



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.

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. Appropriate mathematical instruments may be used.
6. Number the answers correctly according to the numbering system used in this question paper.
7. An information sheet is attached for your use.
8. Wherever motivation, discussion, et cetera is required, be brief.

SECTION A

Answer this section on the attached ANSWER SHEET.

QUESTION 1: ONE-WORD ANSWERS

Write only the word/term for each of the following descriptions next to the question number.

- 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

Match the information in COLUMN A with the information in COLUMN B by writing 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	homogeneous 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 the correct statement.

- 3.1 Non-metallic solids are ductile. (2)
- 3.2 ${}_{10}^{20}\text{Ne}$ and ${}_{10}^{22}\text{Ne}$ 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:
- $$2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2 \quad (2)$$
- 3.5 You can push your hand into water because liquids are compressible. (2)

[10]**QUESTION 4: MULTIPLE-CHOICE QUESTIONS**

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer, which in your opinion, is the correct or best one and mark the appropriate block on the answer sheet with a cross (X).

- 4.1 Which ONE of the following is a correct example of the law of multiple proportions?
- A CuO and CuCO₃
 - B H₂O and H₂O₂
 - C MgO and MgCO₃
 - D H₂ and H₂O (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 N_3H . (3)

[15]**TOTAL SECTION A: 35**

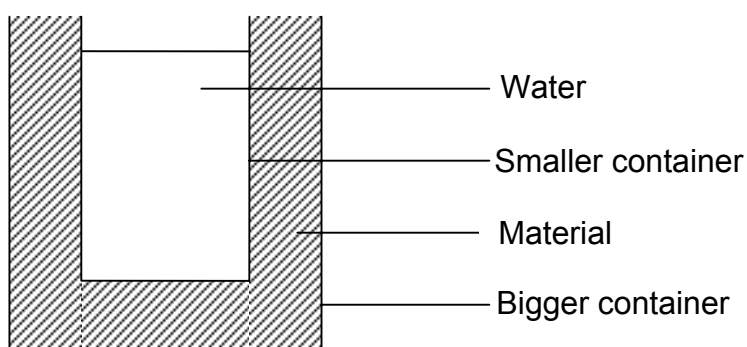
SECTION B**INSTRUCTIONS**

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.



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 Name any TWO other apparatus required to perform the investigation. (4)
- 5.5 Name the independent variable in this investigation? (2)
- 5.6 Name 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 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

- 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 Which TWO elements exert the strongest attractive forces 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. Which 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.

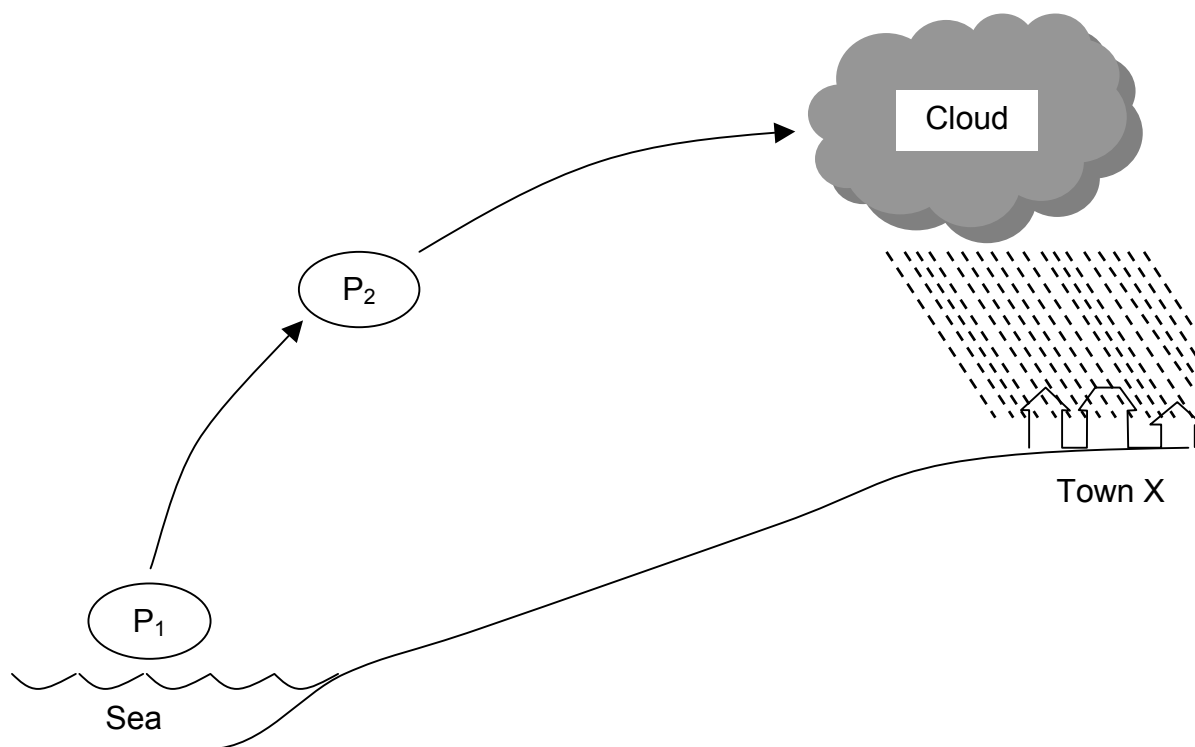
The equation for this spontaneous reaction is as follows: $\text{P}_4(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{P}_2\text{O}_5(\text{s})$

