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GRADE 10

NOVEMBER 2020

**TECHNICAL SCIENCES P2
(EXEMPLAR)**

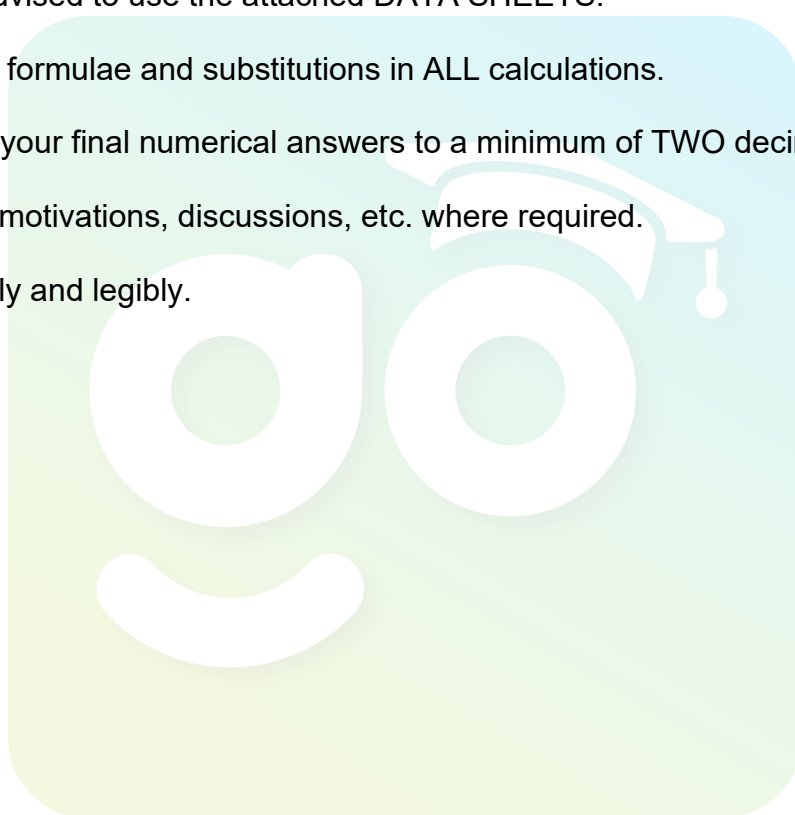
MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, including 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. You may use a non-programmable calculator.
5. LEAVE a line open between subsections, i.e. QUESTION 2.1 and QUESTION 2.2.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions, etc. where required.
10. 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 numbers (1.1–1.10) in the ANSWER BOOK, for example 1.11 D.

- 1.1 The number of protons in an atom is the same as the ...
A electrons.
B neutrons.
C mass number.
D atomic number. (2)
- 1.2 Name TWO particles that are found in the nucleus of an atom.
A Neutrons and electrons
B Protons and electrons
C Protons and neutrons
D Neutrons and charges (2)
- 1.3 The correct s-p notation for Boron is ...
A $1s^2 2s^2$.
B $1s^2 2s^2 2p^5$.
C $1s^2 2s^2 2p^1$.
D $1s^2 2s^2 2p^6 3s^1$. (2)
- 1.4 Which symbol represents an element which is an alkaline-earth metal on the periodic table?
A Ba
B Na
C Al
D Ni (2)
- 1.5 The VALENCY of iron in FeSO_4 is ...
A +1
B +2
C +3
D -2 (2)

- 1.6 Which ONE of the properties can be used to identify a substance?
- A Length
 - B Weight
 - C Density
 - D Temperature (2)
- 1.7 An example of a ferromagnetic substance is ...
- A Co.
 - B Mg.
 - C Be.
 - D Cu. (2)
- 1.8 An unknown material is connected in a circuit consisting of a battery, ammeter and connecting wires. The reading on the ammeter is 0 A. The type of unknown material is therefore a/an ...
- A conductor.
 - B metal.
 - C insulator.
 - D metalloid. (2)
- 1.9 The correct chemical name for Al_2O_3 is ...
- A aluminium oxide.
 - B aluminium dioxide.
 - C aluminium trioxide.
 - D aluminium monoxide. (2)
- 1.10 The missing Stock notation for $CuNO_2$ is ...
- A I.
 - B II.
 - C III.
 - D IV. (2)

