education

Department of Education
FREE STATE PROVINCE

GRADE 10

PROVINCIAL FORMAL ASSESSMENT TASK

PHYSICAL SCIENCES (PHYSICS AND CHEMISTRY)

SEPTEMBER 2015

TIME: 2 HOURS

MARKS: 100

This paper consists of 9 pages and 2 information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate spaces on the ANSWER BOOK.
2. The QUESTION paper consists of SEVEN QUESTIONS. Answer ALL 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 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: MULTIPLE CHOICE QUESTIONS

Four options are given as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A, – D) next to the question number (1.1 – 1.10) in your ANSWER BOOK, for example 1.11. D.

1.1 Electric current strength is defined as the …

A flow of charge.

B rate of flow of charge.

C work done per charge.

D potential difference per charge. (2)

1.2 The electric current in a wire …

A only depends on the resistance of the wire.

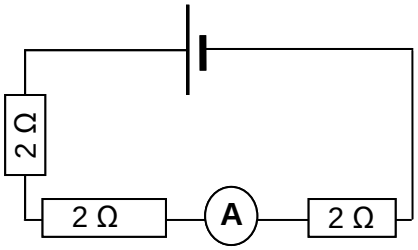
B only depends on the potential difference across the wire.

C does not depend on the potential difference across the wire.

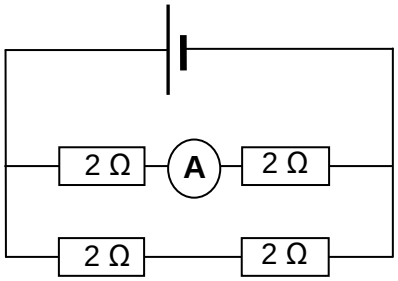
D depends on the potential difference across and the resistance of the wire. (2)

1.3 Consider the circuits represented below.

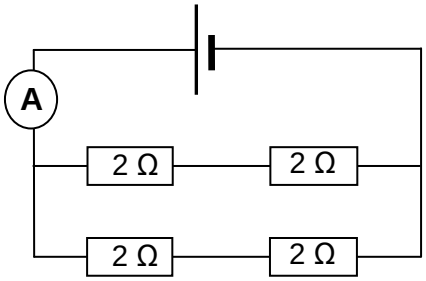
I



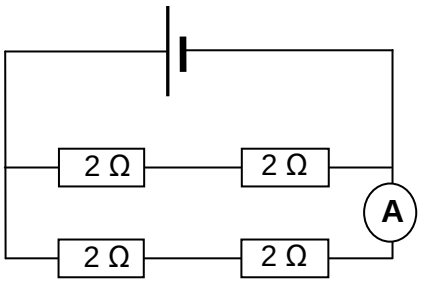
II



III



IV



In which circuit(s) does the ammeter measure the main current?

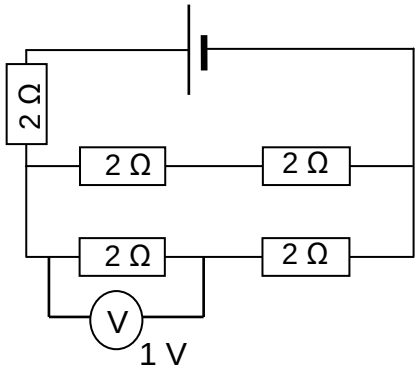
A I, III and IV

B Only I

C III and IV

D I and III (2)

1.4 In the circuit below the resistances of the battery and the connecting wires are negligible.



The emf of the battery is:

A 1 V

B 2 V

C 4 V

D 6 V (2)

1.5 Consider the balanced equation below.

$$2KC\ell O_3(s) \rightarrow 2KC\ell(s) + 3O_2(g)$$

The number of moles of $O_2(g)$ that can be prepared from 6 moles of $KC\ell O_3(s)$ is:

A 3

B 6

C 9

D 12 (2)

1.6 The empirical formula of a certain compound is C_2OH_4.

Which ONE of the following can be the molecular formula of this compound?

A $C_4O_2H_8$

B $C_4O_2H_4$

C COH

D C_2OH_8 (2)

1.7 Which ONE of the following reactions is NOT a redox reaction?

A $Fe(s) + S(s) \rightarrow FeS(s)$

B $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$

C $2HC\ell(aq) + Zn(s) \rightarrow ZnC\ell_2(aq) + H_2(g)$

D $HC\ell(aq) + NaOH(aq) \rightarrow NaC\ell(aq) + H_2O(\ell)$ (2)

1.8 Acid base reactions are defined as reactions in which …

A gases are formed.

