Education
KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES P2 (CHEMISTRY)

COMMON TEST

SEPTEMBER 2016

NATIONAL SENIOR CERTIFICATE

GRADE 10

TIME: 1 hour

MARKS: 50

This question paper consists of 5 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. You may use a non-programmable calculator.
3. You may use appropriate mathematical instruments.
4. Number the answers correctly according to the numbering system used in this question paper.
5. A periodic table is attached for your use.
6. Give brief motivations, discussions, et cetera where required.
7. Round off your final numerical answers to a minimum of TWO decimal places.

QUESTION 1: MULTIPLE CHOICE

Four possible options are provided as answers. Choose the correct option by writing only the letter next to the question number (1.1 – 1.3).

1.1 A substance that increases the electrical conductivity of water is called a/an

A solvent

B precipitate

C electrolyte

D non-polar liquid (2)

1.2 2 moles of oxygen gas react with hydrogen to form water. How many moles of hydrogen are required for the complete reaction?

A 2

B 4

C 6

D 8 (2)

1.3 Which one of the following represents one mole? The number of:

A atoms in 23 g of sodium

B protons in 1 g of hydrogen gas (H_2)

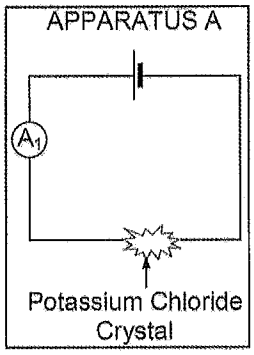
C molecules in 34 g ammonia gas (NH_3)

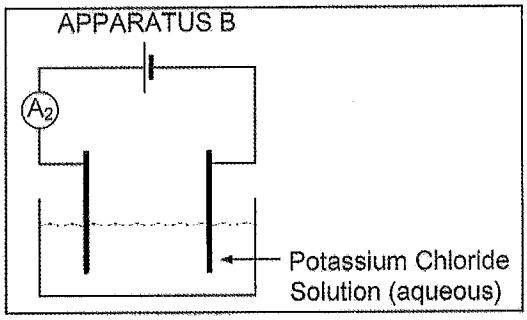
D atoms in 22 g of carbon dioxide (CO_2) (2)

[6]

QUESTION 2

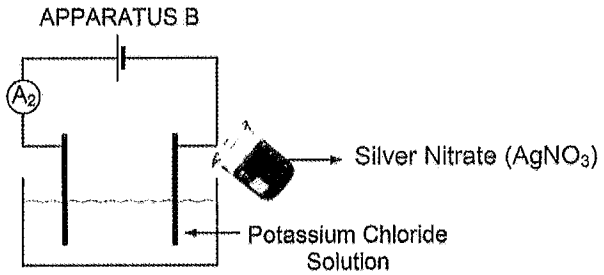
2.1 A learner wishes to test the electrical conductivity of potassium chloride (KCl). He sets up the apparatus as shown below.





2.1.1 Ammeter A_1 reads zero and ammeter A_2 has a reading greater than zero. Explain why A_1 reads zero and A_2 reads greater than zero. (2)

A solution of silver nitrate ($AgNO_3$) is added to apparatus B.



2.1.2 Describe what will be observed in the solution. (2)

2.1.3 How will the reading on ammeter A_2 be affected.
(Choose from INCREASE, DECREASE or REMAIN THE SAME).
Explain the answer. (3)

2.2 A learner is given a bottle of solution and suspects that it is a sulphate.

2.2.1 Describe a positive test to prove that the solution is a sulphate. (2)

2.2.2 How can the learner be sure that the precipitate formed is not a carbonate? (2)

2.3 Identify the type of reaction represented by the chemical equations given below.
Choose from ACID – BASE REACTION, PRECIPITATION REACTION or REDOX REACTION.

2.3.1 $Mg(OH)_2 + H_2SO_4 \longrightarrow MgSO_4 + 2\,H_2O$ (1)

2.3.2 $S + O_2 \longrightarrow SO_2$ (1)

[13]

QUESTION 3

3.1 You are given 25g of sodium sulphate (Na_2SO_4).

3.1.1 Calculate the number of moles of sodium sulphate that you have. (3)

3.1.2 Calculate the number sodium atoms present in 25g of sodium sulphate. (4)

3.2 Determine the mass of iron (Fe) present in 68g of iron oxide (Fe_2O_3). (4)

3.3 A substance contains 40% carbon, 6,67% hydrogen and 53,33% oxygen by mass.

3.3.1 Determine the empirical formula of the given substance. (4)

3.3.2 If the molecular mass of the substance is 60 $g.mol^{-1}$, determine its molecular (true) formula. (2)

[17]

QUESTION 4

4.1 32g of ammonium nitrate (NH_4NO_3) is added to sufficient water to make 250 cm^3 of solution.

