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

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)

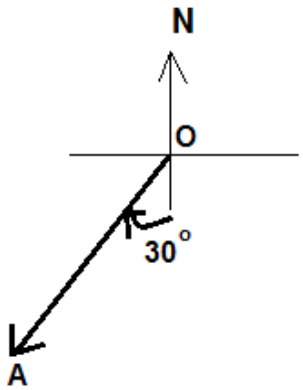
1.2 When you can hear a person talking in another room, it is due to the phenomenon called …

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

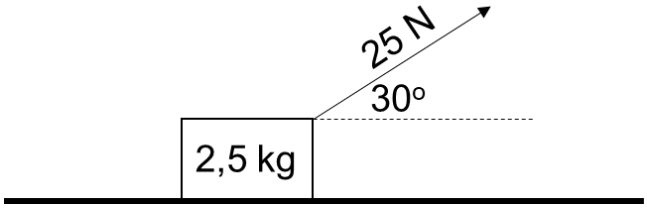
(2)

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

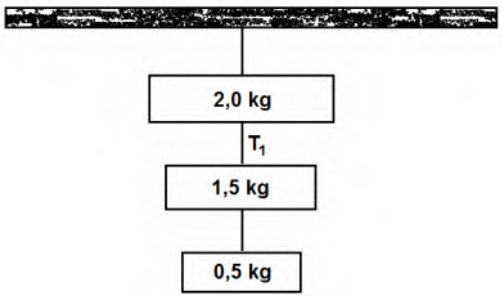
(2)

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?



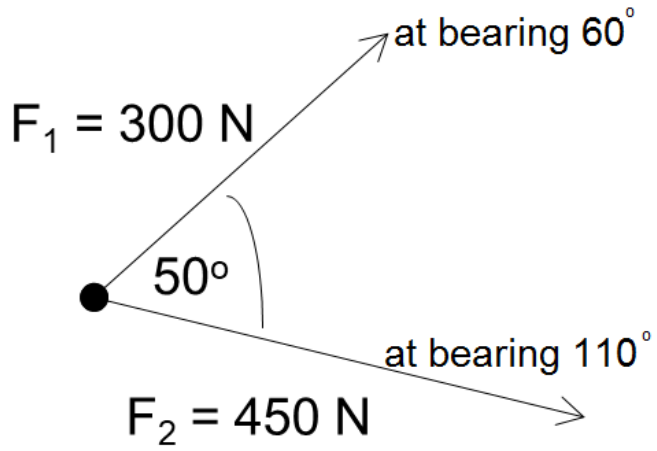
A 39,2 N
B 34,3 N
C 19,6 N
D 4,9 N

(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

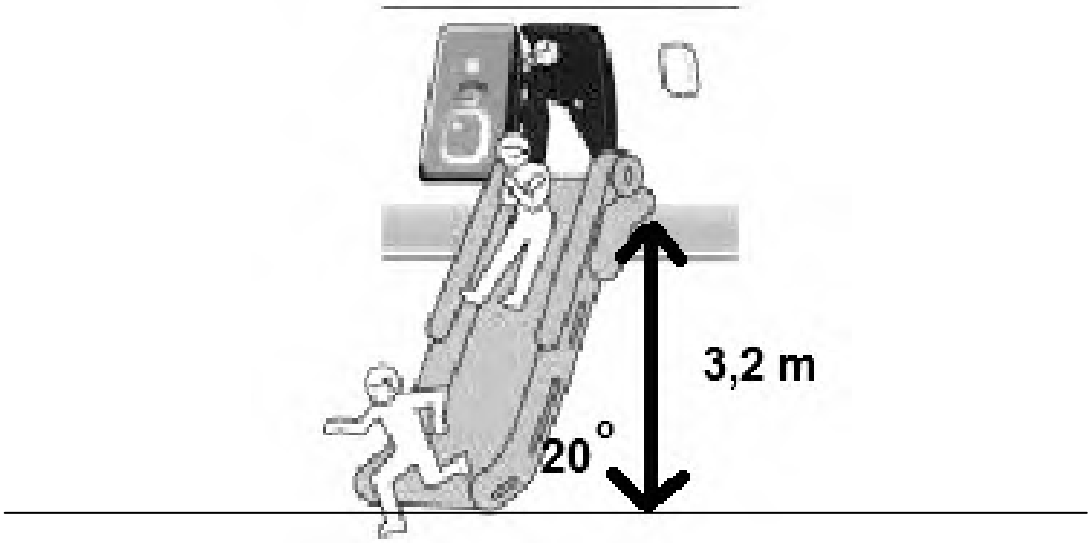
2.3.1 the magnitude of the resultant force. (9)

