



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

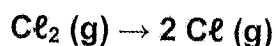
(2)

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:



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.

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 sublimates easily at room temperature.

(1)

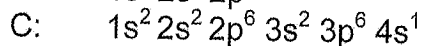
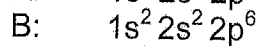
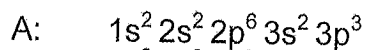
2.2.5 The product of a combustion reaction.

(1)

[9]

QUESTION 3

3.1 The electron configuration of three elements are given below:



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 $Zn(ClO_3)_2$ (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: $Al + N_2 \rightarrow AlN$

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.

(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: $2 \text{Pb}(\text{NO}_3)_2(\text{s}) \rightarrow 2 \text{PbO}(\text{s}) + 4 \text{NO}_2(\text{g}) + \text{O}_2(\text{g})$

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 [$\text{Pb}(\text{NO}_3)_2$] 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:

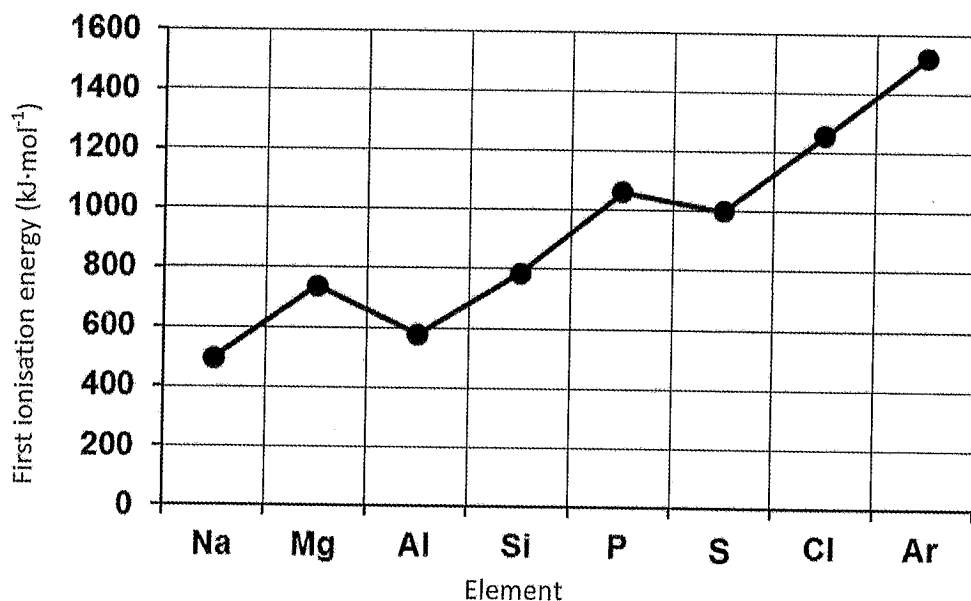
5.4.1 $\text{H}_3\text{PO}_4(\text{aq}) + \text{Na}_2\text{CO}_3(\text{s}) \rightarrow \text{Na}_3\text{PO}_4(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ (2)

5.4.2 $\text{NH}_3(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}(\text{g}) + \text{H}_2\text{O}(\text{l})$ (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)

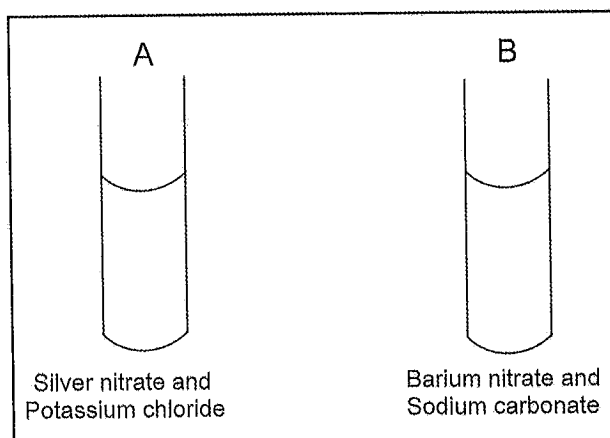
6.2 Describe the general trend in the first ionisation energies from sodium to argon. (1)

