



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**PHYSICAL SCIENCES: PHYSICS (P1)  
FISIESE WETENSAPPE (V1)**

**MEMORANDUM**

**PREPARATORY EXAMINATION 2008  
VOORBEREIDIENDE EKSAMEN 2008**

**MARKS: 150**

**TIME: 3 hours**

**This memorandum consists of 12 pages.  
Hierdie memorandum bestan uit 12 bladsye.**

<b>Learning Outcomes and Assessment Standards</b> <b>Leeruitkomst en Assesseringstandaarde</b>		
<b>LO 1/LU 1</b>	<b>LO 2/LU 2</b>	<b>LO 3/LU 3</b>
<p><b>AS 12.1.1:</b> Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p> <p><b>AS 12.1.2:</b> Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.</i></p> <p><b>AS 12.1.3:</b> Select and use appropriate problem-solving strategies to solve (unseen) problems.</p> <p><i>Kies en gebruik geskikte probleemoplossingsstrategieë om (ongesiene) probleme op te los.</i></p>	<p><b>AS 12.2.1:</b> Define, discuss and explain prescribed scientific knowledge.</p> <p><i>Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.</i></p> <p><b>AS 12.2.2</b> Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite konsepte in eie woorde aan te dui.</i></p> <p><b>AS 12.2.3:</b> Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p><b>AS 12.3.2:</b> Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications.</p> <p><i>Vors gevallestudies na en lewer etiese en morele argumente uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.</i></p>

**SECTION A / AFDELING A****QUESTION 1/VRAAG 1**

- |     |   |          |            |
|-----|---|----------|------------|
| 1.1 | Gravitational force/ <i>gravitasiekrag</i> ✓<br>or/of<br>weight/ <i>gewig</i> | [12.2.1] | (1)        |
| 1.2 | Impulse/ <i>impuls</i> ✓  | [12.2.1] | (1)        |
| 1.3 | Doppler Effect/ <i>Doppler effek</i> ✓  | [12.2.1] | (1)        |
| 1.4 | Alternating current/ <i>wisselstroom</i> ✓                                    | [12.2.1] | (1)        |
| 1.5 | Laser/ <i>Laser</i> ✓   | [12.2.1] | (1)        |
|     |   |          | <b>[5]</b> |

**QUESTION 2 / VRAAG 2**

- |     |    |          |            |
|-----|----|----------|------------|
| 2.1 | D✓ | [12.2.1] | (1)        |
| 2.2 | G✓ | [12.2.1] | (1)        |
| 2.3 | B✓ | [12.2.1] | (1)        |
| 2.4 | H✓ | [12.2.1] | (1)        |
| 2.5 | C✓ | [12.2.1] | (1)        |
|     |    |          | <b>[5]</b> |

**QUESTION 3 / VRAAG 3**

- |     |   |          |             |
|-----|---|----------|-------------|
| 3.1 | True / <i>Waar</i> ✓✓   | [12.2.3] | (2)         |
| 3.2 | False / <i>Onwaar</i> :<br>.....velocity relative to the train is $1 \text{ m}\cdot\text{s}^{-1}$ ✓.<br>..... <i>snelheid relatief tot trein is <math>1 \text{ m}\cdot\text{s}^{-1}</math></i> . ✓          | [12.2.3] | (2)         |
| 3.3 | False: ✓ <i>Onwaar</i> ✓<br>... transmit green and red light and absorb blue light ✓ OR<br>A cyan filter ...<br>... <i>laat groen en rooilig deur and absorbeer bloulig OF</i><br><i>'n Siaanfilter</i> ... | [12.2.3] | (2)         |
| 3.4 | True / <i>Waar</i> ✓✓   | [12.2.1] | (2)         |
| 3.5 | True / <i>Waar</i> ✓✓   | [12.2.1] | (2)         |
|     |   |          | <b>[10]</b> |

**QUESTION 4 / VRAAG 4**

- 4.1 B ✓✓✓ [12.2.3] (3)
- 4.2 D ✓✓✓ [12.1.3] (3)
- 4.3 C ✓✓✓ [12.2.3] (3)
- 4.4 D ✓✓✓ [12.2.1] (3)
- 4.5 D ✓✓✓ [12.1.2] (3)
- [15]**

**TOTAL SECTION A = 35**  
**TOTAAL AFDELING A = 35**

**SECTION B / AFDELING B****QUESTION 5/VRAAG 5**

- 5.1 Consider downward motion as positive

$$v_f^2 = v_i^2 + 2a \Delta y \quad \checkmark$$

$$(0)^2 \checkmark = (-4)^2 + 2(9,8)\Delta y \checkmark \quad \text{[Note: } v_i \text{ \& } a \rightarrow \text{ opposite signs]}$$

$$\Delta y = -0,82 \text{ m}$$

$$= 0,82 \text{ m upwards } \checkmark$$

$$\therefore \Delta y_{\text{above ground}} = 6 + 0,82 = 6,82 \text{ m } \checkmark$$

