Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/GRAAD 11

NOVEMBER 2012

PHYSICAL SCIENCES P1 / FISIESE WETENSKAPPE V1 MEMORANDUM

MARKS: 150
PUNTE

This memorandum consists of 17 pages. / Hierdie memorandum bestaan uit 17 bladsye.

LEARNING OUTCOMES AND ASSESSMENT STANDARDS		
LO1	**LO2**	**LO3**
AS 11.1.1 Plan and conduct a scientific investigation to collect data systematically with regard to accuracy, reliability and the need to control variables.	**AS 11.2.1** Define and discuss basic prescribed and scientific knowledge.	**AS 11.3.1** Recognise, discuss and compare scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims.
AS 11.1.2 Seek pattern and trends, represent them in different forms to draw conclusions, and formulate simple generalisations.	**AS 11.2.2** Express and explain prescribed scientific theories, models and laws by indicating the relationship between different facts and concepts in own words.	**AS 11.3.2** Identify ethical and moral issues related to the development of science and technology and evaluate the impact (pros and cons) of the relationship from a personal viewpoint.
AS 11.1.3 Apply known problem-solving strategies to solve multi-step problems.	**AS 11.2.3** Apply scientific knowledge in everyday life contexts.	**AS 11.3.3** Evaluate the impact of scientific and technological knowledge on sustainable development of resources and suggest long-term and short-term strategies to improve the management of resources in the environment.
AS 11.1.4 Communicate and present scientific arguments with clarity and precision.		

GUIDELINES FOR MARKING

This section provides guidelines for the way in which marks will be allocated. The broad principles must be adhered to in the marking of Physical Sciences tests and examinations.

1.1 MARK ALLOCATION

1.1.1 **Definitions:** Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition.

1.1.2 **Calculations:**

- Marks will be awarded for: correct formula, correct substitution, correct answer with unit.
- No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.

1.1.3 **Explanations and interpretations:** Allocation of marks to questions requiring interpretation or explanation e.g. AS 1.4, 2.2, 2.3, 3.1, 3.2 and 3.3, will differ and may include the use of rubrics, checklists, memoranda, etc. In all such answers emphasis must be placed on scientific concepts relating to the question.

1.2 FORMULAE AND SUBSTITUTIONS

1.2.1 Mathematical manipulations and change of subjects of appropriate formulae carry no marks, but if a candidate starts with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.

1.2.2 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.

1.2.3 Marks are only awarded for a formula if a calculation had been **attempted,** i.e. substitutions have been made or a numerical answer given.

1.2.4 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

1.2.5 All calculations, when not specified in the question, must be done to two decimal places.

1.3 UNITS

1.3.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question**.

1.3.2 Units are only required in the final answer to a calculation.

1.3.3 Marks are only awarded for an answer, and not for a unit per se. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:

- correct answer + wrong unit
- wrong answer + correct unit
- correct answer + no unit.

1.3.4 SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this. (This instruction only applies to Paper 1.)

1.4 POSTIVE MARKING

Positive marking regarding calculations will be followed in the following cases:

1.4.1 **Sub-question to sub-question**: When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.

1.4.2 **A multi-step question in a sub-question**: If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.

1.4.3 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/ appropriate formula is used and that workings, including substitutions, are correct.

1.4.4 Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.

1.4.5 If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.

1.4.6 Normally, if based on a conceptual mistake, an incorrect answer cannot be correctly motivated. If the candidate is therefore required to motivate in question 3.2 the answer given to question 3.1, and 3.1 is incorrect, no marks can be awarded for question 3.2. However, if the answer for e.g. 3.1 is based on a calculation, the motivation for the incorrect answer for 3.2 could be considered.

1.4.7 If instructions regarding method of answering are not followed, e.g. the candidate does a calculation when the instruction was to ***solve by construction and measurement*****,** a candidate may forfeit all the marks for the specific question.

1.4.8 For an **error of principle, no marks** are awarded (Rule 1) e.g. If the potential difference is 200 V and resistance is 25 Ω, calculate the current.

