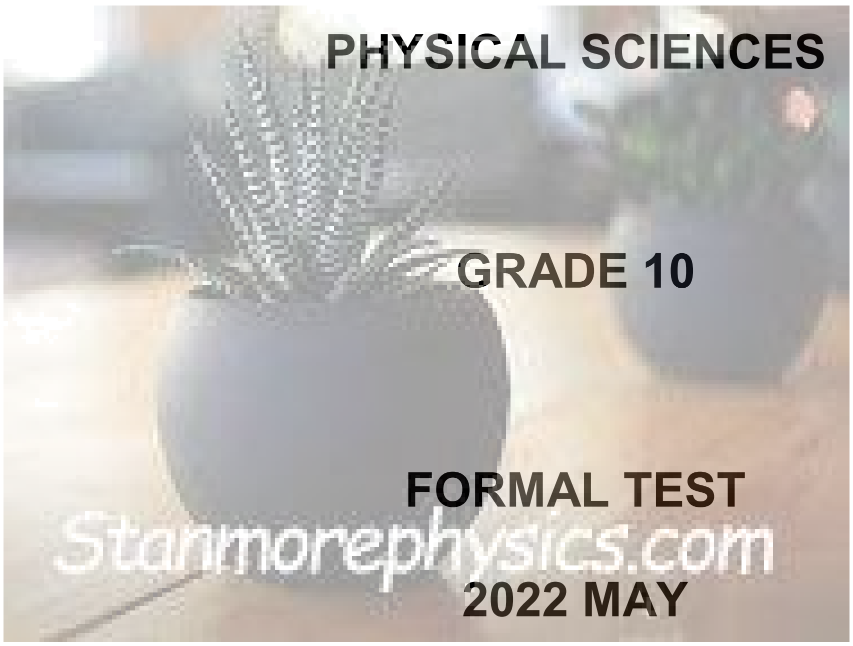
LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

MOPANI EAST EDUCATION DISTRICT



PHYSICAL SCIENCES

GRADE 10

FORMAL TEST

2022 MAY

TERM 2

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages, 1 answer sheet and 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. You may use a non-programmable calculator.
2. You may use appropriate mathematical instruments.
3. You are advised to use the attached DATA SHEETS.
4. Show ALL formulae and substitutions in ALL calculations.
5. Round off your final numerical answers to a minimum of TWO decimal places.
6. Give brief motivations, discussions et cetera where required.
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. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK, for example 1.6 A.

1.1 Which ONE of the following physical quantities is a vector?

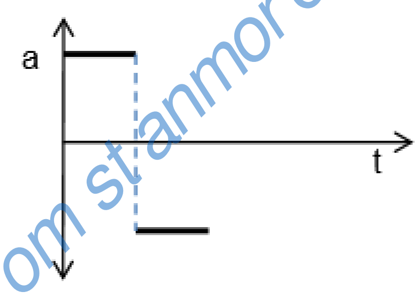
A Distance

B Displacement

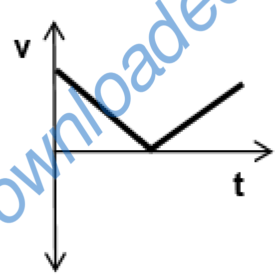
C Mass

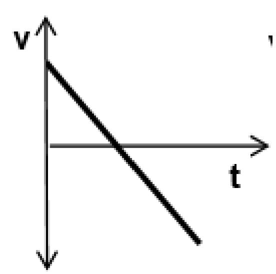
D Time (2)

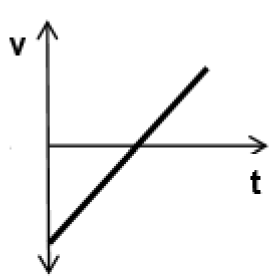
1.2 Consider the acceleration-time graph of an object in motion below.

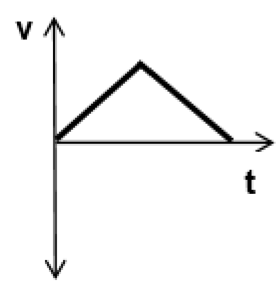


Which ONE of the graphs below represents the velocity-time graph of the object?

