education
Department of Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 12

PHYSICAL SCIENCES

APRIL 2021

MARKS: 100

TIME: 2 HOURS

This paper consists of 10 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 Which one of the following physical properties is equal to the product of the mass and the velocity of an object?

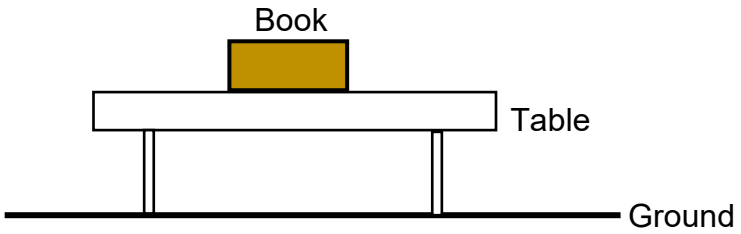
A Impulse

B Net force

C Momentum

D Change in momentum (2)

1.2 A book is at rest on a table, as the diagram below illustrates.



Which ONE of the following is the CORRECT Newton action-reaction force pair?

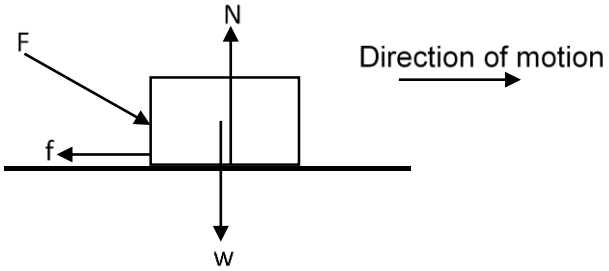
A F_{book} on table and F_{book} on Earth

B F_{book} on table and F_{Earth} on book

C F_{Earth} on book and F_{book} on Earth

D F_{table} on book and F_{table} on Earth (2)

1.3 A force *F* is applied to push a block across a rough horizontal surface at a CONSTANT speed *v*. The force diagram below shows the forces acting on the block whilst moving across the surface. Which one of the following represents the correct relationship between the magnitudes of the given forces?



A F = f and N = w B F > f and N < w

C F > f and N > w D F > f and N = w (2)

1.4 Which ONE of the following statements is equivalent to Newton's second law of motion? The net force experienced by an object is equal to the …

A rate of change in momentum of that object.

B change in momentum of that object.

C impulse experienced by the object.

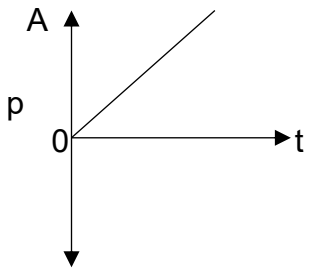
D momentum of that object. (2)

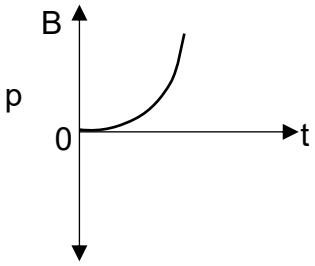
1.5 What is the magnitude and direction of the acceleration on Earth at the turning point for an object that is thrown vertically upwards from the surface of Earth if air resistance is ignored?

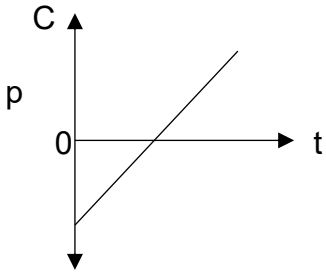
	Magnitude ($m \cdot s^{-2}$)	**Direction**
A	9,8	Upwards
B	9,8	Downwards
C	0	Downwards
D	0	Upwards

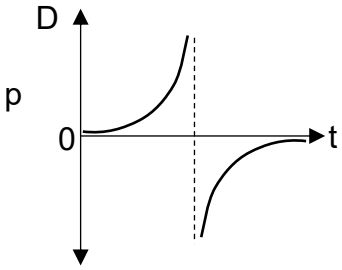
(2)

1.6 A ball is released from rest at a certain height above the ground. Which one of the following momentum versus time graphs correctly describes the momentum of the ball from the instant it is released to the instant just before it hits the ground? Take downward as positive.









(2)

1.7 An object is thrown vertical upwards. Which combination of physical quantities have NON-ZERO values at the instant the object CHANGES DIRECTION?

A Momentum and weight

B Weight and acceleration

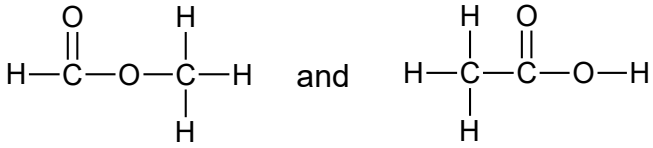
C Acceleration and momentum

D Momentum, acceleration, and weight (2)

1.8 Study the following pairs of organic structures:

I CH_3COCH_3 and CH_3CH_2CHO

II $CH_2CHCH_2CH_3$ and $CH_3CHCHCH_3$

III  and

Which of the above are structural isomers?

