisation energy*? (2)

4.2 Identify the pattern of first ionisation energies in a period. (2)

4.3 Which TWO elements exert the strongest attractive forces on their electrons? Use the data in the table to supply a reason for your answer. (3)

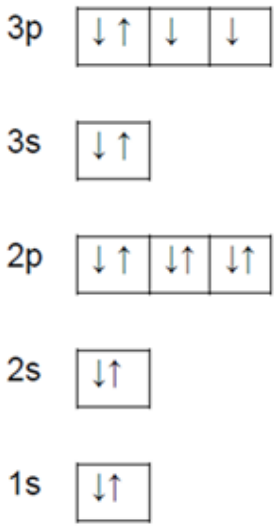
4.4 Draw Aufbau diagrams for the TWO elements in QUESTION 4.3 and explain why these elements are so stable. (4)

4.5 'Group 1 elements readily form positive ions'.
Is this statement correct? Explain your answer by referring to the table. (3)

[14]

Question 5

5.1 The diagram below shows the electron configuration of a neutral atom



Use the information given above to answer the questions that follow:

5.1.1 What name is given to this type of diagram? (1)

5.1.2 Give the name of the element represented by this electron configuration. (1)

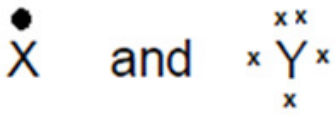
5.1.3 Write the sp-notation for this element. (2)

5.1.4 State the group and period on the periodic table to which this element belongs. (2)

5.1.5 Explain in terms of valence electrons how you arrived at your answer in 5.1.4. (2)

5.1.6 State whether the element is a metal or non-metal. (1)

5.2 Consider the electron dot structures of two hypothetical elements.



5.2.1 Draw the Lewis diagram for the product X and Y. (2)

5.2.2 Write down all the possible symbols that could represent X and Y. (2)

5.2.3 Draw the Couper structure of the product in 5.2.1. (2)

5.3 Draw the lewis structure of the compound that forms when aluminium and oxygen bond. (2)

[17]

Question 6

6.1 Write down the chemical formulae for the following:

6.1.1 Sodium chloride (1)

6.1.2 Copper(II) sulphate (1)

6.1.3 Zinc phosphate (1)

6.1.4 Silver nitrite (1)

6.2 What is the household (common) name for sodium chloride? (1)

6.3 Write down the name of the group of metals to which copper belongs. (1)

6.4 Write down the chemical names for the following:

6.4.1 $K_2Cr_2O_7$ (1)

6.4.2 $Ca(OH)_2$ (1)

6.4.3 $FeSO_4$ (1)

6.4.4 $Mg(CH_3COOH)_2$ (1)

6.5 Write **balanced** equations for the each of the following descriptions:

6.5.1 Butane gas (C_4H_{10}) reacts with oxygen and produces carbon dioxide and water. (4)

6.5.2 Ammonia reacts with oxygen gas and produces nitrogen monoxide and water. (3)

[17]

Question 7

During a demonstration to illustrate the difference between a chemical and a physical change, the following experiments are performed:

Experiment A: Sugar is dissolved in boiling water.

Experiment B: Sugar is heated on the stove until a brown syrup is formed.

7.1 Classify each of the changes during the above experiments as a physical or a chemical change. (2)

7.2 Give a reason for your classification of each of the above. (2 x 1)

7.3

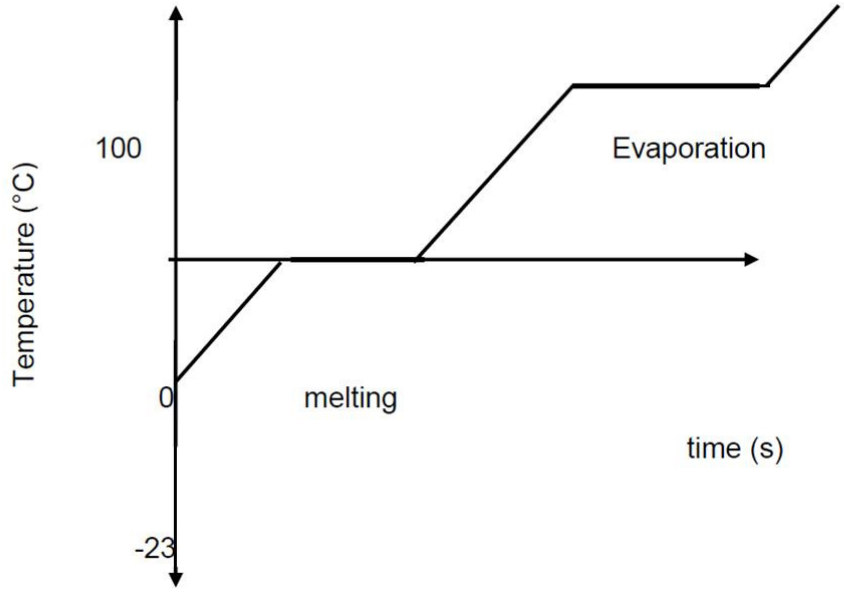
In the northern Kalahari the most commonly used poison for the arrows of the San was made from the larva and pupae of chrysomelid beetles. The contents of the larvae/pupae were squeezed directly on to the arrows. The arrows were then dried over a fire. Is this an example of a chemical or a physical change?