2.3.2 The direction of the resultant force. (3)

[17]

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)

[19]

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)

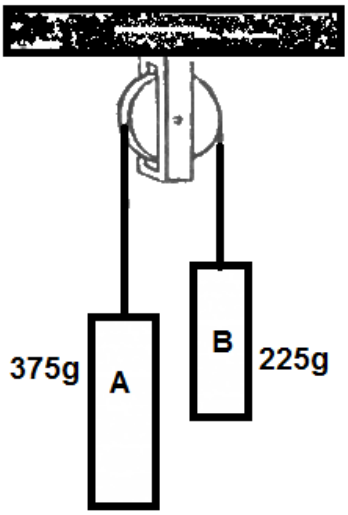
PART 2:

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.

[11]

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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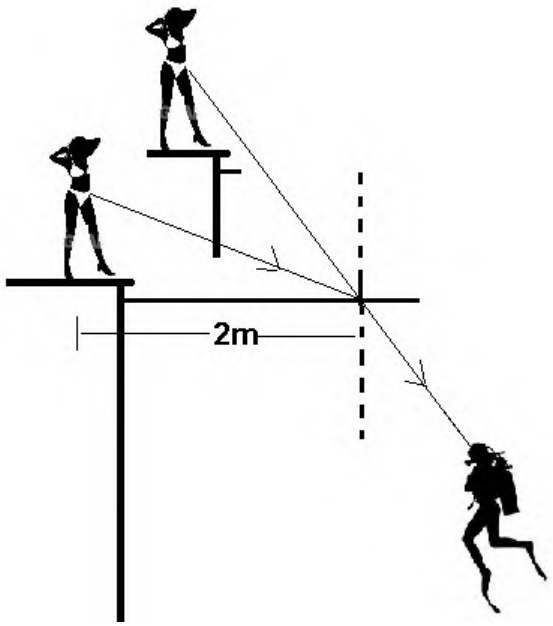
QUESTION 7: (START ON A NEW PAGE.)

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)

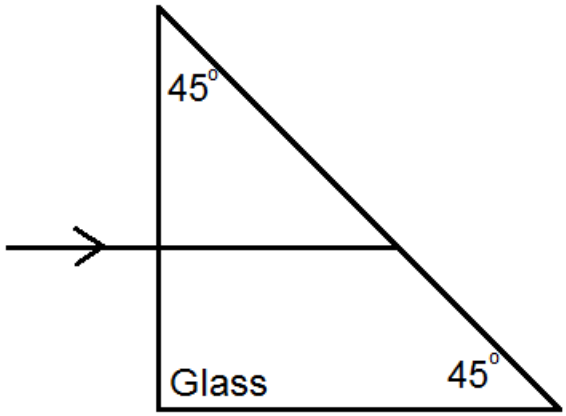
7.6 Complete the diagram of the light rays on the attached answer sheet to show where the girl would see the diver. (3)

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)

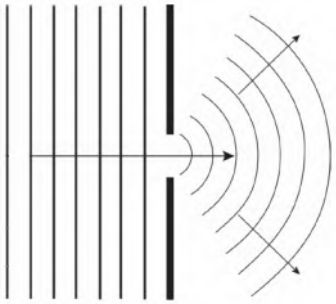
8.5 Give an application where prisms can be used as in the diagram above. (2)

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)

[19]

QUESTION 9: (START ON A NEW PAGE.)

Study the picture below and answer the questions that follow.