A I and II

B I and III

C II and III

D I, II and III (2)

1.9 What is the EMPIRICAL FORMULA of ethyl ethanoate?

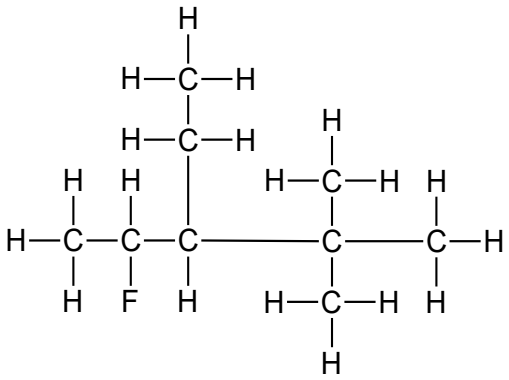
A $C_4H_8O_2$

B $C_5H_{10}O_2$

C C_2H_4O

D $C_3H_6O_2$ (2)

1.10 The structural formula of an organic compound is shown below.



Which ONE of the following is the correct IUPAC name of this compound?

A 4,4-dimethyl-3-ethyl-2-fluoropentane

B 3-ethyl-4-fluoro-2,2-dimethylpentane

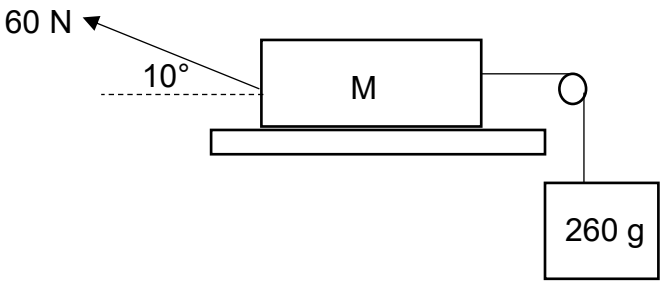
C 2-fluoro-3-ethyl-4,4-dimethylpentane

D 3-ethyl-2-fluoro-4,4-dimethylpentane (2)

[20]

QUESTION 2

A block, mass *M*, resting on a rough, horizontal table, is connected by a light, inextensible string, passing over a light, frictionless pulley, to another block with a mass of 260 g. The 260 g block hangs vertically as shown in the diagram below.



A force of 60 N is applied to the stationary block on the table at an angle of 10° to the horizontal. It causes this block to accelerate at 2,89 $m \cdot s^{-2}$ to the left. The coefficient of kinetic friction between the block and the surface of the table is 0,3. Ignore the effects of air friction.

2.1 Define the term *normal force* in words. (2)

2.2 Calculate the:

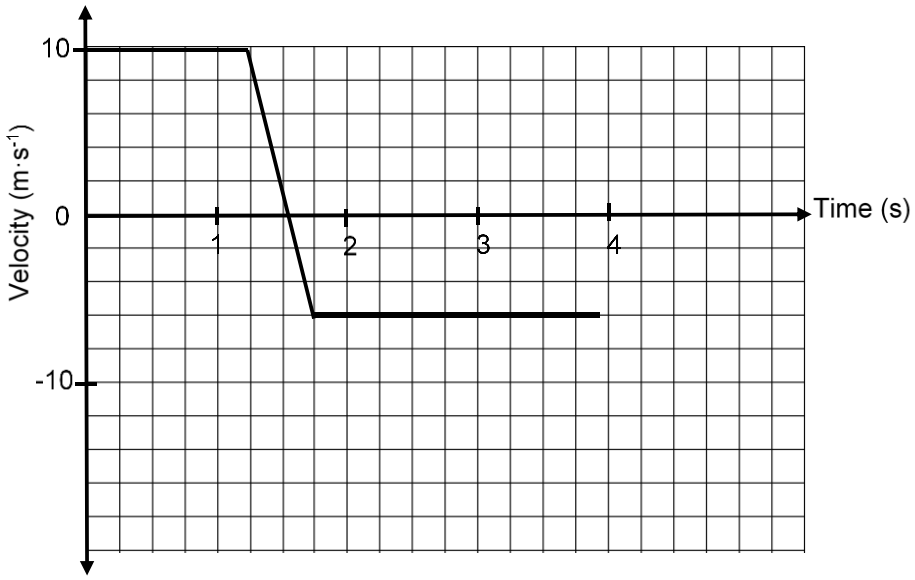
2.2.1 Tension in the string (3)

2.2.2 Mass *M* (5)

[10]

QUESTION 3

Ball **P**, with a mass *m*, is initially rolling eastwards when it collides with an identical ball **Q**, which is rolling westwards at 15 $m \cdot s^{-1}$. Ignore the rotation effects of the balls and friction. The graph below shows how the velocity of ball **P** changes with time.



