GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

JUNE 2019

GRADE 11

PHYSICAL SCIENCES
PHYSICS
PAPER 1

NAME OF LEARNER: _____

GRADE: _____

MARKS: 150

TIME: 3 hours

16 pages

P.T.O.

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

PHYSICAL SCIENCES:
PHYSICS P1

TIME: 3 hours

MARKS: 150

INSTRUCTIONS:

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of NINE questions. Answer ALL questions in the ANSWER BOOK except QUESTION 7.6 which has to be answered on the graph paper attached to this question paper. Write your name in the appropriate space on the graph paper.
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 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)** in the ANSWER BOOK, for example **1.3 A**.

1.1 Choose the set of physical quantities which are only vectors.

A Force, mass, time, power
B Work, energy, weight, distance
C Force, distance, speed, acceleration
D Force, displacement, velocity, acceleration (2)

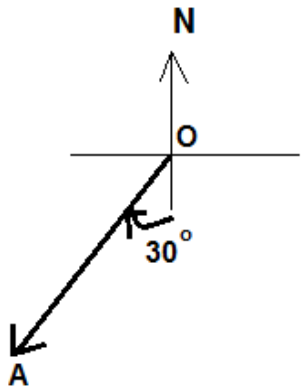
1.2 When you can hear a person talking in another room, it is due to the phenomenon called …

A reflection.
B diffraction.
C refraction.
D dispersion. (2)

1.3 The acceleration due to gravity experienced by an object falling depends on

A the mass of the object only.
B the mass of the object and the mass of the planet.
C the mass and radius of the planet only.
D the mass and radius of the planet and the mass of the object. (2)

1.4 Which one of the following indicates the direction of the vector **OA** in the picture below?



A 210˚ West of South
B 210˚
C 30˚
D 30˚ West (2)

1.5 The refractive index of amber is 1,55. When light moves from air to amber it will refract and change speed. Which of the following is correct?

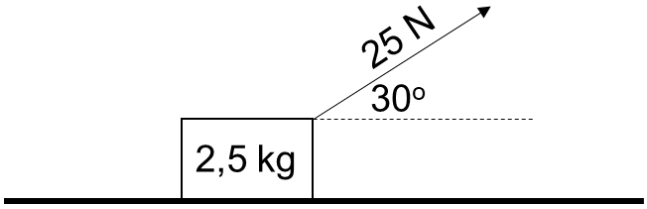
	Refraction	Speed
A	Away from the normal	Decreases
B	Towards the normal	Increases
C	Away from the normal	Increases
D	Towards the normal	Decreases

(2)

1.6 Two boys are playing with a ball. One boy pulls the ball with a force of 1.5 N to the right and the other boy pulls the ball with a force of 2 N at a right angle to the first boy. The magnitude of the resultant force on the ball will be…

A 3,5 N
B 2,5 N
C 3 N
D 6,25 N (2)

1.7 A box of 2,5 kg is being pulled with a force of 25 N at an angle of 30^0 to the horizontal, as shown in the diagram.



The normal force is ...

A 24,5 N.
B 12,5 N.
C 12 N.
D 37 N. (2)

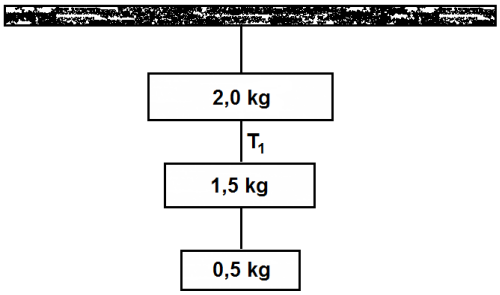
1.8 A net force applied to mass **m** will have an acceleration of **a**, if a ¼ F is now applied to half the mass, what will the acceleration be?

A ½ a
B ¼ a
C 2 a
D 4 a (2)

1.9 The height above the surface of the earth at which an astronaut will experience only a third of the gravitational force to which he is subjected on earth, is ... times the radius of the earth.

A 0,73
B 1,73
C 8
D 9 (2)

1.10 Three objects of masses; 2 kg, 1,5 kg and 0,5 kg respectively, are suspended by means of a thin string as shown in the diagram. What is the tension that the string experiences at T_1?

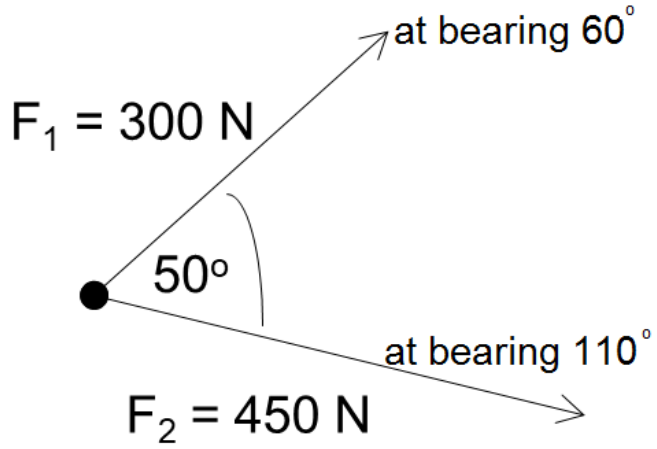


A 39,2 N
B 34,3 N
C 19,6 N
D 4,9 N (2)

10 x 2 = **[20]**

QUESTION 2: (START ON A NEW PAGE.)

Two boys are trying to pull a tree stump out of the ground. One boy applies a force of 300 N and the other boy applies a force of 450 N at 50° to the 300 N force.



The tree stump moves because there is a resultant force acting on it.

2.1 Define the term *resultant force*. (2)

2.2 Draw a vector diagram of all the components of F_1, showing at least one angle. (3)

2.3 Calculate

2.3.1 the magnitude of the resultant force. (9)

2.3.2 The direction of the resultant force. (3)

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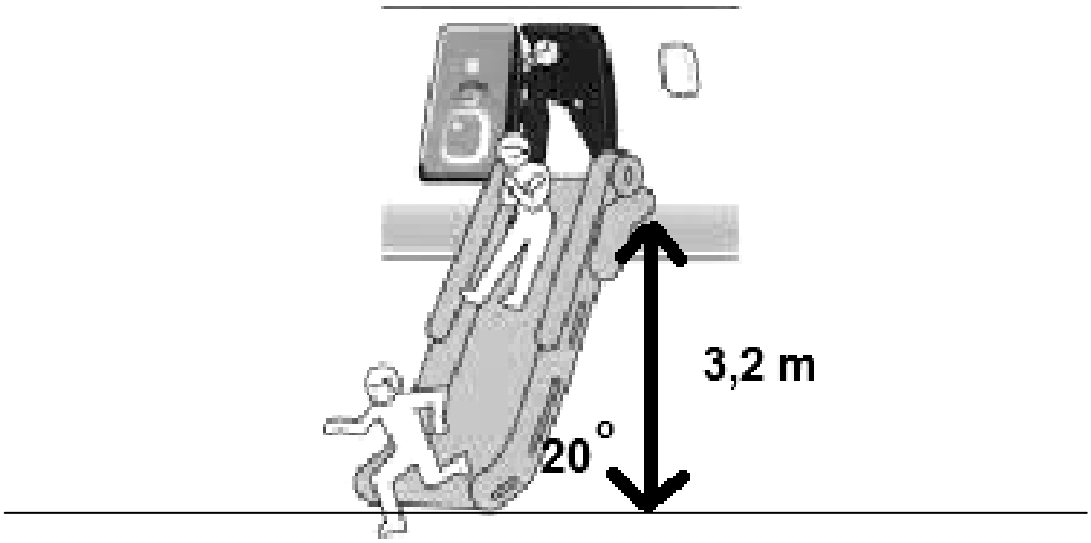
QUESTION 3: (START ON A NEW PAGE.)

