education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 10

PHYSICAL SCIENCE: CHEMISTRY (P2)

EXEMPLAR PAPER

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages, an answer sheet and 1 information sheet.

156 2 E

INSTRUCTIONS AND INFORMATION

1.   Write your examination number (and centre number if applicable) in the appropriate spaces provided on the ANSWER BOOK.

2.   Answer ALL the questions.

3.   Answer SECTION A on the ANSWER SHEET provided. Answer SECTION B in the ANSWER BOOK.

4.   Non-programmable calculators may be used.

5.   Show ALL the formulae as well as the calculations, including substitutions.

6.   Appropriate mathematical instruments may be used.

7.   Number the answers correctly according to the numbering system used in this question paper.

8.   An information sheet is attached for your use.

9.   Wherever motivation or discussion, et cetera is required, be very brief.

SECTION A

Answer this section on the ANSWER SHEET.

QUESTION 1: ONE-WORD ANSWERS

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1 - 1.5).

1.1   An element in Period 3 that has greatly influenced the electronic industry   (1)

1.2   The number of nucleons in the atom   (1)

1.3   The property that determines how easily a liquid flows   (1)

1.4   A composition of two or more atoms that act as a unit   (1)

1.5   A chemical reaction that is accompanied by a rapid increase in heat and volume   (1)

[5]

QUESTION 2: MATCHING ITEMS

Choose an item from COLUMN B to match the information in COLUMN A. Write only the letter (A - I) next to the question number (2.1 - 2.5).

COLUMN A		COLUMN B	
2.1	A carbonate	A	HCl
2.2	Souring of milk	B	K^+
2.3	An example of an ionic compound	C	CO_3^{2-}
2.4	A positive ion with the electronic configuration of argon	D	physical change
2.5	A solution in which all components are in the same phase	E	$CaCl_2$
		F	heterogeneous mixture
		G	Al^{3+}
		H	chemical change
		I	homogeous mixture

[5]

QUESTION 3: TRUE OR FALSE

Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (3.1 - 3.5). If the statement is FALSE, write down only the correct statement.

3.1   Non-metallic solids are ductile.   (2)

3.2 $^{20}_{10}$Ne en $^{20}_{10}$Ne each have 10 protons, 12 electrons and 12 neutrons.   (2)

3.3   Atoms and molecules are conserved during a chemical reaction.   (2)

3.4   The following chemical equation is an example of a decomposition reaction:

$$2 H_2O_2 \rightarrow 2 H_2O + O_2$$ (2)

3.5   You can push your hand into water because liquids are compressible.   (2)

[10]

QUESTION 4: MULTIPLE-CHOICE QUESTIONS

Various possible options are provided as answers to the following questions. Choose the correct answer and make a cross (X) over the letter (A - D) next to the question number (4.1 - 4.5) on the answer sheet.

4.1   Which ONE of the following is a correct example of the law of multiple proportions?

      A CuO and $CuCO_3$
      B H_2O and H_2O_2
      C MgO and MgO_2
      D H_2 and H_2O (3)

4.2   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.   (3)

4.3   If Rutherford used neutrons, instead of alpha particles in his scattering experiment, the neutrons would ...

      A   not deflect because it has no charge.
      B   have deflected more often.
      C   have been attracted to the nucleus easily.
      D   have given the same results.   (3)

4.4   Which ONE of the following uses the most underground water?

     A   Industrial processes
     B   Domestic purposes
     C   Agricultural purposes
     D   Mining processes   (3)

4.5   Ammonia, an ingredient in household cleaners, can be broken down to form one part nitrogen (N) and three parts hydrogen (H). This means that ammonia ...

     A   is a colourless gas.
     B   is not a compound.
     C   cannot be an element.
     D   has the formula NH_3.   (3)
                                                                                                        [15]

                                                              TOTAL SECTION A: 35

SECTION B

Answer this section in the ANSWER BOOK.

INSTRUCTIONS

1.   Answer this section in the ANSWER BOOK.

2.   In ALL calculations, formulae and substitutions must be shown.

3.   Round off your answers to TWO decimal places.

QUESTION 5

A camper wants to find a suitable insulator to put under his mattress in his tent. He has a choice of three materials: newspaper, plastic and towels.

To know which one of the three materials to take along, he performs an investigation to test their insulating properties, using a sample of each of the materials. He uses the apparatus illustrated below and measures the decrease in temperature of the water over a fixed time interval.