A


B


C


D


(2)

1.3 In the equation $v_f = v_i + a\Delta t$, the SI unit for $a\Delta t$ is …

A m

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

C $m{\cdot}s^{-1}$

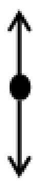
D s^{-1} (2)

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

A 

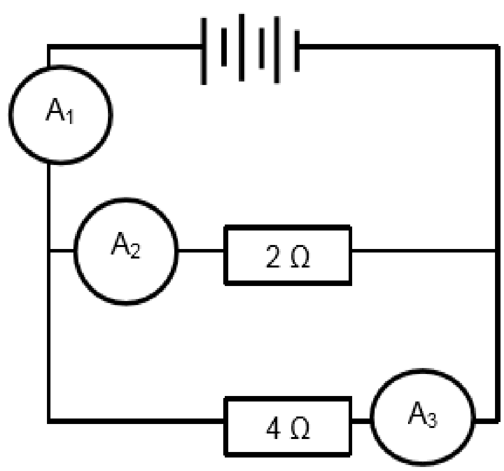
B 

C 

D 

(2)

1.5 Consider the circuit diagram below.



How will the readings on ammeters A_1, A_2 and A_3 compare with each other?

A $A_1 = A_2 = A_3$

B $A_1 = A_2 + A_3$

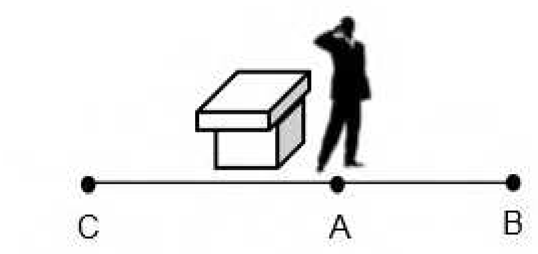
C $(A_2 + A_3) > A_1$

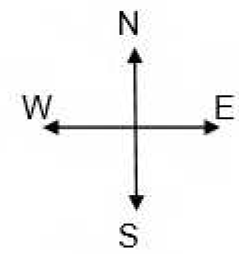
D $A_2 < A_3 < A_1$ (2)

[10]

QUESTION 2 (Start on a new page.)

An impatient businessman paces up and down while making a business call on his cellphone.





He starts at his desk and walks 5 m east (from A to B) and then walks 7 m west (from B to C). This process takes him 20 s.

2.1 Use a vector scale diagram and represent the two displacements of the man (from A to B AND from B to C). Label ALL the vectors clearly and write down the displacements next to the vectors. Use a scale of 1 cm representing 1 m for your diagram. (2)

2.2 What is the businessman's change in position at C relative to A? (2)

2.3 Calculate the total distance the man covers. (2)

2.4 Explain why the value calculated in QUESTION 2.2 differs from the one calculated in QUESTION 2.3. (2)

2.5 Define the term velocity. (2)

2.6 Calculate the man's average velocity. (4)

[14]

QUESTION 3 (Start on a new page.)

A man walks 40 m East, and then 30 m North

3.1 Define resultant vector (2)

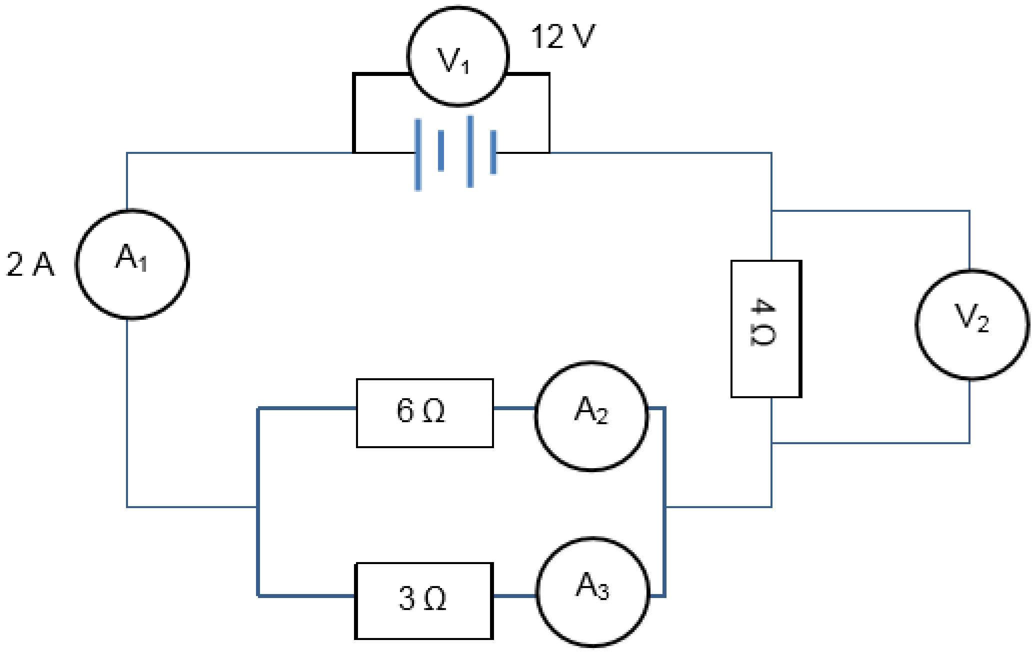
3.2 Calculate the total distance the man walked. (2)

