education

Department of
Education
FREE STATE PROVINCE

CONTROL TEST / *KONTROLETOETS*

GRADE 12 / *GRAAD 12*

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

MARCH 2022 / *MAART 2022*

MARKS: 100 / *PUNTE: 100*

This memorandum consists of eight pages.
Hierdie memorandum bestaan uit agt bladsye.

QUESTION 1 / *VRAAG 1*

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

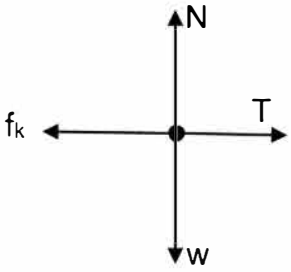
[20]

QUESTION 2 / *VRAAG 2*

2.1 When a net force is applied to an object, the object accelerates in the direction of the net force. Acceleration is directly proportional to the net force ✓and inversely proportional to the mass of the object. ✓

Wanneer 'n resulterende/netto krag op 'n voorwerp inwerk, versnel die voorwerp in die rigting van die netto krag teen 'n versnelling direk eweredig aan die netto krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2



Accepted labels *Aanvaarbare byskrifte*		
w	F_g / gravitational force / weight *F_g / gravitasiekrag / gewig*	✓
N	F_N / normal force / normal *F_N / normaalkrag / normaal*	✓
T	F_T/tension *F_T/spanning/spanningskrag*	✓
f_k	$F_{friction}$/f/friction / kinetic frictional force *$F_{wrywing}$/f/wrywing/kinetiese wrywingskrag*	✓

(4)

2.3 **A:**

$F_{net} = ma$ ✓
$F_H + T + f_k = ma$
$80\cos 30° - T - 7{,}68$ ✓ $= 8a$ ✓ both/beide
$T = 61{,}60 - 8a$ ..... (1)

B:

$F_{net} = ma$
$T + f_k = ma$
$T - 4{,}9$ ✓ $= 5a$
$T = 5a + 4{,}9$ ..... (2)

Solve for (1) and (2)

$a = 4{,}36\ m \cdot s^{-2}$ ✓ (5)

[11]

QUESTION 3 / *VRAAG 3*

3.1 Opposite (direction) ✓ Dieselfde (rigting) (1)

3.2 The total (linear) momentum of an isolated system remains constant (is conserved).
Die totale lineêre momentum in 'n geïsoleerde sisteem bly konstant (behoue).✓✓ (2)

3.3 A system on which the net external force is zero. ✓✓
'n Sisteem waarop die netto, eksterne krag nul is. (2)

3.4 3,5 – 2 = 1,5 s ✓ (1)

3.5 Σp(before/*voor*) = Σp(after/*na*) ✓
$m_t v_{it} + m_c v_{ic} = (m_c+m_t)v_f$
(2 000)v_{it} ✓ + 900 x (-4,5) ✓ = (2900)(3,2) ✓
v_{it} =6,665 m·s^{-1} (No mark here. / *Geen punt hier.*) (4)

3.6 **POSITIVE MARKING FROM 3.4. / *POSITIEWE NASIEN VANAF 3.4.***

$F_{net}\Delta t = \Delta p$ ✓ F_{net}(1,5) ✓ = **900**(3,2 -(-4,5) ✓ F_{net} = 4 620 N F_{net} = 4 620 N; opposite to car's direction of motion / *teenoorgesteld aan motor se bewegingsrigting* ✓	$F_{net}\Delta t = \Delta p$ ✓ F_{net}(1,5) ✓ = **2 000**(3,2 –6,665) ✓ F_{net} = -4 620 N F_{net} (**on car / op motor**) = 4 620 N; opposite to car's direction of motion / *teenoorgesteld aan motor se bewegingsrigting* ✓

(4)

3.7 ΣK(before) = ½mv^2 + ½mv^2
(*voor*) = ½(2000)(6,665)^2 + ½(900)(-4,5)^2 ✓
= 53 534,725 J

ΣK(after) = ½mv^2
(*na*) = ½(2 900)(3,2)^2 ✓
= 14 848 J

✓ Any one / *Enigeen*

ΣK(before/*voor*) ≠ ΣK(after/*na*) ✓ **OR/*OF***
ΣK(before/*voor*) > ΣK(after/*na*)

Inelastic/*Onelasties* ✓ (5)

