higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(Second paper)

NQF LEVEL 2

(10021002)

24 November 2022 (Y-paper)
13:00–16:00

Drawing instruments and a non-programmable calculator may be used.

This question paper consists of 10 pages and 1 periodic table.

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TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a black or blue pen.
6. Show all calculations, formula and substitutions.
7. Approximate all final answers to TWO decimal places.
8. Write neatly and legibly.

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SECTION A

QUESTION 1

Give ONE term for each of the following descriptions by writing it next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Measure of a material's ability to conduct heat

1.2 Electrons found in the outermost energy shell

1.3 Substance suspended in a solution

1.4 Method of separating the parts of a mixture based on their different boiling points

1.5 Process of losing water through tiny pores in the leaves of plants

(5 × 1) **[5]**

QUESTION 2

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–I) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Carbonic acid	A	hydrochloric acid
2.2	Name of group VIII (18) elements	B	H_2CO_3
2.3	Weak acid	C	conduction
2.4	Heat energy transfer through a liquid or gas	D	desalination
2.5	Removing salt from seawater	E	noble gases
		F	convection
		G	$CaC\ell_2$
		H	halogens
		I	CH_3COOH

(5 × 1) **[5]**

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QUESTION 3

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK. Correct the statement if it is FALSE.

3.1 A compound is a simple chemical substance that consists of molecules of only one kind.

3.2 Water becomes hard when lime is dissolved in it.

3.3 Acid is a solution with a pH level less than 7.

3.4 The relative formula mass of aluminium hydroxide is 74 g/mol.

3.5 Hydrosphere includes all the earth's water and the distribution of that water on the planet.

(5 × 2) **[10]**

QUESTION 4

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 The bond between the nitrogen atoms in a N_2 molecule:

A Ionic
B Dative covalent
C Metallic
D Covalent

4.2 The percentage of the earth's surface covered in water:

A 40%
B 71%
C 90%
D 97%

4.3 Method of water treatment which is most environmentally friendly:

A Draining lakes
B Dumping chemicals into water
C Building dams
D Water treatment plants

4.4 Collective name given to the subatomic particles in the nucleus of an atom:

A Protons
B Neutrons
C Electrons
D Nucleons

4.5 All the stone, rock and soil layers on earth:

A Biosphere
B Hydrosphere
C Lithosphere
D Atmosphere

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5: MATTER AND MATERIALS

5.1

	SUBSTANCE
A	Iron fillings and sand
B	Copper
C	Sulphur
D	Air
E	Silicon
F	$CC\ell_4$
G	Oil
H	Ammonium sulphate
I	$A\ell_2O_3$

5.1.1 Identify the substance that has a dull surface and cannot conduct electricity. (1)

5.1.2 Which substance has magnetic properties? (1)

5.1.3 Name substance F. (2)

5.1.4 Give the chemical formula for substance H. (2)

5.1.5 Name TWO techniques that can be used to separate substance A into its components. (2)

5.2 Explain why frying pans and pots are made of metal, while the handles are made of hard plastics or wood. (4)

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5.3

SUBSTANCE	MELTINGPOINT (°C)	BOLING POINT (°C)
Lead	317	174
Radon	-71	-62
Ethanol	-117	78
Cobalt	1 492	2 900
Nitrogen	-210	-196
Propane	-188	-42
Ethanoic acid	16	118

5.3.1 Define the term *boiling point* of a substance. (2)

5.3.2 Which TWO substances are gaseous at -50 °C? (2)

5.3.3 Which substance is a liquid at 2 500 °C? (1)

5.3.4 Is nitrogen a liquid, solid or gas at 35 °C? (2)

[19]

QUESTION 6: MATTER AND MATERIALS

The sp notation of an unknown element X is shown below:

$$1S^2\ 2S^2\ 2P^4$$

6.1 For element X, write down the:

6.1.1 Symbol of the element

6.1.2 Number of valence electrons

6.1.3 Period where this element is found on the periodic table

6.1.4 Total number of nucleons

(4 × 1) (4)

6.2 Sodium combines with the chlorine to form sodium chloride.

6.2.1 Write down the type of bond formed between sodium and chlorine. (1)

6.2.2 Draw the Aufbau (energy level) diagram for the sodium ion. (2)

6.2.3 Draw the Lewis dot diagram to show the bond formation between sodium and chorine. (4)

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6.3 Ordinary potassium is composed of three isotopes, namely K-39, K-40 and K-41. The radioactivity from these naturally occurring isotopes presents no appreciable health hazard.

