

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES
COMMON TEST
JUNE 2021

NATIONAL
SENIOR CERTIFICATE

GRADE 11

TIME: 1 hour

MARKS: 50

This question paper consists of 7 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK.**
2. This question paper consists of FOUR questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subsections, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached DATA SHEET.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, et cetera where required.

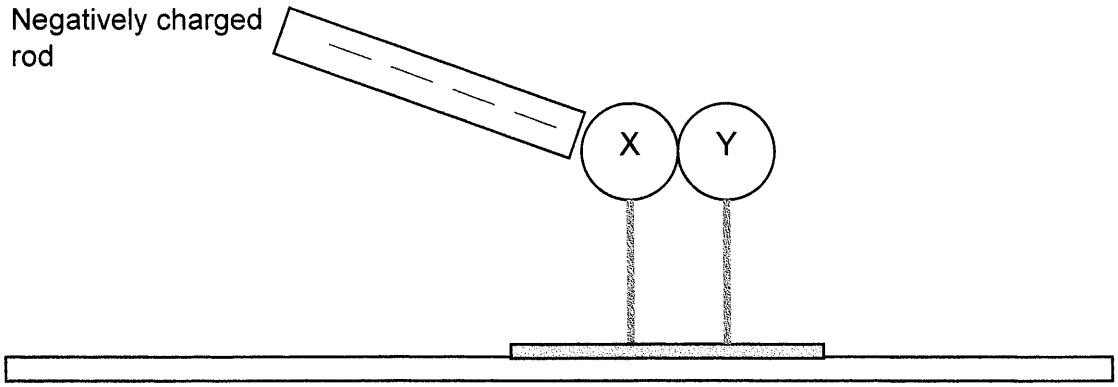
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QUESTION 1 : MULTIPLE CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 — 1.4) in the ANSWER BOOK, for example 1.5 E.

1.1 Two neutral metal spheres X and Y, on an insulating stand, are brought into contact with each other. A negatively charged rod is held near X without touching it.



The spheres are separated and the rod is removed. The charges on the spheres X and Y after separation will be…

A Positive and negative respectively
B Both neutral
C Both positive
D Negative and positive respectively (2)

1.2 Two identical small metal spheres on insulated stands carry equal charges and are a distance d apart. Each sphere experiences an electrostatic force of magnitude F. The spheres are now placed a distance 3 d apart.
The magnitude of the electrostatic force each sphere now experiences is ...

A 3 F
B $^1/_3$ F
C 9 F
D $^1/_9$ F (2)

1.3 Which ONE of the following substances has dipole-dipole forces between the molecules?

A H_2
B CO_2
C H_2O
D CH_4 (2)

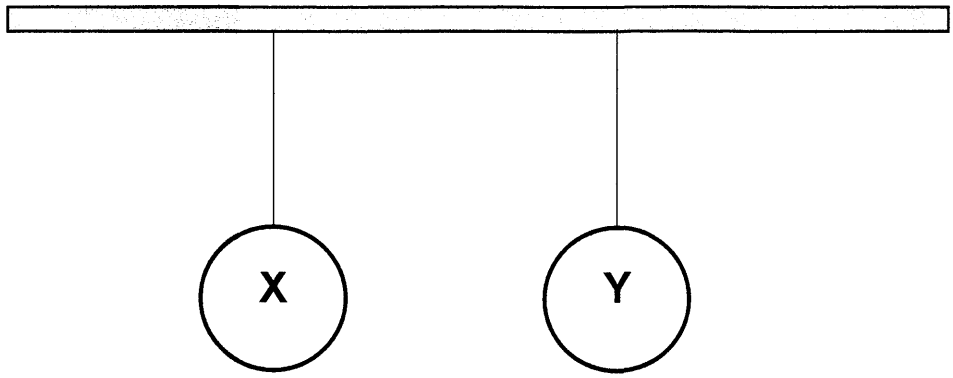
1.4 The number of atoms in 2g of H_2 is:

A $3,01 \times 10^{23}$
B $6,02 \times 10^{23}$
C 2
D $12,04 \times 10^{23}$ (2)

[8]

