LIMPOPO
PROVINCIAL GOVERNMENT
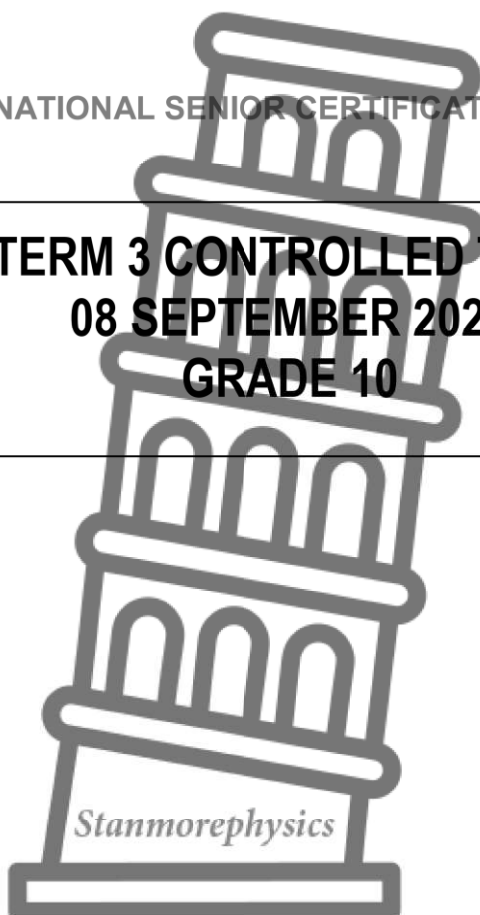REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

MOGALAKWENA DISTRICT

PHYSICAL SCIENCES

NATIONAL SENIOR CERTIFICATE

**TERM 3 CONTROLLED TEST
08 SEPTEMBER 2023
GRADE 10**

MARKS: 100

TIME: 2 hours

Stanmorephysics

This question paper consists of 11 pages including this one

INSTRUCTIONS

1. This question paper consists of 11 pages including the cover page

2. Answer all the questions in the answer book

3. You are advised to use the attached DATA SHEETS.

4. Round off your final answer to a minimum of TWO decimal places

5. Show all your calculations including formulae where applicable.

6. Candidates may use non-programmable calculators.

7. 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. Write only the letter (A-D) next to the question number (1.1 - 1.10) in the ANSWER BOOK

1.1   A car is travelling at a speed of 30 m.s^{-1} on a straight road. What would be the speed of the car in km·h^{-1} ?

A   30 km·h^{-1}

B   130 km·h^{-1}

C   8.33 km·h^{-1}

D   108 km·h^{-1} (2)

1.2   The gravitational potential energy of an object relative to the ground is dependent on the object's

A   velocity

B   Position

C   Change in velocity

D   Speed   (2)

1.3   What volume (in dm^3) does 1 gram of hydrogen gas occupy at STP?

A   11.2

B   44.8

C   22.4

D   5.6   (2)

1.4   The gradient of a velocity time graph is equivalent to the …

A   Acceleration

B   Position

C   Total distance covered

D   Displacement   (2)

1.10   Which ONE of the vector diagrams below will result in the largest resultant vector?

(2)

[20]
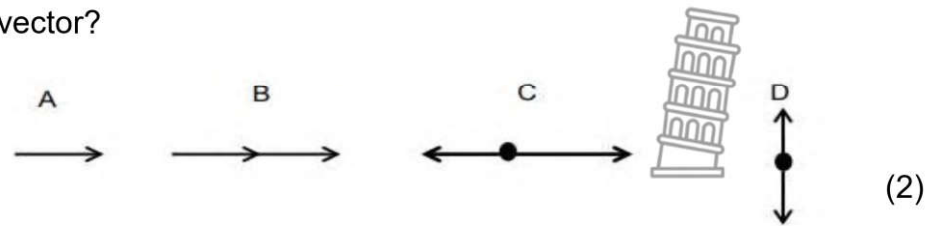
QUESTION 2
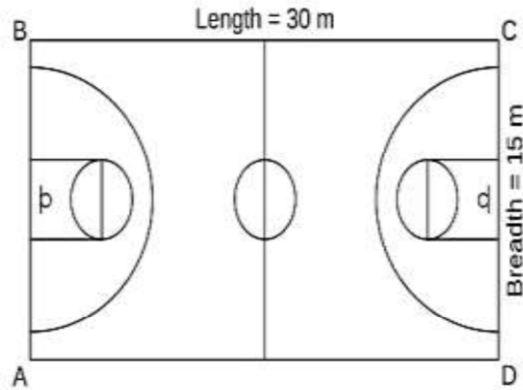
2.1   (2)

Define displacement

2.2

During a practice session, a basketball player runs around the basketball court starting from point A. He runs to point B, C, D and then returns to point A.