CORRECT	ANSWER (1)	POSSIBLE	ANSWER (2)	POSSIBLE
$I = \frac{V}{R}$ ✓ $= \frac{200}{25}$ ✓ $= 8A$ ✓	$R = \frac{V}{I}$ ✓ $= \frac{200}{25}$ ***x*** $= 8A$ ***x***	$R = \frac{V}{I}$ ***x*** $= \frac{200}{25}$ $= 8A$	$R = \frac{V}{I}$ ✓ $I = \frac{R}{V}$ ***x*** $= \frac{25}{200}$ $= 0,125\ A$ ***x***	$I = \frac{V}{R}$ ✓ $= 8A$ ✓

SECTION / AFDELING A

QUESTION / VRAAG 1

1.1	weight / gewig √	[11.2.1]	(1)
1.2	crumple zone / frommelsones √	[11.2.1]	(1)
1.3	focal point / brandpunt √	[11.2.1]	(1)
1.4	direct current / gelykstroom √	[11.2.1]	(1)
1.5	Sound / klank √	[11.2.1]	(1)
			[5]

QUESTION / VRAAG 2

2.1	D √√	[11.1.3]	(2)
2.2	D √√	[11.1.3]	(2)
2.3	C √√	[11.1.3]	(2)
2.4	B √√	[11.2.1]	(2)
2.5	B √√	[11.1.3]	(2)
2.6	C √√	[11.2.1]	(2)
2.7	C √√	[11.1.2]	(2)
2.8	A √√	[11.1.3]	(2)
2.9	D √√	[11.2.1]	(2)
2.10	C √√	[11.2.1]	(2)
			[20]

TOTAL SECTION A: 25

SECTION / AFDELING B

QUESTION / VRAAG 3

3.1

Force between q_1 and q_2 / krag tussen q_1 en q_2

$$F_{q_1q_2} = \frac{k\,q_1q_2}{r^2} \surd$$

$$= \frac{9\,x\,10^9\,x\,3\,x\,10^{-6}\,x\,4\,x\,10^{-6}}{(0{,}2)^2} \surd$$

$$= 2{,}7\ N \surd$$

Force between q_1 and q_3 / krag tussen q_1 en q_3

$$F_{q_1q_3} = \frac{k\,q_1q_3}{r^2} \surd$$

$$= \frac{9\,x\,10^9\,x\,3\,x\,10^{-6}\,x\,7\,x\,10^{-6}}{(0{,}15)^2} \surd$$

$$= (0{,}15)^2 \surd$$

$$= 8{,}4\ N$$

F_{q1q2} and F_{q1q3} are acting in opposite directions /
F_{q1q2} en F_{q1q3} werk in teenoorgestelde rigtings √

$$F_{net} = F_{q1q2} + F_{q1q3} \surd$$

$$= -2{,}7\ N + 8{,}4\ N \surd$$

$= 5{,}7$ N to the right or towards q_3 √
na regs of na q_3 [11.2.3] (6)

3.2 3.2.1 Electrons flow from the negative charge q_3 to the positive charge q_1 √ until both have the same number of electrons and therefore also the same charge during contact. √/
Gedurende kontak vloei elektrone van die negatiewe lading q_3 na die positiewe q_1 √ totdat beide dieselfde aantal elektrone en dus ook dieselfde lading het. √ [11.1.1] (2)

3.2.2 The charges repel one another / ladings stoot mekaar af. √ [11.1.1] (1)
[9]

QUESTION / VRAAG 4

4.1 The current in a conductor is directly proportional to the voltage or potential difference across its ends √ for a conductor at constant temperature. √ /
Die stroom in die geleier is direk eweredig aan die spanning of potensiaalverskil oor sy ente √ vir 'n geleier by konstante temperatuur. √ [11.2.2] (2)

4.2 $\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2}$ √

$= \frac{1}{2} + \frac{1}{8}$ √ $= \frac{5}{8}$

$= 1{,}6\ \Omega$ √ [11.1.3] (3)

POSITIVE MARKING FROM 4.2 / POSITIEWE NASIEN VAN 4.2.

