

MEMORANDUM

PHYSICAL SCIENCE/FISIESE WETENSAPPE

SEPTEMBER 2018

CW PLC COMMON PAPER 1

QUESTION 1			
1.1	A		(2)
1.2	A		(2)
1.3	C		(2)
1.4	D		(2)
1.5	D		(2)
1.6	A		(2)
1.7	B		(2)
1.8	B		(2)
1.9	D		(2)
1.10	D		(2)
			[20]

QUESTION 2			
21.	2.1.1	<p>When a resultant/net force acts on an object, the object accelerates in the direction of the (net) force at an acceleration directly proportional to the force ✓ and inversely proportional to the mass of the object. ✓</p> <p><i>Wanneer 'n resultante /netto krag op 'n voorwerp uitgeoefen word, versnel die voorwerp in die rigting van die (netto) krag met 'n versnelling direk eweredig aan die grootte van die krag ✓ en omgekeerd eweredig aan die massa van die voorwerp. ✓</i></p>	(2)
	2.1.2	<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Notes/Aantekeninge:</p> <ul style="list-style-type: none"> • Correct arrow and label for each force for one mark. / Korrekte pyle en benoeming vir elke krag vir een punt. • Comparative lengths of arrows are not required. / Vergelykende lengte van pyle nie vereiste nie. </div>	(3)
	2.1.3	<p>(a)</p> <p>For block X / Vir blok X: $F_{net} = ma$ ✓ $180 - w - T = ma$ $180 - (4)(9,8) - T = 4a$ ✓ $140,8 - T = 4a$(i)</p> <p>For block Y / Vir blok Y: $F_{net} = ma$ $T - w = ma$ $T - (8)(9,8) = 8a$ ✓ $-78,4 + T = 8a$(ii)</p> <p>$281,6 - 2T = 8a$ $-78,4 + T = 8a$ ✓ $360 - 3T = 0$ $T = 120$ N $T = 120$ N upwards / opwaarts ✓</p> <p><u>Option 2 for resolving two equations:</u> $140,8 - T = 4a$(i) $-78,4 + T = 8a$(ii) $62,4 = 12 a$ $a = 5,2 \text{ ms}^{-2}$ $T = 8 a + 78,4$ $= 120$ N</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note/Aantekeninge:</p> <ul style="list-style-type: none"> • If the system approach is used to first calculate acceleration and then acceleration is substituted to obtain T: Max. 3/5 • Indien die stelsel benader word om eerstens versnelling te bereken en dan die versnelling gebruik om T te bereken: Maks 3/5 </div>	(5)

Commented [1]: If a candidate add the masses (12 kg) directly into $F_{net} = ma$, 2 marks maximum!

-1 mark for formula
- 1 mark for correct calculation of combined weight (117,6 N)

Commented [2]: Accepted

Commented [3]: Candidate receives full marks for (b) if Option 2 is used in (a). Candidate must show the answer in (b)

Commented [4]: Yes...answer MUST be shown in (b).

2.1.3	(b) POSITIVE MARKING FROM QUESTION 2.3.1 / POSITIEWE NASIEN VAN VRAAG 2.3.1 <table border="1" data-bbox="342 506 987 701"> <tr> <td data-bbox="342 506 639 615"> OPTION / OPSIE 1 $-78,4 + T = 8a$ $-78,4 + 120 = 8a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$ </td> <td data-bbox="639 506 987 615"> OPTION / OPSIE 2 $140,8 - T = 4a$ $140,8 - 120 = 4a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$ </td> </tr> <tr> <td colspan="2" data-bbox="342 615 987 701"> OPTION / OPSIE 3 $281,6 - 2T = 8a$ $281,6 + 220 = 8a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$ </td> </tr> </table>	OPTION / OPSIE 1 $-78,4 + T = 8a$ $-78,4 + 120 = 8a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$	OPTION / OPSIE 2 $140,8 - T = 4a$ $140,8 - 120 = 4a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$	OPTION / OPSIE 3 $281,6 - 2T = 8a$ $281,6 + 220 = 8a \checkmark$ $a = 5,2 \text{ m}\cdot\text{s}^{-2} \checkmark$		(2)
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2.2						
2.2.1	$2 \times 10^3 \text{ N.} \checkmark$	(1)				
2.2.2	<p>Option 1:</p> $F = Gm_1m_2 / r^2 \checkmark$ $(2 \times 10^3) \checkmark = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(400) \checkmark}{r^2}$ $r = 8,93 \times 10^6 \text{ m} \checkmark$ <p>Distance above Earth's surface/ Afstand bo Aardoppervlak =</p> $= (8,93 \times 10^6) - (6,38 \times 10^6)$ $= 2,55 \times 10^6 \text{ m} = 2,55 \times 10^3 \text{ km} \checkmark$ <p>Option 2:</p> $F = \frac{Gm_1m_2}{r^2} \checkmark$ $2 \times 10^3 \checkmark = \frac{(6,67 \times 10^{-11})(5,98 \times 10^{24})(400) \checkmark}{(h + (6,38 \times 10^6))^2 \checkmark}$ $(h + 6,38 \times 10^6)^2 = 7,99732 \times 10^{13}$ $h + 6,38 \times 10^6 = 8,93 \times 10^6$ $h = 2,55 \times 10^6 \text{ m}$ $= 2,55 \times 10^3 \text{ km} \checkmark$	(5)				
		[18]				