OR

$$E_t(\text{top}) = E_t(\text{bottom})$$

$$E_p + E_k = E_p + E_k \quad \checkmark$$

$$mgh + \frac{1}{2}mv_i^2 = mgh + \frac{1}{2}mv_f^2$$

$$(m)(9,8)(6) \checkmark + \frac{1}{2}m(-4)^2 \checkmark = m(9,8)h + 0 \checkmark$$

$$h = 6,82 \text{ m } \checkmark$$

[12.2.3] (5)

- 5.2 Consider downward motion as positive:

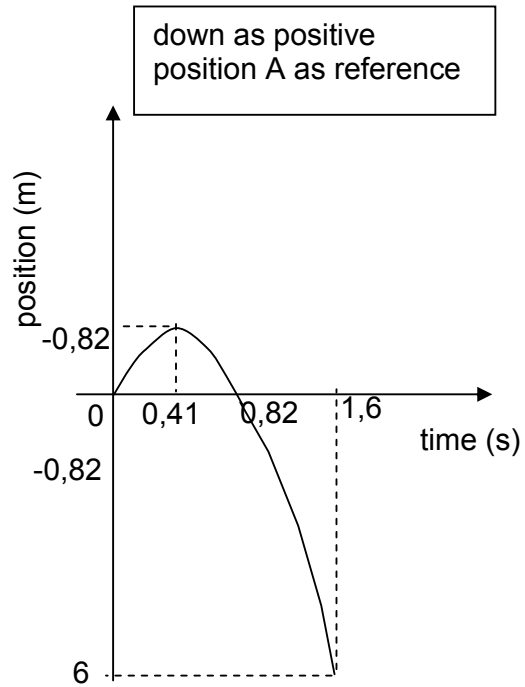
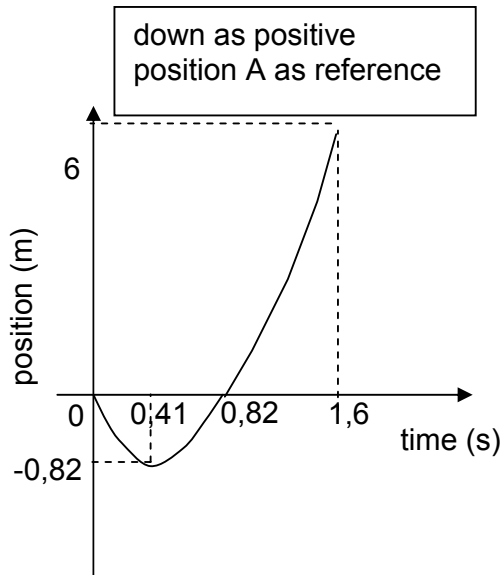
$$v_f = v_i + a\Delta t \quad \checkmark$$

$$0 = (-4) + (9,8) \Delta t \checkmark \quad \text{[Note: } v_i \text{ \& } a \rightarrow \text{ opposite signs]}$$

$$\Delta t = 0,41 \text{ s } \quad \checkmark$$

[12.2.3] (3)

5.3



<b>Checklist/Kontrolelys</b>		<b>Marks/ Punte</b>
<b>Criteria for graph/ Kriteria vir grafiek</b>		
Correct shape of graph 0 – 0,41 s / Korrekte vorm van grafiek 0 – 0,41 s		✓
Correct shape of graph 0,41s – 1,6 s / Korrekte vorm van grafiek 0,41s- 1,6 s		✓
Coordinates 0,41 s ; 0,82 m for highest position indicated / Ko-ordinate 0,41 s; 0,82 m vir hoogste punt aangedui		✓
Coordinates 0,s ; 0,82 m indicated / Ko-ordinate 0 s; 0,82 m aangedui		✓
Coordinates 1,6s ; 6 m indicated / Ko-ordinate 0,41 s; 0,82 m aangedui		✓

[12.1.2] (5)  
**[13]**

**QUESTION 6/VRAAG 6**

6.1  $1,96 \times 10^4 \text{ N}$  ✓, upward /opwaarts✓ [12.2.3] (2)