[20]

QUESTION 2

2.1 Study the following properties of materials and answer the questions that follow.

thermal conductivity; ductile; melting point; magnetic; electrical conductivity; brittle; boiling point; non-magnetic; density; malleable

Write down numbers (2.1.1 to 2.1.5) in your ANSWER BOOK, and next to each number write down ONE of correct relevant properties that describes the statement below the best.

- 2.1.1 A hard block of margarine will change its state from solid in the fridge to a runny liquid on a hot day (2)
- 2.1.2 A ladder made of aluminium is much easier to carry a steel ladder due to a certain property (2)
- 2.1.3 Sheet metal that is pressed into the shape of car body panels (2)
- 2.1.4 Copper and low carbon steel are materials used to manufacture wire (2)
- 2.1.5 Aluminium cup containing boiling water and keeps the water warmer for a longer time period (2)

2.2 Read the following and answer the questions that follow.

Aluminium is used for kitchen foil and the top of cool drink cans.

Carbon is used to make the lead inside a pencil, and coal and burnt wood are mostly carbon.

Uses of *iron* in daily life include machinery and tools as well as vehicles and structural elements of buildings and bridges.

Water pipes are often *copper*, so you would be able to find an off cut.

The outside metal of a cheap AA size torch cell is made of *zinc*.

Nickel is used in a variety of metal alloys. You might find it in armour plating, nails or pipes.

2.2.1 State whether the following statement is TRUE or FALSE.

All the elements mentioned in the above paragraph are metals.

Explain your choice. (2)

- 2.2.2 If all these elements are placed on a flat surface in the presence of a bar magnet, which of the following elements will be attracted or repelled by the bar magnet?

Redraw the table in your ANSWER BOOK and complete the table.

SUBSTANCE	REPEL / ATTRACT
Aluminium	
Carbon	
Iron	
Copper	
Zinc	
Nickel	

(6 x 1) (6)

- 2.2.3 What type of property do the substances that are attracted to the bar magnet, possess? (1)

- 2.3 Substances mentioned in the above paragraph with other materials are given below in a table with their different thermal conductivity. Study the table and answer the questions that follow.

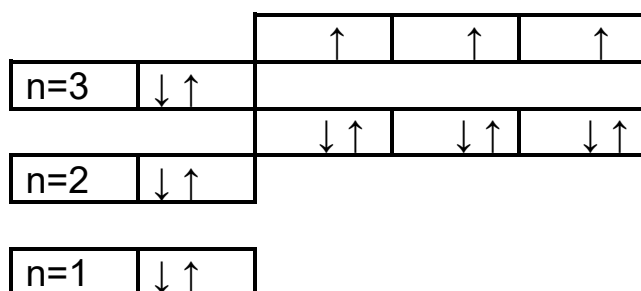
MATERIAL	THERMAL CONDUCTIVITY (W M ⁻¹ K ⁻¹) AT 25 °C
Air	0,0262
Aluminium	205
Brick	0,15
Polyester	0,05
Glass	1,05
Copper	401
Stainless steel	16

- 2.3.1 Define the term *insulator*. (2)
- 2.3.2 Identify TWO of the most effective insulators in the table. (2)
- 2.3.3 Give a reason why you have identified the substances in QUESTION 2.3.2 to be insulators. (1)

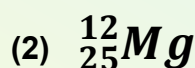
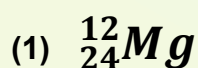
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QUESTION 3

