

Physical Sciences Grade 12 Memorandum Controlled Test 1

Question 1

- 1.1. A ✓✓ (2)  
1.2. D ✓✓ (2)  
1.3. D ✓✓ (2)  
1.4. B ✓✓ (2)  
1.5. A ✓✓ (2)  
1.6. B ✓✓ (2)  
1.7. C ✓✓ (2)

[14]

**QUESTION 2**

2.1. The normal force,  $N = w = mg$  ✓  
 $= (6\text{kg})(9.8\text{m}\cdot\text{s}^{-2})$  ✓  
 $= 58.8 \text{ N}$  ✓

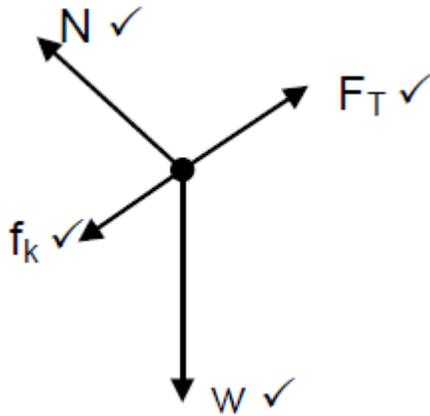
Maximum static friction,  $F^{\text{max}} = \mu_s N$   
 $= 0,4(58.8)$  ✓  
 $= 23,52\text{N}$  ✓ (5)

2.2. *Static frictional force*,  $f_s$ , is defined as the force that opposes the tendency of motion of a stationary object relative to a surface. ✓✓ (2)

2.3. Newton's second law of motion: When a resultant/net force acts on an object, the object will accelerate in the direction of the force at acceleration directly proportional to the force and inversely proportional to the mass of the object. ✓✓ (2)

2.4. Remains the same ✓ (1)

2.5.



Accepted labels	
W	$F_g/F_w$ /weight/mg/gravitational force
f	$F_{friction}/F_f$ /friction
N	$F_N/F_{normal}$ /normal force
$F_T$	$F_T$ /T/tention

(4)

2.6.1. Up the incline as positive

$$F_{net} = ma$$

$$F_T + f_k + w_{//} = ma$$

$$F_T + \mu_k N + w \sin 30^\circ = ma$$

$$F_T + \mu_k mg \cos 30^\circ + mg \sin 30^\circ = ma$$

$$F_T - (0,2)(6)(9,8) \cos 30^\circ - (9)(9,8) \sin 30^\circ = (6)(4)$$

$$F_T = 63,58 \text{ N}$$

} Any one

(5)

2.6.2. Up the incline as positive

$$F_{net} = ma$$

$$F_T + f_{k(6kg)} + f_{k(3kg)} + w_{//} = ma$$

$$F_T + \mu_k N_{(6kg)} + \mu_k N_{(3kg)} + mg \sin 30^\circ = ma$$

$$F_T - (0,2)(6)(9,8) \cos 30^\circ - (0,1)(3)(9,8) \cos 30^\circ - (9)(9,8) \sin 30^\circ = 0$$

$$F_T = 56,83 \text{ N}$$

} Any one

(4)

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### QUESTION 3

3.1. Projectile is described as an object upon which the only force acting is the force of gravity. ✓✓ (2)

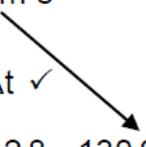
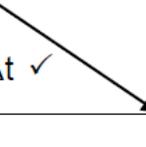
3.2.1. Upwards ✓ (1)

3.2.2. Downwards ✓ (1)

3.3. Q ✓

Weight is the only force acting on the rocket. ✓ (2)

3.4.