Commented [5]: I added Option 2

Commented [6]: Thanks

Commented [7]: I suggest that the candidate receives full marks for a final answer in meter.

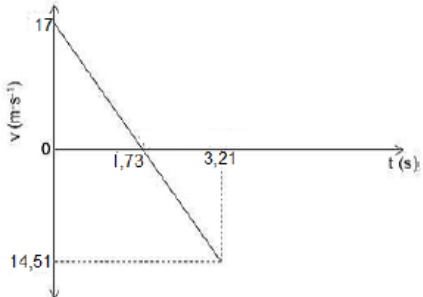
Commented [8]: Accepted

QUESTION 3	
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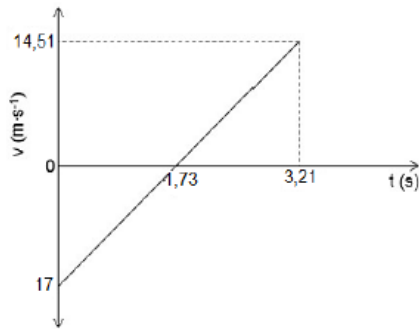
3.1	$g = 9,8 \text{ m}\cdot\text{s}^{-1}$ ✓ downwards/afwaarts ✓		(2)		
3.2	3.2.1	<table border="1"> <tr> <td> OPTION/OPSIE 1 (downward positive/afwaarts positief) $v_f = v_i + g\Delta t$ ✓ $0 = (-17) + 9,8\Delta t$ ✓ $\Delta t = 1,73 \text{ s}$ ✓ </td> <td> OPTION/OPSIE 2 (upwards positive/opwaarts positief) $v_f = v_i + 2g\Delta t$ ✓ $0 = (17)^2 + (-9,8)\Delta t$ ✓ $\Delta t = 1,73 \text{ s}$ ✓ </td> </tr> </table>	OPTION/OPSIE 1 (downward positive/afwaarts positief) $v_f = v_i + g\Delta t$ ✓ $0 = (-17) + 9,8\Delta t$ ✓ $\Delta t = 1,73 \text{ s}$ ✓	OPTION/OPSIE 2 (upwards positive/opwaarts positief) $v_f = v_i + 2g\Delta t$ ✓ $0 = (17)^2 + (-9,8)\Delta t$ ✓ $\Delta t = 1,73 \text{ s}$ ✓	(3)
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	3.2.2	<table border="1"> <tr> <td> OPTION/OPSIE 1 Downwards is positive Afwaarts positief $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (-17)^2 + 2 \times (9,8)(-4)$ ✓ $v_f^2 = 210,6$ $v_f = 14,51 \text{ m}\cdot\text{s}^{-1}$ downward /afwaarts ✓ </td> <td> OPTION/OPSIE 2 Upwards is positive Opwaarts positief $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (17)^2 + 2 \times (-9,8)(4)$ ✓ $v_f^2 = 210,6$ $v_f = 14,51 \text{ m}\cdot\text{s}^{-1}$ downward /afwaarts ✓ </td> </tr> </table>	OPTION/OPSIE 1 Downwards is positive Afwaarts positief $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (-17)^2 + 2 \times (9,8)(-4)$ ✓ $v_f^2 = 210,6$ $v_f = 14,51 \text{ m}\cdot\text{s}^{-1}$ downward /afwaarts ✓	OPTION/OPSIE 2 Upwards is positive Opwaarts positief $v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (17)^2 + 2 \times (-9,8)(4)$ ✓ $v_f^2 = 210,6$ $v_f = 14,51 \text{ m}\cdot\text{s}^{-1}$ downward /afwaarts ✓	(3)
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OPTION/OPSIE 3	OPTION/OPSIE 4
<p>Time taken to reach maximum height from the ground./ Tyd om maksimum hoogte bo grond te bereik</p>	<p>Time taken to reach maximum height from the ground./ Tyd om maksimum hoogte te bereik bo grond te bereik</p>
<p>$v = v_i + g\Delta t$ $0 = -17 + 9,8\Delta t$ $\Delta t = 1,73 \text{ s} \checkmark$</p>	<p>$v = v_i + g\Delta t$ $0 = 17 + -9,8\Delta t$ $\Delta t = 1,73 \text{ s} \checkmark$</p>
<p>From the maximum height to the top of the building/ Vanaf maksimum hoogte tot bopunt van gebou</p>	<p>From the max height to the top of the building/ Vanaf maksimum hoogte tot bopunt van gebou</p>
<p>$v = v_i + a\Delta t$ $14,51 \checkmark = 0 + 9,8\Delta t$ $\Delta t = 1,48 \text{ s} \checkmark$</p>	<p>$v = v_i + a\Delta t$ $-14,51 \checkmark = 0 + -9,8\Delta t$ $\Delta t = 1,48 \text{ s} \checkmark$</p>
<p>The total time from the point from the ground to the top of the building:</p>	<p>The total time from the point from the ground to the top of the building:</p>
<p>Totale tyd vanaf grond tot bopunt van gebou</p>	<p>Totale tyd vanaf grond tot bopunt van gebou</p>
<p>$\Delta t_{\text{total}} = 1,73 + 1,48 = 3,21 \text{ s} \checkmark$</p>	<p>$\Delta t_{\text{total}} = 1,73 + 1,48 = 3,21 \text{ s} \checkmark$</p>