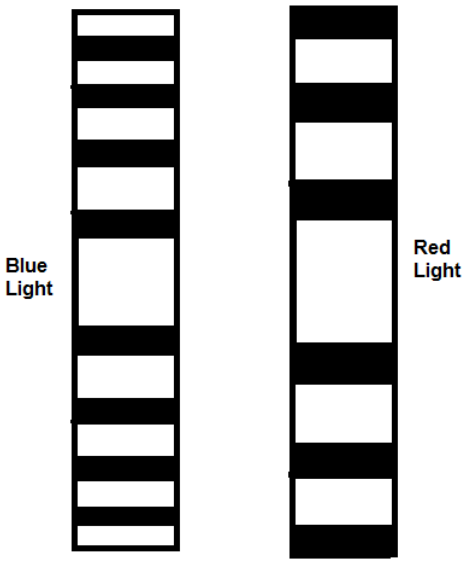


9.1 State Huygens's Principle. (2)

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)

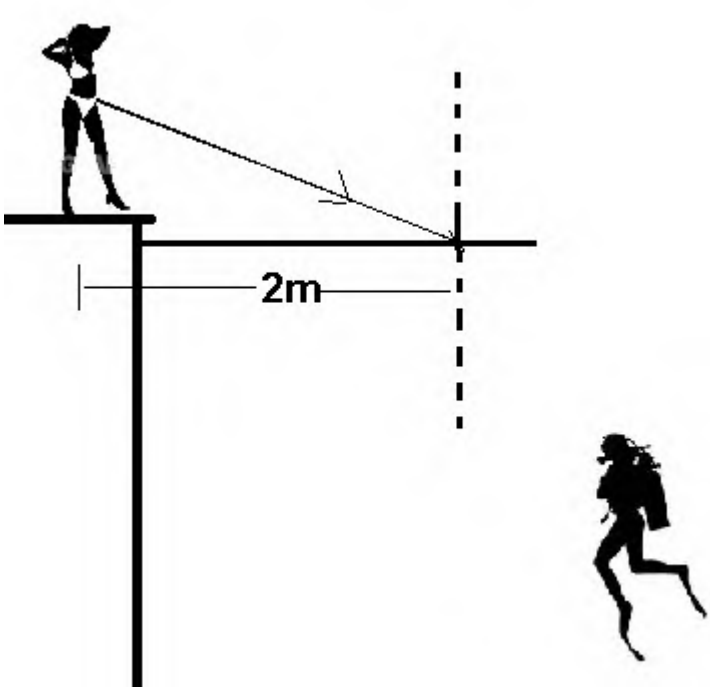
[14]

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	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
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*

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

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*

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

END

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION /

GAUTENGSE DEPARTEMENT VAN ONDERWYS

PROVINCIAL EXAMINATION / PROVINSIALE EKSAMEN

JUNE / *JUNIE* 2019

GRADE / *GRAAD* 11

PHYSICAL SCIENCES /
FISIESE WETENSKAPPE
Physics / *Fisika*
Paper 1 / *Vraestel 1*

MEMORANDUM

14 pages / *bladsye*

GAUTENG DEPARTMENT OF EDUCATION /
GAUTENGSE DEPARTEMENT VAN ONDERWYS

PREPARATORY EXAMINATION /
VOORBEREIDENDE EKSAMEN

PHYSICAL SCIENCES /
FISIESE WETENSKAPPE
(Paper / *Vraestel 1*)

QUESTION 1 / *VRAAG 1:*

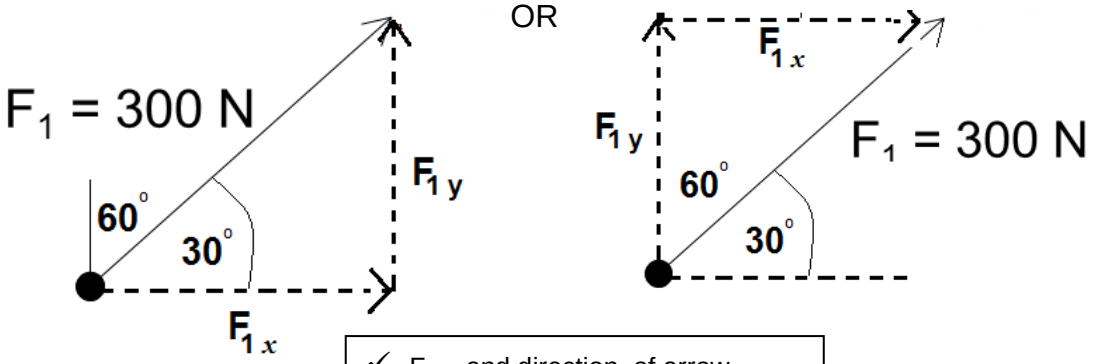
1.1	D	✓✓	(2)
1.2	B	✓✓	(2)
1.3	C	✓✓	(2)
1.4	B	✓✓	(2)
1.5	D	✓✓	(2)
1.6	B	✓✓	(2)
1.7	C	✓✓	(2)
1.8	A	✓✓	(2)
1.9	A	✓✓	(2)
1.10	C	✓✓	(2)

[20]

QUESTION 2 / *VRAAG 2*:

2.1 The vector sum of all the vectors/forces acting on an object ✓✓ **OR**
The single vector that will have the same effect as the original vectors/forces taken together.
Die vektorsom van al die vektore/kragte wat op 'n voorwerp inwerk ✓✓ ***OF***
Die enkele vektor wat dieselfde effek het as al die ander vektore/kragte saam. (2)

2.2



✓ F_{1y}, and direction of arrow
F_{1y}, en rigting van pylpunt.
✓ F_{1x} and direction correct
F_{1x}, en rigting korrek
✓ an angle shown 30˚ or 60˚ /
'n *hoek* 30˚ of 60˚ *aangetoon*

(3)

2.3.1 F_{1y} = F x sin 30˚ ✓
= 300 x sin 30˚
= 150 N at 0˚ / North/ upwards
Noord / opwaarts

F_{1x} = F x cos 30˚ ✓
= 300 x cos 30˚
= 259,80... N at 90˚ / East/ right
Oos/ regs

F_{2y} = F x sin 20˚✓
= 450 x sin 20˚
= 153,90... N at 180˚ / South/ down
Suid / afwaarts

F_{1x} = F x cos 20˚✓
= 450 x cos 20˚
= 422,86... N at 90˚ / East/ right
Oos/ regs

F_{1y} = F x cos 60˚ ✓
= 300 x cos 60˚
= 150 N at 0˚ / North/ upwards
Noord / opwaarts

F_{1x} = F x sin 60˚ ✓
= 300 x sin 60˚
= 259,81 N at 90˚ / East/ right
Oos/ regs

F_{2y} = F x cos 70˚
= 450 x cos 70˚
= 153,91 N at 180˚/South/ down
Suid / afwaarts

F_{1x} = F x sin 70˚
= 450 x sin 70˚
= 422,86 N at 90˚ / East/ right
Oos/ regs

$F_{net\,y} = F_{1}y + F_{1}y$ ✓

$= + 150 - 153,91$

$= - 3,91$ N

$=$ 3,91 N at 180˚ south/ downwards *Suid / afwaarts* ✓

$F_{net\,x} = F_{1}x + F_{1}x$

$= + 259,81 + 422,86$

$=$ 682,67 N at 90˚ / East/ right Oos/ regs ✓

$F_{net}^{2} = F_{net\,y}^{2} + F_{net\,x}^{2}$ ✓

$= 3,91^{2} + 682,67^{2}$

$F_{net} = 682,68$ N ✓

(9)

2.3.2 OPTION 1: $\tan \theta = \frac{o}{a}$ ✓

$\theta = \tan^{-1}(T_B / F_g)$

$= \tan^{-1} \times (3,91 / 682,67)$ ✓

$= 0,328$ ˚✓

OPTION 2: $\sin \theta = \frac{o}{h}$

$\sin \theta = F_x / F_{net}$ ✓

$= (3,91 / 682,68)$ ✓

$= 0,328$ ˚✓

OPTION 3:

$\cos \theta = \frac{a}{h}$

$\cos \theta = F_y / F_{net}$ ✓

$= (682,67 \div 682,68)$ ✓

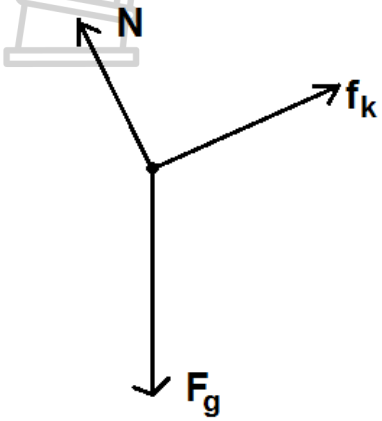
$= 0,31$ ˚✓

(3)

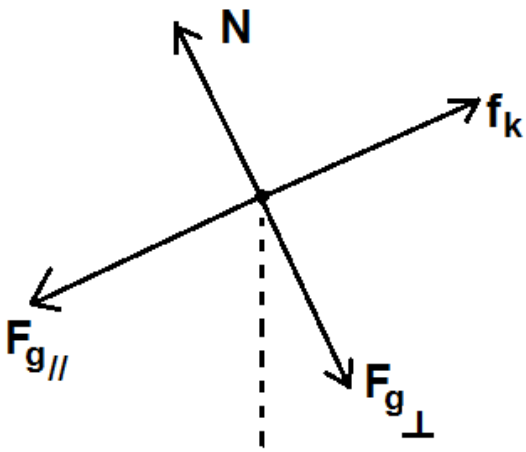
[17]

QUESTION 3 / VRAAG 3:

3.1



ACCEPT:



OR

Criteria for Free body diagram / *Kriteria vir vryliggaam :*	Marks/ *Punte*
F_k – upwards /opwaarts	✓
Fg/ W // $Fg_\perp$ &$Fg_{//}$ – down towards centre of earth - afwaarts na middel van aarde	✓
F_N - upwards ⊥ to F_k / opwaarts ⊥ met F_k	✓

(3)

3.2 The force that opposes the motion of an object and which acts parallel to the surface. ✓✓

Is die krag wat die beweging van 'n voorwerp teëstaan en wat parallel met die oppervlak werk✓✓ (2)

3.3 **OPTION 1:**

$f_k = \mu_k \times N$ ✓

$= 0,112$ ✓ x (70 x 9,8 ✓ x cos 20˚) ✓

= 72, 20 N ✓// up the slope ✓ *// op met helling*

OPTION 2:

N = Fg x cos 20˚✓

= (70 x 9,8) x cos 20˚ ✓

= 644,63 N ✓

$f_k = \mu_k \times N$ ✓

$= 0,112 \times 644,63$ ✓

= 72, 20 N // up the slope ✓ *// op met helling* (6)

3.4.1 DECREASE ✓✓ *VERMINDER* (2)

3.4.2 Fg ⊥ will decrease ∴ Normal F will decrease ✓

- *Fg ⊥ sal verminder as die helling steiler word ∴ die Normale krag sal verminder.* ✓

Since $f_k \alpha N$, then f_k will also decrease. ✓

Aangesien $f_k \alpha N$, sal die f_k ook verminder. ✓ (2)

3.5.1 REMAIN THE SAME ✓✓

- *BLY DIESELFDE* ✓✓ (2)

3.5.2 As the mass increase, the normal will increase ✓∴ f_k will increase proportionally $f_k \alpha N$ and μ remains the same for the surface. ✓

As die massa verhoog, sal die Normaalkrag verhoog ✓∴ f_k sal proporsioneel verhoog $f_k \alpha N$ en μ bly dieselfde vir die spesifieke oppervlak. ✓ (2)

OR / *OF*

$a \alpha {}^{1}/_{m}$ ∴ as m increase, a will decrease, but $F_{g//}$ and f_k will proportionally increase as well

$a \alpha {}^{1}/_{m}$ ∴ as m vermeerder sal a verminder, maar $F_{g//}$ en f_k sal proporsioneel verhoog

[19]

QUESTION 4 / *VRAAG 4:*

4.1 An object will remain at rest or, if it is moving, will carry on moving in a straight line unless acted upon by a resultant/ net force. ✓✓

'n *Voorwerp sal in 'n toestand van rus of konstante snelheid bly voortbeweeg tensy 'n eksterne resultante/netto krag daarop inwerk.* ✓✓ (2)

4.2 The box will continue to move forward at 30 $m.s^{-1}$✓✓

Die boks sal aanhou vorentoe beweeg teen 30 $m.s^{-1}$ ✓✓ (2)

4.3

F_{net} = m x a ✓

= 20 x - 30 ✓

= - 600 N

= 600 N✓ against the motion ✓/ *teen rigting van beweging* ✓ (4)

4.4

The back of the car seat has a much bigger area than the straps✓ ∴as pressure α 1/ area ✓ it will mean that the baby/toddler has a much bigger chance to survive as the pressure will decrease significantly.✓

Die agterkant van die karstoeltjie het 'n baie groter oppervlak as die veiligheids-gordels ✓ ∴ as die druk α1/area ✓ dit sal dus beteken dat die baba/kleuter 'n baie groter kans het op oorlewing. ✓ (3)

[11]

QUESTION 5: *VRAAG 5*

5.1

✓ F_g / w (lower case) and direction of arrow *F_g / w (klein letter), rigting van pylpunt.* ✓ T and direction correct *T en rigting korrek*

(2)

5.2 If a resultant force act on a body, it causes the body to accelerate in the direction of the force ✓ and **the acceleration** is directly proportional to the resultant force and indirectly proportional to the mass of the body. ✓

*Indien 'n resulterende /net krag op 'n voorwerp inwerk, sal die voorwerp versnel in the rigting van die resulterende krag. ✓ Die **versnelling** is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. ✓* (2)

5.3 $F_{net\ on\ A} = m \times a = -T + F_g$ ✓ $F_{net\ on\ B} = m \times a = -F_g + T$ ✓

$0{,}375a = -T + (0{,}375 \times 9{,}8)$ $0{,}225a = -(0{,}225 \times 9{,}8) + T$

$T = -0{,}375a + 3{,}675 \ldots (1)$ ✓ $T = 0{,}225a + 2{,}205 \ldots . (2)$ ✓

(1) = (2): $-0{,}375a + 3{,}675 = 0{,}225a + 2{,}205$ ✓

$0{,}6\ a = 1{,}47$

$a = 2{,}45\ m{\cdot}s^{-2}$ ✓ (5)

5.4

Into (1)	/ Into (2)
$T = -0{,}375a + 3{,}675 \ldots (1)$ ✓	$T = 0{,}225a + 2{,}205 \ldots . (2)$
$T = (-0{,}375 \times 2{,}45) + 3{,}675$ ✓	$T = (0{,}225 \times 2{,}45) + 2{,}205$
$T = 2{,}76$ N ✓	$T = 2{,}76$ N

(3)

[12]

QUESTION 6 / VRAAG 6:

6.1 Every particle in the universe exerts a force of gravitational attraction on every other particle. The force between the two particles is directly proportional to the product of their masses ✓and inversely proportional to the square of the distance between them. ✓

Elke voorwerp in die heelal trek elke ander voorwerp aan met 'n krag wat direk eweredig is aan die produk van die massas van die voorwerpe ✓*en omgekeerd eweredig is aan die kwadraat van die afstand tussen die massa-middelpunte van die twee voorwerpe.* ✓ (2)

6.2 $F = \frac{Gm_1m_2}{r^2}$ ✓

$= \frac{6,67 \times 10^{-11} \times 5,98 \times 10^{24} \times 419725}{r^2}$ ✓

$3,64 \times 10^6$ ✓

r = 6781804,029 m accept / *aanvaar* 6781804,03 m

∴distance above the earth

= r – radius of the earth

= 6781804,029 – $6,38 \times 10^6$ ✓

= 401804,029 m

= 401,80 km ✓above the surface of the earth/

bokant die oppervlak van die aarde (5)

