

# Education

KwaZulu-Natal Department of Education  
REPUBLIC OF SOUTH AFRICA

**PHYSICAL SCIENCES: PHYSICS (P2)**

**COMMON TEST**

**MARCH 2017**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 10**

**MARKS:** 50

**TIME:** 1 hour

This question paper consists of 7 pages and 1 data sheet.

**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 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 – 1.3 ) in the ANSWER BOOK, for example 1.4 C

1.1 Which one of the following sets of elements is classified as ALKALI-EARTH METALS?

- A Li, Na, K
- B F, Cl, Br
- C Be, Mg, Ca
- D He, Ne, Ar

(2)

1.2 An example of a substance that allows heat to be transferred easily and has magnetic properties is ...

- A stainless steel
- B ceramic
- C copper
- D glass

(2)

1.3 Which combination is CORRECT concerning the compounds of iron?

	CHEMICAL NAME	CHEMICAL FORMULA	ATOMS
A	Iron (II) hydroxide	FeOH <sub>2</sub>	1 iron atom, 1 oxygen atom and 2 hydrogen atoms
B	Iron(III) oxide	Fe <sub>2</sub> O <sub>3</sub>	2 iron atoms and 3 oxygen atoms
C	Iron (II) oxide	Fe <sub>2</sub> O <sub>3</sub>	2 iron atoms and 3 oxygen atoms
D	Iron (II)hydroxide	Fe(OH) <sub>2</sub>	1 iron atom, 1 oxygen atom and 2 hydrogen atoms

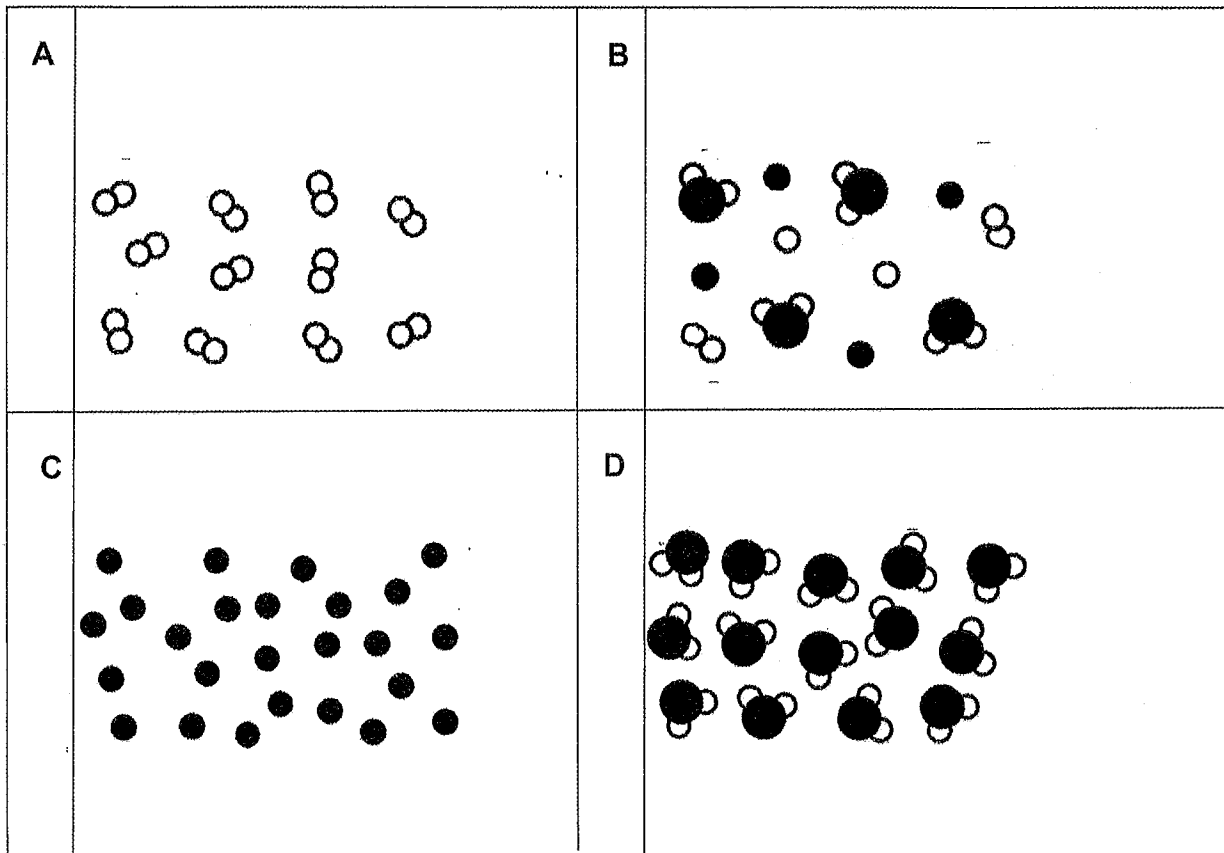
(2)

**[6]**

**QUESTION 2**

Study the diagrams below of different substances and answer the questions set:

Each circle represents an atom and when atoms touch each other they are bonded together.



