KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

COMMON TEST

MARCH 2022

MARKS: 75

TIME: 1½ hour

This question paper consists of 11 pages.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions. Answer ALL the questions in the ANSWER BOOK.

2. Number the answers correctly according to the numbering system used in this question paper.

3. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.

4. You may use a non-programmable calculator.

5. You may use appropriate mathematical instruments.

6. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.

7. Show ALL formulae and substitutions in ALL calculations.

8. Round off your FINAL numerical answers to a minimum of TWO decimal places.

9. Give brief motivations, discussions, et cetera where required.

10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE

Four options are provided as possible answers to the following questions.
Each question has only ONE correct answer. Write down only the letter (A-D)
next to the question number (1.1 - 1.5) in the answer book, for example 1.6 D.

1.1 Which ONE of the following regarding thermal conductivity and electrical
conductivity in most metals is TRUE?

	THERMAL CONDUCTIVITY	ELECTRICAL CONDUCTIVITY
A	Good	Bad
B	Good	Good
C	Bad	Good
D	Bad	Bad

(2)

1.2 Temperature is defined as a measure of the … of the particles of a substance.

A average kinetic energy
B kinetic energy
C potential energy
D internal energy (2)

1.3 How many valence electrons does helium have?

A 0
B 1
C 2
D 3 (2)

1.4 Which ONE of the following substances does NOT have a simple
molecular structure?

A sulphur
B carbon dioxide
C potassium bromide
D water (2)

1.5 A neutral object becomes positively charged when…

A protons are removed from it
B electrons are removed from it
C protons are added to it
D electrons are added to it (2)
[10]

QUESTION 2

Given the following information, answer the questions that follow.

| A.	Plastic
B.	Sulphur
C.	Boron
D.	Mercury
E.	Aluminium
F.	Magnesium nitrate
G.	Air

2.1   Explain why substance A cannot be used to make a needle of a compass.   (1)

2.2   Which substance:

    2.2.1   Can be hammered into thin sheets   (1)

    2.2.2   Is a liquid at room temperature and is also a good conductor of electricity   (1)

    2.2.3   Is a metalloid   (1)

2.3   Write down the chemical formula for F.   (2)

2.4   Is air a good thermal insulator? Choose from YES or NO.   (1)

2.5   Identify the substance that is brittle.   (1)

[8]

QUESTION 3

Grade 10 learners conducted an experiment to determine the heating curve of water at standard pressure by using crushed ice. The experiment was set up as shown below.
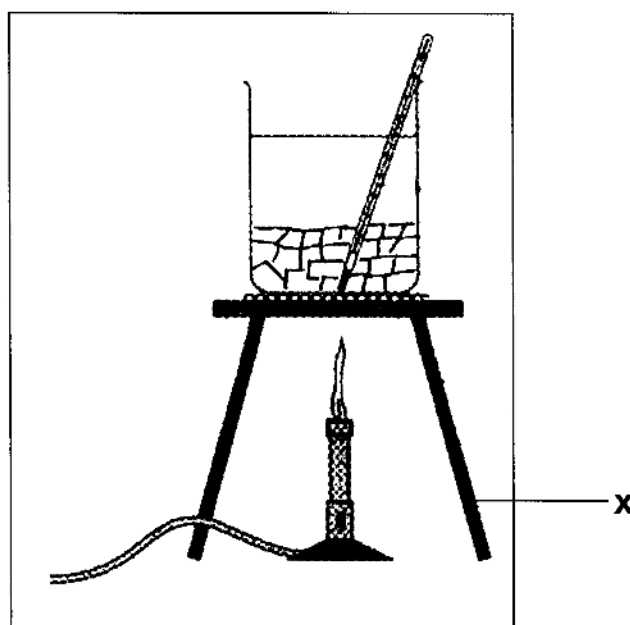
3.1 Define the term *boiling point*. (2)

