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education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

# PROVINCIAL ASSESSMENT

## GRADE 10

## PHYSICAL SCIENCES: CHEMISTRY (P2)
## NOVEMBER 2024

**MARKS: 100**

**TIME: 2 hours**

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**This question paper consists of 10 pages and 2 data sheets.**

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## INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
2. Start the answers to EACH question at the top of a NEW page.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub-questions, e.g., between QUESTION 2.1 and QUESTION 2.2
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL questions.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. You are advised to use the DATA SHEETS.
11. Write neatly and legibly.

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## QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.7) in the ANSWER BOOK, e.g. 1.8 E.

1.1 The process when a solid substance change directly to gaseous phase is called …

A evaporation.

B condensation.

C sublimation.

D boiling. (2)

1.2 Which ONE of the following substances is a pure substance?

A Steel

B Sulphur

C Juice

D Salt water (2)

1.3 Which ONE of the following represents the electronic structure of Phosphorus (P).

A $1s^2 2s^2 2p^6 3s^2$

B $1s^2 2s^2 2p^6 3s^2 3p^3$

C $1s^2 2s^2 2p^6 3s^2 3p^5$

D $1s^2 2s^2 2p^6 3s^2 3p^6$ (2)

1.4 In which ONE of the following compounds do covalent bond occur between elementary particles?

A Sodium chloride

B Mercury

C Ammonia

D Carbon (2)

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1.5 What is the percentage of hydrogen in a molecule of hydrogen peroxide with molar mass of 34 g.mol$^{-1}$, if one mole of hydrogen reacts with one mole of oxygen?

A 72,72 %

B 94,12 %

C 11,11 %

D 5,88 % (2)

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

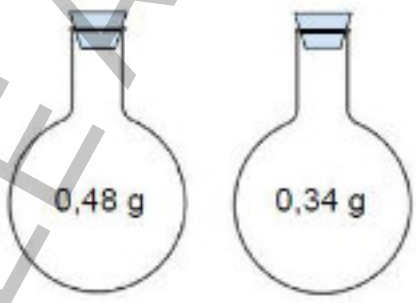
A The total mass of the products will be equal to 55 g.

B The total mass of products for any unreacted reactants will be less than 55 g.

C The total mass of products for any unreacted reactants will be greater than 55 g.

D The total mass of products for any unreacted reactants will be 55 g. (2)

1.7 Two identical flasks are filled with different gasses at the same temperature and pressure. One flask contains ozone ($O_3$) and the other an unknown gas X.




The mass of the ozone gas in the flask is 0,48 g and the mass of gas X in the flask is 0,34 g. Gas X is:

A $O_2$

B $SO_2$

C $H_2S$

D $NH_3$ (2)
**[14]**

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**QUESTION 2**

2.1 In the table below are different substances. Use the following substances to answer the questions that follow.

| | SUBSTANCES |
|---|---|
| **A** | Cobalt |
| **B** | Gold |
| **C** | Phosphorus |
| **D** | Silicon |
| **E** | Air |
| **F** | Ammonium nitrate |

2.1.1 Identify the ELEMENT that has a dull surface and cannot conduct electricity. (1)

2.1.2 Identify ONE substance that is ductile. (1)

2.1.3 Which element has magnetic properties? (1)

2.1.4 Identify the element that is a metalloid. (1)

2.1.5 Write down the chemical formula for substance F (Ammonium nitrate). (2)

2.2 The base of a frying pan is made from aluminium while the handle is made of hard plastic.

2.2.1 What benefit does the base of the pan, made from aluminium, have? (1)

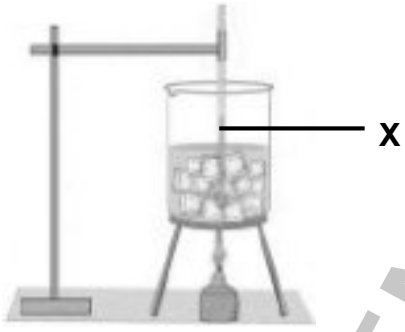
2.2.2 Why would the handle of the pan be made of plastic? (1)
**[8]**

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**QUESTION 3**

Grade 10 learners conducted an experiment to determine the heating curve of water by using ice cubes. The experiment was set up as shown below.