An aeroplane does an emergency landing at the International airport in Cape Town. The passengers leave the aeroplane by means of a slide 3,2m high which makes an angle of 20° with the tar surface.



3.1 Draw a labelled free-body diagram of all the forces working on a passenger at the top of the slide. (3)

3.2 Define the term *frictional force*. (2)

3.3 Calculate the frictional force experienced by a passenger of 70 kg sliding down the slide, if the slide has a coefficient of friction of 0,112. (6)

3.4 If the slope of the track increases, how will the friction experienced by the passenger change?

3.4.1 Write only INCREASE, DECREASE or REMAIN THE SAME. (2)

3.4.2 Explain your answer to Question 3.4.1 (2)

3.5 If the passenger has a 10 kg toddler in his arms. How does his acceleration down the slope change?

3.5.1 Write only INCREASE, DECREASE or REMAIN THE SAME. (2)

3.5.2 Explain your answer to Question 3.5.1 (2)
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QUESTION 4: (START ON A NEW PAGE.)

A toddler with a mass of 20 kg strapped into his car seat, is in a car moving at 30 $m \cdot s^{-1}$. On the seat next to the child is a box with toys. The car is involved in an accident and stops suddenly. Ignore all effects of friction.

4.1 Define Newton's first law. (2)

4.2 Describes the movement of the box immediately after the collision. (2)

4.3 Calculate the net force acting on the toddler when the car experiences a negative acceleration of 30 $m \cdot s^{-2}$. (4)

4.4 The Child Car Seat Law that became effective on 1 May 2015 state that all children under the age of three will be required to only travel in a car if they are secured in a car seat.

PART 1:

Infants should ride rear-facing at least until they are a year old. Once they exceed the weight or height limit set by the manufacturer of the infant safety seat, they should continue to ride rear-facing in a convertible safety seat. It is best to keep toddlers rear-facing as long as possible. (3)

PART 2:

Pressure is defined as the force per unit area ∴ The area of the seatbelt on the child seat is 0,01 m^2 and a baby's body can only withstand a max of 5 000 $N.m^2$ for a very short time.
Explain why the first statement of Part 1 of the Law is so important.

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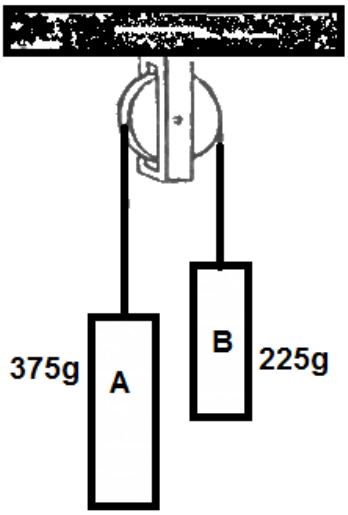
QUESTION 5: (START ON A NEW PAGE)

Two blocks, **A** with a mass of 375 g and **B** with a mass of 225 g, hang on a thin string over a frictionless and weightless pulley as shown.



5.1 Draw a free-body diagram for block **A.** (2)

5.2 Define Newton's second Law of motion. (2)

5.3 Calculate the acceleration of block **B**. (5)

5.4 Calculate the tension in the rope onto which the blocks hang. (3)
[12]

QUESTION 6: (START ON A NEW PAGE.)

The International Space Station was launched 20 November 1998. It experiences an average net attraction force of 3,64 x 10^6 N. The mass of the International Space Station is 419 725 kg.

