GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
JUNIE EKSAMEN
GRADE/*GRAAD* 12

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MARKING GUIDELINES/NASIENRIGLYNE

TECHNICAL SCIENCES/
TEGNIESE WETENSKAPPE

(PAPER/*VRAESTEL* 1)

11 pages

QUESTION/*VRAAG* 1

1.1 D ✓✓

1.2 C ✓✓

1.3 A ✓✓

1.4 B ✓✓

1.5 B ✓✓

1.6 C ✓✓

1.7 D ✓✓

1.8 D ✓✓

1.9 C ✓✓

1.10 C ✓✓ (20)

QUESTION/*VRAAG* 2

2.1 2.1.1 Inertia ✓ – The tendency of an object to resist any change in its state of motion (resist change of direction and speed). ✓✓

OR

Newton's first law- ✓An object will remain in its state of rest or continue moving with a constant/uniform velocity ✓ unless acted upon by unbalanced net force. ✓

Traagheid ✓– Die neiging van 'n voorwerp om enige verandering in sy bewegingstoestand te weerstaan (weerstaan verandering van rigting en spoed). ✓✓

OF

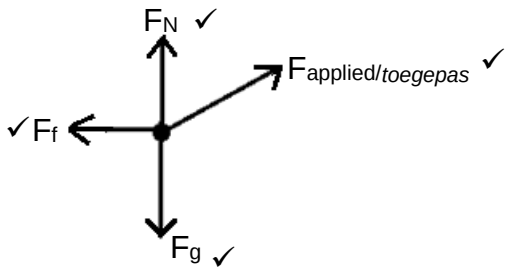
Newton se eerste wet- ✓'n Voorwerp sal in sy rustoestand bly of aanhou beweeg met 'n konstante/uniforme snelheid ✓tensy 'n ongebalanseerde netto krag ✓daarop inwerk. (3)

2.1.2 The air bag increases contact time, Δt, ✓ this in turn decreases net force ✓ exerted on the driver. From $F_{net} = \frac{\Delta P}{\Delta t}$ the net force is inversely proportional ✓ to contact time for the same change in momentum.
Lugsak verhoog kontaktyd $F_{net}t = \Delta t$ ✓dit verminder op sy beurt netto krag ✓wat op die bestuurder uitgeoefen word. Vanaf $F_{net} = \frac{\Delta P}{\Delta t}$ is die netto krag omgekeerd eweredig ✓vir kontaktyd vir dieselfde verandering in momentum. (3)

2.1.3 120 km.h^{-1} x 1 000 ✓/3 600 ✓ = 33,33 m·s^{-1} ✓ (simple conversion/ *eenvoudige omskakeling*) (3)

2.2 2.2.1 When a net force acts on an object it produces acceleration in the direction of the net force. Acceleration is directly proportional to net force ✓ and is inversely proportional to the mass of the object. ✓
Wanneer 'n netto krag op 'n voorwerp inwerk, veroorsaak dit versnelling in die rigting van die netto krag. Versnelling is direk eweredig aan netto krag ✓en is omgekeerd eweredig aan die massa van die voorwerp. ✓ (2)

2.2.2 ONE mark per correct force. Arrows must be indicated. No extra forces.
EEN punt per korrekte krag. Pyltjies moet aangedui word. Geen ekstra kragte nie.



(4)

2.3 2.3.1 Newton's third law ✓ – When object A exerts a force on object B, ✓ object B will simultaneously exert the same magnitude of force on object A but in the opposite direction ✓.
Newton se derde wet ✓– Wanneer voorwerp A 'n krag op voorwerp B uitoefen, ✓sal voorwerp B gelyktydig dieselfde grootte krag uitoefen op voorwerp A maar in die teenoorgestelde rigting ✓. (3)

2.3.2 $F_g = mg$ ✓
50.96N = m x 9.8 m.s^{-2} ✓
m = 5,2kg ✓ (3)

2.3.3 $F_{net} = ma$ ✓
F_{net} = 5,2 kg x 1,67 m.s^{-2} ✓
8,68 N to the right/*na regs* ✓ (3)