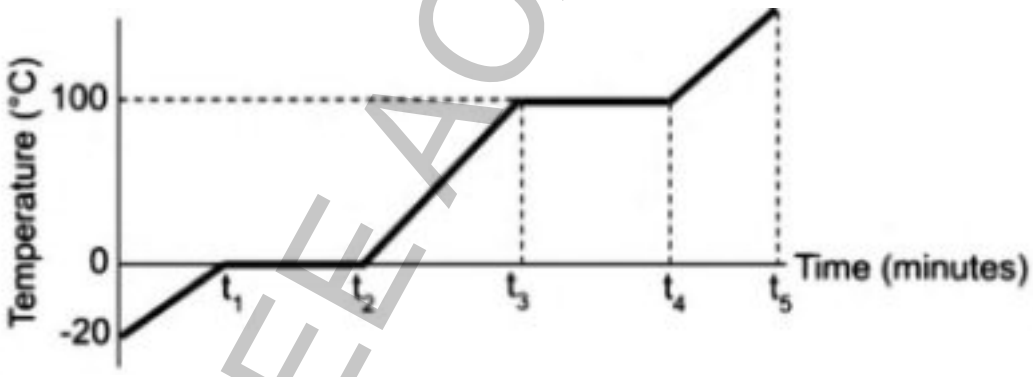



3.1 Define the term *temperature*. (2)

3.2 Name the apparatus labelled X. (1)

3.3 Why is it important to continuously stir the melting ice with a glass rod? (1)

3.4 The graph below shows the results of the experiment.




3.4.1 Name the process taking place between $t_1$ and $t_2$. (1)

3.4.2 Will the water particles move SLOWER or FASTER between $t_2$ and $t_3$ when compared to the movement of the particles between 0 and $t_1$? Give a reason for your answer. (2)

3.4.3 Will the potential energy between $t_3$ and $t_4$ INCREASE, DECREASE or REMAIN THE SAME? (1)

3.4.4 Can the particles be compressed between $t_4$ and $t_5$? Answer YES or NO only. (1)

3.4.5 The forces between particles of ethanol are weaker than those in water. Will the boiling point for ethanol be GREATER THAN or LESS THAN 100 °C under the same standard conditions? (1)

**[10]**

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**QUESTION 4**

4.1 Naturally occurring oxygen consists of three isotopes indicated below:

| ISOTOPE | PERCENTAGE ABUNDANCE (%) |
|---|---|
| O-16 | 99,76 |
| O-17 | 0,04 |
| O-18 | X |

4.1.1 Define *isotopes*. (2)

4.1.2 What percentage abundance does O-18 occupy? (2)

4.1.3 Calculate the relative atomic mass of oxygen. (4)

4.2 Aluminium is a metal and a good conductor of electricity.

4.2.1 Name the type of bonding between the aluminium atom that makes it a good conductor of electricity. (1)

4.2.2 State AND explain another one property of aluminium that can be attributed to the type of bond identified. (2)

Aluminium reacts with nitrogen according to the following reaction equation:

$$Al + N_2 \rightarrow AlN$$

4.2.3 Name the product that forms. (2)

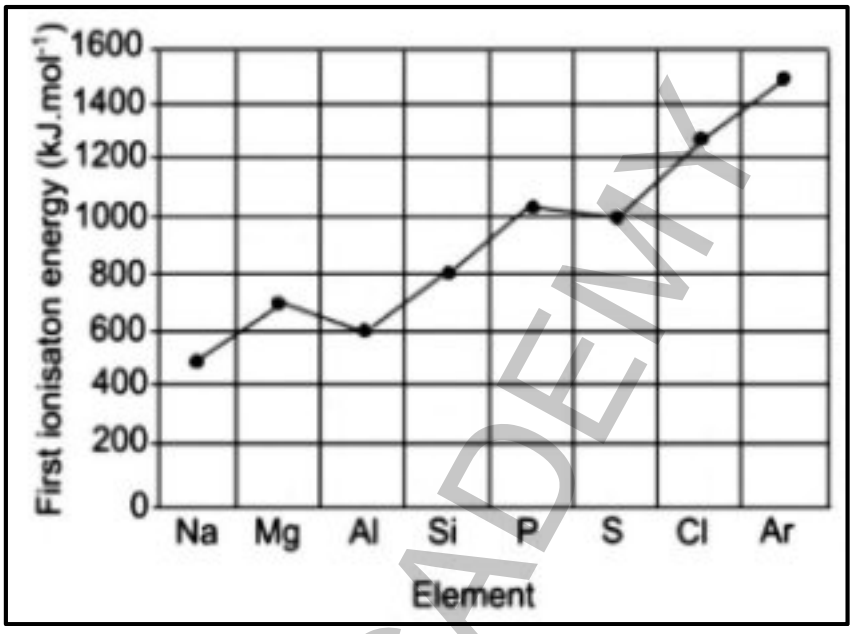
4.2.4 Use Lewis diagrams to show how the product is formed. (4)
**[17]**