6.1 State Newton's Law of Universal Gravitation in words. (2)

6.2 Calculate how many kilometers **above** the earth's surface the satellite is moving, if it experiences a force of 3,64 x 10^6 N on it in order to keep it in that specific orbit. (5)

6.3 A man has a weight of 650N on Earth. Calculate his mass on the space station. (3)

6.4 One of the rockets of the space station is now started to accelerate it away from the earth to a new orbit. Calculate the force which the rocket must exert to accelerate the space station at 0,6 m.s^{-2} away from the earth. (5)

6.5 After the rockets stopped firing:

6.5.1 How does the acceleration of the space station change? Only answer INCREASE, DECREASE, REMAIN THE SAME (2)

6.5.2 Explain your answer in 6.5.1 (2)

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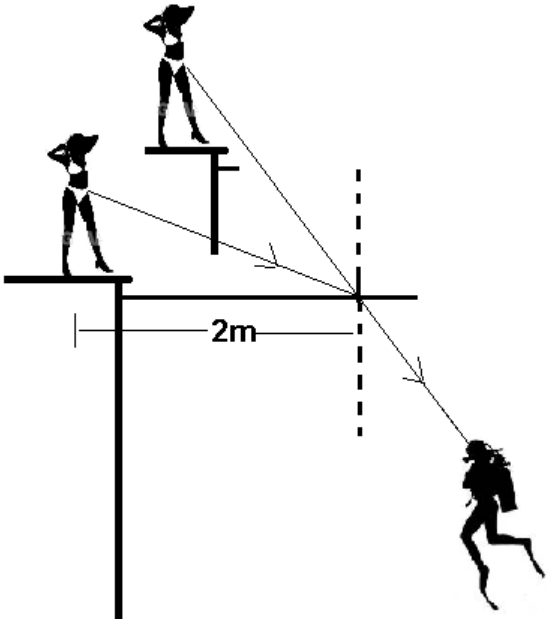
QUESTION 7: (START ON A NEW PAGE.)

Light travels from the air to a diver under the water. The refractive index of the water is 1,33



7.1 Give the meaning of the term *refractive index*. (2)

7.2 Explain, referring to refraction of the light, why the diver would see the girl on the side of the pool, as if she is above the place she is standing, as indicated in the picture. (2)

7.3 Calculate the speed of light in the water. (3)

7.4 Calculate the size of the refracted angle if the incident angle is 42°, when the light travels from air to water. (4)

7.5 7.5.1 Identify the law you used to determine your answer in 7.4 (2)

7.5.2 State the Law named in 7.5.1, in words. (2)

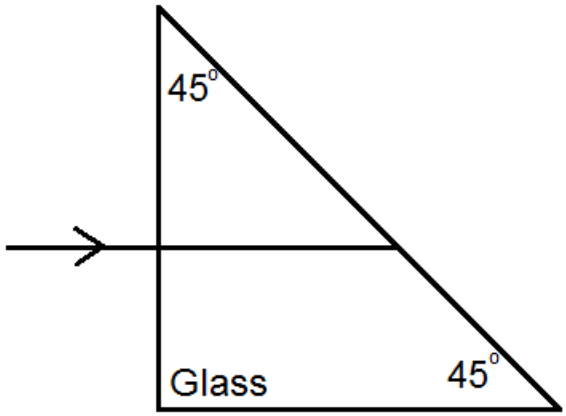
7.6 Complete the diagram of the light rays on the attached answer sheet to show where the girl would see the diver. (3)

7.7 If a bird tries to catch a fish in the water, they hover directly above the fish. Explain in your own words why they would do that. (3)

[21]

QUESTION 8: (START ON A NEW PAGE.)