4.3 $V = IR$ √

$= 3\ x\ 1{,}6$ √

$= 4{,}8\ V$ √ [11.1.3] (3)

POSITIVE MARKING FROM 4.3 / POSITIEWE NASIEN VAN 4.3

4.4

$I_{2\Omega} = \frac{V}{R}$

$= \frac{4{,}8}{2}$ √

$= 2{,}4\ A$

$I_{8\Omega} = 3 - 2{,}4$ √

$= 0{,}6\ A$

$V_2 = 0{,}6\ x\ 3$ √

$= 1{,}8\ V$ √

OR/OF $I_{8\Omega} = \frac{1}{5}\ x\ 3\ A$ √√

$= 0{,}6\ A$

$V_2 = 0{,}6\ x\ 3$ √

$= 1{,}8\ V$ √

OR/OF $I_{8\Omega} = \frac{V}{R}$

$= \frac{4{,}8}{8}$ √√

$= 0{,}6$

$V_2 = IR = 0{,}6\ x\ 3$ √

$= 1{,}8\ V$ √

[11.1.3] (4)

4.5 $emf = I\ (R + r)$ √

12 √$= 3\ (1{,}6 + r)$ √

$r = 2{,}4\ \Omega$ √

OR/OF lost/verlore volts $= 12 - 4{,}8$ √

$= 7{,}2\ V$

$V_{int} = Ir$ √

$7{,}2 = 3\ r$ √

$r = 2{,}4\ \Omega$ √ [11.1.3] (4)

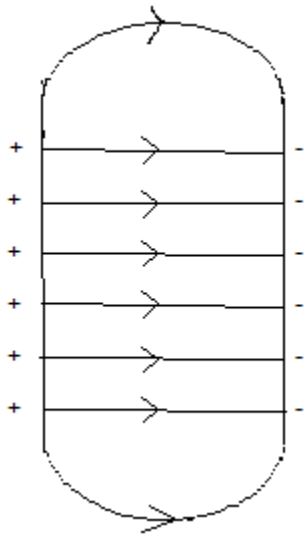
4.6 The internal resistance becomes very high. √ Energy is used to move the charge through the cell and less energy is available for the external circuit. √
Die interne weerstand raak baie hoog. √ Energie word gebruik om lading deur die sel te beweeg en minder energie is beskikbaar vir die eksterne stroombaan. √ [11.3.2] (2)

4.7 The total resistance of the circuit will increase, √ the total current will decrease and the ammeter reading will decrease. √ Since emf and r stay the same, the internal voltage decreases; therefore reading on V_1 will increase,√ the reading on V_2 will be zero. √
Die totale weerstand van die stroombaan verhoog √ die totale stroom verminder en die ammeter verminder. √ Omdat die emk en r konstant bly, sal die interne volt afneem, dus die lesing op V_1 sal vermeerder √ die lesing op V_2 sal nul wees. √ [11.1.3] (4)

[22]

QUESTION / VRAAG 5

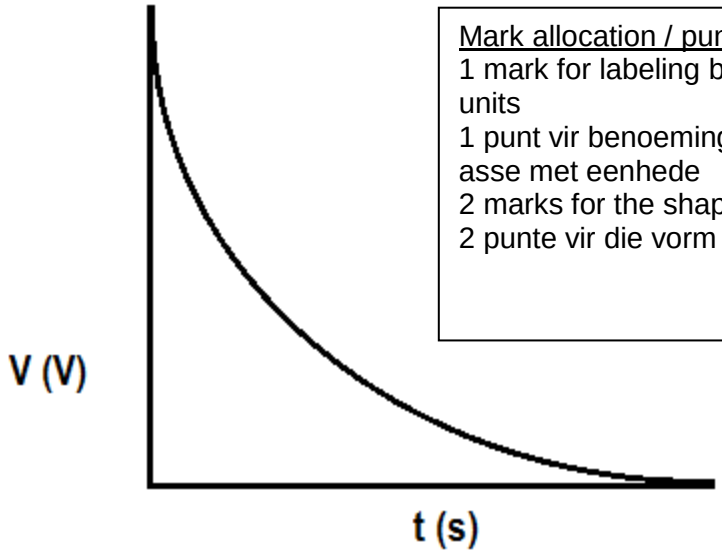
5.1



Mark allocation / puntetoekenning
1 mark for uniform field between the plates
1 punt vir uniforme veld tussen plate
1 mark for field lines bent near the edges
een punt vir veldlyne wat buig by kante
1 mark for direction of electric field lines i.e. from positive to negative plate
1 punt vir rigting van veldlyne van positief na negatief

[11.1.2] (3)

5.2 The graph of potential difference vs time / Die grafiek van potensiaalverskil teenoor tyd



Mark allocation / puntetoekenning
1 mark for labeling both axis with units
1 punt vir benoeming van beide asse met eenhede
2 marks for the shape of the graph
2 punte vir die vorm van die grafiek

[11.1.2] (3)

5.3 The discharge is initially rapid √ but slows down as the potential difference across the plate drops. √ /
Die ontlading is aanvanklik vinnig √ maar word stadiger soos die potensiaalverskil oor die plate minder word. √ [11.1.2] (2)

5.4 $C = Q/V$ √

$1{,}2 \times 10^{12}F = Q/12$ √

$Q = 1{,}44 \times 10^{12}C$ √ [11.1.3] (3)

[11]

QUESTION / VRAAG 6

6.1 Direct current supplies a constant magnetic flux √ and cannot induce current. √ /
Gelykstroom veroorsaak 'n konstante magnetiese vloed √ en kan nie stroom induseer nie. √ [11.1.2] (2)

6.2 Step up transformer / verhogingstransformator √ [11.1.3 (1)

6.3 $\frac{N_S}{N_p} = \frac{V_S}{V_P}$ √

$\frac{N_S}{17}$ √ $= \frac{4\,150}{120}$ √

$N_s = 587{,}92$ √ [11.1.3] (4)

6.4 $V_P I_P = V_S I_S$ √

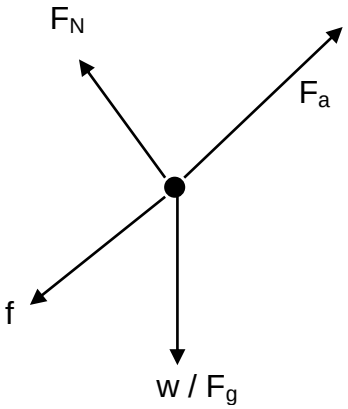
$\sqrt{}\,120\,x\;I_P = 4\,150\;x\;0{,}1$ √

$I_P = 3{,}46\,A$ √ [11.1.3] (4)

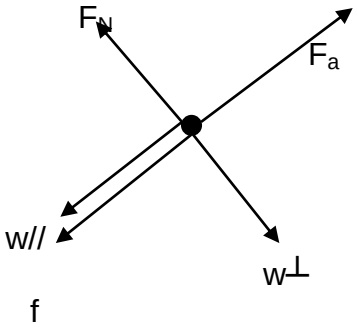
[11]

QUESTION / VRAAG 7

7.1



OR/
OF



F_N → normal force √ / normaalkrag
F_a → Force applied √ / toegepaste krag
w /F_g → weight of the car √ OR w// & w⊥ → components of weight
gewig van kar OF komponente van gewig
f → friction √ / wrywing [11.1.2] (4)

7.2 $F_{NET} = ma$ √
$7\,400 = 1\,400\ x\ a$ √
$a = 5,29\ m.s^{-2}$√ [11.2.2] (3)

7.3 $\mu = \frac{f}{N}$ √

$0,23 = \frac{f}{(1\,400)(9,8)\,(\cos 25°)}$ √

f = 2 859,94 N √ [11.2.3] (3)

POSITIVE MARKING FROM 7.3 / POSITIEWE NASIEN VAN 7.3.

7.4 $F_{NET} = F_{applied} + W \sin\theta + f$ √
$7\,400 = F_{applied} + (-1\,400\ x\ 9,8\ sin\ 25°) - 2\,859;\ 94$ √
$F_{applied} = 10\,058,26\ N$ √ [11.2.2] (3)
[13]

QUESTION / VRAAG 8

8.1 Net force is the rate of change in momentum./ Netto krag is die tempo van verandering in momentum √√ [11.2.1] (2)

8.2

$F_{net} = \frac{m(V_F - V_I)}{\Delta t}$ √

$= \frac{0{,}06\ (0-(-15))}{1}$ √

$= 0{,}9$ N √

OR / OF

$F_{net} = \frac{m(V_F - V_I)}{\Delta t}$ √

$= \frac{0{,}06\ (0-(-15))}{1}$ √

$= -0{,}9$ N √

thus/dus 0,9 N [11.2.3] (4)