<p><b><u>OPTION 1/OPSIE 1</u></b>  <b>Upwards positive/Opwaarts positief:</b>  <math>\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark</math>  <math>\therefore -225,6 \checkmark = (112,8) \Delta t \checkmark + \frac{1}{2} (-9,8) \Delta t^2 \checkmark</math>  <math>\therefore \Delta t = 24,87 \text{ s}</math>              Total time/Totale tyd:  <math>4 + \checkmark 24,87 = 28,87 \text{ s} \checkmark</math></p> <p><b>Downwards positive/Afwaarts positief:</b>  <math>\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark</math>  <math>\therefore 225,6 \checkmark = (-112,8) \Delta t \checkmark + \frac{1}{2} (9,8) \Delta t^2 \checkmark</math>  <math>\therefore \Delta t = 24,87 \text{ s}</math>              Total time/Totale tyd:  <math>4 + \checkmark 24,87 = 28,87 \text{ s} \checkmark</math></p>	<p><b><u>Notes/Aantekeninge:</u></b>            Accept/Aanvaar:            g or/of a  <math>s = ut + \frac{1}{2} at^2</math>  <math>\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2</math></p>
<p><b><u>OPTION 2/OPSIE 2</u></b>  <b>Upwards positive/Opwaarts positief:</b>  <math>v_f^2 = v_i^2 + 2a\Delta y</math>  <math>\therefore v_f^2 = (112,8)^2 + 2(-9,8)(-225,6) \checkmark</math>  <math>\therefore v_f = 130,94 \text{ m}\cdot\text{s}^{-1}</math>    <math>\Delta y = \left( \frac{v_i + v_f}{2} \right) \Delta t \checkmark</math>  <math>-225,6 \checkmark = \left( \frac{112,8 - 130,94}{2} \right) \Delta t \checkmark</math>  <math>\therefore \Delta t = 24,87 \text{ s}</math>              Total time/Totale tyd :  <math>4 + \checkmark 24,87 = 28,87 \text{ s} \checkmark</math></p> <p><b>Downwards positive/Afwaarts positief:</b>  <math>v_f^2 = v_i^2 + 2a\Delta y</math>  <math>\therefore v_f^2 = \frac{(-112,8)^2 + 2(9,8)(225,6)}{\checkmark}</math>  <math>\therefore v_f = 130,94 \text{ m}\cdot\text{s}^{-1}</math>    <math>\Delta y = \left( \frac{v_i + v_f}{2} \right) \Delta t \checkmark</math></p>	<p><b><u>Notes/Aantekeninge:</u></b>            Accept/Aanvaar:            g or/of a  <math>v_f^2 = v_i^2 + 2a\Delta x</math>  <math>v^2 = u^2 + 2as</math>  <math>\Delta x = \left( \frac{v_i + v_f}{2} \right) \Delta t</math>  <math>s = \left( \frac{u + v}{2} \right) t</math></p>

$225,6 \checkmark = \left( \frac{-112,8 + 130,94}{2} \right) \Delta t \checkmark$ $\therefore \Delta t = 24,87 \text{ s}$ <p style="text-align: center;">↓</p> <p>Total time / Totale tyd:</p> $4 + \checkmark 24,87 = 28,87 \text{ s} \checkmark$	
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<p><b><u>OPTION 3/OPSIE 3</u></b></p> <p><b>Upwards positive / Opwaarts positief:</b>  Time from point where fuel is used up to maximum height / Tyd vanaf punt waar brandstof opgebruik is tot maksimum hoogte :  <math>v_f = v_i + a\Delta t \checkmark</math>  <math>\therefore 0 = 112,8 + (-9,8)\Delta t \checkmark</math>  <math>\therefore \Delta t = 11,51 \text{ s}</math></p> <p>Time from maximum height to ground / Tyd vanaf maksimum hoogte tot die grond:  <math>\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2</math>  <math>= (112,8)(11,51) + \frac{1}{2}(-9,8)(11,51)^2</math>  <math>\therefore \Delta y = 649,18 \text{ m}</math></p> <p>Maximum height / Maksimum hoogte:  <u>225,6 + 649,18 = 874,78 m</u></p> $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2 \checkmark$ $\therefore -874,78 = (0)\Delta t + \frac{1}{2}(-9,8)\Delta t^2 \checkmark$ $\therefore \Delta t = 13,36 \text{ s}$ <p>Total time / Totale tyd:  <u>4 + \checkmark 11,51 + 13,36 = 28,87 s \checkmark</u></p>	<p><b><u>Notes/Aantekeninge:</u></b>  Accept/Aanvaar:  g or/of a  <math>v = u + at</math>  <math>v_f^2 = v_i^2 + 2a\Delta x</math>  <math>v^2 = u^2 + 2as</math>  <math>s = ut + \frac{1}{2} at^2</math>  <math>\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2</math></p>
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**Downwards positive/Afwaarts positief:**