6.3 Fg / w = m x g ✓

650 = m x 9,8

m = 66,33 kg ✓ (= 66,3265 kg)

Mass remains constant / *Massa is 'n konstante* ✓ (3)

6.4 $F = m \times a$

$= 419\,725 \times 0,6$ ✓

$= 251835$ N

$\therefore F_{net} = F_{app} - F_{earth}$ ✓

$251835 = F_{app} - 3,64 \times 10^6$ ✓

$= 3891835$ N ✓away from the earth. / Weg van die aarde af ✓ (5)

6.5.1 DECREASE / *VERMINDER* ✓✓ (2)

6.5.2 The gravitational force decreases as the satellite moves away from the earth. ✓

$g \alpha 1/r^2$ ✓ (2)

Die gravitasiekrag verminder hoe verder die sateliet van die aarde af beweeg.✓

$g \alpha 1/r^2$ ✓

[19]

QUESTION 7 / VRAAG 7:

7.1 The refractive index (n) is the ratio of the speed of light in air to the speed of light through another medium. ✓✓ (2)

Die brekingsindeks (n) is die verhouding van die spoed van lig in 'n vakuum tot die spoed van lig in die medium ✓✓

7.2 When light is moving from a less dense medium (air) to a more dense medium (water) it will be refracted towards the normal. ✓✓ (2)

Wanneer lig van 'n minder digte medium (lug) na 'n meer digte medium (water) beweeg word dit na die normaal toe gebreek. ✓✓

7.3 $n = \frac{c}{v}$ ✓

$1,33 = \frac{3 \times 10^8}{v}$ ✓

$v = 2,26 \times 10^8$ $m \cdot s^{-1}$ ✓ (3)

7.4 $n_i \sin \theta_i = n_r \sin \theta_r$ ✓

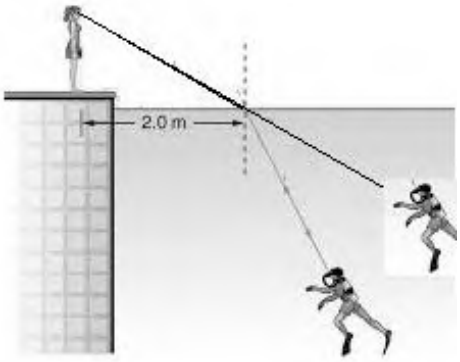
$1 \times \sin 42° ✓ = 1,33 ✓ \sin \theta_r$

$\theta_r = 30,21°$ ✓ (4)

7.5.1 Snell's law ✓✓/ *Snell se wet* ✓✓ (2)

7.5.2 The ratio of the sine of the angle of incidence in one medium to the sine of the angle of refraction in the other medium is constant. ✓✓
Die verhouding van sin van die invalshoek in een medium tot sin van die brekingshoek in die ander medium is konstant. ✓✓ (2)

7.6



Marking Grid: *Merk gids*
✓The line is extrapolated straight into the water. *Die lyn word reguit verleng in die water in.*
✓ The driver is seen higher up in the water. *Die duiker word hoër op in die water gesien*.
✓ the diver is a bit further away from the normal. *Die duiker word 'n bietjie verder van die normaal af waargeneem*.

(3)

7.7 If the light from the fish hits the surface at 90˚ ✓ there will be no refraction of the light, ✓ making it much easier for the bird to determine the exact position of the fish. ✓ (3)
As die lig wat van die vis af weerkaats die oppervlak teen 90˚✓bereik, sal daar geen breking/ buiging van die lig plassvind nie.✓wat dit dus makliker maak vir die voël om die presiese posisie van die vis vas te stel.✓

[21]

QUESTION 8 / *VRAAG 8*

8.1 45 ˚ ✓✓ (2)