4.1.1 Define concentration. (2)

4.1.2 Calculate the concentration of the solution. (4)

4.2 Solid potassium chlorate ($KClO_3$) is heated to produce potassium chloride and oxygen gas according to the chemical equation given below.

$$2\ KClO_3 \longrightarrow 2\ KCl + 3\ O_2$$

4.2.1 Calculate the mass of potassium chlorate that must be used to produce 160g of potassium chloride at STP. (4)

4.2.2 Calculate the volume of oxygen gas produced at STP if 200g of potassium chloride is produced. (4)

[14]

TOTAL MARKS: [50]

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

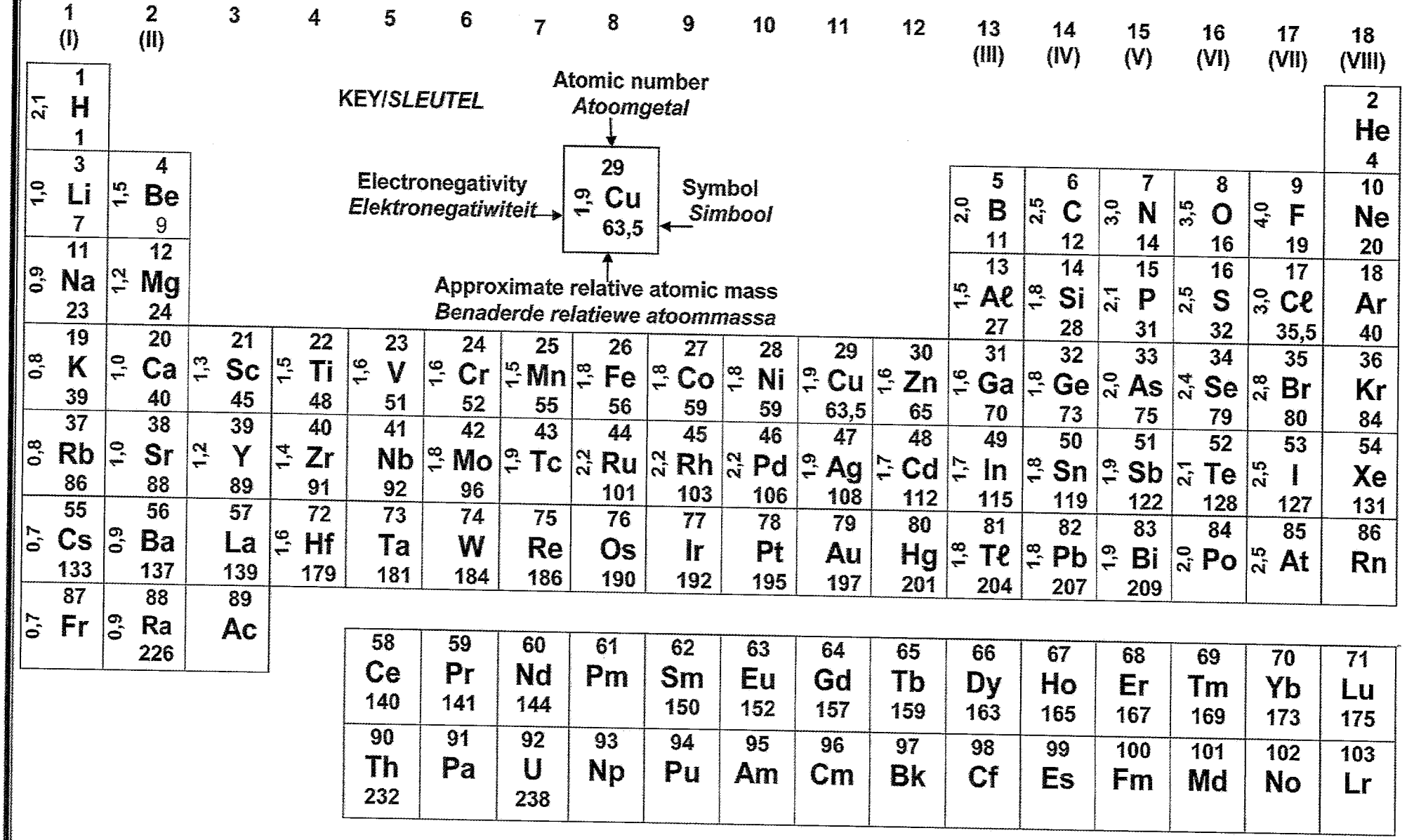
TABLE 1: PHYSICAL CONSTANTS

Standard pressure	p^{θ}	$1{,}013 \times 10^{5}$ Pa
Molar gas volume at STP	V_m	$22{,}4$ dm^3·mol^{-1}
Standard temperature	T^{θ}	273 K
Charge on electron	e	$-1{,}6 \times 10^{-19}$ C
Avagadro's constant	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE

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

TABLE 3: THE PERIODIC TABLE OF ELEMENTS



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PHYSICAL SCIENCES P2 (CHEMISTRY)
COMMON TEST
MEMORANDUM
SEPTEMBER 2016

NATIONAL SENIOR CERTIFICATE

GRADE 10

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This memorandum consists of 4 pages.