Time from point where fuel is used up to maximum height/ Tyd vanaf punt waar brandstof opgebruik is tot maksimum hoogte:

$$v_f = v_i + a\Delta t \checkmark$$

$$\therefore 0 = -112,8 + (9,8)\Delta t \checkmark$$

$$\therefore \Delta t = 11,51 \text{ s}$$

Time from maximum height to ground: Tyd vanaf maksimum hoogte tot die grond:

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} a \Delta t^2 \\ &= (-112,8)(11,51) + \frac{1}{2}(9,8)(11,51)^2 \\ \therefore \Delta y &= -649,18 \text{ m} \end{aligned}$$

Maximum height/ Maksimum hoogte:

$$225,6 + 649,18 = 874,78 \text{ m}$$

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

$$\therefore 874,78 = (0)\Delta t + \frac{1}{2}(9,8)\Delta t^2 \checkmark$$

$$\therefore \Delta t = 13,36 \text{ s}$$

Total time/Totale tyd

$$4 + \checkmark 11,51 + 13,36 = 28,87 \text{ s} \checkmark$$

**Notes/Aantekeninge:**

Accept/Aanvaar:

g or/of a

$$v = u + at$$

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$v^2 = u^2 + 2as$$

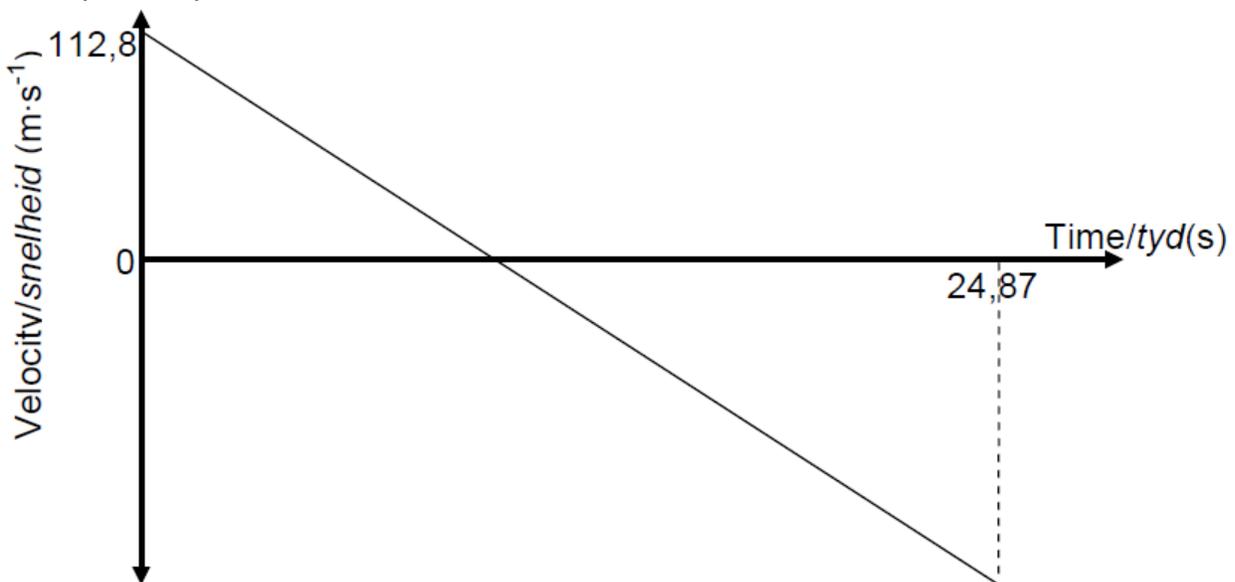
$$s = ut + \frac{1}{2}at^2$$

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

(6)