3.1 Define the term *impulse* in words. (2)

3.2 Calculate the velocity of ball **Q** after the collision. (5)

3.3 It is observed that the kinetic energy of the system DECREASES by 28,8 J. Calculate:

3.3.1 Mass *m* (5)

3.3.2 The magnitude of the net force acting on ball **P** during the collision. (4)

3.4 Consider the initial momentum, final momentum and change in momentum of ball **P**.

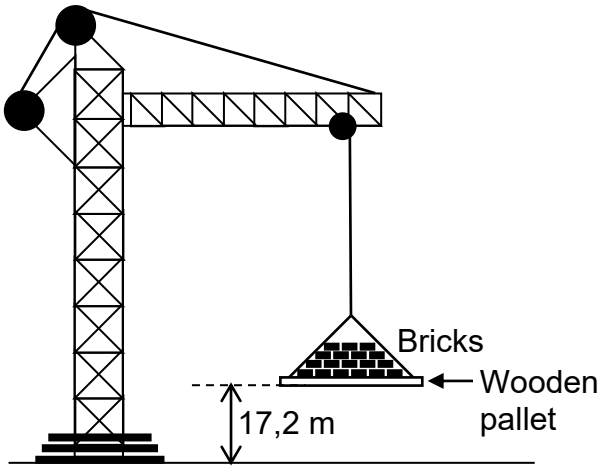
3.4.1 Which one of these three vectors represents the RESULTANT vector of the other two? (1)

3.4.2 Draw a vector diagram to explain your answer to question 3.4.1. Remember to label the vectors in your diagram. (2)

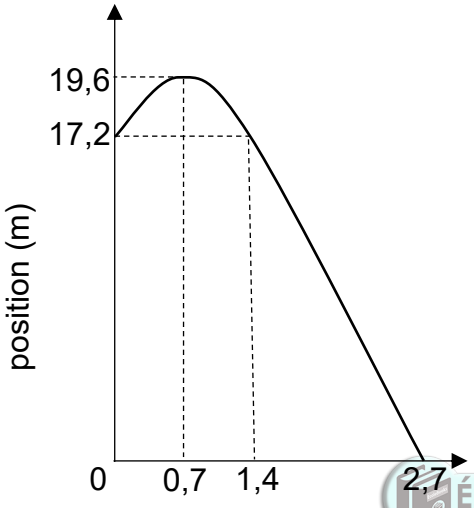
[19]

QUESTION 4

A crane on a building site is lifting a pile of bricks on a wooden pallet at a CONSTANT SPEED. When the pallet is at a height of 17,2 m above the ground, ONE of the bricks falls off and hits the ground after 2,7 seconds. Ignore the effect of air resistance.



The diagram below shows the position-time graph for the falling brick.



4.1 Why does the falling brick go up before it goes down? (1)

4.2 Define the term *free fall* in words. (2)

4.3 How long does it take the brick to reach its maximum height? (1)

4.4 Calculate the velocity with which the:

4.4.1 Pile of bricks were LIFTED by the crane. (4)

4.4.2 Falling brick HITS the GROUND. (4)

4.5 Sketch the velocity versus time graph for the motion of the brick from the moment it falls from the pallet until it hits the ground. Indicate ALL the time values and corresponding velocities. (4)

When the brick lands on the ground, it is in contact with the ground for 0,3 seconds and then bounces vertically upwards with a speed of 4,59 $m \cdot s^{-1}$.

4.6 Calculate the distance between the pallet and the brick when the brick is at its maximum height after the first bounce. Assume that the speed at which the pallet moves upwards has remained constant. (6)

4.7 Calculate the impulse on the brick during the bounce. Take the mass of the brick as 1,9 kg. (4)

[26]

QUESTION 5

The letters **A** to **C** in the table below represent three organic compounds.

A	$C_5H_{12}O$	**B**	$CH_3CH_2COCH_3$
C	CH_3CHCCH | CH_2CH_3		

Use the information in the table to answer the questions that follow.

5.1 Compound **A** is a tertiary alcohol

5.1.1 Define the term *tertiary alcohol* (2)

Write down the following for compound **A**:

5.1.2 Name of its functional group (1)

5.1.3 IUPAC name (3)

5.1.4 Structural formula of its chain isomer (2)

5.2 Write down the following for compound **B**:

5.2.1 Structural formula of its functional group (1)

5.2.2 IUPAC name of its STRAIGHT CHAIN functional isomer (2)

5.3 Write down the following for compound **C**:

5.3.1 General formula (1)

5.3.2 IUPAC name (3)

[15]

QUESTION 6

The boiling points of five organic compounds (**P**, **Q**, **R**, **S** and **T**) are studied.

COMPOUND	IUPAC NAME	MOLECULAR MASS ($g \cdot mol^{-1}$)
P	2,2-dimethylpropanal	86
Q	2-methylbutanal	86
R	Pentanal	86
S	Pentan-1-ol	88
T	Butanoic acid	88

6.1 Define the term *boiling point* (2)

6.2 The boiling points of compounds **P**, **Q** and **R** are compared.

6.2.1 Besides the conditions used to determine boiling points, give a reason why this is a fair comparison. (1)

6.2.2 The boiling points increase from compound **P** to **R**. Fully explain this trend. (3)

The boiling points of compounds **R**, **S** and **T** are given below (NOT necessarily in the correct order).