(1)

[5]

Question 8

The diagram below represents the heating curve for a certain substance



8.1 Define the (a) boiling point and (b) melting point of a substance. (4)

8.2 State the phase(s) of the substance between -23°C and when it reaches 0°C. (2)

8.3 Give a reason to your answer in question 8.2 above. (1)

8.4 Give a reason why the above substance is water. (1)

8.5 Draw 2 molecules of water and use the diagram to show where intramolecular and intermolecular bonding occurs. (2)

8.6 For a water molecule name the type of:

8.6.1 intramolecular bonding and

8.6.2 the intermolecular bonding present. (1 x 2)

8.7 Bromine, a toxic deep-red, oily liquid with a sharp smell has a boiling point of 58,8°C.

Compare the type of intermolecular bonding present in bromine with water and use this to explain the difference in the boiling point between the two liquids. (3)

8.8 Mothibi and Mpumi place a solid compound on a heating plate and heat the substance uniformly at a constant rate. The table below shows the temperatures of the object at different times during the experiment:

Time (minutes)	0	2	4	6	8	10	12	14	16	18	20	22	24	26
Temperature (°C)	15,5	27	37	37	37	48	59	70	80	80	80	80	91	102

8.8.1 Suggest a suitable investigative question for this experiment. (2)

8.8.2 Suggest a suitable hypothesis for this experiment. (1)

8.8.3 Name ONE condition that must be kept constant to ensure a reliable result. (1

8.8.4 What would you have observed in the beaker at 37°C? (2)

[21]

Question 9

9.1 Define the term molar mass. (1)

9.2 Calculate the number of oxygen atoms present in 2 moles of potassium nitrate. (3)

9.3 Calculate the mass of $4,5 \times 10^{25}$ silicon atoms. (5)

9.4 96 g of sulphur reacts with 192g of oxygen according to the following equation.

$$2S + 3O_2 \rightarrow 2SO_3$$

Calculate :

9.4.1 the number of moles in 96g of sulphur. (3)

9.4.2 which reactant is in excess. (3)

9.4.3 the mass of the reactant that is left over in the container at the end of the reaction.(the excess reactant) (3)

9.4.4 the volume of sulphur dioxide produced at STP. (4)

9.5 Glucose comes from the digestion of starchy foods, such as bread and rice. Insulin, a hormone produced by your pancreas, helps your body to use glucose for energy.

9.5.1 Calculate the mass of Carbon present in 420 g of glucose ($C_6H_{12}O_6$). (5)

9.6 When 207 g of lead, Pb, combines with oxygen, 239 g of a certain oxide of lead is formed. Use a calculation to determine the formula of this oxide of lead. (5)

[32]

Question 10

When bees or wasps sting a person, they inject venom through their stinger into the skin of the victim. Joanna got a bee sting and remembered that she could use bicarbonate of soda to soothe the sting.

10.1 What is the chemical name for bicarbonate of soda? (1)

10.2 What is the purpose of the bicarbonate of soda for the sting? (1)

10.3 Complete the following acid-base reactions

10.3.1 $H_2CO_3 + CuO \rightarrow$

10.3.2 $HNO_3 + Zn \rightarrow$

10.3.3 $H_2SO_4 + Mg(OH)_2 \rightarrow$

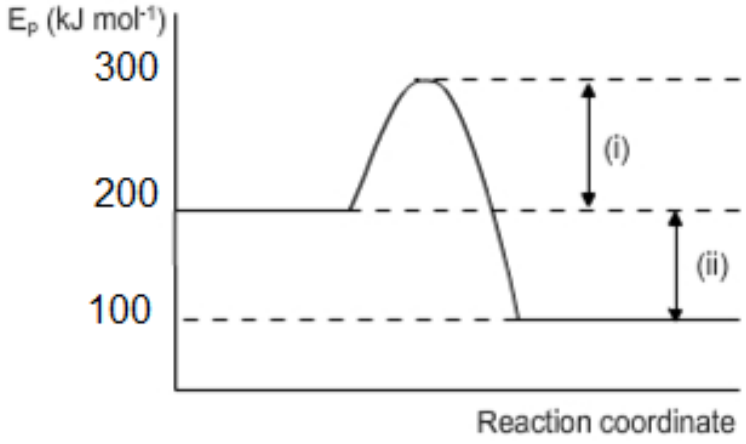
(2 x 3 = 6)

10.4 Identify the conjugate acid-base pair in the following reaction

$NH_4^+ + F^- \rightarrow NH_3 + HF$ (2)

[10]

Question 11



11.1 State whether the above graph of the potential energy of a reaction represents an endothermic and exothermic reaction (1)

Only give the value of the following:

11.2 the activation energy for the forward reaction (1)

11.3 the ΔH for the forward reaction (1)

11.4 the activation energy for the reverse reaction (1)

11.5 the ΔH for the reverse reaction (1)

[5]

Total 140

FORMULA SHEET

$n = \frac{m}{M}$	
$n = \frac{No}{NA}$	$N_A = 6.02 \times 10^{23}$
$n = \frac{V}{Vm}$	$V_o = 22.4\ dm^3$
$C = \frac{n}{V}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE