education

Department of
Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 12

PHYSICAL SCIENCES

MARCH 2025

MARKS: 100

TIME: 2 HOURS

This paper consists of 12 pages and two information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of SIX questions. Answer ALL questions in 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 sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket 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 where applicable.
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 down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 The equivalent unit of force is …

A $kg \cdot m \cdot s^{-1}$.

B $kg \cdot m \cdot s^{-2}$.

C $kg \cdot m \cdot s$.

D $kg \cdot m^{-1}$. (2)

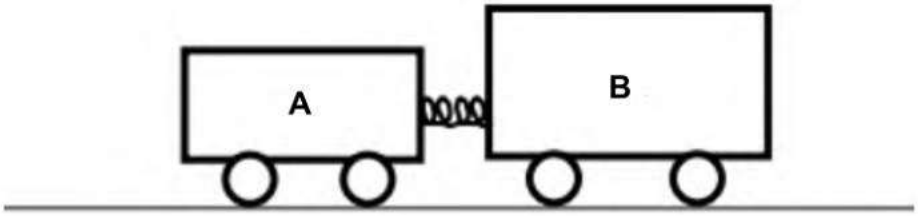
1.2 A learner drops two identical cell phones, **A** and **B**, from the same height. Cell phone **A** falls on a concrete floor and its screen breaks and cell phone **B** falls on a woollen carpet and its screen does not break.

Which one of the following combinations is CORRECT for cell phone **B** compared to cell phone **A** for the same change in momentum?

	TIME OF CONTACT WITH CARPET	NET FORCE ON CELL PHONE B
A	Larger	Larger
B	Smaller	Larger
C	Larger	Smaller
D	Smaller	Smaller

(2)

1.3 Two trolleys, **A** and **B**, with masses $\frac{1}{2}m$ and $2m$ respectively are connected by the spring as shown in the diagram below. The trolleys are initially at rest. Ignore all types of friction.



When the spring is released, both trolleys have a momentum with a magnitude of p. Trolley **B** moves with a velocity of v to the right.
The magnitude of the velocity of trolley **A** will be:

A v

B $\frac{1}{2}v$

C $2v$

D $4v$ (2)

1.4 An object is thrown vertically upwards. Which one of the following regarding the object's acceleration at the highest point of its motion is CORRECT? Ignore the effects of friction.

A $0\ m{\cdot}s^{-2}$

B $-9{,}8\ m{\cdot}s^{-2}$, downwards

C $9{,}8\ m{\cdot}s^{-1}$, downwards

D $9{,}8\ m{\cdot}s^{-2}$, downwards (2)

1.5 A ball is dropped from rest and reaches a velocity v after it has travelled $3m$. What will the magnitude of the velocity of the ball be after it has travelled $9m$? Ignore the effects of friction.

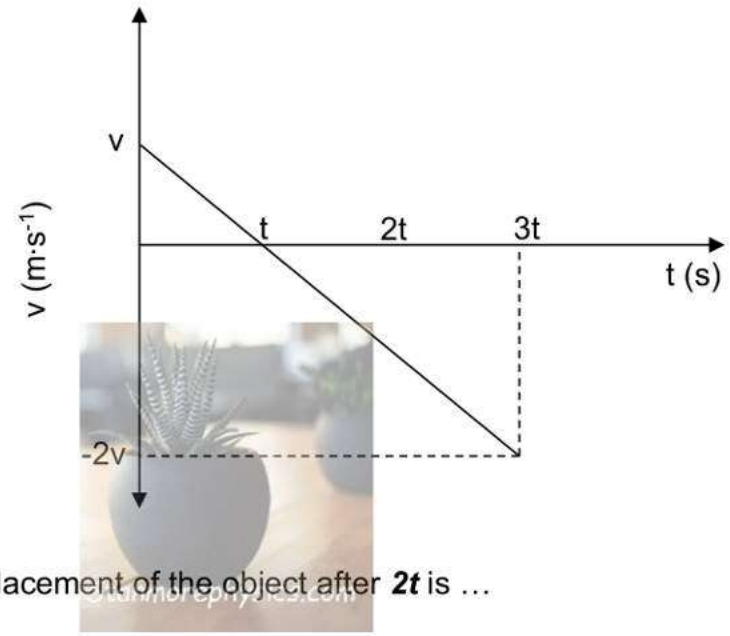
A $\frac{1}{3}v$

B $\sqrt{3}v$

C $3v$

D $6v$ (2)

1.6 The velocity versus time graph below represents the movement of an object that is initially projected vertically upwards. Ignore the effects of friction.



The displacement of the object after ***2t*** is …

A 0

B $\frac{1}{2}vt$

C vt

D $-\frac{3}{2}vt$ (2)

1.7 $CH_3COOCH_2CH_2CH_3$ is a condensed structural formula of …

A pentanoic acid.

B propyl ethanoate.

C ethyl propanoate.

D methyl butanoate. (2)

1.8 The list below has IUPAC names of compounds with five carbons.

(i) Methyl butanoate.
(ii) Pentanoic acid.
(iii) Pentan-3-one
(iv) 2-methylbutanal

A Functional isomer of pentanal is … only.

