

**NATIONAL
SENIOR CERTIFICATE**

GRADE 10

NOVEMBER 2019

**PHYSICAL SCIENCES (CHEMISTRY) P2
(EXEMPLAR)**

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your examination number and centre number in the appropriate space on the ANSWER BOOK.
2. This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the question correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. Show ALL formulae and substitution in your calculations.
9. Round off your FINAL numerical answers to a minimum of TWO decimal places.
10. Give a brief motivation, discussions et cetera where required.
11. You are advised to use the attached DATA SHEETS.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

- 1.1 What is the percentage of hydrogen in a molecule of hydrogen peroxide with molar mass of $34 \text{ g}\cdot\text{mol}^{-1}$, if one mole of hydrogen reacts with one mole of oxygen? (2)
- A 72,72%
B 94,12%
C 11,11%
D 5,88%
- 1.2 In which ONE of the following compounds do ionic bond occur between elementary particles? (2)
- A Sodium Chloride
B Mercury
C Water
D Sulphur
- 1.3 2 molecules of hydrogen gas at STP occupy a volume of ... (2)
- A 11,2 litres.
B 44,8 litres.
C 2 litres.
D 22,4 litres.
- 1.4 Which ONE of the following substances is responsible for acid rain? (2)
- A H_2SO_3
B BaCO_3
C HCl
D NH_4^+
- 1.5 Which ONE of the following is removed from river water by boiling it? (2)
- A Soil
B Twigs and leaves
C Harmful bacteria
D Lead concentration

1.6 Which ONE of the following is correct regarding a PHYSICAL CHANGE of a substance?

- (I) No new substances are formed.
- (II) Intermolecular forces are broken.
- (III) Energy changes are large.
- (IV) Number of atoms are conserved

- A I and II only
- B I, II and IV only
- C I, II and III only
- D I, III and IV only

(2)

1.7 Which ONE of the following statements best explains why gases are easily compressed?

- A Gases are made up of particles which are in constant motion.
- B The distance between the particles is large compared to the particle size.
- C The particles collide with each other without incurring a loss of energy.
- D When the average kinetic energy of the particles increases, the particles move faster.

(2)

1.8 Which of the following statements below explain why ice melts outside the refrigerator?

- A The volume of the material decreases at high temperature.
- B Atoms move further apart at high temperature.
- C Kinetic energy of atoms decreases at high temperature.
- D Kinetic energy of atoms stays the same at high temperature.

(2)

1.9 Which ONE of the following is the possible strategy that a community can adopt to ensure that they have regular water supply?

- A Floods
- B Building of dams
- C High degree of evaporation
- D Removal of boreholes

(2)

1.1 Which ONE of the following is the NAME for the underlined phrase: solid, rocky crust covering the entire plane?

- A The atmosphere
- B The hydrosphere
- C The lithosphere
- D The biosphere

(2)

[20]

QUESTION 2

Study the list below that shows a variety of substances.

glass; brass; copper wire; iron; aluminium; table salt; air; sodium chloride

- 2.1 Define the term *homogeneous mixture*. (2)
- 2.2 Use the information above and write down:
- 2.2.1 TWO substances that are NOT mixtures (2)
- 2.2.2 A homogeneous mixture (1)
- 2.2.3 A compound (1)
- 2.2.4 ONE substance that is malleable (1)
- 2.2.5 A brittle substance (1)
- 2.2.6 Chemical name for table salt (1)
- 2.2.7 A magnetic material (1)

[10]

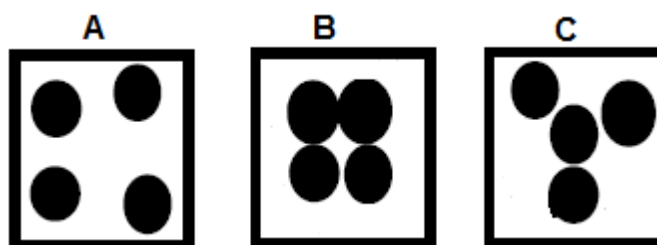
QUESTION 3

Learners have investigated the melting and boiling points of 6 substances, A–F, and the results are given in the table below.

SUBSTANCES	MELTING POINT (°C)	BOILING POINT (°C)
A	3000	4200
B	200	500
C	-150	-200
D	-5	15
E	-220	-300
F	1083	2567

- 3.1 Define the term *boiling point*. (2)
- 3.2 For the above investigation, write down:
- 3.2.1 The dependent variable (1)
- 3.2.2 An investigative question (2)
- 3.3 From the above table of results, write down the letter (A–F) that represents the substance(s) which:
- 3.3.1 Is a gas at 25 °C. (1)
- 3.3.2 Is a liquid at 300 °C. (1)
- 3.3.3 Has the strongest forces of attraction between particles.
Give a reason for your answer. (2)
- 3.3.4 Has the weakest forces of attraction between particles.
Give a reason for your answer. (2)
- 3.4 Grade 10 learners are investigating the effect of increasing temperature on three different substances (A, B and C).

