basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

PHYSICAL SCIENCES

GRADE 11 CONTROLLED TEST

TERM 4 2021

MARKS: 100

TIME: 2 hours

DATE: NOV 2021

This question paper consists of 9 pages and 3 data sheets.

INSTRUCTIONS AND INFORMATION

1. This Question paper consists of 7 questions. Answer ALL the questions.
2. Start each question on a new page in your answer book or on folio paper.
3. Number your answers correctly according to the numbering system used in this question paper.
4. Leave a line open between sub-questions.
5. You may use a non-programmable calculator.
6. Show all formulae and substitutions.
7. You are advised to use the data sheets attached at the back of this question paper.
8. Round off all answers to a minimum of TWO decimal places where necessary.
9. Give brief motivations and discussions where required.
10. Write neatly and legibly.

QUESTION 1

MULTIPLE CHOICE: Four possible answers are provided. Choose the answer which is the most correct. Write only the question number and the letter of your choice.
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 1.1.1 D

1.1 The magnitude of an electrostatic force is _____ to the magnitude of the product of the charges. (2)

A directly proportional

B inversely proportional

C same

D uniform

1.2. Two charges + 4pC and -6 pC are placed at a distance of 6m apart. The force between two point charges is_____. (2)

A repulsion

B attraction

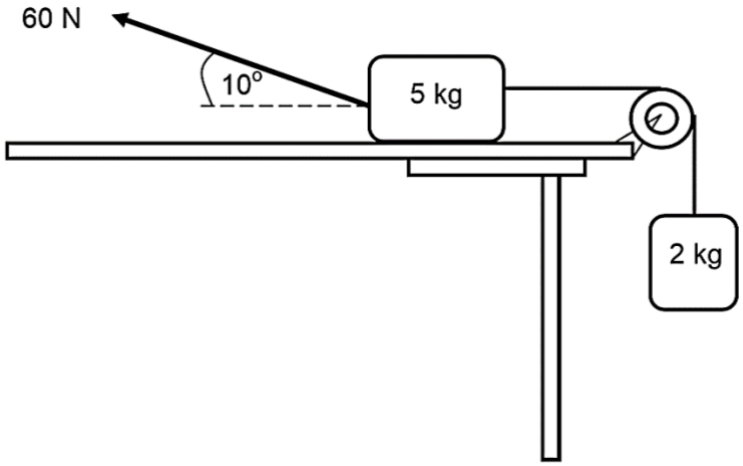
C charges

D positive

QUESTION 2 (Start on a new page)

A 5 kg block is resting on a rough table as shown in the diagram below. The 5 kg block is connected to a suspended 2 kg block by a light inextensible string over a frictionless pulley. The coefficient of kinetic friction between the table and the 5 kg block is 0,5.

A 60 N force is applied at an angle of 10^{o} to the horizontal which causes the block to accelerate to the LEFT.



2.1 Define Newton's second law of motion. (2)

2.2 Draw a free body diagram of all the forces acting on the 5kg block. (5)

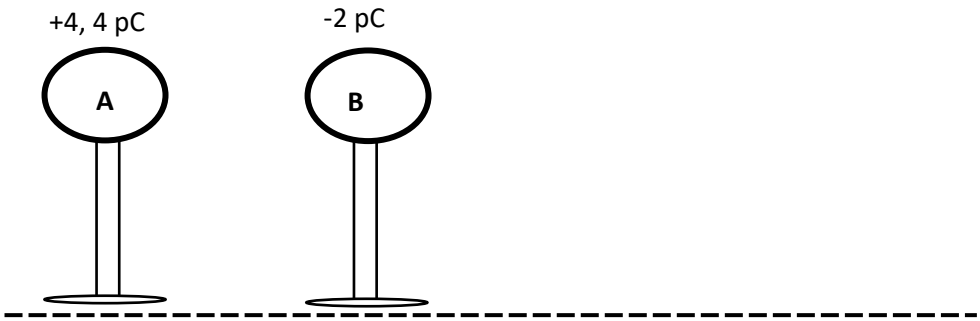
2.3 Calculate the normal force acting on the 5 kg block. (3)

2.4 Calculate the acceleration of the system. (6)

[16]

QUESTION 3

Two identical metal spheres **A** and **B** are placed on insulated stands. Spheres **A** and **B** carry charges of +4, 4 pC and -2 pC respectively.



