education

Department of Education
FREE STATE PROVINCE

CONTROL TEST/ *KONTROLETOETS*

GRADE/*GRAAD* 12

PHYSICAL SCIENCES

MARCH 2025

CONTROLLED TEST

MARKING GUIDELINE/ *NASIENRIGLYN*.

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

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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]

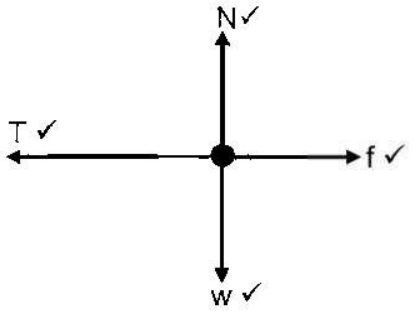
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QUESTION 2 / *VRAAG 2*

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 product of an object's mass and its velocity.✓✓
Momentum is die produk van die massa en snelheid 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 Velocity/momentum is constant between 0 s and 10 s✓
Change in momentum/Δp = 0 ✓
∴According to $F_{net} = \frac{\Delta p}{\Delta t}$ ✓, F_{net} = 0 N

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

OR/OF

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

Snelheid is konstant tussen 0 s en 10 s
Verandering in snelheid/Δv = 0 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)

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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

✓Any one/*Enige een*

$F_{net} = ma$
20000 = m(4)✓
m = 5000 kg✓ (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 ✓

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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)

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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*

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$
$$-100\checkmark = 12\Delta t + \frac{1}{2}(-9{,}8)\Delta t^2 \checkmark$$
$$\Delta t = 5{,}91 \text{ s}$$

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

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

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

OPTION/*OPSIE* 2

Up/*Op* -ve

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

$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2 \checkmark$$
$$100\checkmark = -12\Delta t + \frac{1}{2}(9{,}8)\Delta t^2 \checkmark$$
$$\Delta t = 5{,}91 \text{ s}$$

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

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

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

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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*

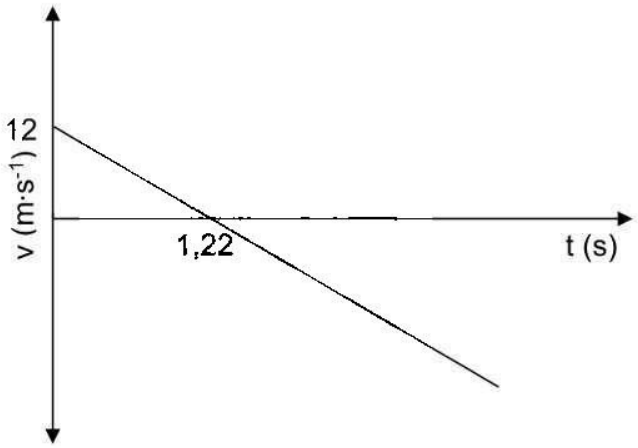
$$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2\checkmark$$
$$15\checkmark = 3\Delta t + \frac{1}{2}(0)\Delta t^2 \checkmark$$
$$\Delta t = 5 \text{ s}$$

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

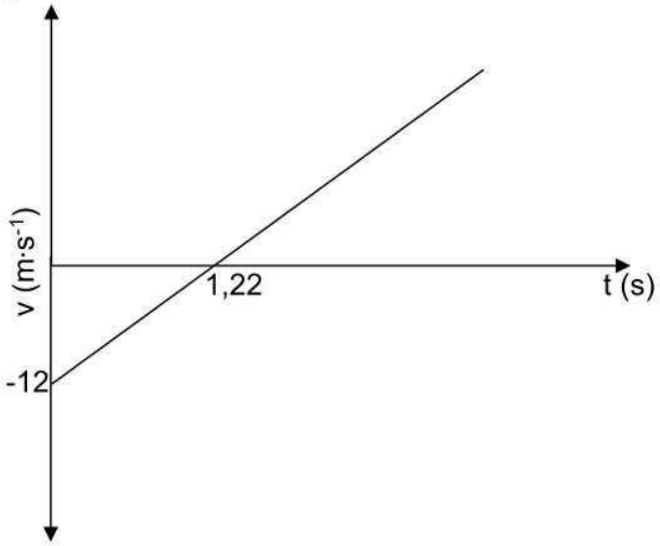
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4.6 **POSITIVE MARKING FROM QUESTION 4.3**
POSITIEWE NASIEN VANAF VRAAG 4.3

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

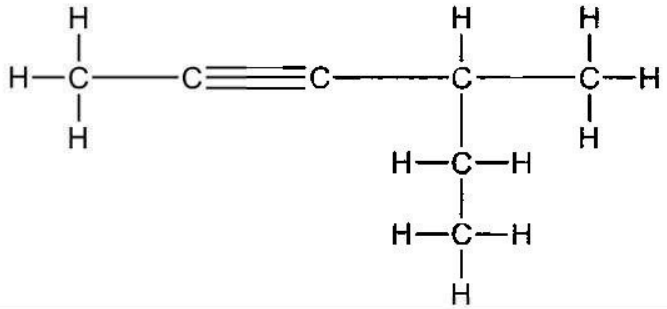
5.3.2 6-bromo-3-ethyl-2-methylheptane/ *6-bromo-3-etiel-2-metielheptaan*

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.✓

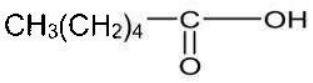
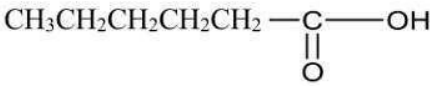
Nasienkriteria:
- *Korrekte funksionele groep (drievoudige binding) getrek*
- *Hele struktuur korrek*

(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.

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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

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