Education and Sport Development

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

NATIONAL SENIOR CERTFICATE

GRADE 11

PHYSICAL SCIENCES

JUNE 2017

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages and 3 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name on the ANSWER SHEET.
2. This question paper consists of TWELVE questions. Answer ALL the questions on 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 subquestions, for example 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. Choose the answer and write only the letter (A-D) next to the question number (1.1-1.10) in the ANSWER BOOK, for example 1.11 D

1.1 A brick slides on a rough horizontal surface. Which one of the following actions will increase the frictional force acting on the brick?

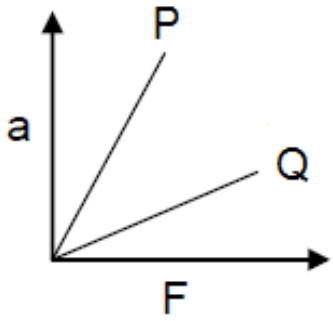
A Decreasing the surface area of contact

B Increasing the surface area of contact

C Putting a second brick on it

D Decreasing the mass of the brick (2)

1.2 The graphs below show the relationship between the net force and the Acceleration for two masses P and Q.



Which one of the following statements is true?

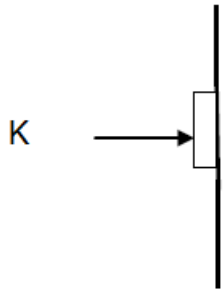
A The bodies have equal masses

B Body P has a smaller mass

C Body Q has a smaller mass

D The mass does not affect the gradient of the graph (2)

1.3 Consider a man pressing a book against a wall with a force K as shown in the sketch below:



The reaction force to force K will be:

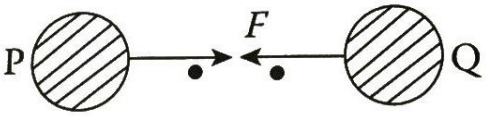
A the force with which the wall presses on the book

B the force with which the book presses on the wall

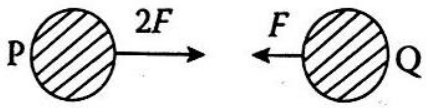
C the force with which the wall presses on the man

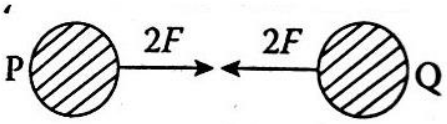
D the frictional force between the book and the wall (2)

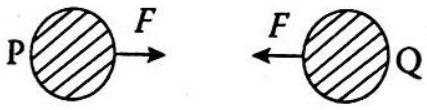
1.4 The gravitational force exerted by two identical metal spheres P and Q on each other can be represented as shown in the sketch below:

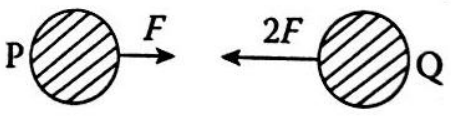


Which one of the following diagrams represent the force correctly if the mass of P is doubled?

A


C


B


D


(2)

1.5 The bond which involves the donation of electrons into an empty orbital is a/an-

A Ionic bond

B Dative covalent bond

C Covalent bond

D Metallic bond (2)

1.6 Adhesive forces are found in ……

A surface tension

B viscosity

C hydrogen bonding

D capillary action (2)

1.7 The liquid that exhibit the highest vapour pressure at 25 ºC is:

A water, boiling point 100 ºC

B ether, boiling point 34,6 ºC

C ethyl alcohol, boiling point 78,3 ºC

D glycerin, boiling point 290 ºC (2)

1.8 A clear plastic bead has a critical angle of 40º. Light inside the bead strikes the surface with angle of incidence of 42º. At the surface…

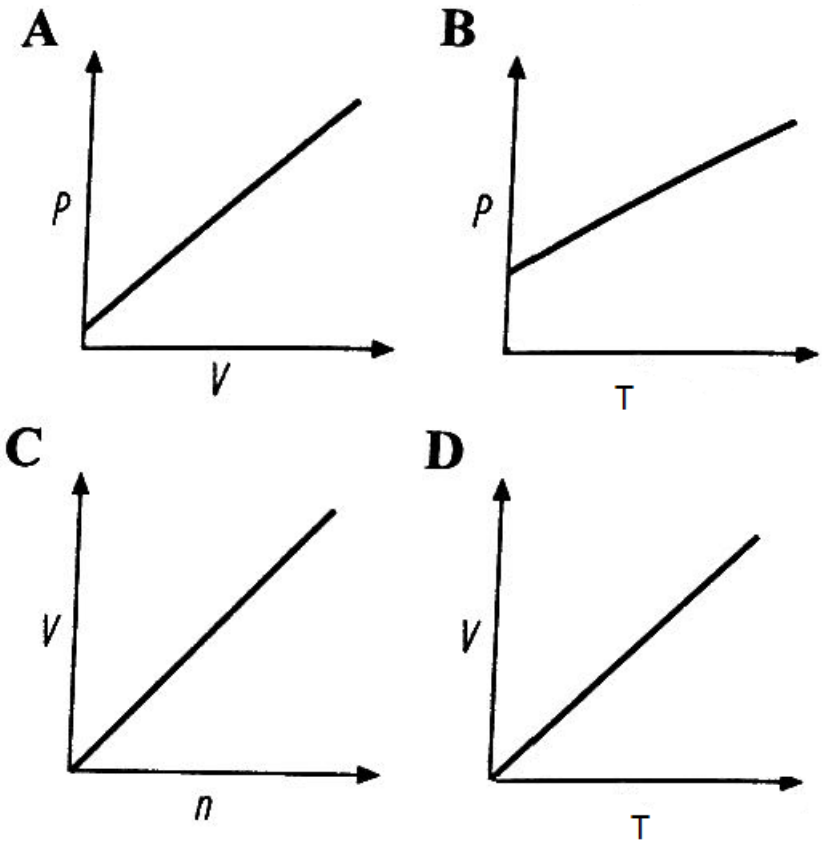
A all the light is reflected

B all the light is transmitted to the air

C the light travels along the boundary

D some light is reflected and some light is refracted (2)

1.9 Which one of the following graphs does not represent a gas relationship?



(2)

1.10 Which statement regarding the Kinetic Molecular theory of ideal gases is incorrect?

A Gas molecules are in random motion

B Gas molecules collide inelastically

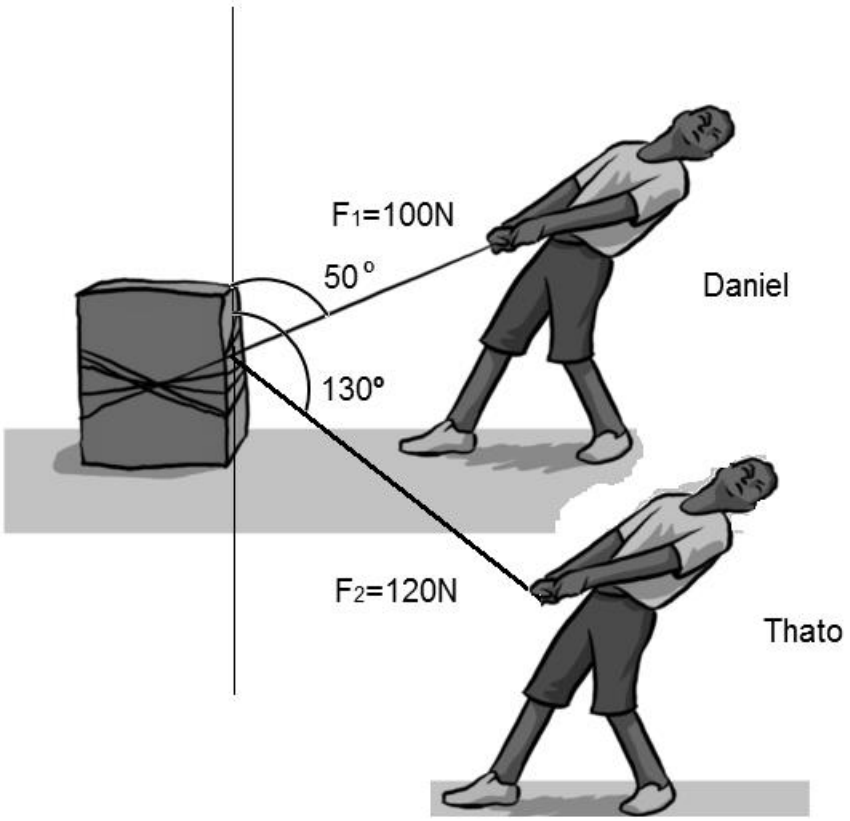
C The gas molecules occupy zero volume

D Attractive and repulsive forces can be neglected (2)

[20]

QUESTION 2

2.1 Daniel and Thato are pulling a cement block as shown in the sketch below. Daniel pulls with a force of 100N at a bearing of 50º and Thato pulls with a force of 120 N at a bearing of 130º.



2.1 Explain what is meant by resultant force? (2)

2.2 Calculate the magnitude of the sum of the vertical and horizontal components of the force applied by Daniel and Thato ? (6)

2.3 Calculate the magnitude and direction of the combined pulling force by adding the vector components. (4)

[12]

QUESTION 3

Vusi was pushing a truck with a force of 100 N. The mass of the truck is 1500 kg and the truck is at rest.

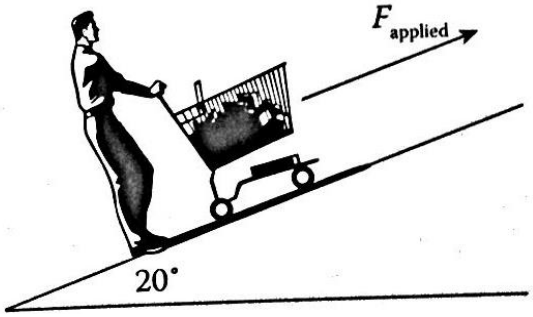
3.1 What is the magnitude of the weight of the truck? (2)

3.2 Explain the difference between static and kinetic frictional force (4)

[6]

QUESTION 4

A supermarket built a ramp for their customers to push their fully laden trolleys to their parked cars in the roof parking area above the supermarket. They completed a survey and found that the average loaded trolley has a mass of 20 kg.
The material they used for the ramp resulted in a coefficient of static friction of 0,7.
The ramp is inclined at 20º as shown in the figure below.



4.1 Draw a labelled force diagram of all the forces acting on the trolley? (3)

4.2 Calculate the minimum force a person must apply to push the trolley up the ramp (9)

[12]

QUESTION 5

A 10 N force is used to pull a toy train, which has an engine and another cart attached to it, as shown in figure below. The train engine has a mass of 1 kg and the cart has a mass of 500 g. The track is smooth, therefore there is no friction.

5.1 Calculate the acceleration of the train? (4)

5.2 Calculate the tension in the link between the train and the cart. (2)
[6]

QUESTION 6

An astronaut measures his weight on the Earth. As his spaceship travels away from the Earth, he measures the Earth's force of attraction on him at various stages. The table below indicates the forces of attraction acting on the man, though not in the same order as they were measured.

Study the table below and answer the following questions:

Point	**Earth's attraction on astronaut(N)**
P	392
Q	98
R	588
S	784
T	196

6.1 At which point was he on the Earth's surface? Explain (2)

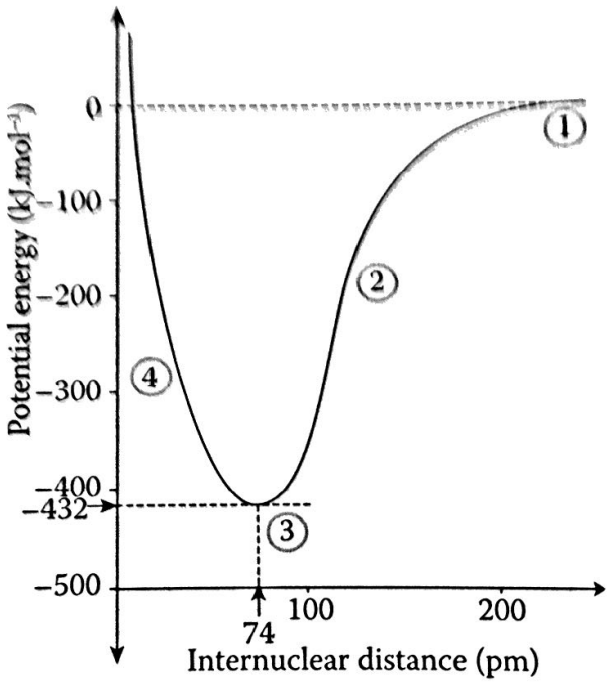
6.2 At which point was he furthest away from the Earth? (1)

6.3 At which point was he approximately double the Earth's radius from the centre of the Earth? Explain (2)

6.4 What is the astronaut's mass in kilograms? (2)
[7]

QUESTION 7

The graph below shows the energy involved in the formation of the carbon-carbon Bond. Use the graph to answer the questions that follow.



7.1 What is the bond energy for the formation of the C-C bond? (1)

7.2 What is the C-C bond length? (1)

7.3 What is the relationship between bond length and bond energy? (1)

7.4 Describe the shape of the graph in sections 1 to 4 on the formation of the C-C bond (4)

7.5 The molecules of both carbon dioxide and water have three atoms each, but they have different molecular shapes.

Name the shapes of both and explain the difference by referring to the polarity of the bonds and the molecules. (4)

7.6 Use Lewis structures to show the formation of the following molecules and write the name of each molecular shape.

7.6.1 $BeCl_2$ (2)

7.6.2 PCl_5 (2)

[15]

QUESTION 8

8.1 Copy the table given below on your answer book and complete the table

Substance	Type of particles	Type of intramolecular force	Type of intermolecular force	Polar, nonpolar or none
NH_4Cl				
CCl_4				
NH_3				

(12)

8.2 The table below shows the boiling points and molar masses of the hydrides of group sixteen elements

Compound	Molar mass($g \cdot mol^{-1}$)	Boiling point in(ºC)
H_2O	18,0	100
H_2S	33,06	-61
H_2Se	79,96	-41
H_2Te	128,60	-2

8.2.1 Draw a graph of boiling point versus molar mass (3)

8.2.2 Explain the trend in boiling points of H_2S, H_2Se and H_2Te (4)

8.2.3 Explain why water has a higher boiling point than all the hydrides of group sixteen elements. (2)

[21]

QUESTION 9

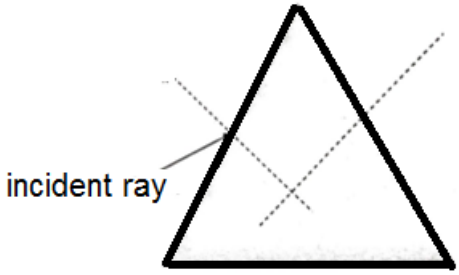
9.1 Define the term Refraction (2)

9.2 The speed of a beam of yellow light travelling through a glass block is found to be 1,97 X 10^8 m·s^{-1}

9.2.1 What is the speed of the yellow light when it travels through air? (1)

9.2.2 Determine the refractive index of the glass block? (3)

9.3 A light ray is incident on the face of a triangular glass prism in air, as shown in the diagram below.



Copy the diagram on your answer book and draw the path of the ray through the prism and as it emerges from the prism. Include the following labels in your diagram.
(Normal, angle of incidence, angle of refraction and refracted ray) (4)