138°C	103°C	163,5°C

6.3 Which ONE of the three boiling points is most likely the boiling point of compound **S**? Explain the answer. (4)
[10]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 12
CONTROL TEST - TERM 1

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
KONTROLETOETS - KWARTAAL 1

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstante*	G	6,67 x 10^{-11} $N \cdot m^2 \cdot kg^{-2}$
Radius of the earth *Radius van die aarde*	R_E R_A	6,38 x 10^6 m
Mass of the earth *Massa van die aarde*	M_E M_A	5,98 x 10^{24} kg

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

MOTION / *BEWEGING*

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

FORCE / *KRAG*

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

WEIGHT AND MECHANICAL ENERGY / *GEWIG EN MEGANIESE ENERGIE*

$w = mg$ or/*of* $F_g = mg$	$U = mgh$ or/*of* $E_p = mgh$
$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$	

THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE

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																	**He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

Ce 140	**Pr** 141	**Nd** 144	**Pm**	**Sm** 150	**Eu** 152	**Gd** 157	**Tb** 159	**Dy** 163	**Ho** 165	**Er** 167	**Tm** 169	**Yb** 173	**Lu** 175
Th 232	**Pa**	**U** 238	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*

Electronegativity / *Elektronegatiwiteit*

29 | 1,9 | Cu | 63,5

Symbol / *Simbool*

Approximate relative atomic mass / *Benaderde relatiewe atoommassa*

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GRADE 12 / *GRAAD 12*

PHYSICAL SCIENCES
FISIESE WETENSKAPPE

MEMORANDUM

APRIL 2021

MARKS*:* 100 / *PUNTE: 100*

TIME: 2 HOURS / *TYD: 2 UUR*

This memorandum consists of 11 pages.
Hierdie memorandum bestaan uit 11 bladsye.

QUESTION 1 / *VRAAG 1*

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

[10 x 2 = 20]

QUESTION 2 / *VRAAG 2*

2.1

Marking criteria / *Nasienriglyne*
If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark. / *Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

The perpendicular force, or component of a force, exerted by a surface on an object in contact with the surface.✓✓
Die loodregte krag, of komponent van 'n krag, wat deur die oppervlak op die voorwerp uitgeoefen word waarmee dit in kontak is. (2)

2.2.1

$$\left.\begin{aligned} F_{net} &= ma \\ T - F_g &= ma \end{aligned}\right\} \checkmark$$

$$T - (0{,}26)(9{,}8) = (0{,}26)(2{,}89) \checkmark$$

$$T = 3{,}299 \text{ N} \checkmark$$

(3)

2.2.2 **POSITIVE MARKING FROM QUESTION 2.2.1.**
POSITIEWE NASIEN VANAF 2.2.1.

OPTION 1 / *OPSIE 1*

Take motion to the left as positive / *Neem beweging na links as positief.*

$$\left.\begin{aligned} F_{net} &= ma \\ F_H - T - f &= ma \end{aligned}\right\}$$

$$\underline{60\cos 10° \checkmark - 3{,}2994} - \underline{0{,}3[(M \times 9{,}8) \checkmark - 60\sin 10°)]} = M(2{,}89) \checkmark$$

$$\therefore M = 10{,}11 \text{ kg} \checkmark$$

OPTION 2 / *OPSIE 2*

Take motion to the left as negative / *Neem beweging na links as negatief.*

$$\left.\begin{aligned} F_{net} &= ma \\ f + T - F_H &= ma \end{aligned}\right\}$$

$$\underline{0{,}3[(M \times 9{,}8) \checkmark - 60\sin 10°)]} + \underline{3{,}2994 \checkmark - 60\cos 10° \checkmark} = M(-2{,}89) \checkmark$$

$$\therefore M = 10{,}11 \text{ kg} \checkmark$$

(5)
[10]

QUESTION 3 / *VRAAG 3*

3.1

Marking criteria / *Nasienriglyne*
If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark. / *Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

The product of the resultant/net force acting on an object and the time the resultant/net force acts on the object. ✓✓
Die produk van die resultante/netto krag wat op 'n voorwerp inwerk en die tyd wat die resultante/netto krag op die voorwerp inwerk. (2)

3.2 **OPTION 1 / *OPSIE 1***

Neem beweging na oos as positief.
Take motion to the east as positive

$\sum p_{before} = \sum p_{after}$
$m_P v_{Pi} + m_Q v_{Qi} = m_P v_{Pf} + m_Q v_{Qf}$ Any ✓
$m(10) + m(-15) = m(-6) + mv_{Qf}$ ✓
$v_{Qf} = +1$
$\therefore v_{Qf} = 1$ m·s^{-1} ✓; east ✓ *oos*

