



education

Department of
Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 10

PHYSICAL SCIENCES

SEPTEMBER 2017

MARKS: 100

TIME: 2 HOURS

This paper consists of NINE pages, one data sheet and one periodic table.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEETS.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

QUESTION 1

Four options are given as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter A, B, C or D next to the question number (1.1 – 1.10) in your ANSWER SHEET.

1.1 A rod acquires a negative charge after it has been rubbed with wool. Which one of the following best explains this observation?

- A Positive charges are transferred from the rod to the wool.
- B Negative charges are transferred from the rod to the wool.
- C Positive charges are transferred from the wool to the rod.
- D Negative charges are transferred from the wool to the rod. (2)

1.2 Which one of the following metals is NOT ferromagnetic?

- A Iron
- B Nickel
- C Silver
- D Cobalt (2)

1.3 Which one of the following quantities and SI units are related to one another?

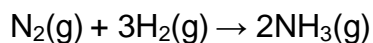
	Quantity	SI unit
A	Current	$C \cdot s^{-1}$
B	Potential difference	J·C
C	Current	C·s
D	Potential difference	$C \cdot J^{-1}$

(2)

1.4 What amount of charge flows through a resistor in 2,5 minutes if the current is 1,2 A?

- A $\frac{1,2 \times 2,5}{60}$
- B $1,2 \times 2,5$
- C $\frac{2,5 \times 60}{1,2}$
- D $1,2 \times 2,5 \times 60$ (2)

1.5 Consider the following balanced equation:



How many moles of H_2 will react with 3 moles of N_2 ?

- A 1
- B 3
- C 6
- D 9 (2)

1.6 A compound consists of ions X^{2+} and Y^{3-} . Which one of the following is a possible formula for the compound?

- A $3\text{X}_2\text{Y}$
- B X_2Y_3
- C X_3Y_2
- D $(\text{XY})_6$ (2)

1.7 Which one of the following is the correct formula for copper sulphate with waters of crystallisation?

- A CuSO_4
- B $\text{Cu}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$
- C $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
- D $\text{CuSO}_4 + 5\text{H}_2\text{O}$ (2)

1.8 Which one of the following reactions best represents the dissociation of copper sulphate crystals?

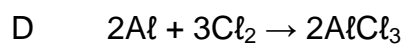
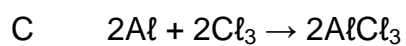
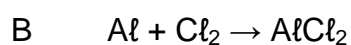
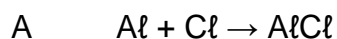
- A $\text{CuSO}_4(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$
- B $\text{CuSO}_4(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$
- C $\text{CuSO}_3(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{SO}_3^{2-}(\text{aq})$
- D $\text{CuSO}_4(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Cu}^{2+}(\text{s}) + \text{SO}_4^{2-}(\text{aq})$ (2)

1.9 Which one of the following is correct for ONE mole of ammonia gas?

	Number of atoms	Number of moles
A	$1 \times 6,02 \times 10^{23}$ N atoms	1 mol of N atoms
B	$1 \times 6,02 \times 10^{23}$ H atoms	3 mol of H atoms
C	$3 \times 6,02 \times 10^{23}$ N atoms	3 mol of N atoms
D	$3 \times 6,02 \times 10^{23}$ H atoms	1 mol of H atoms

(2)

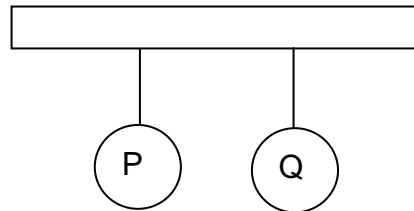
1.10 Which one of the following represents the balanced chemical equation for the reaction between aluminium and chlorine to form aluminium chloride?



(2)
[20]

QUESTION 2

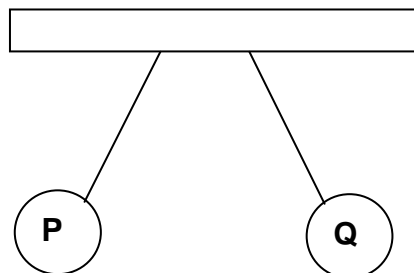
Two identical metallic spheres, **P** and **Q**, are suspended from strings as indicated below. The charges on **P** and **Q** are $+4\text{ C}$ and -12 C respectively. They are held a small distance apart without changing the charges.



