Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES: CHEMISTRY (P2)

COMMON TEST

JUNE 2017

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: 100

TIME: 2 hours

This question paper consists of 8 pages and a periodic table.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 10A) in the appropriate spaces on the ANSWER BOOK.
2. Answer ALL the questions in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your **FINAL** answers to a minimum of TWO decimal places.
9. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to each of the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question number (1.1 – 1.6) in the ANSWER BOOK, for example 1.8 C

1.1 The following are statements about compounds.

I A compound is a pure substance
II Elements chemically combine in any ratio to form a compound
III All compounds can be broken down into elements using physical methods

Which of the above statements are FALSE?

A I and II
( ) B II and III
C I and III
D I , II and III

(2)

1.2 Which of the following mixtures can be separated using a separating funnel?

A Two solids with different particle sizes
B Two liquids with different densities
C Two gases with different boiling points
D A solid suspended in a liquid

(2)

1.3 The process when chlorine atoms form from a chlorine molecule involves an energy change is shown according to the balanced equation below:

$$C\ell_2\ (g) \rightarrow 2\ C\ell\ (g)$$

( ) The name AND the type of the energy change involved during this process is:

	NAME OF ENERGY	ENERGY CHANGE
A	Electron Affinity	Energy is released
B	Ionisation	Energy is needed
C	Dissociation	Energy is needed
D	Dissociation	Energy is released

(2)

1.4 In which ONE of the following compounds do BOTH ions have the same electron structure as neon?

A Sodium oxide
B Magnesium chloride
C Lithium fluoride
D Calcium sulphide

(2)

1.5 When atom X of an element in group 2 ionises to become X^{2+}, the ...

A mass number of X^{2+} remains the same
B charge of the nucleus of X^{2+}increases
C number of neutrons of X^{2+} increases
D number of electrons of X^{2+} increases (2)

1.6 A compound that is soluble in water is ...

A Silver Carbonate
B Ammonium Carbonate
C Copper Carbonate
D Calcium Carbonate (2)

1.7 Which ONE of the following solutions can be used to test for the presence of sulphate ions?

A KNO_3
B NaOH
C $BaCl_2$
D $Mg(NO_3)_2$ (2)
[14]

QUESTION 2

2.1 When some oxygen gas is bubbled into a beaker of water a mixture is formed.

2.1.1 Is this a homogeneous or heterogeneous mixture? (1)

2.1.2 What are the pure substances making up this mixture?

(Choose from: TWO ELEMENTS; TWO COMPOUNDS or ONE ELEMENT and ONE COMPOUND?)

Explain. (3)

2.2 Below is a list of solids.

Iodine ; Diamond ; Magnesium oxide ; Sodium chloride ; dry ice

Choose from this list when identifying each of the following.

2.2.1 A network solid consisting of covalently bonded atoms. (1)

2.2.2 A diatomic molecular solid. (1)

2.2.3 An ionic solid that dissolves easily in water. (1)

2.2.4 A solid that sublimes easily at room temperature. (1)

2.2.5 The product of a combustion reaction. (1)
[9]

QUESTION 3

3.1 The electron configuration of three elements are given below:

A: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
B: $1s^2\ 2s^2\ 2p^6$
C: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$

3.1.1 Which element is a noble gas? (1)

3.1.2 Draw an aufbau diagram showing the electron structure of element A. (2)

3.1.3 Which element is in group 5, period 3? (1)

3.1.4 Which element is a metal? (1)

3.2 Write down the name of each of the following substances.

3.2.1 H_3P (2)

3.2.2 $Zn(C\ell O_3)_2$ (2)

3.2.3 $(NH_4)_2SO_3$ (2)
[11]

QUESTION 4

4.1 Naturally occurring oxygen consists of three isotopes indicated below:

ISOTOPE	PERCENTAGE ABUNDANCE (%)
O-16	99,76
O-17	0,04
O-18	X

4.1.1 What are isotopes? (2)

4.1.2 What is the percentage abundance of O-18? (1)

4.1.3 Calculate the relative atomic mass of oxygen. (4)

4.1.4 How many neutrons does the isotope O-17 have? (2)

4.2 Aluminium is a metal and a good conductor of electricity.

4.2.1 Name the type of bonding between the aluminium atoms that makes it a good conductor of electricity. (1)

4.2.2 State AND explain another two properties of aluminium that can be attributed to the type of bond identified. (4)

Aluminium reacts with nitrogen: $A\ell + N_2 \rightarrow A\ell N$

4.2.3 Name the product formed. (2)

4.2.4 Use Lewis diagrams to show how the product is formed. (4)

4.2.5 Name the type of chemical bond formed between the atoms of aluminium and nitrogen. (1)
[21]

QUESTION 5

5.1 The table below shows the boiling points and melting points of substances A, B and C.

SUBSTANCE	MELTING POINT	BOILING POINT
A	25	115
B	107	249
C	-47	59

5.1.1 Define boiling point. (2)

5.1.2 Describe the phase change of substance A at 115° C (1)

5.1.3 In what phase (Solid, Liquid or Gas) are the particles of B at room temperature? (1)

5.1.4 Identify the substance that will change from LIQUID to GAS when it is heated from 0°C to 100°C. (1)

5.1.5 Which substance will change from SOLID to LIQUID when it is heated from 0°C to 100°C? (1)

5.1.6 By referring to the strength of the intermolecular forces and the energy of the particles, explain the changes that take place when substance C is cooled from 80°C to – 10°C. (3)

5.2 In each of the following, classify the change as either PHYSICAL or CHEMICAL.

5.2.1 Iron metal is melted. Explain your answer. (2)

5.2.2 Grey hair is dyed to a red colour. (1)

5.2.3 A car rusts. (1)

5.3 Consider the balanced equation: $2\ Pb(NO_3)_2(s) \rightarrow 2\ PbO(s) + 4\ NO_2(g) + O_2(g)$

5.3.1 What type of reaction is shown above? (1)

5.3.2 Show that the Law of Conservation of Mass is TRUE for this reaction. (5)

5.3.3 When 6.62 g of lead nitrate [$Pb(NO_3)_2$] is heated, 4,46 g of solid is produced. What is the mass of gas that will be produced? (2)

5.4 Balance each of the following reactions:

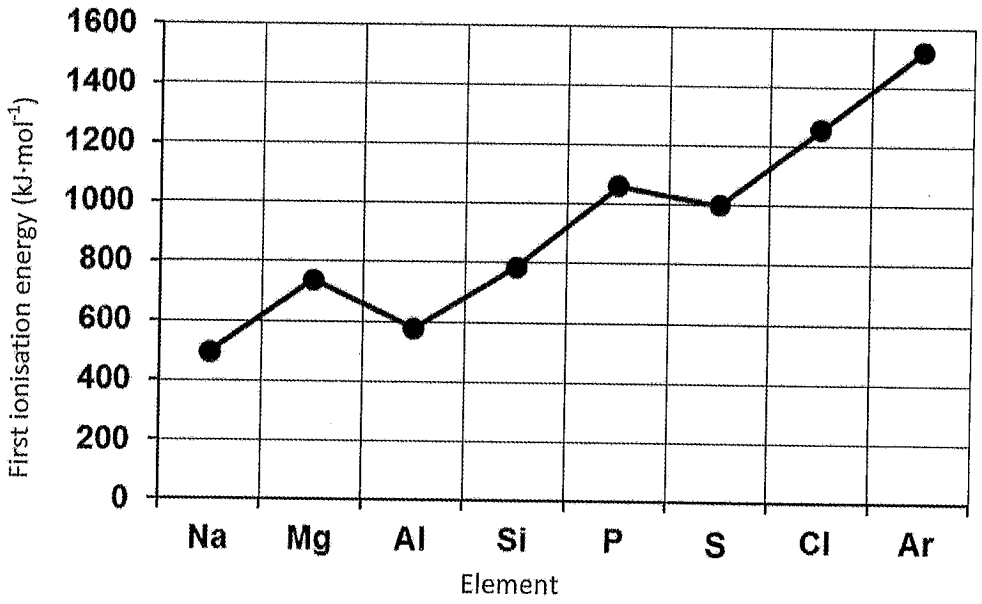
5.4.1 $H_3PO_4\,(aq) + Na_2CO_3(s) \rightarrow Na_3PO_4(aq) + CO_2(g) + H_2O\,(\ell)$ (2)

5.4.2 $NH_3(g) + O_2(g) \rightarrow NO\,(g) + H_2O\,(\ell)$ (2)

[25]

QUESTION 6

The graph shows the first ionisation energies of the elements of period 3 in the periodic table.