3.3 Determine the resultant displacement of a man by means of a diagram (6)

[10]

QUESTION 4 (Start on a new page.)

In the circuit diagram below the reading on voltmeter V_1 is 12 V and the reading on ammeter A_1 is 2 A.



4.1 Define potential difference across the ends of a conductor. (2)

4.2 Calculate the:

4.2.1 Total resistance of the circuit (4)

4.2.2 Reading on V_2 (3)

4.2.3 Reading on A_2 (3)

4.2.4 Amount of charge that flows through ammeter A_1 in 120 s (3)

4.3 How will the reading on ammeter A_1 be affected if the 6 Ω resistor is removed from the circuit?

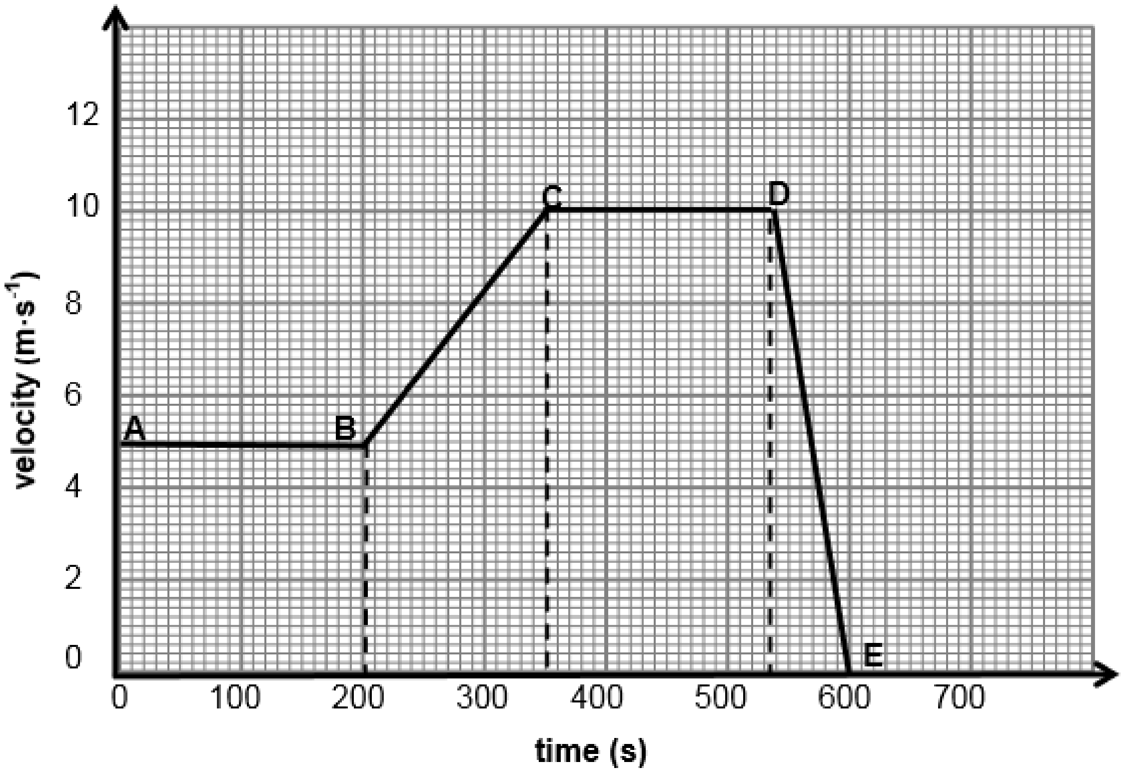
Write down only INCREASE, DECREASE or REMAIN THE SAME. (1)