Analyse and study the Aufbau diagram of an unknown element which is drawn and shown in the diagram below:



- 3.1 Define the term *element*. (2)
- 3.2 Identify in which group number and period the element is situated. (2)
- 3.3 Write the atomic number of this element. (1)
- 3.4 Write down the s-p notation of this element. (3)
- 3.5 Give the NAME and SYMBOL of this element. (2)
- 3.6 Identify the number of VALENCE electrons in the element. (1)
- 3.7 Write down the Aufbau diagram for the ion-form of this element. (3)
- 3.8 Identify whether this element in its ion-form can be a CATION or an ANION. (1)
- 3.9 Below are given atoms with the same atomic number but different mass number.



- 3.9.1 Provide the correct term for the underlined words. (1)
- 3.9.2 Which substance has an excess number of electrons? Write only number (1) or (2). (1)
- 3.9.3 What will be the charge of **Mg** when changed from an atom to an ion? Write positive or negative. (1)

- 3.9.4 Study the following table by writing down **ONLY** the question number and the letters (a) to (h) in your ANSWER BOOK and next to it write **ONLY** the correct answer (name or number).

Name	Symbol	No. of protons	No. of neutrons	No. of electrons
Sodium	(a)	11	(b)	11
(c)	Li ⁺	3	4	(d)
Potassium	(e)	19	(f)	19
(g)	(h)	8	8	10

(9 x 1) (9)

- 3.10 Define the *atomic mass of an atom*. (2)

- 3.11 Balance the chemical reactions given below:



- 3.12 Study the following table and answer the questions that follow.

A $\text{Ca} + \text{CO}_2 + \text{H}_2\text{O} \rightarrow$	B Magnesium sulphate
C SO_4^{2-}	D $\text{KNO}_3 \rightarrow \dots + \dots$
E Sulphuric acid + Zinc \rightarrow	F SO_3^{2-}
G NH_4Cl	H Sodium hydroxide
I Mg^{2+}	J Nitrogen dioxide

- 3.12.1 Define the term *compound*. (2)

- 3.12.2 Complete reaction number **D** by writing the formulae of the products formed. (4)

- 3.12.3 Identify the letters that react as reactants to produce compound **B** as a product. (2)

- 3.12.4 Write the NAMES of the product formed in **E**. (4)

- 3.12.5 Write down the chemical formula of letters **H** and **J**. (4)

[49]

QUESTION 4

4.1 Define *pure substance*. (2)

4.2 Write ONE example on each of the concepts listed below:

4.2.1 Insulator (1)

4.2.2 Conductor (1)

4.3 Define the term *cation*. (2)

4.4 Determine from the chemical substances given their:

4.4.1 Cation in CO_2 (2)

4.4.2 Anion in H_2O (2)

4.5 Complete the Stock notation for the following:

4.5.1 FeO_3 (2)

4.5.2 CuCl_2 (2)

4.6 Look at the table below. It shows a simplified version of the periodic table. Elements are replaced with letters (a) to (l).

(i)																(j)
(a)										(d)	(l)		(f)			
	(b)										(e)			(k)	(g)	
							(h)			(c)						

Write down the letter(s) representing:

4.6.1 Metalloids (2)

4.6.2 Gas used to fill balloons (1)

4.6.3 A gas found in group 1 (1)

4.6.4 Alkali-earth metal (1)

4.6.5 Halogen (1)

- 4.6.6 Has got an atomic number of 12 (1)
- 4.6.7 Has 3 protons in its nucleus (1)
- 4.6.8 Its highest energy orbitals are fully filled with paired electrons (1)
- 4.6.9 Noble gas in period 3 (1)
- 4.7 Write the SYMBOLS and NAMES of elements represented by (b); (f) and (i). (6)
- 4.8 Define the term *diatomic*. (2)
- 4.9 Which letters can be identified as diatomic elements? (3)

[35]



QUESTION 5

Study the following table where substances are measured at a room temperature of 20 °C.