9.4 FOR QUESTION 9.4 USE THE INFORMATION GIVEN IN THE TABLE BELOW.

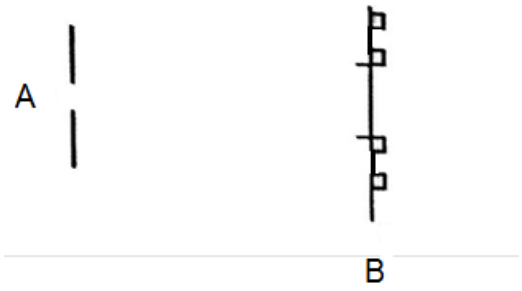
Substance	**Refractive index**
Air	1,0
Water	1,33
Perspex	1,5
Glass	1,5
Diamond	2,4

A transparent block lies under water. A diver shines his flash light onto it so that the ray of light makes an angle of 59º on the block.
The resulting angle of refraction is 27º. Identify the material that the block is made of. (4)

[14]

QUESTION 10

Monochromatic green light is shown through a very narrow slit A and the image is cast on a screen in a dark room as shown in the sketch below.



10.1 Define the term monochromatic. (1)

10.2 Describe the pattern that is observed on the screen. (2)

10.3 Give the name of this phenomenon and define this phenomenon. (3)

10.4 Name and state the principle that can be used to explain this phenomenon. (3)
[9]

QUESTION 11

In a class experiment, learners varied the pressure on an enclosed amount of gas, and obtained this set of results with respect to the pressure, volume and temperature.

Pressure (kPa)	**Volume(cm^3)**	**Temperature (^oC)**
198	25,4	23
158,6	31,71	23
120	X	23

11.1 In this experiment, what is/are the

11.1.1 Independent variable? (1)

11.1.2 Dependent variable? (1)

11.1.3 Controlled variables? (1)

11.2 State an investigation question for the experiment. (2)

11.3 These results illustrate a certain law. Name the law and state it in words (3)

11.4 Show clearly, by means of calculations that the first two sets of readings obey this law. (3)

11.5 Calculate the value of 'X' given in the table. (2)

[13]

QUESTION 12

The results obtained during an experiment to investigate the relationship between volume and temperature of a given mass of gas at constant pressure is given below.

Volume (cm^3)	**Temperature(ºC)**
0,0546	0
0,0746	100

12.1 Make use of a calculation to show that this gas is behaving as an ideal gas. (3)

12.2 State two main assumptions that are made about the particles of an ideal gas. (2)

12.3 Calculate the volume of the given gas at 200ºC. (2)

12.4 Ammonium nitrate decomposes according to the following equation:

$$NH_4NO_3(g) \rightarrow N_2O(g) + 2H_2O(g)$$

A 2,8 g sample of ammonium nitrate is sealed and then heated in a I dm^3 flask. The ammonium nitrate decomposed completely.

12.4.1 Calculate the total number of moles of gaseous products that form. (5)

12.4.2 If the temperature in the flask 71ºC, what is the pressure in the flask in kPa? (3)

[15]

TOTAL: 150

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 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstant*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	3,0 x 10^8 $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	6,63 x 10^{-34} $J \cdot s$
Coulomb's constant *Coulomb se konstante*	k	9,0 x 10^9 $N \cdot m^2 \cdot C^{-2}$
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 Earth *Massa van Aarde*	M	5,98 x 10^{24} kg
Radius of Earth *Radius van Aarde*	R_E	6,38 x 10^6 m

TABLE 2: FORMULAE

MOTION

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

FORCE

$F_{net} = ma$	$p = mv$
$f_s^{\,max} = \mu_s N$	$f_k = \mu_k N$
	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/*of*	$g = G\frac{M}{d^2}$ or/*of* $g = G\frac{M}{r^2}$

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

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

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*