6.3.1 What is an *isotope*? (2)

6.3.2 Which subatomic particle is responsible for the formation of isotopes? (1)

6.3.3 How many protons are in this atom? (1)

6.4 Give the chemical name for each of the following compounds:

6.4.1 Washing soda

6.4.2 Quicklime

6.4.3 Table salt

(3 × 2) (6)

6.5 Give the chemical formula for each of the following compounds:

6.5.1 Calcium nitrate

6.5.2 Aluminium oxide

6.5.3 Ammonia

(3 × 2) (6)

[27]

QUESTION 7: CHEMICAL CHANGE

7.1 Explain each of the following terms:

7.1.1 Heat capacity

7.1.2 Specific heat capacity

(2 × 2) (4)

7.2 The temperature of a copper ball rises from 20 °C to 90 °C when it receives 400 kJ of heat. Take the specific heat capacity of copper as 389 J/kg.°C.

Calculate:

7.2.1 The change in temperature (2)

7.2.2 The mass of the copper ball (3)

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7.3 Classify each of the following as a heterogeneous mixture, homogeneous mixture or pure substance. Give a reason for the answer.

7.3.1 Silicon dioxide

7.3.2 Argon

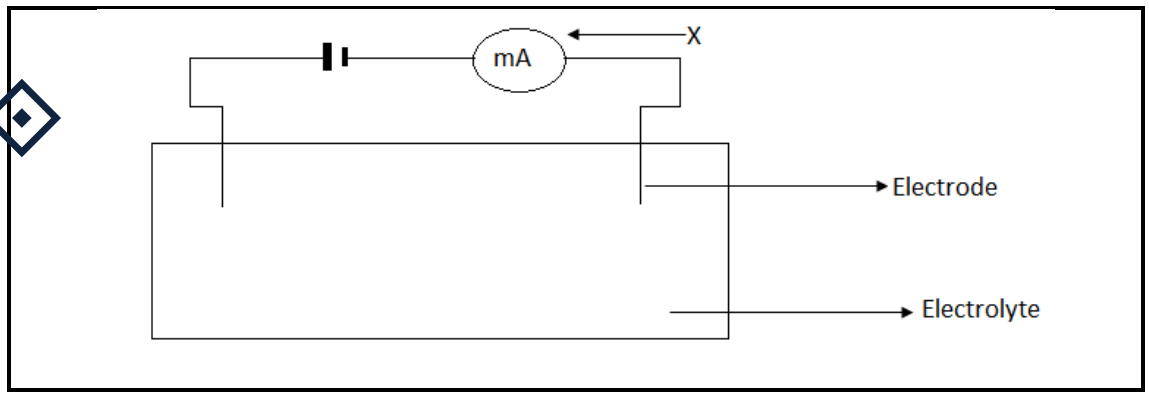
7.3.3 Sand and stone

(3 × 2) (6)

[15]

QUESTION 8: CHEMICAL CHANGE

8.1 Sodium chloride crystals are added to water and dissociate to form an electrolyte. The experiment set up below was used to determine the electrical conductivity of a sodium chloride solution.



8.1.1 Define the term *electrolyte*. (2)

8.1.2 Which physical quantity is measured by component X? (1)

8.1.3 What is *dissociation*? (3)

8.1.4 Use a chemical equation to explain the answer to QUESTION 8.1.3. (4)

8.2 35 g of ammonium nitrate (NH_4NO_3) is added to sufficient water to make 250 cm^3 of solution.