4.4 Explain the answer to QUESTION 4.3 WITHOUT any calculations. (3)

[19]

QUESTION 5 (Start on a new page.)

The velocity-time graph below represents the motion of a girl riding her bicycle in a northerly direction.



5.1 Write down the girl's initial velocity. (2)

5.2 Write down the magnitude of the girl's velocity at 300 s. (2)

5.3 Use the information on the graph to describe the motion of the girl:

5.3.1 From B to C (2)

5.3.2 From C to D (2)

5.4 **WITHOUT USING EQUATIONS OF MOTION,** calculate each of the following:

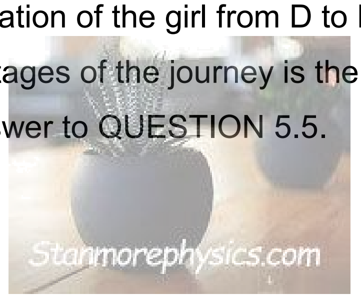
5.4.1 Distance covered by the girl from A to C (4)

5.4.2 Acceleration of the girl from D to E (4)

5.5 During which stages of the journey is the change in speed the greatest? (2)

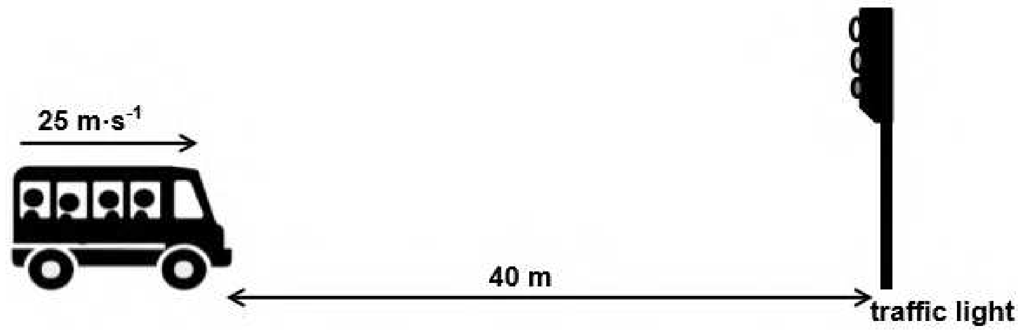
5.6 Explain the answer to QUESTION 5.5. (2)

[20]



QUESTION 6 (Start on a new page.)

A taxi is travelling at a speed of 25 m·s^{-1} when a traffic light, 40 m ahead, changes to red.



6.1 Define the term acceleration. (2)

The driver takes 1 s to react (reaction time) before he slams on the brakes. The taxi then stops within 2 s.

6.2 Is the velocity and acceleration of the braking taxi in the SAME DIRECTION as it moves towards the traffic light? (1)

6.3 Give a reason for the answer to QUESTION 6.2. (1)

6.4 Calculate the distance the taxi travels during the reaction time. (4)

6.5 Will the taxi stop at the traffic light? Show ALL calculations. (5)

6.6 Draw a position versus time graph for the motion of the taxi. (graph paper provided at the end of this question paper) (4)

[17]

QUESTION 7 (Start on a new page.)

A motorcycle travelling east, starts from rest, moves in a straight line with a constant acceleration and covers a distance of 64 m in 4s

7.1 Define velocity (2)

7.2 Calculate

7.2.1 The acceleration of the motorcycle after 4 s. (4)

7.2.2 The final velocity of the motorcycle after 4 s (4)

[10]

TOTAL: 100 MARKS

DATA FOR PHYSICAL SCIENCES GRADE 10

TABLE 1: PHYSICAL CONSTANTS

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

MOTION

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

ELECTRIC CIRCUITS

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

ANSWER SHEET FOR QUESTION 6.6

NAME: ____ CLASS: _____

Hand in this ANSWER SHEET together with the ANSWER BOOK.