6.2  $p_{\text{before}} = p_{\text{after}}$   
 $m_1 v_{i1} + m_2 v_{i2} = (m_1 + m_2) v_f$  ✓  
 $(0) \checkmark + (2\,000)(3) \checkmark = (1\,500 + 2\,000) v_f \checkmark$   
 $v_f = 1,71 \text{ m}\cdot\text{s}^{-1}$  ✓ westwards✓ [12.2.3] (6)

6.3  $F_{\text{net}} \Delta t = \Delta p$   
 $F_{\text{net}} = \frac{m(v-u)}{\Delta t} / \frac{m(v_{\text{fB}} - v_{\text{iB}})}{\Delta t}$  } ✓  
 $= \frac{2000(1,71 - 3)}{0,5}$  ✓✓  
 $= -5\,160 \text{ N}$   
 $\therefore$  Magnitude of  $F = 5\,160 \text{ N}$  ✓ [12.2.3] (4)

6.4 The air bubbles will increase the time of impact ✓ and thus reduce the Force. ✓ This may minimize damage to the equipment. ✓

*Die lugborrels verleng die impaktyd ✓ en verminder dus die krag wat die vertraging veroorsaak. ✓ Hierdie effek kan verhoed dat die voorraad beskadig word. ✓* [12.3.2] (3)  
**[15]**

**QUESTION 7/VRAAG 7**

7.1  $E_{\text{mech}}$  is not conserved. ✓ This is not an isolated system / there is friction ✓

$E_{\text{meg}}$  bly nie behoue. ✓ Is nie 'n geïsoleerde sisteem / daar is wrywing. ✓

[12.2.3] (2)

7.2  $E_k = K = \frac{1}{2}mv^2$  ✓

$$= \frac{1}{2}(55)(10)^2$$
 ✓

$$= 2\,750 \text{ J}$$
 ✓

[12.2.3] (3)

7.3  $W_{\text{nc}} = \Delta E_k + \Delta E_p$

$$F \cos \theta \Delta x = E_{\text{kf}} - E_{\text{ki}} + E_{\text{pf}} - E_{\text{pi}}$$
 ✓

$$(18) \cos 180^\circ (8) = \left( \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \right) + (mgh_f - mgh_i)$$
 ✓

$$-144 = E_{\text{kf}} - \frac{1}{2}(55)(10)^2 + (55)(9,8)(1,2) - 0$$
 ✓

$$E_{\text{kf}} = 1\,959,2 \text{ J}$$
 ✓

OR

$$E_p = U = mgh \text{ (gained)}$$

$$= (55)(9,8)(1,2)$$
 ✓

$$= 646,8 \text{ J}$$
 ✓

Work done against friction / Werk gedoen teen wrywing.

$$W = F \cdot \cos \theta \Delta x = (18)(\cos 180^\circ)(8)$$

$$= (18)(-1)(8)$$
 ✓

$$= -144 \text{ J}$$
 ✓ (lost)

$$\therefore (E_p + E_k)_{\text{bottom}} = (E_p + E_k)_{\text{top}} + W$$
 ✓

$$(0 + 2\,750) = 646,8 + E_k + 144$$

$$E_{k(\text{top})} = 1\,959,2 \text{ J}$$
 ✓

OR

$$W_{\text{net}} = \Delta E_k$$
 ✓

$$F_{\text{net}} \cos \theta \Delta x = \Delta E_k$$

$$(mg \sin \theta + f) \cos \theta \Delta x = E_{\text{kf}} - E_{\text{ki}}$$

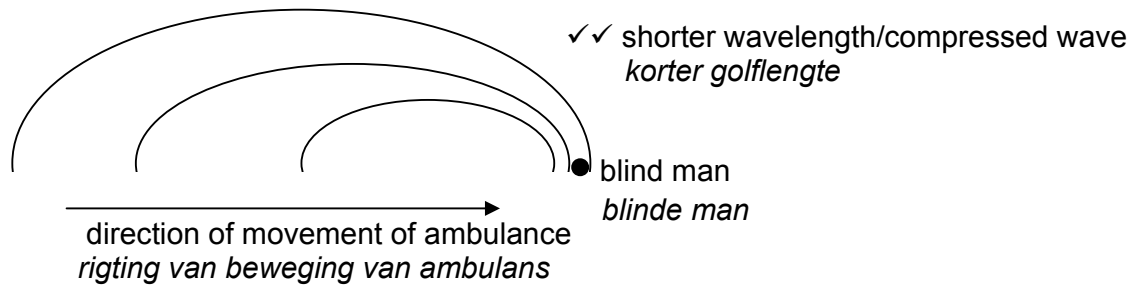
$$\left[ (55)(9,8) \left( \frac{1,2}{8} \right) + 18 \right] (\cos 180^\circ)(8) = E_{\text{kf}} - 2\,750$$
 ✓

$$E_{\text{ki}} = 1\,959,2 \text{ J}$$
 ✓

[12.1.3] (8)  
[13]