2.3.4 F_{net} = 10 – 8,684 N ✓
= 1,316N ✓ to the left/*na links* ✓ (3)

QUESTION/*VRAAG* 3

3.1 Inelastic collision/*Onelastiese botsing* ✓✓ (1)

3.2 The total linear momentum in a closed system remains constant in magnitude and direction. ✓✓

OR

The total momentum before collision in a closed system remains the same as the total momentum after collision. ✓✓
Die totale lineêre momentum in 'n geslote sisteem bly konstant in grootte en rigting. ✓✓

OF

Die totale momentum voor botsing in 'n geslote sisteem bly dieselfde as die totale momentum na botsing. ✓✓ (2)

3.3 **OPTION/*OPSIE* 1**

Total Momentum before = Total momentum after
Totale momentum voor = Totale momentum na
$\Sigma p_B = \Sigma p_A$
$m_A v_{iA} + m_B v_{iB} = (m_A + m_B)\, v_f$ ✓
$(2\,200)(14) + (1\,200)(-40)$ ✓ $= (2\,200+1\,200)v_f$ ✓
$v_f = -5{,}06\ m\cdot s^{-1}$
$v_f = 5{,}06\ m\cdot s^{-1}$ west/*wes* ✓ (–1 if no units, no direction/*–1 vir geen eenhede of rigting nie*)

OPTION/*OPSIE* 2

Total Momentum before = Total momentum after
Totale momentum voor = Totale momentum na
$\Sigma p_B = \Sigma p_A$
$m_A v_{iA} + m_B v_{iB} = (m_A + m_B)\, v_f$ ✓
$(2\,200)(-14) + (1\,200)(40)$ ✓ $= (2\,200+1\,200)v_f$ ✓
$v_f = -5{,}06\ m\cdot s^{-1}$ west/*wes* ✓ (4)

3.4 3.4.1 Equal in size ✓ but opposite in direction ✓ **OR** Δp(A) = –Δp(B)
*Ewe groot ✓maar in die teenoorgestelde rigting ✓**OF** Δp(A) = –Δp(B)* (2)

3.4.2 The change in momentum for both cars are equal in magnitude. ✓ The contact time (Δt) is the same for both cars. ✓
Die verandering in momentum vir beide motors is ewe groot. ✓Die kontaktyd (Δt) is dieselfde vir beide motors. ✓

$m_A (v_f – v_i)_A = m_B(v_i – v_f)_B$
$(v_f – v_i)_A < (v_f – v_i)_B$

It is a safer situation for the passenger in the heavier car **A** because of the smaller change in velocity for the car ✓ and therefore the statement is correct.
*Dit is 'n veiliger situasie vir die passasier in die swaarder motor **A** as gevolg van die kleiner verandering in snelheid vir die motor✓en daarom is die stelling korrek.* (3)

3.5 $F_{net}\Delta t = \Delta p = m(v_i – v_f)$ ✓
$F_{net}\Delta(0.1)$ ✓ $= 2\,000(0 – 10)$ ✓
–200 000 N ✓away from the wall/*weg van die muur af* ✓ (5)

3.6 3.6.1 Total momentum before = Total momentum after (*this differs from 3.3 where the objects got stuck, note the direction*)
Totale momentum voor = Totale momentum na (dit verskil van 3.3 waar die voorwerpe vasgehak het, let op die rigting)

OPTION/*OPSIE* 1

$m_Av_{iA} + m_Bv_{iB} = m_Av_{FA} + m_Bv_{fB}$ ✓
(0,02 x 3) + (0,05)(–1) ✓ = (0,02 x –2,5) + (0,05)(v_f) ✓
v_f = 0,12 m·s^{-1} to the right/*na regs* ✓

OPTION/*OPSIE* 2

$m_Av_{iA} + m_Bv_{iB} = m_Av_{FA} + m_Bv_{fB}$ ✓
(0,02 x –3) + (0,05)(1) ✓ = (0,02 x 2,5) + (0,05)(v_f) ✓
v_f = –0,12 m·s^{-1} to the right/*na regs* ✓ (4)

3.6.2 ΣE_k (before/*voor*) = E_k (Ball/*Bal* A) + E_k (Ball/*Bal* B) ✓
= $(\frac{1}{2} mv^2)_A + (\frac{1}{2} mv^2)_B$
= $(0,5 \times 0,02 \times 3^2) + (0,5 \times 0,05 \times -1^2)$ ✓
= 0,065 (Except/*Aanvaar* 0,07) J ✓

