Education and Sport Development
Department of Education and Sport Development
Departement van Onderwys en Sport Ontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko
NORTH WEST PROVINCE

PROVINCIAL MID YEAR EXAMINATION

GRADE 11

PHYSICAL SCIENCES

MAY/JUNE 2018

QUESTION PAPER

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages, a graph paper, 3 data sheets and a periodic table.

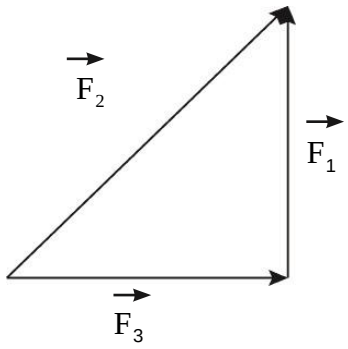
INSTRUCTIONS AND INFORMATION

1. Write your name on your ANSWER SHEET.
2. This question paper consists of ELEVEN questions. Answer ALL the questions in the ANSWER SHEET.
3. Start EACH question on a NEW page on the ANSWER SHEET.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, 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 SHEETS.
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.
12. 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. Write only the letter (A-D) next to the question number (1.1-1.10) on your ANSWER SHEET, for example 1.1 D.

1.1 According to the vector diagram of the forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ the resultant force is:



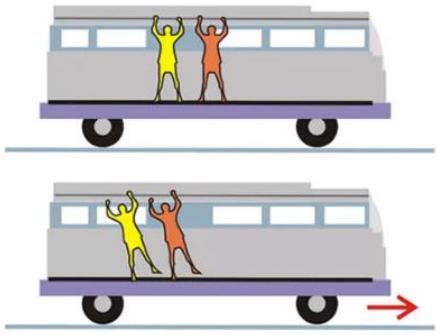
A $\vec{F}_1$

B $\vec{F}_2$

C $\vec{F}_3$

D Zero (2)

1.2 As a bus pulls away from the curb, the standing passengers move backwards as a result of one of Newton's Law's. Which law?



A Newton's First Law

B Newton's Second Law

C Newton's Third Law

D Newton's Law of Universal Gravity (2)

1.3 Which ONE of the following is an example of a non-contact force?

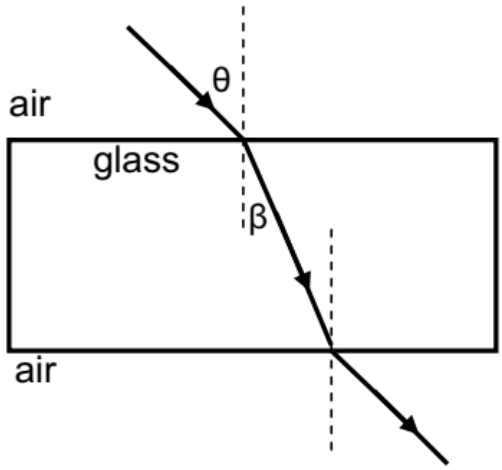
A Frictional force

B Gravitational force

C Tension force

D Normal force (2)

1.4 A ray of light strikes a glass block at an angle θ, as shown below. The ray passes through the glass block and emerges on the opposite side.



At what angle to the normal does the ray emerge from the glass block?

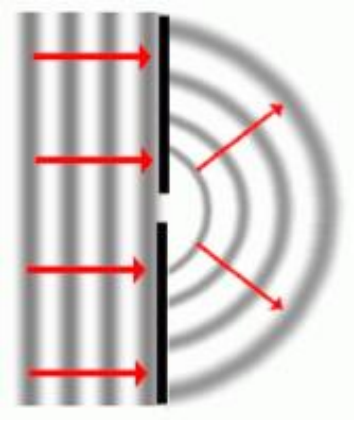
A β

B θ

C 90° – θ

D 90° – β (2)

1.5 The diagram below shows water waves that spread out after passing through a single slit.



The wave phenomenon observed after the water waves passes through the slit is …

A reflection

B diffraction

C dispersion

D total internal reflection (2)

1.6 According to the VSEPR theory, the shape of an aluminium chloride ($AlCl_3$) molecule is:

A Trigonal planar

B Trigonal bi-pyramidal

C Trigonal pyramidal

D Tetrahedral (2)

1.7 What forces occur between molecules of ammonia (NH_3)?

A Ion-ion forces

B Non-polar – non-polar forces

C London forces

D Hydrogen bonds (2)

1.8 The phenomenon that allows water strider to walk on water'

A Capillarity

B Adhesion

C Evaporation

D Surface Tension (2)

1.9 The temperature (in kelvin) of a fixed mass of an enclosed gas is given as T. Which ONE of the following CORRECTLY represents the new temperature if both the pressure and the volume of the gas are doubled?

A ¼T

B ½T

C 2T

D 4T (2)

1.10 The mass of 4,48 dm^3 of oxygen (O_2 gas) at STP is ...

A 6,4 g

B 3,2 g

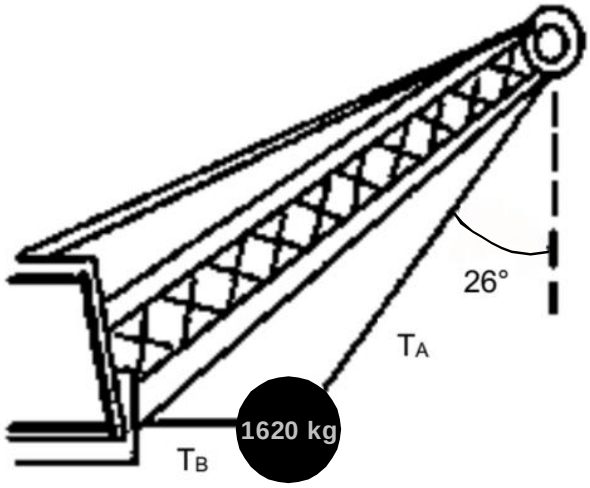
C 4,48 g

D 0,8 g (2)

[20]

QUESTION 2

A large wrecking ball is held in place by two light steel cables. The mass, m, of the wrecking ball is 1620 kg.



2.1 Explain the concept Forces in Equilibrium. (2)

2.2 Draw a triangle of forces in equilibrium and indicate at least one angle. (4)

2.3 Calculate

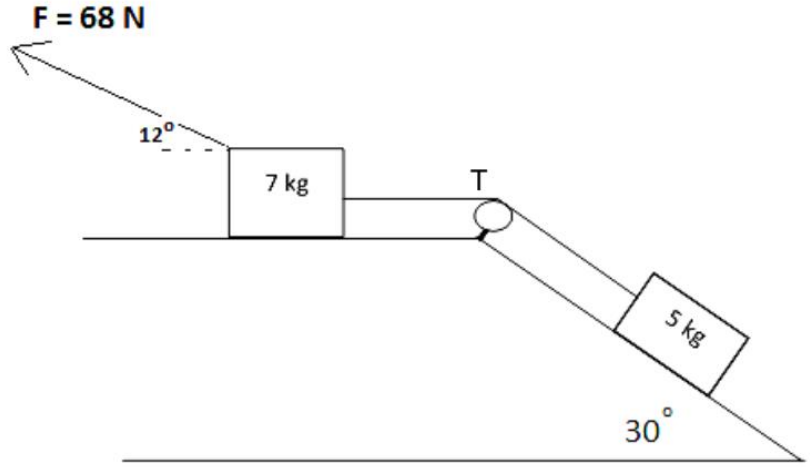
2.3.1 the magnitude of the tension T_A in the cable that makes an angle of 26° with the vertical. (3)

2.3.2 the magnitude of the tension T_B in the horizontal cable. (3)

[12]

QUESTION 3

Two blocks of masses 7 kg and 5 kg respectively are connected by a light inextensible string that runs over a light frictionless pulley as shown in the diagram below. The 7 kg block is pulled to the left with a force of 68 N at an angle of 12° to the horizontal .The 7 kg block experiences a frictional force of 6 N.
The coefficient of kinetic friction between the 5 kg block and the surface of the inclined plane is 0,18.



3.1 Define the term Normal Force. (2)

3.2 Draw a labelled, free-body diagram to indicate ALL the forces acting on the 5 kg object. (4)

3.3 Distinguish between static friction and kinetic friction. (4)

3.4 Calculate

3.4.1 the frictional force acting between the 5 kg block and the surface of the inclined plane. (4)

3.4.2 the acceleration of the 7 kg block. (7)

3.4.3 the magnitude of the tension T in the string between the blocks. (3)

[24]

QUESTION 4

Satellite A with a mass of 615 kg is in orbit around the Earth

4.1 State Newton's Law of Universal Gravitation. (2)

4.2 The Earth exerts a force of 5000 N on satellite A to keep it in orbit, calculate the height, in kilometers, of the satellite above the surface of the Earth. (5)

[7]

QUESTION 5

Learners investigate how the path of a light ray incident on an air-glass boundary changes as it enters the glass medium. Their results are shown in the table below.

angle i˚	angle r˚	sin Θ i˚	sin Θ r˚
15	10	0,259	0,174
25	16	0,423	0,276
45	28	0,707	0,469
55	33	0,819	0,545
60	35	0,866	0,574
70	39	0,940	0,629

5.1 For this investigation, write down the:

5.1.1 Dependent variable (1)

5.1.2 Independent variable (1)

5.1.3 Constant (control) variable (1)

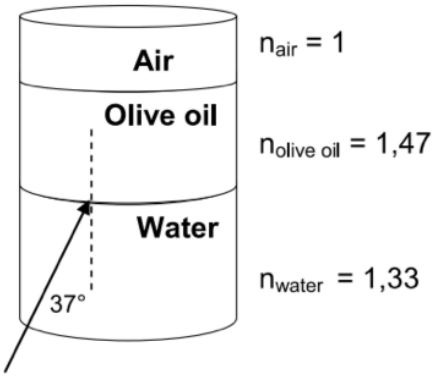
5.2 Draw an appropriate graph of the data in the table **and use it to obtain the refractive index** of the glass material.
USE THE GRAPH PAPER ATTACHED TO YOUR QUESTION PAPER TO ANSWER THIS QUESTION. (8)

5.3 Use the result in QUESTION 5.2 to calculate the *speed of light* through the glass material. (3)

[14]

QUESTION 6

Olive oil floats on water because its density is less than the density of water. However, the refractive index of olive oil is 1,47 while the refractive index of water is 1,33.



6.1 Define the term *refractive index*. (2)

6.2 If light travels through water and hits the water-olive oil at an angel of 37º, calculate the angle of refraction of light in olive oil. (4)

6.3 What does the refractive index of oil tell us about the optical density of olive oil compared to the optical density of water? (2)

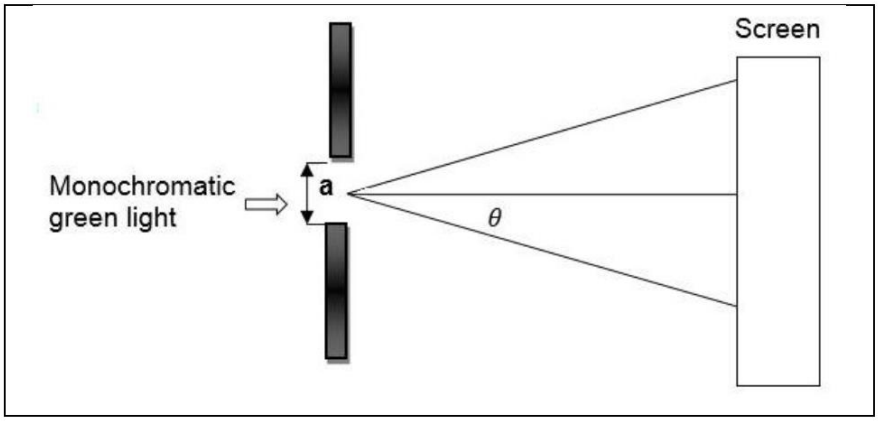
6.4 If the light ray exits the oil into the air, will it refract TOWARDS or AWAY from the normal? **Give a reason** for your answer. (2)

6.5 At which surface is total internal reflection most likely to occur when a light ray travels from : ..? Choose from *oil to air* **or** *water to oil.* (1)

[11]

QUESTION 7

Learners pass a green light with wavelength 534 nm through a single slit of width $1,8 \times 10^{-4}$ m and shines it on a screen. They set up the apparatus as shown in the diagram below.