- 8.1 Balance the chemical equation. (2)
- 8.2 Prove that the law of conservation 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. A group of people told the community 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 rainwater? Justify your answer from the sketch. (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 this group who told them that *it will never stop raining*.

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

9.4 What possible strategies can the community leaders adopt 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. (2)
- 10.3 Briefly describe how the property mentioned in QUESTION 10.1 affects the survival of aquatic life during winter. (4)
- [7]**

QUESTION 11

A certain brand of fertiliser contains urea $[\text{CO}(\text{NH}_2)_2]$, 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 $\text{CO}(\text{NH}_2)_2$	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 from the fertiliser. (6)
- 11.2 *The human population is growing at a high 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]**

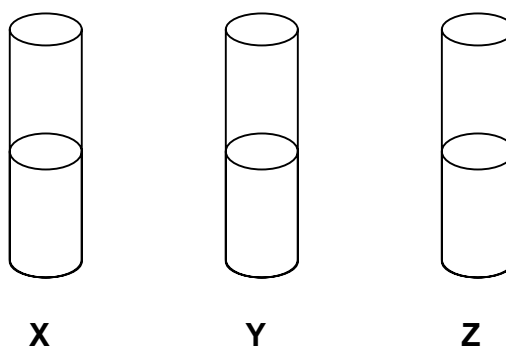
QUESTION 12

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 TWO possible effects 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 each contains a solution of an unknown potassium salt.



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)
- _____ (1)
- [5]**

QUESTION 2 / VRAAG 2

- 2.1 _____ (1)
- 2.2 _____ (1)
- 2.3 _____ (1)
- 2.4 _____ (1)
- 2.5 _____ (1)
- _____ (1)
- [5]**

QUESTION 3 / VRAAG 3

- 3.1 _____ (2)
- 3.2 _____ (2)
- 3.3 _____ (2)
- 3.4 _____ (2)
- 3.5 _____ (2)
- _____ (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

1 (I)	2 (II)	SLEUTEL / KEY										13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)	
		Atoomgetal Atomic number ↓ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 29 Cu 63,5 </div> ↑ Benaderde relatiewe atoommassa Approximate relative atomic mass																
		Elektronegatiwiteit Electronegativity →																
		←																
		Simbool Symbol																
2,1 1 H 1													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 He 4
1,0 3 Li 7	1,5 4 Be 9												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
0,9 11 Na 23	1,2 12 Mg 24	3	4	5	6	7	8	9	10	11	12		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 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		1,7 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
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91		1,8 42 Mo 96	1,9 43 Tc 98	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		1,8 81 Tl 204	1,8 82 Pb 207	1,9 83 Bi 209	2,0 84 Po 209	2,5 85 At 210	86 Rn 222
0,7 55 Cs 133	0,9 56 Ba 137	89 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							
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		