          Water

          Smaller container

          Material

          Bigger container
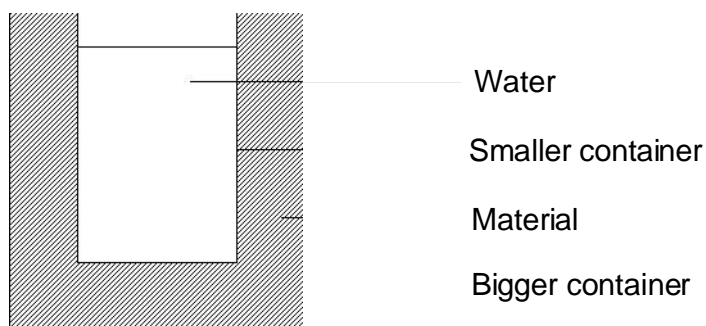
Answer the following questions concerning the investigation:

5.1	Explain the difference between a thermal conductor and an insulator.	(2)
5.2	Write down a possible investigative question.	(2)
5.3	Write down a possible hypothesis.	(2)
5.4	What other apparatus is required in order to perform the investigation? Name TWO.	(4)
5.5	What is the independent variable in this investigation?	(2)
5.6	What is the dependent variable in this investigation?	(2)
5.7	Name at least ONE variable that must be controlled during this investigation.	(2)

[16]

QUESTION 6

The following table illustrates 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

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

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

6.3   In which TWO elements are the strongest attractive force exerted on their electrons? Use the data in the table to supply a reason for your answer.   (4)

6.4   Draw Aufbau diagrams for the TWO elements in QUESTION 6.3 and explain why these elements are so stable.   (5)

6.5   It is safer to use helium gas than hydrogen gas in balloons. What property of helium makes it a safer substitute?   (2)

6.6   Group 1 elements readily form positive ions.

      Is this statement correct? Explain your answer by referring to the table.   (3)

[18]

QUESTION 7

Indigenous people worked with metals long ago. The remains of several furnaces (ovens) used for extraction of iron can be seen in our country. The iron ore (Fe_2O_3) was smelted in clay furnaces, in which the ore was refined using charcoal (C) and employing bellows to blow air over the charcoal to make the temperature high enough to melt the ore.

Modern extraction methods make use of almost the same processes as used by indigenous people. Iron ore, coke (almost pure carbon) and limestone ($CaCO_3$) are mixed together in a blast furnace. The limestone removes impurities, resulting in a better quality of iron. Hot air is blasted into the furnace through pipes.

Use a table to compare the indigenous methods for extracting iron with the modern method.

In your table use the following criteria for your comparison:

(i)   Reactants used or in use
(ii)   Method used to increase temperature
(iii)   Type of furnace
(iv)   Purity of product   **[10]**

QUESTION 8

Chemical weapons were banned by the Geneva Protocol in 1925. According to this protocol, all chemicals that release suffocating and poisonous gases are not to be used as weapons. White phosphorus, a very reactive allotrope of phosphorus, was recently used during a military attack. Phosphorus burns vigorously in oxygen. Many people got severe burns and some even died as a result.

The equation for this spontaneous reaction is as follows: $P_4(s) + O_2(g) \rightarrow P_2O_5(s)$

8.1   Balance the chemical equation.   (2)

8.2   Prove that the law of conversation of mass is obeyed during this chemical reaction.   (5)

8.3   Name the product formed during this reaction.   (2)

8.4   Classify the reaction as exothermic or endothermic. Give a reason for your answer.   (3)

8.5   Classify the reaction as a synthesis or a decomposition reaction. Give a reason for your answer.   (3)

8.6   Was white phosphorous used as a chemical weapon? Substantiate your answer.   (3)

8.7   What effect can the irresponsible use of phosphorous have on humans and the environment?   (4)
                                                                                                   [22]