3.1 Which sphere has more electrons? A or B (1)

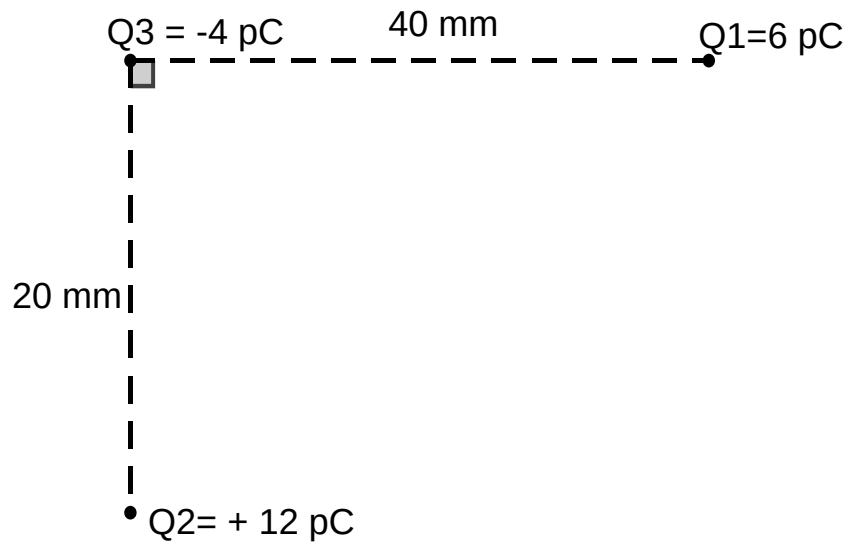
3.2 The spheres are allowed to come together and separated.

3.2.1 Will the spheres attract or repel each other after separation? Motivate your answer. (3)

3.2.2 Calculate the charge on each sphere after they have separated. (3)

3.2.3 Calculate the number of electrons at charge B. (3)

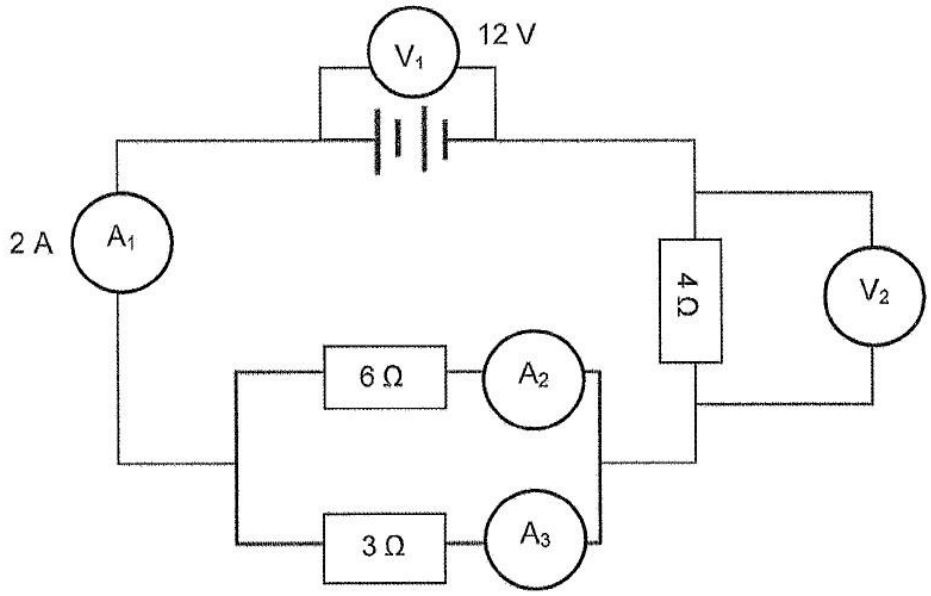
3.3 Three point charges, Q ,$Q_{1\,2}$ andQ_3, carrying charges of 6 pC, - 4pC and +12 pC respectively, are arranged in space as shown in the diagram below. The distance between Q_3 and Q_1 is 40 mm and that between Q_3 and Q_2 is 20 mm.



3.3.1 State Coulomb's Law in words. (2)
3.3.2 Calculate the net force acting on charge Q3 due to the presence of Q1 and Q2. (7)
3.3.3 Define electric field at a point in words. (2)
3.3.4 Draw the net electric field pattern due to charges Q2 and Q3. (3)
3.3.5 Calculate the magnitude and direction of electric filed between Q3 and Q1. (3)
[27]

QUESTION 4

In the circuit diagram below the reading on voltmeter V_1 is 12 V and the reading on ammeter A_1 is 2 A.