OPTION 2 / *OPSIE 2*

Neem beweging na oos as negatief.
Take motion to the east as negative

$\sum p_{before} = \sum p_{after}$
$m_P v_{Pi} + m_Q v_{Qi} = m_P v_{Pf} + m_Q v_{Qf}$ Any ✓
$m(-10) + m(15) = m(6) + mv_{Qf}$ ✓
$v_{Qf} = -1$
$\therefore v_{Qf} = 1$ m·s^{-1} ✓; east/*oos* ✓

(5)

3.3.1

$\sum K_i = \sum K_f + \text{energy loss}$ *energieverlies*
$\frac{1}{2} m_P v_{Pi}^2 + \frac{1}{2} m_Q v_{Qi}^2 = \frac{1}{2} m_P v_{Pf}^2 + \frac{1}{2} m_Q v_{Qf}^2 + 28{,}8$ Any ✓
$\frac{1}{2} m(10^2 + 15^2)$ ✓ $= \frac{1}{2} m(6^2 + 1^2)$ ✓ $+ 28{,}8$ ✓
$m = 0{,}2$ kg ✓

(5)

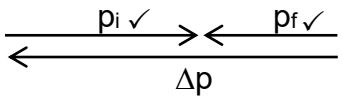
3.3.2 **POSITIVE MARKING FROM 3.2 AND 3.3.1.**
POSITIEWE NASIEN VANAF 3.2 EN 3.3.1.
Note: Force on ball **P** is exerted by ball **Q**.
Nota: *Krag op bal **P** word uitgeoefen deur bal **Q**.*

$F_{net} = \frac{\Delta p}{\Delta t}$
$= \frac{m(v_f - v_i)}{t_f - t_i}$ Any ✓
$= \frac{0{,}2(-6-10)}{1{,}75-1{,}25}$ ✓✓
$= -6{,}4$
$= 6{,}4$ N ✓

Accept/*Aanvaar*
$F_{net} = \frac{\Delta p}{\Delta t}$
$= \frac{m(v_f - v_i)}{t_f - t_i}$ Any ✓
$= \frac{0{,}2(1-(-15))}{1{,}75-1{,}25}$ ✓
$= +64$ 6,4
$= 64$ N ✓ 6,4 N

(4)

3.4.1 Final momentum / p_f / *Finale momentum* ✓ (1)
Negative marking. / *Negatiewe nasien.*

3.4.2 

(2)
[19]

QUESTION 4 / *VRAAG 4*

4.1 **Anyone of / *Enigeen van* ✓**
Because of inertia. / *As gevolg van traagheid.*
It has an upward velocity. / *Dit het 'n opwaartse snelheid.*
It has an upward momentum. / *Dit het 'n opwaartse momentum.* (1)

4.2 Motion of an object under the influence of gravitational force ONLY.✓✓
Beweging van 'n voorwerp onder die invloed van SLEGS gravitasiekrag. $\left(\frac{2}{2}\right)$ or/*of* $\left(\frac{0}{2}\right)$ (2)

4.3 0,7 s ✓ (1)

4.4.1

Option 1 / *Opsie 1* **Up + / *Op +***	**Option 2 / *Opsie 2*** **Down + / *Af +***
$v_f = v_i + g\Delta t$ ✓	$v_f = v_i + g\Delta t$ ✓
0 ✓ $= v_i + (-9,8)(0,7)$ ✓	$0 = v_i + (9,8)(0,7)$ ✓
$v_i = 6,86$ m·s^{-1} upward ✓	$v_i = -6,89$
	$\therefore v_i = 6,86$ m·s^{-1} upwards ✓

(4)