8.3 Greater than / groter as √
The change in momentum is greater than that of the clay √√
(since there was a direction change) /
Die verandering in momentum is groter as die van klei (omdat daar 'n rigtingverandering was).
.
Since m and t remain the same, thus F_{net} α Δv $F_{net} = m(v_f - v_i)$/
Omdat m en t dieselfde bly, dus F_{net} α Δv $F_{net} = m(v_f - v_i)$ √ [11.1.2] (4)

8.4 total momentum before collision = total momentum after collision √
totale momentum voor botsing = totale momentum na botsing

$0 = m_1v_{f1} + m_2v_{f2}$
√ $0 = 54(2{,}5)$ √ $+ 88\ (v_{f2})$ √

$v_{f2} = -1{,}534\ m.s^{-1}$
$= 1{,}53\ m.s^{-1}$ to the left / away from other skater √
na links / weg van ander skaatser [11.2.3] (5)

8.5 8.5.1 'Arrive alive campaign' / 'Kom veilig aan veldtog' √ [11.3.1] (1)

8.5.2 Driving under the influence of drugs and alcohol / Bestuur onder die invloed van dwelms en drank √
Exceeding speed limits / spoedgrens oorskry √
(Or any other relevant answer / Enige ander relevante antwoord) [11.1.2] (2)

[18]

QUESTION / VRAAG 9

9.1	Newton's law of Universal Gravitation / Newton se universele gravitasiewet √		[11.1.2]	(1)
9.2	9.2.1	2F √√	[11.1.2]	(2)
	9.2.2	$^{1}/_{4}$ F √√	[11.1.2]	(2)
	9.2.3	4F √√	[11.1.2]	(2)
	9.2.4	2F √√	[11.1.2]	(2)
				[9]

QUESTION / VRAAG 10

10.1	Torque is force times perpendicular distance √ / Torque = force x perpendicular distance Draaimoment is krag maal loodregte afstand / draaimoment = krag x loodregte afstand		[11.2.2]	(1)
10.2	pivot/fulcrum / draaipunt of spil √		[11.2.2]	(1)
10.3	10.3.1	0,02 √ or/of 0,0196	[11.1.2]	(1)
	10.3.2	0,1 √ o or/of 0,102	[11.1.2]	(1)
	10.3.3	0,29 √ or/of 0,294	[11.1.2]	(1)
10.4	Neither / geen. √		[11.1.2]	(1)
10.5	Principle of moments states that for any object that is in equilibrium √ the sum of clockwise moments is equal the sum of anti-clockwise moments. √ Die beginsel van kragmoment stel dat vir enige voorwerp in ewewig, die som van die kloksgewyse momente gelyk is √ aan die som van die antikloksgewyse momente. √		[11.1.2]	(2)
				[8]

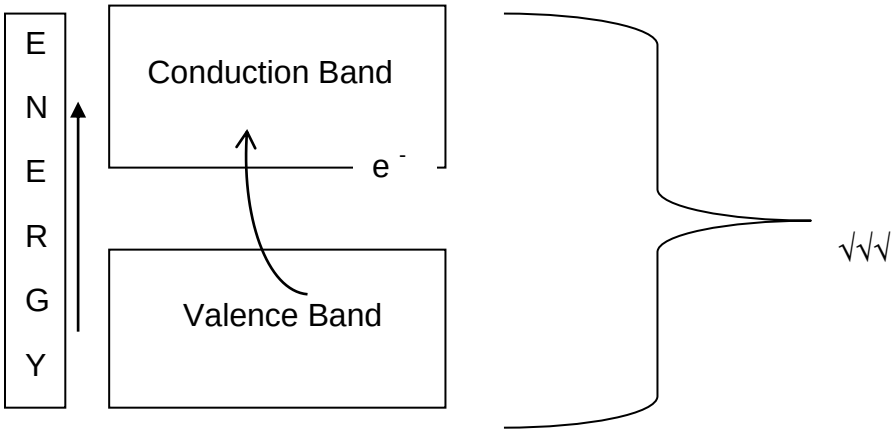
QUESTION / VRAAG 11

11.1 Doping / dotering √ [11.1.2] (1)

11.2 *There is an energy gap between the valence band and conduction band of a semi-conductor √ which makes it difficult for an electron to jump from the valence band to the conduction band / *Daar is 'n energie-gaping tussen die valensband en geleidingsband van halfgeleiers wat dit vir elektrone moeilik maak om van die valensband na die geleidingsband te beweeg

*****When a semi-conductor is heated, √ the electrons become excited and jump to the conduction band √ and the semi-conductor becomes a conductor / Wanneer 'n halfgeleier verhit word, kry elektrone energie om na die geleidingsband te beweeg en die halfgeleier word geleidend.