3.2 Name the apparatus labelled **X**. (1)

3.3 How does placing a wire gauze on top of apparatus **X** assist with the heating process? (1)

3.4 The graph below shows the results obtained.
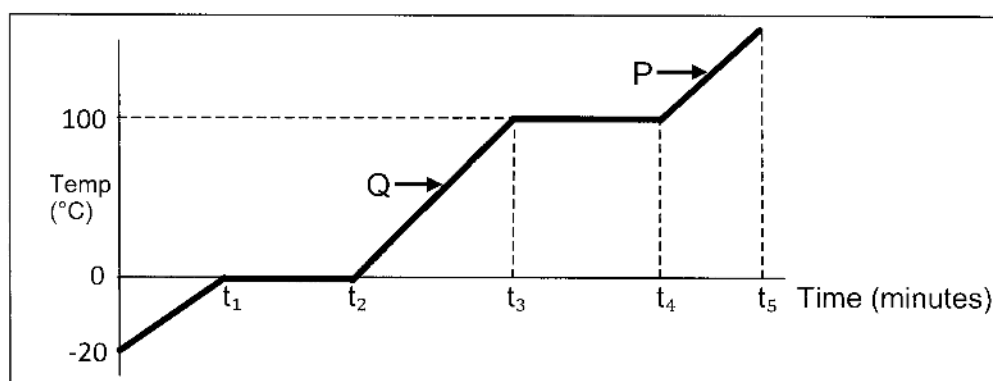
3.4.1 Can diffusion occur between t_0 and t_1?
Choose from YES or NO. Explain the answer. (2)

3.4.2 Will the potential energy between t_1 and t_2 INCREASE, DECREASE or REMAIN THE SAME? (1)

3.4.3 Give a reason why the forces of attraction between the particles at point P are LESS THAN the forces of attraction between particles at point Q. (1)

3.4.4 Name the process taking place between times t_3 and t_4. (1)

3.4.5 Another experiment was conducted under similar conditions where the amount of ice used was now DOUBLED. How will this affect the readings on temperature axis of the graph?
Choose from: INCREASES, DECREASES or REMAINS THE SAME (1)

[10]

QUESTION 4

4.1 Define the term *relative atomic mass*. (2)

4.2 In nature, neon has the following common isotopes only.

| Isotopes	Abundance (%)
^{20}Ne	90,00
^{21}Ne	0,27
^{22}Ne	x

4.2.1 Write down the value of x (1)

4.2.2 Calculate the relative atomic mass of neon. (3)

4.3 Complete the table below for $A\ell$ and Ca^{2+}. Write down ONLY the question number (4.3.1 and 4.3.2) and next to it the answer in the answer book.

	Number of Protons	Number of Electrons	Number of Neutrons
$^{27}A\ell$	13	13	(4.3.1) _____
$^{40}Ca^{2+}$	20	(4.3.2) _____	20

(2)

4.4 Write down the electron configuration notation (sp notation) for the phosphide ion. (2)

4.5 What is the name given to the group 17 (group VII) elements? (1)

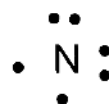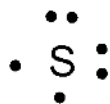4.6 The graph below shows the first ionization energies of elements from Period 3 of the Periodic Table.
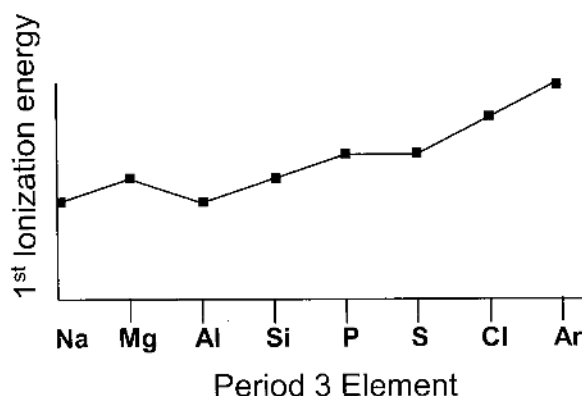
Explain why the first ionization energies generally increases from Na to Ar. (3)

[14]

QUESTION 5

5.1 Define the term *covalent bond*. (1)

5.2 Refer to the Lewis dot diagrams of the 3 elements below.

      5.2.1 Draw the Lewis dot diagram for the oxygen molecule. (2)

      5.2.2 Draw the Lewis dot diagram for ammonia. (2)

      5.2.3 What is the valency of sulphur? (1)

5.3 During the formation of sodium chloride a crystal lattice is formed.

      5.3.1 Draw a sketch to show the arrangement of ions in the lattice. (1)

      5.3.2 Identify the cation. (1)

   5.3.3 Draw the Lewis dot structure for the NaCℓ formula unit. (2)

[10]

                                Please turn over

QUESTION 6

A small neutral metal sphere, A, is rubbed with a woollen cloth until it acquires a charge of -3,2 µC. The sphere is then placed on an insulated stand.