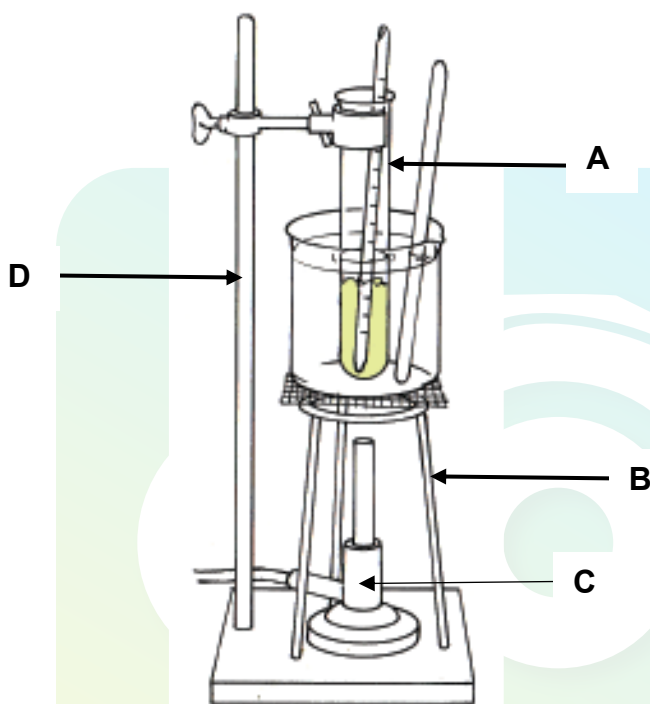
SUBSTANCE	MELTING POINT °C	BOILING POINT °C
Oxygen	-219	-183
Ethanol	-15	78
Sodium	98	890
Sulphur	119	445
Iron	1 540	2 900
Glass	1 400	2 230
Diamond	3 550	4 832

- 5.1 Define *temperature*. (2)
- 5.2 Name the instrument that was used to measure the temperatures. (1)
- 5.3 What type of scale was used by the instrument mentioned in QUESTION 5.2 in order to get readings? (1)
- 5.4 Name TWO other different types of instruments besides the one named in QUESTION 5.3 that is used in our daily lives to measure temperature. (2)
- 5.5 Convert the following to Kelvin temperature:
- 5.5.1 Oxygen melting point temperature (2)
- 5.5.2 Sulphur boiling point temperature (2)
- 5.6 Identify ONE substance of the following phases by studying their melting points and boiling points in the table given:
- 5.6.1 Solid (1)
- 5.6.2 Liquid (1)

- 5.7 A group of learners perform an experiment to determine at which temperature paraffin wax melts and solidifies.

The following procedures were performed:

1. A test tube containing solid wax will be heated until the wax melts.
2. The hot molten wax will be cooled and the temperature recorded at regular intervals.
3. The solid wax will then be reheated and the temperature recorded at regular intervals until it melts again.



The following results were obtained from the experiment.

TIME(S)	TEMPERATURE (°C)	OBSERVATIONS
0	27	White solid
120	28	White solid
240	29	White solid
360	31	White solid
480	46	White solid, partly liquid
600	58	White solid, partly liquid
720	62	White liquid
840	66	White liquid
960	70	Clear liquid
1 080	70	Clear liquid

5.7.1 Define *heat*. (2)

5.7.2 Identify the time period where the wax was still a solid. (1)

- 5.7.3 At what temperature did the solid wax melt? (1)
- 5.7.4 What is the source of heat in this experiment? (1)
- 5.7.5 It is unsafe to heat paraffin wax in the laboratory over an open flame.
Give a reason for this. (2)
- 5.7.6 Identify letters **A**, **B** and **D**. (3)

[22]

TOTAL: 150



**NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT**

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

**GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIIESE KONSTANTES

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

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$	$pV = nRT$