Length = 30 m

2.2.1   Draw the vector diagram the movement of the basketball   (2)
           player for one lab around the court. (Ensure that diagram is
           fully labelled).
           Using scale 1cm=5m

2.2.2   Calculate the distance he travelled for one lap   (2)

2.3   If it took 19 seconds for the basketball player to complete lab around
       the court.

2.3.1   Calculate his average speed.   (4)

                                                                        [10]

QUESTION 3

3.1   Define empirical formula   (2)

3.2   An inorganic substance was analyzed and found to be containing 65.31% of oxygen, 32.65% of Sulphur and **x** amount of hydrogen.

      3.2.1   Calculate the percentage of hydrogen element in the   (2)
              substance

      3.2.2   Determine the empirical formula for the compound.   (4)

3.3   6.257g of hydrated copper sulphate ($CuSO_4 \cdot nH_2O$) was heated, and during the heating the mass was recorded. The mass of the content was decreasing and after a while the mass remained unchanged at 4g.

      3.3.1   Give a reason why the mass decreased.   (2)

      3.3.2   Determine the value of **n** in the $CuSO_4 \cdot nH_2O$ (4)

3.4   Define the term molar mass.   (2)

3.5   Calculate the following for $A\ell_2(SO_4)_3$:

      3.5.1   Its molar mass   (2)

      3.5.2   Its percentage composition   (3)

      3.5.3   The number of moles present in 85,5 g   (3)

[24]

QUESTION 4

A skateboarder, starting from the top of a ramp 4,5 m above the ground, skates down the ramp, as shown in the diagram below. The mass of the skateboarder and his board is 65 kg. Ignore the effects of friction.
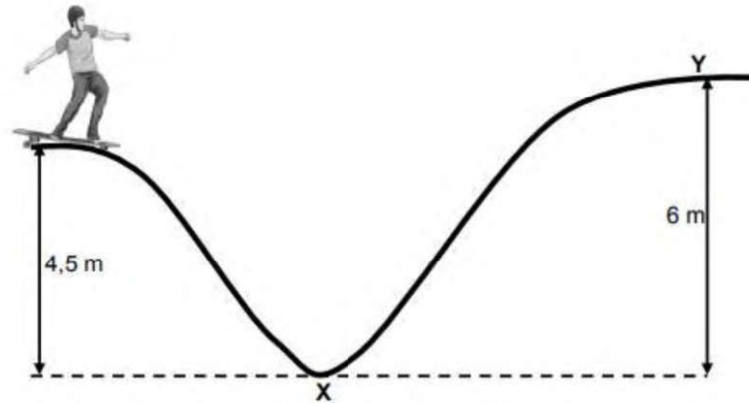
4.1   Define the term gravitational potential energy in words.   (2)

4.2   Calculate the gravitational potential energy of the skater just before he skates down the ramp.   (3)

4.3   State the principle of conservation of mechanical energy in words.   (2)

4.4   Use the principle stated in QUESTION 4.3 to calculate the magnitude of the velocity of the skateboarder when he reaches the ground at point **X**.   (4)

4.5   Will the skateboarder be able to reach point Y if he were to remain on his skateboard? Write YES or NO and support the answer with a relevant calculation.   (5)

[16]

QUESTION 5

A car accelerates from rest at $15\ m.s^{-2}$ for 2 seconds on a horizontal road.

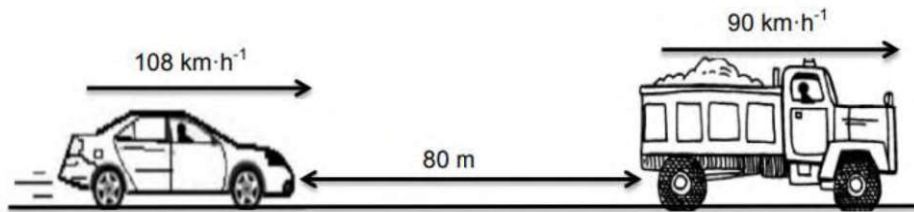5.1   Define the term acceleration.   (2)

5.2   Calculate the:

5.2.1   Distance covered by the car.   (3)

5.2.2   Velocity of the car.   (3)

While travelling at a constant velocity of $108\ km.h^{-1}$, the driver of a car notices a sign warning motorists to keep a safe 2-second following distance. At that instant the car is 80 m behind a truck that is travelling at a constant velocity of 90 $km.h^{-1}$.

5.3   Explain the meaning of a safe 2-second following distance.   (2)

5.4   Calculate the safe 2-second following distance behind the truck.   (6)
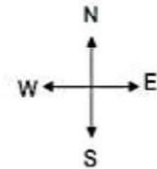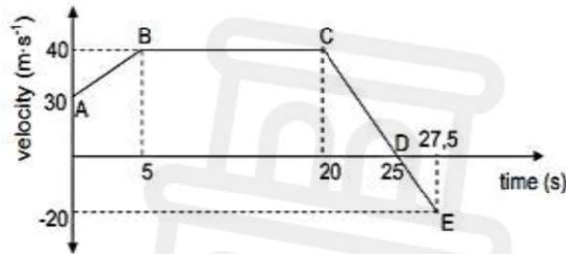
5.5   Calculate how long it will take the motorist to get to a safe 2-second following distance behind the truck.   (5)

[21]

QUESTION 6

The velocity versus time graph for a racing car moving eastwards, is shown below.

6.1   Write down the initial velocity of the car.   (2)

6.2   Write down the speed of the car at time t = 10 s   (2)

6.3   Describe the motion of the car for the section labelled CD   (2)

6.4   Support the answer to QUESTION 4.3 above by calculating the   (4)
        acceleration for section CD

6.5   Without any calculation, compare the magnitude of the acceleration   (2)
        of the car in part DE with that of part CD of the journey. Write only
        GREATER THAN, LESS THAN or EQUAL TO. Give a reason for the
        answer.

6.6   Determine the total displacement for the motion of the car.   (7)

                                                                              [19]

                                                                    Total [100]

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8 \ m \cdot s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8} \ m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34} \ J \cdot s$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19} \ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31} \ kg$

TABLE 2: FORMULAE/TABEL 2: FORMULES

MOTION/BEWEGING

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

WORK, ENERGY AND POWER/ARBEID, ENERGIE EN DRYWING

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$
$E_M = E_k + E_p$ or/*of* $E_M = K + U$	

WAVES, SOUND AND LIGHT/GOLWE, KLANK EN LIG

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

ELECTROSTATICS/ELEKTROSTATIKA

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/ELEKTRIESE STROOMBANE

$Q = I \Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{q}$

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure *Standaarddruk*	p^{θ}	$1{,}013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4$ $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	$1{,}6 \times 10^{-19}$ C
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \dfrac{m}{M}$	$n = \dfrac{N}{N_A}$
$c = \dfrac{n}{V}$ or/of $c = \dfrac{m}{MV}$	$n = \dfrac{V}{V_m}$

Physical Sciences   Grade 10   Controlled test term 3

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

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

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

MOGALAKWENA DISTRICT

MEMORUNDOM

PHYSICAL SCIENCES

NATIONAL SENIOR CERTIFICATE

TERM 3 CONTROLLED TEST
08 SEPTEMBER 2023
GRADE 10

MARKS: 100   **TIME: 2 hours**

This question paper consists of 7 pages including this one

QUESTION 1

1.1.   D ✓✓
1.2.   B ✓✓
1.3.   C ✓✓
1.4.   A ✓✓
1.5.   B ✓✓   **[10]**
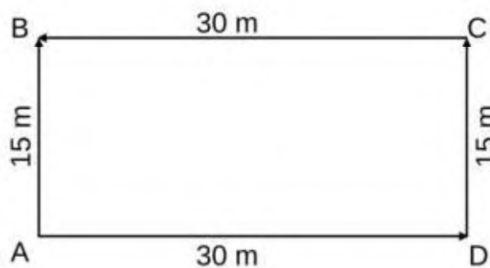
QUESTION 2

2.1. The difference in position (space) ✓✓   (2)
2.2.1

Marking Criteria
✓ lines drawn to scale
✓ 4 arrows shown, touching each other
✓ correct shape of drawing