(4)

<p>3.3</p>	<p>OPTION/OPSIE 1 Velocity vs. time graph (Upwards is positive) Snelheid vs. tyd grafiek (Opwaarts positief)</p> 
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OPTION/OPSIE 2 Velocity vs. time graph (Downwards is positive)
Snelheid vs. tyd grafiek (Afwaaarts positief)



Correct shape/Korrekte vorm ✓

(NOTE: The graphs are not drawn to scale. The length on the y-axis between 0 and 17 should be longer than the length between 0 and 14,51)

Criteria to mark the graph/ <i>Kriteria vir merk van grafiek</i>	Marks/Punte
Graph starts at $v = 17 \text{ m}\cdot\text{s}^{-1}/-17 \text{ m}\cdot\text{s}^{-1}$ and $t = 0 \text{ s}$ <i>Grafiek begin by $v = 17 \text{ m}\cdot\text{s}^{-1}/-17 \text{ m}\cdot\text{s}^{-1}$ en $t = 0 \text{ s}$</i>	✓
Graph cuts t-axis at 1,73 s at $v = 0 \text{ m}\cdot\text{s}^{-1}$ <i>Grafiek sny t-as by 1,73 s by $v = 0 \text{ m}\cdot\text{s}^{-1}$</i>	✓
Graph shows the ball bouncing with $v = -14,51 \text{ m}\cdot\text{s}^{-1}/$ $14,51 \text{ m}\cdot\text{s}^{-1}$ at $t = 3,21 \text{ s}$ <i>Grafiek toon die bal bons met $v = -14,51 \text{ m}\cdot\text{s}^{-1}/14,51$ $\text{m}\cdot\text{s}^{-1}$ by $t = 3,21 \text{ s}$</i>	✓

(4)

(NOTE: The graphs are not drawn to scale. The length on the y-axis between 0 and 17 should be longer than the length between 0 and 14,51)

[15]