7.1 Define the term monochromatic light. (1)

7.2 How will the broadness of the central band change if …
(Write only INCREASES, DECREASES or REMAINS THE SAME)

7.2.1 the green light is replaced by a red light? (1)

7.2.2 the slit width is smaller? (1)

7.3 Describe the pattern observed on the screen. (2)

[5]

QUESTION 8

In the table below, the melting points and boiling points of different substances at standard pressure are given. Use the information given in the table to answer the following questions.

Substance /Molecule	Melting point in C°	Boiling point in C°
$CC\ell_4$	-23	77
CH_4	-18	-162
He	-272	-269
$NaC\ell$	800	1413
NH_3	−77.73	−33.34
$HC\ell$	-114.9	-85.06

8.1 Define the term boiling point. (2)

8.2 Which substance ...

8.2.1 has the weakest intermolecular forces? (1)

8.2.2 has hydrogen bonds between the molecules? (1)

8.2.3 requires the most energy to undergo phase change? (1)

8.2.4 is liquid at room temperature? (1)

8.3 Name the type of forces that exist between the molecules of CH_4? (1)

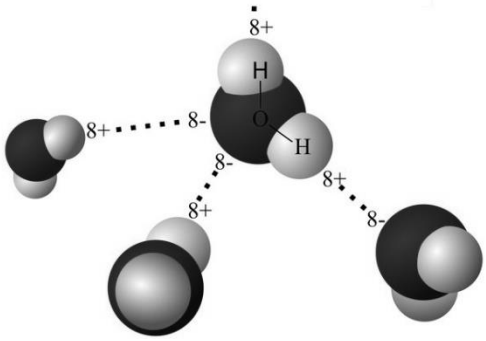
8.4 What type of bond is formed between an H^+-ion and the ammonia molecule? (1)

8.5 The substances which have polar covalent bonds between the atoms, but the molecule as a whole is non-polar. (2)

[10]

QUESTION 9

When compared with other liquids, water has some unique physical properties. It has a high specific heat capacity and a high heat of vaporization but it has a low viscosity. Water acts as a solvent for other substances.



9.1 Name the forces (found between the H_2O molecules) that are responsible for the high specific heat capacity and heat of vaporization of water. (1)

9.2 Define the term *specific heat capacity*. (1)

9.3 Draw a Lewis structure for H_2O. (2)

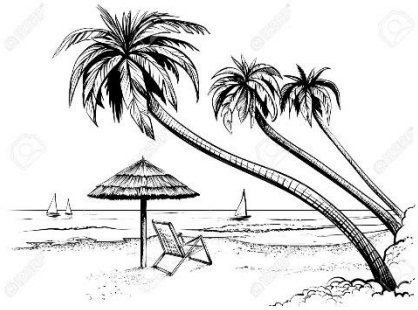
9.4 Use the Lewis diagram in QUESTION 9.3 (and the VSEPR theory) to predict the shape of a water molecule. (1)

9.5 Are water molecules polar or non-polar? Explain your answer. (4)

9.6 Which ONE of the two substances, KCℓ or I_2, will be able to dissolve in water? Give a reason for your answer. (2)

9.7 Water is able to move up narrow glass tubes. **Name and explain** this phenomenon. (2)

9.8 Climates are generally more moderate near the coast. During summers, land areas near a large body of water may not heat up as much as areas that are not close to water. Coastal areas also tend to be less cold during winters than individual areas



9.8.1 Explain which property of water is responsible for the low fluctuations in temperature between winter and summer. (2)