Study the diagrams of the substances bellow and answer the following questions.



- 3.4.1 Rearrange the diagrams according to the increasing average kinetic energy of the substances. (2)
- 3.4.2 At which phase is substance C? (1)

[14]

QUESTION 4

The atomic theory has changed over the years. The atomic models **A** and **B** demonstrates such changes.

Model A

Model B

- 4.1 Write down the name of the scientist that suggested model **A**. (1)
- 4.2 How does model **B** disprove the suggestions made in model **A**? (3)

In another atomic model isotopes were discovered. Copper has two isotopes, namely:



The relative atomic mass of the two isotopes is 63,5 amu.

- 4.3 Write down the definition of *isotopes* in words. (2)
- 4.4 Determine, by calculations, which isotope of copper is the most abundant in nature. (5)
- [11]**

QUESTION 5

The diagram below shows the simplified periodic table of elements. The letters **A** to **L** in the periodic table represent some of the main group of elements but are NOT the chemical symbols of the elements.

	1	2		13	14	15	16	17	18
1	A								K
2	B				G			J	
3	C	E		F		H	I		L
4	D								

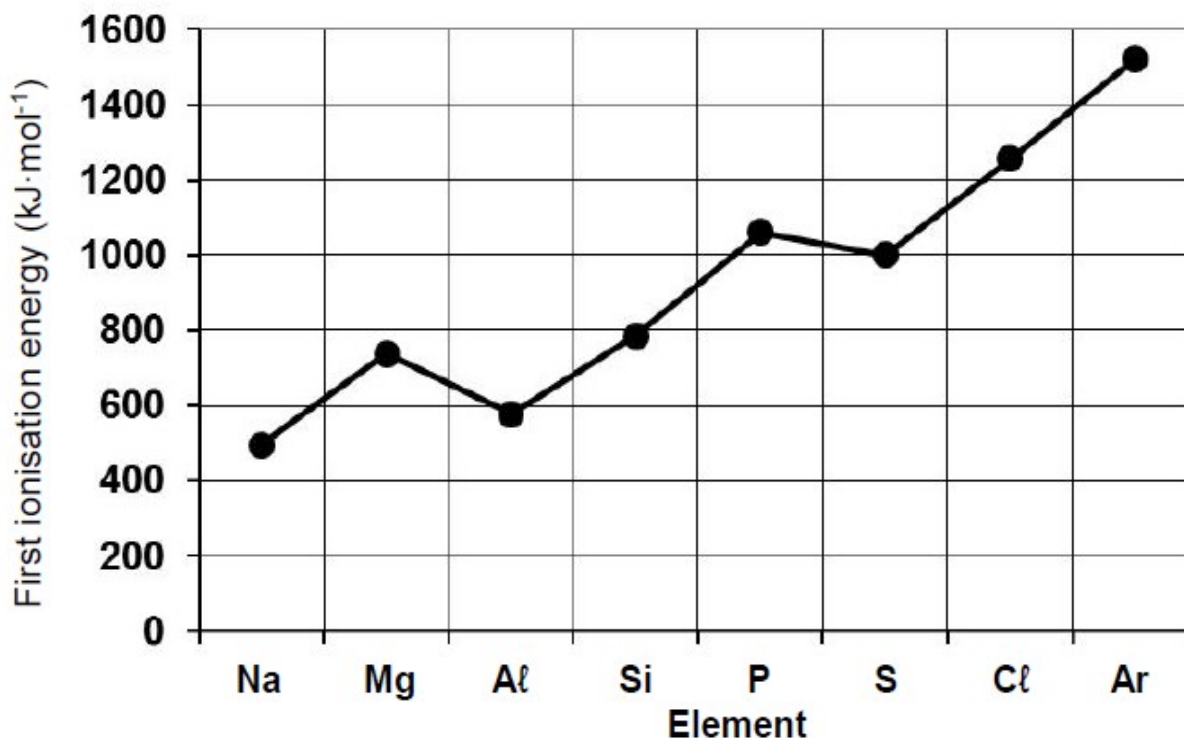
- 5.1 How many protons does an atom of element **K** have? (1)
- 5.2 Write down the sp-notation for an element represented by the letter **K**. (2)
- 5.3 Write down the number of valence electrons of an element represented by **F**. (1)
- 5.4 Write down the letter that represents magnesium in the periodic table. (1)
- 5.5 Write down the letter that represents an element which:
- 5.5.1 Is in period 2 that will form an X^- ion (1)
- 5.5.2 Has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$ (1)
- 5.5.3 Has the same number of electrons as Ca^{2+} (1)
- 5.5.4 Has similar chemical properties as oxygen (1)
- 5.5.5 Is in period 3 that forms an ion with a -3 charge (1)
- 5.6 Which ONE of the letters **C**, **D** and **F** represent an element with the lowest electron affinity? Explain your answer. (3)
- The letter **J** represents an element that is less reactive than an element represented by letter **B**.
- 5.7 Explain this statement by referring to the electronegativity between elements represented by letter **J** and letter **B**. (4)

[17]

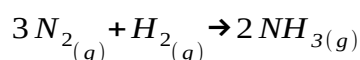
QUESTION 6

The graph below shows the first ionisation energies of elements from period 3 in the periodic table.