OR/OF



Energy / Energie
Conduction band / Geleidingsband
Valence band / Valensband

[11.1.2] (3)

11.3 computer monitors, bank ATM, cellphones, closed circuit TV, closed circuit TV cameras, et cetera. (Any 2)/ rekenaarskerms, bank OTM, selfone, geslotebaan TV, geslotebaan TV kameras, ensovoorts. √√ (Enige 2) [13.1.2] (2)

[6]

QUESTION / VRAAG 12

12.1 $T = \frac{1}{\mathrm{F}}$ √

$= \frac{1}{45}$

$= 0{,}02\ \mathrm{s}$ √ [11.1.3] (2)

12.2 $V = f\lambda$ √

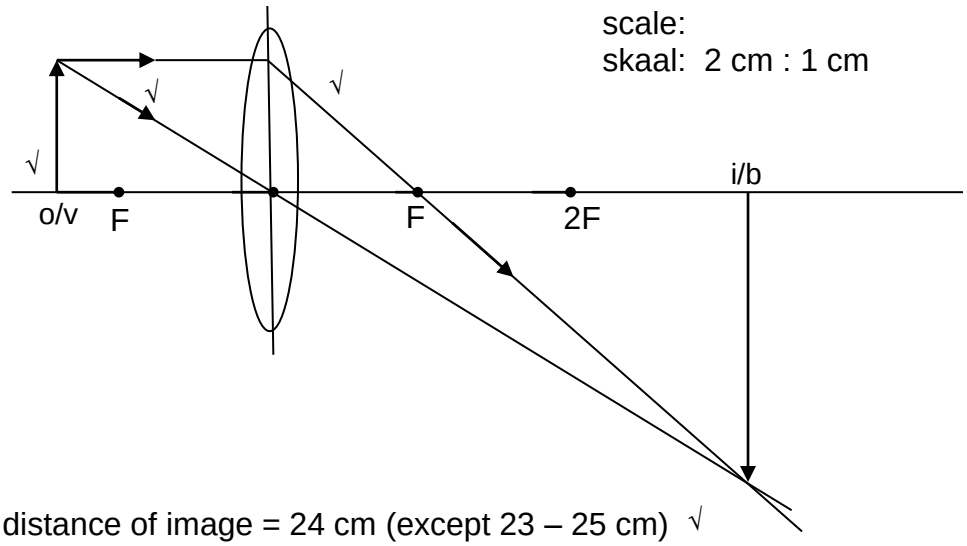
$22 = 45\lambda$ √

$\lambda = 0{,}49\ m$ √ [11.1.3] (3)

12.3 The speed of light is much greater than the speed of sound √ and the time it takes for light to reach the observer is negligible √ √ since the speed of sound is approximately 333 m.s $^{-1}$ √ and d = vt √ it takes sound 3 s to travel 1 000 m (1 km) √
Die spoed van lig is baie meer √ as die spoed van klank √ en die tyd wat dit neem vir lig om die waarnemer te bereik kan buite rekening gelaat word √ omdat die spoed van klank ongeveer 333 m.s $^{-1}$ is √ en d = vt √ sal klank in 3 s 1 000 m (1 km) aflê. √ [11.1.2] (4)
[9]

QUESTION / VRAAG 13

13.1



distance of image = 24 cm (except 23 – 25 cm) √
beeldafstand = 24 cm (aanvaar 23 – 25 cm)

[11.1.3] (4)

13.2 $m = -d_i/d_0$ √ OR/OF m = image size / object size

m = beeld grootte / voorwerp grootte

$= \frac{24}{8}$ $= \frac{12}{4}$

$= 3$ √ $= 3$ [11.1.3] (2)

13.3 The image is real, inverted and enlarged /
Die beeld is reëel, omgekeer en vergroot. √ [12.2.3] (3)
[9]

TOTAL SECTION/ TOTAAL AFDELING B: 125
GRAND TOTAL / GROOTTOTAAL: 150