A (iii) and (iv)

B (ii) and (iii)

C (iii)

D (iv) (2)

1.9 Which molecular formula of an organic compound is similar to the EMPIRICAL FORMULA of butanoic acid AND to which homologous series does the compound belong?

	MOLECULAR FORMULA	HOMOLOGOUS SERIES
A	$C_4H_8O_2$	Carboxylic acid
B	C_2H_4O	Carboxylic acid
C	C_2H_4O	Aldehydes
D	$C_2H_4O_2$	Esters

(2)

1.10 Which compound has the lowest boiling point?

A 2,2-dimethylpropane.

B 2-methylbutane.

C 2-chlorobutane.

D Butan-1-ol. (2)
[20]

QUESTION 2

Toolbox **A** of mass *6 kg* is joined by an inextensible string to toolbox **B** with the mass of *4 kg*. A pulling force of **F** is exerted on **A** to accelerate the boxes to the left. The coefficient of kinetic friction on the boxes is *0,3* and *0,2* respectively. Both toolboxes accelerate at *5,852* $m \cdot s^{-2}$ to the left.

2.1 State Newton second law of motion in words. (2)

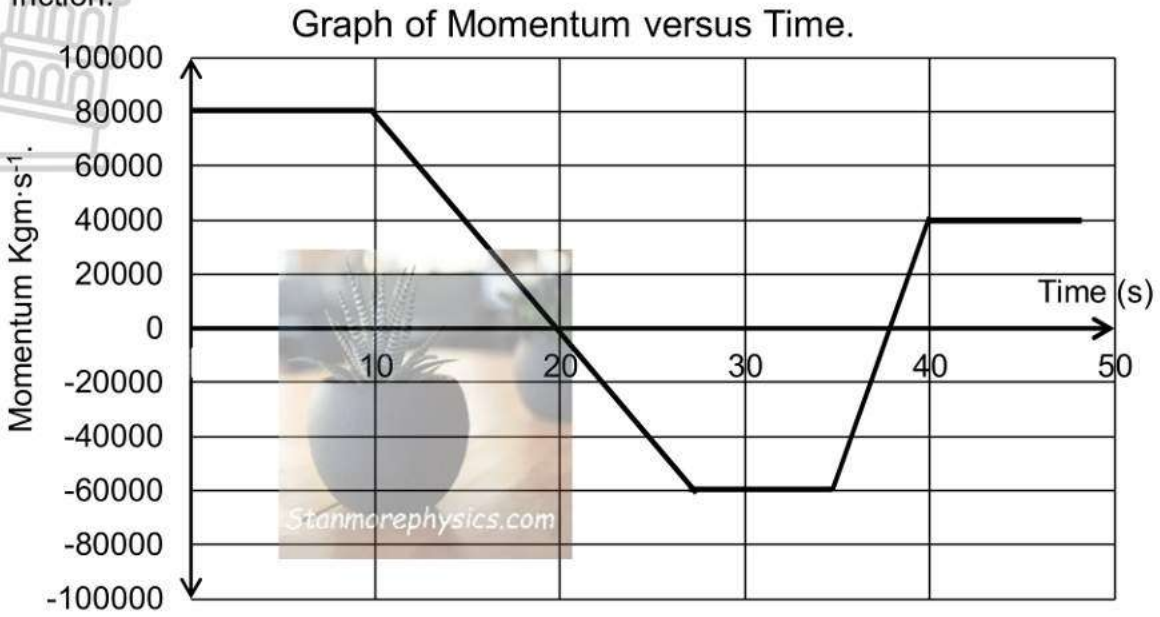
2.2 Draw a free body diagram showing all forces acting on toolbox **B**. (4)

2.3 Calculate the magnitude of the pulling force ***F*** acting on the 6 kg box. (6)

2.4 Write down the reaction force to the weight of toolbox **A**. (2)
[14]

QUESTION 3

The following graph shows the change in **momentum** of a truck over a period of time. The truck is initially moving EASTWARDS in a straight line. Ignore the effects of friction.



3.1 Define the term *momentum*. (2)

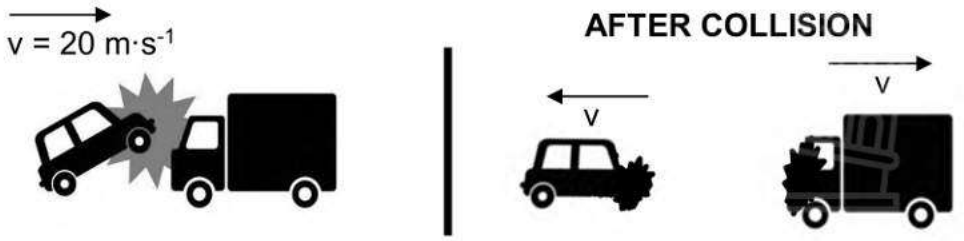
3.2 Write down the:

3.2.1 direction of the truck at t = 30 s. (2)

3.2.2 magnitude of the net force acting on the truck for the first 10 s. (1)

3.3 Explain your answer to QUESTION 3.2.2. (3)

3.4 The truck collides with a car at t = 35 s. The car has a mass of *2000 kg* and is moving at a constant velocity of *20 m·s^{-1}* east before the collision. After the collision, the car has a velocity to the west.