4.4.2 **POSITIVE MARKING FROM 4.4.1/ *POSITIEWE NASIEN VANAF 4.4.1.***

Whole motion	From maximum height	From 1,4 s
Option 1 / *Opsie 1* Down + / *Af +* $v_f = v_i + g\Delta t$ ✓ $= -6{,}86 + (9{,}8)(2{,}7)$ ✓ $= +19{,}6$ $= 19{,}6$ m·s^{-1} down ✓ Down - / *Af -* $v_f = v_i + g\Delta t$ ✓ $= 6{,}86 + (-9{,}8)(2{,}7)$ ✓ $= -19{,}6$ $= 19{,}6$ m·s^{-1} down ✓	**Option 4 / *Opsie 4*** Down + / *Af +* $v_f = v_i + g\Delta t$ ✓ $= 0 + (9{,}8)(2{,}0)$ ✓ $= +19{,}6$ $= 19{,}6$ m·s^{-1} down ✓ Down - / *Af -* $v_f = v_i + g\Delta t$ ✓ $= 0 + (-9{,}8)(2{,}0)$ ✓ $= -19{,}6$ $= 19{,}6$ m·s^{-1} down ✓	**Option 7** Down + / *Af +* $v_f = v_i + g\Delta t$ ✓ $= 6{,}86 + (9{,}8)(1{,}3)$ ✓ $= +19{,}6$ $= 19{,}6$ m·s^{-1} down ✓ Down - / *Af -* $v_f = v_i + g\Delta t$ ✓ $= -6{,}86 + (-9{,}8)(1{,}3)$ ✓ $= -19{,}6$ $= 19{,}6$ m·s^{-1} down ✓
Option 2 / *Opsie 2* Down - / *Af -* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (6{,}86)^2 + 2(-9{,}8)(-17{,}2)$ ✓ $= 384{,}179$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓ Down + / *Af +* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (-6{,}86)^2 + (9{,}8)(17{,}2)$ ✓ $= 384{,}179$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓	**Option 5 / *Opsie 5*** Down - / *Af -* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (0)^2 + 2(-9{,}8)(-19{,}6)$ ✓ $= 384{,}16$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓ Down + / *Af +* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (0)^2 + 2(9{,}8)(19{,}6)$ ✓ $= 384{,}16$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓	**Option 8 / *Opsie 8*** Down - / *Af -* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (-6{,}86)^2 + 2(-9{,}8)(-17{,}2)$ ✓ $= 384{,}179$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓ Down + / *Af +* $v_f^2 = v_i^2 + 2g\Delta y$ ✓ $= (6{,}86)^2 + (9{,}8)(17{,}2)$ ✓ $= 384{,}179$ $\therefore v_f = -19{,}6$ $v_f = 19{,}6$ m·s^{-1} down ✓

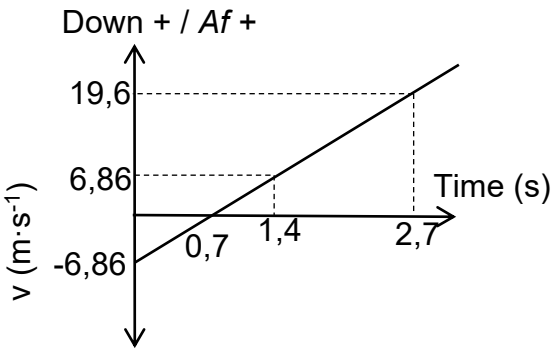
Option 3 / *Opsie 3*	**Option 6 / *Opsie 6***	**Option 9 / *Opsie 9***
Down - / *Af -* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $-17,2 = \left(\frac{v_f + 6,86}{2}\right)(2,7)$ ✓ ✓ $v_f = -19,6$ $v_f = 19,6$ m·s^{-1} down ✓ Down + / *Af +* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $17,2 = \left(\frac{v_f + (-6,86)}{2}\right)(2,7)$ ✓ ✓ $v_f = +19,6$ $v_f = 19,6$ m·s^{-1} down ✓	Down - / *Af -* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $-19,6 = \left(\frac{v_f + 0}{2}\right)(2,0)$ ✓ ✓ $v_f = -19,6$ $v_f = 19,6$ m·s^{-1} down ✓ Down + / *Af +* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $19,6 = \left(\frac{v_f + 0}{2}\right)(2,0)$ ✓ ✓ $v_f = +19,6$ $v_f = 19,6$ m·s^{-1} down ✓	Down - / *Af -* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $-17,2 = \left(\frac{v_f + (-6,86)}{2}\right)(1,3)$ ✓ ✓ $v_f = -19,6$ $v_f = 19,6$ m·s^{-1} down ✓ Down + / *Af +* $\Delta y = \left(\frac{v_f + v_i}{2}\right)\Delta t$ ✓ $17,2 = \left(\frac{v_f + (6,86)}{2}\right)(1,3)$ ✓ ✓ $v_f = +19,6$ $v_f = 19,6$ m·s^{-1} down ✓

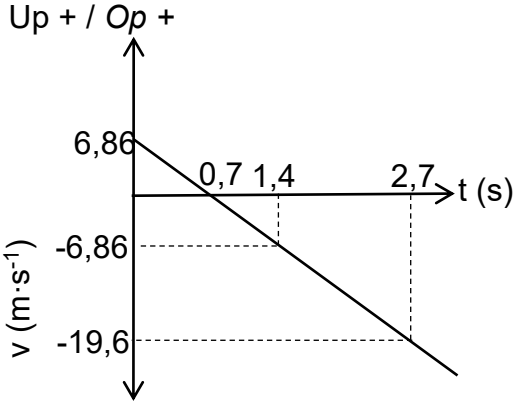
(4)

4.5

Marking criteria / *Nasienriglyne*

- Zero velocity at 0,7 s. / *Zero snelheid by 0,7 s.* ✓
- Initial velocity of +/- 6,86 m·s^{-1} indicated at t_o. ✓
  Aanvanklike snelheid van +/- 6,86 m·s^{-1} aangedui by t_o.
- Same magnitude velocities with opposite signs at t = 0 s and t = 1,4 s. ✓
  Gelyke grootte snelhede met teenoorgestelde tekens by t = 0 s and t = 1,4 s.
- Straight line graph intersecting x-axis at t = 0,7 s. ✓
  Reguitlyngrafiek wat x-as by t = 0,7 s sny.