2.1 Define an element. (2)

2.2 Identify the substance(s) that:

2.2.1 Can be classified as an element. (2)

2.2.2 Could be helium gas? (1)

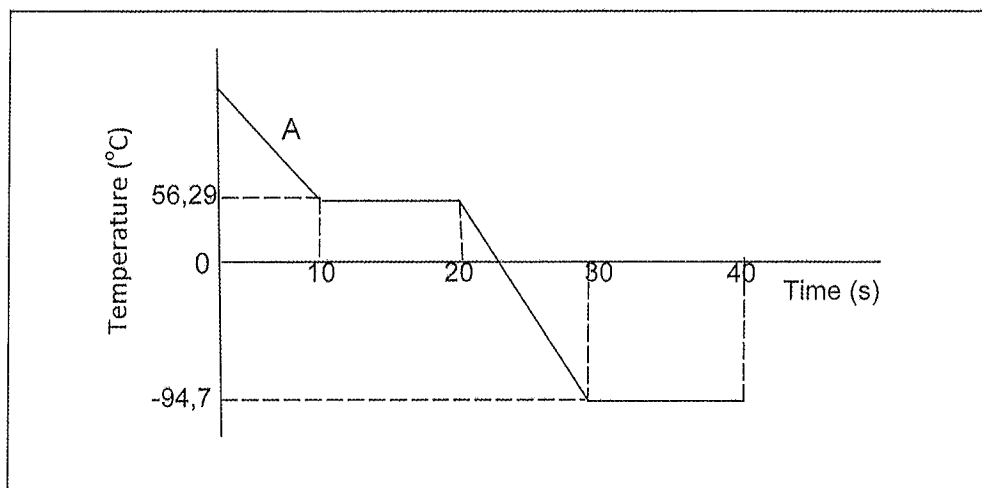
2.2.3 Could be a sample of air? Give a reason. (2)

**[7]**

**QUESTION 3**

Study the temperature versus time graph for acetone and answer the questions that follow.

The boiling point of acetone is  $56,29\text{ }^{\circ}\text{C}$  and its melting point is  $-94,7\text{ }^{\circ}\text{C}$ .



- 3.1 Is the above graph a heating curve or a cooling curve of acetone?  
Give a reason. (2)
- 3.2 In what phase (Gas; liquid or solid) are the particles at:
- 3.2.1 A? (1)
- 3.2.2 room temperature ( $25^{\circ}\text{C}$ )? (1)
- 3.3 Describe the phase change that takes place during the following time intervals:
- 3.3.1 10 s – 20 s (1)
- 3.3.2 30 s – 40 s (1)
- 3.4 How is the kinetic energy of the acetone molecules affected from 30 s to 40 s?  
Choose from INCREASE; DECREASE; or REMAIN THE SAME.  
Give a reason. (2)
- 3.5 Define melting point. (2)

**[10]**

**QUESTION 4**

The table below shows the atomic structure of several substances.  
Answer the questions that follow:

SUBSTANCE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
A	15	16	18
B	18	22	18
C	20	20	20
D	20	22	20

- 4.1 What is the atomic number of substance A? (1)
- 4.2 Write out the chemical formula for the ion in the table. (1)
- 4.3 Determine, by means of a calculation, two substances with the same mass number. (2)
- 4.4 Identify the isotopes in the table. (1)
- 4.5 Substance A reacts with substance D.
- 4.5.1 Write down the chemical formula for the product formed. (2)
- 4.5.2 What is the chemical name of this compound? (1)
- 4.6 Identify the substance that is a gas at room temperature. (1)
- [9]**

**QUESTION 5**

- 5.1 State Pauli's Exclusion principle. (2)
- 5.2 Write down the electronic configuration for the sodium ion. (1)
- 5.3 How many core electrons does the sodium ion have? (1)
- 5.4 Is the radius of the sodium ion GREATER THAN; LESS THAN or EQUAL TO the radius of the sodium atom?  
Explain fully. (3)

5.5 Lithium and sodium are in group 1 in the Periodic Table.

ELEMENT	FIRST IONISATION ENERGY ( KJ.mol )
Lithium	520
Sodium	494

5.5.1 Define ionisation energy. (2)

5.5.2 Which element, sodium or lithium is more reactive. Explain. (3)  
[12]

### QUESTION 6

Consider the compounds: **water (H<sub>2</sub>O)** and **sodium chloride (NaCl)**