First ionisation energies of elements from period 3



- 6.1 Define the term *first ionisation energy*. (2)
- 6.2 Explain the difference in first ionisation energy between sodium and magnesium. (2)
- 6.3 From the graph, write down the approximate first ionisation energy of sodium. (1)
- 6.4 Explain why magnesium becomes ionised easily. (2)
- 6.5 Use the information in the graph above and calculate the energy needed to remove an electron from sodium atom. (3)
- 6.6 Draw an Aufbau diagram of a sodium ion. (2)
- 6.7 The Haber process uses the reaction between nitrogen and hydrogen to make ammonia. The formation of ammonia is exothermic, releasing 46 kilojoules per mole of ammonia formed.



- 6.7.1 What type of bond exists in the molecule of ammonia? (1)
- 6.7.2 Explain your answer to QUESTION 6.7.1. (2)

[15]

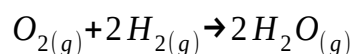
QUESTION 7

A chlorine gas can be prepared in the laboratory by having concentrated hydrochloric acid react with manganese dioxide. Manganese (II) chloride and water are formed.

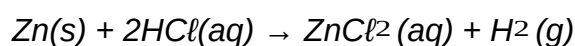
- 7.1 Define the term *molecule*. (2)
- 7.2 State the law of conservation of mass. (2)
- 7.3 Write down:
- 7.3.1 The Lewis structure for the water molecule (2)
- 7.3.2 A balanced chemical equation of the above chemical reaction. Show all phases of the reactants and products (4)
- 7.4 Calculate the molar mass of water. (2)
- [12]**

QUESTION 8

- 8.1 8,78 g of oxygen gas is required to react with an unknown mass of hydrogen gas to form water vapour. The balanced equation for this is:



- 8.1.1 Define the term *exothermic reaction*. (2)
- 8.1.2 Is this reaction a synthesis or a decomposition reaction? Give a reason for the answer. (2)
- 8.1.3 Calculate the number of moles of water vapour formed. (2)
- 8.2 The reaction between zinc and dilute hydrochloric acid is represented by the balanced equation below:



The concentration of hydrochloric acid solution is $0,1 \text{ mol}\cdot\text{dm}^{-3}$. The mass of zinc chloride formed is 0,85 g.

- 8.2.1 Define the term *concentration* in words. (2)
- 8.2.2 Is the above reaction an example of a redox reaction? Write down **YES** or **NO** and give a reason for the answer. (2)
- 8.2.3 Calculate the volume of hydrochloric acid solution needed to react with the zinc to form 0,85 g of $ZnCl_2$. (5)

[15]

QUESTION 9

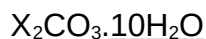
9.1 A 60 g sample of tetraethyllead, a gasoline additive, is found to contain 38,43 g of lead, 17,83 g carbon, and 3,74 g hydrogen.

9.1.1 Define the term *empirical formula*. (2)

9.1.2 Use relevant calculations to determine the empirical formula of this compound. (4)

9.2 Determine the molecular formula of the compound with an empirical formula of CH and a molecular mass of $78 \text{ g}\cdot\text{mol}^{-1}$. (2)

9.3 A formula of the hydrated carbonate of an unknown group 1 metal represented by **X** with the formula mass of 268 is given below:



9.3.1 What is the general name for a substance in which water is not directly attached to the metal ion as indicated above? (1)

9.3.2 Determine, by calculation, the unknown group 1 metal represented by **X** in the formula. (3)

[12]

QUESTION 10

The three test tubes, **X**, **Y** and **Z** below, contain colourless solutions. The solutions in each test tube can either be potassium iodide or sodium carbonate or magnesium sulphate. Tests are carried out to determine which test tube contains which salts.

X Y Z

The following tests were carried out and the observations were made:

- Barium chloride solution is added to solution **X**; the solution remains colourless.
- Barium chloride solution is added to **Y** and **Z**; a white precipitate is formed in both cases.
- Dilute nitric acid is added to the precipitate in solution **Y**; the precipitate dissolves.

(2)

10.1 Define the term *dissociation*.

10.2 Give a reason why barium chloride solution can be used as electrolyte.

(2)

10.3 Write down the name of the precipitate in test tube **Z**.

(1)

Use the above information to identify the solutions in each of the test tubes **X**, **Y** and **Z**.

