NATIONAL
SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: CONTROLLED TEST 2

23 SEPTEMBER 2015

NAME OF SCHOOL: ____

MARKS: 100
DURATION: 2 HOURS

This question paper consists of 11 pages, including the cover page and the data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name, grade and date on the Answer Sheet.
2. Answer all the questions.
3. This question paper consists of TEN questions.
4. Start EACH question on a NEW page in the Answer Sheet
5. Non-programmable calculators can be used.
6. Appropriate mathematical instruments may be used.
7. Number the answers correctly according to the numbering system used in this question paper.
8. You are advised to use the Data Sheet provided.
9. Show ALL formulae and substitutions in all calculations.
10. Round off your final answers to ONE decimal place.
11. 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 – 1.6) in the ANSWER BOOK.

1.1 Which ONE of the following physical quantities is a vector?

A. Time
B. Velocity
C. Speed
D. Distance (2)

1.2 A characteristic property of motion at constant acceleration is that the …

A. Change in position per unit time is constant.
B. Change in velocity per unit time is constant.
C. Velocity remains constant for the duration of the motion.
D. Change in position remains constant for the duration of the motion. (2)

1.3 In the equation $\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$, the part $\frac{1}{2}a\Delta t^2$ represents the …

A. Displacement
B. Velocity
C. Time
D. Acceleration (2)

1.4 Which ONE of the following represents one mole of gas at STP?

A.	22,4 dm^3 Ar	C.	32 dm^3 H_2
B.	28 dm^3 N_2	D.	44,8 dm^3 He

(2)

1.5 The number of atoms in ONE formula-unit of copper(II)sulphate ($CuSO_4$) is …

A. 4.

B. 6.

C. 16

D. 12

(2)

1.6 Study the equation below:

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

Which ONE of the statements below is CORRECT?

A. 2 molecules of hydrogen gas react with 1 atom of oxygen gas to form 2 atoms of water vapour.

B. 4 atoms of hydrogen gas react with 2 molecules of oxygen gas to form 2 moles of water vapour.

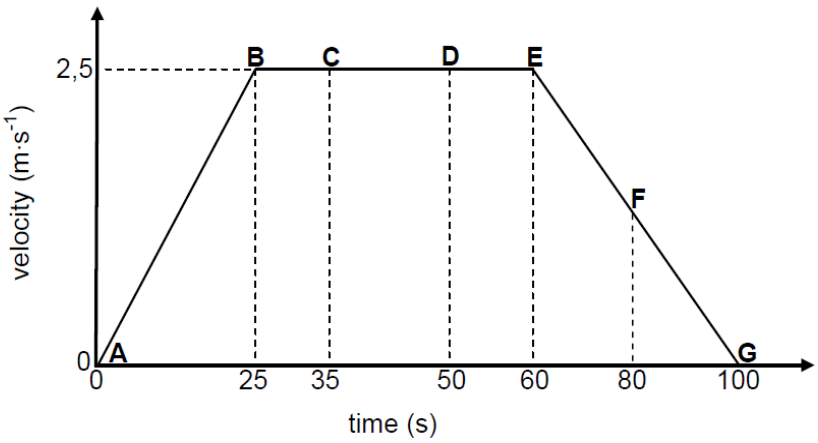
C. 2 moles of hydrogen gas react with 1 mole of oxygen gas to form 2 moles of water vapour.

D. 4 g of hydrogen gas react with 16 g of oxygen gas to form 18 g of water vapour. (2)

[12]

QUESTION 2 (Start on a new page.)

A man runs from point A in a straight line along a track ABCDEFG. The velocity-time graph below represents the motion of the man.



2.1. Using the information on the graph, describe the motion of the man from:

2.1.1. **A to B** (3)

2.1.2. **B to D** (2)

2.2. **WITHOUT USING EQUATIONS OF MOTION**, calculate the:

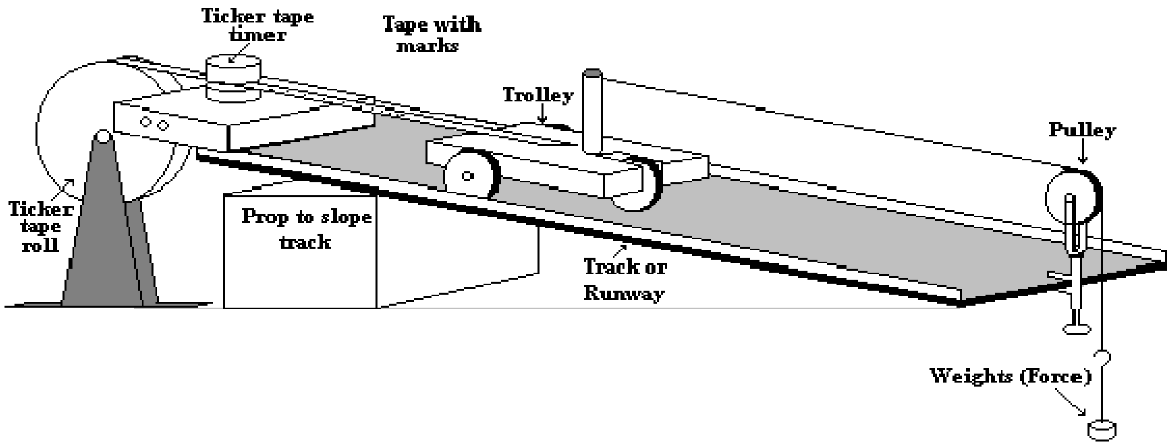
2.2.1. Acceleration of the man between E and G (4)

2.2.2. Distance covered by the man in 100 s (4)

[13]

QUESTION 3 (Start on a new page.)

To investigate the motion of a trolley travelling at uniform acceleration, a runway is set up as shown in the sketch below. The slope of the runway is adjusted before readings are taken.



3.1. Give a reason why the slope of the runway has to be adjusted. (2)

The ticker tape is analysed and the displacement (change in position) is measured after each 0,2 s. The table below shows the data obtained.

Time (s)	Position (m)
0,0	0
0,2	0,20
0,4	0,60
0,6	1,20
0,8	2,00
1,0	3,00

3.2. For this investigation, write down the:

3.2.1. Independent variable (2)

3.2.2. Dependent variable (2)

3.3. Draw a graph of position versus time on the attached GRAPH PAPER.

Indicate the following on your graph:

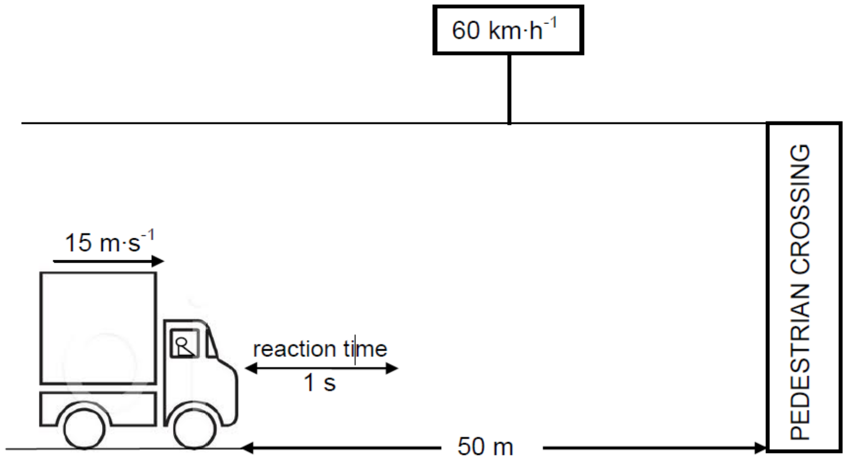
- A suitable heading
- Correct labels on both axes
- An appropriate scale on both axes
- The six plotted points (5)

3.4. What type of motion (UNIFORM MOTION or UNIFORM ACCELERATED MOTION) is represented by the graph drawn in QUESTION 3.3? Give a reason for the answer. (2)

[13]

QUESTION 4 (Start on a new page.)

A delivery van is travelling at a constant speed of 15 $m \cdot s^{-1}$ in a 60 $km \cdot h^{-1}$ speed zone when the driver sees people walking across a pedestrian crossing 50 m ahead of him.
The driver takes exactly one second (1 s) to react before he applies brakes as hard as he can. It takes a further 3 seconds for the van to come to a stop.



4.1. Complete the following sentence:

The equations of motion are only valid for motion at constant (4.1.1) ……….. in a (4.1.2) ………… line (2)

4.2. Did the driver of the delivery van exceed the speed limit? Show ALL calculations. (3)

4.3. Calculate the distance that the delivery van travels during the 1 second reaction time. (3)

4.4. Will the van stop before the pedestrian crossing? Show ALL calculations. (6)

4.5. Will the stopping distance of the van INCREASE or DECREASE when the road is wet and slippery?

By referring to velocity and time, briefly explain how you arrived at the answer. (3)

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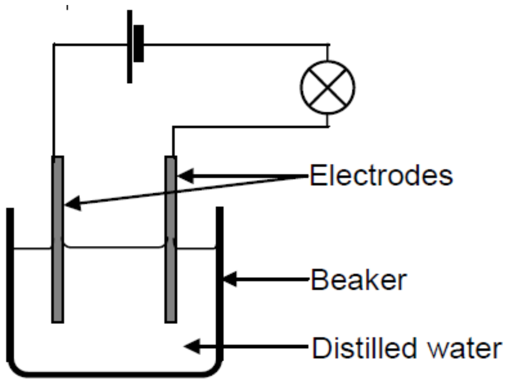
QUESTION 5 (Start on a new page.)