6.1 Name of the type of bonding that takes place in:

6.1.1 NaCl (1)

6.1.2 H<sub>2</sub>O (1)

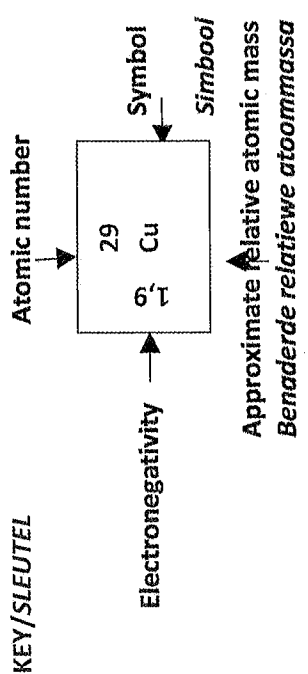
6.2 Draw the Lewis Dot structure for water. (2)

6.3 Sodium chloride does not conduct electricity in the solid state but when sodium chloride is dissolved in water it conducts electricity. Explain this observation. (2)  
[6]

**TOTAL MARKS: 50**

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)
1 H 1,0	2 He 4																
3 Li 7	4 Be 9																
11 Na 23	12 Mg 24																
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 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 Tl 204	82 Pb 207	83 Bi 209	84 Po 210	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac 227															



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





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PHYSICAL SCIENCES (P2)  
(CHEMISTRY)  
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MEMORANDUM

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This memorandum consists of 3 pages.

### MEMORANDUM

#### QUESTION 1

- 1.1 C ✓✓ (2)
- 1.2 A ✓✓ (2)
- 1.3 B ✓✓ (2)

[6]

#### QUESTION 2

- 2.1 A pure substance consisting of one type of atom. ✓✓ (2 or 0) (2)
- 2.2.1 A ✓ and C ✓ (2)
- 2.2.2 C ✓ (1)
- 2.2.3 B ✓ Substance made up of different particles ✓ (2)

#### QUESTION 3

- 3.1 A cooling curve. ✓ The temperature of the particles decreases over time. ✓ (2)
- 3.2.1 gas ✓ (1)
- 3.2.2 liquid ✓ (1)
- 3.3.1 gas to liquid ✓ (1)
- 3.3.2 liquid to solid ✓ (1)



3.4 REMAIN THE SAME ✓

The temperature remains constant ✓ (2)

3.5 The temperature at which a solid, when given sufficient heat, becomes a liquid. ✓✓ (2 or 0) (2)

[10]

#### QUESTION 4

- 4.1 15 ✓ (1)
- 4.2 A<sup>3</sup> ✓ or P<sup>3</sup> ✓ (1)
- 4.3 B and C ✓ (2)


B: A = 18 + 22 = 40 C: A = 20 + 20 = 40 ✓

4.4 C and D ✓ (1)

- 4.5.1  $D_3 A_2$  ✓✓ OR  $Ca_3P_2$  ✓✓ (2)  
 4.5.2 Calcium phosphide ✓ (1)  
 4.6 B ✓ OR argon ✓ OR Ar ✓ (1)  
 [9]


**QUESTION 5**

- 5.1 Maximum of two electrons per orbital provided they spin in opposite directions. ✓✓ (2)  
 5.2  $1s^2 2s^2 2p^6$  ✓ (1)  
 5.3 2 core electrons ✓ (1)  
 5.4 Less than ✓ (1)

 sodium atom has three energy levels whereas the sodium ion has lost its valence electron and it has two energy levels. ✓ The volume of the atom is greater than its ion ✓, therefore the atom has a greater atomic radius. (3)

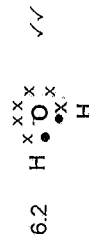
- 5.5.1 Energy needed per mole to remove an electron(s) from an atom in the gaseous phase. ✓✓ OR energy needed to remove one mole of electrons from one mole of gaseous atoms ✓✓ (2 or 0) (2)

5.5.2 Sodium ✓

 The sodium atom has a lower first ionisation energy than the lithium atom. Lesser energy is needed to overcome the weak force of attraction by its nucleus on the valence electron. ✓ (3)  
 [12]

**QUESTION 6**

- 6.1.1 Ionic bond ✓ (1)  
 6.1.2 Covalent bond ✓ (1)



- 6.3 The ions are tightly held by a strong electrostatic force/ionic bond ✓ in the solid state but are free moving (charge carriers) in the aqueous state ✓ (2)  
 [6]

**TOTAL: 50 MARKS**