6.1 Define Ionisation Energy. (2)

6.2 Describe the general trend in the first ionisation energies from sodium to argon. (1)

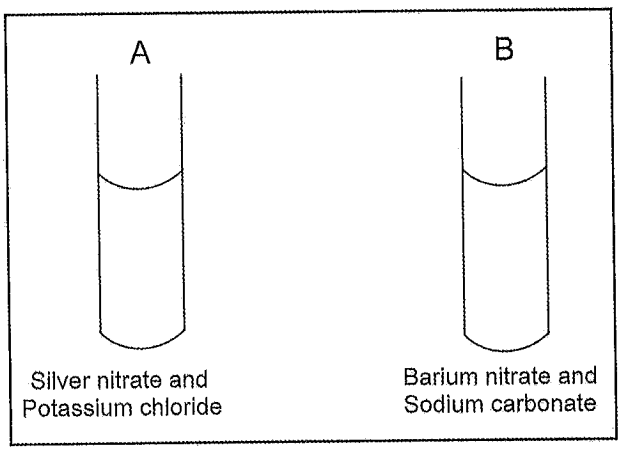
6.3 Explain the difference in the first ionisation energies of magnesium and chlorine. (3)

6.4 How will the SECOND ionisation energy for the sodium compare to its FIRST ionisation energy? (Choose from GREATER THAN; EQUAL TO or LESS THAN) Explain (4)
[10]

QUESTION 7

A learner mixes the following solutions:

Test tube A: silver nitrate solution with a potassium chloride solution.
Test tube B: barium nitrate solution with sodium carbonate solution.



7.1 What will be observed in each test tube? (1)

7.2 Write down a balanced chemical equation for the reaction that takes place in the test tube A.
Show ALL phases of the reactants and products. (4)

7.3 Name the type of reaction that takes place in test tube A. (1)

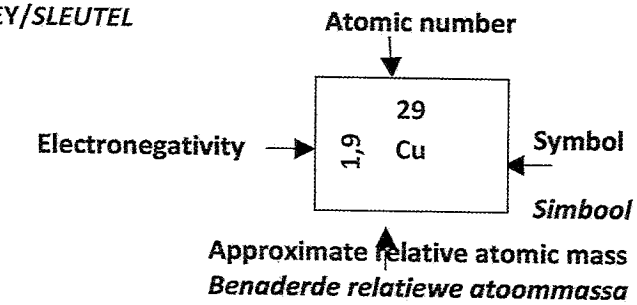
7.4 When concentrated nitric acid is added to test tube B, bubbles form. Write the chemical formula for these bubbles. (1)

7.5 State another observation made when the concentrated nitric acid is added to test tube B. (1)

7.6 Name the substance that reacted with the concentrated acid. (2)
[10]

TOTAL MARKS: 100

TABLE 3: THE PERIODIC TABLE OF ELEMENTS



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 2,1 H 1																	2 He 4
3 1,0 Li 7	4 1,5 Be 9											5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24											13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 0,9 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

GREENBURY Grades 10 & 11

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MARKING GUIDELINE

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: 100

TIME: 2 hours

This marking guideline consists of 6 pages.

QUESTION 1

1.1	B	✓✓	(2)
1.2	B	✓✓	(2)
1.3	C	✓✓	(2)
1.4	A	✓✓	(2)
1.5	A	✓✓	(2)
1.6	B	✓✓	(2)
1.7	C	✓✓	(2)

[14]

QUESTION 2

2.1.1 Homogenous ✓ (1)

2.1.2 One element and one compound. ✓
Oxygen is made up of the one type of atom. ✓
Water is a chemical combination of different atoms. ✓ (3)

2.2.1 Diamond ✓ (1)

2.2.2 iodine ✓ (1)

2.2.3 Sodium chloride ✓ (1)

2.2.4 dry ice ✓ (1)

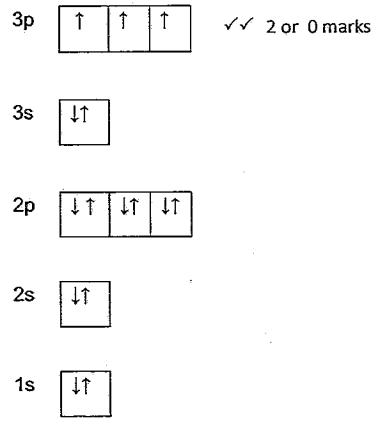
2.2.5 magnesium oxide ✓ (1)