B precipitates are formed.

C electrons are transferred.

D hydrogen ions are transferred. (2)

1.9 $Na_2SO_4(aq)$ is added to EXCESS $Ba(NO_3)_2(aq)$ in a beaker. The ions that will be present in the solution after a while are:

A Na^+ ; NO_3^-

B Na^+ ; Ba^{2+} ; NO_3^-

C Na^+ ; SO_4^{2-} ; NO_3^-

D Na^+ ; SO_4^{2-} ; Ba^{2+} ; NO_3^- (2)

1.10 Which ONE of the following represents one mole?

The number of:

A Molecules in 22,4 dm^3 of water at STP

B Atoms in 6,02 x 10^{23} g sodium

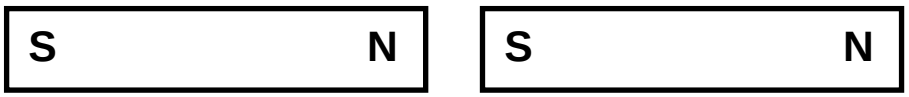
C Protons in 1 g of $H_2(g)$

D Molecules in 34 g of $NH_3(g)$ (2)

[20]

QUESTION 2

Two bar magnets are brought closer to each other as show below.



2.1 Define the term *magnetic field*. (2)

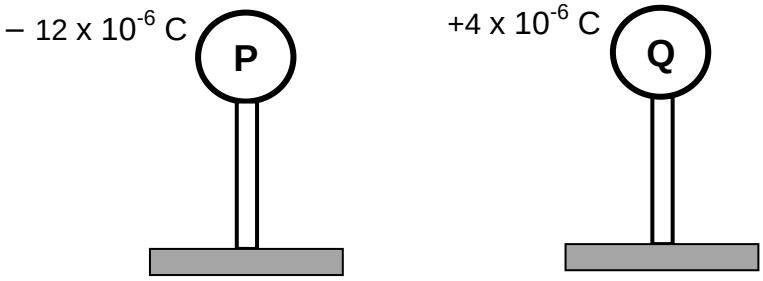
2.2 Will the two magnets REPEL or ATTRACT each other? (1)

2.3 Draw the magnetic field pattern in the region between the two magnets. (2)

2.4 The first magnet is now rotated so that the S pole faces the S pole of the second magnet. Draw the magnetic field pattern in the region between the two magnets. (2)
[7]

QUESTION 3

Two spheres, **P** and **Q**, on insulated stands, carry charges of - 12 x 10^{-6} C and + 4 x 10^{-6} C respectively as shown below.



THE SPHERES ARE NOW ALLOWED TO TOUCH EACH OTHER AND THEN SEPARATED AGAIN.

3.1 Write down the *principle of conservation of charge.* (2)

3.2 In which direction will electrons flow while spheres **P** and **Q** are in contact? Write down only from **P** to **Q** or from **Q** to **P**. (1)

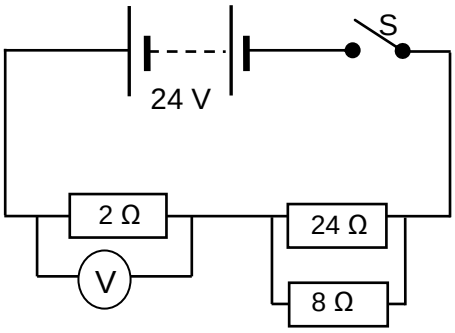
3.3 Calculate the new charge on each sphere after separation. (3)

3.4 Calculate the net charge gained or lost by sphere **P**. (3)

3.5 Calculate the number of electrons transferred from one sphere to the other during contact. (2)
[11]

QUESTION 4

In the circuit below, the connecting wires and the battery have negligible resistance.