(4)

4.6 **POSITIVE MARKING FROM 4.4.1. / *POSITIEWE NASIEN VANAF 4.4.1.***

Time for brick to reach maximum height after the bounce.
Tyd vir baksteen om maksimumhoogte na hop te bereik.

Option 1 / *Opsie 1*
Up + / *Af* +

$v_f = v_i + a\Delta t$
$0 = 4{,}59 + (-9{,}8)\Delta t$ ✓
$\Delta t = 0{,}468\,s$

Option 2
Down + / *Af* +

$v_f = v_i + a\Delta t$
$0 = -4{,}59 + (9{,}8)\Delta t$
$\Delta t = 0{,}468\,s$

Tyd geneem deur die hyskraan vir die volle beweging:
Time taken by the crane for the whole motion = 2,7 + 0,3 + 0,468
= 3,468 s

Distance by pallet (Up +) / Afstand van pallet (Op +)

$\Delta y = v_i\Delta t + a\Delta t^2$
$= 6{,}86(3{,}468) + 0$ ✓
$= 23{,}79\,m$

h = 23,79 ✓

Height above ground / *Hoogte bo grond*

23,79 + 17,2 = 40,99 m

Distance by brick / *Afstand deur baksteen*

Up + / *Op* +

$v_f^2 = v_i^2 + 2g\Delta y$
$0 = (4{,}59)^2 + 2(-9{,}8)\Delta y$ ✓
Δy = 1,075 m

Down + / *Af* +

$v_f^2 = v_i^2 + 2g\Delta y$
$0 = (-4{,}59)^2 + 2(9{,}8)\Delta y$
Δy = -1,075 m

Height above ground / *Hoogte by grond* = 1,075 m ✓

Distance between pallet and brick / *Afstand tussen pallet en baksteen*
= 40,99 – 1,075 = 39,915 m ✓ (6)

4.7 **POSITIVE MARKING FROM 4.4.2. / *POSITIEWE NASIEN VANAF 4.4.2.***

Option 1 / *Opsie 1*
Down + / *Af* +
$F_{net}\Delta t = m(v_f - v_i)$✓
$= 1{,}9\,(-4{,}59 - (+19{,}6))$✓
$= -45{,}96$
$= 45{,}96$ N·s✓ up✓

Option 2 / *Opsie 2*
Up + / *Op* +
$F_{net}\Delta t = m(v_f - v_i)$✓
$= 1{,}9\,(4{,}59 - (-19{,}6))$✓
$= +45{,}96$
$= 45{,}96$ N·s✓ up✓

(4)
[26]

QUESTION 5 / *VRAAG 5*

5.1.1 The C atom bonded to the hydroxyl group is bonded to three other C-atoms ✓✓
Die C-atoom wat aan die hidroksielgroep gebind is, is ook gebind aan drie ander C-atome. (2)

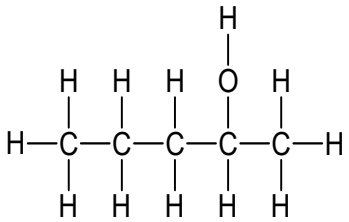
5.1.2 Hydroxyl (group) / *Hidroksiel(groep)* ✓ (1)

5.1.3 2-methylbutan-2-ol/2-methyl-2-butanol / 2-metielbutan-2-ol/2-metiel-2-butanol
OR **OF**
3-methylbutan-2-ol/3-methyl-2-butanol / 3-metielbutan-2-ol/3-metiel-2-butanol

Marking criteria / *Nasienriglyne*
- Correct stem i.e. butanol ✓
  Korrekte stam, d.i. butanol
- The substituent (methyl) correctly identified. ✓
  Die substituent (metiel) korrek geïdentifiseer.
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓
  IUPAC-naam heeltemal korrek insluitende nommers, volgorde, koppeltekens en kommas.

(3)

5.1.4

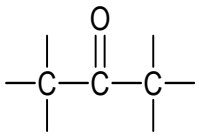


Marking criteria / *Nasienriglyne*
- Whole structure correct: $^{2}/_{2}$
  Hele struktuur korrek
- Only functional group correct: Max: $^{1}/_{2}$
  Slegs funksionele groep korrek

IF/*INDIEN*
- More than one functional group: $^{0}/_{2}$
  Meer as een funksionele groep

(2)

5.2.1



✓ (1)

5.2.2 Butanal/*Butanaal*

Marking criteria / *Nasienriglyne*
- Correct stem, i.e. but / *Korrekte stam, d.i. but* ✓
  Whole name correct / *Hele naam korrek* ✓

(2)

5.3.1 C_nH_{2n-2} ✓ (1)

5.3.2 3-methylpent-1-yne/3-methyl-1-pentyne
3-metielpent-1-yn/3-metiel-1-pentyn

Marking criteria / *Nasienriglyne*
- Correct stem i.e. pentyne ✓
  Korrekte stam, d.i. pentyn
- The substituent (methyl) correctly identified. ✓
  Die substituent (metiel) korrek geïdentifiseer.
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓
  IUPAC-naam heeltemal korrek insluitende nommers, volgorde, koppeltekens en kommas.