[9]

QUESTION 3

3.1.1 B ✓ (1)

3.1.2



✓✓ 2 or 0 marks (2)

3.1.3 A ✓ (1)

3.1.4 C ✓ (1)

3.2.1 Hydrogen phosphide ✓✓ (2)

3.2.2 Zinc chlorate✓✓ (2)

3.2.3 Ammonium Sulphite ✓✓ (2)

[11]

QUESTION 4

4.1.1 Atoms of the same element having the same number of protons, but different numbers of neutrons. ✓✓ (2 or 0) (2)

4.1.2 % abundance of O-18 = 100 – (99,76 + 0,04) = 0,2 ✓ (1)

4.1.3 Relative atomic mass of $O = \frac{(99.76 \times 16)^{\checkmark} + (0,04 \times 17)^{\checkmark} + (0,2 \times 18)}{100}$ ✓

$= 16,0044$ ✓ (4)

4.1.4 9 ✓✓ (2)

4.2.1 metallic bonding ✓ (1)

4.2.2 Aluminium is ductile ✓ as aluminium has an ability to be stretched into a wire ✓

Aluminium is malleable ✓ as aluminium has an ability to be hammered into shape without breaking ✓ (4)

4.2.3 Aluminium nitride ✓✓ (2)

4.2.4  (4)

4.2.5 Ionic bond ✓ (1)

[21]

QUESTION 5

5.1.1 The temperature of a liquid at which its vapour pressure equals external (atmospheric) pressure. ✓✓ (2 or 0) (2)

5.1.2 liquid becomes a gas ✓ (1)

5.1.3 solid ✓ (1)

5.1.4 C ✓ (1)

5.1.5 A ✓ (1)

5.1.6 Kinetic energy of the particles decrease ✓ on cooling. The strength of the intermolecular forces increases ✓ and C becomes a liquid. ✓ (3)

5.2.1 Physical ✓ A phase change takes place ✓, the chemical composition of the metal remains the same. (2)

5.2.2 Physical ✓ (1)

5.2.3 Chemical ✓ (1)

5.3.1 Decomposition ✓ (1)

5.3.2 2 [207 + 2(14) + 3(16)] ✓ = 2 (207 + 16) ✓+ 4 [14 +(2 x 16)] ✓+ (2 x 16)✓

2 (207 + 124) = 446 + 184 + 32

662 = 662 ✓ (5)

5.3.3 6,62 g – 4,46 g ✓ = 2,16 g ✓ (2)

5.4.1 $2\ H_3PO_4\ (aq) + 3\ Na_2CO_3(s)$ ✓ → $2\ Na_3PO_4(aq) + 3\ CO_2(g) + 3\ H_2O\ (\ell)$ ✓ (2)

5.4.2 $4\ NH_3(g) + 5\ O_2(g)$✓→ $4\ NO\ (g) + 6\ H_2O\ (\ell)$ ✓ (2)

[25]

QUESTION 6

6.1 The energy needed per mole to remove the first electron from an atom in the gaseous phase. ✓✓(2 or 0) (2)

6.2 increases ✓ (1)

6.3 -Chlorine has a greater first ionisation energy than magnesium. C
-Chlorine and magnesium have the same number of energy levels but chlorine has more protons and electrons than magnesium.✓
-Therefore chlorine nucleus attracts the valence electrons more strongly ✓ than the magnesium nucleus.
-More energy is needed to overcome the strong attractive electrostatic force.✓ (3)

6.4 GREATER THAN ✓

- The sodium ion has a completely filled outer most energy level✓ and therefore does not want to lose anymore electrons. / This represents a state of greater stability.
-the second electron to be removed is closer to the nucleus and will experience a greater force of attraction with the nucleus ✓ , hence more energy will be needed to overcome/break that force ✓ (4)

[10]

QUESTION 7

7.1 White precipitate forms ✓ (1)

7.2 $Ag\ NO_3\ (aq)$ ✓+ $KI\ (aq)$ ✓ → $KNO_3\ (aq)$ ✓ + $AgI(s)$ ✓ (–1 if phases not indicated or incorrect) (4)

7.3 Precipitation reaction ✓ or ion exchange reaction ✓ (1)

7.4 $CO_2\ (g)$ ✓ (1)

7.5 The white precipitate disappears ✓ (1)

7.6 Barium carbonate ✓✓ (2)

[10]

TOTAL MARKS: 100