When the spheres are released, they move towards each other and touch.

- 2.1 Write down the *principle of conservation of charge* in words. (2)
- 2.2 How does the number of protons compare to the number of electrons in the case of sphere **P**? Choose your answer from LESS THAN, SAME AS or MORE THAN. (1)
- 2.3 Explain why the spheres move towards each other? (1)

The two spheres separate after having touched each other as indicated below.

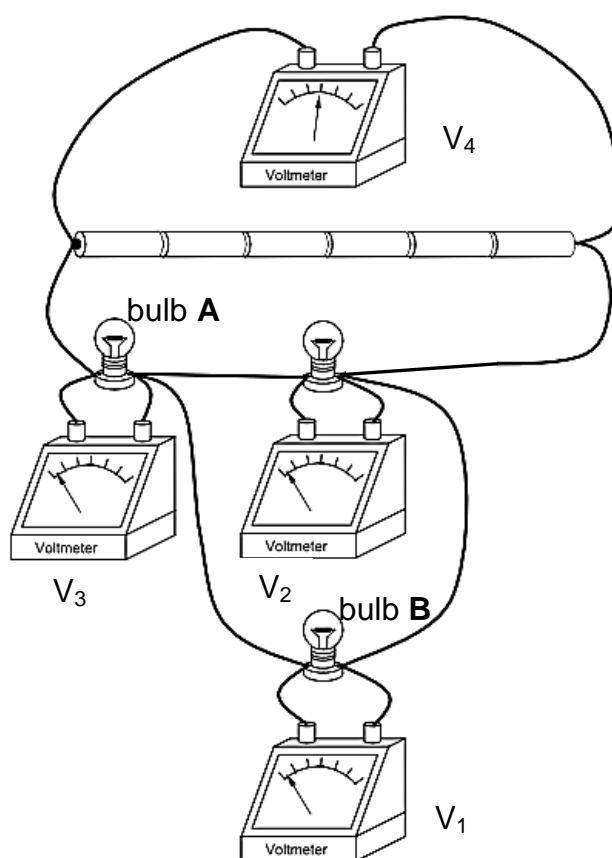


- 2.4 In which direction did electrons flow while they were in contact? Write only **P TO Q** or **Q TO P**. Explain your choice. (2)
- 2.5 Calculate the charge on each sphere AFTER separation. (3)
- 2.6 Calculate the number of electrons on sphere **Q** AFTER separation. (3)

[12]

QUESTION 3

In the circuit represented below, the bulbs are identical. The resistance of the connecting wires and battery can be ignored.

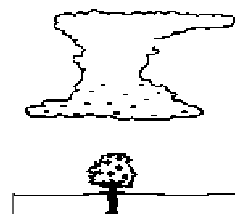


- 3.1 Draw a circuit diagram for the circuit by using the correct symbols. (4)
- 3.2 Define the term *potential difference*. (2)
- 3.3 The reading on voltmeter V_1 is 2 V. Determine the following:
 - 3.3.1 Reading on voltmeter V_2 in volt. (2)
 - 3.3.2 Reading on voltmeter V_3 in volt. (2)
 - 3.3.3 Reading on voltmeter V_4 in volt. (2)
 - 3.3.4 EMF, in volt, of each cell (2)
- 3.4 What is the current in bulb **B** if the current in bulb **A** is 2 A? (2)
- 3.5 Calculate the total resistance of the circuit if each bulb has a resistance of $2\ \Omega$. (5)

[21]

QUESTION 4

The diagram shows a charged thundercloud. The base of the cloud has a negative charge of 18 C and the tree has a positive charge. The potential difference between the base of the cloud and the ground is $1,2 \times 10^9$ V.



- 4.1 Calculate the maximum amount of energy that can be transferred to the ground by a flash of lightning.

(3)

- 4.2 Calculate the current if the cloud discharges in 2s.

(3)

[6]

QUESTION 5

A mass of 2,235 g of potassium chloride (KCl) completely dissolves in 250 cm^3 of distilled water.

- 5.1 Define the term *dissociation*.