QUESTION 1

1.1 C ✓✓ (2)

1.2 B ✓✓ (2)

1.3 A ✓✓ (2)

[6]

QUESTION 2

2.1 2.1.1 In apparatus A there are no free ions to act as charge carriers ✓
In apparatus B there are free ions which act as charge carriers ✓ (2)

2.1.2 A white✓ precipitate forms.✓ (2)

2.1.3 Remain the same. ✓
The concentration of the anions and cations remain unchanged. ✓✓ (3)

2.2.1 - Add some barium chloride to the solution. ✓
- A white precipitate forms. ✓ (2)

2.2.2 - Add some hydrochloric acid to the precipitate. ✓
- No reaction occurs✓ (2)

2.3 2.3.1 Acid – base reaction ✓ (1)

2.3.2 Redox reaction ✓ (1)

[13]

QUESTION 3

3.1 3.1.1 $M(Na_2SO_4) = (2\times23) + (32) + (4\times16) = 142\,g\cdot mol^{-1}$

$n = \frac{m}{M}$ ✓

$= \frac{25}{142}$ ✓

$= 0,18\,mol$ ✓ (3)

3.1.2 1 mol has $6,02 \times 10^{23}$ molecules of Na_2SO_4 ✓
1 mol has $2 \times 6,02 \times 10^{23}$ atoms of Na ✓
0,18 mol has x atoms of Na

$x = 0,18\times2\times6,02\times10^{23}$ ✓

$= 2,17\times10^{23}$ atoms ✓ (4)

3.2 $M(Fe_2O_3) = (2\times56) + (3\times16) = 160\,g\cdot mol^{-1}$ ✓

$\%\,Fe\ in\ Fe_2O_3 = \frac{112}{160}\times100$

$= 70\,\%$ ✓

mass of Fe in 68g $Fe_2O_3 = 70\%\times68$ ✓

$= 47,60g$ ✓ (4)

3.3 3.3.1 Assume we have 100g of the sample

	%	mass	$n=\frac{m}{M}$	Ratio	
C	40	40	3,33	1	✓
H	6,67	6,67	6,67	2	✓
O	53,33	53,33	3,33	1	✓

The empirical formula is CH_2O ✓ (4)

3.3.2 $n = \frac{Molecular\ mass}{Empirical\ mass}$

$= \frac{60}{30}$

$= 2$ ✓

The molecular formula is $C_2H_4O_2$ ✓ (2)

[17]

QUESTION 4

4.1 4.1.1 Concentration is a measure of the amount solute/substance that is dissolved in a given volume of a solvent. ✓✓ (2)

4.1.2 $M(NH_4NO_3) = 14) + (4\times1) + (14) + (3\times16) = 80\,g\cdot mol^{-1}$

$250\,cm^3 = 0,25\,dm^3$

$n = \frac{m}{M}$

$= \frac{32}{80}$ ✓

$= 0,4\,mol$

$C = \frac{n}{V}$ ✓

$= \frac{0,4}{0,25}$ ✓

$= 1,60\,mol\cdot dm^{-3}$ ✓ (4)

4.2 4.2.1 $2\,KClO_3 \longrightarrow 2\,KCl + 3\,O_2$

2 mol $KClO_3$ produces 2 mol KCl ✓
1 mol $KClO_3$ produces 1 mol KCl
122,5g $KClO_3$ produces 74,5 KCl ✓
xg $KClO_3$ produces 160g KCl

$x = \frac{122,5\times160}{74,5}$ ✓

$= 263,09\,g$ ✓ (4)

4.2.2 2 mol KCl is produced together with 3 mol O_2
2 mol KCl is produced together with $3 \times 22,4\,dm^3\ O_2$ ✓
2 x 74,5g KCl is produced together with $67,2\,dm^3\ O_2$ ✓
200g KCl is produced together with $x\,dm^3\ O_2$

$x = \frac{67,2\times200}{149}$ ✓

$= 90,20\,dm^3$ ✓ (4)

[14]

Total Marks: 50