3.4.1 The ACCELERATION of the truck, between t = 35 s and t = 40 s, is *4 m·s^{-2}* east. Calculate the mass of the truck. (5)

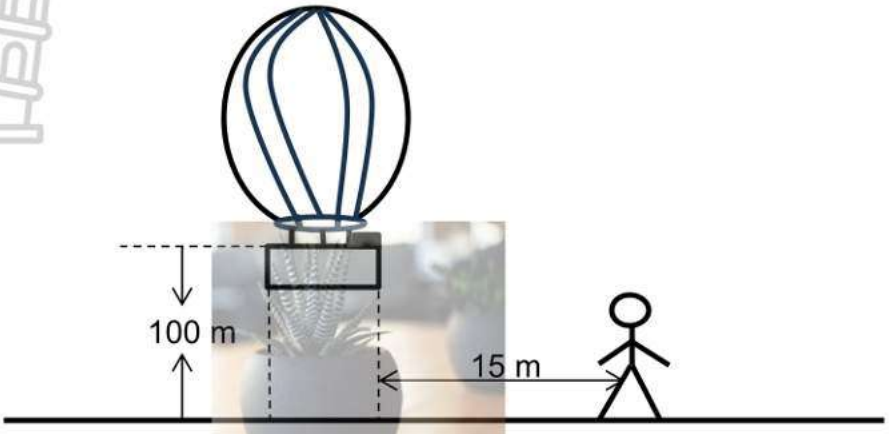
3.4.2 Calculate the velocity of the truck before the collision. (3)

The sum of the kinetic energy of the car and truck after the collision is $1,06 \times 10^6$ J.

3.4.3 Prove by means of a calculation whether the collision between the car and the truck is *ELASTIC* or *INELASTIC*. (4)
[20]

QUESTION 4

A hot-air balloon is moving vertically upwards at a constant speed of *12 m·s^{-1}*.
A camera is accidentally dropped from the balloon at a height of *100 m* as shown in the diagram below. Ignore the effects of friction.



4.1 Is the hot-air ballon a projectile while it is moving upwards?
Write YES or NO and give a reason for your answer. (2)

4.2 What is the velocity of the camera immediately after it is dropped from the hot-air ballon. (2)

4.3 Calculate the time taken by the camera to reach its maximum height. (3)

4.4 Calculate the distance between the hot-air balloon and the camera when the camera is at its maximum height. (5)

4.5 A jogger running at a constant speed of 3 m·s^{-1}, is 15 m away from the hot-air balloon as shown in the above diagram. If the jogger sees the camera at the same instant it is dropped from the balloon, will he be able to catch the camera before it strikes the ground?

Support your answer by means of a calculation. (6)

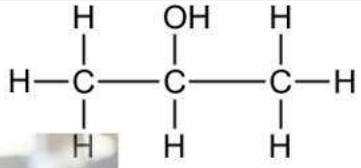
4.6 Draw a sketch graph of velocity versus time for the entire motion of the camera.

Indicate the following on the graph:
- Initial velocity
- Time taken to reach the maximum height (3)

[21]

QUESTION 5

Consider the compounds **V**, **W**, **X**, **Y** and **Z** in the table below.

	COMPOUNDS
V	2-methylpropane
W	$CH_3CCCH(CH_2CH_3)CH_3$
X	
Y	$C_6H_{12}O_2$
Z	$CH_3CHBrCH_2CH_2CH(CH_2CH_3)CH(CH_3)CH_3$

5.1 Write down a LETTER for a compound that is:

5.1.1 an unsaturated hydrocarbon. (1)

5.1.2 a haloalkane. (1)

5.1.3 a chain isomer of butane. (1)

5.2 Write down the NAME of the functional group of compound **X**. (1)

5.3 Give the IUPAC name of:

5.3.1 a positional isomer of **X.** (2)

5.3.2 compound **Z.** (3)

5.4 Draw a structural formula of compound **W**. (2)

5.5 Compound is **Y** a straight chain carboxylic acid. For compound **Y**, write down the:

5.5.1 general formula of the homologous series to which it belongs. (1)

5.5.2 condensed structural formula. (2)
[14]

QUESTION 6

A group of learners investigate the factors that affect the melting points of organic compounds **A**, **B**, **C** and **D**. Compound **D** has an unknown melting point **X**.
All these compounds have comparable molecular masses.

	COMPOUND	MELTING POINT (ºC)
A	2-methylbutane	- 159,77
B	Butan-2-ol	- 115
C	Propanoic acid	- 21
D	2-fluorobutane	**X**

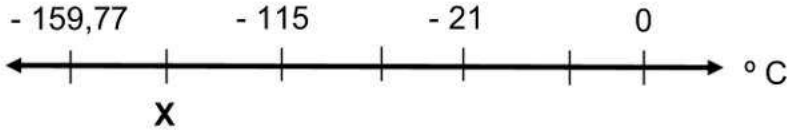
6.1 Define the term melting point. (2)

6.2 Give the independent variable for this investigation. (1)

6.3 What type of alcohol is compound **B**? Only write down PRIMARY, SECONDARY OR TERTIARY and give a reason for your answer. (2)

6.4 Is compound **C** a liquid or solid at 0°C? (1)

6.5 On the number line below (not drawn to scale), the unknown melting point is at a position as shown below. Write down a complete explanation for this.