## 3.5. OPTION 1

Upwards positive



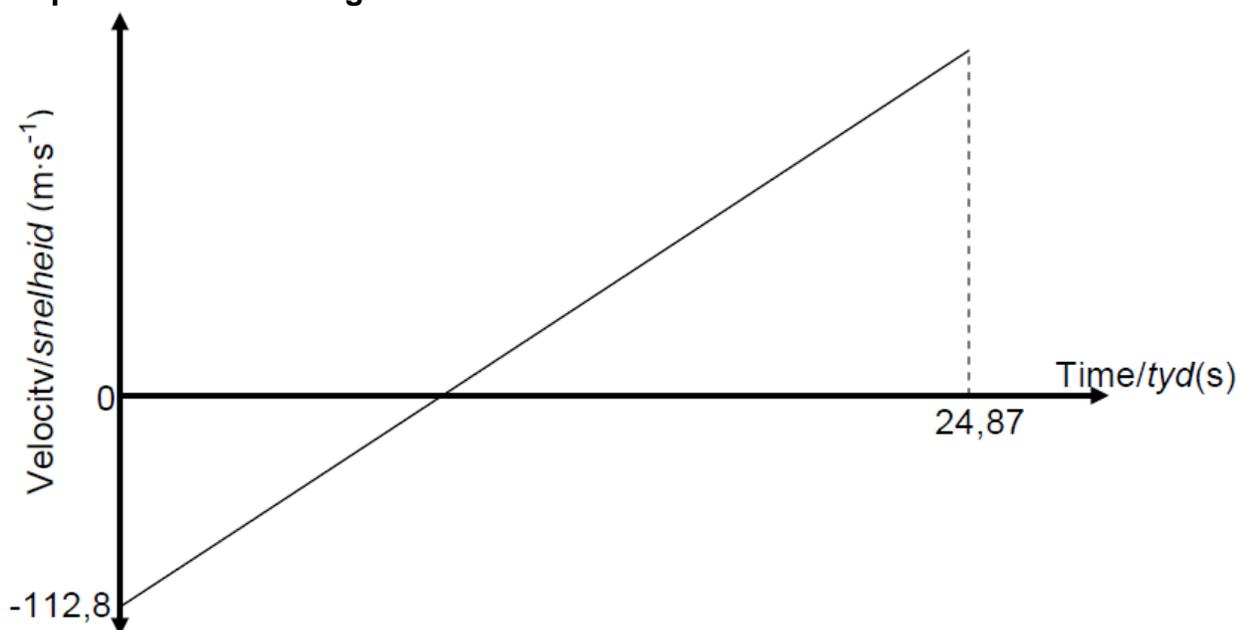
Criteria for graph	Marks
Graph starts at (0; 112,8).	✓
Graph is a straight line with a gradient.	✓
Graph has a negative gradient	✓
<b>POSITIVE MARKING FROM QUESTION 3.4.</b> Graph extends below x-axis until t = 24,87 s. and Graph extends below the x-axis to a magnitude of the velocity greater than (112,8 m·s <sup>-1</sup> ).	✓

(4)

Notes: If wrong labels – max.  $\frac{3}{4}$

### OPTION 2

If upwards taken as negative: Max.  $\frac{3}{4}$



Criteria for graph	Marks
Graph starts at (0; -112,8)	✓
Graph is a straight line with a gradient.	✓
Graph has a negative gradient	✓
<b>POSITIVE MARKING FROM QUESTION 3.4.</b> Graph extends above x-axis until t = 24,87 s. and Graph extends above the x-axis to a magnitude of the velocity greater than (112,8 m·s <sup>-1</sup> ).	✓

(4)

[15]