                                                                                                    (3)

2.2.2 Distance=AB+BC+CD+DA

$\qquad$ =(15)+(30)+(15)+(30)

$\qquad$ =90m✓✓   (2)

2.3.1 Avarage Speed $= \dfrac{\text{distance}}{\text{time}}$✓

$\qquad\qquad = \dfrac{90\text{m}✓}{19\text{ s}✓}$

$\qquad\qquad = 4.74\text{m}.\text{s}^{-1}$✓

                                                                                                    (4)

                                                                                            [10]

QUESTION 3

3.1 The simplest whole number ratio of atoms in a compound. ✓✓ (2)

3.2.1 %H= 100-65,31%-32,65%=2,04% (2)

3.2.2

	H	S	O	
Mass (g)	2.04	32.65	65.31	
M (g/mol)	1	32	16	
Mole=m/M	2.04	1.02	4.08	✓✓
Ratio	2	1	4	✓

Empirical formula H_2SO_4✓

(4)

3.3

3.3.1 water changes into gas ✓ and leaves the (system)✓ (2)

3.3.2

	$CuSO_4$	H_2O	
Mass (g)	4	2.257	✓
M (g/mol)	159.50	18	
Mole=m/M	0.0251	0.125	✓✓
Ratio	1	**5** ✓	

3.4. The <u>mass of one of a substance</u> measured in g.mol^{-1}✓✓ (2)

3.5.1. M(Aℓ_2(SO$_4$)$_3$) = 2(27) +3(32) +12(16)
$\qquad\qquad$ = 342 g.mol^{-1}✓✓ (2)

3.5.2 % Al $=\frac{2(27)}{342}$×100
$\qquad$ = 15, 79%✓

$\quad$ % S $=\frac{3(32)}{342}$×100
$\qquad$ = 28,07%✓

$\quad$ % S $=\frac{12(16)}{342}$×100
$\qquad$ = 56,14%✓

(3)

3.5.3 **POSITIVE MARKING FROM**

$\qquad$ n(Aℓ_2(SO$_4$)$_3$) = $\dfrac{m}{M}$ ✓

$\qquad\qquad$ = $\dfrac{85,5}{342}$ ✓

$\qquad\qquad$ = 0, 25 mol ✓ (3)

[24]

QUESTION 4

4.1. The energy an object has because of its position in the gravitational field ✓relative to some reference point ✓ (2)

4.2 $E_P = mhg$ ✓

$= (65)+(9.8)+(4.5)$ ✓

$= 2\ 866,5\ J$ ✓ (3)

4.3 The net/total mechanical energy (sum of kinetic and gravitational potential energy) in an isolated/closed system✓ remains constant/ is conserved✓ (2)

4.4

$$(E_p + E_k)_{top/bo} = (E_p + E_k)_{bottom/onde}$$
$$mgh + 0 = mgh + \tfrac{1}{2}mv^2$$
✓
$$\underline{(65)(9,8)(4,5)} ✓ = \underline{0 + \tfrac{1}{2}(65)v^2} ✓$$
$$v = 9,39\ m\cdot s^{-1} ✓$$

OR/OF
$$(E_p + E_k)_{top/bo} = (E_p + E_k)_{bottom/onder}$$
$$mgh + 0 = mgh + \tfrac{1}{2}mv^2$$
✓
$$2\ 866,5 ✓ = \underline{0 + \tfrac{1}{2}(65)v^2} ✓$$
$$v = 9,39\ m\cdot s^{-1} ✓$$

(4)

4.5
OPTION 1

$$(E_p + E_k)_{top} = (E_p + E_k)_{bottom}$$
$$mgh + 0 = mgh + \tfrac{1}{2}mv^2 \qquad ✓$$
$$(65)(9,8)h ✓ + 0 = 0 + \tfrac{1}{2} \times 65 \times (9,39)^2 \qquad ✓$$
$$637h = 2\ 865,6$$
$$h = 4,49\ m$$
$$No ✓ : h = 4,49\ m < 6m ✓$$

OPTION 2

$E_{p\ at\ Y} = mgh$✓

$= (65)(9,8)(6)$ ✓

$= 3\ 822\ J$ ✓

$E_{mech} < E_{p\ at\ Y}$ ✓therefore he will not reach point Y✓

(5)