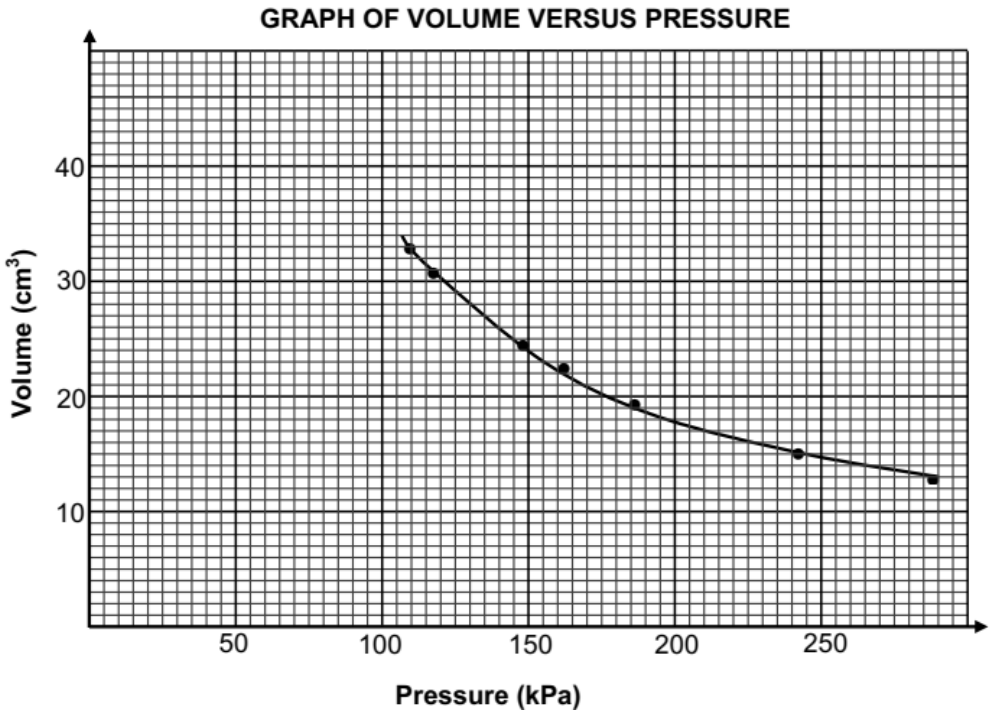
9.8.2 Explain why water has this property. (2)

9.8.3 How do you think our country would be affected if we did not have such large amounts of water? (2)

[19]

QUESTION 10

A fixed mass of oxygen is used to verify one of the gas laws. The results obtained are shown in the graph below.



10.1 Write down:

10.1.1 A mathematical expression, in symbols, for the relationship between the variables shown in the graph (1)

10.1.2 The name of the gas law investigated. (1)

10.1.3 Explain the relationship in QUESTION 10.1.1 in terms of the kinetic theory of gases. (2)

10.2 Write down TWO variables that must be kept constant during this investigation and briefly describe how this is done. (4)

10.3 From the graph, write down the volume of oxygen, in cm^3, when the pressure is 120 kPa. (1)

10.4 Calculate the pressure, in kPa, exerted on the gas when it is compressed to 5 cm^3. (4)

10.5 Write down TWO conditions under which oxygen gas will deviate from ideal gas behavior. (2)

[15]

QUESTION 11

During the summer season in South Africa, many homeowners have to maintain their swimming pools to keep it crystal clear. Sometimes, especially after heavy storms, it is necessary to add “settling salts” to the pool to get it clear again. The “settling salts” combines with the dirt and algae to form a sludge, which settles at the bottom of the pool. The sludge can then be hand vacuumed to leave the water clear again. “Settling salts” is a common name for aluminium sulphate.