10.4 Write down the LETTER that represents the test tube and next to it, the NAME of the solution and the reason for the choice.

(6)

10.5 What type of reaction takes place between the precipitate in **Y** and the nitric acid?

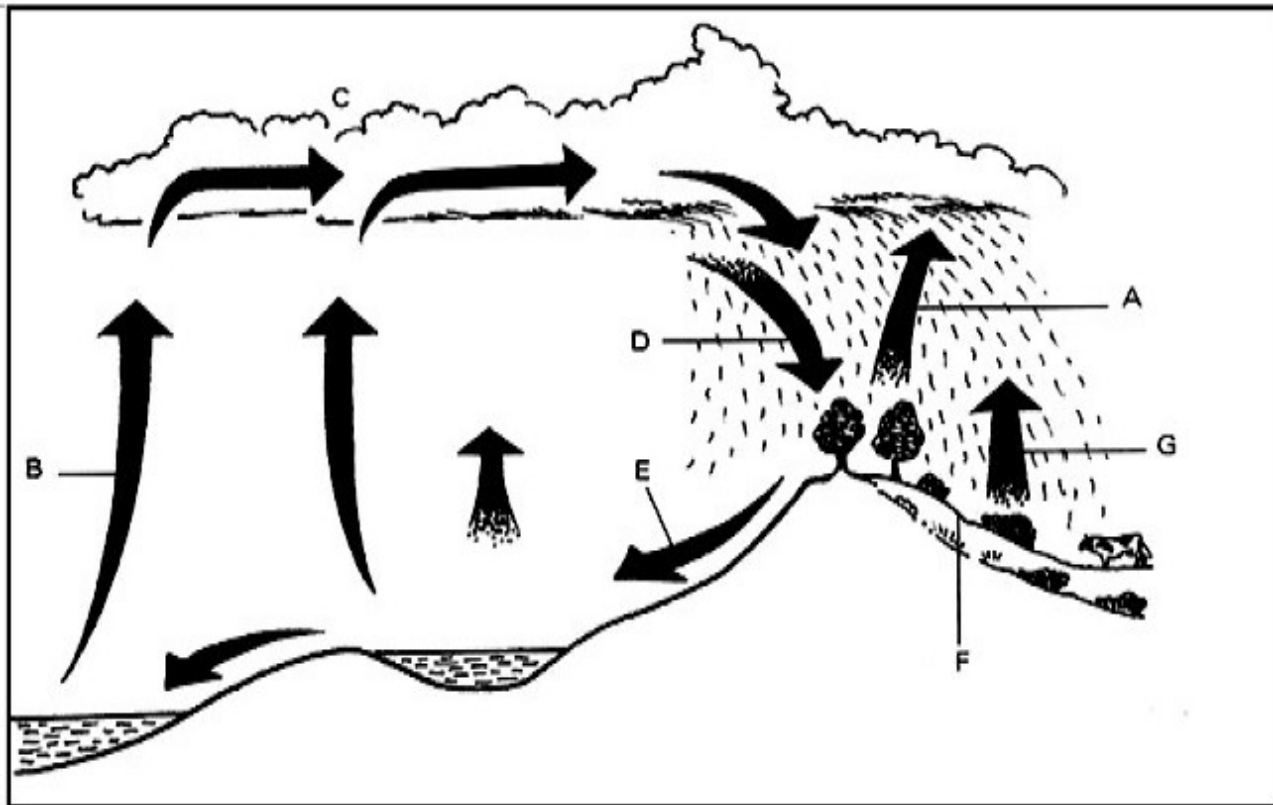
(1)

[12]

QUESTION 11

There are many cycles that occur globally. Water is found in oceans, ice caps, rivers and lakes, and in the air we breathe. Many physical changes take place during the water cycle and energy transfer also occurs.

Below is the diagram of the water cycle.



- 11.1 Briefly explain the term *hydrosphere*. (1)
- 11.2 Write down the name of the process labelled:
 - 11.2.1 A (1)
 - 11.2.2 B (1)
 - 11.2.3 C (1)
- 11.3 Explain how the atmosphere and hydrosphere interacts. (2)
- 11.4 The water cycle takes place in a closed system, which means that the total amount of water on earth remains constant. Give THREE possible reasons why so many countries in the world today, including South Africa, are facing a shortage of water. (6)

[12]

TOTAL: 150

**DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)**

**GEGEWENS VIR FISIESTE WETENSAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESTE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Avogadro's constant <i>Avogadro-konstante</i>	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
Charge on electron <i>Lading op elektron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$
Molar gas volume at STP <i>Molêre gasvolume by STD</i>	V_m	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$c = \frac{n}{V}$		
	or/of	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$
	$c = \frac{m}{MV}$		