Calculate the:
4.1 Reading on V_2 (3)
4.2 Reading on A_2 (4)
4.3 Amount of charge that flows through ammeter A_1 in 120 s (3)

[10]

CHEMISTRY SECTION B

QUESTION 1
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 – 1.2) in the ANSWER BOOK, for example 1.1.1 D

1.1 The type of intermolecular forces present between methane (CH_4) (2)

A London forces

B Ion Dipole forces

C Dipole-dipole forces

D Hydrogen Bond

1.2 Butene has the empirical formula CH_2. The molecular mass of butene is 56g.mol^{-1}. The molecular formula of butane is_____ (2)

A $C4\ H_8$

B CH_4

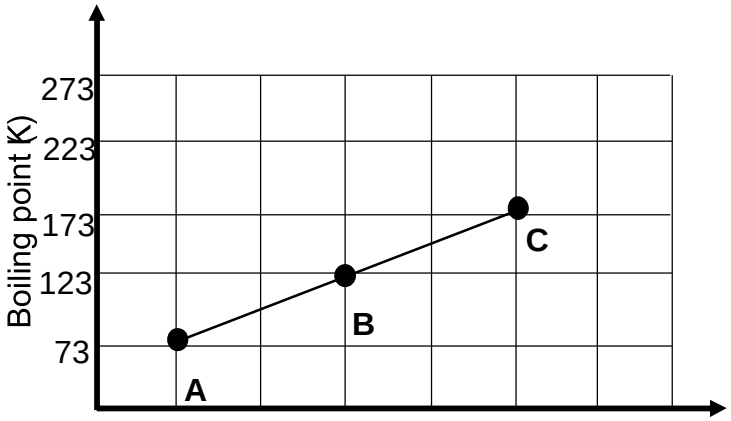
C $C3\ H_6$

D CH_2

QUESTION 2

2.1 The graph of molecular size versus the boiling point is given below.

The **letters A**, **B** and **C** represent the compounds CH_4 , C_4H_6 and C_3H_8 respectively.



2.1.1 Define the term *boiling point*. (2)

2.1.2. Describe the trend in the boiling points of the compounds as shown by the graph. (2)

2.1.3. Explain the answer to QUESTION 2.1.2 by referring to MOLECULAR SIZE, TYPE and STRENGTH of INTERMOLECULAR FORCES. (3)

2.1.4 Which ONE of the compounds (**A, B** or **C**) has the HIGHEST vapour pressure? Explain the answer by referring to the data on the graph. (2)

2.2 Consider the two molecules in the table below.

NAME OFSUBSTANCE	**FORMULA**	**MOLACULAR MASS (g)**	**BOILING POINT (ºC)**
Ammonia	NH_3	17	- 33
Phosphine	PH_3	x	– 87,4

2.2.1 Determine the molecular mass (x) of phosphine (1)

2.2.2 Explain the difference in the boiling points by referring to the TYPE and STRENGTH of INTERMOLECULAR FORCES. (3)

[13]

QUESTION 3

3. 1.Learners made a mini volcano in science laboratory by adding sodium bicarbonate to ethanoic acid. They added 100 ml of a 0, 2 mol.dm^{-3} ethanoic acid solution to 10 g of $NaHCO_3$ to start the reaction of the volcano.

The balanced equation for this reaction is:

$$CH_3COOH_{(aq)} + NaHCO_3(s) \rightarrow CH_3COONa_{(aq)} + H_2O_{(l)} + CO_2(g)$$

3.1.1 Define the term limiting reagent. (2)
3.1.2 Determine the limiting reagent in this reaction. (6)
3.1.3 Calculate the mass of the other substance in excess. (3)

3.1.4 Calculate the volume of CO_2 produced at STP. (4)

3.2 .A solution of potassium hydroxide (KOH) is prepared by dissolving 3,36 g crystals of KOH in 250 cm^3 of water.

Calculate the concentration of the potassium hydroxide solution. (4)

3.3 .25 cm^3 of a potassium hydroxide solution of concentration 0,25 mol.dm-3 completely neutralises a dilute solution of sulphuric acid (H_2SO_4) in a flask.

The unbalanced equation below represents the reaction that takes place:

$$H_2SO_4(aq) + KOH(aq) \longrightarrow K_2SO_4(aq) + H_2O(\ell)$$

3.3.1 Balance the above equation. (2)

3.3.2 Calculate the mass of sulphuric acid in the flask. (5)

[25]

TOTAL: 100 DATA FOR PHYSICAL SCIENCES GRADE 11

DATA FOR PHYSICAL SCIENCES
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	$6,38 \times 10^6\ m$
Coulomb's constant *Coulomb se konstante*	K	$9,0 \times 10^9\ N{\cdot}m^2{\cdot}C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^8\ m{\cdot}s^{-1}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$
Mass of the earth *Massa van die Aarde*	M	$5,98 \times 10^{24}\ kg$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION/*BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^{\,2} = v_i^{\,2} + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

FORCE / *KRAG*

$F_{net} = ma$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$\mu_s = \frac{f_{s(max)}}{N}$
$\mu_k = \frac{f_k}{N}$	

NSC

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

KEY/*SLEUTEL*

Electronegativity / *Elektronegatiwiteit*	Atomic number / *Atoomgetal*	Symbol / *Simbool*	Approximate relative atomic mass / *Benaderde relatiewe atoommassa*
1,9	29	Cu	63,5

(Each cell: atomic number, symbol, approximate relative atomic mass; electronegativity in brackets.)

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	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**															

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**