3.7 Equal to ✓ Gelyk aan
Newton's third law of motion ✓ Newton se derde bewegingswet (2)
[21]

QUESTION 4 / *VRAAG 4*

4.1 An object which has been given an initial velocity and then it moves under the influence of the gravitational force only. ✓✓
'n Voorwerp waaraan 'n beginsnelheid gegee is en wat dan slegs onder die invloed van die gravitasiekrag beweeg. (2)

4.2.1

Up positive / *Op positief*	**Down positive / *Af positief***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ 0 ✓$= 10^2 + 2(-9,8)\ \Delta y$ ✓ $\Delta y = 5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ 0✓ $= (-10)^2 + 2(9,8)\ \Delta y$ ✓ $\Delta y = -5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓
From maximum height ***Vanaf maksimum hoogte*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(-10)^2$✓ $= 0^2 + 2(-9,8)\ \Delta y$✓ $\Delta y = -5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓	**From maximum height** ***Vanaf maksimum hoogte*** $v_f^2 = v_i^2 + 2a\Delta y$ ✓ 10^2 ✓$= 0^2 + 2(9,8)\ \Delta y$✓ $\Delta y = 5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓
$v_f = v_i + a\Delta t$ ✓ both/*beide* $0 = 10 + (-9,8)\Delta t$ ✓ $\Delta t = 1,0204$ s $\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ $= (10)(1,0204) + (0,5)(-9,8)(1,0204)^2$ ✓ $\Delta y = 5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓	$v_f = v_i + a\Delta t$ ✓ both/*beide* $0 = (-10) + (9,8)\Delta t$ ✓ $\Delta t = 1,0204$ s $\Delta y = v_i\Delta t + \frac{1}{2} a\Delta t^2$ $= (-10)(1,0204) + (0,5)(9,8)(1,0204)^2$ ✓ $\Delta y = -5,10$ m Max height / *Maks hoogte* = 40 + 5,10 = 45,10 m ✓

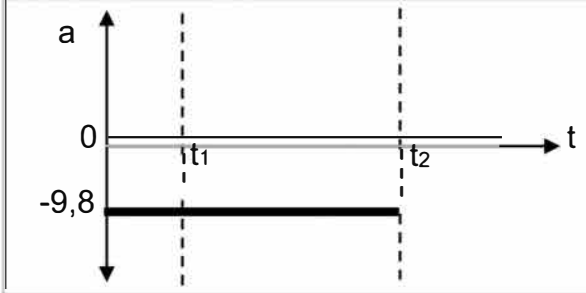
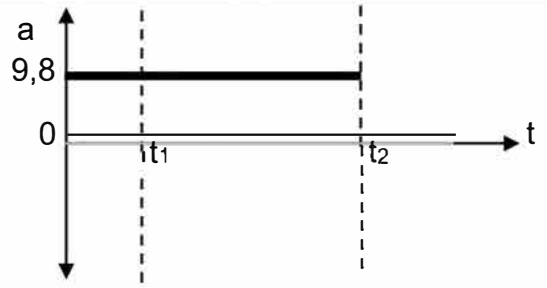
(4)

4.2.2

Up positive / *Op positief*	**Down positive / *Af positief***
$v_f^2 = v_i^2 + 2a\Delta y$ $= 10^2 + 2(-9,8)(-40)$ ✓ $v_f = -29,7321\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $-29,7321 = 10 + (-9,8)\Delta t$ ✓ $\Delta t = 4,05\ s$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ $= (-10)^2 + 2(9,8)(40)$ ✓ $v_f = +29,7321\ m\cdot s^{-1}$ $v_f = v_i + a\Delta t$ ✓ $29,7321 = -10 + (9,8)\Delta t$ ✓ $\Delta t = 4,05\ s$ ✓
FROM MAXIMUM HEIGHT: POSITIVE MARKING FROM 4.2.1 FOR THE HEIGHT. ***VANAF MAKSIMUM HOOGTE: POSITIEWE NASIEN VANAF 4.2.1 VIR DIE HOOGTE.***	
If Δt was NOT calculated in 4.2.1: $v_f = v_i + a\Delta t$ $0 = 10 + (-9,8)\Delta t$ ✓ $\Delta t = 1,0204\ s$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-45,10 = 0^2 + (0,5)(-9,8)\Delta t^2$ ✓ $\Delta t = 3,0338\ s$ $\Delta t = 3,0338 + 1,02 = 4,05\ s$ ✓ **If Δt WAS calculated in 4.2.1:** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $-45,10$ ✓$= 0^2 + (0,5)(-9,8)\Delta t^2$ ✓ $\Delta t = 3,0338\ s$ $\Delta t = 3,0338 + 1,02 = 4,05\ s$ ✓	**If Δt was NOT calculated in 4.2.1:** $v_f = v_i + a\Delta t$ $0 = -10 + (9,8)\Delta t$ ✓ $\Delta t = 1,0204\ s$ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $45,10 = 0^2 + (0,5)(9,8)\Delta t^2$ ✓ $\Delta t = 3,0338\ s$ $\Delta t = 3,0338 + 1,02 = 4,05\ s$ ✓ **If Δt WAS calculated in 4.2.1:** $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $45,10$ ✓$= 0^2 + (0,5)(9,8)\Delta t^2$ ✓ $\Delta t = 3,0338\ s$ $\Delta t = 3,0338 + 1,02 = 4,05\ s$ ✓

(4)

4.3

Up positive / *Op positief*	**Down positive / *Af positief***
	

Horizontal line from t = 0 up to t_2. *Horisontale lyn vanaf t = 0 tot by t_2.*	✓
Above t-axis if down is positive. Below t-axis if up is positive. *Bo t-as as af positief is.* *Onder t-as as op positief is.*	✓

No mark on the value.
Geen punt op die waarde nie.

If indication of direction is not given, the second mark is forfeited (Max 1/2).
As rigtingaanduiding nié gegee is nie, word die tweede punt verbeur (Maks. 1/2).

(2)

4.4.1

Up positive / *Op positief*	**Down positive / *Af positief***
$v_f = v_i + a\Delta t$ ✓ $= \underline{10 + (-9,8)(3,4)}$ ✓ $= -23,32\ m{\cdot}s^{-1}$ $v_f = 23,32\ m{\cdot}s^{-1}$ downward/*afwaarts* ✓	$v_f = v_i + a\Delta t$ ✓ $= \underline{-10 + (9,8)(3,4)}$ ✓ $v_f = 23,32\ m{\cdot}s^{-1}$ $v_f = 23,32\ m{\cdot}s^{-1}$ downward/*afwaarts*✓

(3)

4.4.2

Up positive / *Op positief*	**Down positive / *Af positief***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(10)(3,4)}$ ✓$+ \underline{(0,5)(-9,8)(3,4)^2}$ ✓ $= -22,644$ m $h = \underline{40 - 22,644}$ ✓ $= 17,36$ m ✓ (17,356)	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(-10)(3,4)}$ ✓ + $\underline{(0,5)(9,8)(3,4)^2}$ ✓ $= 22,644$ m $h = \underline{40 - 22,644}$ ✓ $= 17,36$ m ✓ (17,356)
POSITIVE MARKING FROM 4.2.2. AND 4.4.1. ***POSITIEWE NASIEN VANAF 4.4.2 EN 4.4.1.***	
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(-23,32)(0,65)}$ ✓$+ \underline{(0,5)(-9,8)(0,65)^2}$ ✓ $= -17,23$ m ✓ $h = 17,23$ m ✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓ $= \underline{(23,32)(0,65)}$ ✓$+ \underline{(0,5)(9,8)(0,65)^2}$ ✓ $= 17,23$ m ✓ $h = 17,23$ m ✓
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(-29,7321)^2$ ✓$= \underline{(-23,32)^2 + 2(-9,8)\Delta y}$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $29,7321^2$ ✓$= \underline{23,32^2 + 2(9,8)\ \Delta y}$ ✓
$\Delta y = 17,36$ m ✓ (17,35 m) $h = 17,36$ m ✓ (17,35 m)	$\Delta y = 17,36$ m ✓ (17,35 m) $h = 17,36$ m ✓ (17,35 m)
$\Delta y = \frac{(v_f + v_i)}{2}\Delta t$ ✓ $= \frac{(-29,7321) + (-23,32)}{2}$ ✓(0,65)✓ $= -17,24\ m$ ✓ $h = 17,24$ m ✓	$\Delta y = \frac{(v_f + v_i)}{2}\Delta t$ ✓ $= \frac{(29,7321 + 23,32)}{2}$ ✓(0,65)✓ $= 17,24\ m$ ✓ $h = 17,24$ m ✓

If ground striking velocity was not used in 4.2.2, that calculation must be shown here to earn one of the substitution marks.
As grondtref-snelheid nié in 4.2.2 gebruik is nie, moet daardie berekening hier gewys word om een van die substitusiepunte te kry.

Δt in 4.2.2 minus 3,4 s.

Δt in 4.2.2 minus 3,4 s.

Δt in 4.2.2 minus 3,4 s.

(5)
[20]

QUESTION 5 / *VRAAG 5*

5.1 Compounds in which there are no multiple bonds between C atoms in their hydrocarbon chains. ✓✓
Verbindings waarin daar geen meervoudige bindings tussen C-atome in hul koolwaterstofkettings is nie. (2)

5.2.1 D ✓ (1)

5.2.2 4-ethyl-2,5-dimethylheptane 4-etiel-2,5-dimetielheptaan (3)

Marking criteria / Nasienriglyne:
- Correct stem, i.e. heptane ✓
  Korrekte stam, d.i. heptaan
- Substituents (ethyl & methyl) correctly identified. ✓
  Substituente/sykettings (etiel & metiel) korrek geïdentifiseer.
- IUPAC name completely correct including numbering, sequence, hyphens, and commas ✓
  IUPAC-naam heeltemal korrek insluitende nommers, volgorde, koppeltekens en kommas.

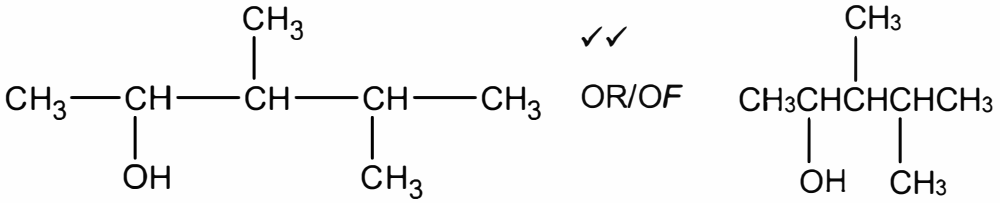
5.2.3 G ✓ (1)

5.2.4 Carbonyl (group) ✓ Karboniel(groep) (1)

5.2.5 C_nH_{2n} ✓ (1)

5.3 A series of organic compounds that can be described by the same general formula **OR** A series of organic compounds in which one member differs from the next with a CH_2 group. ✓✓
*'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word **OF** 'n Reeks organiese verbindings waarin die een lid van die volgende verskil met 'n CH2-groep.* (2)

5.4.1 Alcohols ✓ Alkohole (1)

5.4.2  ✓✓ OR/*OF*

OR/*OF*

$CH_3CH(OH)CH(CH_3)CH(CH_3)_2$ (2)

5.4.3 Secondary ✓ Sekondêr (1)

5.4.4 The carbon atom bonded to the hydroxyl/OH group is bonded to two other carbons atoms. ✓
Die koolstofatoom wat aan die hidroksiel/OH-groep verbind is, is ook aan twee ander koolstofatome verbind. (1)

[16]

QUESTION 6 / *VRAAG 6*

6.1 The pressure exerted by a vapour at equilibrium ✓with its liquid in a closed system ✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem. (2)

6.2 Chain length/length of carbon chain ✓
Kettinglengte/lengte van koolstofketting (1)

6.3 D ✓; lowest boiling point. D; laagste kookpunt (2)

6.4.1 Higher than ✓ Hoër as (1)

6.4.2

Marking criteria
- Compare structures. ✓
- Compare strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

Nasienriglyne
- Vergelyk strukture. ✓
- Vergelyk sterkte van intermolekulêre kragte.
- Vergelyk energie benodig om intermolekulêre kragte te oorkom. ✓

- **Structure/Struktuur:**
  Between the molecules of **A** (in addition to London forces) hydrogen forces are present. ✓ Between pentane molecules London forces ✓ are present.
  *Tussen die molekule van **A** (bykomend tot Londonkragte) is waterstofbindings. Tussen pentaanmolekule is Londonkragte.*

- **Intermolecular forces / Intermolekulêre kragte**
  Stronger intermolecular forces are present in compound **A** than in pentane. ✓
  *Sterker intermolekulêre kragte is teenwoording in verbinding **A** as in pentaan.*
  (Or opposite arguments / *Of teenoorgestelde argumente*)
- **Energy/Energie:**
  More energy is needed to overcome the intermolecular forces in **A**. ✓
  *Meer energie is nodig om die intermolekulêre kragte in **A** te oorkom.* (4)
  (Or opposite arguments / *Of teenoorgestelde argumente*)

6.5 Boiling point increases ✓with an increase in the chain length / size of the molecule. ✓
Kookpunt neem toe met 'n toename in die kettinglengte / grootte van die molekuul. (2)

[12]

GRAND TOTAL / *GROOTTOTAAL*: 100