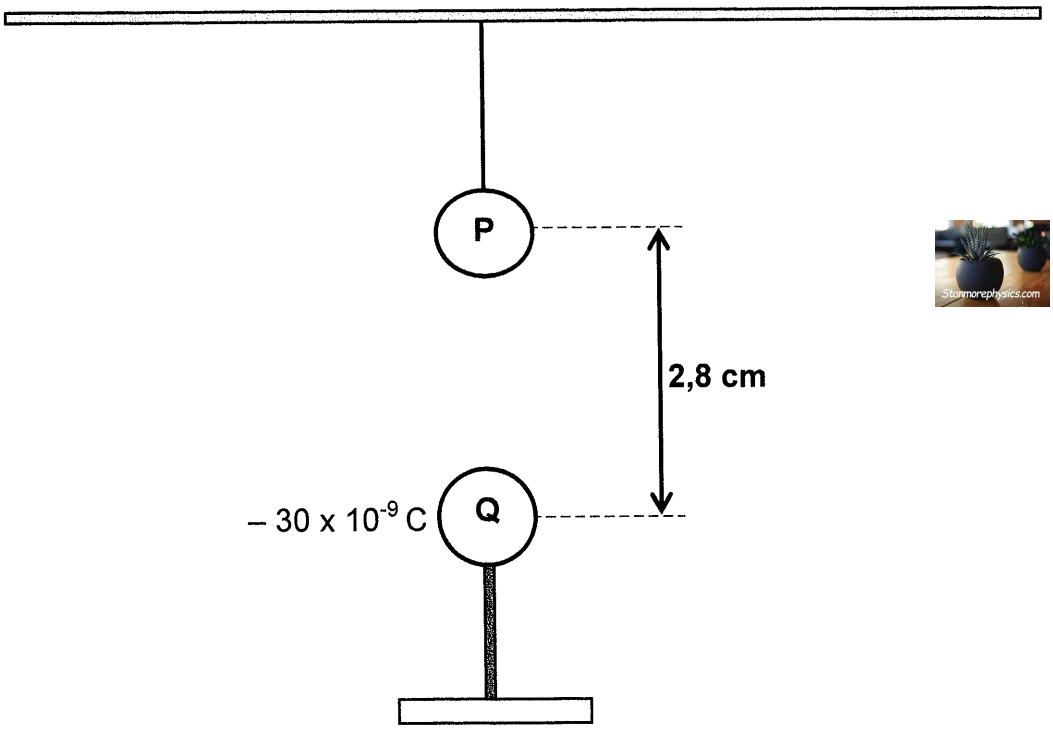
QUESTION TWO

2.1 Two identical spheres, X and Y, are suspended by insulated threads from a ceiling, as shown in the diagram below.



Sphere **X** has an excess of 25 electrons and the charge on Y is unknown.
The spheres are brought into contact with each other and then separated.
The charge on each sphere after separation is 8×10^{-18} C.
Calculate the charge on sphere Y before it made contact with sphere X. (3)

2.2 A small sphere, P, with a charge of + 15 x 10^{-9} C, is suspended from a light string attached to the ceiling. Sphere, Q, with a charge of – 30 x 10^{-9} C is fixed on an insulated stand directly below P. The distance between the centres of the two spheres is 2,8 cm. The tension in the string holding sphere P is 0,05 N.