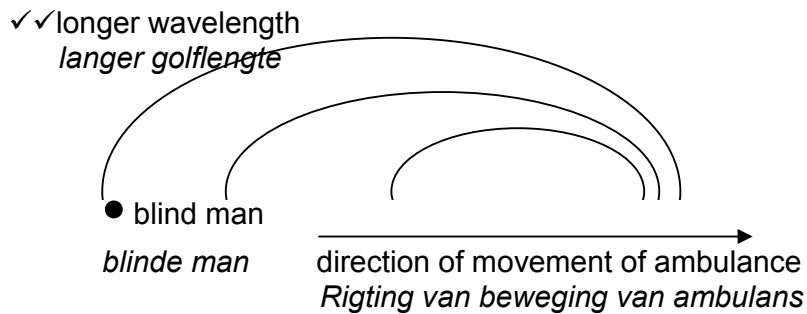
**QUESTION 8/VRAAG 8**

8.1.1



[12.1.2] (2)

8.1.2



[12.1.2] (2)

8.2

$$f_L = \left( \frac{v \pm v_L}{v \pm v_s} \right) f_s \checkmark$$

$$= \left( \frac{340 \pm 0}{340 - 40} \right) 350 \checkmark$$

$$= 396,7 \text{ Hz } \checkmark$$

[12.2.3] (1)

8.3

When crossing a street, a blind person can determine whether a car is moving towards✓ or away✓ from him

Wanneer 'n blinde persoon 'n straat oorsteek kan bepaal word of die motor kar na✓ of weg✓ van die persoon beweeg

[12.3.2] (2)

**[11]**



**QUESTION 9/VRAAG 9**

- 9.1 Light consisting of a single frequency. ✓✓ (or one wavelength)  
*Lig wat net uit'n enkele frekwensie bestaan. ✓✓ (of een golflengte)* [12.2.1] (2)
- 9.2 Alternate red✓ and dark bands✓ are observed.  
*Afwisselende rooi✓ en donker stroke✓ is waargeneem* [12.2.3] (2)
- 9.3 Red bands as result of constructive and dark bands as result of destructive interference.  
*Rooibande as gevolg van konstruktiewe en donkerbande as gevolg van destruktiewe interferensie* [12.2.3] (2)
- 9.4 The coloured bands are narrower ✓✓/ A greater number of dark bands, closer together are seen.  
The wavelength of blue light is shorter than red✓✓, resulting in more points of interference.  
*Die gekleurede bande is nouer✓✓ / 'n Groter aantal donker en rooi stroke nader aan mekaar.*  
*Die golflengte van blou lig is korter as rooi, ✓✓ en veroorsaak meer interferensie.* [12.2.2] (4)
- 9.5 More dark and light bands are seen. ✓✓  
*Meer donker en lig stroke word waargeneem. ✓✓* [12.2.2] (2)  
**[12]**

**QUESTION 10/VRAAG 10**

- 10.1 
$$R_{||} = \frac{R_1 R_2}{R_1 + R_2} \checkmark$$
  
$$= \frac{(5)(15)}{(5 + 15)}$$
  
$$= 3,75 \Omega \checkmark$$
  
$$R_T = 20 + 3,75 = 23,75 \Omega \checkmark$$
  
$$I_T = \frac{V}{R_T} \checkmark$$
  
$$= \frac{60}{23,75} \checkmark$$
  
$$= 2,53 \text{ A} \checkmark$$
 [12.1.3] (6)
- 10.2 
$$V_{20\Omega} = IR_{20\Omega}$$
  
$$= (2,53)(20) \checkmark$$
  
$$= 50,6 \text{ V} \checkmark$$
  
$$V_{||} = (60 - 50,6)$$
  
$$= 9,4 \text{ V} \checkmark$$
 [12.2.3] (3)  
**[9]**

**QUESTION 11/VRAAG 11**

11.1  $C = \frac{\epsilon_0 A}{d} \checkmark$   
 $= \frac{8,85 \times 10^{-12} \cdot 0,04}{0,002} \checkmark \checkmark$   
 $= 1,77 \times 10^{-10} \text{ F} \checkmark$  [12.2.3] (4)

11.2  $C = \frac{Q}{V} \checkmark$   
 $1,77 \times 10^{-10} = \frac{Q}{250} \checkmark$   
 $1,77 \times 10^{-10} \cdot 250 = Q$   
 $Q = 4,425 \times 10^{-8} \text{ C} \checkmark$  [12.2.3] (3)