(2)

- 5.2 Does a solution of KCl conduct electricity? Write only YES or NO and explain your answer.

(2)

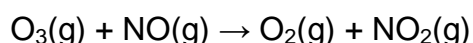
- 5.3 Calculate the concentration of the solution in $\text{mol} \cdot \text{dm}^{-3}$.

(6)

[10]

QUESTION 6

7,2 g of O_3 react completely with a sufficient volume of NO gas at STP. The balanced equation for this is:



- 6.1 Give the value and correct unit of:

6.1.1 Standard temperature

(1)

6.1.2 Standard pressure?

(1)

- 6.2 Calculate the:

6.2.1 Number of moles of O_3 molecules in 7,2 g O_3

(3)

6.2.2 Mass of NO_2

(3)

6.2.3 Volume of NO_2

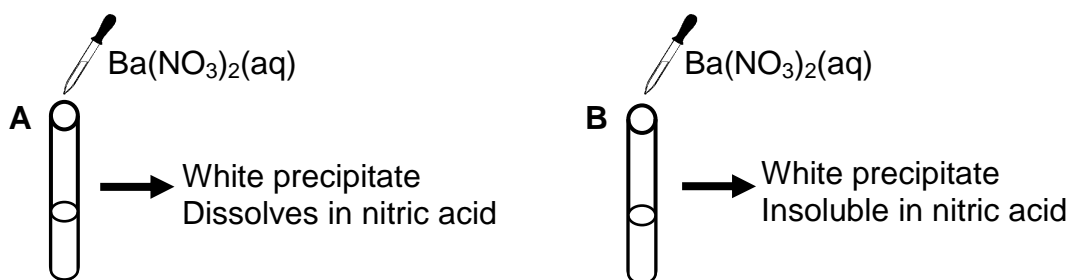
(3)

[11]

QUESTION 7

You are supplied with two unknown SODIUM compounds. It is known that one of them is a sulphate and the other one a carbonate.

In order to identify the two compounds, a small amount of each is dissolved in distilled water in two test-tubes marked **A** and **B**. A few drops of a barium nitrate solution are added to each test-tube and a white precipitate forms in each. After the addition of a nitric acid solution to each of the test-tubes, the precipitate in **A** DISSOLVES, whilst the precipitate in test-tube **B** REMAINS.



- 7.1 Give the name or formula of the original sodium compound that was dissolved in water in:
- 7.1.1 Test-tube **A** (2)
- 7.1.2 Test-tube **B** (2)
- 7.2 Give the name or formula of the precipitate that forms in:
- 7.2.1 Test-tube **A** (2)
- 7.2.2 Test-tube **B** (2)
- 7.3 What type of reaction takes place between the precipitate in **A** and the nitric acid? (1)
- [9]**

QUESTION 8

A certain substance consists of 39,9% carbon, 6,7% hydrogen and 53,4% oxygen.

- 8.1 Briefly explain the meaning of *empirical formula*. (2)
- 8.2 Determine, by means of calculations, the EMPIRICAL formula of this substance. (7)
- 8.3 Write down the MOLECULAR formula of the substance if its molar mass is equal to $60 \text{ g} \cdot \text{mol}^{-1}$. (2)

[11]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 10
GEGEWENS VIR FISIIESE WETENSKAPPE GRAAD 10

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIIESE KONSTANTES

NAME / NAAM	SYMBOL / SIMBOOL	VALUE / WAARDE
Charge on electron <i>Lading op elektron</i>	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass <i>Elektronmassa</i>	m_e	$9,11 \times 10^{-31} \text{ kg}$
Avogadro's constant <i>Avogadro se konstante</i>	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
Molar gas volume at STP <i>Molêre gasvolume by STD</i>	V_m	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$

TABLE 2: FORMULAE / TABEL 2: FORMULES

ELECTRIC CIRCUITS / ELEKTRIESE STROOMBANE

$V = \frac{W}{Q}$	$I = \frac{Q}{\Delta t}$
$R = \frac{V}{I}$	
$R_s = R_1 + R_2 + R_3 + \dots$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

CHEMISTRY FORMULAE / CHEMIEFORMULES

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

KEY/SLEUTEL

Electronegativity
Elektronegativiteit

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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