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**QUESTION 5**

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




5.1 Define *ionisation energy*. (2)

5.2 Describe the general trend in the first ionisation energies from sodium to argon. (1)

5.3 Explain the difference in the first ionisation energies of magnesium and chlorine. (4)

5.4 How will the SECOND ionisation energy of sodium compare to its FIRST ionisation energy? Choose from GREATER THAN, EQUAL TO or LESS THAN. Explain your answer. (4)
**[11]**

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## QUESTION 6

6.1 Classify the following as a PHYSICAL or CHEMICAL change.

6.1.1 Iron metal is melted. Explain your answer. (2)

6.1.2 Grey hair is dyed to a red colour. (1)

6.1.3 A car rusts. (1)

6.2 The balanced equation for the reaction is:

$$2\ Pb(NO_3)_2(s) \rightarrow 2\ PbO(s) + 4\ NO_2(g) + O_2(g)$$

6.2.1 What type of reaction is shown above? (1)

6.2.2 By use of a calculation prove that the law of conservation of mass is TRUE for this reaction. (5)

6.2.3 When 6,62 g of lead nitrate [ $Pb(NO_3)_2$ ] is heated, 4,46 g of solid is produced. What is the mass of gas that will be produced? (2)

6.3 Balance the following reaction equation:

$$NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(\ell)$$ (2)

**[14]**

## QUESTION 7

7.1 Calculate the concentration of a solution prepared by dissolving 5,85 g of sodium chloride in enough water to make a 500 $cm^3$ solution. (4)

7.2 Explain the concept of water of crystallisation and give the formula of a common hydrated salt. (3)

7.3 A learner heats 5 g of a hydrated salt until all the water of crystallisation has evaporated, leaving 3 g of the anhydrous salt. Determine the percentage of water of crystallisation in the hydrated salt. (2)

**[9]**

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**QUESTION 8**

There are several steps in the production of fertelisers. In the third step, nitrogen dioxide is absorbed by water to produce nitric acid. Nitric acid and ammonia can react together in an acid-base process to form the salt, ammonium nitrate, which is soluble in water.

$$3\ NO_2(g) + H_2O(\ell) \rightleftharpoons 2\ HNO_3(aq) + NO(g)$$

$$NH_3(\ell) + HNO_3(\ell) \rightleftharpoons NH_4NO_3(s)$$

8.1 Define *mole*. (2)

8.2 Give the scientific name of nitric acid. (1)

8.3 Calculate the:

8.3.1 molecular mass of ammonium nitrate. (2)

8.3.2 number of moles of ammonium nitrate if 15 g of it was formed. (3)

8.3.3 volulme of 12 g of nitrogen oxide at STP. (5)

8.3.4 number of nitrogen atoms present in 2 moles of ammonium nitrate. (4)
**[17]**

**TOTAL: 100**

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

## TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

| NAME/*NAAM* | SYMBOL/*SIMBOOL* | VALUE/*WAARDE* |
|---|---|---|
| Standard pressure<br>*Standaarddruk* | $p^\theta$ | $1{,}013 \times 10^5$ Pa |
| Molar gas volume at STP<br>*Molêre gasvolume by STD* | $V_m$ | $22{,}4\ dm^3 \cdot mol^{-1}$ |
| Standard temperature<br>*Standaardtemperatuur* | $T^\theta$ | 273 K |
| Charge on electron<br>*Lading op elektron* | e | $-1{,}6 \times 10^{-19}$ C |
| Avogadro's constant<br>*Avogadro-konstante* | $N_A$ | $6{,}02 \times 10^{23}\ mol^{-1}$ |

## TABLE 2: FORMULAE/*TABEL 2: FORMULES*

| | |
|---|---|
| $n = \frac{m}{M}$ | $n = \frac{N}{N_A}$ |
| $c = \frac{n}{V}$ OR $c = \frac{m}{MV}$ | $n = \frac{V}{V_m}$ |

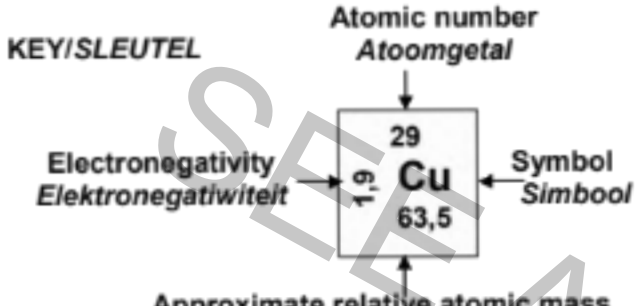
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## TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*




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

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