11.3 Increase the potential difference  $\checkmark \checkmark$   
*Verhoog die potensiaalverskil  $\checkmark \checkmark$*  [12.2.2] (2)

11.4 dielectric / *diëlektrikum*  $\checkmark$  [12.2.1] (1)

11.5 It stores charge.  $\checkmark$  This large amount of charge can cause shock to the body.  
*Dit berg lading.  $\checkmark$  Die groot hoeveelheid gebergde lading kan skok veroorsaak  $\checkmark$*  [12.3.2] (2)  
**[13]**

**QUESTION 12/VRAAG 12**

- 12.1 Electric energy ✓ converted to (rotational) mechanical energy. ✓  
*Elektriese energie ✓ word omgesit in meganiese energie* [12.2.1] (2)
- 12.2.1 A DC motor reverses current direction with the aid of the commutator whenever the coil is in the vertical ✓ position to ensure continuous rotation.  
An AC motor, with alternating current as input, works without commutators since the current alternates. ✓  
  
*'n Gelykstroom motor verander die stroomrigting sodra die spoel in 'n vertikale posisie is, om die rotasie te volhou.  
'n Wisselstroommotor, wat deur 'n wisselstroom gevoer word, werk sonder kommutators want die stroom wissel.* [12.2.1] (2)
- 12.3 Increase the number of turns on each coil/increased number of coils ✓  
Stronger magnets ✓ Bigger current ✓  
*Verhoog die aantal windings op elke spoel/meer spoele ✓ / Sterker magnete ✓ / groter stroom ✓* [12.2.2] (3)
- 12.4.1 Clockwise ✓ / *Klokgewys* [12.2.3] (1)
- 12.4.2 Its own momentum ✓ / split ring commutator changes direction ✓ of current, every time the coil reaches the vertical position.  
*Eie momentum ✓ / Die kommutator verander die stroomrigting ✓ sodra die spoel die vertikale posisie bereik* [12.2.3] (2)  
**[10]**

**QUESTION 13/VRAAG 13**

- 13.1 The voltage can change using transformers ✓. Electrical energy can be transmitted over long distances at low current ✓, and experience low energy loss.  
*Die elektriese spanning kan verander word deur transformators. ✓  
Elektriese energie kan gelei oor langafstande word een lae stroomsterkte ✓, en beperk dus energie verlies* [12.3.2] (2)
- 13.2  

$$\Delta V_{\text{rms}} = \frac{\Delta V_{\text{max}}}{\sqrt{2}} \checkmark$$

$$= \frac{325}{\sqrt{2}} \checkmark$$

$$= 0,707 (325)$$

$$= 230 \text{ V}$$

$$P = V_{\text{rms}} I_{\text{rms}} \checkmark$$

$$= (230)(13) \checkmark$$

$$= 2\,990 \text{ W} \checkmark$$
[12.1.3] (5)  
**[7]**

**QUESTION 14/VRAAG 14**

- 14.1.1 Photo electric effect ✓  
*Foto elektriese effek* ✓ [12.2.1] (1)
- 14.1.2 increases / *verhoog* ✓  
The higher intensity more photo-electrons emitted per second ✓ /  
intensity is proportional to the photo-current  
*Hoe hoër intensiteit, hoe meer foto-elektrone per sekonde vrygestel* ✓ /  
*intensiteit is eweredig aan foto-elektrone* [12.2.2] (2)
- 14.1.3 Increases / *toeneem* ✓  
Blue light has a higher frequency ✓ than red light therefore a higher  
energy ✓  
*Blou lig het hoër frekwensie* ✓ *as rooi lig en dus hoër energie* ✓ [12.2.2] (3)
- 14.2.1 High frequency / High energy ✓  
*Hoë frekwensie / hoë energie* ✓ [12.3.2] (1)
- 14.2.2 High frequency UV light kills microbes and sterilises food. ✓  
*Hoe frekwensie UV lig maak mikro organisme dood* ✓ *en steriliseer*  
*voedsel.* ✓ [12.3.2] (1)
- 14.2.3  $E = W_o + E_k$  ✓  
 $(2,95 \times 10^{-19}) \checkmark = (1 \times 10^{-20}) \checkmark + \frac{1}{2} mv^2$   
 $\frac{1}{2} (9,11 \times 10^{-31}) v^2 \checkmark = (2,95 \times 10^{-20}) - (1 \times 10^{-20})$   
 $v = 2,069 \times 10^5 \text{ m}\cdot\text{s}^{-1} \checkmark$  [12.2.3] (5)
- [13]**  
**TOTAL = 150**  
**TOTAAL = 150**