8.2.1 Define the term *concentration*. (2)

8.2.2 Calculate the concentration of this solution. (4)

8.3 Physical Science L2 learners were given 30 g of sodium sulphate (Na_2SO_4) to prepare an experiment.

Calculate the number of moles of sodium sulphate that they have. (4)

8.4 Balance each of the following reactions and state whether the reaction is a decomposition, synthesis or combustion reaction.

8.4.1 $C_2H_6 + O_2 \longrightarrow CO_2 + H_2O$

8.4.2 $KCℓO_3 \longrightarrow KCℓ + O_2$

(2 × 4) (8)
[28]

QUESTION 9: CHEMICAL SYSTEM AND INDUSTRY

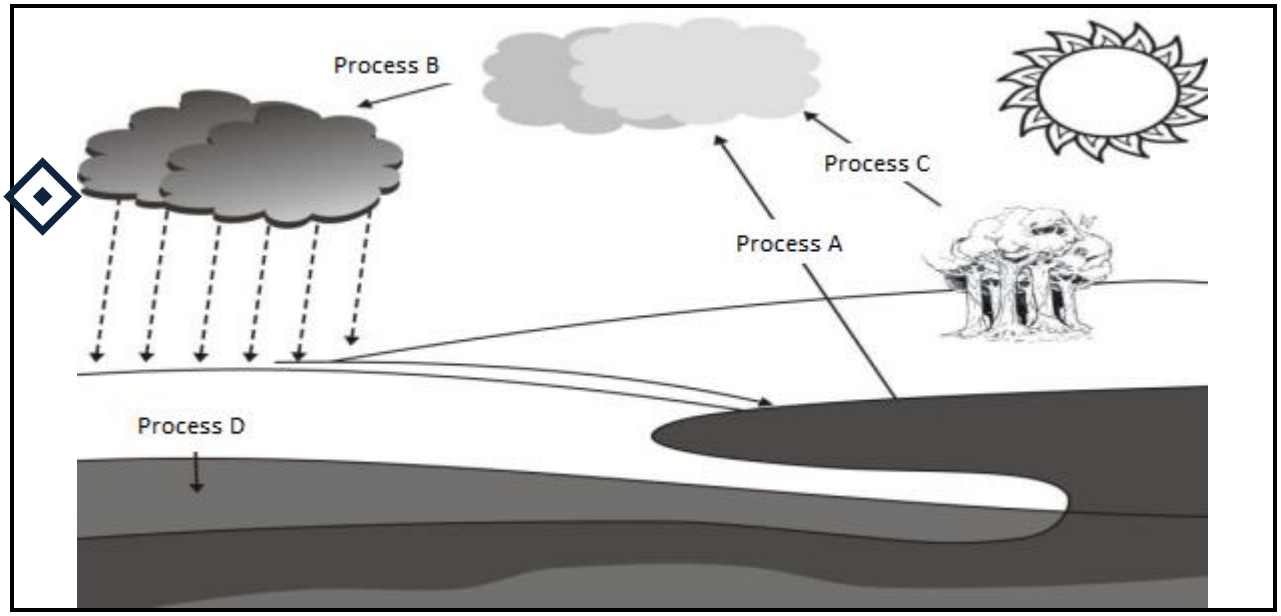
9.1 Define the term *pollution*. (2)

9.2 Give THREE causes of pollution in rivers and dams. (3 × 2) (6)

9.3 Name TWO chemicals that make water temporarily hard. (2)

9.4 Name TWO substances responsible for making water permanently hard. (2)
[12]

QUESTION 10: CHEMICAL SYSTEM AND INDUSTRY



10.1 Name each of the following processes:

10.1.1 A

10.1.2 B

10.1.3 C

10.1.4 D

(4 × 1) (4)

10.2 Explain the energy changes during the process. Write down the energy gained or energy lost. (2)

10.3 Write a balanced equation for the reaction that takes place when sulphur dioxide dissolves in water to form sulphurous acid. (3)

10.4 Give a reason why chlorine is added to drinking water. (2)

10.5 List THREE macroscopic properties of water. (3)
[14]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE