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PHYSICAL SCIENCES

GRADE 10

FORMAL TEST MEMORANDUM

2022 MAY

TERM 2

MARKS: 100

TIME: 2 hours

This memorandum consists of 09 pages.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1	B	✓✓	(2)
1.2	D	✓✓	(2)
1.3	C	✓✓	(2)
1.4	B	✓✓	(2)
1.5	B	✓✓	(2)
			[10]

QUESTION 2

2.1

MARKING ALLOCATIONS

✓ X line AB: length, arrow, label

✓ x line BC: length, arrow ,label

(2)

2.2 2 m ✓ to the left✓ OR 2 m ✓ west✓ (2)

2.3 Total distance
= 5 + 7✓
= 12 m✓ (2)

2.4 For the total distance, the whole path length travelled is considered. ✓ For change in position, only the original position and final position ✓ of the man are considered. (2)

2.5 Velocity is the rate ✓ of change of displacement. ✓ (2)

2.6 $v = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{2}{20}$ ✓

$= 0,1\ m\cdot s^{-1}$ ✓ west/to the left✓ (4)

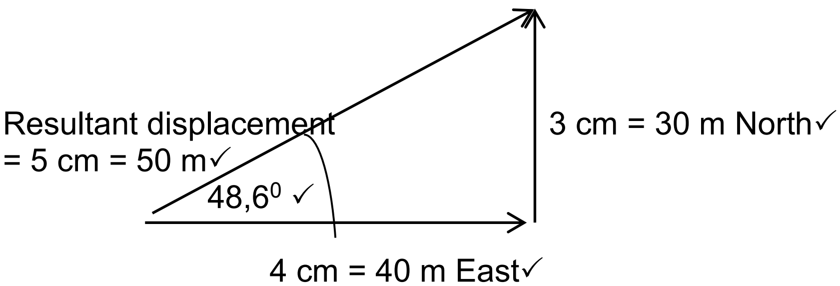
[14]

QUESTION 3

3.1 A resultant vector is a single vector ✓ having the same effect as two or more vectors together ✓ (2)

3.2 Total distance = 40 m + 30 m✓ (2)
$\quad\quad\quad\quad\quad\quad$ = 70 m✓

3.3 Suitable scale: 1 cm = 10 m✓



Therefore the man walked 50 m at 48,6^0 ✓

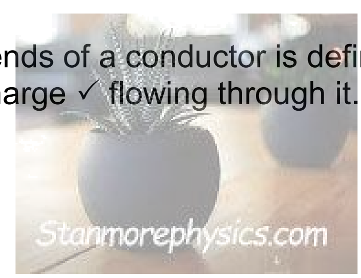
MARK ALLOCATION

✓ Choosing suitable scale
✓ Correct distance to North
✓ Correct distance to South
✓ Correct resultant displacement answer
✓ Correct drawing
✓ Correct angle

(6)
[10]

QUESTION 4

4.1 Potential difference across the ends of a conductor is defined as the energy transferred ✓ per unit electric charge ✓ flowing through it. (2)



4.2

4.2.1 **OPTION 1**

$$\frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2} ✓$$

$$= \frac{1}{6} + \frac{1}{3} ✓$$

$$\therefore R_{//} = 2\Omega$$

Therefore $R_{total} = 4 + 2$ ✓
$= 6\Omega$ ✓

OPTION 2

$$R_{//} = \frac{R_1 \times R_2}{R_1 + R_2} ✓$$
$$= \frac{6 \times 3}{6+3} ✓$$
$$= 2\Omega$$

Therefore $R_{total} = 4 + 2$ ✓
$= 6\Omega$ ✓

OPTION 3

$$R = \frac{V_1}{I_1} ✓$$
$$= \frac{12 ✓}{2 ✓}$$
$$= 6\ \Omega ✓$$

(4)

4.2.2 $R_{4\Omega} = \frac{V_2}{I_T}$ ✓
$4 = \frac{V_2}{2}$ ✓
$\therefore V_2 = 8\ V$ ✓ (3)

4.2.3 **OPTION 1**

$$I = \frac{V}{R} ✓$$
$$= \frac{12 - 8}{6} ✓$$
$$= 0{,}67\ A ✓$$

OPTION 2

$R \propto \frac{1}{I}$ ✓ or in words:
resistance is inversely proportional to current and
$\therefore$ ratio of resistors is 6 : 3
2 : 1

$\therefore$ ratio of current is 1 : 2 ✓
$A_2 : A_3$
$\therefore I_{A2} = \frac{2}{3} \times 1$
$\therefore I_{A2} = 0{,}67\ A$ ✓

(3)

4.2.4 $A_1 = 2$ A

$\therefore Q = I\,\Delta t$ ✓

$= 2 \times 120$ ✓

$= 240$ C ✓ (3)

4.3 Decrease ✓ (1)

4.4
- If the 6 Ω resistor is removed, the resistance of the whole circuit increases ✓
- Since $R \propto \frac{1}{I}$, if R increases, and V is constant √ and I of the circuit decreases✓ (3)

[19]

QUESTION 5

5.1 5 $m \cdot s^{-1}$ ✓ north ✓ (accept range from 4,5 to 4,9) (2)

5.2 8,1 $m \cdot s^{-1}$ ✓✓ (accept range from 8,0 to 8,6) (2)

5.3

5.3.1
- The velocity is uniformly increasing.
- Velocity increases from 5 $m \cdot s^{-1}$ to 10 $m \cdot s^{-1}$ in 350 s.
- Positive acceleration.
- The girl is speeding up.

Any ONE of the options ✓✓ (2)

5.3.2
- Uniform/constant velocity
- No acceleration
- Same speed

Any ONE of the options ✓✓ (2)

5.4

5.4.1 **OPTION 1**

Distance A to C

$= \ell \times b + \frac{1}{2} \times b \times h$✓

$= \underline{5 \times 350}$ ✓$+ \underline{\frac{1}{2} \times 150 \times 5}$✓

$= 2\,125$ m ✓

OPTION 2

Distance A to C

$= \ell \times b + \ell \times b + \frac{1}{2} \times b \times h$✓

$= \underline{200 \times 5 + 150 \times 5}$✓$+ \frac{1}{2} \times 150 \times 5$✓

$= 2\,125$ m ✓

OPTION 3
Distance A to C
$= \ell \times b + \frac{1}{2}$ (sum of parallel sides)h✓
$= \ell \times b + \frac{1}{2}$ (som van parallele sye)h✓
$= \underline{5 \times 200}$ ✓+ $\underline{\frac{1}{2}(5 + 10)(150)}$ ✓
= 2 125 m ✓ (4)

5.4.2 $a = \frac{\Delta v}{\Delta t}$✓
I_T
$= \frac{0-10}{600-535}$ ✓✓
$= -0{,}154\ m \cdot s^{-2}$
$\therefore$ $a = 0{,}154\ m \cdot s^{-2}$ South✓ (4)

5.5 D to E. ✓✓ (2)

5.6 The change in speed from D to E is (-)10 $m \cdot s^{-1}$ ✓ and that occurs over (50 s) a shorter period. ✓

OR

From B to C, the change in speed is 5 m·s-1 over a period of 150 s. ✓✓

OR

Gradient is the steepest✓✓ (2)

[20]

QUESTION 6

6.1 Acceleration is the rate✓ of change of velocity✓.

OR

Acceleration is the change in velocity✓ per unit time✓. (2)

6.2 No ✓ (1)

6.3 Velocity to the right, acceleration to the left ✓.

OR

Taxi slowing down so acceleration is in opposite direction ✓ to movement. (1)

6.4 **OPTION 1**

$\Delta x = v_i t + \frac{1}{2}a\Delta t^2$ ✓
$= 25 \times 1$ ✓ $+ \frac{1}{2} \times 0 \times 1^2$ ✓
$= 25\ m$ ✓

OPTION 2

$\Delta x = \frac{(v_f + v_i)}{2}\Delta t$ ✓
$= \frac{25 + 25}{2}$ ✓ $\times 1$ ✓
$= 25\ m$ ✓ (4)

6.5 **POSITIVE MARKING FROM 6.4**

OPTION 1

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

$= \frac{(0+25)}{2} \times 2$ ✓
$= 25\ m$

∴ total distance
$= 25 + 25$ ✓
$= 50\ m$ ✓

∴taxi will not stop at the traffic light as distance > 40 m ✓

OPTION 2

Only one mark for either equation

$v_f = v_i + a\Delta t$ ✓

$a = \frac{v_f - v_i}{\Delta t}$

$a = \frac{(0 - 25)}{2}$ ✓
$= -12,5\ m \cdot s^{-2}$

$v_f^2 = v_i^2 + 2a\Delta x$
$0 = 252 + 2 \times -12,5 \times \Delta x$ ✓
$\therefore \Delta x = 25m$

∴ total distance
$= 25 + 25$
$= 50\ m$ ✓

∴taxi will not stop at the traffic light as distance > 40 m✓

OPTION 3

$a = \dfrac{(v_f - v_i)}{\Delta t}$ ✓

$= \dfrac{(0 - 25)}{2}$ ✓

$= -12{,}5\ m \cdot s^{-2}$

$\Delta x = v_i t + ½ a \Delta t^2$

$= 25 \times 2 + ½ \times -12{,}5 \times 2^2$ ✓

$= 25\ m$

∴ total distance

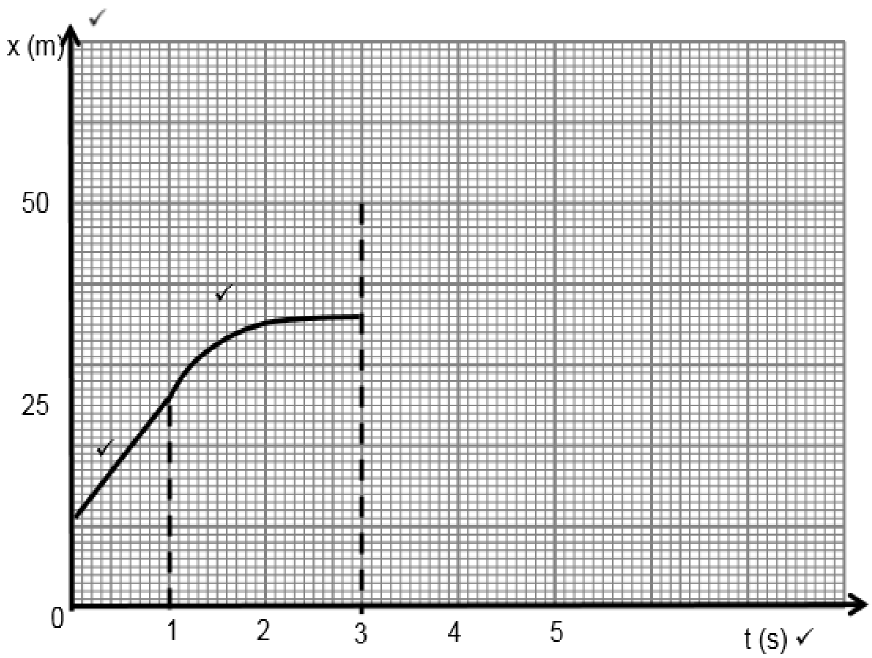
$= 25 + 25$

$= 50\ m$✓

Only one mark for either equation

∴taxi will not stop at the traffic light, as distance > 40 m✓ (5)

6.6



(4)

MARK ALLOCATION

✓ Both axes correctly labelled
✓ Straight line (t =0 s and t = 1 s)
✓✓ Curve shape (t = 1 s and t = 3)

[17]

QUESTION 7

7.1 Velocity is the rate of change in position, ✓✓

OR

Velocity is the displacement divided by a very small time interval ✓✓ (2)

7.2

7.2.1 $x = v_i t + 1/2at^2$ ✓
.
$64 = (0 \times 4) + 1/2a(4)^2$✓
$64 = (8)a$
$a = 8 m.s^{-2}$✓ east✓ (4)

7.2.2 $v_f = v_i + at$ ✓
$v_f = 0 + (8)(4)$ ✓
$= 32\ m.s^{-1}$ ✓east✓ (4)

[10]

TOTAL: 100 MARKS