QUESTION 4						
4.1	<p>The total linear momentum in a closed system <u>remains constant/is conserved / Die totale lineêre momentum in 'n geslote stelsel bly konstant/bly behoue.</u> ✓✓</p> <p>OR/OF</p> <p>In a closed/isolated system, the total momentum before a collision is equal to the total momentum after the collision./In 'n geslote/geïsoleerde stelsel is die totale momentum voor 'n botsing gelyk aan die totale momentum na die botsing.</p> <p style="text-align: right;">(2)</p>					
4.2	4.2.1	$\Sigma p_i = \Sigma p_f \checkmark$ $m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$ $(m_1 + m_2) v_i = m_1 v_{1f} + m_2 v_{2f}$ $0 \checkmark = (0,4) v_{1f} + 0,6 (4) \checkmark$ $v_{1f} = -6 \text{ m}\cdot\text{s}^{-1}$ $= 6 \text{ m}\cdot\text{s}^{-1} \text{ to the left/na links} \checkmark$ <p style="text-align: right;">(4)</p>				
	4.2.2	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; padding: 5px;"> <p>OPTION 1/OPSIE 1</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,6)(4) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,6(4 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ </td> <td style="width: 50%; padding: 5px;"> <p>OPTION 2/OPSIE 2</p> $v_f = v_i + a \Delta t$ $4 = 0 + a(0,3)$ $a = 13,33 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,6(13,33)$ $F_{\text{net}} = 8 \text{ N} \checkmark$ </td> </tr> <tr> <td style="padding: 5px;"> <p>OPTION 3/OPSIE 3</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,4)(6) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,4(6 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ </td> <td style="padding: 5px;"> <p>OPTION 4/OPSIE 4</p> $v_f = v_i + a \Delta t$ $6 = 0 + a(0,3)$ $a = 20 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,4(20)$ $F_{\text{net}} = 8 \text{ N} \checkmark$ </td> </tr> </tbody> </table> <p style="text-align: right;">(4)</p>	<p>OPTION 1/OPSIE 1</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,6)(4) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,6(4 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$	<p>OPTION 2/OPSIE 2</p> $v_f = v_i + a \Delta t$ $4 = 0 + a(0,3)$ $a = 13,33 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,6(13,33)$ $F_{\text{net}} = 8 \text{ N} \checkmark$	<p>OPTION 3/OPSIE 3</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,4)(6) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,4(6 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$	<p>OPTION 4/OPSIE 4</p> $v_f = v_i + a \Delta t$ $6 = 0 + a(0,3)$ $a = 20 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,4(20)$ $F_{\text{net}} = 8 \text{ N} \checkmark$
<p>OPTION 1/OPSIE 1</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,6)(4) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,6(4 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$	<p>OPTION 2/OPSIE 2</p> $v_f = v_i + a \Delta t$ $4 = 0 + a(0,3)$ $a = 13,33 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,6(13,33)$ $F_{\text{net}} = 8 \text{ N} \checkmark$					
<p>OPTION 3/OPSIE 3</p> $\Delta p = F_{\text{net}} \Delta t \checkmark$ $[(0,4)(6) - 0] \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$ <p>OR/OF</p> $m(v_f - v_i) = F_{\text{net}} \Delta t \checkmark$ $0,4(6 - 0) \checkmark = F_{\text{net}} (0,3) \checkmark$ $F_{\text{net}} = 8 \text{ N} \checkmark$	<p>OPTION 4/OPSIE 4</p> $v_f = v_i + a \Delta t$ $6 = 0 + a(0,3)$ $a = 20 \text{ m}\cdot\text{s}^{-2}$ $F_{\text{net}} = ma$ $= 0,4(20)$ $F_{\text{net}} = 8 \text{ N} \checkmark$					
4.3	<p>Greater than/groter as v</p> <p style="text-align: right;">(1)</p>					
		[11]				