4.1 Name the physical quantity measured by a voltmeter. (1)

4.2 Define the term *resistance*. (2)

4.3 Calculate the:

4.3.1 Equivalent resistance of the resistors connected in parallel (3)

4.3.2 Total resistance of the circuit (2)

4.4 When the switch is closed, the voltmeter connected across the 2 Ω resistor measures 6 V. Determine the potential difference across the parallel combination. (1)

4.5 A charge of 18 C flows through the battery in 6 s.

4.5.1 Define a *coulomb of charge*. (2)

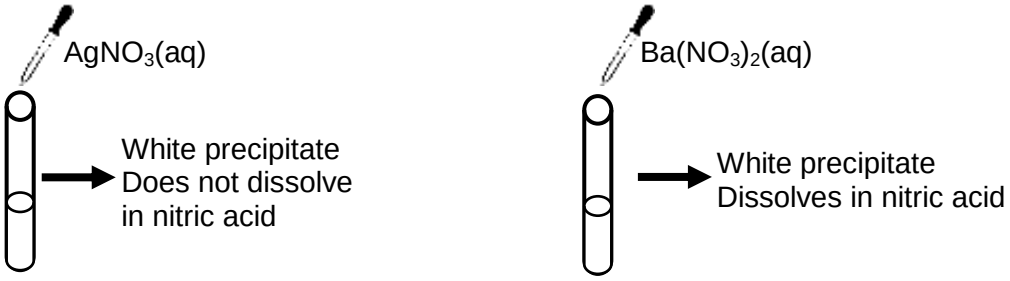
4.5.2 Use the data supplied in QUESTION 4.5 and calculate the current in the 2 Ω resistor. (3)

4.5.3 Use ratios to determine the current in the 24 Ω resistor. (2)

[16]

QUESTION 5

Each of test tubes **A** and **B** illustrated below contains colourless potassium solutions. A few drops of silver nitrate solution are added to test tubes **A** and a few drops of barium nitrate solution are added to test tube **B** as shown.



Test tube A **Test tube B**

A white precipitate forms in each test tube. After addition of nitric acid, the precipitate in test tube **B** dissolves, whilst that in test tube **A** does not dissolve.

5.1 Define the term *dissociation*. (2)

5.2 Write down a balanced equation to show how barium nitrate dissociates in water. (3)

5.3 Give a reason why a silver nitrate solution can be used as electrolyte. (1)

5.4 Write down the formula of the potassium salt in:

5.4.1 Test tube **A** (2)

5.4.2 Test tube **B** (2)

5.5 Write down the name of the precipitate that forms in test tube **A**. (1)

5.6 Write down a balanced equation for the reaction that takes place in test tube **B** WHEN NITRIC ACID IS ADDED TO THE PRECIPITATE. Indicate the phases of all reactants and products. (4)
[15]

QUESTION 6

When a mixture of 0,63 g hydrogen gas and 0,76 g oxygen gas is ignited, a fast reaction takes place to form water and heat is released. The reaction is represented by the equation below:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

6.1 Define *one mole* of a substance. (2)

6.2 Calculate the initial number of moles of:

6.2.1 Oxygen gas (3)

6.2.2 Hydrogen gas (2)

6.3 Which ONE of hydrogen gas or oxygen gas is the limiting reagent? Fully explain the answer. (4)

6.4 Give a reason why helium is preferred above hydrogen when filling balloons to entertain children? (1)
[12]

QUESTION 7

7.1 The reaction between zinc and dilute hydrochloric acid is represented by the balanced equation below:

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

During an experiment, 3,5 g of zinc reacts completely with a 0,2 $mol \cdot dm^{-3}$ hydrochloric acid solution to produce hydrogen gas at STP.

Calculate the:

7.1.1 Volume (in dm^3) of hydrogen gas produced at STP (4)

7.1.2 Minimum volume of hydrochloric acid needed (3)

7.1.3 Number of chloride ions present in the $ZnC\ell_2$ produced (3)

7.2 Consider the molecular formula of copper(II) sulphate:

$$CuSO_4.\underline{5H_2O}$$

7.2.1 Write down the name used for the underlined part in the above formula. (1)

7.2.2 Calculate the percentage of copper in copper(II) sulphate. (3)

7.3 A calcium compound consists of 29,4% calcium, 23,5% sulphur and 47,1% oxygen by mass. Use relevant calculations to determine the empirical formula of this compound. (5)
[19]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 10
CONTROL TEST - TERM 3

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
KONTROLTOETS - KWARTAAL 3

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

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

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\,\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{q}$

QUANTITATIVE ASPECTS OF CHEMICAL CHANGE / *KWANTITATIEWE ASPEKTE VAN CHEMIESE VERANDERING*

$n = \frac{m}{M}$	$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$

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