#### QUESTION 4

$$\begin{aligned} 4.1.1. \Delta p &= m(v_f - v_i) \quad \checkmark \\ &= 0,3\text{kg} \checkmark (- 8\text{m}\cdot\text{s}^{-1} \checkmark - 12\text{m}\cdot\text{s}^{-1} \checkmark) \\ &= -6\text{kg}\cdot\text{m}\cdot\text{s}^{-1} \\ &= 6\text{kg}\cdot\text{m}\cdot\text{s}^{-1} \text{ to the left } \checkmark \quad (5) \end{aligned}$$

$$4.1.2. F\Delta t = \Delta p \checkmark = 6\text{kg}\cdot\text{m}\cdot\text{s}^{-1} \text{ to the left } \checkmark \quad (2)$$

$$\begin{aligned} 4.1.3. \Delta p &= - 6\text{kg}\cdot\text{m}\cdot\text{s}^{-1} \\ \Delta t &= 0,01\text{s} \\ F\Delta t &= \Delta p \checkmark \\ F(0,01\text{s}) \quad \checkmark &= - 6\text{kg}\cdot\text{m}\cdot\text{s}^{-1} \checkmark \\ F &= - 600\text{N} \end{aligned}$$

The force F is 600N to the left  $\checkmark$  (4)

$$\begin{aligned} 4.2. \quad m_1v_{i1} + m_2v_{i2} &= m_1v_{f1} + m_2v_{f2} \checkmark \\ (0,6\text{kg})(5\text{m}\cdot\text{s}^{-1}) \checkmark + (0,3\text{kg})(0\text{m}\cdot\text{s}^{-1}) \checkmark &= (0,6\text{kg})(2\text{m}\cdot\text{s}^{-1}) \checkmark + (0,3)v_2 \checkmark \\ v_2 &= 6\text{m}\cdot\text{s}^{-1} \checkmark \quad (6) \end{aligned}$$

[17]

#### QUESTION 5

5.1.1. B  $\checkmark$  (1)

5.1.2. E  $\checkmark$  (1)

5.1.3. B  $\checkmark$  & F  $\checkmark$  (2)

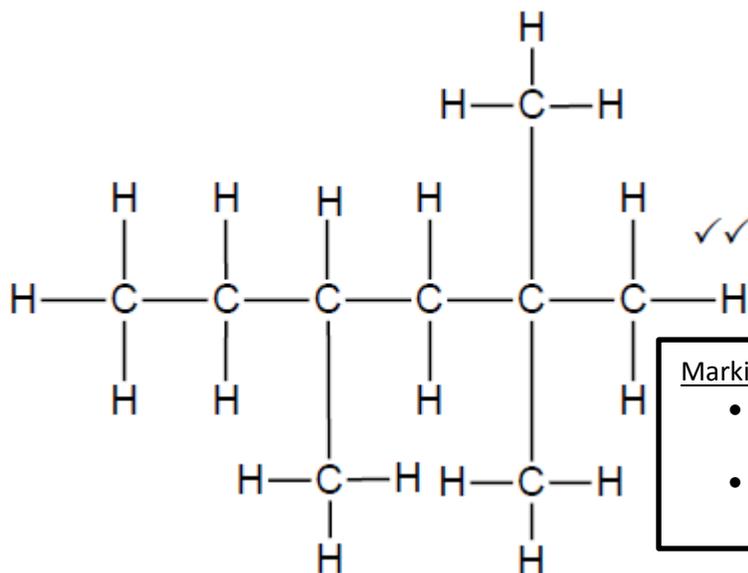
5.2.1. 2-bromo-3-chloro-4-methylpentane

Marking criteria

- Correct stem i.e. pentane.  $\checkmark$
- All substituents correctly identified, in alphabetical order, hyphens and commas correctly used  $\checkmark$  (2)

5.2.2. Ethene  $\checkmark$  (1)

5.3.1.

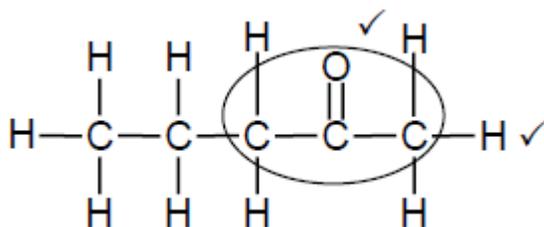


Marking criteria

- Six saturated C atoms in longest chain i.e. hexane ✓
- Three methyl substituents on second C and fourth C ✓

(2)

5.3.2.