11.1 Give the FORMULA for aluminium sulphate. (1)

11.2 Calculate the mole aluminium sulphate in 40g. (4)

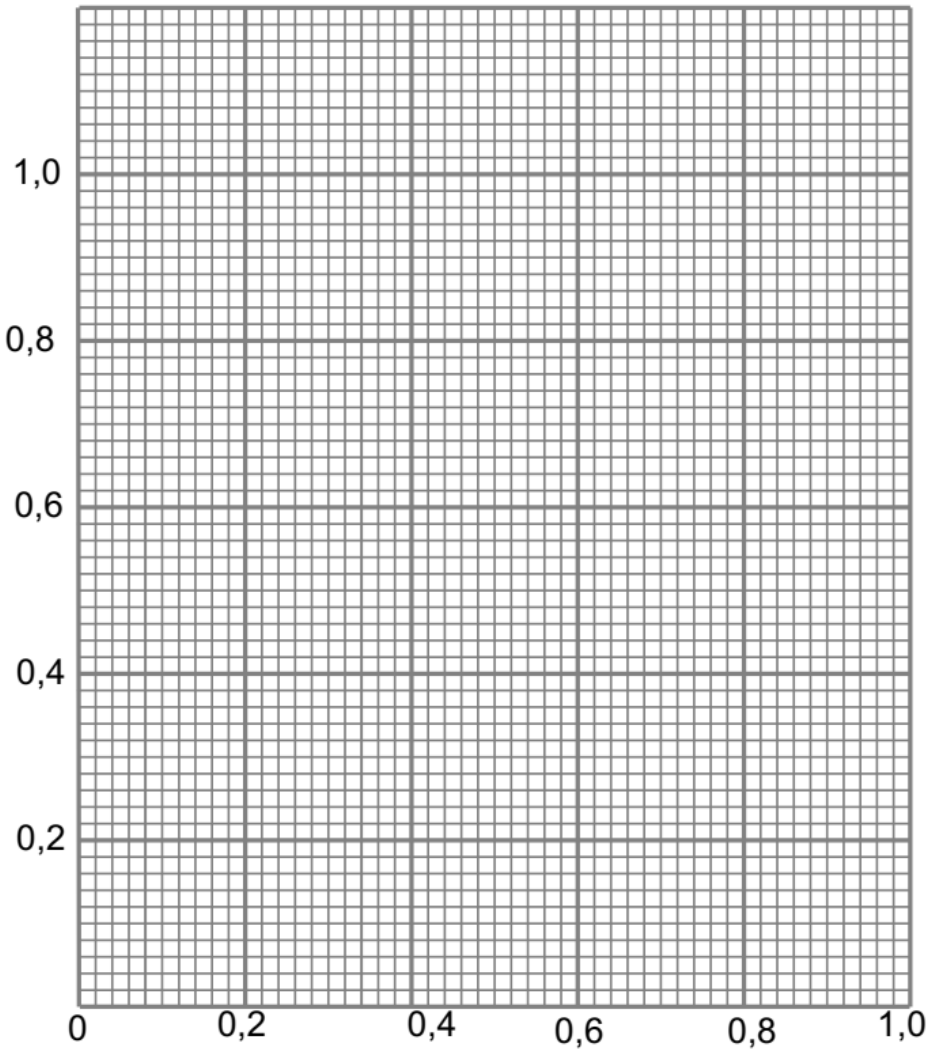
11.3 Calculate the percentage composition of aluminium sulphate. (3)

11.4 Determine the empirical formula for aluminium sulphate. (5)
[13]

GRAND TOTAL: [150]

NAME:

GRAPH PAPER FOR QUESTION 5.2



DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
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 $m \cdot s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of Earth *Straal van Aarde*	R_E	6,38 x 10^6 m
Coulomb's constant *Coulomb se konstante*	K	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Charge on electron *Lading op elektron*	e	-1,6 x 10^{-19} C
Electron mass *Elektronmassa*	m_e	9,11 x 10^{-31} kg
Mass of the earth *Massa van die Aarde*	M	5,98 x 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*

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

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

ELECTROSTATICS/*ELEKTROSTATIKA*

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

ELECTROMAGNETISM/*ELEKTROMAGNETISME*

$\varepsilon = -N\frac{\Delta\Phi}{\Delta t}$	$\Phi = BA\cos\theta$

CURRENT ELECTRICITY/*STROOMELEKTRISITEIT*

$I = \frac{Q}{\Delta t}$	$R = \frac{V}{I}$
$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \ldots$	$R = r_1 + r_2 + r_3 + \ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P = \frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P = \frac{V^2}{R}$

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 2 (CHEMIE)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}$ mol^{-1}
Molar gas constant *Molêre gaskonstante*	R	8,31 J·K^{-1}·mol^{-1}
Standard pressure Standaarddruk	p^θ	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	22,4 dm^3·mol^{-1}
Standard temperature *Standaardtemperatuur*	T^θ	273 K

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1}=\frac{p_2V_2}{T_2}$	$pV=nRT$
$n=\frac{m}{M}$	$n=\frac{N}{N_A}$
$n=\frac{V}{V_m}$	$c=\frac{n}{V}$ OR/*OF* $c=\frac{m}{MV}$

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 below: 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