QUESTION 9

The sketch shows a process that leads to rainfall in town **X**. The town has been relying only on rainfall for its water supply, because it has no access to rivers or tap water. The community of the town has been told by a group of people that they will never run out of rainwater because *it will never stop raining*.
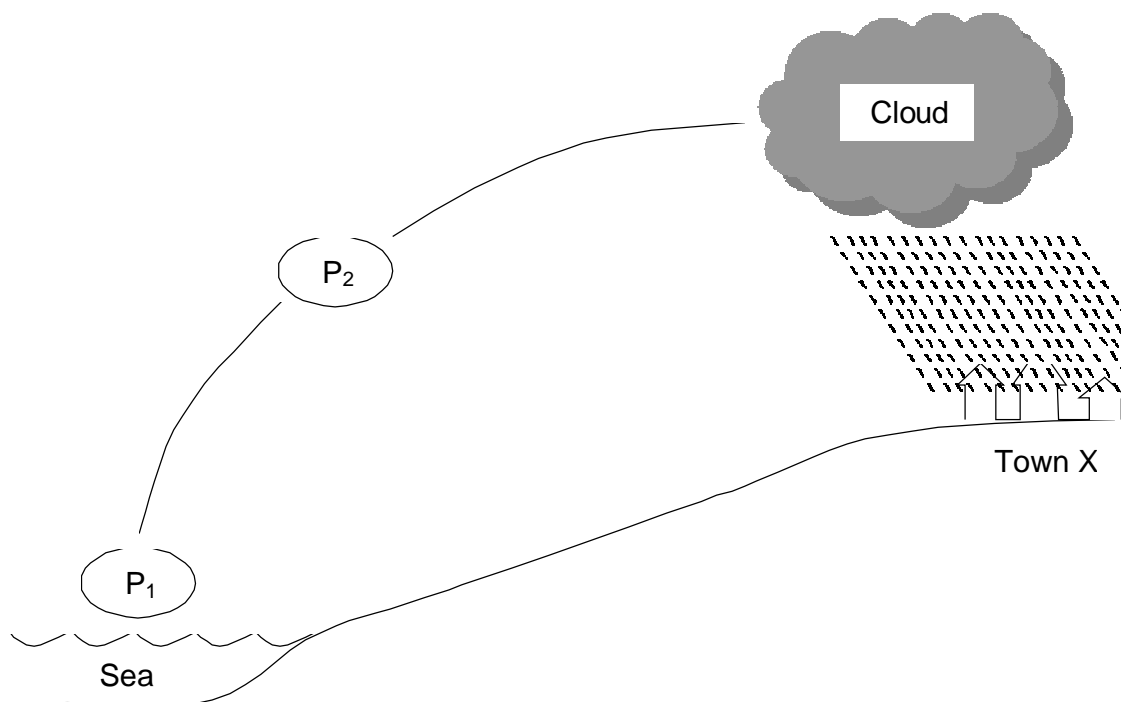
9.1　　List the processes labelled P_1 and P_2 that lead to rainfall in town X.　　　(2)

9.2　　Is this group of people correct in saying that town X will never run out of rain-water?　Justify your answer.　　　(3)

Recently, the amount of rainfall has decreased considerably. Various reasons have been given to explain the drought. Some of the community members are blaming the group who told them that *it will never stop raining*.

9.3　　What scientific arguments can you use to convince the community members that the group of people who told them this should not be blamed for the drought?　　　(6)

9.4　　What possible plan can the community leaders use to ensure that they have a regular supply of water?　　　(3)

[14]

QUESTION 10

A learner returns home from school on a hot afternoon. In order to get cold water to drink, she puts ice cubes into a glass of water. She makes the following observations:

Observation I   The ice cubes float in the water.
Observation II   After a while the water becomes cold and the ice cubes melt.

10.1   What property of ice cubes allows them to float in the water?   (1)

10.2   Briefly explain why the water gets cold as the ice cubes melt.   (4)

10.3   Briefly describe how the property mentioned in QUESTION 10.1 affects the sustainability of aquatic life during winter.   (2)

                                                                                               [7]

QUESTION 11

A certain brand of fertiliser contains urea $[CO(NH_2)_2]$, ammonium chloride (NH_4Cl) and potassium chloride (KCl). Some of the properties of these substances are shown in the table below:

Substance	State of substance	Degree of solubility in water	Changes on heating
Urea $CO(NH_2)_2$	Solid	Does not dissolve	It melts
Ammonium chloride (NH_4Cl)	Solid	Dissolves very well	It sublimes
Potassium chloride (KCl)	Solid	Dissolves very well	It melts

11.1   For each of the substances, name a process that may be used to obtain a pure sample for the fertiliser.   (6)

11.2   *The human population is increasing at a higher rate*.

         Explain the importance of fertilisers in light of this statement.   (4)

11.3   *Excessive use of fertilisers has a negative effect on the environment*.
         Explain this statement.   (4)

   **[14]**

QUESTION 12

Plants need carbon dioxide gas (CO_2) to manufacture food. However, the engines of motor vehicles cause too much CO_2 gas to be released into the atmosphere.

12.1　State the possible consequence of having too much carbon dioxide gas in the atmosphere. (2)

12.2　Explain the possible effect on humans if the amount carbon dioxide in the atmosphere becomes too low. (4)

[6]

QUESTION 13

The test tubes labelled **X, Y** and **Z** below contains solutions of unknown potassium salts.

X　　　　**Y**　　　　**Z**
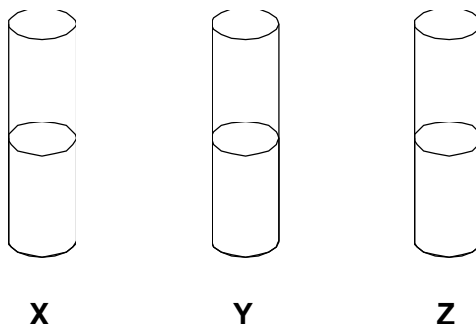
The following observations were made during a practical investigation to identify the solutions in the test tubes:

A　　A white precipitate formed when silver nitrate ($AgNO_3$) was added to test tube Z.