QUESTION 5		
5.1	<p>Option 1</p> $(E_P + E_K)_A = (E_P + E_K)_B \checkmark$ $mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$ $3(9.8)(1.5) \checkmark + 0 = 0 + \frac{1}{2}(3)v^2 \checkmark$ $v = 5,42 \text{ m} \cdot \text{s}^{-1}$ <p>Option 2</p> $W_{\text{net}} = \Delta E_K \checkmark$ $W_{F_{\text{gll}}} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $mg \sin \theta \Delta x \cos \theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \mid$ $3(9.8) \frac{1.5}{\Delta x} \Delta x \cos 0^\circ \checkmark = \frac{1}{2}(3)v^2 - 0 \checkmark$ $v = 5,42 \text{ m} \cdot \text{s}^{-1}$ <p>Option 3:</p> $W_{\text{nc}} = \Delta E_p + \Delta E_k \checkmark$ $0 \checkmark = mg(h_f - h_i) + \frac{1}{2}m(v_f^2 - v_i^2)$ $0 = 3 \times 9,8 (0 - 0,15) \checkmark + \frac{1}{2} \times 3 (v_f^2 - 0^2) \checkmark$ $v_f = 5,42 \text{ m} \cdot \text{s}^{-1} \checkmark$	(3)
5.2	<p>0 J \checkmark net force = 0/ constant velocity/E_k is the same/ only F_g present \checkmark</p> <p>0 J. Nul resulterende krag/ konstante snelheid/kinetiese energie is die selfde/slegs konserwatiewe kragte is teenwoordig</p>	(2)
5.3	<p>Net work done on an object is equal to the change in the object's kinetic energy. $\checkmark \checkmark$</p> <p>OR</p> <p>The work done on an object by a net force is equal to the change in the object's kinetic energy. $\checkmark \checkmark$</p> <p>Die netto/totale arbeid op 'n voorwerp verrig is gelyk aan die verandering in die kinetiese energie van die voorwerp</p> <p>OF</p> <p>Die arbeid verrig op 'n voorwerp deur 'n resulterende/netto krag is gelyk aan die voorwerp se verandering in kinetiese energie.</p>	(2)

Commented [9]: I added option 3

Commented [10]: Thank you

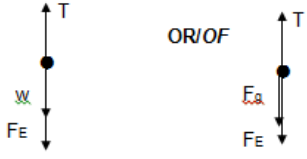
5.4	<p style="text-align: center;">OR</p>	(3)
5.5	<p>Option 1</p> $W_{\text{net}} = \Delta E_K \checkmark$ $W_f + W_{F_{g }} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $-30 \checkmark + mgsin\theta \Delta x \cos 180^\circ = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $-30 + 3(9.8) \frac{h}{5} (5)(-1) \checkmark = 0 - \frac{1}{2}(3)(5,42)^2 \checkmark$ $h = 0,48m \checkmark$ <p>Option 2</p> $W_{\text{net}} = \Delta E_K \checkmark$ $W_f + W_{F_{g }} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $-30 \checkmark + mgsin\theta \Delta x \cos 180^\circ = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ $-30 + 3(9.8) \sin \theta (5)(-1) \checkmark = 0 - \frac{1}{2}(3)(5,42)^2 \checkmark$ $\sin \theta = 0,248$ $\frac{h}{5} = 0,096$ $h = 0,48m \checkmark$ <p>Option 3:</p> $W_{nc} = \Delta E_p + \Delta E_k \checkmark$ $-30 \checkmark = mg(h_f - h_i) + \frac{1}{2}m(v_f^2 - v_i^2)$ $-30 = 3 \times 9,8 (0 - h) \checkmark + \frac{1}{2} \times 3 (0^2 - 5,42^2) \checkmark$ $h = 0,48 \text{ m} \checkmark$	(5)
		[15]