ΣE_k (after/*na*) = E_k (Ball A) + E_k (Ball B)
= $(\frac{1}{2} mv^2)_A + (\frac{1}{2} mv^2)_B$
= $(0,5 \times 0,02 \times -1^2) + (0,5 \times 0,05 \times 0,12^2)$ ✓
= 0,01 J ✓
$E_{k\ before} \neq E_{k\ after}$ the collision is inelastic ✓
E_k voor ≠ E_k na die botsing is onelasties ✓ (6)

QUESTION/*VRAAG* 4

4.1 Work is the product of the net force applied on an object and the displacement in the direction of the force. ✓✓
Werk is die produk van die resultante krag wat op 'n voorwerp toegepas word en die verplasing in die rigting van die krag. ✓✓ (2)

4.2 **OPTION/*OPSIE* 1**

$W_{Fg} = F_g \Delta x \cos\theta$
$= mg \Delta x \cos\theta$
$= mg \Delta x \cos 180°$ ✓
$= 0,3 \times 9,8 \times 0,8 \times \cos 180°$ ✓
$= 0,3 \times 9,8 \times 0,8 \times -1$
$= -2,35$ J ✓
∴ W_{Fg} = 2,35 J against the motion of the phone/*teen die beweging van die foon*

OPTION/*OPSIE* 2

Work done by Fg (W_{Fg}) = $-\Delta$ Ep
Arbeid verrig deur Fg (W_{Fg}) = $-\Delta$ Ep
$W_{Fg} = -mg(hf - hi)$ ✓
$= -(0,3)(9,8)(0,8 - 0)$ ✓
$W_{Fg} = -2,35$ J ✓
∴ W_{Fg} = 2,35 J against the motion of the phone/*teen die beweging van die foon* (3)

4.3 Power is the rate at which work is done. ✓✓
Drywing is die tempo waarteen werk verrig word. ✓✓

OR/*OF*

Power is the rate at which energy is expended/transferred. ✓✓
Drywing is die tempo waarteen energie verbruik/oorgedra word. ✓✓

OR/*OF*

Power is the rate at which energy changes/is transferred. ✓✓
Drywing is die tempo waarteen energie verander/oorgedra word. ✓✓ (2)

4.4 **OPTION/*OPSIE* 1**

$W = F_{net} \Delta x \cos\theta$
$= 15 \times 0,8 \times \cos 0°$✓
$= 12$ J
$P = \frac{W}{\Delta t}$ ✓
$P = \frac{12}{4}$ ✓
$P = 3$W

OPTION/*OPSIE* 2

$P = \frac{W}{\Delta t}$ or $P = \frac{Fnet\ \Delta x Cos\ \theta}{\Delta t}$
$P = \frac{15 \times 0,8 \times Cos\ \theta}{\Delta t}$ *(one mark for substitute/een punt vir substitusie* 15 x 0,8 x Cos 0°✓)
$= 12$J ✓ (4)

4.5 The total mechanical energy in an isolated system remains constant/is conserved. ✓✓
Die totale meganiese energie in 'n geïsoleerde sisteem bly konstant/word bewaar. ✓✓

The sum of gravitational potential energy and kinetic energy in an isolated system remains constant/is conserved. ✓✓
Die som van gravitasie-potensiële energie en kinetiese energie in 'n geïsoleerde sisteem bly konstant/word bewaar. ✓✓ (2)
[13]

QUESTION/*VRAAG* 5

5.1 A = length x breath (width)/*A = lengte x breedte*
= 0,06 x 0,02 ✓
= 0,0012 m^2 or 1,2 x 10^{-3} m^2 ✓

$\sigma = \frac{F}{A}$ ✓

$= \frac{0,05}{0,0012}$ ✓

= 41,67 Pa ✓ (5)

5.2 5.2.1 The ratio of change in dimension to the original dimension.
Die verhouding van verandering in dimensie tot die oorspronklike dimensie. (2)

5.2.2 **Conversion/*omskakeling*** ✓: 10 kN x 1 000 = 10 000 N

Radius = $\frac{\text{diameter/ } \textit{deursnee}}{2}$

$= \frac{50}{2}$ ✓

= 25 mm (25 mm to 0,025) ✓

$A = \pi r^2$
$= 3,14\ (0,025)^2$ ✓
= 1,9625 x 10^{-3} m^2 ✓

$\sigma = \frac{F}{A}$ ✓

$= \frac{10\ 000}{1,9625 \quad x\ 10^{-3}}$ ✓

= 5 095 Pa ✓ (8)

5.2.3 $\varepsilon = \frac{\Delta l}{L}$ ✓

$= \frac{0,1}{5000}$ ✓

= 2 x 10^{-5} or 0,00002 ✓ (3)

5.3 Hooke's law states that, within the limit of elasticity, stress is directly proportional to strain. ✓✓
Hooke se wet bepaal dat, binne die limiet van elastisiteit, spanning direk eweredig aan rekking is.3] ✓✓ (2)
[20]

QUESTION/*VRAAG* 6

6.1 Society of Automotive Engineers ✓/*Vereniging van Motoringenieurs* ✓ (1)

6.2 The viscosity decreases with an increase in temperature. Inversely proportional. ✓✓
Die viskositeit neem af met 'n toename in temperatuur. Omgekeerd eweredig ✓✓ (2)

6.3 Lower-viscosity oils pass more freely throughout engines, increasing oil volume circulation. Too low viscosity can also lead to excessive volatilisation and oil consumption in engines, it does not lubricate as well as thick oils. ✓✓
Olies met laer viskositeit beweeg meer vrylik deur enjins, wat die olievolume sirkulasie verhoog. Te lae viskositeit kan ook lei tot oormatige vervlugtiging en olieverbruik in enjins, dit smeer nie so goed soos dik olies nie. ✓✓ (2)

6.4 All liquids thin out as heat increases but a multigrade oil keeps viscosity at optimum levels within a certain temperature range, e.g. 10W-40. Monograde oils do not have a low temperature requirement. Therefore, as the temperature decreases, they thicken considerably faster than equivalent multigrade oils. ✓✓
Alle vloeistowwe verdun soos hitte toeneem, maar 'n multigraad hou viskositeit op optimum vlakke binne 'n sekere temperatuurreeks, bv. 10W-40. Monograad olies het nie 'n lae temperatuur vereiste nie. Daarom, soos die temperatuur daal, verdik hulle aansienlik vinniger as ekwivalente multigraad-olies. ✓✓ (2)

6.5 15W-40 viscosity grade means it flows like a 15 weight oil from start up in winter, but provides the protection of a 40 weight once the engine reaches full operating temperature. ✓✓
15W-40-viskositeitsgraad beteken dit vloei soos 'n 15-gewig-olie vanaf die motor begin draai in die winter, maar bied die beskerming van 'n 40-gewig sodra die enjin die volle werkstemperatuur bereik. ✓✓ (2)
[9]

QUESTION/*VRAAG* 7

7.1 7.1.1 For a continuous liquid at equilibrium, the pressure applied at a point is transmitted equally to the other parts of the liquid. ✓✓
Vir 'n kontinue vloeistof by ewewig, word die druk by 'n punt toegepas eweredig na die ander dele van die vloeistof oorgedra. ✓✓ (2)

7.1.2 Pressure is greater at the bottom than at the top. ✓ As you go deeper more water with weight is above you, ✓ increasing the pressure. ✓
Druk is groter aan die onderkant as die bokant. ✓*Soos jy dieper gaan, is meer water met gewig bo jou,* ✓*dit verhoog die druk.* ✓ (3)

7.1.3 No, ✓ the pressure is applied equally at a certain depth according to Pascal's law. ✓✓
Nee, ✓*die druk word eweredig toegepas op 'n sekere diepte volgens Pascal se wet.* ✓✓ (2)

7.2 $\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓

The area of the piston is unknown, but/*Die area van die suiers is onbekend maar:*

$A = \pi r^2$

$$\frac{F_1}{\pi r_1^2} = \frac{F_2}{\pi r_2^2}$$

$$\frac{F_1}{(3{,}14)(5{,}0 \times 10^{-2})^2 ✓} = \frac{13\,300}{(3{,}14)(15{,}0 \times 10^{-2})^{2 ✓}}$$