Marking criteria

- Whole structure correct: 2/2
- Only functional group correct: 1/2

(2)

[11]

**QUESTION 6**

6.1.1.



<u>Criteria for investigative question</u>	
The dependent and independent variables are stated	✓
Ask a question about the relationship between the independent and dependent variables <u>Examples</u> How does an increase in chain length/molecular size/molecular structure/molecular mass/surface area influence boiling point? What is the relationship between chain length/molecular size/molecular structure/molecular mass/surface area and boiling point?	✓

(2)

6.1.2.

- **Structure**

The chain length/ molecular size/molecular structure/molecular mass/surface area increases. ✓

- **Intermolecular forces**

Increase in strength of intermolecular forces/induced dipole/London/dispersion/Van der Waals forces. ✓

- **Energy**

More energy needed to overcome/break intermolecular forces ✓

OR

- **Structure**

From propane to methane the chain length/ molecular size/molecular structure/molecular mass/surface area increases.

- **Intermolecular forces**

Decrease in strength of intermolecular forces/induced dipole/London/dispersion/Van der Waals forces.

- **Energy**

Less energy needed to overcome/break intermolecular forces (3)

- Between propane molecules are London forces/dispersion forces/induced dipole forces ✓
- Between propan-1-ol molecules are London forces/dispersion forces/induced dipole forces and hydrogen bonds. ✓
- Hydrogen bonds/Forces between alcohol molecules are stronger or need more energy than London forces/dispersion forces/induced dipole forces ✓

OR

Between propane molecules are weak London forces/dispersion forces/induced dipole forces ✓ and between propan-1-ol are strong hydrogen bonds ✓✓ (3)

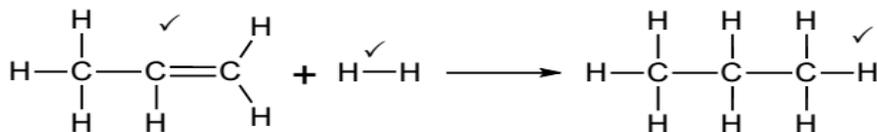
## QUESTION 7

7.1.1. Substitution / chlorination / halogenation ✓ (1)

7.1.2. Substitution / hydrolysis ✓ (1)

7.2.1. Hydrogenation ✓ (1)

7.2.2.



### Notes / Aantekeninge:

- Ignore/Ignoreer ⇌
- Accept H<sub>2</sub> if condensed. / Aanvaar H<sub>2</sub> as gekondenseerd.
- Any additional reactants and/or products

Enige addisionele reaktanse en / of produkte:

Max./Maks. 2/3

- Accept coefficients that are multiples.  
Aanvaar koëffisiënte wat veelvoude is.
- Molecular / condensed formulae

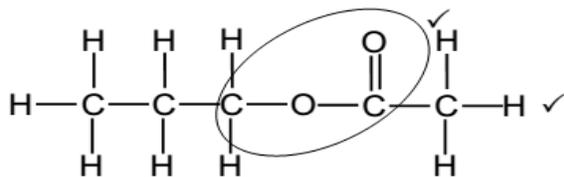
Molekulêre-/ gekondenseerde formule:

Max./Maks. 2/3

(3)

7.3.1. (Concentrated) H<sub>2</sub>SO<sub>4</sub> / (Concentrated) sulphuric acid ✓ (1)

7.3.2.



### Marking criteria / Nasienriglyne:

- Whole structure correct / Hele struktuur korrek: 2/2
- Only functional group correct / Slegs funksionele groep korrek: 1/2

7.4. Sulphuric acid / H<sub>2</sub>SO<sub>4</sub> / Phosphoric acid / H<sub>3</sub>PO<sub>4</sub> ✓ (1)

7.5. C<sub>3</sub>H<sub>8</sub> + 5O<sub>2</sub> ✓ → 3CO<sub>2</sub> + 4H<sub>2</sub>O ✓ bal ✓ (3)

TOTAL: 100