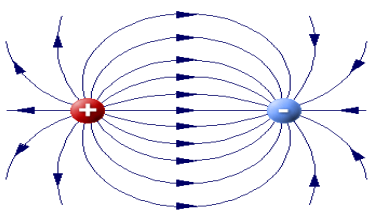
QUESTION 6	
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6.1	<p>It is the (apparent) change in frequency (or pitch) of the sound (detected by a listener) ✓ because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓</p> <p>OR</p> <p>An (apparent) change in (observed/detected) frequency (pitch), (wavelength) ✓ as a result of the relative motion between a source and an observer ✓ (listener).</p>		(2)
6.2	6.2.1	170 Hz	(1)
	6.2.2	130 Hz	(1)
6.3	$f_L = \frac{v \pm v_L}{v \pm v_s} f_s \checkmark$ $170 = \frac{(340 + 0)}{(340 - v_s)} \times f_s \dots \dots \dots (1)$ $130 = \frac{(340 - 0)}{(340 + v_s)} \times f_s \dots \dots \dots (2)$ $v_s = 45,33 \text{ m} \cdot \text{s}^{-1} \checkmark (45,33 - 45,45 \text{ m} \cdot \text{s}^{-1})$		(6)
6.4	<p>ANY ONE/ENIGE EEN</p> <p>Doppler flow meter/Doppler-vloeimeter</p> <p>Measuring foetal heartbeat/Meet van fetale hartslag</p> <p>Measure speed of blood flow/Meet spoed van bloedvloei</p> <p>Ultra sound/Ultraklank</p> <p>Sonar</p> <p>Radar (for speeding/vir jaag)</p>		(1)
6.5	<p>The red shift occurs when the spectrum of a distant star moving away from the earth is shifted toward the red end of the spectrum. ✓✓</p> <p><i>Rooi verskuiwings vind plaas wanneer die spektrum van 'n vêr afgeleë ster wat vanaf die aarde wegbeweeg na die rooi ent van die spektrum skuif.</i></p>		(2)
			[13]

Commented [11]: 6.3: 3/6 if candidate take fs = 150 Hz. (fs is in fact 147,33 Hz) give the first three marks

QUESTION 7	
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7.1	<p>The force of attraction that two charges at rest exert on each other is directly proportional to the product of the two charges✓ and inversely proportional to the square of the distance between their centres.✓</p> <p><i>Die aantrekkingskrag wat twee ladings in rus op mekaar uitoefen is direk eweredig aan die produk van die twee ladings en✓ omgekeerd eweredig aan die vierkant van die afstand tussen die middelpunte.✓</i></p>	(2)								
7.2	<div style="text-align: center;">  </div> <table border="1" data-bbox="227 898 880 1050"> <thead> <tr> <th colspan="2">Accepted labels/Aanvaarde byskrifte</th> </tr> </thead> <tbody> <tr> <td>W</td> <td>F_g/F_w/weight/mg/gravitational force F_g/F_w/gewig/mg/gravitasiekrag</td> </tr> <tr> <td>T</td> <td>FT/tension F_s/spanning</td> </tr> <tr> <td>FE</td> <td>F_e/electrostatic/F_{Q1Q2}/Coulomb force/F F_e/elektrostatiese/F_{Q1Q2}/Coulomb krag/F</td> </tr> </tbody> </table>	Accepted labels/Aanvaarde byskrifte		W	F _g /F _w /weight/mg/gravitational force F _g /F _w /gewig/mg/gravitasiekrag	T	FT/tension F _s /spanning	FE	F _e /electrostatic/F _{Q1Q2} /Coulomb force/F F _e /elektrostatiese/F _{Q1Q2} /Coulomb krag/F	(3)
Accepted labels/Aanvaarde byskrifte										
W	F _g /F _w /weight/mg/gravitational force F _g /F _w /gewig/mg/gravitasiekrag									
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FE	F _e /electrostatic/F _{Q1Q2} /Coulomb force/F F _e /elektrostatiese/F _{Q1Q2} /Coulomb krag/F									
7.3	<div style="border: 1px solid black; padding: 5px;"> <p>$F_{net} = 0$ $mg + F_E = T$ $mg + k \frac{Q_1 Q_2}{r^2} - T = 0$ $(0,007)(9,8) + \frac{(32 \times 10^{-9})(55 \times 10^{-9})}{(1,52)^2} = T$ $\therefore T = 0,137 \text{ N}$</p> <p>ACCEPT/AANVAAR $F_E = W_{02}$ $(0,007)(9,8) + (0,007)(9,8) = T$ $T = 0,137 \text{ N}$</p> </div>	(5)								
		[10]								

QUESTION 8		
8.1	The <u>electric force</u> ✓ <u>per unit charge</u> ✓ at that point.	(2)
8.2	 <p>Mark allocation: Number of electric field lines from both spheres the same ✓ Correct direction of electric field lines ✓ Correct pattern ✓</p>	(3)
8.3	<p>OPTION 1:</p> $E_{A \text{ at } X} = \frac{kQ}{r^2} \checkmark$ $= \frac{(9 \times 10^9)(2 \times 10^{-9})}{(3 \times 10^{-2})^2} \checkmark$ $= 20\,000 \text{ N/C, right } \checkmark$ $E_{B \text{ at } X} = \frac{kQ}{r^2}$ $= \frac{(9 \times 10^9)(2 \times 10^{-9})}{(6 \times 10^{-2})^2} \checkmark$ $= 5\,000 \text{ N/C, right } \checkmark$ $\therefore E_{\text{net at } X} = 25\,000 \text{ N/C, right } \checkmark$	