- 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	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
		(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)	(XVI)	(XVII)	(XVIII)			
2,1	1	H 1																	He 2			
1,0	3	Li 7	Be 9														B 11	C 12	N 14	O 16	F 19	Ne 20
0,9	11	Na 23	Mg 24														Al 27	Si 28	P 31	S 32	Cl 35,5	Ar 40
0,8	19	K 39	Ca 40	Sc 45	Ti 48	V 51	Cr 52	Mn 55	Fe 56	Co 59	Ni 59	Cu 63,5	Zn 65	Ga 70	Ge 73	As 75	Se 79	Br 80	Kr 84			
0,8	37	Rb 86	Sr 88	Y 89	Zr 91	Nb 92	Mo 96	Tc 101	Ru 101	Rh 103	Pd 106	Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127	Xe 131			
0,7	55	Cs 133	Ba 137	La 139	Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	Hg 201	Tl 204	Pb 207	Bi 209	Po 209	At 209	Rn 222			
0,7	87	Fr 226	Ra 226	Ac 227																		

KEY/SLEUTEL	Atomic number	Symbol	Simbool
Electronegativity	29	Cu	
Approximate relative atomic mass	63,5		
Benderde relatiewe atoommassa			

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

C

C



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MARKING GUIDELINE

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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 ✓

3.1.2

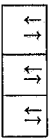


✓✓ 2 or 0 marks

3s



2p



2s



1s



3.1.3 A ✓

3.1.4 C ✓

3.2.1 Hydrogen phosphide ✓✓

3.2.2 Zinc chloride ✓✓

3.2.3 Ammonium Sulphite ✓✓

QUESTION 4

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

4.1.2 % abundance of O-18 = $100 - (99,76 + 0,04) = 0,2$ ✓4.1.3 Relative atomic mass of O = $\frac{(99,76 \times 16) + (0,04 \times 17) + (0,2 \times 18)}{100}$ ✓

= 16,0044 ✓

4.1.4 9 ✓✓

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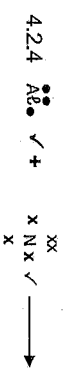
(1)

4.2.1 metallic bonding ✓

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 ✓

4.2.3 Aluminium nitride ✓✓



4.2.5 Ionic bond ✓

QUESTION 5

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

5.1.2 liquid becomes a gas ✓

5.1.3 solid ✓

5.1.4 C ✓

5.1.5 A ✓

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

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

5.2.2 Physical ✓

5.2.3 Chemical ✓

5.3.1 Decomposition ✓

(1)

(1)

(4)

(2)

(4)

(1)

[21]

(2)

(1)

(1)

(1)

(1)

(3)

(2)

(1)

(1)

(1)

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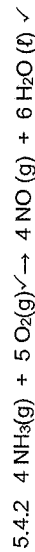
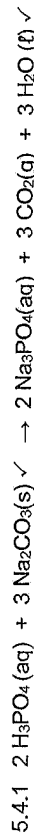
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$$5.3.2 \quad 2 [207 + 2(14) + 3(16)] \checkmark = 2 (207 + 16) \checkmark + 4 [14 + (2 \times 16)] \checkmark + (2 \times 16) \checkmark$$

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

$$662 = 662 \checkmark$$

$$5.3.3 \quad 6,62 \text{ g} - 4,46 \text{ g} \checkmark = 2,16 \text{ g} \checkmark$$

**QUESTION 6**

- 6.1 The energy needed per mole to remove the first electron from an atom in the gaseous phase. $\checkmark \checkmark$ (2 or 0) (2)
- 6.2 increases \checkmark (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. \checkmark
 -Therefore chlorine nucleus attracts the valence electrons more strongly \checkmark than the magnesium nucleus.
 -More energy is needed to overcome the strong attractive electrostatic force. \checkmark (3)

6.4 **GREATER THAN** \checkmark

- \ominus
 - The sodium ion has a completely filled outer most energy level \checkmark 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 \checkmark , hence more energy will be needed to overcome/break that force \checkmark

(4)
[10]**QUESTION 7**

- 7.1 White precipitate forms \checkmark (1)
- 7.2 $\text{AgNO}_3(\text{aq}) \checkmark + \text{KI}(\text{aq}) \checkmark \rightarrow \text{KNO}_3(\text{aq}) \checkmark + \text{AgI}(\text{s}) \checkmark$ (-1 if phases not indicated or incorrect) (4)
- 7.3 Precipitation reaction \checkmark or ion exchange reaction \checkmark (1)
- 7.4 $\text{CO}_2(\text{g}) \checkmark$ (1)
- 7.5 The white precipitate disappears \checkmark (1)
- 7.6 Barium carbonate $\checkmark \checkmark$ (2)

[10]

TOTAL MARKS: 100