8.2 Is that angle of incidence that provides an angle of refraction of 90°✓✓
Die invalshoek wat 'n brekingshoek van 90° tot gevolg het. ✓✓ (2)

8.3.1 Total internal reflextion. ✓✓
Totale interne weerkaatsing. ✓✓ (2)

8.3.2 Light must travel from an optical more dense medium to an optical less dense medium.✓✓
Die invalstraal moet vanaf 'n opties meer digte medium na 'n opties minderdigte medium beweeg. ✓✓
The angle of incidence must be bigger than the critical angle of that medium. ✓✓
Die invalshoek moet groter as die grenshoek van die betrokke medium wees. ✓✓ (4)

8.4 $n = \frac{c}{v}$ ✓

$= \frac{3 \times 10^8}{2{,}21 \times 10^8}$ ✓

= 1,36 ✓ (3)

8.5 Telescope ✓✓/ Microscope/ binoculars (Any One)
Teleskoop/ mikroskoop/ verkyker (Enige een) ✓✓ (2)

8.6 Signal move much faster
Less interference / more data can be transferred
Very difficult to tap/ safer transfer of data
Any 2 ✓✓ (2)

Sein beweeg baie vinniger
Minder steurings / meer data kan versend word
Dit is baie moeilik om inligting te steel.
Enige 2 ✓✓

[17]

QUESTION 9 / VRAAG 9:

9.1 All points on a wave front act like a point source. Each one of these point sources (secondary sources) produces small circular waves moving forwards with the same speed as the wave. The new wave front is obtained by drawing a tangent to all the new little wave fronts. ✓✓ (2)
Elke punt van 'n golffront dien as 'n puntbron van klein sferiese sekondêre golwe. Die golffront is dan 'n raaklyn loodreg op die kleiner sekondêre golwe. ✓✓

9.2.1 Diffraction ✓✓ *Diffraksie* ✓✓ (2)

9.2.2 The ability of a wave to spread out in wave fronts as they pass through a small opening or around a sharp edge. ✓✓ (2)
Die vermoë van 'n golf om uit te sprei in golffronte soos die golf deur 'n klein opening of om 'n skerp hoek voortplant. ✓✓

9.3.1 Constructive interference ✓✓

Konstruktiewe interferensie✓✓ (2)

9.3.2 The angle of interference is directly proportional to the wavelength.✓✓

∴ if the wavelength is longer (red light) the observed diffraction pattern is bigger ✓✓

Die diffraksiehoek is direk eweredig aan die golflengte.✓✓ (4)

∴ hoe langer die golflengte(rooi lig) hoe groter die diffraksiepatroon wat waargeneem word.✓✓

9.3.3 Decrease the opening of the slit.✓✓ (2)

Maak die opening van die spleet kleiner ✓✓

[14]

TOTAL / *TOTAAL:* 150

Taxonomy Grid

Recall		Comprehension		Analysis		Evaluation	
Q no:	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**	**Q no:**	**Mark**
1.1	2	1.3	2	1.7	2	2.3.2	3
1.2	2	1.4	2	1.8	2	3.5	4
2.1	2	1.5	2	1.9	2	4.6	4
3.2	2	1.6	2	1.10	2	6.5	3
4.1	2	2.2	4	2.3.1	9	7.7	3
5.1	2	3.1	4	3.3	6		
5.2	2	4.2	2	3.4	4		
6.1	2	5.4	3	4.3	4		
7.1	2	6.3	3	4.4	3		
7.6.2	2	7.2	2	5.3	5		
8.2	2	7.3	4	6.2	4		
9.1	2	7.4	3	6.4	4		
		8.1	1	7.5	4		
		8.3	6	7.6.1	2		
		8.4	2	8.5	2		
		8.6	4	9.3	6		
		9.2	4	9.4	2		
16%	24	33,33%	50	40%	63	10,67%	17

Total mark	**16%**	**24**	**33,33%**	**50**	**42%**	**63**	**11%**	**17**
Total %/**100%**	**P1&2: 15%**		**P1:35%/P2:40%**		**P1:40%/P2:35%**		**P1&2: 10%**	