OPTION 2:

$$\begin{aligned} F_{A \text{ at } x} &= \frac{kQ_1 Q_2}{r^2} \\ &= \frac{(9 \times 10^9)(2 \times 10^{-9})(1)}{(3 \times 10^{-2})^2} \\ &= 20\,000 \text{ N, right } \checkmark \end{aligned}$$

$$\begin{aligned} F_{B \text{ at } x} &= \frac{kQ_1 Q_2}{r^2} \\ &= \frac{(9 \times 10^9)(2 \times 10^{-9})(1)}{(6 \times 10^{-2})^2} \\ &= 5\,000 \text{ N, right } \checkmark \end{aligned}$$

$$\therefore F_{\text{net at } x} = 25\,000 \text{ N, right } \checkmark$$

$$\begin{aligned} \therefore E_{\text{net at } x} &= \frac{F_{\text{net at } x}}{q} \checkmark \\ &= \frac{25000}{1} \checkmark \\ &= 25000 \text{ N/C, right } \checkmark \end{aligned}$$

(6)

[11]

QUESTION 9		
9.1	$I = V/R \checkmark = 4/4 \checkmark = 1 \text{ A} \checkmark$	(3)
9.2	<p>Opsie 1: (I parallel) : One branch (4 + 4 = 8 Ω) current is 1 A. The 16 Ω branch current is 1 A/2 = 0,5 A \checkmark (dubbel resistance means half the current) $I_{\text{tot}} = I_2 = 1 + 0,5 \checkmark = 1,5 \text{ A} \checkmark$</p> <p>Opsie 2: $V_p = 2 \times 4 = 8 \text{ V}$ therefore $V(R_1) = 20 - 8 = 12 \text{ V}$ $I(R_1) = V/R \checkmark$ $= 12/8 \checkmark$ $= 1,5 \text{ A} \checkmark$</p>	(3)
9.3	$1/R_p = 1/R_1 + 1/R_2$ $= 1/(4 + 4) + 1/16 \checkmark$ $= 3/16 \checkmark$ $= 5,33 \Omega \checkmark$ or $R_p = R_1 \times R_2 / R_1 + R_2 \checkmark$ $= 8 \times 16 / 8 + 16 \checkmark$ $= 5,33 \Omega \checkmark$	(3)
9.4	$\text{emf} = I (R + r) \checkmark$ $24 = 1,5 [(5,33 + 8) + r] \checkmark$ $24 = 19,995 + 1,5 r$ $r = 2,67 \Omega \checkmark$ <p style="text-align: center;">OR</p> $V(\text{int}) = I r. \checkmark$ $4 = 1,5 \times r. \checkmark$ $r = 2,67 \text{ ohm} \checkmark$	(3)
9.5	With S open the total resistance increases and the current decreases. \checkmark	

	<p>$emf = IR + Ir$, emf and r is constant thus Ir will decrease. Therefore V_1 will increase ✓</p> <p><i>Wanneer S oop is neem die totale weerstand van die stroombaan toe, dus sal die stroom afneem</i></p> <p><i>Emk = IR + Ir, emk en r bly konstant daarom sal Ir afneem, dus sal V_1 toeneem</i></p>	(2)
		[14]

QUESTION 10		
10.1.	<p>Move the bar magnet very quickly up ✓ and down inside the coil ✓</p> <p><i>Beweeg die staafmagneet baie vinnig op en af binne in die spoel.</i></p>	(2)
10.2.	10.2.1	Electromagnetic induction/ <i>Elektromagnetiese induksie</i> ✓ (1)
	10.2.2	Commutator/ <i>kommulator</i> / split ring/ <i>splitring</i> ✓ (1)
10.3	10.3.1	