Light travels into a 45° prism along the normal, as indicated in the diagram



8.1 At what angle will the light hit the glass – air boundary? (2)

8.2 Define the term *critical angle*. (2)

8.3 8.3.1 What wave phenomenon will occur at the glass-air boundary? (2)

8.3.2 Expain your answer in 8.3.1 by referring to the requirements for this phenomenon to occur. (4)

8.4 Calculate the refractive index for this glass if the speed of light traveling through it is $2{,}21 \times 10^{8}$ $m.s^{-1}$. (3)

8.5 Give an application where prisms can be used as in the diagram above. (2)

8.6 Fibre optics is used in telecommunications and make use of the same principles as above. Give TWO reasons why fibre optics is better to use than copper cables, besides cost and re-sale value. (4)

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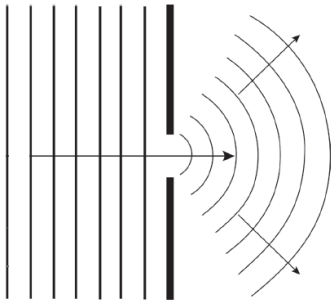
QUESTION 9: (START ON A NEW PAGE.)

Study the picture below and answer the questions that follow.

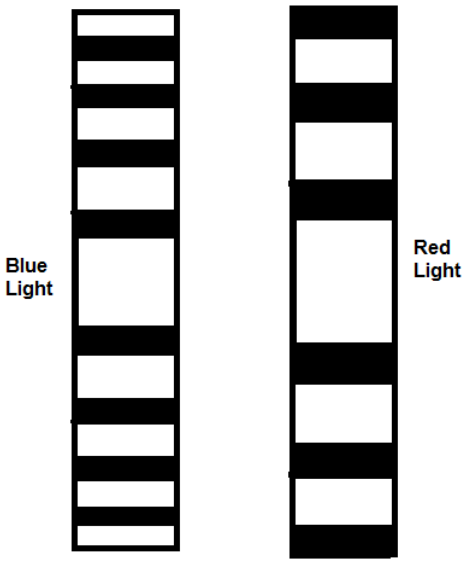


9.1 State Huygens's Principle. (2)

9.2 9.2.1 Name the phenomenon observed in the above picture. (2)

9.2.2 Describe the phenomenon observed in words. (2)

9.3 When monochromatic light passes through a small single slit, the following patterns will be observed



Explain:

9.3.1 The cause of the bright bands. (2)

9.3.2 The difference between the blue and the red patterns, with reference to wavelength and the degree of diffraction. (4)

9.3.3 What change must be made to increase the width of the central bright band in **both** cases above. (2)

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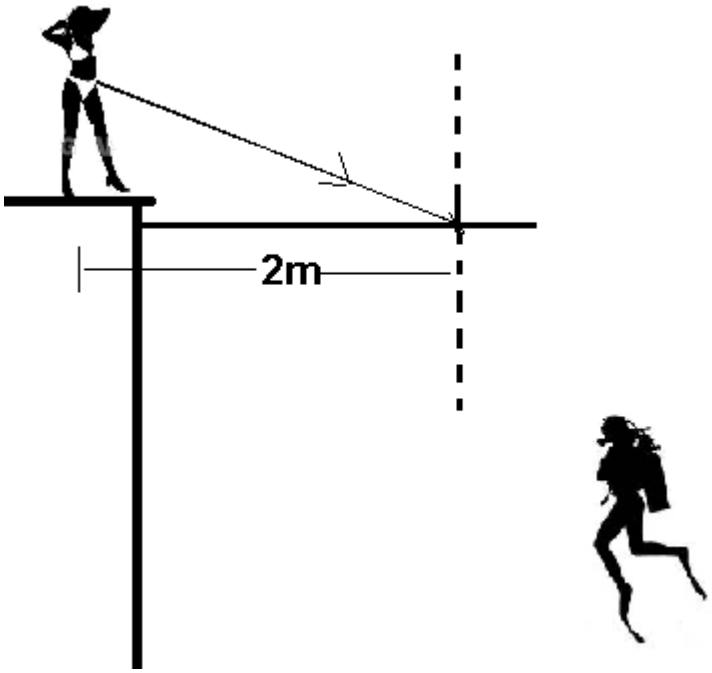
TOTAL: 150

QUESTION 7.6:

NAME OF LEARNER:_____

COMPLETE THE FOLLOWING RAY DIAGRAM



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*

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

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*

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

END