[16]

QUESTION 5

5.1 The rate ✓ of change of velocity ✓. (2)

5.2
5.2.1

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

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

$\Delta x = 30 \text{ m}$ ✓

(3)

5.2.2 positive marking from question 5.2.1

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$v_f^2 = v_i^2 + 2a\Delta x$ ✓	$v_f = v_i + a\Delta t$
$v_f^2 = 0^2$ ✓ $+2(15)(30)$ ✓	$= 0$ ✓ $+ 15 \times 2$ ✓
$v_f = 30 \text{ m·s}^{-1}$ to the right ✓/*regs*	$v_f = 30 \text{ m·s}^{-1}$ to the right ✓/*regs*

Accept: To the right/East/In the direction of motion

(3)

5.3
When following a car, a motorist should keep a safe distance such that it takes more than 2s ✓ to reach the same position ✓ as the car in front.

OR

The car will need 2 s to stop in an emergency and not hit the car in front. ✓✓ (2)

5.4
Convert 90 km·h^{-1} into m·s^{-1}/*Skakel 90 km·h^{-1} om na m·s^{-1}*

$\dfrac{90 \text{ km}}{1 \text{ h}} = \dfrac{90 \times 10^3}{3600}$ ✓ $= 25 \text{ m·s}^{-1}$ ✓

OPTION 1/*OPSIE 1*:	OPTION 2/*OPSIE 2*:
$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓	$\Delta x = \left(\dfrac{v_i + v_f}{2}\right) \Delta t$ ✓
$\Delta x = (25)(2)$ ✓ $+ \frac{1}{2}(0)2^2$ ✓	$\Delta x = \left(\dfrac{25 + 25}{2}\right)$ ✓ (2) ✓
$\Delta x = 50 \text{ m}$ ✓	$\Delta x = 50 \text{ m}$ ✓

(6)

5.6

$$\frac{108 \text{ km}}{1 \text{ h}} = \frac{108 \times 10^3}{3600} \checkmark = 30 \text{ m·s}^{-1}$$

Difference in speed/*Verskil in spoed*: $30 - 25$
$$= 5 \text{ m·s}^{-1}$$

Car has to travel 30 m $(80 - 50)$ at 5 m·s^{-1} to be at a 2 second distance behind the truck. Therefore: distance = $(v)(t)$
$$30 = (5)(t($$
$$t = 6 \text{ s}$$

$\checkmark \checkmark \checkmark \checkmark$

(5)

[21]

QUESTION 6

(2)

6.1   30 m/s $\checkmark\checkmark$

6.2 40m/s $\checkmark\checkmark$ (2)

6.3 The speed decreases $\checkmark$ uniformly (from 40 m/s to 0 m/s)$\checkmark$

   OR
   The car slows down$\checkmark$ and finally stops$\checkmark$

(2)

6.4

$$a = \frac{\Delta y}{\Delta x} \checkmark$$

$$= \frac{(0) - 40}{25 - 20} \begin{matrix}\checkmark\\\checkmark\end{matrix}$$

$$= -8 \text{ m·s}^{-2}\checkmark$$

(4)

6.5 Equal to$\checkmark$, Same gradient $\checkmark$ (2)

6.6

OPTION 1/OPSIE 1
Displacement = Area under the v-t graph✓
Verplasing = Oppervlakte onder v-t grafiek
$$= (A_{trapezium} + A_{rectangle/reghoek} + A_{triangle\ 1/driehoek\ 1}) - A_{triangle\ 2/driehoek\ 2}$$
$$= \frac{1}{2}(40+30)(5)✓ + (15 \times 40)✓ + \frac{1}{2}(5 \times 40)✓ - [\frac{1}{2}(2{,}5 \times 20)]✓$$
$$= 850\ m✓\ east/oos✓$$

OR/OF
Displacement = Area under the v-t graph✓
Verplasing = Oppervlakte onder v–t grafiek
$$= (A_{trapezium/trapesium} + A_{rectangle/reghoek} + A_{triangle/driehoek}) - A_{triangle/driehoek}$$
$$= \frac{1}{2}(20+15)(10)✓ + (30 \times 20)✓ + \frac{1}{2}(5 \times 40)✓ - \frac{1}{2}(2{,}5 \times 20)✓$$
$$= 850\ m✓\ east/oos✓$$

(7)

[19]

Total 100