(3)
[15]

QUESTION 6 / *VRAAG 6*

6.1

Marking criteria / Nasienriglyne
If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark. / *Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af*.

The temperature at which the vapour pressure equals atmospheric (external) pressure. ✓✓
Die temperatuur waar die dampdruk gelyk is aan atmosferiese (eksterne) druk. (2)

6.2.1 Same molecular mass/molecular size ✓
Dieselfde molekulêre massa / molekulêre grootte
OR/*OF*
Same number of C-atoms AND same homologous series
Dieselfde aantal C-atome EN dieselfde homoloë reeks (1)

6.2.2 **From P to R / *Van P na R***
- **Structure/*Struktuur***

Less branched / less compact / less spherical / longer chain length / larger surface area (over which intermolecular forces act) ✓
Minder vertak / minder kompak / minder sferies / langer kettinglengte / groter oppervlakarea (waaroor die intermolekulêre kragte inwerk)
- **Intermolecular forces / *Intermolekulêre kragte***

Stronger / more intermolecular forces / Van der Waals forces / London forces / dispersion forces / induced dipole forces ✓
Sterker / meer intermolekulêre kragte / Van der Waalskrage / London-kragte / dispersiekragte / geïnduseerde dipoolkragte
- **Energy/*Energie***

More energy needed to overcome or break intermolecular forces / Van der Waals forces ✓
Meer energie is nodig om die intermolekulêre kragte te oorkom of te breek / Van der Waalskragte

OR/*OF*

From R to P / *Van R na P*

- **Structure/*Struktuur***

More branched / more compact / more spherical / shorter chain length / smaller surface area (over which intermolecular forces act) ✓
Meer vertak / meer kompak / meer sferies / korter kettinglengte / kleiner oppervlakarea (waaroor die intermolekulêre kragte inwerk)

- **Intermolecular forces / *Intermolekulêre kragte***

Weaker / less intermolecular forces / Van der Waals forces / London forces / dispersion forces / induced dipole forces ✓
Swakker / minder intermolekulêre kragte / Van der Waalskrage / London-kragte / dispersiekragte / geïnduseerde dipoolkragte

- **Energy/*Energie***

Less energy needed to overcome or break intermolecular forces / Van der Waals forces ✓
Minder energie is nodig om die intermolekulêre kragte te oorkom of te breek / Van der Waalskragte (3)

6.3 138 (°C) ✓

Marking criteria / *Nasienriglyn*
- Compare strength of intermolecular forces of **R**, **S** and **T**.
  *Vergelyk sterkte van intermolekulêre kragte van **R**, **S** en **T**.*
- Compare boiling points / energy required to overcome intermolecular forces of aldehydes/**R** and alcohols/**S**.
  *Vergelyk kookpunte / energie benodig om intermolekulêre kragte van aldehiede/**R** en alkohole/**S** te oorkom.*

OR/*OF*
Aldehydes have the lowest boiling point.
Aldehiede het die laagste kookpunt.
- Compare boiling points / energy required to overcome intermolecular force of alcohols/**S** and carboxylic acids/**T**
  *Vergelyk kookpunte / energie benodig om intermolekulêre kragte van alkohole/**S** en karboksielsure/**T** te oorkom.*

- Alcohols/pentan-1-ol/**S** have intermolecular forces which are stronger than those of aldehydes/pentanal/**R**, but weaker than those of carboxylic acids/butanoic acid/**T** ✓
  *Alkohole/pentan-1-ol/**S** het sterker intermolekulêre kragte as dié van aldehiede/pentanaal/**R**, maar swakker intermolekulêre kragte as dié van karboksielsure/butanoësuur/**T**.*
- Therefore alcohols/pentan-1-ol/**S** have higher boiling points than aldehydes/pentanal/**R**, ✓ but lower boiling points than carboxylic acids/butanoic acid/**T** ✓
  Dus het alkohole/pentan-1-ol/**S** hoër kookpunte as aldehiede/pentanaal/**R**, maar laer kookpunte as karboksielsure/butanoësuur/**T**.

OR/*OF*
- Therefore alcohols/pentan-1-ol/**S** require more energy to overcome intermolecular forces than aldehydes/pentanal/**R**, ✓ but require less energy to overcome intermolecular forces than carboxylic acids/butanoic acid/**T** ✓
  *Dus benodig alkohole/pentan-1-ol/**S** meer energie om die intermolekulêre kragte te oorkom as aldehiede/pentanaal/**R**, maar benodig minder energie om die intermolekulêre kragte van karboksielsure/butanoësuur/**T** te oorkom.* (4)

[10]

GRAND TOTAL / *GROOTTOTAAL*: 100