2.2.1 State Coulombs law in words. (2)

2.2.2 Calculate the magnitude of the electrostatic force the spheres exert on each other. (3)

2.2.3 Calculate the weight of sphere P. (4)

2.3

2.3.1 Define *electric field at a point*. (2)

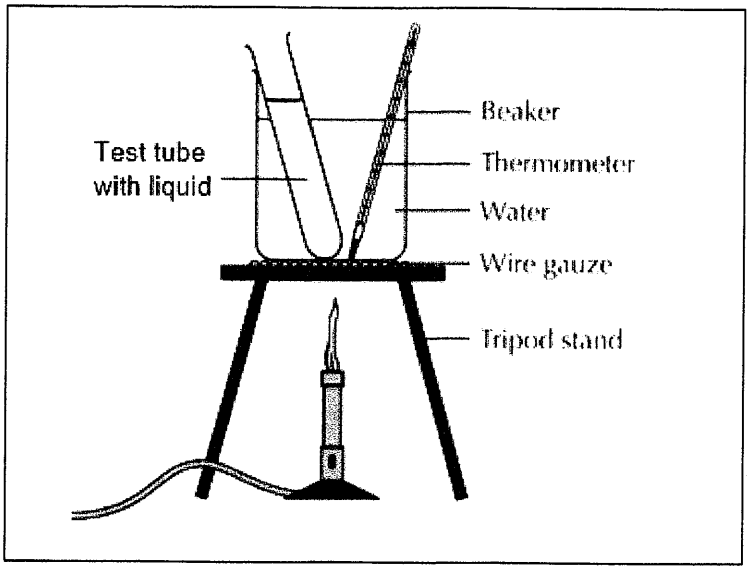
2.3.2 The electric field at a distance of 0,032 m from a charged object is 3.61x10^{5} N·C^{-1}. What is the magnitude of the electric field at a distance of 0,195 m from the same object? (4)

[18]

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QUESTION 3 (Start on a new page)

A group of learners decided to carry out an investigation to study the effect of intermolecular forces on the boiling point of the liquids listed in the table below.
The following apparatus was used.



LIQUID	BOILING POINT (°C)
Acetone	56
Ethanol	78,37
Water	100

3.1 Define *boiling point*. (2)

3.2 Identify the independent variable in this investigation. (1)

3.3 Why must ethanol be heated in a water bath? (1)

3.4 Explain the difference in the boiling points of acetone and water by referring to the TYPES of intermolecular forces in these compounds. (4)

3.5 Write a conclusion for this investigation. (1)

3.6 Will the vapour pressure of ethanol to be HIGHER THAN or LOWER THAN acetone? Give a reason for the answer. (2)
[11]

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QUESTION 4 (Start on a new page)



4.1 A compound has the following percentage composition:

58,065% C 7,527% H 34,408 % O

Determine the molecular formula of this compound if its molar mass is 372 $g \cdot mol^{-1}$ (5)

4.2 1,2g of magnesium (Mg), is reacted with 250 cm^3 of a hydrochloric acid ($HC\ell$) solution of concentration 0,5 $mol \cdot dm^{-3}$ according to the following balanced equation:

$$Mg(s) + 2HCl(aq) \longrightarrow MgC\ell_2(aq) + H_2(g)$$

4.2.1 Define *limiting reagent* (2)

4,2,2 Determine the limiting reagent by means of a calculation (3)

4.2.3 Calculate the volume of H_2(g produced if the molar gas volume is 23,2 $dm^3 \cdot mol^{-1}$ (3)

[13]

TOTAL MARKS: 50

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DATA FOR PHYSICAL SCIENCES GRADE 11

PHYSICS

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9,8 $m \cdot s^{-2}$
Coulomb's constant	k	9,0 x 10 $N \cdot m \cdot C$
Charge on electron	e	$-1,6 \times 10^{-19}$ C
Electron mass	m_e	$9,11 \times 10^{-31}$ kg

TABLE 2 : FORMULAE

ELECTROSTATICS

$F=\frac{kQ_1Q_2}{r^2}$ $(k = 9,0 \times 10^9 N \cdot m^2 \cdot C^{-2})$	$E=\frac{F}{q}$
$E=\frac{kQ}{r^2}$ $(k = 9,0 \times 10^9 N \cdot m^2 \cdot C^{-2})$	$V=\frac{W}{Q}$

TABLE 3: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Avogadro's constant	N_A	$6,02 \times 10^{23}$ mol^{-1}
Molar gas constant	R	8,31 $J \cdot K^{-1} \cdot mol^{-1}$
Standard pressure	p^θ	$1,013 \times 10^5$ Pa
Standard temperature	T^θ	273 K

TABLE 4: FORMULAE

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

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

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	**Pr**	**Nd**	**Pm**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
140	141	144		150	152	157	159	163	165	167	169	173	175

KEY/*SLEUTEL*

Atomic number *Atoomgetal*

Symbol *Simbool*

29 **Cu** 1,9 63,5

Electronegativity *Elektronegatiwiteit*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

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