The arrangement below is used in a class to investigate the conductivity of a solution. The beaker is initially filled with 250 mℓ distilled water. It is observed that the bulb does not glow.



5.1. Give a reason why the bulb does NOT glow. (2)

A 15 g sample of ammonium nitrate is now dissolved in the distilled water. It is observed that the bulb glows brightly.

5.2. Write down the general name given to an aqueous solution that conducts electricity. (2)

5.3. Write down the formulae of the ions present in this solution. (2)

5.4. Calculate the concentration of the ammonium nitrate solution. (5)

[11]

QUESTION 6 (Start on a new page.)

6.1. Learners are given two bottles labelled **A** and **B**. It is known that one bottle contains a $MgSO_4$ solution and the other one contains a $BaC\ell_2$ solution.

They pour a sample from bottle **A** into a test tube and perform two tests to identify its contents. They record their findings in the table below.

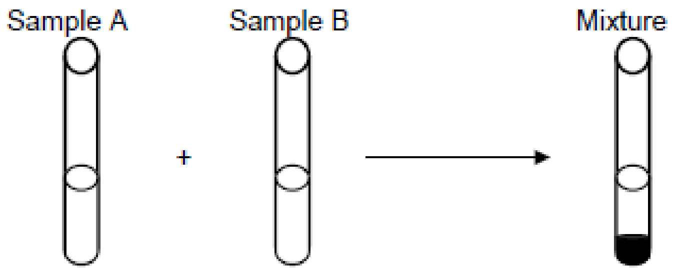
TEST	**OBSERVATION**
Add a small amount of $Ba(NO_3)_2(aq)$ to a sample from bottle **A** in a test tube.	A white precipitate forms.
Add a few drops of dilute nitric acid (HNO_3) to the contents of the test tube.	The white precipitate does not dissolve.

6.1.1 Write down the NAME and FORMULA of the white precipitate that forms in the test tube. **(2)**

6.1.2 Give a reason why it is necessary to add nitric acid to the contents of the test tube after the white precipitate forms. **(2)**

6.1.3 Which bottle (**A** or **B**) contains the $BaC\ell_2$ solution? **(2)**

6.2 The learners now pour a sample from each of bottles **A** and **B** into two separate test tubes and then mix the contents of the two tests tubes. They observe a white precipitate.



6.2.1 Write down a balanced equation for the reaction that takes place in the test tube after mixing the two samples. Show ALL phases of reactants and products. **(4)**

6.2.2 Name the type of reaction that takes place. **(2)**

[12]

QUESTION 7 (Start on a new page.)

7.1. The reaction between magnesium and dilute hydrochloric acid is represented by the balanced equation below.

$Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2(g)$

During an experiment, 1,5 g of magnesium reacts with excess dilute hydrochloric acid to produce hydrogen gas at STP.

Calculate the:

7.1.1 Mass (in gram) of hydrogen gas produced (5)

7.1.2 Volume (in dm3) of hydrogen gas produced at STP (3)

7.1.3 Mass (in gram) of $MgC\ell_2$ produced (4)

7.1.4 Number of chlorine atoms present in the $MgC\ell_2$ produced (3)

7.2. The empirical formula of a certain compound is to be determined. On analysis of a sample of the compound it was found to contain 71,65% $C\ell$, 24,27% C and 4,07% H.

7.2.1 Define the term *empirical formula*. (2)

7.2.2 Determine the empirical formula of the compound. Show ALL calculations. (5)

[22]

TOTAL MARKS: 100

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	G	$9,8 \text{ m·s}^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	C	$3,0 \times 10^{8} \text{ m·s}^{-1}$
Planck's constant *Planck se konstante*	H	$6,63 \times 10^{-34} \text{ J·s}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31} \text{ kg}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Avogadro's constant *Avogadro-konstante*	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19} \text{ C}$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31} \text{ kg}$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22,4 \text{ dm}^3\text{·mol}^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \frac{m}{M}$	$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$

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

KEY/*SLEUTEL*

Atomic number / ***Atoomgetal***: 29

Electronegativity / ***Elektronegatiwiteit***: 1,9

Symbol / ***Simbool***: Cu

Approximate relative atomic mass / ***Benaderde relatiewe atoommassa***: 63,5

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