(5)
[11]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	$9,8\ m{\cdot}s^{-2}$
Universal gravitational constant	G	$6,67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Speed of light in a vacuum	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant	h	$6,63 \times 10^{-34}\ J{\cdot}s$
Coulomb's constant	k	$9,0 \times 10^{9}\ N{\cdot}m^2{\cdot}C^{-2}$
Charge on electron	e	$-1,6 \times 10^{-19}\ C$
Electron mass	m_e	$9,11 \times 10^{-31}\ kg$
Mass of the Earth	M	$5,98 \times 10^{24}\ kg$
Radius of the Earth	R_E	$6,38 \times 10^{6}\ m$

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 $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ OR $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ OR $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{d^2}$ OR $F = \frac{Gm_1m_2}{r^2}$	$g = \frac{GM}{d^2}$ OR $g = \frac{GM}{r^2}$

WORK, ENERGY AND POWER

$W = F\Delta x\cos\theta$	$U = mgh$ OR $E_P = mgh$
$K = \frac{1}{2}mv^2$ OR $E_k = \frac{1}{2}mv^2$	$W_{net} = \Delta K$ OR $W_{net} = \Delta E_k$ $\Delta K = K_f - K_i$ OR $\Delta E_k = E_{kf} - E_{ki}$
$W_{nc} = \Delta K + \Delta U$ OR $W_{nc} = \Delta E_k + \Delta E_p$	$P = \frac{W}{\Delta t}$
$P_{ave} = Fv_{ave}$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 3 7	1,5 Be 4 9											2,0 B 5 11	2,5 C 6 12	3,0 N 7 14	3,5 O 8 16	4,0 F 9 19	10 Ne 20
0,9 Na 11 23	1,2 Mg 12 24											1,5 Aℓ 13 27	1,8 Si 14 28	2,1 P 15 31	2,5 S 16 32	3,0 Cℓ 17 35,5	18 Ar 40
0,8 K 19 39	1,0 Ca 20 40	1,3 Sc 21 45	1,5 Ti 22 48	1,6 V 23 51	1,6 Cr 24 52	1,5 Mn 25 55	1,8 Fe 26 56	1,8 Co 27 59	1,8 Ni 28 59	1,9 Cu 29 63,5	1,6 Zn 30 65	1,6 Ga 31 70	1,8 Ge 32 73	2,0 As 33 75	2,4 Se 34 79	2,8 Br 35 80	36 Kr 84
0,8 Rb 37 86	1,0 Sr 38 88	1,2 Y 39 89	1,4 Zr 40 91	Nb 41 92	1,8 Mo 42 96	1,9 Tc 43	2,2 Ru 44 101	2,2 Rh 45 103	2,2 Pd 46 106	1,9 Ag 47 108	1,7 Cd 48 112	1,7 In 49 115	1,8 Sn 50 119	1,9 Sb 51 122	2,1 Te 52 128	2,5 I 53 127	54 Xe 131
0,7 Cs 55 133	0,9 Ba 56 137	La 57 139	1,6 Hf 72 179	Ta 73 181	W 74 184	Re 75 186	Os 76 190	Ir 77 192	Pt 78 195	Au 79 197	Hg 80 201	1,8 Tℓ 81 204	1,8 Pb 82 207	1,9 Bi 83 209	2,0 Po 84	2,5 At 85	Rn 86
0,7 Fr 87	0,9 Ra 88 226	Ac 89															

KEY

Atomic number

Electronegativity → 29 Cu 63,5 ← Symbol

Approximate relative atomic mass

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

education

Department of Education
FREE STATE PROVINCE

CONTROL TEST/ *KONTROLETOETS*

GRADE/*GRAAD* 12

PHYSICAL SCIENCES/ *FISIESE WETENSKAPPE*

MARCH/*MAART* 2025

MARK/*PUNTE*: 100

MARKING GUIDELINE/ *NASIENRIGLYN*.

This MARKING GUIDELINE consists of 15 pages/ *Hierdie NASIENRIGLYN bestaan uit 15 bladsye*.

Please turn over/*Blaai asseblief om*

QUESTION 1 / *VRAAG 1*

1.1 B ✓✓

1.2 C ✓✓

1.3 D ✓✓

1.4 D ✓✓

1.5 B ✓✓

1.6 A ✓✓

1.7 B ✓✓

1.8 C ✓✓

1.9 C ✓✓

1.10 A ✓✓

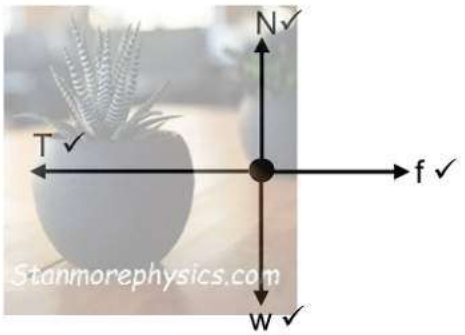
[20]

QUESTION 2 / *VRAAG 2*

2.1 When a net force acts on an object, the object will accelerate in the direction of the force, at an acceleration directly proportional to the 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 krag teen 'n versnelling direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp. (2)

2.2



(4)

ACCEPTED LABELS/*AANVAARBARE BYSKRIFTE*	
w	F_g /weight/gravitational force/ 39,2 N/
f	$F_{friction}$/F_f/friction/f_k/*wrywingskrag*
N	F_N/F_{normal}/Normal force/*Normaalkrag*/*Normaal*
T	F_T/Tension/*Spanning*

NOTE:
- 1 mark awarded for label and arrow.
- Deduct 1 mark ONCE for any additional forces.
- Do not consider the length of the forces.

LET WEL:
- *1 punt toegeken vir etiket en pyl.*
- *Trek 1 punt EEN keer af vir enige bykomende kragte.*
- *Moenie die lengte van die kragte in ag neem nie.*

2.3

Toolbox B/ *Gereedskapkis B*

Fnet = ma
$T + (- f_k) = ma$
$T - \mu_k N = ma$
$T - 0,2 \times 4 \times 9,8$✓ = 4×5,852✓
T = 31,248 N

Toolbox A/ *Gereedskapkis A*
Fnet = ma
$F + (-T) + (- f_k) = ma$
$F - T - \mu_k N = ma$
$F - 31,248 - 0,3 \times 6 \times 9,8$✓ = 6×5,852✓
F = 84 N✓

Anyone/ *Enige een*✓

(6)

2.4 Force of toolbox **A** on earth.✓✓
Krag van gereedskapkis A op aarde

(2)
[14]

QUESTION 3 / *VRAAG 3*

3.1 Momentum is the <u>product of an object's mass and its velocity</u>.✓✓
Momentum is die <u>produk van die massa en snelheid</u> van 'n voorwerp. (2)
(2 or/of 0)

3.2.2 West / Westwards ✓✓
Wes / Weswaarts (2)

3.2.3 0 (N)/Zero ✓ (1)

3.3 <u>Velocity/momentum is constant</u> between 0 s and 10 s✓
Change in momentum/Δp = 0 ✓
∴According to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓, F_{net} = 0 N

<u>Snelheid/momentum is konstant</u> tussen 0 s en 10 s
Verandering in momentum/Δp = 0
∴Volgens Fnet =$\frac{\Delta p}{\Delta t}$, Fnet = 0 N

OR/OF

<u>Velocity is constant</u> between 0 s and 10 s✓
<u>Change in velocity/Δv = 0</u> OR <u>Acceleration/a = 0</u> ✓
∴According F_{net} = ma ✓ ,F_{net} = 0 N

<u>Snelheid is konstant</u> tussen 0 s en 10 s
<u>Verandering in snelheid/Δv = 0</u> OF Versnelling/a = 0
∴Volgens Fnet = ma ,Fnet = 0 N

OR/OF

Gradient of graph between 0 s and 10 s = 0 ✓
Gradient of graph = $\frac{\Delta p}{\Delta t}$ ✓
∴ Accoding to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓ , F_{net} = 0

Gradiënt van grafiek tussen 0 s en 10 s = 0
Gradiënt van grafiek = $\frac{\Delta p}{\Delta t}$
∴Volgens Fnet =$\frac{\Delta p}{\Delta t}$, Fnet = 0 N (3)

3.4.1 $F_{net}\Delta t = \Delta p$
$F_{net}\Delta t = p_f - p_i$
$F_{net}(5)$✓ = $40000 - (-60000)$✓
$F_{net} = 20000$ N

$F_{net} = ma$
$20000 = m(4)$✓
$m = 5000$ kg✓ ✓Any one/*Enige een* (5)

3.4.2 **POSITIVE MARKING FROM QUESTION 3.4.1**
POSITIEWE NASIEN VANAF VRAAG 3.4.1

$p = mv$✓
$(-60000) = (5000)v$✓
$v = -12$ m·s^{-1}
$v = 12$ m·s^{-1} West/Westward/*Wes/Weswaart*✓ (3)

3.4.3 **POSITIVE MARKING FROM QUESTION 3.4.1 and 3.4.2.**
POSITIEWE NASIEN VANAF VRAAG 3.4.1 and 3.4.2.

$E_k = \frac{1}{2}mv^2$ ✓
$\sum E_{ki} = \frac{1}{2}m_{(truck)}v_{(truck)i}^2 + \frac{1}{2}m_{(car)}v_{(car)i}^2$
$\sum E_{ki} = \frac{1}{2}(5000)(12)^2 + \frac{1}{2}(2000)(20)^2$✓

$\sum E_{ki} = 360\,000 + 400\,000$
$\sum E_{ki} = 760\,000$ J

$\sum E_{ki} \neq \sum E_{kf}$✓

∴ Inelastic / *onelasties*✓ (4)
[20]

QUESTION 4 / *VRAAG 4*

4.1 NO✓ *NEE*
Gravitational force is NOT the only force acting on the hot-air ballon/ Acceleration of the ballon is equal to zero/ Net force acting on the hot-air ballon is equal to zero.✓ (2)
Gravitasiekrag is NIE die enigste krag wat op die warmlugballon inwerk nie/Versnelling van die ballon is gelyk aan nul/ Netto krag wat op die warmlugballon inwerk is gelyk aan nul.

4.2 12 $m \cdot s^{-1}$✓upwards✓ (2)
12 $m \cdot s^{-1}$ opwaarts

4.3 **POSITIVE MARKING FROM QUESTION 4.2**
POSITIEWE NASIEN VANAF VRAAG 4.2.

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
Up/*Op* +ve	**Up/*Op* -ve**
$v_f = v_i + a\Delta t$ ✓	$v_f = v_i + a\Delta t$ ✓
$0 = 12 + (-9,8)\Delta t$✓	$0 = -12 + (9,8)\Delta t$✓
$\Delta t = 1,22$ s ✓	$\Delta t = 1,22$ s ✓

(3)

4.4 **POSITIVE MARKING FROM QUESTION 4.2 and 4.3.**
POSITIEWE NASIEN VANAF VRAAG 4.2 and 4.3.

OPTION/*OPSIE* 1
Up/*Op* +ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$= 12(1,22) + \frac{1}{2}(-9.8)(1,22^2)$ ✓
$= 7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= 14,64$ m

∴ Distance/*Afstand* = $\underline{14,64 - 7,35}$ ✓
$= 7,29$ m ✓

OPTION/*OPSIE* 2
Up/*Op* -ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓
$= -12(1,22) + \frac{1}{2}(9.8)(1,22^2)$ ✓
$= -7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= -12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= -14,64$ m

∴ Distance/*Afstand* = $\underline{-14,64 - (-7,35)}$ ✓
$= -7,29$ m
$= 7,29$ m ✓

OPTION/*OPSIE* 3
Up/*Op* +ve
Max. height (camera)/*Maks. hoogte (kamera)*
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = 12^2 + 2(-9,8)\Delta y$ ✓
$\Delta y = 7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= 14,64$ m

∴ Distance/*Afstand* = $\underline{14,64 - 7,35}$ ✓
$= 7,29$ m ✓

OPTION/*OPSIE* 4
Up/*Op* -ve
Max. height (camera)/*Maks. hoogte (kamera)*
$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0^2 = -12^2 + 2(9,8)\Delta y$ ✓
$\Delta y = 7,35$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= -12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= -14,64$ m

∴ Distance/*Afstand* = $\underline{-14,64 - (-7,35)}$ ✓
$= -7,32$ m
$= 7,29$ m ✓

OPTION/*OPSIE* 5
Up/*Op* +ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = (\frac{v_i + v_f}{2}) \times \Delta t$ ✓
$\Delta y = (\frac{12+0}{2}) \times 1,22$ ✓
$\Delta y = 7,32$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= 12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= 14,64$ m

∴ Distance/*Afstand* = $\underline{14,64 - 7,32}$ ✓
$= 7,32$ m ✓

OPTION/*OPSIE* 6
Up/*Op* -ve
Max. height (camera)/*Maks. hoogte (kamera)*
$\Delta y = (\frac{v_i + v_f}{2}) \times \Delta t$ ✓
$\Delta y = (\frac{-12+0}{2}) \times 1,22$ ✓
$\Delta y = -7,32$ m
Height (hot-air balloon) after 1,22 s
Hoogte (warmlugballon) na 1,22 s
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$= -12(1,22) + \frac{1}{2}(0)(1,22^2)$ ✓
$= -14,64$ m

∴ Distance/*Afstand* = $\underline{-14,64 - (-7,32)}$ ✓
$= -7,32$ m
$= 7,32$ m ✓

Note: RANGE FINAL ANSWER (**7,29 m to 7,35 m**)
***Let wel**: REEKS FINALE ANTWOORD (**7,29 m tot 7,35 m**)* (5)

4.5 **OPTION/*OPSIE* 1**

Up/*Op* +ve

Time taken by the camera to reach the ground/ *Tyd wat die kamera neem om die grond te bereik*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

-100✓ $= 12\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2$ ✓

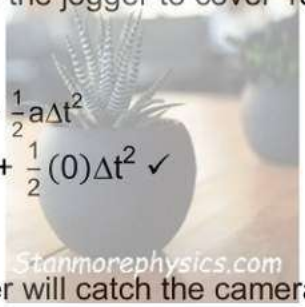
$\Delta t = 5{,}91$ s

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$

15✓$= 3\Delta t + \frac{1}{2}(0)\Delta t^2$ ✓

$\Delta t = 5$ s



Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

OPTION/*OPSIE* 2

Up/*Op* -ve

Time taken by the camera to reach the ground/ *Tyd wat die kamera neem om die grond te bereik*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ ✓

100✓ $= -12\Delta t + \frac{1}{2}(9{,}8)\Delta t^2$ ✓

$\Delta t = 5{,}91$ s

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$

15✓$= 3\Delta t + \frac{1}{2}(0)\Delta t^2$ ✓

$\Delta t = 5$ s

Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

OPTION/*OPSIE* 3:
POSITIVE MARKING FROM 4.3 AND 4.4
POSITIEWE NASIEN VANAF VRAAG 4.3 AND 4.4.
Up/*Op* +ve
Time taken by the camera to reach the ground from Max. height/
Tyd wat die kamera neem om die grond vanaf die Maksimum hoogte te bereik:

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$
$$-(100+7{,}35)\checkmark = 0\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2\ \checkmark$$
$$\Delta t = 4{,}681\text{ s}$$
$$\Delta t\,(\text{total}) = 4{,}681 + 1{,}22$$
$$= 5{,}90\text{ s}$$

Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2\ \checkmark$$
$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2\ \checkmark$$
$$\Delta t = 5\text{ s}$$

Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang

OPTION/*OPSIE* 4:
POSITIVE MARKING FROM 4.3 AND 4.4
POSITIEWE NASIEN VANAF VRAAG 4.3 AND 4.4.
Up/*Op* -ve
Time taken by the camera to reach the ground from the Max. height/
Tyd wat die kamera neem om die grond vanaf die Maksimum hoogte te bereik:

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$$
$$(100+7{,}35)\checkmark = 0\Delta t + \frac{1}{2}(9{,}8)\Delta t^2\ \checkmark$$
$$\Delta t = 4{,}681\text{ s}$$
$$\Delta t\,(\text{total}) = 4{,}681 + 1{,}22$$
$$= 5{,}90\text{ s}$$

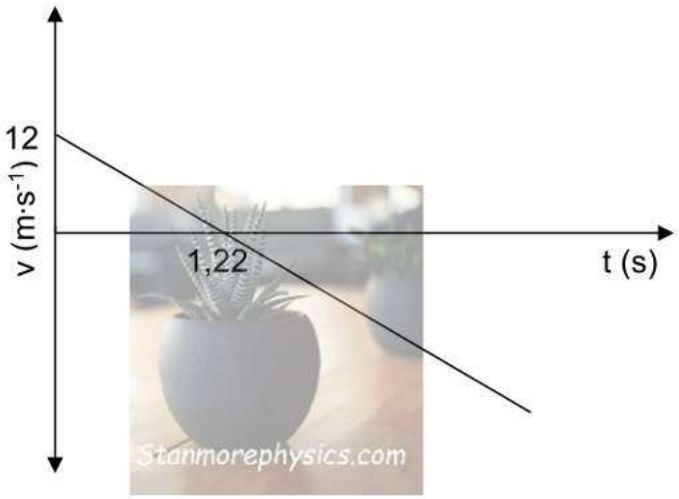
Time taken by the jogger to cover 15 m/ *Tyd wat die joggie neem om 15 m af te lê*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2\ \checkmark$$
$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2\ \checkmark$$
$$\Delta t = 5\text{ s}$$

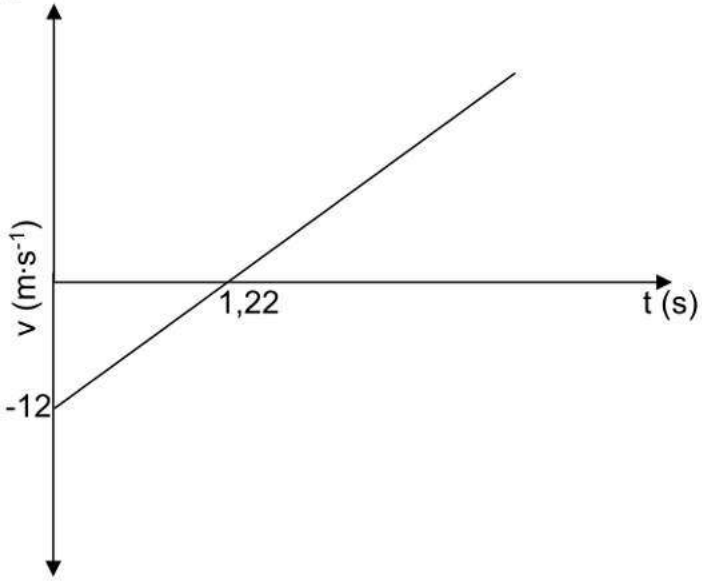
Yes, the jogger will catch the camera ✓
Ja, die joggie sal die kamera vang (6)

4.6 **POSITIVE MARKING FROM QUESTION 4.3**
POSITIEWE NASIEN VANAF VRAAG 4.3

OPTION/*OPSIE* 1
Up/*Op* +ve



OPTION/*OPSIE* 2
Up/*Op* -ve



Criteria for graph/ Kriteria vir grafiek	Marks
Graph starts at/ *Grafiek begin by* v = 12 m·s^{-1} at t = 0 s.	✓
Maximum height reached/*Maksimum hoogte bereik* (v = 0 m·s^{-1}) at//by t = 1,22 s.	✓
Correct shape as shown: straight line with gradient and section of the graph after max height longer than before max height./ *Korrekte vorm soos getoon: reguit lyn met gradiënt en snit van die grafiek na maksimum hoogte langer as voor maksimum hoogte.*	✓

(3)
[21]

QUESTION 5 / *VRAAG 5*

5.1.1 W ✓ (1)

5.1.2 Z ✓ (1)

5.1.3 V ✓ (1)

5.2 Hydroxyl (group) ✓ (1)
Hidroksiel (groep)

5.3.1 Propan-1-ol/ 1-propanol.✓✓ **(2 or 0)** (2)
Propaan-1-ol

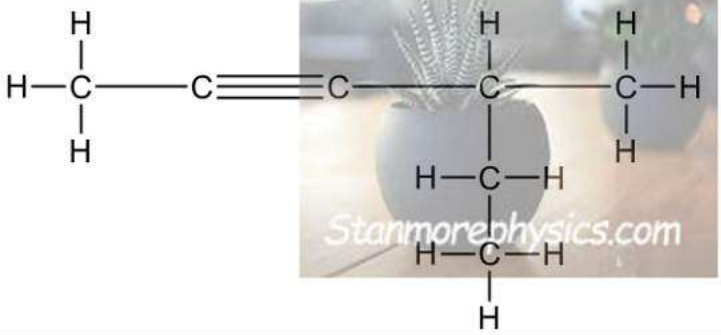
5.3.2 6-bromo-3-ethyl-2-methylheptane/ *6-bromo-3-etiel-2-metielheptaan*

Marking criteria:
- Correct stem i.e. heptane. ✓
- Substituents (bromo, ethyl and methyl) correctly identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas.✓

Nasienkriteria:
- *Korrekte stam d.i. heptaan.* ✓
- *Substituente (bromo, etiel en metiel) korrek geïdentifiseer.* ✓
- *IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

(3)

5.4



Marking criteria:
- Correct functional group (triple bond) drawn. ✓
- Whole structure correct.✓

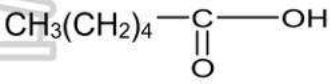
Nasienkriteria:
- *Korrekte funksionele groep (drievoudige binding) getrek*
- *Hele struktuur korrek*

(2)

5.5.1 $C_nH_{2n}O_2$ ✓ (1)

5.5.2 $CH_3CH_2CH_2CH_2CH_2COOH$ OR $CH_3(CH_2)_4COOH$

OR

 OR 

Marking criteria:	Nasienkriteria:
• Functional group for carboxylic acids is correct (carboxyl group) ✓ • Whole structure is correct (carbon with 4 bonds, all H atoms shown) ✓	• Funksionele groep van karboksielsuur is korrek (karboksiel groep) ✓ • Hele struktuur is korrek (koelstof met 4 bindings, al H-atome word getoon) ✓

(2)
[14]

QUESTION 6 / *VRAAG 6*

6.1 The temperature at which the solid and liquid phases of a substance are at equilibrium.✓✓
Die temperatuur waarby die vaste- en vloeistoffases van 'n stof in ewewig is. (2)

6.2 (Type of) Functional group/Type of Intermolecular forces/ Homologous series.✓ (1)
(Tipe van) Funksionele groep/Tipe intermolekulêre kragte/ Homoloë reeks.

6.3 SECONDARY✓, carbon bonded to hydroxyl group (OH^-) is bonded to two other carbon atoms.✓ (2)
SEKONDÊR, koolstof gebind aan hidroksielgroep (OH-) is gebind aan twee ander koolstofatome

6.4 Liquid.✓ (1)
Vloeistof

6.5 A has london forces only✓, D has london forces and dipole-dipole forces✓, B has london forces, dipole-dipole forces and hydrogen bonds.✓

FROM A to D to B:

- Strength of intermolecular forces increases.✓
- Energy required to overcome the strength on intermolecular forces increases.✓

Therefore the melting point of D is greater than that of A but less than that of B.

A het slegs Londense magte, D het Londense kragte en dipool-dipoolkragte, B het Londense kragte, dipool-dipoolkragte en waterstofbindings.

VAN A tot D na B:

- Die sterkte van intermolekulêre kragte neem toe.
- Energie wat nodig is om die sterkte op intermolekulêre kragte te oorkom, neem toe.

Daarom is die smeltpunt van D groter as dié van A maar minder as dié van B.

OR/*OF*

A has london forces only✓, D has london forces and dipole-dipole forces✓,
B has london forces, dipole-dipole forces and hydrogen bonds.✓

FROM B to D to A:

- Strength of intermolecular forces decreases.✓
- Energy required to overcome the strength on intermolecular forces decreases.✓

Therefore the melting point of D is greater than that of A but less than that of B.

A het slegs Londense magte, D het Londense kragte en dipool-dipoolkragte,
B het Londense kragte, dipool-dipoolkragte en waterstofbindings.

VAN B tot D na A:

- *Die sterkte van intermolekulêre kragte neem af.*
- *Energie wat benodig word om die krag op intermolekulêre kragte te oorkom, neem af.*

Daarom is die smeltpunt van D groter as dié van A maar minder as dié van B (5)

[11]

Grand Total: 100 marks

Groottotaal: 100 punte