$F_1 = 1{,}48 \times 10^3$ N ✓ (5)

[12]

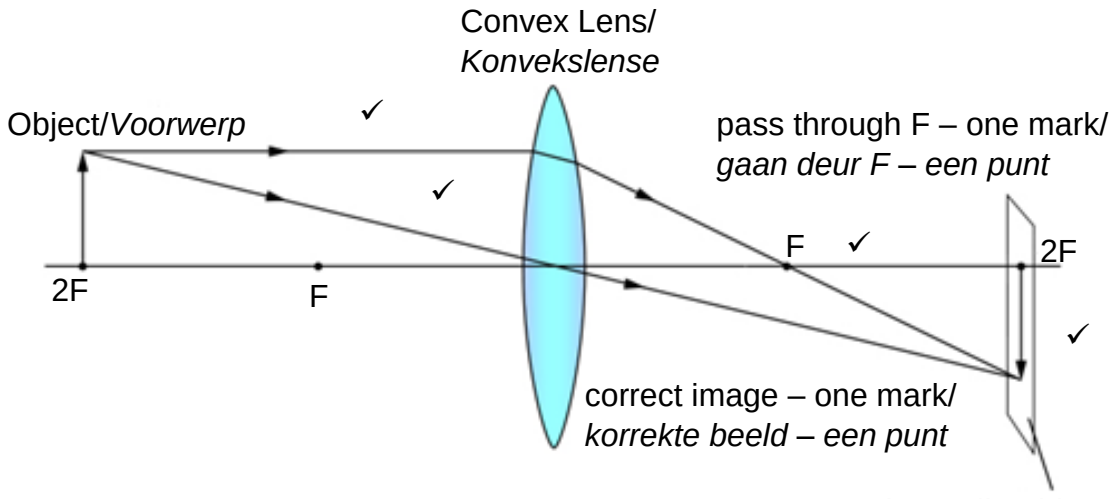
QUESTION/*VRAAG* 8

8.1 8.1.1 Far-sightedness (hyperopia) is a common vision condition in which you can see distant objects clearly, but objects nearby may be blurry. The degree of your far-sightedness influences your focusing ability. ✓✓
Versiendheid (hiperopie) is 'n algemene sigtoestand waarin jy verafgeleë voorwerpe duidelik kan sien, maar voorwerpe naby kan vaag wees. Die mate van jou versiendheid beïnvloed jou fokusvermoë. ✓✓ (2)

8.1.2 Convex lenses/*Konvekslense* ✓ (1)

8.2 8.2.1 The process of white light splitting into its constituent colours is termed dispersion. ✓✓
Die proses van wit lig wat in sy samestellende kleure verdeel word, word dispersie genoem. ✓✓ (2)

8.2.2



(4)

8.2.3 Same size as the object/*Dieselfde grootte as die voorwerp* ✓
Inverted/*Omgekeerd* ✓
Real/*Ware beeld* ✓ **(Any 2/*Enige 2*)** (2)

8.3 8.3.1 EM waves *are waves that* are created as a result of vibrations between an electric field and a magnetic field./Changing magnetic and electric fields are mutually perpendicular to each other and the direction of propagation of the wave. ✓✓
EM-golwe is golwe wat geskep word as gevolg van vibrasies tussen 'n elektriese veld en 'n magnetiese veld./Verandering in magneties en elektries velde is onderling loodreg op mekaar en die voortplantingsrigting van die golf ✓✓ (2)

8.3.2 Indirectly/inversely proportional ✓/*omgekeerd eweredig* (1)

8.4 $c = f \times \lambda$ ✓
$3{,}0 \times 10^{8}\ m\ s^{-1} = 3 \times 10^{-9} \times f$ ✓
$f = 1 \times 10^{17}\ Hz$ ✓ (3)

8.5 red, ✓ orange, ✓ yellow, ✓ green, ✓ blue, ✓ indigo, ✓ and violet ✓
(Any 5 for one mark each.)
rooi,✓oranje,✓geel,✓groen,✓blou,✓indigo,✓en violet✓
(Enige 5 vir een punt elk.) (5)
[22]

TOTAL/*TOTAAL*: 150