	<p>OPTION 1/OPSIE 1</p> $P_{\text{average}} = \frac{V_{\text{rms}}^2}{R} \checkmark$ $= \frac{220^2}{40,33} \checkmark$ $= 1\,200,10 \text{ W (J}\cdot\text{s}^{-1}) \checkmark$ <p>OPTION 2/OPSIE 2</p> $I_{\text{rms}} = \frac{V_{\text{rms}}}{R}$ $= \frac{220}{40,33} \checkmark$ $= 5,45 \text{ A}$ $P_{\text{average}} = I_{\text{rms}}^2 R$ $= (5,45^2)(40,33) \checkmark$ $= 1\,197,9 \text{ W OR/OF } 1\,200,10 \text{ W} \checkmark$ <p>OPTION 3/OPSIE 3</p> $I_{\text{rms}} = \frac{V_{\text{rms}}}{R}$ $= \frac{220}{40,33} \checkmark$ $= 5,45 \text{ A}$ $P_{\text{average}} = V_{\text{rms}} I_{\text{rms}}$ $= (220)(5,45) \checkmark$ $= 1\,199 \text{ W or/of } 1\,200,10 \text{ W} \checkmark$	(3)
10.3.2	<p>OPTION 1/OPSIE 1</p> $V_{\text{rms}} = \frac{V_{\text{max}}}{\sqrt{2}} \checkmark$ $220 = \frac{V_{\text{max}}}{\sqrt{2}}$ $V_{\text{max}} = 311,13 \text{ V} \checkmark$ $I_{\text{max}} = \frac{V_{\text{max}}}{R} = \frac{311,13}{40,33} \checkmark$ $= 7,71 \text{ A} \checkmark$ <p>OR/OF</p> $P_{\text{ave}} = \frac{V_{\text{max}} I_{\text{max}}}{2} \checkmark$ $1200,1 = \frac{(311,13) I_{\text{max}}}{2} \checkmark$ $I_{\text{max}} = 7,71 \text{ A} \checkmark$	

		<p>OPTION 2/OPSIE 2</p> $P_{\text{average}} = V_{\text{rms}} I_{\text{rms}} \checkmark$ $1200,1 = (220) I_{\text{rms}} \checkmark$ $I_{\text{rms}} = 5,455 \text{ A}$ $I_{\text{max}} = \sqrt{2} (5,455) \checkmark$ $= 7,71 \text{ A} \checkmark \quad (7,715 \text{ A})$ <p>OPTION 3/OPSIE 3</p> $P_{\text{average}} = I_{\text{rms}}^2 R \checkmark$ $1200,1 = I_{\text{rms}}^2 (40,33) \checkmark$ $I_{\text{rms}} = 5,455 \text{ A}$ $I_{\text{max}} = \sqrt{2} I_{\text{rms}} \checkmark$ $= \sqrt{2} (5,455)$ $= 7,71 \text{ A} \checkmark$ <p>OPTION 4/OPSIE 4</p> $V_{\text{rms}} = I_{\text{rms}} R \checkmark$ $220 = I_{\text{rms}} (40,33) \checkmark$ $I_{\text{rms}} = 5,455 \text{ A}$ $I_{\text{max}} = \sqrt{2} I_{\text{rms}} \checkmark$ $= \sqrt{2} (5,455)$ $= 7,71 \text{ A} \checkmark$	(4)
			[11]

QUESTION 11			
11.1	11.1.1	Photoelectric effect/foto-elektriese effek✓	(1)
	11.1.2	Increase/neem toe✓ An increase in intensity, will result in more electrons being emitted per second/time unit / 'n toename in intensiteit lei tot meer elektrone wat per sekonde/tydseenheid vrygestel word✓	(2)
	11.1.3	Increase in Kinetic Energy/ toename in kinetiese energie✓ Blue light has higher frequency than red light/blou lig het 'n hoër frekwensie as rooi lig✓ Therefore the energy of blue is higher than red because $E = hf$ /daarom is die energie van blou lig hoër omdat $E = hf$ ✓	(3)
11.2			

	$E = W_0 + K_{\max} \checkmark$ $2,95 \times 10^{-20} \checkmark = 1 \times 10^{-20} \checkmark + 0,5 (9,11 \times 10^{-31}) v^2 \checkmark$ $v = 2,07 \times 10^5 \text{ m.s}^{-1} \checkmark$	(5)
		[11]

TOTAAL: 150