B　　A white precipitate formed in test tubes X and Y on addition of barium chloride ($BaCl_2$).

C　　The precipitate in test tube X dissolved in hydrochloric acid (HCl) and a gas was released.

D　　The precipitate in test tube Y was insoluble in hydrochloric acid.

13.1　Use the above information to identify the solutions in each of the test tubes X, Y and Z. (6)

13.2　Write a balanced chemical equation for the reaction that took place in test tube X before addition of the hydrochloric acid. (2)

[8]

TOTAL SECTION B:　115

GRAND TOTAL:　150

PHYSICAL SCIENCES GRADE 10 ANSWER SHEET
FISIESE WETENSKAPPE GRAAD 10 ANTWOORDBLAD

QUESTION 1 / *VRAAG 1*

1.1
_____ (1)

1.2
_____ (1)

1.3
_____ (1)

1.4
_____ (1)

1.5
_____ (1)
[5]

QUESTION 2 / *VRAAG 2*

2.1
_____ (1)

2.2
_____ (1)

2.3
_____ (1)

2.4
_____ (1)

2.5
_____ (1)
[5]

QUESTION 3 / *VRAAG 3*

3.1
_____

_____ (2)

3.2
_____

_____ (2)

3.3
_____

_____ (2)

3.4
_____

_____ (2)

3.5
_____

_____ (2)
[10]

QUESTION 4 / *VRAAG 4*

4.1	A	B	C	D
4.2	A	B	C	D
4.3	A	B	C	D
4.4	A	B	C	D
4.5	A	B	C	D

(5 x 3) [15]

TOTAL SECTION A / TOTAAL AFDELING A: 35

NSC

THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKETABEL VAN ELEMENTE

SLEUTEL / KEY

Atoomgetal
Atomic number

Elektronegatiwiteit
Electronegativity

1,9 **29 Cu** 63,5

Simbool
Symbol

Benaderde relatiewe atoommassa
Approximate relative atomic masses

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 1 **H** 1																	2 **He** 4
1,0 3 **Li** 7	1,5 4 **Be** 9											2,0 5 **B** 11	2,5 6 **C** 12	3,0 7 **N** 14	3,5 8 **O** 16	4,0 9 **F** 19	10 **Ne** 20
0,9 11 **Na** 23	1,2 12 **Mg** 24											1,5 13 **Al** 27	1,8 14 **Si** 28	2,1 15 **P** 31	2,5 16 **S** 32	3,0 17 **Cl** 35,5	18 **Ar** 40
0,8 19 **K** 39	1,0 20 **Ca** 40	1,3 21 **Sc** 45	1,5 22 **Ti** 48	1,6 23 **V** 51	1,6 24 **Cr** 52	1,5 25 **Mn** 55	1,8 26 **Fe** 56	1,8 27 **Co** 59	1,8 28 **Ni** 59	1,9 29 **Cu** 63,5	1,6 30 **Zn** 65	1,6 31 **Ga** 70	1,8 32 **Ge** 73	2,0 33 **As** 75	2,4 34 **Se** 79	2,8 35 **Br** 80	36 **Kr** 84
0,8 37 **Rb** 86	1,0 38 **Sr** 88	1,2 39 **Y** 89	1,4 40 **Zr** 91	41 **Nb** 92	1,8 42 **Mo** 96	1,9 43 **Tc**	2,2 44 **Ru** 101	2,2 45 **Rh** 103	2,2 46 **Pd** 106	1,9 47 **Ag** 108	1,7 48 **Cd** 112	1,7 49 **In** 115	1,8 50 **Sn** 119	1,9 51 **Sb** 122	2,1 52 **Te** 128	2,5 53 **I** 127	54 **Xe** 131
0,7 55 **Cs** 133	0,9 56 **Ba** 137	57 **La** 139	1,6 72 **Hf** 179	73 **Ta** 181	74 **W** 184	75 **Re** 186	76 **Os** 190	77 **Ir** 192	78 **Pt** 195	79 **Au** 197	80 **Hg** 201	1,8 81 **Tl** 204	1,8 82 **Pb** 207	1,9 83 **Bi** 209	2,0 84 **Po**	2,5 85 **At**	86 **Rn**
0,7 87 **Fr**	0,9 88 **Ra** 226	89 **Ac**															

58 **Ce** 140	59 **Pr** 141	60 **Nd** 144	61 **Pm**	62 **Sm** 150	63 **Eu** 152	64 **Gd** 157	65 **Tb** 159	66 **Dy** 163	67 **Ho** 165	68 **Er** 167	69 **Tm** 169	70 **Yb** 173	71 **Lu** 175
90 **Th** 232	91 **Pa**	92 **U** 238	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**