-3,2 µC

A

6.1   Name the process by which sphere A became charged.   (1)

6.2   Why must the metal sphere be placed on an insulated stand?   (2)

6.3   Determine the number of excess electrons on sphere A.   (3)

6.4   The charge that sphere A acquired is in keeping with the *principle of quantization of charge*. Explain this statement.   (2)

Sphere A is now placed CLOSE to an identical but UNCHARGED sphere B. Both are still on insulated stands.

-3,2 µC   UNCHARGED

A   B
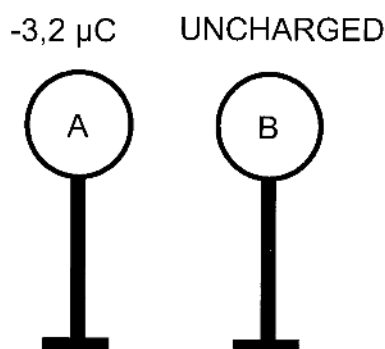
6.5   What is meant by *sphere B is uncharged*?   (2)

The two spheres are now allowed to TOUCH each other and they are then separated.

6.6   In which direction did charges move on touching?
       Choose from: A to B or B to A. Give a reason for the answer.   (2)

6.7   Calculate the new charge on each sphere after touching.   (3)

6.8   State the definition of the principle on which your answer to QUESTION 6.7 is based.   (2)
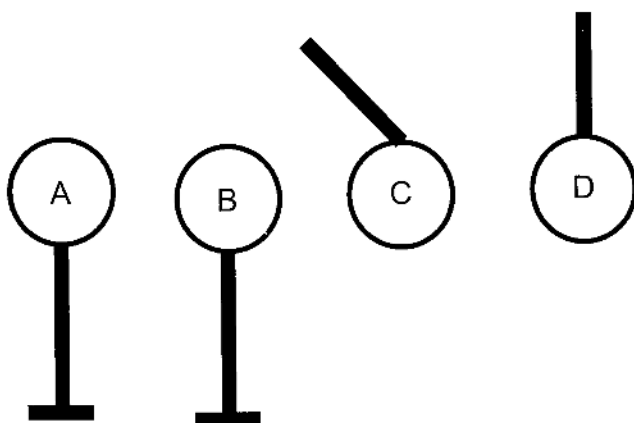
A learner now hangs a polystyrene ball, C, by a thin piece of string near sphere B as shown below. Ball C experiences a FORCE to the RIGHT as shown below.
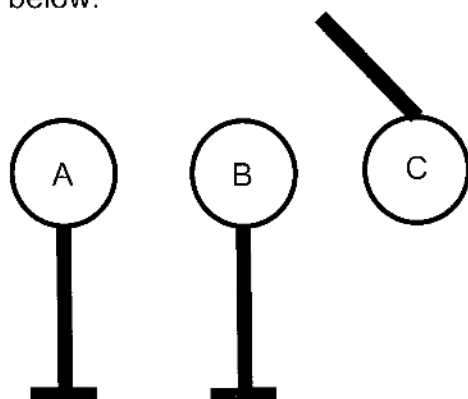
6.9   Is ball C POSITIVELY or NEGATIVELY charged?   (1)

6.10 Define the term polarization.   (2)

Another polystyrene ball, D, hanging by a thin piece of string, is placed NEAR ball C as shown. Ball D is UNCHARGED.

6.11 What happens to ball D?
      (Choose from: MOVES TOWARDS C; MOVES AWAY FROM C or REMAINS
      STATIONARY)   (1)

6.12 Draw a sketch to show the arrangement of the charges on sphere D.   (2)

                                                                                    [23]

DATA FOR PHYSICAL SCIENCES GRADE 10
(PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
(FISIKA)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Electron charge	q_e	$-1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/TABEL 2: FORMULES

ELECTROSTATICS

$n = \dfrac{Q}{Q_e}$	$Q = \dfrac{Q_1 + Q_2}{2}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

KEY/SLEUTEL

Atomic number
Atoomgetal

Symbol
Simbool

$$\begin{array}{c} 29 \\ \mathbf{Cu} \\ 1,9 \qquad 63,5 \end{array}$$

Electronegativity
Elektronegatiwiteit

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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

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**